



वार्षिक प्रतिवेदन ANNUAL REPORT 2025



भा.कृ.अ.प.-केन्द्रीय बकरी अनुसंधान संस्थान

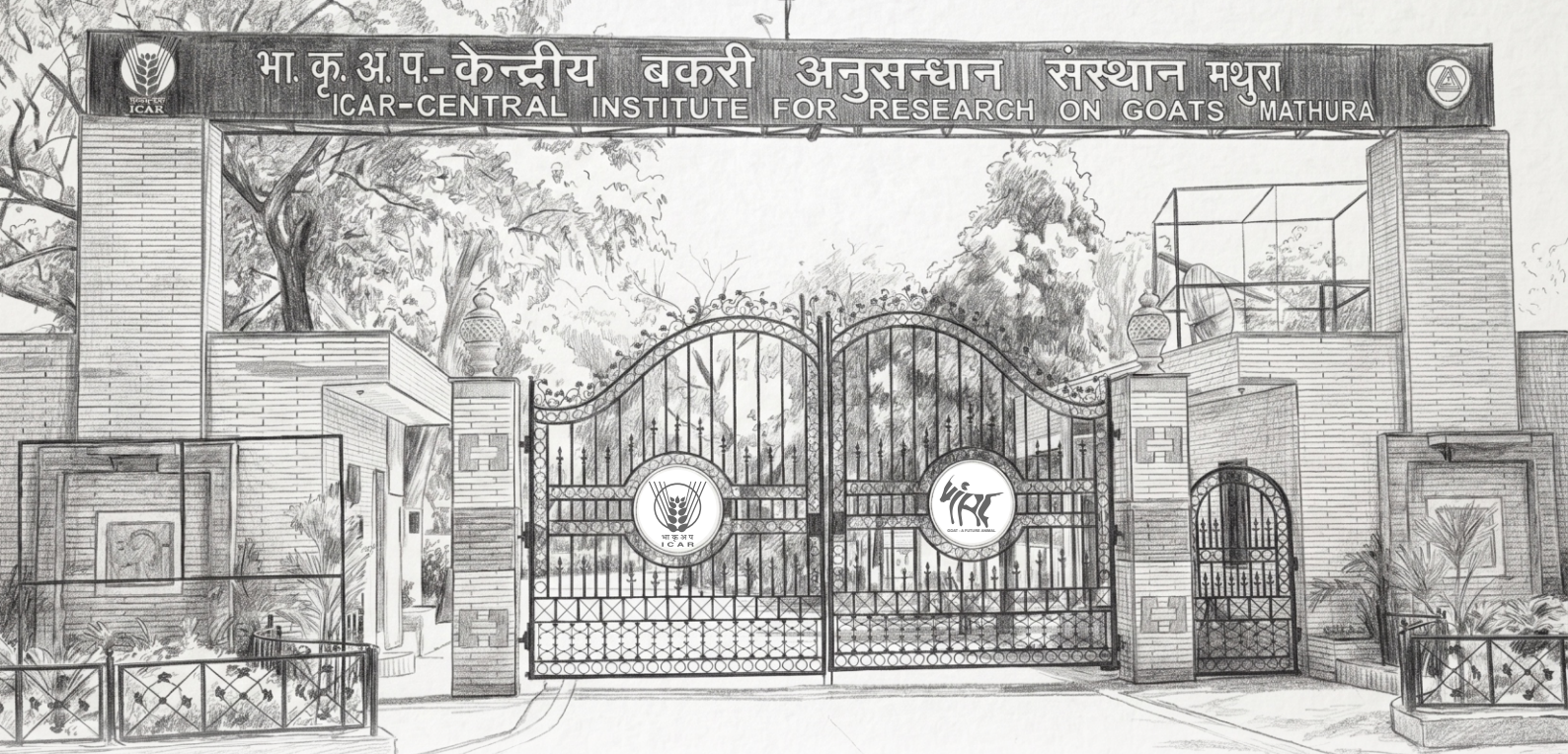
मखदूम फरह - 281122, मथुरा (उ.प्र.) भारत



ICAR-CENTRAL INSTITUTE FOR RESEARCH ON GOATS

MAKHDOOM, FARAH - 281122, MATHURA (U.P.) INDIA

(An ISO 9001:2015 Certified Organization)



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ICAR-CIRG Annual Report 2025

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MESSAGE FROM DIRECTOR



It gives me immense pleasure to present the Annual Report 2025 of the ICAR–Central Institute for Research on Goats (CIRG), Makhdoom. Goat farming continues to be a dependable source of livelihood for millions of rural families across India, particularly smallholders, landless labourers, women, socio-economically disadvantaged communities. As the nation's premier institute dedicated to goat research and development, ICAR-CIRG remains steadfast in its mission to generate scientific innovations and technologies that enhance productivity, profitability, sustainability and resilience of the goat sector while contributing to food and nutritional security.

Established in 1979, the Institute has consistently worked towards strengthening the goat sector through research, technology development, capacity building and extension services. The year 2025 has been particularly rewarding, marked by several noteworthy scientific advancements and impactful outreach initiatives.

Our efforts in genetic improvement and conservation gained further momentum through the dissemination of superior germplasm of indigenous goat breeds and Muzaffarnagari sheep. A remarkable achievement during the year was the recording of 310 litres of milk in a single lactation by a Barbari doe, highlighting the untapped dairy potential of indigenous goats. The inclusion of the renowned Sojat breed in our breeding programme further enriched the Institute's genetic resource base.

Significant progress was also made in reproductive biotechnology and precision breeding. The establishment of a CRISPR/Cas9-based genome editing platform, optimization of laparoscopic artificial insemination resulting in the birth of Jamunapari kids, advancements in embryo technologies and expansion of germplasm cryoconservation programmes reflects our commitment to harnessing frontier technologies for livestock improvement. At the same time, the Institute strengthened its research in Artificial Intelligence, Computer Vision and Precision Livestock Farming, leading to the development of AI-enabled tools for body weight estimation and disease diagnosis using image analytics and infrared thermography.

In animal health research, important milestones were achieved through the development of a recombinant vaccine candidate against enterotoxaemia, rapid diagnostic technologies for infectious diseases and science-based health management solutions for major goat diseases. The Institute also expanded its intellectual property portfolio through patents, copyrights and technology innovations, underscoring our focus on translating research into practical applications.

Research in nutrition, feed resource management and value addition continued to support sustainable livestock production systems. Studies on millet-based feeding strategies, natural farming approaches, rumen microbial resources and utilization of sheep wool generated valuable insights for environmentally responsible farming. The development of value-added products such as artisan goat milk Kaladhi cheese

and goat milk-based personal care products has opened new avenues for entrepreneurship and income generation.

A defining feature of our work remains the successful translation of research into field-level impact. Through DAPSC and DAPST programmes, special emphasis was placed on empowering SC/ST communities and women farmers through scientific goat farming interventions, animal health camps, advisory services, capacity building and technology dissemination. Our training programmes benefited farmers, entrepreneurs, unemployed youth, and livestock professionals from across the country. Outreach efforts were further strengthened through Kisan Melas, educational visits by more than 2,000 students and the widely appreciated “CIRG Bakri Palan Pathshala” radio programme. The Farmers' Single Window System continued to serve as an important interface with stakeholders, addressing thousands of farmer queries and providing timely technical guidance.

These achievements have been possible because of the dedication, hard work, and collaborative spirit of our scientists, technical staff, administrative personnel, students and stakeholders. I sincerely acknowledge the guidance and support of the Secretary, DARE & Director General, ICAR, the Deputy Director General (Animal Science), and ICAR Headquarters. I also express my gratitude to the Assistant Director Generals, Principal Scientists of SMD, collaborating ICAR institutes, State Departments, Krishi Vigyan Kendras, academic institutions and partner organizations for their invaluable contributions towards achieving the Institute's objectives.

I am equally grateful to the farmers, entrepreneurs, development agencies and collaborating institutions whose trust and partnership continue to inspire our efforts. Their active engagement ensures that the technologies developed at the Institute create meaningful impact on the ground.

As we move forward, ICAR-CIRG will continue to pursue excellence in research, innovation, capacity building and technology dissemination. Guided by the vision of sustainable livestock development and inclusive rural prosperity, we remain committed to making goat farming a vibrant driver of economic growth, nutritional security and livelihood enhancement for the nation.

Finally, I wish to place on record my sincere appreciation for the Annual Report 2025 compilation and publication committee for their meticulous efforts. Their dedication in comprehensively documenting and presenting the institute's year-long achievements with such clarity and excellence is truly commendable.



Dr. Manish K. Chatli

Director, ICAR-CIRG

EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

Goat production is a cornerstone of India's rural livestock economy, playing a particularly important role in sustaining the livelihoods of smallholder farmers, landless labourers, and economically weaker sections of society. With an estimated population exceeding 150 million goats and 43 recognised indigenous breeds, India stands among the leading goat-producing countries in the world. The sector contributes substantially to national food security through the production of meat, milk, skin and fibre, while also generating steady and periodic income for rural households.

One of the key strengths of goats lies in their remarkable adaptability to a wide range of agro-climatic conditions. They thrive in arid, semi-arid, and hilly terrains where crop-based agriculture is often limited. Their ability to efficiently utilise sparse and low-quality vegetation, combined with low maintenance requirements and modest initial investment, makes goat rearing one of the most sustainable and inclusive forms of livestock farming. In addition to economic benefits, goat milk and meat provide valuable nutrition, supporting dietary diversity in rural communities.

At the national level, the ICAR–Central Institute for Research on Goats (CIRG), Makhdoom, Uttar Pradesh, has been a premier institute dedicated to advancing goat research, development and innovation. Since its establishment, the institute has played a pivotal role in enhancing goat productivity and improving the socio-economic status of goat farmers across the country. Its contributions span multiple dimensions, including the conservation and genetic improvement of indigenous goat breeds through structured breeding and selection programmes under the All India Coordinated Research Project (AICRP) on Goats.

The Institute has also developed and promoted a wide range of technologies in areas such as animal health management, nutrition optimization, reproductive efficiency and value addition of goat

products. In addition, CIRG has been actively involved in capacity building by conducting training programmes for farmers, veterinarians, entrepreneurs and extension workers, thereby strengthening grassroots knowledge and skill development in the sector.

Furthermore, the Institute has pioneered sustainable livestock production models, including integrated goat farming systems and circular economy approaches that enhance resource efficiency and environmental sustainability. It also contributes to policy formulation and strategic planning aimed at strengthening the goat sector's role in achieving doubling of farmers' income and ensuring national food and nutritional security.

In recent years, there has been a noticeable surge in interest in commercial goat farming and goat-based entrepreneurship among diverse stakeholders, reflected in the increasing participation in CIRG's training and outreach programmes. The institute functions through four major divisions: Animal Genetics and Breeding, Animal Physiology and Reproduction, Animal Nutrition, Management and Products Technology and Animal Health supported by an Extension Education and Socio-economic section that facilitates outreach, farmer engagement and technology transfer.

Through its sustained research efforts and strong extension network, ICAR-CIRG continues to serve as a national leader in driving innovation, productivity enhancement and resilience in India's goat sector.

Animal Genetics and Breeding, Animal Physiology and Reproduction, Animal Nutrition, Management and Products Technology and Animal Health supported by an Extension Education and Socio-economic Section.

2.1 Genetic Improvement of Goats and Sheep

The opening and closing flock strength of nucleus flock of Jamunapari goats was 404 and 349 on 1st January 2025 and 31st December 2025. During this period, a total of 153 kids were born from 118 kidding out of which 80 kids were male and 73 were female. The litter size was 1.30. Multiple born kids were 49%. The averages age at first conception (AFC), age at first kidding (AFK), weight at first service, weight at first kidding and

first kidding interval (FKI) of females born in 2023-24 and kidded in 2025 were 506.19 ± 22.50 , 635.30 ± 22.60 days, 30.09 ± 0.97 , 41.49 ± 1.65 kg and 302.51 ± 15.31 days. The least square means of body weights for kids at birth, 3, 6, 9 and 12 months of age were 3.50 ± 0.03 , 11.81 ± 0.18 , 15.69 ± 0.35 , 19.77 ± 0.46 kg and 26.41 ± 0.73 kg respectively. Year, season of birth, type of birth, sex of kid and parity of dam had significantly affected ($P < 0.01$) kid's body weights. Males had significantly higher body weight than females at all the growth stages. Kids born as multiple had significantly lower weight as compared to those which born as single however, weight gain was higher in multiple born kids as compared to single born kids. The h^2 estimates were 0.17 ± 0.02 , 0.19 ± 0.01 , 0.20 ± 0.02 , 0.16 ± 0.02 and 0.17 ± 0.02 at birth, 3, 6, 9 and 12 months ages. The selection differential for 9 months body weight was 4.98 kg and for dam's total milk yield it was 46.4 litres. Least squares means of lactation milk yield in 90, 140 days, total milk yield and lactation length were 120.72 ± 3.96 , 155.45 ± 8.56 , 180.63 ± 10.79 litre and 177.03 ± 2.0 days, respectively. Year of kidding had significant and pronounced ($P < 0.01$) effect on all the lactation traits with high magnitude. Goats kidded in spring season significantly yielded more milk than those which kidded in spring. The effect of type of birth was also significant on 90 days MY. Significantly lesser milk yield was obtained from first kidders. During the year 80 male and 70 female (total-150) sold for field improvement and 8155 liters milk supplied to GPT section.

The opening balance of Barbari flock on 1st January 2025 was 552 and closing balance was 645 on 31st December 2025. Conception rate through natural services in Ist and IInd and IIIrd services was 70.3, 20.9 and 7.1%. There were 432 kids born from 282 does with litter size of 1.53. Kids born as multiples were 67.6% (single, twin and triplet kidding were 32.4, 62.0 and 5.55%, respectively). Least squares means of age at first service, weight at first service, age at first kidding, weight at first kidding and first kidding interval in 2025 were 407.04 ± 17.13 days, 20.19 ± 0.35 kg, 552.34 ± 17.10 days, 24.19 ± 0.42 kg and 289.56 ± 17.34 days, respectively. An average litter size/kidding was 1.53 and annual kidding

rate/doe was 1.89 this year. Breeding efficiency (%) on the basis of doe's available and doe's tupped were 122.6 and 97.3%. Kidding efficiency (%) on the basis of does available and doe's tupped were 180.7 and 143.5%, respectively. The selection differential for 9 months body weight was 6.77 kg and for dam's 140 days milk yield was 5.0 litres. The least squares means of body weight of kids born in the year 2024 were 2.15 ± 0.01 , 9.18 ± 0.09 , 12.95 ± 0.21 , 19.03 ± 0.27 and 23.97 ± 0.35 kg, respectively at birth, 3, 6, 9 and 12 months of ages. Champion male kid (14457) born as twin recorded highest body weight as 34.0 and 39.5 kg at 9 and 12 months of age under semi-intensive management. Barbari flock revealed moderate h^2 estimates (0.13 ± 0.03 to 0.31 ± 0.04) for growth traits. Average inbreeding coefficient was 2.16% from 1993 to 2020. The least square means for 90 days milk yield, 140 days milk, total lactation yield and lactation length in 2025 were 84.20 ± 1.25 , 124.46 ± 1.83 , 130.17 ± 2.32 litre, 158.45 ± 1.85 days, respectively. Doe Number 12941 has declared as champion goat with a record yield of 310 litre milk in a lactation period of 258 days. A total of 246 goats were provided to farmers and development agencies for improvement in farmers flock.

The opening balance of Jakhrana goats on the first day of the year was 272 which comprised of 75 males and 177 females and closing balance of 252 goats had a stock of 75 males and 177 females. The overall mortality was 6.28%. During this year, a total of 108 kids were born from 73 kidding. Out of total, 52 (54.7%) kids born as single and 43 (45.3%) born as multiples. Out of total, 52 (54.7%) kids born as single and 43 (45.3%) born as multiples. The kidding rate was recorded as 1.30. The replacement rate of the does was 32.7%. The annual tupping, kidding on available and bred basis were recorded as 96.7, 85.0 and 91.25%, respectively. The overall least-squares means of body weights of kids at birth, 3, 6, 9 and 12 month age were $2.68.04 \pm 0.04$, $9.810.12$, 14.73 ± 0.37 , 20.58 ± 0.45 and 25.71 ± 0.48 kg, respectively. The overall least-squares means of 90, 140 days, total milk yield and lactation length were 131.82 ± 3.01 , 164.28 ± 3.81 , 150.90 ± 7.28 litre and 151.42 ± 5.71 days, respectively. The h^2 estimates of birth, 3, 6, 9

and 12 month body weights were 0.202 ± 0.100 , 0.441 ± 0.126 , 0.175 ± 0.097 , 0.283 ± 0.109 and 0.061 ± 0.082 , respectively. The selection differential for 9 month body weight and 90 days milk yield of their dams were respectively 2.5 kg and 19.0 litre. During year 2025, a total of 66 superior germ plasm (31 males and 35 females) were supplied to various developmental agencies, Research organizations, Non-Government organizations and progressive farmers for genetic improvement of their flocks under field conditions. During reporting year, a total of 02 multiplier flocks were established.

The opening balance of Muzaffarnagari sheep was 472 which comprised of 115 males and 357 females and closing balance of 439 sheep had a stock of 111 males and 328 females. During this year a total of 189 lambs born and overall mortality was recorded 4.9%. The overall least-squares means of body weight of lambs at birth, 3, 6, 9 and 12 month age was 3.89 ± 0.04 , 16.220 ± 0.18 , 27.18 ± 0.35 , 30.46 ± 0.54 and 38.65 ± 0.59 kg, respectively. The overall average monthly body weights of adult males and females were 54.37 and 42.08 kg respectively. The average daily gain of Muzaffarnagari lambs during 0-3, 3-6, 6-12 and 3-12 months were 136.77 ± 1.96 , 121.90 ± 3.11 , 79.21 ± 2.95 and 87.18 ± 1.98 gm under semi-intensive feeding management. Sex, year of lambing and type of birth had highly significant effect on all ADGs except non-significant effect of type of birth on ADG during 6-12 and 3-12 month intervals. Similar to body weights, all average daily gains were found significantly ($P < 0.01$) higher in males as compared to females. The single born lambs had higher average daily weight gains during all age intervals. A total of 15 male lambs were kept under feedlot experiment for studying growth potential of the breed, at six month age average body weight was recorded 45.0 kg., which was ever highest since inception of the project. The overall least squares mean for lambs 1st and 2nd six monthly and adult annual clips were calculated to be 417.82 ± 6.13 , 500.80 ± 7.47 and 1103.64 ± 12.82 g, respectively. The overall least-squares means of weight at first service, weight at first lambing, age at first service and age at

first lambing were 31.72 ± 0.63 , 34.930 ± 0.68 kg, 459.25 ± 6.57 and 612.16 ± 6.55 days, respectively. The annual tupping, lambing on ewes available basis and lambing on ewes bred basis were respectively 91.3, 85.7 and 94.0%. The h^2 estimates of birth, 3, 6, 9 and 12 month body weights were 0.191 ± 0.053 , 0.445 ± 0.075 , 0.309 ± 0.064 , 0.133 ± 0.047 and 0.100 ± 0.044 , respectively. The selection differential for the trait under selection was 6.5 kg (2025). A total of 109 superior animals (50 males and 59 females) were supplied to various developmental agencies, Research organizations, Non-Government organizations and progressive farmers for genetic improvement of their flocks under field conditions.

The main activities of DAPSC scheme included input distribution, capacity building & impact analysis in the adopted villages. Under input distribution, a total of 86 goats, 42.85 Tons goat feed, 125 goat feeders, 368 set of medicine kits, 3310 kg mineral mixture, 08 weighing balance, 634 blankets, 9.96 Tons of wheat seed, 157 CIRG Soap, 343 milk can, 06 sewing machine, 256 Unnat Bakri Palan Books etc. were distributed to project beneficiaries. Under capacity building activities, 11 trainings for 1148 beneficiaries, 10 demonstrations on activities of livestock farms, Agricultural farm, natural farming and use of Drone in agriculture, 07 health camps at institute and in adopted villages and 11 exposure visits benefitting of 719 project beneficiaries organized. Organized National Goat Day on 12th July in which 65 farmers participated. Noted 10-15% increase in crop productivity, 20-25% in body weight gain in goats and 8-10% reduction in mortality in the adopted farmers flocks.

2.2 Goat Physiology, Reproduction and Shelter Management

The Animal Physiology and Reproduction (APR) Division made significant advances in reproductive biotechnology, genetic improvement, livestock conservation, precision livestock farming, and animal welfare technologies for goats. The Division successfully established a CRISPR/Cas9-based genome editing platform and generated genome-edited caprine fetuses targeting the myostatin gene,

demonstrating the potential of precision breeding approaches for genetic improvement in small ruminants. Advanced reproductive technologies including embryo production, embryo cryopreservation, embryo transfer, genome editing, and laparoscopic-assisted reproductive interventions were further standardized to accelerate genetic gain and facilitate dissemination of superior germplasm. The Division developed a novel herbal-fortified semen cryopreservation diluter that significantly improved post-thaw semen quality while reducing oxidative stress and enhancing immunoprotective properties, offering promising prospects for intellectual property protection. Efficient estrus synchronization protocols were standardized for major Indian goat breeds, achieving up to 90% estrus induction and fertility response under both farm and field conditions. Laparoscopic Artificial Insemination (LAI) protocols were successfully optimized in Jamunapari goats, resulting in the birth of the first set of kids through LAI under the programme and enabling more effective utilization of elite genetic resources. Substantial progress was made in livestock biodiversity conservation through the establishment and cryopreservation of 440 fibroblast cell lines representing indigenous goat breeds, which were deposited in the national germplasm repository. In addition, a novel low-serum fibroblast culture medium was developed, leading to the filing of a patent application. The Division also strengthened assisted reproductive technology platforms by establishing protocols for in vitro embryo production, vitrification-based embryo cryopreservation and laparoscopic embryo transfer in goats. Innovations in animal housing and welfare included the development of renewable energy-based goat shelters such as solar dryer-cum-winter shelters and plastic-based multi-species two-tier housing systems, contributing to improved animal comfort, welfare and production efficiency. The Division also expanded its research portfolio into Artificial Intelligence (AI), Computer Vision and Precision Livestock Farming. This facilitated the development of model for body weight estimation and disease diagnosis using computer vision technologies. Infrared thermography can be used

as supporting tool for identification of subclinical mastitis and the development of deep-learning models for diagnosis of important goat diseases, including diarrhoea and contagious ecthyma. The institutional Goat Germplasm Bank was further strengthened through cryo-preservation of more than 14,000 doses of superior-quality semen from major indigenous goat breeds, supporting long-term conservation and genetic improvement programmes. The Division also generated revenue through germplasm dissemination, capacity-building programmes, training activities and technology-based services, thereby enhancing institutional outreach and entrepreneurship development. Research efforts were extended towards the development of a point-of-care pregnancy detection assay for goats and novel transdermal drug delivery systems for estrus synchronization, both of which hold promise for farmer-friendly reproductive management solutions. Extensive field surveys covering more than 1,200 goats across multiple villages enabled identification of key reproductive constraints and facilitated delivery of science-based advisory services aimed at improving reproductive efficiency, productivity and farmer livelihoods.

2.3 Goat Nutrition, Feed Formulation and Products Value-addition

The project “ICAR-Network Program on Veterinary Type Culture Collection (Rumen microbes)” focused on the isolation and characterization of anaerobic cellulolytic and tannin-degrading bacteria from goat rumen and wild ruminant fecal samples. Rumen liquor collected from adult Jakhana and Barbari goats was processed through serial dilution to obtain pure bacterial cultures. Five cellulolytic bacterial isolates were identified and characterized using 16S rRNA gene amplification, sequencing and database analysis. Their enzymatic and biochemical properties were evaluated and cultures were submitted to NIANP, Bengaluru, for accession numbers. Additionally, fecal samples from Blackbuck and Sambar deer collected at Lion Safari Park, Etawah, were used to isolate tannin-degrading bacteria under anaerobic conditions. Four bacterial isolates were obtained and characterized through morpho-

logical, biochemical and molecular analyses. DNA sequencing and 16S rRNA-based identification confirmed their taxonomy, and all characterized cultures were preserved and submitted to NIANP repository for accession. Under the project “Global Centre of excellence on Millets” feeding trial was conducted on 30 growing Barbari goats to evaluate the complete pellet feeds prepared from gram straw, pearl millet stovers, sorghum stovers and their enzyme-treated forms. All pellets contained about 12% crude protein and were fed for 120 days. Growth rate, dry matter intake, body condition score, blood and rumen metabolites, carcass traits and meat quality were assessed. Results showed similar growth performance, blood parameters, rumen fermentation, and carcass characteristics across all groups. Enzyme-treated millet stover pellets improved feed conversion efficiency. Meat from goats fed pearl millet stovers showed healthier fatty acid profiles with higher polyunsaturated fatty acids and better health indices.

In another project natural farming-based fodder production practices were evaluated for goats using Jeevamrit and Beejamrit prepared from cow dung, urine, and other organic ingredients. Berseem fodder and barley grain were cultivated under natural and conventional farming systems during Rabi season of 2025. Results showed no significant differences in yield between the two methods. Natural farming produced barley grain yield of 3193.7 kg/ha compared to 3203.3 kg/ha under conventional farming, while berseem fodder yield was 44,596.8 kg/ha versus 45,408.5 kg/ha, indicating only marginal reductions. Different Jeevamrit formulations using cow and goat wastes were developed and analyzed, with mixed-source Jeevamrit showing the highest microbial DNA concentration. Farmer demonstrations were also conducted to promote natural farming practices. A Hexa-copter AGRIBOT Drone (10 L capacity, 25 kg MTOW) was procured under Agri drone project for agricultural demonstrations. It effectively sprayed liquid fertilizers at 1.2–4.0 L/min over a 3–5 m width. Remote Pilot training was completed, and drone demonstrations for Nano urea application and fertilizer spraying were

conducted for trainees and goat farmers through training programs and field demonstrations at CIRG. A study evaluated the use of Muzaffarnagari sheep wool as a slow-release fertilizer and mulch for feed and fodder production. Pot experiments on barley and berseem demonstrated that sheep wool improved crop productivity due to its nutrient release, hygroscopic nature and water-holding capacity. In barley, grain yield increased progressively with higher wool application and fertilizer levels, reaching the maximum yield (186.5 g/pot) with 16 g wool and 100% recommended fertilizer dose. In berseem, wool mulch significantly enhanced fodder biomass production under all irrigation levels, with increases ranging from 30.88% to 79.34% over the control. Results indicate that sheep wool can be effectively utilized as a sustainable soil amendment for improving crop and fodder yields.

Under the project on goat cheese standardization, we standardized the processing of an artisan cheese kaladhi, and its physicochemical, colour, textural, rheological and sensory properties were determined. In an Institute corpus funded project, we isolated the goat milk oligosaccharides (GMOS) from Barbari and Jakhrana goats of similar parity and lactation length. The profiling of the isolated OS samples using LC-MS revealed the presence of 12 components in Barbari samples, while 8 components in Jakhrana samples. Under the project on goat milk-based designer cosmetics, three formulations of goat milk-based bathing bars were prepared and standardized using different oil combinations and additives. The bathing bars were evaluated during storage. Further, different formulations of goat milk-based hand wash were successfully formulated, standardized, and evaluated for their physicochemical, rheological, microbiological, and cellular characteristics during storage study. Fresh goat skin samples were analysed for proximate composition, fatty acids, and amino acid profiles. Black Bengal skin showed superior protein quality with higher essential amino acids, while Barbari goat skin exhibited a collagen-rich profile with elevated glycine content, making it suitable for functional collagen applications. The division developed the technologies and package

of practices to produce goat milk kaladhi cheeses, goat milk-based bathing bar and hand wash in the year 2025.

2.4 Goat Health Management

The significant achievements of the Animal Health Division for the 2025 calendar year, characterized by advanced therapeutic development, precision diagnostics and a robust "One Health" framework, are summarized as follows:

- **Pioneering Recombinant Vaccine Engineering:** The division successfully transitioned from computational *in silico* design to physical *in vitro* expression of a stable trivalent recombinant fusion protein (rETV). This novel vaccine candidate, validated through 200 ns molecular dynamics simulations for structural stability, targets three major *Clostridium perfringens* toxins and provides a critical foundation for future efficacy trials in small ruminants.
- **Precision Diagnostics and Infection Profiling:** Advanced diagnostic capabilities were established through the development of nanoparticle-enhanced lateral flow assays and RNA-based qRT-PCR protocols for rapid field detection of Brucellosis. This approach allows for the identification of active transcriptional infection stages that are frequently missed by traditional serological and DNA-based diagnostic methods.
- **Sustainable Therapeutic Innovations and Ethno-Veterinary Medicine:** The division standardized therapeutic interventions through the development of anti-coccidial herbal prototypes, including bolus and medicated pellet formulations with validated pharmacological potential. Furthermore, a comprehensive Package of Practices (PoP) was established to address the complex multi-pathogen etiology associated with caprine pneumonia.
- **Integrated Disease Management and Therapeutic Standardisation:** A comprehensive Package of Practices (PoP) was formulated to address caprine pneumonia, targeting a complex etiology that includes *Mannheimia haemolytica* and *Ovine Mastadenovirus A*. In parallel, the division

developed standardized anti-coccidial herbal bolus and medicated pellet prototypes, validated for their efficacy in clinically affected weaned kids. Furthermore, metabolic profiles for Barbari and Jamunapari goats were established, identifying age-related susceptibility to urolithiasis and a significant prevalence of subclinical ketosis.

- **Strategic Advancement of Intellectual Property (IP):** Institutional research output was solidified through the filing of a national patent for the simultaneous detection of multiple abortifacient microorganisms. The division significantly fortified its patent and copyright portfolio to protect institutional innovations. This includes the filing of an Indian patent for the simultaneous detection of abortifacient microorganisms (App No. 202611013019). Digital assets were secured through the registration of the Goat Transcriptome Web Resource on Enterotoxaemia (Goa TWR-E) (Certificate No. SW-2025020553), which is accessible via <https://dslab.nbrc.res.in/goaTWR/>. Additionally, two copyrights were filed for the "Interactive Preventive Health Calendar," covering both its literary (App No. LD-2577/2026-CO) and artistic (App No. AT-2565/2026-CO) components

2.5 Technology Dissemination, Capacity Building and Economic Goat Farming

The research initiatives undertaken during the reporting period made significant contributions toward strengthening goat-based livelihood systems, improving value-chain efficiency and promoting scientific goat farming across diverse agro-climatic regions of India. A comprehensive goat value-chain development framework was established in Bundelkhand through extensive field interventions, including 40 farmer outreach programmes, 10 animal health camps covering approximately 1,200 goats, distribution of Barbari and Jamunapari multiplier flocks, and promotion of value-added goat milk products.

A major achievement of the DAPST programme was the empowerment of tribal communities through capacity building and technology dissemination. A total of 1,173 Scheduled Tribe

farmers, including 715 women, were trained on scientific goat husbandry practices through frontline demonstrations, animal health services, and targeted extension activities conducted across four states.

Under non-bovine milk project successfully identified and documented scalable goat milk value-chain models in Uttar Pradesh, Rajasthan, Gujarat, and Maharashtra. The study demonstrated the economic viability of organized milk procurement systems and value addition through the production of goat milk cheese, paneer and ghee. The findings highlighted the importance of assured market linkages and collective marketing mechanisms in enhancing farm income and promoting sustainable goat-based enterprises. Furthermore, detailed price-spread analyses of meat goat markets in Uttar Pradesh and Rajasthan generated critical evidence on market efficiency, revealing higher producer shares and improved value transmission in organized marketing channels.

The section generates scientific and extension output- seven research articles, one policy paper, one book, one popular article, two lead papers, five book chapters and one technical extension publication. Capacity-building efforts were

further strengthened through the organization of nine (9) national training programmes and eight (8) sponsored training programmes on scientific goat farming, benefiting farmers, entrepreneurs, unemployed youth, and livestock professionals from multiple states. Technology dissemination was enhanced through participation in seven (7) Kisan Melas, where ICAR-CIRG goat production technologies were showcased to a large number of stakeholders. More than 2,000 students from schools and universities visited the institute for exposure to scientific livestock research and innovations. Additionally, the “CIRG Bakri Palan Pathshala,” conducted in collaboration with All India Radio, served as an effective mass communication platform for transferring scientific goat farming knowledge. The ten-episode programme was broadcast twice through four regional AIR stations, significantly expanding outreach among livestock farmers. The institute's Farmers' Single Window System played a pivotal role in stakeholder engagement and advisory services. During the reporting period, 9,192 visitors, including farmers, students, researchers, NGOs, and departmental officials, accessed institute services, while 2,566 helpline calls were addressed.



कार्यकारी सारांश

बकरी पालन भारत की ग्रामीण पशुधन अर्थव्यवस्था का एक अहम हिस्सा है। यह छोटे किसानों, भूमिहीन मजदूरों और समाज के आर्थिक रूप से कमजोर वर्गों की आजीविका बनाए रखने में महत्वपूर्ण भूमिका निभाता है। अनुमान के मुताबिक 15 करोड़ से अधिक संख्या में बकरियों एवं 43 मान्यता प्राप्त नस्लों के साथ भारत दुनिया के प्रमुख बकरी-पालक देशों में शामिल है। यह सेक्टर मांस, दुग्ध, खाल और रेशे के उत्पादन से राष्ट्रीय खाद्य सुरक्षा में बड़ा योगदान देता है। साथ ही ग्रामीण परिवारों के लिए लगातार और समय-समय पर होने वाली आय का स्रोत भी बनता है।

बकरियों की एक मुख्य विशेषता यह है कि वे अलग-अलग तरह की कृषि-जलवायु की स्थिति में आसानी से ढल जाती हैं। वे सूखे, कम वर्ष वाले और पहाड़ी क्षेत्रों में भी अच्छी तरह पल जाती हैं, जहाँ खेती-बाड़ी प्रायः सीमित होती है। कम मात्रा में एवं कम गुणवत्ता वाली वनस्पतियों के बेहतर उपयोग करने की उनकी क्षमता एवं कम देखभाल की जरूरत तथा शुरुआती कम निवेश, बकरी पालन को पशुपालन के सबसे टिकाऊ और समावेशी तरीकों में से एक बनाता है। आर्थिक लाभों के अलावा बकरी का दुग्ध एवं मांस जरूरी पोषण देते हैं, जिससे ग्रामीण समुदायों में खान-पान में विविधता बनी रहती है।

राष्ट्रीय स्तर पर भा०कृ०अ०प०-केन्द्रीय बकरी अनुसंधान संस्थान, मखदूम, मथुरा बकरियों से जुड़े अनुसंधान, विकास और नवाचार को आगे बढ़ाने के लिए समर्पित एक प्रमुख संस्थान रहा है। अपनी स्थापना के बाद से ही इस संस्थान ने बकरियों की उत्पादकता बढ़ाने और देश भर के बकरी पालक किसानों की सामाजिक-आर्थिक स्थिति को बेहतर बनाने में अहम भूमिका निभा रहा है। इसके योगदान कई क्षेत्रों में फैले हुए हैं, जिनमें “बकरी पर अखिल भारतीय समन्वित अनुसंधान परियोजना” (एआईसीआरपी ऑन गोट्स) के तहत व्यवस्थित प्रजनन एवं चयन कार्यक्रमों के माध्यम से देशी बकरी की नस्लों का संरक्षण और आनुवंशिक सुधार शामिल है।

इस संस्थान ने पशु स्वास्थ्य प्रबंधन, पोषण को बेहतर बनाने, प्रजनन क्षमता विकास और बकरी के उत्पादों में मूल्य वृद्धि जैसे क्षेत्रों में कई तरह की तकनीकें विकसित और प्रचारित की हैं। इसके अलावा संस्थान किसानों, पशु चिकित्सकों, उद्यमियों और विस्तार कार्यकर्ताओं के लिए प्रशिक्षण कार्यक्रम आयोजित करके क्षमता निर्माण में सक्रिय रूप से शामिल रहा है, जिससे इस क्षेत्र में जमीनी स्तर पर ज्ञान और कौशल विकास को मजबूती मिली है।

इसके अलावा, संस्थान ने लाभकारी एवं स्थिर पशुपालन मॉडल विकसित करने में अग्रणी भूमिका निभाई है, जिनमें एकीकृत बकरी पालन प्रणालियाँ और सर्कुलर इकोनॉमी (चक्रीय अर्थव्यवस्था) के तरीके शामिल हैं, जो संसाधनों के कुशल उपयोग और पर्यावरण की स्थिरता को बढ़ाते हैं। यह संस्थान नीति बनाने और रणनीतिक योजना तैयार करने में भी योगदान देता है, जिसका उद्देश्य किसानों की आय दोगुनी करने और राष्ट्रीय खाद्य व पोषण सुरक्षा सुनिश्चित करने में बकरी पालन क्षेत्र की भूमिका को मजबूत करना है।

हाल के वर्षों में अलग-अलग तरह के लोगों के बीच व्यावसायिक बकरी पालन और बकरी-आधारित उद्यमों में दिलचस्पी काफी बढ़ी है। इसका पता संस्थान के प्रशिक्षण और आउटरीच कार्यक्रमों में लोगों की बढ़ती भागीदारी से चलता है। यह संस्थान चार मुख्य विभागों के माध्यम से काम करता है जिसमें पशु आनुवंशिकी एवं प्रजनन, पशु दैहिकी एवं जनन, पशु पोषण प्रबंधन एवं उत्पाद प्रौद्योगिकी और पशु स्वास्थ्य विभाग हैं। इसके साथ ही एक प्रसार शिक्षा एवं सामाजिक अर्थशास्त्र अनुभाग भी है जो आउटरीच कार्यक्रमों के द्वारा किसानों को जोड़ने और तकनीकी हस्तांतरण में मदद करता है। सतत अनुसंधान और मजबूत प्रसार नेटवर्क के जरिए केन्द्रीय बकरी अनुसंधान संस्थान भारत के बकरी पालन सेक्टर में नवाचार, उत्पादन वृद्धि और मुश्किल हालात का सामना करने की क्षमता विकसित करने में राष्ट्रीय स्तर पर अग्रणी भूमिका निभा रहा है।

2.1 बकरियों और भेड़ों में आनुवंशिक सुधार

जमुनापारी बकरियों के न्यूक्लियस झुंड में 1 जनवरी और 31 दिसंबर, 2025 को झुंड में बकरियों की संख्या क्रमशः 404 और 349 थी। इस वर्ष हुई 118 ब्यांत में कुल 153 मेमने पैदा हुए, जिनमें 80 नर और 73 मादा

थे। प्रति ब्यांत बच्चों की औसत संख्या (लिटर साइज) 1.30 थी। एक से अधिक बच्चे पैदा होने की दर 49% थी। 2023-24 में पैदा हुई और 2025 में बच्चे देने वाली मादाओं के लिए पहली बार गर्भधारण की उम्र, पहली बार बच्चे देने की उम्र, पहली बार प्रजनन के समय वजन, पहली बार बच्चे देने के समय वजन और पहली बार बच्चे देने के बीच का अंतराल क्रमशः 506.19 ± 22.50 दिन, 635.30 ± 22.60 दिन, 30.09 ± 0.97 किग्रा, 41.49 ± 1.65 किग्रा और 302.51 ± 15.31 दिन था। जन्म के समय और 3, 6, 9 व 12 महीने की उम्र में मेमनों के शरीर के वजन का समय न्यूनतम वर्ग औसत क्रमशः 3.50 ± 0.03 , 11.81 ± 0.18 , 15.69 ± 0.35 , 19.77 ± 0.46 किग्रा और 26.41 ± 0.73 किग्रा था। पैदा होने का वर्ष, मौसम, जन्म का प्रकार, बच्चे का लिंग और माँ (डैम) की पैरिटी (बच्चे को जन्म देने की संख्या) का बच्चों के शरीर के वजन पर अति महत्वपूर्ण प्रभाव ($P < 0.01$) पड़ा। शरीर वृद्धि की सभी अवस्थाओं पर नर बच्चों का वजन मादा बच्चों की तुलना में काफी अधिक था। एक साथ एक से अधिक बच्चों के पैदा होने पर बच्चों का वजन अकेले पैदा हुए बच्चों की तुलना में काफी कम था, हालाँकि अकेले पैदा हुए बच्चों की तुलना में एक साथ पैदा हुए बच्चों में वजन बढ़ने की दर ज्यादा थी। जन्म के समय और 3, 6, 9 व 12 महीने की उम्र पर वंशागतित्व क्रमशः 0.17 ± 0.02 , 0.19 ± 0.01 , 0.20 ± 0.02 , 0.16 ± 0.02 और 0.17 ± 0.02 था। 9 महीने की उम्र में शरीर के वजन के लिए चयन विविधता 4.98 किलोग्राम था और माँ (डैम) से कुल 46.4 लीटर दूध प्राप्त हुआ। 90 और 140 दिनों में दूध का उत्पादन, कुल दूध के उत्पादन और दूध देने की अवधि का न्यूनतम वर्ग औसत क्रमशः 120.72 ± 3.96 , 155.45 ± 8.56 , 180.63 ± 10.79 लीटर एवं 177.03 ± 2.0 दिन था। बच्चे के जन्म के वर्ष का दूध देने से जुड़ी सभी विशेषताओं पर अति महत्वपूर्ण प्रभाव ($P < 0.01$) देखा गया। बसंत ऋतु में बच्चे को जन्म देने वाली बकरियों ने, शीत ऋतु में बच्चे को जन्म देने वाली दूसरी बकरियों की तुलना में काफी ज्यादा दूध दिया। 90 दिनों की अवधि में जन्म के प्रकार का भी काफी असर देखा गया। पहली बार बच्चे को जन्म देने वाली बकरियों से काफी कम दूध उत्पादन मिला। इस वर्ष किसानों एवं अन्य बकरी पालकों के झुंड में नस्ल सुधार के लिए 80 नर और 70 मादा (कुल 150) बकरियाँ उपलब्ध कराई गईं

और बकरी उत्पाद प्रौद्योगिकी इकाई को 8155 लीटर दूध प्रदान किया गया।

बरबरी झुंड की शुरुआती संख्या 1 जनवरी 2025 को 552 थी जोकि वर्ष के अंत में 31 दिसंबर 2025 को 645 थी। प्राकृतिक तरीके से पहली, दूसरी और तीसरी बार प्रजनन (सर्विस) कराने पर गर्भधारण दर क्रमशः 70.3%, 20.9% और 7.1% थी। 282 मादा बकरियों के प्रसव से 432 बच्चे पैदा हुए और प्रति प्रसव बच्चों की औसत संख्या (लिटर साइज) 1.53 थी। एक से ज्यादा बच्चे (मल्टीपल बर्थ) पैदा होने की दर 67.6% थी (अकेला बच्चा, जुड़वां बच्चे और तीन बच्चे होने की दर क्रमशः 32.4%, 62.0% और 5.55% थी)। 2025 में पहली बार प्रजनन के समय उम्र, पहली बार प्रजनन के समय वजन, पहली बार बच्चे को जन्म देने के समय उम्र, पहली बार बच्चे को जन्म देने के समय वजन और पहली बार बच्चे को जन्म देने के बीच का अंतराल का औसत क्रमशः 407.04 ± 17.13 दिन, 20.19 ± 0.35 किग्रा, 552.34 ± 17.10 दिन, 24.19 ± 0.42 किग्रा और 289.56 ± 17.34 दिन था। इस वर्ष प्रति प्रसव बच्चों की औसत संख्या 1.53 थी और प्रति मादा बकरी सालाना बच्चे देने की दर 1.89 थी। उपलब्ध मादा बकरियों और प्रजनन की गई मादा बकरियों के आधार पर प्रजनन क्षमता क्रमशः 122.6% और 97.3% थी। उपलब्ध मादा बकरियों और प्रजनन के लिए तैयार मादा बकरियों के आधार पर बच्चे देने की क्षमता क्रमशः 180.7% एवं 143.5% थी। प्रजनक बकरों की चयन विविधिता 9 महीने की शरीर के वजन का 6.77 किग्रा और माँ के 140 दिनों के दूध उत्पादन के लिए यह 5.0 लीटर था। वर्ष 2024 में पैदा हुए बच्चों के शरीर के वजन का औसत जन्म के समय, 3, 6, 9 और 12 महीने की उम्र में क्रमशः 2.15 ± 0.01 , 9.18 ± 0.09 , 12.95 ± 0.21 , 19.03 ± 0.27 और 23.97 ± 0.35 किग्रा था। अर्ध-सघन प्रबन्धन प्रणाली के तहत जुड़वां बच्चों के तौर पर पैदा हुए चौपियन नर मेमने (न० 14457) का शरीर का वजन 9 और 12 महीने की उम्र में सबसे ज्यादा, क्रमशः 34.0 और 39.5 किलोग्राम दर्ज किया गया। बरबरी झुंड में विकास से जुड़े गुणों के लिए मध्यम वंशागतित्व (0.13 ± 0.03 से 0.31 ± 0.04) पाए गए। 1993 से 2020 के बीच औसत अंतःप्रजनन गुणांक 2.16% था। वर्ष 2025 में 90 दिनों के दूध उत्पादन,

140 दिनों के दूध उत्पादन, कुल दूध उत्पादन और दुग्धकाल की अवधि के लिए न्यूनतम वर्ग औसत क्रमशः 84.20 ± 1.25 , 124.46 ± 1.83 , 130.17 ± 2.32 लीटर और 158.45 ± 1.85 दिन थे। बकरी नंबर 12941 को चौपियन बकरी घोषित किया गया, जिसने 258 दिनों की दुग्धकाल अवधि में 310 लीटर दूध का रिकॉर्ड उत्पादन किया। किसानों के झुंड में सुधार के लिए किसानों और विकास संस्थाओं को कुल 246 बकरियां दी गईं।

वर्ष के पहले दिन जखराना बकरियों की शुरुआती संख्या 272 थी, जिसमें 75 नर और 177 मादा बकरियां थीं। वर्ष के अंत में 31 दिसंबर 2025 को बकरियों की संख्या 252 थी, जिसमें 75 नर और 177 मादा बकरियां शामिल थीं। कुल मृत्यु दर 6.28% थी। इस वर्ष 73 ब्याट से कुल 108 मेमने पैदा हुए। कुल मेमनों में से 52 (54.7%) अकेले पैदा हुए और 43 (45.3%) एक साथ (जुड़वां या उससे अधिक) पैदा हुए। प्रसव दर 1.30 दर्ज की गई तथा मादा बकरियों की रिप्लेसमेंट दर 32.7% थी। सालाना टपिंग (प्रजनन के लिए नर से मिलन), उपलब्ध बकरियों के आधार पर किडिंग और प्रजनन के आधार पर किडिंग दरें क्रमशः 96.7%, 85.0% और 91.25% दर्ज की गईं। जन्म के समय और 3, 6, 9 व 12 महीने की उम्र में मेमनों के शरीर के वजन का समग्र न्यूनतम वर्ग औसत क्रमशः 2.68 ± 0.04 , 9.81 ± 0.12 , 14.73 ± 0.37 , 20.58 ± 0.45 और 25.71 ± 0.48 किलोग्राम था। 90 दिनों, 140 दिनों, कुल दूध उत्पादन और दूध देने की अवधि का समग्र न्यूनतम वर्ग औसत क्रमशः 131.82 ± 3.01 लीटर, 164.28 ± 3.81 लीटर, 150.90 ± 7.28 लीटर और 151.42 ± 5.71 दिन था। जन्म के समय और 3, 6, 9 व 12 महीने की उम्र में शरीर के वजन के लिए वंशागतित्व क्रमशः 0.202 ± 0.100 , 0.441 ± 0.126 , 0.175 ± 0.097 , 0.283 ± 0.109 और 0.061 ± 0.082 थे। 9 महीने की उम्र के स्वयं के शरीर के वजन और 90 दिनों के उनकी माताओं के दूध उत्पादन के लिए चयन विविधता क्रमशः 2.5 किलोग्राम और 19.0 लीटर था। वर्ष 2025 के दौरान, किसानों के झुंडों के आनुवंशिक सुधार के लिए विभिन्न विकास संस्थाओं, अनुसंधान संगठनों, गैर-सरकारी संगठनों और प्रगतिशील किसानों को कुल 66 शुद्ध बकरी (31 नर

और 35 मादा) उपलब्ध कराए गए। रिपोर्ट किए गए वर्ष के दौरान कुल 02 मल्टीप्लायर झुंड स्थापित किए गए।

वर्ष के प्रथम दिन मुजफ्फरनगरी भेड़ों की संख्या 472 थी, जिसमें 115 नर और 357 मादा भेड़ें थीं एवं वर्ष के अंत में 439 भेड़ें थी जिसमें 111 नर और 328 मादा भेड़ें थीं। इस वर्ष कुल 189 मेमनों का जन्म हुआ और कुल मृत्यु दर 4.9% दर्ज की गई। जन्म के समय और 3, 6, 9 व 12 महीने की उम्र में मेमनों के शरीर के वजन का समग्र न्यूनतम वर्ग औसत क्रमशः 3.89 ± 0.04 , 16.22 ± 0.18 , 27.18 ± 0.35 , 30.46 ± 0.54 और 38.65 ± 0.59 किलोग्राम था। वयस्क नर और मादा भेड़ों का कुल औसत मासिक शरीर का वजन क्रमशः 54.37 और 42.08 किलोग्राम था। अर्ध-सघन प्रबंधन प्रणाली के तहत मुजफ्फरनगरी मेमनों का औसत दैनिक वजन वृद्धि 0-3, 3-6, 6-12 और 3-12 महीनों के दौरान क्रमशः 136.77 ± 1.96 , 121.90 ± 3.11 , 79.21 ± 2.95 और 87.18 ± 1.98 ग्राम था। मेमनों का लिंग, जन्म का वर्ष और जन्म का प्रकार, इन सभी का दैनिक वजन वृद्धि पर बहुत महत्वपूर्ण प्रभाव पड़ा, सिवाय 6-12 और 3-12 महीने के अंतराल के दौरान दैनिक वजन वृद्धि पर जन्म के प्रकार का प्रभाव महत्वपूर्ण नहीं था। मादाओं की तुलना में नरों में सभी औसत दैनिक वजन वृद्धि महत्वपूर्ण रूप से अधिक ($P < 0.01$) पाई गई। अकेले पैदा हुए मेमनों में सभी उम्र के अंतरालों के दौरान औसत दैनिक भार वृद्धि अधिक थी। इस नस्ल की भार वृद्धि क्षमता का अध्ययन करने के लिए कुल 15 नर मेमनों को सघन प्रबंधन में रखा गया था। इस प्रयोग के दौरान 6 महीने की उम्र में शरीर का औसत भार 45.0 किलोग्राम दर्ज किया गया, जो कि भेड़ परियोजना की शुरुआत से अब तक का सबसे अधिक भार था। मेमनों की पहली और दूसरी छह-मासिक ऊन की कटाई और वयस्क भेड़ों की वार्षिक ऊन उत्पादन का समग्र न्यूनतम वर्ग औसत क्रमशः 626.59 ± 11.47 , 594.23 ± 14.81 और 1392.81 ± 17.14 ग्राम आंकी गई। पहली बार प्रजनन (सर्विस) के समय वजन, पहली बार प्रजनन के समय उम्र और पहली बार बच्चे को जन्म देने के समय उम्र का कुल औसत (लीस्ट-स्क्वेयर मीन्स) क्रमशः 31.72 ± 0.63 , 34.93 ± 0.68 किया, 459.25 ± 6.57 और 612.16 ± 6.55 दिन था। वार्षिक प्रजनन दर,

उपलब्ध मादा भेड़ों के आधार पर बच्चे देने की दर और प्रजनन कराने वाली मादा भेड़ों के आधार पर बच्चे देने की दर क्रमशः 91.3%, 85.7% और 94.0% थी। जन्म के समय और 3, 6, 9 व 12 महीने की उम्र में शरीर के वजन के लिए वंशागतित्व क्रमशः 0.191 ± 0.053 , 0.445 ± 0.075 , 0.309 ± 0.064 , 0.133 ± 0.047 और 0.100 ± 0.044 थे। चुने गए गुण (ट्रेट) के लिए सिलेक्शन डिफरेंशियल 6.5 किलोग्राम था। फील्ड की स्थितियों में अपने झुंडों के जेनेटिक सुधार के लिए अलग-अलग विकास एजेंसियों, रिसर्च संगठनों, गैर-सरकारी संगठनों और प्रगतिशील किसानों को कुल 109 उच्च स्तर के जानवर (50 नर और 59 मादा) उपलब्ध कराए गए।

अनुसूचित जाति विकास कार्य योजना के अंतर्गत अपनाए गए 10 अनुसूचित जाति बाहुल्य गांवों की मुख्य गतिविधियों में सामग्री वितरण, कौशल विकास, वैज्ञानिक बकरी पालन प्रशिक्षण एवं तकनीकी प्रदर्शन सम्मिलित था। सामग्री वितरण के अंतर्गत परियोजना के लाभार्थियों को कुल 86 बकरियां, 42.85 टन पशु आहार, 125 चरही, 368 दवा किट, 3310 किग्रा खनिज मिश्रण, 08 वजन करने वाली मशीनें, 634 कंबल, 9.96 टन उन्नत गेहूँ के बीज, 343 दूध के कैन, 06 सिलाई मशीनें, 256 'उन्नत बकरी पालन' पुस्तकें आदि बांटी गई। कौशल विकास के अंतर्गत 1148 लाभार्थियों के लिए 11 प्रशिक्षण कार्यक्रम पशुधन फार्म, कृषि फार्म, प्राकृतिक खेती और खेती में ड्रोन के प्रयोग पर कराया गया। इसके अतिरिक्त 10 प्रदर्शन कार्यक्रम, 07 स्वास्थ्य शिविर, 719 लाभार्थियों के साथ 11 शैक्षणिक भ्रमण संस्थान और अपनाए गए गांवों में आयोजित की गई। 12 जुलाई को राष्ट्रीय बकरी दिवस मनाया गया, जिसमें 65 अनुसूचित जाति के बकरी पालकों ने भाग लिया। लाभार्थी किसानों को उपलब्ध कराये गए उच्च गुणवत्ता के गेहूँ के बीज से उत्पादन में 10-15% की बढ़ोतरी, बकरी पालन के कौशल विकास से किसानों के पशु-झुंड की बकरियों के शारीरिक वजन में 20-25% की वृद्धि एवं मृत्यु दर में 8-10% की कमी देखी गई।

2.2 बकरी दैहिकी, प्रजनन एवं आवास प्रबंधन

पशु दैहिकी एवं जनन विभाग ने बकरियों के लिए प्रजनन

जैव-प्रौद्योगिकी, आनुवंशिक सुधार, पशु संरक्षण, सटीक (प्रिसाइज) पशु पालन और पशु कल्याण तकनीकों में महत्वपूर्ण प्रगति की है। विभाग ने सफलतापूर्वक CRISPR/Cas9-आधारित जीनोम एडिटिंग प्लेटफॉर्म स्थापित किया और मायोस्टैटिन जीन को लक्षित करते हुए जीनोम-एडिटेड बकरी भ्रूण तैयार किए, जिससे छोटे जुगाली करने वाले पशुओं में जेनेटिक सुधार के लिए सटीक प्रजनन (प्रिसीजन ब्रीडिंग) तरीकों की क्षमता का प्रदर्शन हुआ। आनुवंशिक लाभ में तेजी लाने और बेहतर जर्मप्लाज्म के प्रसार को सुविधाजनक बनाने के लिए भ्रूण उत्पादन, भ्रूण क्रायोप्रिजर्वेशन, भ्रूण स्थानांतरण, जीनोम एडिटिंग और लैप्रोस्कोपिक-सहायता प्राप्त प्रजनन प्रक्रियाओं सहित उन्नत प्रजनन तकनीकों को और अधिक मानकीकृत किया गया। विभाग ने एक नया हर्बल-फोर्टिफाइड वीर्य क्रायोप्रिजर्वेशन डाइल्यूटर विकसित किया, जिसने ऑक्सीडेटिव तनाव को कम करते हुए और इम्यूनोप्रोटेक्टिव गुणों को बढ़ाते हुए 'पोस्ट-थॉ' (पिघलने के बाद) वीर्य की गुणवत्ता में काफी सुधार किया, जिससे बौद्धिक संपदा संरक्षण की आशाजनक संभावनाएं पैदा हुईं। भारतीय बकरियों की प्रमुख नस्लों के लिए कुशल ईस्ट्रस सिंक्रोनाइजेशन प्रोटोकॉल को मानकीकृत किया गया, जिससे फार्म और फील्ड दोनों स्थितियों में 90% तक ईस्ट्रस इंडक्शन और फर्टिलिटी रिस्पान्स प्राप्त हुआ। जमुनापारी बकरियों में लैप्रोस्कोपिक आर्टिफिशियल इनसेमिनेशन के तरीकों को सफलतापूर्वक बेहतर बनाया गया, जिससे इस प्रोग्राम के तहत मेमनों का पहला झुंड पैदा हुआ और बेहतरीन आनुवंशिक संसाधनों का अधिक असरदार उपयोग संभव हो सका। देशी बकरी की नस्लों की 440 फाइब्रोब्लास्ट सेल लाइन्स को तैयार करके और उन्हें क्रायोप्रिजर्व करके पशुधन की जैव-विविधता को बचाने की दिशा में बड़ी प्रगति हुई। इन सेल लाइन्स को राष्ट्रीय जर्मप्लाज्म रिपॉजिटरी में जमा किया गया। इसके अलावा कम-सीरम वाले फाइब्रोब्लास्ट कल्चर मीडियम का एक नया तरीका विकसित किया गया, जिसके पेटेंट के लिए आवेदन भी किया गया। इस विभाग ने बकरियों में इन-विट्रो एम्ब्रियो प्रोडक्शन, विट्रिफिकेशन-आधारित एम्ब्रियो क्रायोप्रिजर्वेशन और लैप्रोस्कोपिक एम्ब्रियो ट्रांसफर के लिए तरीके तय करके असिस्टेड रिप्रोडक्टिव टेक्नोलॉजी प्लेटफॉर्म को भी मजबूत किया। जानवरों के

रहने की जगह और उनकी देखभाल में कई नई चीजें शुरू की गईं जैसे कि रिन्यूएबल एनर्जी (जैसे सोलर ड्रायर-कम-विंटर शेल्टर) पर आधारित बकरियों के आवास और प्लास्टिक से बने मल्टी-स्पीशीज टू-टियर हाउसिंग सिस्टम। इनसे जानवरों को अधिक आराम मिला, उनकी देखभाल बेहतर हुई और उत्पादन क्षमता भी बढ़ी। इस डिवीजन ने आर्टिफिशियल इंटेलिजेंस, कंप्यूटर विजन और प्रिंसीजन लाइवस्टॉक फार्मिंग के क्षेत्र में भी अपने अनुसंधान का दायरा बढ़ाया। इससे कंप्यूटर विजन टेक्नोलॉजी का इस्तेमाल करके शरीर का वजन पता करने और बीमारियों का पता लगाने के लिए मॉडल बनाने में मदद मिली। इन्फ्रारेड थर्मोग्राफी का इस्तेमाल सब-क्लिनिकल मैस्टाइटिस की पहचान करने और दस्त व संक्रामक एक्टिमा जैसी बकरियों की अहम बीमारियों का पता लगाने के लिए डीप-लर्निंग मॉडल बनाने में एक सहायक टूल के तौर पर किया जा सकता है। संस्थान के बकरी जर्मप्लाज्म बैंक को और मजबूत किया गया। इसके लिए बकरियों की मुख्य नस्लों से अच्छी गुणवत्ता वाले भ्रूण की 14,000 से ज्यादा खुराक को क्रायोप्रिजर्व किया गया, जिससे लंबे समय तक संरक्षण और आनुवंशिक सुधार के कार्यक्रमों को बढ़ावा मिला। इस विभाग ने जर्मप्लाज्म प्रसार, क्षमता निर्माण कार्यक्रमों, प्रशिक्षण गतिविधियों और प्रौद्योगिकी आधारित सेवाओं के माध्यम से राजस्व भी अर्जित किया, जिससे संस्थागत पहुंच और उद्यमिता विकास को बढ़ावा मिला। बकरियों के लिए गर्भावस्था का पता लगाने के लिए एक सटीक परीक्षण प्रणाली और मददकर को एक साथ लाने के लिए नई ट्रांसडर्मल दवा वितरण प्रणालियों के विकास की दिशा में अनुसंधान प्रयास किए गए, जो किसान-हितैषी प्रजनन प्रबंधन समाधानों के लिए आशाजनक हैं। कई गांवों में 1,200 से अधिक बकरियों पर किए गए व्यापक सर्वेक्षणों से प्रमुख प्रजनन संबंधी बाधाओं की पहचान करने में मदद मिली और प्रजनन क्षमता, उत्पादकता और किसानों की आजीविका में सुधार लाने के उद्देश्य से विज्ञान-आधारित परामर्श सेवाएं प्रदान करने में सहायता मिली।

2.3 बकरियों का पोषण, चारा तैयार करना एवं उत्पादों का मूल्य संवर्धन

भा०कृ०अ०प०-नेटवर्क प्रोग्राम ऑन वेटेरिनरी टाइप

कल्चर कलेक्शन (रुमेन माइक्रोब्स) परियोजना में बकरियों के रुमेन से एनारोबिक सेल्युलोलाइटिक और जंगली जुगाली करने वाले जानवरों के गोबर से टैनिन-तोड़ने वाले बैक्टीरिया की पहचान और संग्रह करने पर था। वयस्क जखराना और बरबरी बकरियों से लिए गए रुमेन लिक्विड को सीरियल डाइल्यूशन प्रोसेस से गुजारकर शुद्ध बैक्टीरियल कल्चर प्राप्त किए गए। 16S rRNA जीन एम्प्लीफिकेशन, सीक्वेंसिंग और डेटाबेस एनालिसिस का इस्तेमाल करके पांच सेल्युलोलाइटिक बैक्टीरियल आइसोलेट्स की पहचान और विशेषताएं पता की गईं। उनके एंजाइमेटिक और बायोकेमिकल गुणों का मूल्यांकन किया गया और एक्सेसन नंबर के लिए कल्चर को राष्ट्रीय पशु पोषण एवं शरीर क्रिया विज्ञान संस्थान (एनआईएएनपी), बेंगलुरु में जमा किया गया। इसके अलावा इटावा के लायन सफारी पार्क में ब्लैक बक और सांभर हिरण के गोबर के नमूनों का इस्तेमाल एनारोबिक स्थितियों में टैनिन-तोड़ने वाले बैक्टीरिया को अलग करने के लिए किया गया। चार बैक्टीरियल आइसोलेट्स प्राप्त किए गए और मॉर्फोल जिकल, बायोकेमिकल और मॉलिक्यूलर एनालिसिस के जरिए उनकी विशेषताएं पता की गईं। डीएनए सीक्वेंसिंग और 16S rRNA-आधारित पहचान ने उनके वर्गीकरण की पुष्टि की, और सभी पहचाने गए कल्चर को सुरक्षित रखा गया तथा एक्सेसन नम्बर के लिए एनआईएएनपी रिपोजिटरी में जमा किया गया। 'ग्लोबल सेंटर ऑफ एक्सीलेंस ऑन मिलेट्स' प्रोजेक्ट के तहत चने के भूसे, बाजरे की कुट्टी, ज्वार की कुट्टी और उनके एंजाइम-ट्रीटेड रूपों से तैयार किए गए सम्पूर्ण पशु आहार का मूल्यांकन करने के लिए 30 बढ़ती हुई बरबरी बकरियों पर फीडिंग ट्रायल किया गया। सभी पेलेट्स में लगभग 12% क्रूड प्रोटीन था और उन्हें 120 दिनों तक खिलाया गया। शरीर वृद्धि दर, शुष्क पदार्थ ग्राह्यता, बॉडी कंडीशन स्कोर, रक्त और रुमेन मेटाबोलाइट्स, कारकस गुण और मांस की गुणवत्ता का आकलन किया गया। परिणामों से सभी समूहों में समान शरीर वृद्धि प्रदर्शन, रक्तपैरामीटर, रुमेन फर्मेंटेशन और कारकस विशेषताओं का पता चला। एंजाइम-ट्रीटेड बाजरे की कुट्टी से बने पेलेट्स में फीड कन्वर्जन क्षमता में सुधार पाया गया। बाजरे की कुट्टी खिलाई गई बकरियों के मांस में अधिक पॉलीअनसैचुरेटेड फैटी एसिड और बेहतर स्वास्थ्य सूचकांकों के साथ स्वस्थ फैटी एसिड प्रोफाइल

दिखाई दी।

एक अन्य परियोजना, गाय के गोबर, मूत्र और अन्य ऑर्गेनिक चीजों से बने जीवामृत और बीजामृत का इस्तेमाल करके बकरियों के लिए प्राकृतिक खेती-आधारित चारा उत्पादन के तरीकों का मूल्यांकन किया गया। 2025 के रबी ऋतु के दौरान प्राकृतिक और पारंपरिक खेती के तरीकों से बरसीम चारा और दाने के लिए जौ उगाए गए। नतीजों से पता चला कि दोनों तरीकों से पैदावार में कोई खास अंतर नहीं था। प्राकृतिक खेती में जौ के दाने की पैदावार 3193.7 किग्रा/है. थी, जबकि पारंपरिक खेती में यह 3203.3 किग्रा/है. थी। वहीं बरसीम चारे की पैदावार प्राकृतिक और पारंपरिक खेती में क्रमशः 44,596.8 किग्रा/है. एवं 45,408.5 किग्रा/है. थी। गाय और बकरी के वेस्ट का इस्तेमाल करके अलग-अलग तरह के जीवामृत बनाए गए और उनका विश्लेषण किया गया, जिसमें मिली-जुली चीजों से बने जीवामृत में सबसे ज्यादा माइक्रोबियल डीएनए कंसंट्रेशन पाया गया। प्राकृतिक खेती के तरीकों को बढ़ावा देने के लिए किसानों के लिए प्रदर्शन भी आयोजित किए गए। खेती से जुड़े प्रदर्शन के लिए एग्री-ड्रोन परियोजना के तहत एक हेक्सा-कॉप्टर एग्रीबॉट ड्रोन (10 लीटर क्षमता वाले टैंक एवं 25 किग्रा कुल वजन) खरीदा गया। इसके द्वारा 3-5 मीटर की चौड़ाई में 1.2-4.0 लीटर/मिनट की दर से लिक्विड फर्टिलाइजर का प्रभावी तरीके से छिड़काव किया गया। ड्रोन उड़ाने के लिए आवश्यक रिमोट पायलट ट्रेनिंग पूरी की गई। संस्थान में प्रशिक्षण कार्यक्रमों के प्रशिक्षार्थियों और बकरी पालक किसानों के लिए नैनो यूरिया के इस्तेमाल और छिड़काव के लिए ड्रोन का खेत में प्रदर्शन कराया गया। एक और अध्ययन में चारे और दाने के उत्पादन के लिए मुजफ्फरनगरी भेड़ की ऊन के धीरे-धीरे विघटित होकर खाद बनने एवं मल्व के रूप में इस्तेमाल का मूल्यांकन किया गया। जौ और बरसीम पर किए गए पॉट एक्सपेरिमेंट से पता चला कि भेड़ की ऊन से फसल की पैदावार में सुधार हुआ क्योंकि यह न्यूट्रिएंट्स छोड़ती है, नमी सोखती है और पानी रोके रखने की क्षमता रखती है। जौ में ऊन और खाद की मात्रा बढ़ाने के साथ दाने की पैदावार धीरे-धीरे बढ़ी। प्रयोग में 16 ग्राम ऊन और 100% अनुशंसित खाद के साथ सबसे ज्यादा पैदावार (186.5 ग्राम/पॉट) मिली। बरसीम में ऊन के मल्व ने

सिंचाई के सभी लेवल पर चारे के बायोमास उत्पादन को काफी बढ़ाया, जिसमें कंट्रोल के मुकाबले 30.88% से 79.34% तक की बढ़ोतरी हुई। नतीजों से पता चलता है कि फसल और चारे की पैदावार बढ़ाने के लिए मुजफ्फरनगरी भेड़ की ऊन का उपयोग मिट्टी को उपजाऊ बनाने एवं जल धारण क्षमता बढ़ाने के लिए प्रभावी ढंग से किया जा सकता है।

बकरी के दूध से बनी चीज के मानकीकरण परियोजना के तहत (कलधी) नाम की खास चीज बनाने की प्रक्रिया को मानकीकृत किया गया और इसके फिजिकोकेमिकल, रंग, बनावट, रियोलॉजिकल और सेंसरी गुणों का पता लगाया। संस्थान द्वारा वित्त पोषित एक परियोजना में एक जैसी पैरिटी (ब्याने की संख्या) और लैक्टेशन पीरियड (दूध देने की अवधि) वाली बरबरी और जखराना बकरियों के दूध से ओलिगोसैकेराइड्स (जीएमओएस) अलग किए गए। एलसी-एमएस का उपयोग करके अलग किए गए ओएस सैंपल की प्रोफाइलिंग से पता चला कि बरबरी सैंपल में 12 कंपोनेंट थे, जबकि जखराना सैंपल में 8 कंपोनेंट थे। 'बकरी के दूध से बने कॉस्मेटिक्स' परियोजना के तहत अलग-अलग तेलों के कॉम्बिनेशन और एडिटिव्स का इस्तेमाल करके बकरी के दूध से बने बाथिंग बार (नहाने के साबुन) के तीन फॉर्मूलेशन तैयार और मानकीकृत किए गए। भंडारण के दौरान इन बाथिंग बार का मूल्यांकन किया गया। इसके अलावा बकरी के दूध से बने हैंड वॉश के अलग-अलग फॉर्मूलेशन सफलतापूर्वक तैयार और मानकीकृत किए गए तथा भंडारण मूल्यांकन के दौरान उनके फिजिकोकेमिकल, रियोलॉजिकल, माइक्रोबायोलॉजिकल और सेलुलर गुणों का मूल्यांकन किया गया। बकरी की ताजी खाल के नमूने का प्रॉक्सिमेट कंपोजिशन, फैटी एसिड और अमीनो एसिड प्रोफाइल के लिए विश्लेषण किया गया। ब्लैक बंगाल बकरी की खाल में जरूरी अमीनो एसिड की ज्यादा मात्रा के साथ बेहतर प्रोटीन गुणवत्ता पाई गई, जबकि बरबरी बकरी की खाल में ज्यादा ग्लाइसिन कंटेंट के साथ कोलेजन-रिच प्रोफाइल पाया गया, जो इसे फंक्शनल कोलेजन इस्तेमाल के लिए उपयुक्त बनाता है। इस विभाग ने वर्ष 2025 में बकरी के दूध से कलधी चीज, बाथिंग बार और हैंडवॉश बनाने की तकनीक और पैकेज ऑफ प्रैक्टिस विकसित किए।

2.4 बकरी स्वास्थ्य प्रबंधन

- वर्ष 2025 के दौरान पशु स्वास्थ्य विभाग की प्रमुख उपलब्धियाँ जिनमें एडवांस्ड थेराप्यूटिक विकास, सटीक डायग्नोस्टिक्स और एक मजबूत 'वन हेल्थ' फ्रेमवर्क शामिल हैं जिनका वर्णन नीचे दिया गया है -
- **रीकॉम्बिनेंट वैक्सीन इंजीनियरिंग में नई पहल :** विभाग ने कम्प्यूटेशनल इन-सिलिको डिजाइन से एक स्टेबल ट्राइवैलेंट रीकॉम्बिनेंट फ्यूजन प्रोटीन (rETV) के फिजिकल इन-विट्रो एक्सप्रेसन तक सफलतापूर्वक बदलाव किया। यह नई वैक्सीन, जिसे स्ट्रक्चरल स्टेबिलिटी के लिए 200 ns मॉलिक्यूलर डायनामिक्स सिमुलेशन के जरिए प्रमाणित किया गया है, क्लोस्ट्रीडियम परफ्रिंजेस के तीन मुख्य टॉक्सिन्स को टारगेट करती है और छोटे जुगाली करने वाले जानवरों में भविष्य के असरदार परीक्षण के लिए एक जरूरी आधार तैयार करती है।
- **सटीक डायग्नोस्टिक्स और इन्फेक्शन प्रोफाइलिंग :** बुसेलोसिस का बकरियों के झुंड में तेजी से पता लगाने के लिए नैनोपार्टिकल-एन्हांस्ड लेटरल फ्लो एसे और आरएनए-आधारित qRT&PCR प्रोटोकॉल विकसित करके एडवांस्ड डायग्नोस्टिक क्षमता स्थापित की गई। यह विधि एक्टिव ट्रांसक्रिप्शनल इन्फेक्शन स्टेज की पहचान करने में मदद करती है, जो अक्सर पारंपरिक सीरोलॉजिकल और आरएनए आधारित डायग्नोस्टिक तरीकों से छूट जाते हैं।
- **सतत् थेराप्यूटिक इन्वेषण एवं एथनो-वेटेरिनरी दवाएँ :** इस विभाग ने एंटी-कॉक्सीडियल हर्बल प्रोटोटाइप (जैसे बोलस और दवा-युक्त पेलेट) विकसित करके उपचार के तरीकों को मानकीकृत किया तथा इन प्रोटोटाइप की फार्माकोलॉजिकल क्षमता को प्रमाणित किया गया है। इसके अलावा बकरियों में होने वाले निमोनिया से जुड़े जटिल मल्टी-पैथोजन कारणों से निपटने के लिए 'पैकेज ऑफ प्रैक्टिसेज' तैयार किया गया।
- **एकीकृत रोग प्रबंधन एवं थेराप्यूटिक मानकीकरण :** बकरियों में निमोनिया के उपचार के लिए एक व्यापक 'पैकेज ऑफ प्रैक्टिसेज' बनाया गया, जिसमें मनहीमिया हीमोलिटिका और ओवाइन

मस्टाडिनोवाइरस जैसे जटिल कारणों को ध्यान में रखा गया। साथ ही विभाग ने मानकीकृत एंटी-कॉक्सीडियल हर्बल बोलस और दवा-युक्त पेलेट प्रोटोटाइप विकसित किए, जिनकी प्रभावशीलता को बीमारी से प्रभावित मेमनों पर प्रमाणित किया गया। इसके अलावा बरबरी और जमुनापारी बकरियों के लिए मेटाबोलिक प्रोफाइल तैयार किए गए जिनसे यूरोलियासिस के प्रति उच्च-संबंधी संवेदनशीलता और सब-क्लिनिकल कीटोसिस की काफी अधिक उपस्थिति का पता चला।

- **बौद्धिक संपदा का रणनीतिक विकास :** गर्भपात का कारण बनने वाले कई सूक्ष्मजीवों का एक साथ पता लगाने की तकनीक के लिए राष्ट्रीय पेटेंट (आवेदन संख्या 202611013019) दाखिल करके संस्थान के शोध कार्यों को मजबूती दी गई। संस्थान के नवाचार को सुरक्षित रखने के लिए इस विभाग ने अपने पेटेंट और कॉपीराइट पोर्टफोलियो को काफी मजबूत किया। 'एंटेरोटॉक्सिमिया पर गोट ट्रांसक्रिप्टोम वेब रिसोर्स' (प्रमाणपत्र संख्या SW&2025020553) के पंजीकरण के माध्यम से डिजिटल एसेट्स को सुरक्षित किया गया। इसे <https://dslab-nbr-res-in/goaTWR/> पर देखा जा सकता है। इसके अतिरिक्त 'इंटरैक्टिव प्रिवेंटिव हेल्थ कैलेंडर' के लिए दो कॉपीराइट दाखिल किए गए, जिनमें इसके साहित्यिक (आवेदन संख्या LD&2577/2026&CO) और कलात्मक (आवेदन संख्या AT&2565/2026&CO) दोनों हिस्से शामिल हैं।

2.5 तकनीकी प्रसार, क्षमता निर्माण एवं लाभकारी बकरी पालन

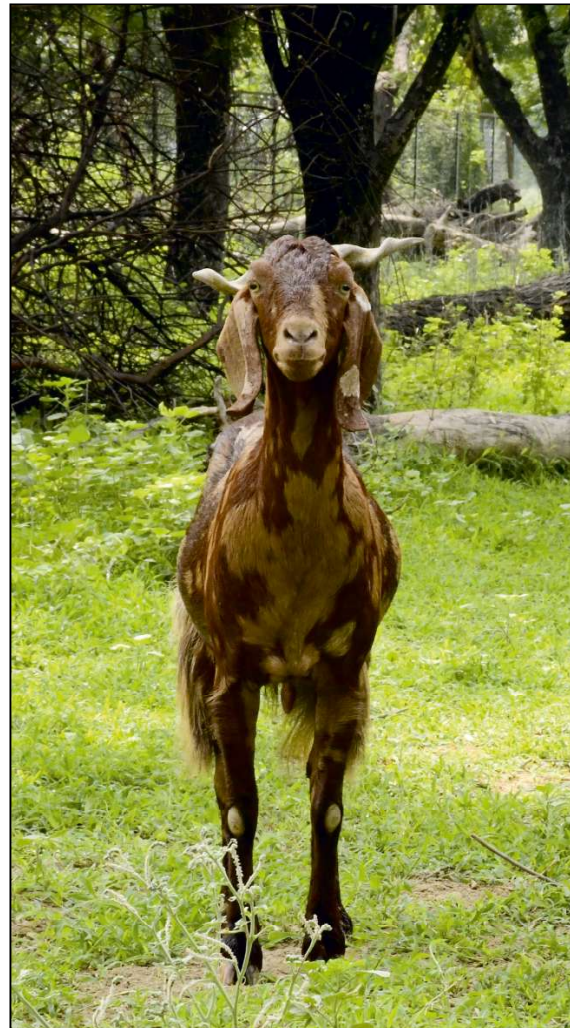
संस्थान द्वारा किए गए अनुसंधान कार्यों ने देश के अलग-अलग कृषि-जलवायु क्षेत्रों में बकरी-आधारित आजीविका प्रणालियों को मजबूत करने, वैल्यू-चेन की कार्यक्षमता को बेहतर बनाने और वैज्ञानिक बकरी पालन को बढ़ावा देने में महत्वपूर्ण योगदान दिया। बुंदेलखंड में बड़े पैमाने पर फील्ड गतिविधियों के जरिए बकरी वैल्यू-चेन विकास का एक व्यापक ढांचा तैयार किया गया। इन गतिविधियों में 40 किसान संपर्क कार्यक्रम, लगभग 1200 बकरियों के लिए 10 पशु स्वास्थ्य शिविर, बरबरी और जमुनापारी नस्ल के मल्टीप्लायर

झुंडों का वितरण और बकरी के दूध से बने मूल्य संवर्धित उत्पादों को बढ़ावा देना शामिल था।

अनुसूचित जनजाति विकास कार्य योजना की एक बड़ी उपलब्धि क्षमता निर्माण और तकनीक के प्रसार के माध्यम से आदिवासी समुदायों को सशक्त बनाना था। चार राज्यों में चलाए गए फ्रंटलाइन डेमोंस्ट्रेशन, पशु स्वास्थ्य सेवाओं और खास तौर पर तय की गई विस्तार गतिविधियों के माध्यम से कुल 1173 अनुसूचित जनजाति के किसानों (जिनमें 715 महिलाएं शामिल थीं) को वैज्ञानिक विधि से बकरी पालन का प्रशिक्षण दिया गया।

गैर-गोवंशीय दुग्ध परियोजना के अंतर्गत उत्तर प्रदेश, राजस्थान, गुजरात और महाराष्ट्र में बकरी दूध के वैल्यू-चेन के ऐसे मॉडल की पहचान एवं डॉक्यूमेंटेशन किया गया जिन्हें बड़े पैमाने पर अपनाया जा सकता है। इस अध्ययन से संगठित दूध खरीद प्रणालियों और बकरी के दूध से चीज, पनीर और घी बनाकर मूल्यवर्धन करने की आर्थिक व्यवहार्यता स्थापित हुई। परिणामों से पता चला कि किसानों की आय बढ़ाने और बकरी-आधारित सतत एवं स्थिर उद्यमों को बढ़ावा देने के लिए पक्के मार्केट लिंकेज और सामूहिक विपणन प्रणाली कितने महत्वपूर्ण हैं। इसके अलावा उत्तर प्रदेश और राजस्थान में मांस के लिए पाली जाने वाली बकरियों की बाजार में कीमत के अंतर के विस्तृत विश्लेषण से बाजार की कार्यक्षमता के बारे में अहम जानकारी मिली एवं पता चला कि संगठित विपणन श्रृंखला में उत्पादकों को अधिक हिस्सा मिलता है और मूल्य हस्तांतरण बेहतर होता है। इस अनुभाग ने बकरी पालन से संबंधित कई वैज्ञानिक एवं विस्तार साहित्य तैयार किया जिनमें सात रिसर्च आर्टिकल, एक पॉलिसी पेपर, एक पुस्तक, एक आम लोगों के लिए आर्टिकल, दो मुख्य पेपर, पाँच पुस्तकों के अध्याय और एक तकनीकी विस्तार लेख हैं। वैज्ञानिक बकरी पालन पर 9 राष्ट्रीय प्रशिक्षण कार्यक्रम एवं 8 प्रायोजित प्रशिक्षण कार्यक्रम आयोजित करके क्षमता-निर्माण के प्रयासों को और मजबूत किया गया। इससे कई राज्यों के किसानों, उद्यमियों, बेरोजगार युवाओं और पशुपालन से जुड़े व्यवसायियों को लाभ मिला। इस दौरान 7 किसान मेलों में भाग लेकर बकरी पालन की तकनीक का प्रचार-प्रसार किया गया। वैज्ञानिक विधि से पशुपालन अनुसंधान एवं नवाचार के

बारे में जानने के लिए स्कूलों और विश्वविद्यालयों के 2000 से अधिक छात्रों ने संस्थान का भ्रमण किया। इसके अतिरिक्त ऑल इंडिया रेडियो के सहयोग से चलाया गया 'सीआईआरजी बकरी पालन पाठशाला' वैज्ञानिक बकरी पालन की जानकारी देने के लिए बड़े पैमाने पर संचार का एक प्रभावी माध्यम बना। 10 एपिसोड वाले इस प्रोग्राम को चार क्षेत्रीय आल इंडिया रेडियो स्टेशनों के माध्यम से दो बार प्रसारित किया गया, जिससे पशुपालकों तक इसकी पहुँच काफी बढ़ गई। संस्थान के 'फार्मर्स सिंगल विंडो सिस्टम' ने संबंधित लोगों से जुड़ने और सलाह देने वाली सेवाओं में अहम भूमिका निभाई। इस दौरान, किसानों, छात्रों, अनुसंधानकर्ताओं, गैर सरकारी संस्थाओं एवं विभिन्न विभाग के अधिकारियों सहित 9192 लोगों ने संस्थान की सेवाओं का लाभ उठाया और 2566 हेल्पलाइन कॉल्स का उत्तर दिया गया।



CHAPTER 1

CIRG : AN INTRODUCTION



1

CIRG : AN INTRODUCTION

The Indian Council of Agricultural Research (ICAR) laid the foundation of a dedicated National Goat Research Centre at Makhdoom, Farah in the Mathura district of Uttar Pradesh on 12 July, 1976, marking a significant milestone in organised goat research in India. In recognition of its growing mandate, the Centre was elevated to the status of a full-fledged institute on the same date in 1979 and subsequently designated as the ICAR-Central Institute for Research on Goats (CIRG).

Strategically situated at an equidistant location from two historically and culturally renowned cities Mathura, the revered birthplace of Lord Krishna (approximately 25 km away), and Agra, home to the world famous Taj Mahal (approx. 32 km away) the Institute enjoys both geographical accessibility and cultural prominence.

The Institute is headed by a Director, who serves as the chief executive authority, overseeing its academic, administrative, and research functions. The overall governance and strategic direction of the Institute are guided by statutory and advisory bodies, including the Institute Management Committee (IMC), the Research Advisory Committee (RAC), and the Quinquennial Review Team (QRT), which collectively ensure scientific rigor, accountability and relevance of its research programmes.

ICAR-CIRG comprises four specialized research divisions along with one dedicated section, supported by robust infrastructural facilities. These include a well-equipped library, the Agricultural Knowledge Management Unit (AKMU), the Project Management and

Evaluation (PME) Cell, an experimental agricultural farm, the Information Technology and Management Unit (ITMU), a livestock farm, and a dedicated health section. Together, these facilities enable the Institute to effectively execute its mandate of advancing goat production systems through multidisciplinary research and innovation.

A key component of ICAR-CIRG is its role as the Coordinating Unit of the All India Coordinated Research Project (AICRP) on Goats. This flagship initiative focuses on the systematic improvement of diverse indigenous goat breeds across different agro-climatic regions of the country, under both farm and field conditions, with the objective of enhancing productivity, adaptability and overall performance.

The Institute is also well equipped with modern information and communication infrastructure to facilitate seamless connectivity and stakeholder engagement. It can be contacted through telephone numbers 0565-2970995, and a dedicated helpline at 0565-2970999. Further information regarding its mandate, research activities, and ongoing programmes is accessible through its official website: www.cirg.res.in.

Through its sustained scientific contributions, institutional strength, and national outreach, ICAR-CIRG continues to serve as a premier centre of excellence in goat research, development and technology dissemination in India.

VISION

To develop - the Goat- as a source of livelihood and nutritional security for the prosperity of India.

Administration & Management	Animal Genetics & Breeding Division
Dr. Manish K. Chatli, Director	Dr. M.K. Singh, Pr. Scientist & Head
Dr. Arvind Kumar, Vigilance Officer	Dr. Gopal Dass, Pr. Scientist
Sh. Shyam Sunder, Sr. Admin. Officer	Sh. V.K. Sharma, ACTO
Sh. Jagbir Singh, Admin. Officer	Sh. Pushpendra Verma, T-1
Sh. Pushpendra Yadav, Asstt. Admin. Officer	Sh. Saurab Singh, T-1
Sh. Arvind Chauhaan, AAO & I/c, F&AO	Sh. Shashi Kumar Kesari, T-1
	Sh. Rishi Raj, T-1

Animal Health Division	ANM&PT Division
Dr. Ashok Kumar, Pr. Scientist & Head	Dr. Ravindra Kumar, Pr. Scientist & Head
Dr. K. Gururaj, Pr. Scientist	Dr. B. Rai, Pr. Scientist
Dr. A.K. Mishra, Sr. Scientist	Dr. Arvind Kumar, Pr. Scientist
Dr. Nisha Bisht, Scientist	Dr. V. Rajkumar, Pr. Scientist
Dr. Vinay Chaturvedi, CTO	Dr. A.K. Verma, Sr. Scientist
Dr. Neha Gupta, STO	Dr. T.P. Singh, Scientist
Sh. T.K. Gautam, ACTO	Dr. Varsha Vihan, STO
Mrs. Anjali Singh, T-4	Sh. Suraj Pal, ACTO
Ms. Smriti Bharti, T-1	Sh. Rajendra Singh
	Sh. Amit Singh, T-1
	Ms. Vaishali, T-1
Animal Physiology & Reproduction Division	EE&SE Section
Dr. Mukesh Bhakat, Pr. Scientist & Head	Dr. A.K. Dixit, Pr. Scientist
Dr. Ravi Ranjan, Pr. Scientist	Dr. Khushyal Singh, Sr. Scientist
Dr. S.P. Singh, Pr. Scientist	Sh. Pravesh Sethi, T-4
Dr. Y.K. Soni, Sr. Scientist	
Dr. Gayathri S. Lal, Scientist	
Sh. Komal, T-1	
AICRP on Goats Improvement	Network Project on Sheep
Dr. M.K. Singh, Pr. Scientist & I/c	Dr. Gopal Dass, Pr. Scientist & PI
Dr. Gopal Dass, Pr. Scientist	Sh. Rishi Raj, T-1
Prioritization, Monitoring and Evaluation (PME) Cell	Agriculture Farm
Dr. K. Gururaj, Senior Scientist & I/c	Dr. Arvind Kumar, Pr. Scientist & I/c
Dr. A. K. Verma, Senior Scientist & II nd I/c	Sh. Sugad Singh, T.O.
Dr. Y.K. Soni, Senior Scientist & Member	Sh. Prakash Bharatiya, T-1
Dr. Nitika Sharma, Senior Scientist, Member	
Training & Skill Development Cell	AKMU Unit
Dr. Khushyal Singh, Sr. Scientist & Nodal Officer	Dr. V. Rajkumar, Pr. Scientist & I/c
	Sh. Satish Chandra, ACTO
Medical Dispensary	Vehicle Section
Dr. Nitika Sharma, Sr. Scientist & I/c	Sh. Jagbir Singh, Admin. Officer & I/c
Sh. Om Prakash, LDC	Sh. Om Prakash, LDC
Sh. Raju Kumar, LDC	
RTI Cell	Estate & Maintenance Section
Sh. Jagbir Singh, Admin. Officer & CPIO	Sh. P.K. Sharma, Security Officer & I/c
Sh. Prakhar Saxena, DA	Sh. Santosh Kumar Gupta, T-1
HRD Cell	Security Section
Dr. T.P. Singh, Scientist & I/c	Dr. A.K. Dixit, Pr. Scientist & I/c
	Sh. P.K. Sharma, Security Officer
Institute Technology Management Unit	Library
Dr. Ravi Ranjan, Principal Scientist & I/c	Sh. Jagbir Singh, Admin. Officer & I/c
Dr. T.P. Singh, Scientist & Member	Sh. Shiv Singh, LDC
Dr. A.K. Mishra, Sr. Scientist & Member	
Horticulture Section	Rajbhasha Hindi Cell
Sh. Virendra Kumar, T.O	Dr. T. P. Singh, Scientist & Incharge
Sh. Rohan Singh, T-1	Shri Mahesh Kumar, Assistant

Project Staff	Designation	Project Staff	Designation
Dr. Rakesh Kaushik	Research Associate	Mr. Dharmendra Singh	Young Professional-I
Dr. Juhi Pathak	Research Associate	Mr. Manoj Sharma	Young Professional-I
Mr. Akhilesh Kumar	Young Professional-II	Mr. Suneel Kumar	Young Professional-I
Mr. Ashutosh Mishra	Young Professional-II	Mr. Subhash Rajoria	Young Professional-I
Mr. Narendra Pratap Singh	Young Professional-II	Mr. Satendra Kumar Singh	Young Professional-I
Dr. Manisha Pathak	Young Professional-II	Mr. Ravi Kant	Young Professional-I
Mr. Manish Kumar	Young Professional-II	Mr. Pravesh Agarwal	Young Professional-I
Mr. Deepak Kumar	Young Professional-II	Mr. Nishant Sharma	Young Professional-I
Mr. Ankit Tiwari	Young Professional-II	Sh. Munesh Kumar	Young Professional-I
Mr. Kamal Singh	Young Professional-I	Mr. Shiv Singh	Young Professional-I
Ms. Komal	Young Professional-I	Mr. Rajesh Kumar	Young Professional-I
Mr. Sandeep Kumar	Young Professional-I	Ms. Shradha Gemini	Young Professional-I
Mr. Kunj Bihari Rajpoot	Young Professional-I	Sh. Chandan Singh	Skilled Worker
Mr. Chokhe Lal	Young Professional-I	Mr. Rajveer Singh	Skilled Worker
Mr. Praveen Kumar	Young Professional-I	Mr. Ashish Churamani	Junior Research Associate
Mr. Ranjeet Singh	Young Professional-I	Mr. Dinesh Chand	Project Associate
Mr. Deshraj	Young Professional-I	Mr. Ramavtar	Field Worker
Ms. Tanuja Kushwah	Young Professional-I	Mohd. Sohil	Lab Attendant
Mr. Manish Kushwah	Young Professional-I	Mr. Gopal	Lab Attendant
Mr. Abhishek Kumar	Junior Research Associate	Mr. Nitin Kumar	Field Worker
Mr. Krishna Kumar	Semi Skilled Worker		

MISSION

Improvement in productivity of goat through research, extension and HRD support.

MANDATE

To undertake Research, Training and Extension Education Programmes for improving milk, meat and fiber production of goats and to develop processing technologies of goat products.

QUALITY POLICY

CIRG is committed to enhance goat productivity through research, extension and HRD support for the benefit of society, industry and scientific community.

Towards this, we shall,

- Continue to align our actions with organizational values
- Implement QMS as a platform for improving performance standard
- Continually improve our performance by periodical review of quality objectives
- Actively involve and adequately empower all personnel.

OBJECTIVES

- To undertake basic and applied research in all disciplines relating to goat production and products technology.
- To develop update and standardize area specific package of practices on breeding, feeding, management prophylactic and curative health cover of goats.
- To impart National and International Trainings in specialized fields of goat research and development.
- To transfer technologies for improving milk, meat and fibre production and value addition of goat products.
- To provide referral and consultancy services on goat production and product technologies.

Major Institutional Achievements

The Institute has made significant and sustained contributions towards the advancement of goat production systems in India through the development of a wide spectrum of farmer-centric packages of practices and commercially viable technologies. These innovations have

been designed with a strong emphasis on field applicability, economic feasibility, and scalability, thereby directly benefiting goat rearers across diverse agro-climatic regions of the country.

Over the years, the Institute has successfully filed 20 patents, reflecting its strong commitment to innovation and intellectual property generation in the field of goat science and allied technologies. In addition, 12 developed technologies have already been successfully commercialized, facilitating wider dissemination and adoption at the field level and contributing to improved productivity and profitability in goat farming enterprises.

Beyond these achievements, several promising technologies are currently at various stages of refinement and commercialization. These include value-added goat meat and milk products aimed at enhancing market opportunities and nutritional diversification, advanced diagnostic tools for economically important diseases such as brucellosis and Johne's disease (JD), herbal and ethnoveterinary formulations for improved animal health management, and intravaginal pessaries designed to enhance reproductive efficiency in goats.

Collectively, these advancements underscore the Institute's pivotal role in translating scientific research into practical, farmer-oriented solutions, thereby strengthening the goat production sector and contributing to rural livelihood security and entrepreneurship development.

The following represent the key achievements of the Institute:

AGB Division

- Recorded excellent milk production with 180.63 L total lactation yield and 155.45 L milk yield in 140 days in Jamunapari goats.
- Achieved steady growth performance, with kids reaching 26.41 kg at 12 months of age in Jamunapari goats.
- Demonstrated genetic improvement potential with moderate heritability estimates ($h^2 = 0.16-0.20$) and a selection differential of 4.98 kg for 9-month body weight in Jamunapari goats.
- Supplied 150 superior Jamunapari goats for field improvement and provided 8,155 litres of milk to the GPT section.
- Achieved high reproductive efficiency with an

annual kidding rate of 1.89 per doe and kidding efficiency up to 180.7% in Barbari Goats.

- Maintained strong growth performance, with champion male kid reaching 39.5 kg at 12 months under semi-intensive management in Barbari Goats.
- Barbari doe No. 12941 achieved a remarkable 310 litres milk yield in 258 days, highlighting the breed's dairy potential.
- Distributed 246 superior Barbari goats to farmers and development agencies for genetic improvement programs.
- Recorded average 90-days milk yield as 131.86 litre which ranged from 108-172 litre in Sojat goats.
- Recorded average 6 months body weight of kids: 21-34, ranged from 16-34 kg in Sojat goats.
- Recorded average litter size/ kidding: 1.5 in Sojat goats
- Recorded zero mortality during birth to 3 month and 3-6 months of age in Sojat goats.
- Recorded average adult and overall mortality rate as 4.88 and 3.57%, respectively in Jakhrana goats.
- Recorded excellent milk production with 164.28 L milk yield in 140 days and 150.90 L total lactation yield in Jakhrana goats.
- Recorded 25.71 kg body weight at 12 months in Jakhrana goats.
- Results showed significant genetic improvement potential with heritability estimates up to 0.441 for 3-month body weight in Jakhrana goats.
- Supplied 66 superior Jakhrana breeding animals and established 2 multiplier flocks for field-level genetic improvement.
- Recorded 38.65 kg average body weight at 12 months age and in adult males averaging 54.37kg in Muzaffarnagri sheep.
- Recorded high average daily gains of 136.77 g/day during 0-3 months, reflecting superior growth potential in Muzaffarnagri lambs.
- A total of 15 Muzaffarnagri male lambs were kept under feedlot experiment and recorded 45.0kg. body weight at six month age, which was ever highest since inception of the project.

- Results showed significant genetic improvement with heritability estimates up to 0.445 for 3-month body weight and a selection differential of 6.5 kg in Muzaffarnagri sheep.
- Supplied 109 superior Muzaffarnagri sheep to research organizations, development agencies, NGOs, and progressive farmers for breed improvement programs.

APR Division

- Developed a Plastic based Multi-purpose Animal Shelters for housing goats and poultry.
- Development of Herbal Fortified Buck Semen Diluter containing Herb of (*A. racemosus*, *Whithania somnifera*, *Moringa oleifera* and *Tribulus terrestris*) and a particular combination (ABC) improved the cryopreservation efficiency of elite buck semen.
- Developed an in-house IVM medium enhancing oocyte maturation and post-IVF embryo development.
- Formulated a melatonin-supplemented vitrification medium for cryopreservation of oocytes and embryos.
- Until now, fibroblast cells of 28 goat breeds have been isolated, cultured, characterized and cryopreserved.
- Established and optimized a CRISPR/Cas9-mediated MSTN gene editing workflow in caprine fetal fibroblast cells and embryos (both IVF-derived and MOET-derived), including sgRNA screening, electroporation-based transfection, single cell isolation, clonal cell line development, validation through T7E1 assay and Sanger sequencing and cryopreservation of edited cell lines and embryos.
- Successfully achieved pregnancy following transfer of edited embryos and confirmed genome editing in one recovered fetus, demonstrating the feasibility of producing genetically edited goats through electroporation-mediated embryo editing.
- Successfully validated developed estrus synchronization protocol in 112 female goats and sheep with up-to 88% estrus induction and up-to 75% pregnancy rates.
- An interactive android based mobile application for scientific reproductive management of goats named CIRG Goat-ReproXpert is under development.
- Successfully optimized the technique of laparoscopic Artificial insemination in Jamunapari goats.
- First time produced 03 Jamunapari kids (one twin and one singleton) through laparoscopic AI.
- Deep learning and machine learning models were developed for goat body weight estimation
- First prototype of web application for goat bodyweight estimation has been developed and standardization is going on.
- 14 Goat breeds dataset was captured.
- Infrared thermography can be used as supportive tool for monitoring subclinical mastitis in Goats.
- Deep learning models were developed for identification of Ecthyma and diarrhoea in goats.
- Transrectal ovarian ultrasound scanning for the detection of ovulations by means of the disappearance of large follicles (5 to 6 mm) were seen up to 24 hr. from the start of estrus. Hence preliminary data suggest that AI should be done after 24 hr. of estrus detection.
- Optimization of BaCl₂ concentration (1% w/v)-based precipitation assay for urine samples with respect to pregnancy diagnosis. Reduction of non-specific turbidity through controlled acid pre-treatment.
- Successfully optimized the film formation using different formulation of pharmacological ingredients.
- Developed and filed one design patent, one trademark and one copy right.

ANM & PT Division

- Five anaerobic cellulolytic bacterial isolates were successfully isolated from rumen liquor of adult Jakhrana and Barbari goats and identified using 16S rRNA gene sequencing and database analysis.
- The isolates were evaluated for their enzymatic, biochemical, morphological, and molecular characteristics and the characterized cultures were submitted to NIANP, Bengaluru, for accession and long-term preservation.
- Four anaerobic tannin-degrading bacterial isolates were obtained from Blackbuck and

Sambar deer faecal samples collected at Lion Safari Park, Etawah, characterized through molecular techniques, and deposited in the NIANP repository.

- Feeding trial on 30 growing Barbari goats evaluated complete pellet feeds made from gram straw, pearl millet stovers, sorghum stovers, and their enzyme-treated forms, all containing about 12% crude protein and fed for 120 days.
- Enzyme-treated millet stover pellets improved feed conversion efficiency, while pearl millet stover-based diets produced meat with a healthier fatty acid profile, including higher polyunsaturated fatty acids and better health indices.
- Natural farming proved comparable to conventional farming, with only marginal differences in productivity. Barley grain yield under natural farming was 3193.7 kg/ha compared to 3203.3 kg/ha under conventional farming, while berseem fodder yield was 44,596.8 kg/ha versus 45,408.5 kg/ha.
- Muzaffarnagari sheep wool proved effective as a slow-release fertilizer and mulch, improving soil moisture retention and nutrient availability for feed and fodder crops.
- In barley, grain yield increased with higher wool application and fertilizer levels, achieving the highest yield (186.5 g/pot) with 16 g wool combined with 100% recommended fertilizer dose.
- Successfully standardized the manufacturing process of traditional artisan goat milk Kaladhi cheese.
- Established breed-specific differences in milk oligosaccharide composition from Barbari and Jakhrana goats.
- Formulated and standardized the technology and package of practices for goat milk-based bathing bars and hand wash.
- Characterized goat skin from different breeds for proximate composition, fatty acid profile, and amino acid composition.

Animal Health Division

- Extensive AMR Surveillance Network: Processed 288 diverse biosamples across four districts of Uttar Pradesh, successfully isolating 286 bacterial targets (*E. coli*, *S.*

aureus, and *Salmonella* spp.) to map localized resistance baselines.

- Identification of High-Risk AMR Markers: Uncovered critical resistance traits in livestock milk and nasal isolates, including a 27.5% prevalence of MRSA and a 3.75% prevalence of VRSA (carrying the VanB gene) in goat milk.
- Enzymatic Resistance Mapping in *E. coli*: Documented a high burden of antimicrobial resistance genes (ARGs) in *E. coli*, driven by AmpC-type β -lactamase (49.5%), ESBL (18.1%), and the high-risk carbapenemase gene NDM-1 (2.02%).
- Successful Expression of Trivalent Vaccine Clones: Reverse-engineered a bioinformatics-assisted multi-epitope vaccine construct for Enterotoxaemia by cloning and expressing a stable trivalent fusion protein from *C. perfringens* toxins (A, B, and C) in an *E. coli* expression vector.
- Copyright for GoaTWR-E Database: Secured official copyright registration (Certificate No. SW-2025020553) from the Government of India for the "Goat Transcriptome Web Resource on Enterotoxaemia" software database.
- Isolation and Characterization of Candidate Lytic Phages: Purified 13 *E. coli* bacteriophages from environmental and clinical samples, identifying three isolates (4, 12, and 13) with the broadest lytic activity (up to 66.67%) against caprine mastitis strains.
- Phage Stability and Kinetics Validation: Confirmed that selected *E. coli* and *S. aureus* phages possess robust kinetic properties for therapeutic deployment, featuring a short 20-minute latent period, high burst sizes (up to 415), and extreme stability across temperatures up to 55°C and pH ranges from 5 to 11.
- Large-Scale Small Ruminant Mycoplasmosis Profiling: Screened 696 biological samples via PCR, establishing a 24.57% overall positivity rate for *Mycoplasma* spp. and identifying respiratory lung tissue as the primary infection reservoir (70.18%).
- Metagenomic Dissection of Caprine Pneumonia: Unveiled the polymicrobial nature of caprine pneumonia using metagenomic sequencing on 70 lung samples, identifying a

heavy predominance of bacterial pathogens and anaerobic clusters alongside low-abundance viral predisposing factors.

- **Formulation of a Pneumonia Control Package:** Developed a comprehensive "Package of Practices (PoP) for the Prevention and Control of Caprine Pneumonia" to significantly minimize herd incidence and boost farmers' livelihood security.
- **Validation of Anti-Coccidial Polyherbal Extracts:** Demonstrated a highly effective ethno-veterinary alternative by creating an oral semi-liquid polyherbal formulation from Plant XVII (leaves) and Plant XVIII (pods) that safely and drastically reduced fecal oocyst counts in infected kids.
- **Bioactive Phytochemical Profiling:** Published a comprehensive "Research Herbarium Atlas" after successfully profiling and characterizing potent secondary plant metabolites using GC-MS and FTIR spectroscopy.
- **In-silico Design of Brucella Diagnostic Construct:** Engineered a high-confidence chimeric diagnostic construct integrating mature Protein A epitopes from *Brucella melitensis* (OMP31) with a caprine β -defensin-2 adjuvant to lay the foundation for rapid field test assays.
- **Mapping Transcriptional Signatures of Brucella Latency:** Defined stage-specific immune interactome differences across goat breeds, proving that RNA-based qRT-PCR effectively catches latent carriers missed by traditional serological monitoring.
- **Risk-Profiling of Major Metabolic Disorders:** Established clear management baselines for herd-health disruptors, identifying a massive 80% pregnancy toxemia prevalence in multi-bearing does under extensive systems and proving that intensive concentrate feeding shifts urolithiasis prevalence in bucks to 66.67%.

EE&SE Section

- Developed a comprehensive goat value-chain model in Bundelkhand through 40 farmer outreach programmes, 10 animal health camps covering 1,200 goats, distribution of Barbari and Jamunapari multiplier flocks, and promotion of value-added goat milk products.
- Empowered 1,173 Scheduled Tribe farmers (including 715 women) under the DAPST

programme through training, frontline demonstrations, animal health services, and scientific goat husbandry interventions across four states.

- Identified and documented scalable goat milk value-chain models in Uttar Pradesh, Rajasthan, Gujarat, and Maharashtra, demonstrating the economic viability of organized milk procurement and value-added products such as cheese, paneer, and ghee.
- Generated evidence on market efficiency and price spread in meat goat markets of Uttar Pradesh and Rajasthan, highlighting higher producer share and improved value transmission through organized marketing channels.
- Produced significant scientific and extension outputs, including 7 research articles, 1 policy paper, 1 book, 5 book chapters, 2 lead papers, 1 popular article, and 1 technical extension publication, alongside 17 training programmes on scientific goat farming.
- Strengthened technology dissemination and stakeholder engagement through Kisan Melas, AIR-based "CIRG Bakri Palan Pathshala," student exposure visits, and advisory services, reaching over 9,192 visitors and addressing 2,566 farmer helpline queries.

Awards and Achievements

- ICAR's Sardar Patel Outstanding Institute-2010.
- ICAR-Rajshri Tandan Rajbhasha award for two successive years 2008 and 2009 – for significant achievement in popularization and progressive use of Rajbhasha (Hindi).
- NRDC National Societal Innovation Award, 2014 and 2018
- ICAR–Rafi Ahmad Kidwai Award- 2016.
- VASVIK Industrial Award 2019 by IARI, New Delhi.
- Rajbhasha Gaurav Award (2015) to Dr. D K Sharma to his book Bakri-Bhed Rog: Chikitsa Avam Prabandhan.by Rajbhasha Vibhag Govt of India (Bestow by President of India) on 14 Sept 2016
- International Endeavour award-2018 by Government of Australia.
- ICMR-DHR Longterm Fellowship-2024

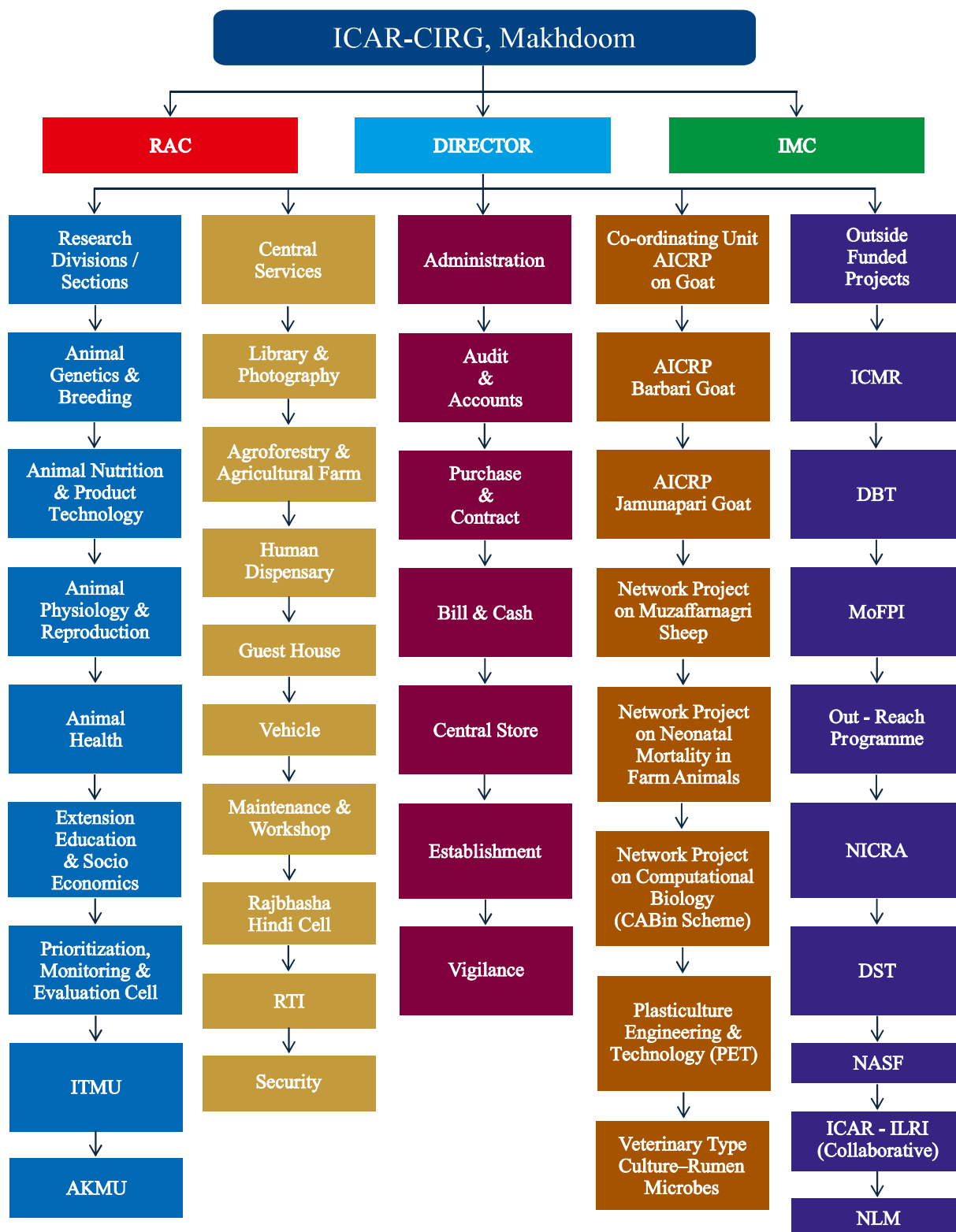
CHAPTER 2

ORGANIZATIONAL SETUP



2

ORGANIZATIONAL SETUP



CHAPTER 3

INFRASTRUCTURE DEVELOPMENT



3

INFRASTRUCTURE DEVELOPMENT



Renovation of Shalihotra Hostel



Renovation of Central Hall (Auditorium)



Renovation of Barbari Unit



Renovation of Jamunapari Unit



Road construction

Renovation of office room



Renovation of GPT Lab



Infrared Thermal Camera



Micromanipulation system



Cell Fusion Machine



Table top film former



Lab 29



MRL Lab



Molecular and Genetics Lab



Milk pasteurization unit



Spray dryer



Softy making machine

CHAPTER 4

RESEARCH ACCOMPLISHMENTS



4

RESEARCH ACCOMPLISHMENTS

4.1 Animal Genetics and Breeding Division

4.1.1 Project Title: Genetic improvement of Barbari goats for milk and meat production (Funded by ICAR-AICRP)

Principal Investigator Dr. M. K. Singh

Co-Principal Investigators Dr. Gopal Dass, Dr. Ravi Ranjan, Dr. Ravindra Kumar, Dr. V. Rajkumar, Dr. A. K. Dixit, Dr. S. P. Singh and Dr. Manish Kumar Chatli

Barbari goats have occupied a significant place for commercial farming not only in India but in many SAARC countries due to high prolificacy-fecundity, delicious meat, good milk yield and adaptability over wide range of agro-climatic conditions and feeding management. Barbari goat is native of Agra-Aligarh division of Uttar Pradesh however its breeding tract has extended almost all Northern states and sub-humid and sub temperate regions of northern, southern and eastern regions of India.

The opening balance of flock on 1st January 2025 was 552 and closing balance was 645 on 31st December 2025. Conception rate through natural services in Ist and IInd and IIIrd services was 70.3, 20.9 and 7.1%. Incidence of abnormal kidding was 3.9%. Fertility status of bucks was observed satisfactory as >82% females conceived through natural service in first service. Oestrous exhibition pattern during this year showed relatively more cyclicity during peak winters (December, January and February) and lesser cyclicity in July-August months. There were 432 kids born from 282 does with litter size of 1.53. Kids born as multiples were 67.6% (single, twin and triplet kidding were 32.4, 62.0 and 5.55%, respectively). Litter size was

significantly less (1.29) in Ist parity however, remains >1.84 from IInd parity onwards. Average age at first service, weight at first service, age at first kidding, weight at first kidding and first kidding interval in 2025 was 407.04 ± 17.13 days, 20.19 ± 0.35 kg, 552.34 ± 17.10 days, 24.19 ± 0.42 kg and 289.56 ± 17.34 days, respectively (Table-1). Nearly 8.4% reduction was obtained this year in average age at first service and first kidding interval. Females born as single have significantly less age at first kidding than their counterparts. There has been consistent improvement (decline) in reproductive traits over the years in the flock. Kidding interval also significantly declined after IInd kidding onwards. Barbari females though, attain sexual maturity at the age of 220 days, slightly more (10-15%) age at first service is due to restriction of breeding in spring, rainy and winter seasons for better management, kid's growth and survivability and doe's lactation performances. An average litter size/kidding was 1.53 and annual kidding rate/doe was 1.89 this year. Breeding efficiency (%) on the basis of doe's available and doe's tupped were 122.6 and 97.3%. Kidding efficiency (%) on the basis of does available and doe's tupped were 180.7 and 143.5%, respectively.



Fig. 1 : Barbari Doe in Grazing Area



Fig. 2 : A young boy feeding leaves to a goat kids

Table 1: First parity reproductive performance in Barbari goats over the year

Overall Mean	Reproductive performance				
	Age at first Service (d)	Age at first kidding (d)	Wt. at first Service (kg)	Wt. at first kidding (kg)	First Kidding Interval (d)
	461.68±8.36 (286)	601.35±8.34 (286)	20.00±0.17 (286)	23.79±0.20 (286)	331.56±24.44 (171)
Year of birth		**	*	**	**
2020	490.47 ^a ±17.96 (61)	632.77 ^a ±17.92 (61)	19.57 ^b ±0.37 (61)	23.03 ^a ±0.44 (61)	366.38 ^a ±18.58 (39)
2021	496.87 ^b ±18.74 (56)	670.78 ^b ±18.71 (56)	19.82 ^b ±0.39 (56)	23.16 ^b ±0.46 (56)	344.02 ^b ±17.49 (44)
2022	445.65 ^c ±20.68 (46)	587.13 ^c ±20.64 (46)	18.74 ^b ±0.43 (46)	23.04 ^b ±0.51 (46)	354.14 ^c ±19.61 (35)
2023	441.34 ^b ±18.74 (56)	585.73 ^c ±18.71 (56)	21.70 ^b ±0.39 (56)	25.50 ^a ±0.46 (56)	311.26 ^d ±20.84 (34)
2024	407.04 ^c ±17.13 (67)	552.34 ^c ±17.10 (67)	20.19 ^b ±0.35 (67)	24.19 ^c ±0.42 (67)	289.56 ^c ±17.34 (19)
** <i>P</i> <0.01, * <i>P</i> <0.05					

Table 2. Selection differential (9 months body weight and 140 days milk yield)

Year	9-M weight (kg)	Population Mean (Body wt.)	140-d MY	140-d MY	Selection differential	
	of Selected male		(Selected Male's doe yield)	Population Mean	Body Weight (kg)	Doe's Milk (lit.)
2021-22	22.46 (4)	14.85	133.0	121	7.61	12.0
2022-23	19.27 (10)	15.82	134.0	116.0	3.45	17.94
2023-24	24.0 (10)	16.50	149.0	114.2	7.50	34.8
2024-25	25.4 (11)	17.20	131.8	123.4	8.20	8.4
2025-26	25.6 (8)	18.83	129.3	124.3	6.77	5.0

The least squares means of body weight of kids born in the year 2025 were 2.15±0.01, 9.18±0.09, 12.95±0.21, 19.03±0.27 and 23.97±0.35 kg, respectively at birth, 3, 6, 9 and 12 months of ages (Table-3). Champion male kid (14457) born as twin recorded highest body weight as 34.0 and 39.5 kg at 9 and 12 months of age under semi-intensive management. These body weights were significantly affected by the year and season of birth, type of birth, sex of kid and parity. Higher body weights of kids at different ages were obtained this year. Single born kids and males were significantly heavier than those born as multiple and female and maintained superiority for body weight up to 9 month however, magnitude of difference in body weight between single and multiple declines with the advancement of age. The selection differential for 9 months body weight was 6.77 kg and for dam's 140 days milk yield was 5.0 litres. Flock revealed moderate h^2 estimates (0.13±0.03 to 0.31±0.04) for growth traits in this flock.

An experiment conducted in Barbari kids both in male and females of 6 month aged kids. The liver tonic @3%, linseed oil @ 3% and 2% of concentrate ration was provided to growing kids as per schedule of diet i.e. 300 gram concentrate to kids during 6-9 months of age to assess the effect

of 3% liver tonic and linseed oil @2% and 3% of kids body weight. Highest kids body weight was recorded in IInd group (3% linseed oil) followed by 3% liver tonic both in male and females. However, relative effect was more pronounced in male as compared to females.

The least square means for 90 days milk yield, 140 days milk, total lactation yield and lactation length in 2025 were 84.20±1.25, 124.46±1.83, 130.17±2.32 litre, 158.45±1.85 days, respectively (Table-5). Sustainable improvement in lactation performances in the herd from last ten years was recorded. Year and season of kidding and parity are major non-genetic factors affecting lactation performance. Goats produced 145-165, 166-200 and >200 liter milk constitutes 13, 8.5 and 3.8% % of total kidding in the year 2025. Maximum yield recorded by a female was 310 liter in 258 days of lactation period. Doe Number 12941 has declared as *champion goat* with a record yield of 310 litre milk in a lactation period of 258 days. Multiparous yielded more milk than primiparous goats. Heritability for lactation traits was moderate (0.15 to 0.20) in this flock.

Incidences of mortality in Birth-1M, 1-3M, 3-6 M, 6-12 m and in adults (>12 month) were 1.15, 4.14, 3.17, 1.0 and 2.34%, respectively The

Table 3: Least square means of body weight (kg) in Barbari goats

Factor	Body weight at different ages (Growth Performance)				
	Birth	3-Month	6-Month	9-Month	12-Month
Overall Mean	1.94±0.01 (1709)	8.12±0.05 (1608)	11.61 ±0.10 (1179)	16.39±0.13 (1097)	20.94±0.16 (853)
Year of birth	**	**	**	**	**
2021	1.86 ^a ±0.02 (458)	7.77 ^a ±0.08 (449)	11.32 ^a ±0.14 (411)	15.70 ^a ±0.18 (391)	19.66 ^a ±0.22 (283)
2022	1.85 ^b ±0.02 (249)	7.16 ^b ±0.11 (228)	9.89 ^b ±0.19 (166)	14.04 ^b ±0.27 (145)	18.20 ^b ±0.31 (112)
2023	1.83 ^c ±0.02 (262)	7.52 ^c ±0.10 (235)	11.47 ^c ±0.17 (198)	16.25 ^c ±0.23 (169)	20.57 ^c ±0.26 (142)
2024	2.02 ^d ±0.02 (308)	8.96 ^d ±0.09 (296)	13.61 ^d ±0.16 (250)	18.11 ^d ±0.21 (242)	22.32 ^c ±0.22 (226)
2025	2.15 ^d ±0.01 (432)	9.18 ^b ±0.09 (400)	12.95 ^e ±0.21 (154)	19.03 ^c ±0.27 (150)	23.97 ^c ±0.35 (90)
Season of birth		**	**	**	**
1	1.99±0.01 (790)	8.43 ^b ±0.07 (757)	12.03 ^a ±0.12 (680)	16.77 ^a ±0.16 (645)	21.36 ^a ±0.18 (509)
2	1.90±0.01 (919)	7.91 ^b ±0.06 (851)	11.19 ^b ±0.13 (499)	16.00 ^b ±0.18 (452)	20.52 ^b ±0.20 (344)
Sex of kid	**	**	**	**	**
Male	2.04 ^a ±0.01 (855)	8.57 ^a ±0.07 (805)	12.55 ^a ±0.12 (582)	18.94 ^a ±0.16 (537)	23.09 ^a ±0.19 (395)
Female	1.84 ^b ±0.01 (854)	7.77 ^b ±0.07 (803)	10.87 ^b ±0.12 (597)	15.94 ^b ±0.16 (560)	19.40 ^b ±0.18 (458)
Type of birth	**	**	**	**	**
1	2.16 ^a ±0.01 (538)	9.04 ^a ±0.08 (512)	12.56 ^a ±0.14 (397)	17.21 ^a ±0.18 (376)	21.67 ^a ±0.21 (291)
2	1.91 ^b ±0.01 (1028)	7.84 ^b ±0.05 (970)	11.44 ^b ±0.10 (690)	16.22 ^b ±0.13 (637)	20.91 ^b ±0.15 (497)
≥3	1.77 ^c ±0.02 (143)	7.62 ^b ±0.13 (126)	10.83 ^c ±0.24 (92)	15.73 ^b ±0.32 (84)	20.25 ^b ±0.37 (65)
Parity	**	**	**	**	*
1	1.79 ^a ±0.02 (431)	7.63 ^a ±0.09 (404)	11.21 ^a ±0.17 (289)	16.05 ^a ±0.23 (269)	20.73 ^a ±0.26 (216)
2	1.89 ^b ±0.02 (396)	8.03 ^b ±0.09 (361)	11.64 ^b ±0.16 (278)	16.65 ^b ±0.21 (262)	20.87 ^b ±0.24 (202)
3	1.96 ^c ±0.02 (286)	8.11 ^b ±0.10 (274)	11.54 ^b ±0.18 (208)	16.50 ^c ±0.24 (187)	20.88 ^b ±0.27 (138)
4	1.98 ^d ±0.02 (204)	8.38 ^c ±0.11 (193)	11.82 ^c ±0.21 (140)	16.44 ^d ±0.27 (135)	21.13 ^b ±0.32 (98)
5	1.99 ^d ±0.02 (156)	8.24 ^b ±0.13 (151)	11.50 ^b ±0.21 (121)	16.15 ^c ±0.28 (113)	20.81 ^b ±0.32 (92)
6	1.99 ^d ±0.03 (118)	8.11 ^b ±0.14 (113)	11.65 ^b ±0.30 (68)	16.59 ^c ±0.37 (62)	21.48 ^b ±0.44 (47)
Parity ≥7	1.99 ^d ±0.03 (118)	8.32 ^b ±0.15 (112)	11.86 ^b ±0.27 (75)	16.42 ^c ±0.36 (69)	20.90 ^b ±0.39 (60)
**P<0.01, *P<0.05					

Table 4: Liver tonic and linseed oil experiment in Barbari male & female

Traits	Control		Gp-1 (3% liver tonic)		Gp-2 (3% linseed oil)		Gp-3 (2% linseed oil)	
	Male	Female	Male	Female	Male	Female	Male	Female
Average age (d)	179	183	182	184	183	184	182	184
Body weight (kg)	11.81	10.80	11.72	10.84	11.68	10.77	11.77	10.89
Average age (d)	270	270	270	270	270	270	270	270
Body weight (kg)	18.72	16.31	20.43	17.46	20.80	18.12	20.45	17.10
Average ADWG (g/d)	76.90	61.11	95.70	73.55	101.11	81.67	96.44	69.00

overall mortality and overall culling rate were 5.01 and 3.81% of flock strength. Growing kids (3-6 month age group) observed to most vulnerable with respect to mortality rates. The major cause of culling was poor/stunted growth.

A total of 246 goats were provided to farmers and development agencies for improvement in farmers flock. A milk yield of 14980 litres was obtained and supplied to GPT section for sale and

value addition. Barbari unit has generated revenue of Rs. 34.23 lacs primarily by sale of animals (74.91%) and milk (17.50%). This year attention was given to enhance the capacity of farm to mitigate effect of climate change, strengthening of multiplier scheme and revenue generation. Therefore, 3 goat sheds were developed and improvised at Barbari Farm. Agro-forestry structures are utilized to develop goat

Table 5: Lactation performance of Barbari goats

Factor	Lactation Performance			
	90d milk yield (L)	140dmilk yield (L)	Total milk yield (L)	Lactation length (d)
Overall Mean	81.06±0.90 (1055)	122.82±1.21 (928)	133.77±1.58 (1006)	172.12±1.26 (1006)
Year of Kidding	**	**	**	**
2021	76.50 ^a ±1.25 (282)	120.89 ^a ±1.63 (277)	136.88 ^a ±2.18 (282)	181.19 ^a ±1.75 (282)
2022	84.37 ^b ±1.53 (157)	135.47 ^b ±2.03 (147)	152.62 ^b ±2.68 (157)	179.50 ^b ±2.14 (157)
2023	75.20 ^c ±1.42 (162)	108.90 ^c ±1.89 (151)	115.34 ^c ±2.48 (162)	155.24 ^c ±1.98 (162)
2024	85.25 ^b ±1.36 (192)	124.58 ^{ad} ±1.82 (175)	135.84 ^a ±2.37 (192)	176.23 ^b ±1.89 (192)
2025	84.20 ^b ±1.25 (262)	124.46 ^{ad} ±1.83 (178)	130.17 ^d ±2.32 (213)	158.45 ^c ±1.85 (213)
Season of Kidding				**
1 (Spring)	82.45±1.06 (471)	124.00±1.42 (449)	136.14±1.87 (471)	175.45 ^a ±1.49 (471)
2 (Autumn)	79.97±1.00 (584)	121.65±1.37 (479)	131.40±1.77 (535)	168.80 ^b ±1.41 (535)
Type of Kidding				
Single	81.00±0.91 (524)	122.92±1.25 (468)	133.43±1.62 (500)	172.35±1.29 (500)
Twin	79.01±0.78 (485)	119.35±1.07 (418)	130.39±1.38 (461)	171.91±1.10 (461)
≥ Triplet	83.18±2.38 (46)	126.19±3.17 (42)	137.49±4.19 (45)	172.11±3.35 (45)
Parity	**	**	**	*
1	69.89 ^a ±1.27 (334)	105.34 ^a ±1.71 (301)	117.98 ^a ±2.27 (313)	173.72 ^a ±1.82 (313)
2	77.98 ^b ±1.27 (234)	115.74 ^b ±1.69 (212)	129.95 ^b ±2.26 (223)	176.34 ^b ±1.81 (223)
3	82.54 ^c ±1.47 (163)	124.00 ^c ±1.95 (150)	139.45 ^c ±2.60 (157)	178.07 ^c ±2.08 (157)
4	82.08 ^d ±1.64 (118)	123.34 ^d ±2.28 (98)	133.39 ^d ±2.94 (112)	171.16 ^d ±2.35 (112)
5	86.28 ^e ±1.84 (84)	132.08 ^e ±2.55 (70)	141.65 ^d ±3.26 (81)	170.93 ^e ±2.61 (81)
6	84.29 ^e ±2.22 (57)	127.95 ^e ±3.03 (49)	138.45 ^d ±3.90 (56)	169.89 ^e ±3.12 (56)
Parity ≥7	84.38 ^e ±2.09 (65)	131.32 ^e ±3.07 (48)	135.54 ^d ±3.68 (64)	164.74 ^e ±2.94 (64)



Fig 3. : Barbari doe under intensive management system

production models under intensive management.

Technology development and validation

Eight multiplier flocks were established in the year 2025 for sustainable genetic improvement, in-situ conservation, technology transfer and development of goat based business/ entrepreneurship models. Currently 67 Barbari goat based multiplier flocks are in progress with flock strength from 25 to 300 in 6 states of India. These units have emerged as strong supply chain

and provided 1011 pedigreed goats to other nearby farmers for community goat genetic improvement, commercial farming and business model development, however, majority (>66% in self-multiplication stage) are. Development and validation of intensive and semi-intensive goat production models for arid and semi-arid regions are in progress. 02 Research papers were published in high reputed journals.



Award

(i). Goat Breeding calendar developed based on Barbari, Jamunapari and Black Bengal data awarded **Artistic and Literary Copyright** in the year 2025 by Government of India.

(ii). Best Farm Award was given to Barbari Goat Farm for the year 2024-25. (**Institute Award**)

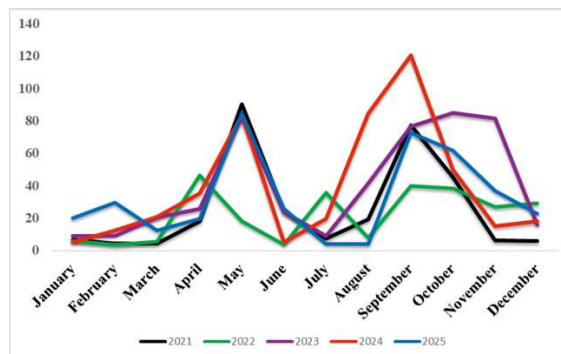


Fig. 4 : Estrus Exhibition patterns in Barbari Goat throughout the Year

4.1.2 Project Title: Improvement and sire evaluation of Jamunapari goats for milk production (Funded by ICAR-AICRP)

Principal Investigator

Dr. M. K. Singh

Co- Principal Investigators

Dr. Gopal Dass, Dr. K. Gururaj, Dr. Y. K. Soni, Dr. T. P. Singh, Dr. Vinay Chaturvedi and Dr. Manish K. Chatli

Jamunapari goat is one of the large size goat breeds of India (75-100 cm length and height), and is known for milk production in the subcontinent. These goats are also known as “*Etawa Goat*” and queen of goats due to their majestic look. The natural habitat of this breed is ravine locked Chakarnagar block of Etawah and Auriya districts in Uttar Pradesh. These goats are more adapted to those semi-arid areas which are rich in shrubs and trees based eco-system.

Jamunapari goats have been extensively utilized for genetic potential improvement of non-descript and low performing breeds in India and abroad. Considering its role and importance in overall goat development a selective breeding programme has been implemented at Central Institute for Research on Goats since 1985 and later on Farm Unit of AICRP from 1993.

The opening and closing flock strength of nucleus flock of Jamunapari goats was 404 and 349 on 1st January 2025 and 31st December 2025. During the period 153 kids were born from 118 kiddings out of which 80 kids were male and 73 were female. The average litter size/kidding was 1.30. Multiple born kids were 49%. The averages age at first conception (AFC), age at first kidding (AFK), weight at first service, weight at first kidding and first kidding interval (FKI) of females born in 2023-24 and kidded in 2025 were 506.19±22.50 day, 635.30±22.60 day, 30.09±0.97 kg, 41.49±1.65 kg and 302.51±15.31 days (Table-1).

There were 22.5, 21.6 and 16.5% reduction in average values of AFC, AFK and FKI compared to previous year. The year and season of birth had significant effect ($P<0.05$) on age at first service and kidding. Female born in season-1 (spring) had low age at first service and kidding, similarly multiple born females also have higher age at first



Fig 1. Jamunapari



Fig 2. Jamunapari buck in grazing area

Table 1: First parity reproductive performance in Jamunapari goats over the years

Factor	Reproductive Performance (s)				
Overall Mean	Age at first Service (d)	Age at first kidding (d)	Wt. at first Service (kg)	Wt. at first kidding (kg)	First Kidding Interval (d)
	629.27±10.96 (204)	779.80±11.01 (204)	32.67±0.47 (204)	37.76±0.49 (204)	398.60±26.37 (139)
Year of birth	**	**	*	**	**
2020	580.93 ^a ±17.87 (61)	730.13 ^a ±17.95 (61)	30.25 ^a ±0.77 (61)	34.60 ^a ±0.79 (61)	434.97 ^a ±31.79 (32)
2021	620.89 ^b ±24.95 (31)	773.26 ^b ±25.06 (31)	34.44 ^b ±1.07 (31)	38.61 ^b ±1.11 (31)	413.80 ^b ±27.62 (27)
2022	624.37 ^b ±18.92 (54)	773.19 ^b ±19.01 (54)	31.64 ^c ±0.81 (54)	35.43 ^a ±0.84 (54)	389.36 ^c ±29.50 (30)
2023	619.97 ^b ±28.04 (23)	772.12 ^b ±28.17 (23)	30.92 ^a ±1.20 (23)	36.65 ^{ab} ±1.24 (23)	352.51 ^d ±23.41 (37)
2024	506.19 ^c ±22.50 (35)	635.30 ^c ±22.60 (35)	36.09 ^d ±0.97 (35)	41.49 ^c ±1.60 (35)	302.51 ^e ±15.31 (13)
Different subscript indicate (a, b,...) significant difference at ** (P<0.01) and *significant at (P< 0.05)					

Table 2: Least square means of body weight (kg) in Jamunapari goats at different ages

Factor	Body weight at different ages				
Overall Mean	Birth weight	3-month weight	6- month weight	9- month weight	12 month weight
	3.36±0.02 (917)	10.76±0.08 (861)	15.55 ±0.11 (702)	19.81±0.13 (651)	25.32±0.19 (551)
Year of birth	**	**	**	**	**
2021	3.41 ^a ±0.03 (228)	11.39 ^a ±0.13 (222)	17.32 ^a ±0.16 (213)	22.09 ^a ±0.18 (203)	25.65 ^a ±0.25 (166)
2022	3.63 ^b ±0.03 (274)	10.67 ^b ±0.13 (260)	14.49 ^b ±0.15 (224)	18.67 ^b ±0.18 (213)	23.27 ^b ±0.25 (178)
2023	2.94 ^c ±0.06 (087)	9.02 ^c ±0.22 (084)	13.06 ^c ±0.26 (075)	18.69 ^b ±0.30 (072)	25.18 ^a ±0.41 (062)
2024	3.21 ^d ±0.04 (175)	10.74 ^b ±0.16 (155)	16.10 ^d ±0.19 (147)	20.13 ^c ±0.22 (131)	26.11 ^c ±0.29 (125)
2025	3.50 ^b ±0.04 (153)	11.81 ^d ±0.18 (140)	15.69 ^c ±0.35 (43)	19.77 ^d ±0.46 (32)	26.41 ^c ±0.73 (20)
Season of birth	**	*		*	**
1	3.42 ^a ±0.03 (361)	10.31 ^a ±0.12 (333)	15.00±0.15 (299)	19.82 ^a ±0.18 (265)	26.11 ^a ±0.26 (207)
2	3.26 ^a ±0.02 (556)	11.14 ^b ±0.09 (528)	14.51±0.14 (403)	18.90 ^b ±0.16 (386)	24.65 ^a ±0.23 (344)
Sex of kid	**	**	**	**	**
Male	3.44 ^a ±0.03 (484)	11.04 ^a ±0.10 (453)	15.54 ^a ±0.13 (371)	20.05 ^a ±0.15 (344)	26.09 ^a ±0.23 (279)
Female	3.24 ^b ±0.03 (433)	10.42 ^b ±0.11 (408)	14.16 ^b ±0.14 (331)	18.57 ^b ±0.17 (307)	24.55 ^b ±0.24 (272)
Type of birth	**	**	**	**	*
1	3.48 ^a ±0.03 (456)	11.13 ^a ±0.11 (429)	15.25 ^a ±0.14 (352)	19.83 ^a ±0.17 (329)	25.90 ^a ±0.25 (278)
≥2	3.20 ^b ±0.03 (461)	10.32 ^b ±0.10 (432)	14.34 ^b ±0.13 (350)	18.89 ^b ±0.16 (322)	24.95 ^b ±0.23 (273)
Parity				**	**
1	3.23 ^a ±0.03 (336)	10.13 ^a ±0.12 (309)	14.26±0.16 (230)	18.76±0.19 (216)	24.87±0.28 (171)
2	3.36 ^b ±0.03 (217)	10.89 ^b ±0.14 (205)	15.01±0.18 (165)	19.53±0.21 (153)	25.30±0.28 (132)
3	3.27 ^c ±0.04 (153)	10.40 ^a ±0.17 (149)	14.49±0.21 (129)	19.05±0.25 (115)	25.01±0.35 (101)
4	3.42 ^c ±0.05 (97)	11.27 ^a ±0.21 (92)	15.15±0.25 (84)	19.62±0.30 (78)	25.71±0.41 (69)
Parity ≥5	3.41 ^c ±0.05 (114)	10.95 ^b ±0.20 (106)	14.84±0.24 (94)	19.58±0.28 (89)	25.74±0.39 (78)
Different subscript indicate (a, b,...) significant difference at ** (P<0.01) and *significant at (P< 0.05)					

kidding. Oestrous detection studied over the month in last three years revealed large fluctuation in heat exhibition pattern. Majority of goats exhibited estrus in April, May, June in summer and September, October and November in autumn seasons which is a normal pattern. However, sizable goats (10%) in 2025 exhibited estrus in peak winter season (December and January). Fluctuation in estrus exhibition in

different months in a year and over the years is shown in Fig-5.

The least square means of body weights for kids at birth, 3, 6 and 9 months of age were 3.50±0.03, 11.81±0.18, 15.69±0.35, 19.77±0.46 kg and 26.41±0.73 kg respectively (Table-2). Year, season of birth, type of birth, sex of kid and parity of dam had significantly affected (P<0.01) kid's


Fig 3. Doe with 502 litre milk

Fig 4: Champion Doe with 460 litre
Table 3: Selection differential 9 month body weight (kg.) and total milk yield (lit.)

Year	9-M weight (Sel. male)	Population Mean (Body Weight)	90-d MY/TMY (Sel. male's doe yield)	90-d MY/TMY Population Mean	Selection differential Body wt. (kg)	Doe's Milk (litre)
2021	25.50 (10)	20.92	118 (10)	99.78	4.58	18.22
2022	26.00 (8)	21.30	196 (8)	108	4.7	88
2023	23.90 (9)	18.80	207.5 (9)	117.5	5.1	90
2024	23.15 (10)	21.90	223.8 (10)	116.9	1.25	106.9
2025	24.05 (10)	19.07	227.0 (10)	180.6	4.98	46.4

·Selection differential from 2023 onwards calculated on the basis of Total Milk Yield instead 90 days milk yield which was applicable up to 2023.

Table 4: Least square means of lactation performance of Jamunapari goats (litre)

Factor	Lactation Performance of Goats			
Overall Mean	90d milk yield (L)	140dmilk yield (L)	Total milk yield (L)	Lactation length (d)
	98.89±1.88 (651)	139.69±3.06 (512)	151.73±3.96 (597)	177.03±2.00 (597)
Year of Kidding	**	**	**	*
2021	101.98 ^a ±3.27 (158)	145.34 ^a ±4.90 (146)	157.78 ^a ±6.60 (158)	178.66 ^a ±3.33 (158)
2022	91.65 ^b ±3.10 (177)	131.06 ^b ±4.83 (149)	135.04 ^b ±6.26 (177)	170.59 ^a ±3.16 (177)
2023	78.04 ^c ±4.90 (067)	119.15 ^c ±8.04 (053)	121.59 ^c ±9.86 (067)	167.07 ^a ±4.98 (178)
2024	95.08 ^{ab} ±3.53 (136)	135.74 ^b ±5.53 (114)	149.92 ^d ±7.09 (136)	188.15 ^b ±3.58 (136)
2025	120.72 ^d ±3.96 (113)	155.45 ^d ±8.56 (50)	180.63 ^e ±10.79 (59)	180.68 ^{ab} ±5.44 (59)
Season of Kidding				
1 (Spring)	95.26±2.79 (249)	137.62±4.38 (216)	143.16±5.64 (249)	174.13±2.84 (249)
2 (Autumn)	93.52±2.11 (402)	131.77±3.82 (296)	147.30±4.86 (348)	179.93±2.45 (348)
Type of Kidding			*	
Single	81.25 ^a ±2.76 (363)	129.83±4.80 (276)	140.75±6.16 (325)	177.28±3.11 (325)
≥ Twin	99.54 ^b ±2.69 (288)	139.56±4.53 (236)	151.72±5.84 (272)	176.78±2.94 (272)
Parity	*		*	*
1	81.23 ^a ±2.99 (252)	115.49±5.33 (189)	128.18 ^a ±6.73 (226)	165.29 ^a ±3.39 (226)
2	91.79 ^b ±3.24 (164)	136.30±5.45 (125)	141.19 ^b ±7.04 (146)	176.45 ^b ±3.55 (146)
3	97.14 ^c ±4.30 (97)	141.43±6.95 (81)	153.69 ^c ±9.05 (093)	181.54 ^b ±4.57 (93)
4	102.23 ^c ±4.90 (64)	143.41±7.45 (58)	169.16 ^c ±10.23 (60)	189.49 ^b ±5.16 (60)
Parity ≥5	96.07 ^c ±4.22 (74)	138.84±7.66 (59)	144.44 ^b ±9.64 (72)	172.38 ^b ±4.86 (72)

Different subscript indicate (a, b,..) significant difference at ** (P<0.01) and *significant at (P< 0.05)

body weights. Momentum of weight gain got adversely affected by outbreak of CCPP in August 2025, however recovered after 4-5 month of incidence. At present several kids attained up to 27 kg weight at 6 months of age.

Males have significantly higher body weight than females at all the growth stages. Kids born as multiple had significantly lower weight as compare to those which born as single however, weight gain was higher in multiple born kids as compared to single born kids. The h^2 estimates were 0.17 ± 0.02 , 0.19 ± 0.01 , 0.20 ± 0.02 , 0.16 ± 0.02 and 0.17 ± 0.02 at birth, 3, 6, 9 and 12 months ages. Ten males were selected on the basis of their 9 month weight; their dams total milk yield, and individual body score. The overall selection differential for 9 months body weight was 4.98 kg and dam's total milk yield was 46.4 liters (Table-3). Due emphasis has been given for milk yield in formation of selection index from last some years.

Least squares means of lactation milk yield in 90, 140 days, total milk yield and lactation length were 120.72 ± 3.96 , 155.45 ± 8.56 , 180.63 ± 10.79 litre and 177.03 ± 2.0 days, respectively (Table-4). Year of kidding had significant and pronounced ($P < 0.01$) effect on all the lactation traits with high magnitude. There was 14.52 to 27.36% improvement recorded in lactation traits performance over the previous year.

Goat kidded in spring season significantly yielded more milk than those which kidded in spring. The effect of type of birth was also significant on 90 days. Significantly lesser milk yield was obtained from first kidders. Significant improvement recorded in lactation performance i.e. 41, 18, 18, 4.2 and 5.9% goats kidded in the year out total goat kidded yielded 150-200, 201-250, 251-300, 301-350 and >350 liter milk in a lactation

During the year 80 male and 70 female (total-150) sold for field improvement, and 8155 liters



milk supplied to GPT section. Development of 3 multiplier flocks was supported. The overall mortality and culling in the flock was 10.6 and 10.9% of flock strength, relatively higher attributed to outbreak of CCPP and mixed infection. More than 70% of total loss occurred during outbreak in a period of 2.5 month. Animals died during birth to 1, 1-3 month, 3 to 6, 6 to 12 month, adult and overall category were 2.12, 4.17, 6.10, 3.76, 8.08 and 10.60% of their respective population size.

Several facilities developed (i) Expansion of open area in 8 sheds to create more space (ii) 3 small size sheds developed (iii) One bhusa store constructed with capacity of 375 q straws. (iv) Partial fencing of 6 acres agro-forestry (700 meter) (v) Sick ward improvised, renovated, expanded and partitioned to accommodate more goats of different ages. (vi) One submersible pump installed.

One hectare undulating land which was developed in previous year for agro-forestry was equipped with irrigation facility with more plantations of fodder trees. Total revenue generated in the year was Rs. 2264930, mainly due to sale of animal (72.5%) and sale of milk (13%).

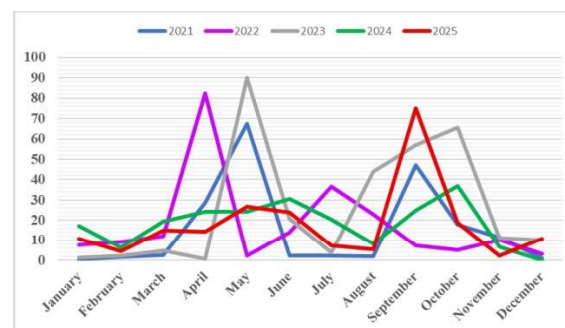


Fig. 5: Estrus Exhibition Patterns in Jamunapari Goat over the months and year



4.1.3 Project Title: Genetic evaluation and improvement of Muzaffarnagari sheep for body weight (Funded by ICAR-NWPSI)

Principal Investigator

Dr. Gopal Dass

Co-Principal Investigators

**Dr. Arvind Kumar, Dr. Mukesh Bhakat, Dr. Nitika Sharma,
Dr. Vinay Chaturvedi and Dr. Y. K. Soni**

Muzaffarnagari, the mutton breed of the country is mainly distributed in Muzaffarnagar and its adjoining districts of Western Uttar Pradesh viz. Meerut, Bulandshahar, Saharanpur and Bijnor. Now, the animals of this breed are also found in and around Mathura, Agra and Bareilly districts of Uttar Pradesh and in some parts of Rajasthan, Haryana and Delhi states. Muzaffarnagari is the heaviest among 45 sheep breeds available in the country.



The breed is generally reared for mutton production as wool production is low with course quality, thus not suitable for carpet manufacture. The breed is considered as less known genotype exhibiting better growth and good adaptability than other Indian sheep breeds. The institute has been maintaining a pure-bred flock of Muzaffarnagari sheep under a “Network Project on Sheep improvement” since 1992 and presently the efforts are being made to improve the breed for higher mutton production through selective breeding.

Management of flocks

Flocks were maintained under semi-intensive system of feeding management with 6-7 hours grazing supplemented with 100-500 concentrate in various stage and age group of the animals. Dry and green fodder was also offered as per the requirement. Controlled breeding was practiced to improve the managerial efficiency. Ewes were bred during May-June and October-

Table 1: Growth performance of Muzaffarnagari lambs (kg)

Particulars	Birth Wt.	3M Wt.	6M Wt.	9M Wt.	12M Wt.
Overall mean	3.7390±0.0174 (1238)	15.713±0.099 (1086)	25.813±0.167 (904)	30.139±0.163 (814)	36.667±0.165 (760)
Sex	**	**	**	**	**
Male	3.829±0.022 (613)	16.493±0.126 (538)	28.005±0.212 (438)	32.090±0.210 (376)	39.872±0.215 (339)
Female	3.649±0.022 (625)	14.933±0.126 (548)	23.620±0.207 (466)	28.188±0.196 (438)	33.462±0.196 (421)
Year	**	**	**	**	*
2021	3.650±0.028 (325)	15.434±0.154 (307)	25.243±0.261 (241)	30.500±0.249 (220)	36.695±0.250 (206)
2022	3.688±0.029 (320)	15.512±0.178 (238)	25.471±0.295 (198)	29.910±0.294 (170)	36.346±0.297 (159)
2023	3.697±0.040 (157)	15.851±0.231 (130)	25.968±0.373 (112)	29.846±0.344 (109)	36.386±0.347 (101)
2024	3.668±0.036 (216)	15.711±0.194 (205)	25.680±0.309 (181)	30.397±0.296 (167)	36.900±0.304 (151)
2025	3.992±0.035 (220)	16.058±0.188 (206)	26.701±0.310 (172)	30.041±0.306 (148)	37.008±0.305 (143)
Parity	**	NS	NS	NS	*
I	3.544±0.034 (250)	15.541±0.200 (203)	25.373±0.336 (161)	29.769±0.324 (143)	36.225±0.328 (133)
II	3.806±0.036 (216)	15.792±0.200 (191)	25.884±0.323 (164)	30.387±0.307 (151)	36.715±0.308 (142)
III	3.806±0.033 (231)	15.595±0.187 (204)	26.167±0.307 (172)	30.062±0.296 (154)	36.855±0.299 (145)
IV	3.754±0.033 (222)	15.999±0.184 (199)	26.088±0.301 (168)	30.456±0.291 (148)	36.882±0.294 (138)
>V	3.785±0.029 (319)	15.638±0.161 (289)	25.552±0.267 (239)	30.021±0.258 (218)	36.657±0.261 (202)
Type of Birth	**	**	**	**	**
Single	4.070±0.016 (968)	16.589±0.091 (860)	26.673±0.145 (737)	30.996±0.137 (671)	37.340±0.139 (626)
Twins	3.408±0.030 (270)	14.837±0.174 (226)	24.952±0.299 (167)	29.282±0.294 (143)	35.994±0.297 (134)

November followed by lambing in the months of October–November and March–April, respectively. The lambs were weaned at 2 months of age due to poor milk production as well short lactation period of their dams. All the sheds and corrals were disinfected frequently with lime. Regular treatment and strict prophylactic measures were practiced for vaccination against Enterotoxaemia, Foot and Mouth Disease, Sheep Pox, H.S., PPR etc. De-worming with different anthelmintic was practiced at pre-monsoon and post monsoon seasons and as and when required. Dipping was done after 15-20 days of each shearing. On the first day of the year the opening balance was 472 which comprised of 115 males and 537 females and closing balance of 439 sheep had a stock of 111 males and 328 females. During this year a total of 189 lamb's born and overall mortality was recorded 4.9%.

Production performance

The overall least-squares means of body weight of lambs at birth, 3, 6, 9 and 12 month age was 3.89 ± 0.04 , 16.220 ± 0.18 , 27.18 ± 0.35 , 30.46 ± 0.54 and 38.65 ± 0.59 kg, respectively (Table 1). The effect of sex, year of lambing, type of birth and parity was highly significant ($P < 0.01$) on all body weights except non-significant effect of parity on 3, 6 and 9 month body weights. Male lambs

gained higher weights as compared to female lambs at all growth stages. Lambs born as multiples (twins and triplets) had significantly lower body weights at all stages as compared to those lambs born as singles. The overall average monthly body weights of adult males and females were 54.37 and 42.08 kg respectively.

The average daily gain of Muzaffarnagari lambs during 0-3, 3-6, 6-12 and 3-12 months were 136.77 ± 1.96 , 121.90 ± 3.11 , 79.21 ± 2.95 and 87.18 ± 1.98 g under semi-intensive feeding management (Table 2). Sex, year of lambing and type of birth had highly significant effect on all ADGs except non-significant effect of type of birth on ADG during 6-12 and 3-12 month intervals. Similar to body weights, all average daily gains were found significantly ($P < 0.01$) higher in males as compared to females. The single born lambs had higher average daily weight gains during all age intervals. A total of 15 male lambs were kept under feedlot experiment for studying growth potential of the breed. In this experiment, the average body weight of lambs at six month age was recorded as 45.0 kg., which was ever highest since inception of the project.

The overall least squares mean for lambs 1st and 2nd six monthly and adult annual clips were calculated to be 417.82 ± 6.13 , 500.80 ± 7.47 and

Table 2: Average daily weight gains (ADG) Muzaffarnagari lambs (g)

Particulars	ADG (0-3 M)	ADG (3-6 M)	ADG (6-12 M)	ADG (3-12 M)
Overall mean	132.722 ± 1.060 (1086)	108.456 ± 1.437 (902)	60.242 ± 0.879 (760)	75.641 ± 0.656 (760)
Year	**	**	**	**
2021	130.755 ± 1.645 (307)	100.801 ± 2.229 (241)	61.796 ± 1.333 (206)	75.257 ± 0.995 (206)
2022	131.053 ± 1.902 (238)	107.576 ± 2.522 (198)	57.683 ± 1.584 (159)	75.299 ± 1.182 (159)
2023	134.768 ± 2.465 (130)	109.531 ± 3.185 (112)	55.941 ± 1.847 (101)	72.675 ± 1.379 (101)
2024	133.774 ± 2.070 (205)	109.010 ± 2.641 (181)	61.931 ± 1.621 (151)	78.267 ± 1.209 (151)
2025	133.263 ± 2.011 (206)	115.363 ± 2.673 (170)	63.860 ± 1.624 (143)	76.705 ± 1.212 (143)
Sex	**	**	**	**
Male	140.371 ± 1.342 (538)	123.020 ± 1.817 (438)	66.704 ± 1.146 (339)	84.114 ± 0.855 (339)
Female	125.073 ± 1.344 (548)	93.893 ± 1.774 (464)	53.780 ± 1.043 (421)	67.168 ± 0.778 (421)
Parity	NS	NS	NS	NS
I	132.674 ± 2.134 (203)	105.436 ± 2.872 (161)	59.792 ± 1.749 (133)	74.882 ± 1.305 (133)
II	132.930 ± 2.140 (191)	107.900 ± 2.759 (164)	59.437 ± 1.642 (142)	75.427 ± 1.225 (142)
III	130.861 ± 2.001 (204)	112.220 ± 2.622 (172)	60.861 ± 1.593 (145)	75.341 ± 1.189 (145)
IV	135.693 ± 1.967 (199)	108.868 ± 2.579 (167)	61.100 ± 1.565 (138)	76.223 ± 1.168 (138)
V	131.454 ± 1.720 (289)	107.857 ± 2.291 (238)	60.021 ± 1.390 (202)	76.330 ± 1.038 (202)
Type of Birth	**	**	NS	NS
Single	138.722 ± 0.969 (860)	109.153 ± 1.238 (737)	58.854 ± 0.740 (626)	75.164 ± 0.552 (626)
Twins	126.723 ± 1.855 (226)	107.760 ± 2.564 (165)	61.630 ± 1.581 (134)	76.118 ± 1.180 (134)

Table 3: Greasy fleece yields of lambs and adults (g).

Particulars	Lambs Clip		Adult annual
	First season	Second season	
Overall mean	417.821±6.124(889)	500.801±7.470(668)	1103.642±12.819 (1213)
Sex	**	**	**
Male	426.548±7.783(424)	543.590±9.703(292)	1343.612±25.081 (62)
Female	409.094±7.518(465)	458.013±8.723(376)	863.67±5.811(1151)
Year	**	**	**
2021	298.185±9.697(227)	369.791±10.558(201)	834.261±16.535 (274)
2022	391.834±0.465(206)	369.336±12.766(150)	970.055±17.787 (237)
2023	397.1651±3.547(110)	599.905±14.538(98)	1211.517±6.614 (227)
2024	375.3321±1.202(181)	570.743±14.308(116)	1109.568±17.417(274)
2025	626.5881±1.466(165)	594.232±14.811(103)	1392.811±17.137(201)

1103.64±12.82g, respectively (Table 3). Sex and year of lambing had highly significant ($P<0.01$) influence on all the lamb's and adult clips except significant ($P<0.05$) effect of sex on lamb's first clip. The males produced significantly higher greasy fleece yield than females in all the clips which might be due to larger surface area for wool growth in males as compared to females.

Reproduction performance

The overall least-squares means of weight at first service, weight at first lambing, age at first service and age at first lambing were 31.72±0.63, 34.930.68 kg, 459.25±6.57 and 612.16±6.55 days, respectively. The effect of year of lambing was found highly significant on age at first service and age at first lambing. The annual tupping, lambing on ewes available basis and lambing on ewes bred basis were respectively 91.3, 85.7 and 94.0%. During this year, the twinning rate and inter lambing period were recorded to be 9.4% and 341 days.

Growth performance in field

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age was 3.10±0.04, 13.84±0.13, 20.67±0.21 and 27.74±0.23kg, respectively in farmers flocks. The effect of sex and year of lambing was highly significant ($P<0.01$) on all body weights. On comparison, it was found that males gained higher weights than females at all age

Genetic parameters and selection criteria

The h^2 estimates of birth, 3, 6, 9 and 12 month body weights were 0.191±0.053, 0.445±0.075, 0.309±0.064, 0.133±0.047 and 0.100±0.044,

respectively. The h^2 estimates of birth weight, 9 & 12 month weights were low which might be because of great influence of maternal and other environmental factors on the growth during these stages. All the genetic and phenotypic correlations were positive, moderate to high except few cases where these were negative. The genetic correlations between and among body weights were relatively higher as compared to phenotypic correlations.

Selection of rams and selection differential

All the male lambs born during year 2023 were ranked on the basis of their 6 month body weight and out of total, top 10 were selected for breeding purpose. The selection differential for the trait under selection was 6.5 kg (2025). The population mean and the average of sire selected was 26.0 & 31.5kg, respectively. The selection differential for 6 month body weight was 6.5 kg.

Breeding rams (10) were selected based on their 6 month body weight and then evaluated for various semen characteristics before using in breeding programme. Rams showing better libido and semen qualities in terms of volume, sperm concentration, mass motility etc. were finally selected and used as breeding rams in the flocks.

Distribution of elite germplasm and revenue generation

A total of 109 superior animals (50 males and 59 females) were supplied to various developmental agencies, Research organizations, Non-Government organizations and progressive farmers for genetic improvement of their flocks under field conditions. During year 2025, a revenue of Rs. 19,75,697/- was generated which

comprised of Rs. 13,86,700/- from sale of breeding animals, Rs. 1,60,214/- from sale of culled animals, Rs. 3,80,000 from internally

transferred animals and Rs. 11,883 from sale of wool.

4.1.4 Project Title: Genetic improvement of Jakhrana goats for milk and meat production under farm and field conditions (Funded by Institute)

Principal Investigator

Dr. Gopal Dass

Co-Principal Investigators

**Dr. M. K. Singh, Dr. Mukesh Bhakat, Dr. Ravindra Kumar,
Dr. Vinay Chaturvedi and Dr. T. P. Singh**

Jakhrana is one of the large sized and high milk producing goat breed of the country. It has very limited breeding tract in Alwar district of Rajasthan and derived its name from the name of the village “Jakhrana” where it is found in most pure forms. The pure breed Jakhrana goats are distributed in Jakhrana and its adjoining villages viz. Naisarana, Neemrana, Naghaudi etc. in Behrod Tehsil of Alwar. Some of the animals of this breed are also found in Narnaul, Gurugram, Bhiwani and Mahendragarh districts of Haryana. The population of this breed in the breeding tract is decreasing continuously due to transportation of this breed to other places in the country. Due to high milk production ability of this breed, the progressive goat farmers are transporting this breed from the breeding tract to near cities and rearing mainly for milk production. The animals of this breed have ability to grow higher, producing more milk and giving multiple births. Central Institute for Research on Goats, Makhdoom has been maintaining a pure bred flock of Jakhrana goat since 2005 and efforts are being made to improve the breed for higher milk and meat production through selective breeding.

Management of flocks

Flocks were maintained under semi-intensive system of feeding management with 6-7 hours grazing supplemented with 100-500 concentrate in various stage and age group of the animals. Dry and green fodder was also offered as per the requirement. Controlled breeding was practiced to improve the management efficiency. Does were bred during May-June and October-November followed by kidding in the months of October–November and March–April, respectively. The lambs were weaned at 3 months of age and male and female kids separated at this age. All the sheds and corrals were disinfected frequently with lime. Regular treatment and strict



prophylactic measures were practiced for vaccination against Enterotoxaemia, Foot and Mouth Disease, Goat Pox, H.S., PPR etc. De-worming with different anthelmintic was practiced at pre-monsoon and post monsoon seasons and as and when required. On the first day of the year the opening balance was 274 which comprised of 77 males and 179 females and closing balance of 252 goats had a stock of 75 males and 177 females. During this year, a total of 108 kids born and overall mortality was recorded 6.28%.

Production performance

The overall least-squares means of body weights of kids at birth, 3, 6, 9 and 12 month age were $2.68.04 \pm 0.04$, $9.810.12$, 14.73 ± 0.37 , 20.58 ± 0.45 and 25.71 ± 0.48 kg, respectively (Table 1). Except effect of year on 6 month body weight, the effect of sex and year of kidding was highly significant ($P < 0.01$) on all body weights, whereas parity had significant effect on birth weight, season on 3 month and 12 month weights and type of birth on birth weight. Male kids gained higher weights as compared to female kids at all growth stages. Kids born as twins and triplets had significantly lower body weights at all stages as compared to those kids born as single.

The average daily gain of Jakhrana kids during 0-3, 3-6, 6-12 and 3-12 months were 78.59 ± 1.31 ,

Table 1: Least square means of body weight (kg) of Jakhrana kids

	BWT	3M WT	6M WT	9M WT	12M WT
Overall mean	2.875±0.019 (493)	9.145±0.057 (443)	14.431±0.141 (319)	19.816±0.178 (277)	24.505±0.195 (242)
Year	**	**	NS	**	**
2021	3.171±0.044 (101)	9.433±0.129 (97)	14.832±0.303 (77)	18.847±0.372 (74)	22.672±0.492 (49)
2022	2.897±0.043 (89)	7.388±0.138 (75)	13.765±0.315 (62)	17.843±0.406 (50)	24.308±0.434 (47)
2023	2.855±0.042 (94)	9.315±0.125 (87)	14.365±0.305 (65)	21.981±0.409 (50)	26.307±0.435 (47)
2024	2.773±0.039 (108)	10.277±0.123 (91)	14.460±0.294 (66)	19.825±0.368 (57)	23.522±0.388 (54)
2025	2.680±0.041 (101)	9.812±0.122 (93)	14.731±0.371 (49)	20.584±0.455 (46)	25.715±0.483 (45)
Sex	**	**	**	**	**
Male	2.971±0.025 (251)	9.553±0.079 (220)	14.899±0.196 (152)	21.383±0.252 (127)	25.995±0.279 (109)
Female	2.780±0.026 (242)	8.737±0.080 (223)	13.962±0.190 (167)	18.249±0.234 (150)	23.014±0.253 (133)
Parity	**	NS	NS	NS	NS
Parity 1	2.736±0.034 (140)	9.218±0.106 (126)	14.268±0.261 (91)	19.394±0.326 (80)	24.060±0.358 (67)
Parity 2	2.844±0.039 (103)	9.193±0.118 (95)	14.468±0.290 (68)	19.843±0.376 (56)	24.698±0.406 (50)
Parity 3	2.934±0.038 (106)	9.254±0.124 (88)	14.313±0.290 (69)	19.802±0.358 (61)	24.631±0.395 (54)
Parity 4	2.912±0.046 (79)	8.932±0.139 (74)	14.296±0.333 (54)	19.936±0.421 (46)	24.774±0.466 (40)
Parity 5	2.950±0.052 (65)	9.129±0.157 (60)	14.809±0.397 (37)	20.105±0.486 (34)	24.360±0.528 (31)
Season of Birth	NS	**	NS	NS	*
Feb-Mar	2.904±0.027 (264)	8.789±0.082 (240)	14.258±0.200 (172)	19.519±0.256 (148)	23.937±0.303 (129)
Octo-Nov	2.846±0.027 (229)	9.501±0.082 (203)	14.603±0.217 (147)	20.113±0.276 (129)	25.072±0.304 (113)
Birth Type	**	NS	NS	NS	NS
Single	3.051±0.029 (213)	9.172±0.090 (188)	14.518±0.220 (131)	20.013±0.282 (109)	24.777±0.314 (94)
Twins	2.700±0.024 (280)	9.118±0.072 (255)	14.343±0.179 (188)	19.619±0.221 (168)	24.232±0.237 (148)
(*Significant at 5% level, **Significant at 1% level, NS Non Significant)					

60.05±3.25, 61.54±2.22 and 62.67±1.76 g under semi-intensive feeding management. Except non significant effect of sex on ADG during 3-6 month, sex and year of kidding had highly significant effect on all ADGs. Similar to body weights, all average daily gains were found significantly ($P<0.01$) higher in males as compared to females. The single born kids had higher ADG during 0-3 and 3-6 month age groups, thereafter kids born as multiples had higher average daily weight gain during 6-12 and 3-12 months duration.

The overall least-squares means of 90, 140 days, total milk yield and lactation length were 131.82±3.01, 164.28±3.81, 150.90±7.28 litre and 151.42±5.71days, respectively (Table 2). The year of birth, type of birth and parity had highly significant ($P<0.01$) effect on all milk production traits except non significant effect of parity on lactation length. On comparison, it was found that does kidded with multiple birth produced more milk and had longer lactation length than those kidded with singles. The comparison of milk production in different parities indicated

increasing trend with the increase in the parities and highest milk yield was recorded in 5th parity.

Reproduction performance

The annual tugging, kidding on available and bred basis were recorded as 96.7, 85.0 and 91.25%, respectively. During this year, a total of 95 kids were born from 73 kidding. Out of 95, 45 (47.4%) were males and 50 (52.6%) were females. Out of total, 52 (54.7%) kids born as single and 43 (45.3%) born as multiples. The kidding rate was recorded as 1.30. The replacement rate of the does was calculated to be 32.7%.

Genetic parameters

The h^2 estimates of birth, 3, 6, 9 and 12 month body weights were 0.202±0.100, 0.441±0.126, 0.175±0.097, 0.283±0.109 and 0.061±0.082, respectively. The h^2 estimates of birth weight was higher which might be because of great influence of maternal and other environmental factors on the growth of fetus. The heritability estimates of 3, 6 and 9 month body weights were recorded moderate. The heritability estimates of body

Table 2: Least square means of milk production (liter) of Jakhrana goats

Traits	90D MY	140D MY	TMY	LL
Overall mean	120.75±1.47 (326)	158.04±1.92 (301)	156.34±2.72 (322)	155.96±2.13 (322)
Year	**	**	**	**
2021	132.60±3.44 (60)	177.00±4.64 (52)	168.81±5.98 (68)	151.75±4.69 (68)
2022	81.48±3.54 (50)	113.93±4.97 (39)	103.01±5.91 (61)	134.01±4.63 (61)
2023	124.55±3.09 (67)	165.32±3.84 (67)	180.39±5.61 (68)	172.43±4.39 (68)
2024	133.29±2.87 (78)	169.65±3.60 (76)	178.56±5.18 (80)	170.17±4.06 (80)
2025	131.82±3.01 (71)	164.28±3.81 (67)	150.90±7.28 (45)	151.42±5.71 (45)
Type of birth	**	**	**	**
Single	114.35±1.99 (196)	151.03±2.65 (178)	143.22±3.58 (192)	149.02±2.80 (192)
Multiple	127.14±2.18 (130)	165.04±2.77 (123)	169.45±4.06 (130)	162.90±3.18 (130)
Season	NS	NS	NS	NS
1	121.46±2.08 (167)	160.53±2.79 (150)	161.50±3.71 (173)	157.41±2.91 (173)
2	120.03±2.05 (159)	155.55±2.59 (151)	151.17±4.15 (149)	154.51±3.25 (149)
Parity	**	**	**	NS
1	101.01±2.69 (93)	134.99±3.50 (83)	129.30±4.87 (100)	150.14±3.82 (100)
2	124.50±2.87 (77)	160.67±3.69 (72)	163.36±5.35 (75)	161.85±4.20 (75)
3	124.87±2.97 (70)	162.32±3.80 (66)	158.89±5.50 (66)	153.94±4.31 (66)
4	125.79±3.71 (46)	163.82±4.66 (45)	165.27±6.78 (45)	158.15±5.32 (45)
5	127.57±3.99 (40)	168.39±5.30 (35)	164.86±7.28 (36)	155.71±5.93 (36)
(**Significant at 1% level, NS Non Significant)				



weights increased with the age up to 3 month age than declined . All the genetic and phenotypic correlations of body weights were positive. The genetic correlations between and among body weights were relatively higher as compared to phenotypic correlations. In general, the phenotypic of particular body weight with other body weights decreased with the increase in age and it was reverse in case of genetic correlations.

Selection of breeding bucks

All the male kids were ranked on the basis of their 9 month body weight and 90 days milk yield of their dams in first parity, top 10 were selected for breeding purpose. The selection differential for 9

month body weight and 90 days milk yield of their dams were respectively 2.5 kg and 19.0 litre (2023). The population mean and the average of sire selected were for 9 month body weight and 90 days milk yield 21.3kg & 101 litre and 23.8kg & 120.0litre, respectively.

Distribution of elite germplasm

A total of 66 superior germ plasm (31 males and 35 females) were supplied to various developmental agencies, Research organizations, Non-Government organizations and progressive farmers for genetic improvement of their flocks under field conditions. During reporting year, a total of 02 multiplier flocks were established.

Revenue generation and milk supply

During reporting year 2025, a revenue of Rs. 11,11,041/- was generated which comprised of Rs. 7,88,500/- from sale of breeding animals, Rs. 1,12,201/- from sale of culled animals, Rs. 38,500 from internally transferred animals and Rs. 1,71,840 from sale of milk. During this year a total of 4,296 litre milk was produced and supplied to GPT section of the institute for sale and preparation of various milk products.

4.1.5 Project Title: Genetic improvement of Sojat goat for economic traits and entrepreneur models development (Funded by Institute)

Principal Investigator

Dr. M K Singh

Co-Principal Investigators

Dr. Ravi Ranjan, Dr. Nitika Sharma and Dr. Manish Kumar Chatli

There were 41 goats purchased in June 2025 from the home tract of Sojat goat (Pali and Bayawar districts in Rajasthan). Out of 41 animals, 20 females and 2 males were adult (> one year of age) and 1 male and 12 female were in 6–12 month age group. After one month quarantine, these goats were shifted to the AICRP–Jamunapari Goat Farm Complex in the month of July 2025. Ten females were found to be pregnant and kidded in October–November 2025.

Body conditions of these goats revealed that Sojat goats have quickly adapted in this region. A total of 15 kids were born out of 10 kidding, 9 were male and 6 were female. It makes opening and closing balance of stock as 41 and 54.

The body weight of kids at birth and at 3 months of age was 3.64 kg and 13.23 kg, ranged up to 19 kg. The litter size was 1.50. The average weight gain during birth to 3 months of age was 107 gm/day under semi-intensive management. The average 90-day milk yield was 132 liters, ranged from 108



Fig. 3. Six month kids body weight-34 kg

to 172 liters, with a peak milk yield of 2.1 liters/day. Kids' mortality during birth to 3 months period was nil.

However, 2 adult females died due to CCPP/ mixed infection. The current body weight of males (bucks) averaged 64 kg, ranged up to 85 kg. The average body weight of adult females was 52 kg, ranged up to 74 kg. The Overall performance and body condition indicate that the Sojat goat is a hardy and promising breed with significant potential for commercial goat farming in India.

Growth, production and survival performance of Sojat Goats

1. Average 90-days milk yield: 131.86, ranged 108-172 liter.
2. Birth weight: 3.64, ranged from 1.8-4.8 kg
3. Average 3 month weight: 13.23 ranged from 9.5-18.5 kg.
4. Average 6 months body weight of kids: 21-34, ranged from 16-34 kg.
5. Average litter size/ kidding: 1.5
6. Mortality rate during birth to 3 month and 3-6 months of age: Nil
7. Adult Mortality: 4.88%
8. Overall Mortality: 3.57%



Fig. 1. Sojat buck with 80 kg body weight



Fig. 2. Sojat Doe with 425 litre milk in lactation

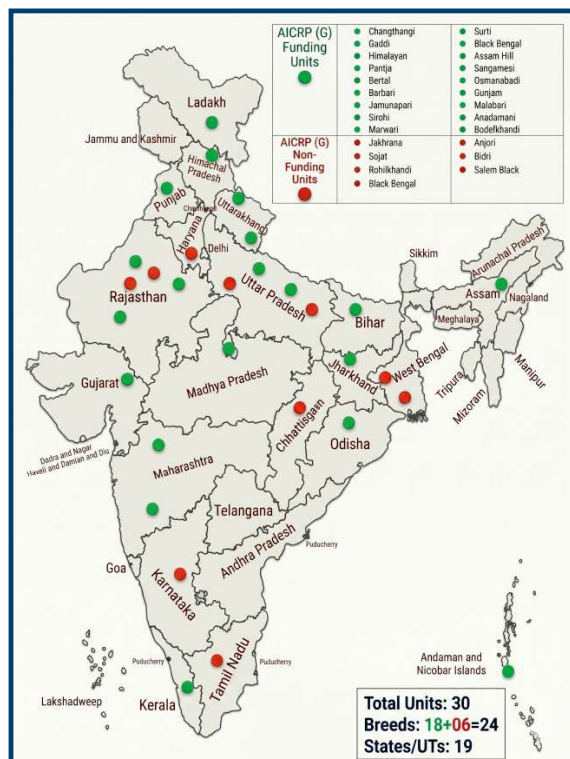
4.2 All India Co-ordinated Research Project on Goat

AICRP on Goat Improvement is a unique long term, structured programme aimed to bring upon genetic improvement and conservation of goat genetic resources of the country in their respective habitat and development of germ-plasm resource centres. The programme explores genetic

variations in local breeds through systemic animal identification and performance recording, selecting superior goats on the basis of their performances, development of breed and region-specific package of management practices, technologies and its validation in farmers' flock.

Table 1: Coordinating centers of AICRP on goat improvement

S.N.	Centre	Location	Starting Year
1	Project Coordinator Cell	ICAR-CIRG, Makhdoom, Uttar Pradesh	1977
Funding Units			
Farm Units			
1	Barbari	ICAR-CIRG, Makhdoom, Uttar Pradesh	1993-94
2	Jamunapari	ICAR-CIRG, Makhdoom, Uttar Pradesh	1993-94
3	Sirohi	ICAR-CSWRI, Avikanagar, Rajasthan	1993-94
Field Units			
4	Marwari	RAJUVAS, Bikaner, Rajasthan	1988-89
5	Ganjam	OUAT, Bhubaneswar, Odisha	2001-02
6	Malabari	KV&ASU Mannuthy, Thrissur, Kerala	2001-02
7	Sirohi	RAJUVAS, Vallabh Nagar, Rajasthan	2001-02
8	Surti	N.A.U., Navsari, Gujarat	2001-02
9	Sangamneri	MPKV, Rahuri, Maharashtra	2002-03
10	Assam Hill	AAU, Khanpara, Guwahati, Assam	2009-10
11	Gaddi	HPKV, Palampur, Himachal Pradesh	2009-10
12	Osmanabadi	NARI, Phaltan, Maharashtra,	2009-10
13	Andamani	ICAR-CIARI, Port Blair, A & N Island	2014-15
14	Changthangi	SKUAST, Kashmir, Leh-Ladakh, J&K	2014-15
15	Chaugarkha	ICAR-IVRI Campus, Mukteshwar, Uttarakhand	2014-15
16	Pantja	GBPUA & T, Pantnagar, Uttarakhand	2014-15
17	Black Bengal	ICAR-RCER, Patna (New Centre)	2018-19
18	Bundelkhandi	IGFRI, Jhansi (New Centre)	2018-19
19	Beetal	GADVASU, Ludhiana, Punjab	2022-23
Non-Funding Units			
1	Black Bengal	BAU, Kanke, Ranchi, Jharkhand	2009-10
2	Anjori	DSVCKV, Durg	2023-24
3	Black Bengal	ICAR-IVRI, ERS, Kolkata	2023-24
4	Black Bengal	ICAR-NDRI-ERS, Kalyani, Nadia (W.B)	2023-24
5	Bidri	KVAFSU, Nandinagar, Bidar, Karnataka	2023-24
6	Jakhrana	ICAR-CIRG, Makhdoom, Uttar Pradesh	2023-24
7	Jakhrana	LUVAS, Hisar, Haryana	2023-24
8	Rohilkhandi	ICAR-IVRI, Izatnagar	2023-24
9	Sojat	RAJUVAS, Vallabh Nagar, Rajasthan	2023-24
10	Sojat	MPUAT, Udaipur, Rajasthan	2023-24
11	Salem Black	VCRI, Namakkal, Tamil Nadu, India	2023-24



Presently, program is covering 18 breeds and 19 centres as funding units and 7 breeds with 11 centres as non-funding units across the country. Three breeds namely Barbari, Jamunapari and Sirohi are being improved under semi-intensive farming system at institutional organized farms. Other breeds are being improved under farmer's flock in their respective home tracts. The project is maintaining 500-750 goats under farm unit at Institutional nucleus flock, 100-150 goats of nucleus flock under field units and 3500-5000 goats with adopted farmer's flock. Currently project is focusing on building farmer participatory infrastructure for sustainable genetic improvement and conservation of caprine resources, action plan for breed specific research issues, development of multiplier flocks to ensure superior goat availability for improvement, entrepreneurship and skill of farmers, adoption of technologies, promoting animal welfare and women participation, enhancing employment and income of farmers and goat based livelihood activities for deprived communities and people of disadvantageous regions.

4.2.1 Barbari Farm Unit, ICAR-CIRG Makhdoom, Farah, Mathura, Uttar Pradesh

The opening and closing balance of flock on 01-04-2025 and 31-03-2026 was 596 and 585 with 234 and 264 adult females. There were 353 kids

born from 229 kidding with average litter size/kidding of 1.54. Conception rate through natural services in Ist and IInd and IIIrd services was 76.3, 15.9 and 4.1%. Maximum goats exhibited estrus in May (84.6%) during summer and in September (72.7%) in autumn season, however, sizable goats also exhibited estrus in peak winter season (25-58%). The average age at first service, weight at first service, age at first kidding, weight at first kidding and first kidding interval in 2025 was 401.04 ± 17.13 days, 20.19 ± 0.35 kg, 550.34 ± 17.10 days, 24.19 ± 0.42 kg and 309.26 ± 20.84 days, respectively. Breeding efficiency (%) and kidding efficiency (%) on the basis of doe's available were 122.6 and 180.7. Least squares means for average age at first service, weight at first service, weight at first kidding, age at first kidding and first kidding interval were 422.79 ± 4.43 days, 20.84 ± 0.30 kg, 23.25 ± 0.36 kg, 573.49 ± 7.59 days and 282.38 ± 11.37 days, respectively. Maximum goats exhibited estrus in May (80%) in summer and in September, October and November (75-84%) months in autumn season. The least squares means for live weights of kids born during 2025 were 2.15 ± 0.02 , 9.21 ± 0.09 , 13.66 ± 0.14 , 18.94 ± 0.27 and 25.01 ± 0.33 kg at birth, 3, 6, 9 and 12 months of ages, respectively. The effects of sex, type of birth, year of birth, season of birth and parity were significant. The h^2 estimates were 0.166 ± 0.032 , 0.194 ± 0.035 , 0.231 ± 0.038 and 0.161 ± 0.031 0.128 ± 0.029 for birth, 3, 6, 9 and 12 month weight. The least square means for 90 days milk yield, 140 days milk, total lactation yield and lactation length of goats kidded in 2025 were 84.18 ± 1.52 litre, 129.03 ± 2.080 litre, 132.86 ± 2.77 litre and 162.28 ± 2.33 days, respectively. There was 45 to 105% improvement in milk yield traits over the base years. The year and season of kidding and parity had significantly affected the lactation performances. The selection differential for 9 months body weight was 8.20 kg and 8.40 liters for dam's 140 days milk yield. The h^2 estimates were 0.192 ± 0.052 , 0.209 ± 0.052 , 0.201 ± 0.051 and 0.081 ± 0.031 for 90-D, 140-D, TLMY and LL. A total of 258 goats (144 male and 144 females) were provided to farmers and other stake holders for improvement. Multiplier flocks also sold 754 pedigreed goats to farmers. Milk produced was 17146 litres from 204 goats through 248 kiddings. Ten new multiplier flocks were added in the year. Annual culling and mortality rate was 2.39 and 7.16%. One hectare waste land improvised and developed agro-forestry making

total land as 5.5 hectare under agro-forestry cum Horti-pasture. Two shades were enlarged and one shed developed. Two technologies developed, validated and disseminated in farmers flock. Goat Breeding Calendar developed was awarded for Artistic and Literary Copyright in the year 2025 by Government of India. Three research papers were published in international and national journals. Nearly 2200 farmers were trained on goat management through 20 trainings on scientific goat farming's. Total revenue generated was Rs. 35.55 lakhs.

4.2.2 Jamunapari Farm Unit, ICAR-CIRG Makhdoom, Farah, Mathura, Uttar Pradesh

The opening and closing balance of flock on 01-04-2025 and 31-03-2026 was 447 and 365 with 206 and 173 adult females. There were 151 kids born from 110 kidding with average litter size/kidding of 1.37. Significant decline (improvement) of 22.5, 21.6 and 16.5% was observed in Age at First Service, first kidding and first kidding interval over the previous years and periods. The least squares means for body weights of kids born during 2025 were 3.49 ± 0.05 , 11.87 ± 0.17 , 17.51 ± 0.27 , 19.34 ± 0.42 and 26.50 ± 0.70 kg at birth, 3, 6, 9 and 12 months of ages, respectively. The stagnated growth performance in 6 and 9 months body weight was attributed to outbreak of mixed infections resulted in high mortality and poor growth of kids passing in 5 to 8 months of age. Males and single born kids were heavier than the females and twin born kids, respectively at all the stages of growth. The effects of sex, type of birth, year and season of birth and parity were significant. The h^2 estimates were 0.101 ± 0.032 , 0.359 ± 0.056 , 0.411 ± 0.061 , 0.279 ± 0.049 and 0.221 ± 0.043 for birth, 3, 6, 9 and 12 month weight. The least square means for 90 days milk yield, 140 days milk, total lactation yield and lactation length of goats kidded in 2025 were 119.84 ± 4.43 litre, 181.20 ± 7.00 litre, 210.86 ± 9.28 litre and 180.71 ± 4.36 days, respectively. Significant improvement recorded in lactation performance i.e. 41, 18, 18, 4.2 and 5.9% goats yielded 150-200, 201-250, 251-300, 301-350 and >350 liter milk in a lactation. Lactation traits showed 15-30% increase in milk yields. The year and season of kidding and parity had significantly affected the lactation performances. The selection differential for 9 months body weight was 5.98 kg and 46.4 liters for dam's 140 days milk yield. The h^2 estimates were 0.192 ± 0.045 , 0.202 ± 0.046 , 0.194 ± 0.045

and 0.104 ± 0.036 for 90-D, 140-D, TLMY and LL. There were 80 male and 70 females (150) pedigreed goats sold to farmers for field improvement. Four multiplier flocks establishment was supported by providing pedigreed goats as foundation stock. There was 8115 litre milk supplied to GPT section. Several facilities developed such as Expansion of open area in 8 sheds to create more space, three small sizes shads, one straw store, and fencing of agro-forestry area in 700 meter, Sick ward improvisation and installation of one submersible pump. One hectare waste land developed and fenced for agro-forestry unit with >200 plants. Total revenue generated was Rs. 27.62 lakhs. Goat Breeding Calendar developed was awarded for Artistic and Literary Copyright in the year 2025 by Government of India. One research papers were published in international journals. Nearly 1280 farmers were trained on goat management through 20 trainings on scientific goat farming's

4.2.3 Sirohi Farm Unit, ICAR-CSWRI, Avikanagar, Rajasthan

The opening balance of flock strength as on 01.04.2025 was 183 males and 333 females totalling 516 animals. The closing balance as on 31.03.2026 was 190 males and 349 females totalling 539 animals. The overall least squares means (LSM $\pm$ SE) for live weights of kids born in 2025-26 were 3.17 ± 0.03 , 12.79 ± 0.14 , 20.44 ± 0.24 , 26.95 ± 0.53 , and 31.70 ± 0.71 kg, respectively. The overall least squares means ($\pm$ SE) for growth rate, expressed as average daily gain, were 109.24 ± 0.58 g/day from 0 to 3 months (PDG 0-3) and 68.68 ± 0.58 g/day from 3 to 12 months (PDG 3-12). Kids born in 2025-26 exhibited growth rates of 106.42 ± 1.47 g/day and 60.72 ± 2.27 g/day for PDG 0-3 and PDG 3-12, respectively. Male and single-born kids were consistently heavier than female and multiple-born kids at all growth stages. The effects of year, sex, type of birth, and regression of dam weight were significant for all traits, except for the regression of dam weight on post-weaning average daily gain (3-12 months; PDG 3-12). The overall least squares means for milk yield of does kidded during 2025-26 were 88.09 ± 0.79 , 126.28 ± 1.22 and 130.50 ± 1.83 litres, and 170.21 ± 2.27 days, respectively. The effect of year of kidding was significant on all the traits except 150DMY, while the effects of lactation order and regression of dam weight were significant on all

these traits. Out of 182 does available for breeding during 2025 major season, 177 were tupped and 146 kidded with 34 gave birth to twins and one triplet. The tupping percentage was 97.25. The breeding efficiency was 83.52 and 85.88%, on the basis of does available and does tupped, respectively. The kidding percentage was 100.00 and 102.82 on the basis of does available and does tupped, respectively. The litter size was 1.25. The mortality rates in 0-3, 3-6, 6-12 month, adults and overall were 5.13, 1.14, 0.30, 1.05 and 2.85%. A total of 169 Sirohi goat of 87 males and 82 females were sold/distributed to the farmers, Government and non-government agencies for genetic improvement of their goats for meat and milk production. The total revenue generated from sale/transfer/culling of different items like animals, milk etc. during the year was Rs. 24,43,645.00.

4.2.4 Assam Hill Goat Field unit, Assam Agricultural University, Burnihat

ICAR-AICRP on Goat Improvement, Assam Hill Goat Field Unit was started in 2009. The unit has six clusters. The activities of the project have been expanded to other North eastern states viz., Meghalaya, Nagaland and Arunachal Pradesh. Two clusters each in Meghalaya and Nagaland. Five nucleus herd of Assam Hill Goat each in ICAR-KVK, Ri-Bhoi, Meghalaya, ICAR-KVK, Longding, Arunachal Pradesh, KVK, Diphu, Karbi Anglong, Lakhimpur College of Veterinary Science (AVFU), Livestock Research Station, Mandira, AVFU. A total of 719 farmers adopted covering 8337 goats. The opening and closing balance of animal is 176 and 201 at nucleus herd and 4278 and 5837 for field flock respectively. Average body weight at birth, 3, 6, 9 and 12 months were 1.37 ± 0.03 , 5.68 ± 0.03 , 8.93 ± 0.08 , 11.92 ± 0.130 and 14.93 ± 0.10 kg respectively in field flock. Corresponding values were 1.62 ± 0.03 , 6.08 ± 0.13 , 8.92 ± 0.31 , 11.69 ± 0.59 and 14.98 ± 0.18 kg in nucleus herd. Average AFS, WFS, AFK, WFK, FKI, FSP and litter size were 251.48 ± 2.51 days, 12.32 ± 0.13 kg, 398.67 ± 2.60 days, 18.12 ± 0.17 kg, 231.87 ± 4.62 days, 79.85 ± 3.17 days, 1.69 in field flock respectively. Corresponding values were 245.13 ± 5.84 days, 13.98 ± 0.65 kg, 392.88 ± 5.63 days, 18.83 ± 0.60 kg, 227.11 ± 6.54 days, 75.72 ± 3.25 days and 1.73 in nucleus herd. Average 60 and 90 days milk yield were 8.12 ± 1.46 and 12.48 ± 1.62 kg in field flock and 9.75 ± 0.95 and 14.70 ± 1.02 kg in nucleus herd.

Total milk yield was 12.48 ± 1.62 and 14.70 ± 1.02 kg in field flock and nucleus herd respectively. Selection differential were 2.11 kg and 1.84 kg for nucleus herd and 2.08 kg and 1.88 kg for field flock at 6 and 9 month body weight respectively. Ninety eight (98) bucks were distributed which covered almost 2148 does. Three (3) multiplier flocks were established with flock strength of 234 goats. Overall mortality rate was 5.86, 5.73 and 6.93% respectively in nucleus, farmers flock and multiplier flock. A total of 181 non-descript goats were upgraded. Income per goat/year was Rs. 4848.84, Rs. 4943.37, and Rs. 5451.72 in nucleus, farmer and multiplier flock respectively. Supplied 20 goats for the establishment of Nucleus flock to Meghalaya government Seventy (70) numbers of deworming, vaccination, castration and treatment camps, three kid shows, exposure visit for 3 clusters were organized. Sixty entrepreneurs were trained to establish goat unit. During the period of report, the project has four success stories and published three research papers, seven leaflets, two book chapters, one monograph and one status report on Assam Hill Goat. Income Generation per doe productivity per year has increased from Rs. 1,223.00 at the beginning of the project to Rs. 4943.37 in the year 2025-26. Revenue generated in the year 2025-26 was Rs. 80,000.00.

4.2.5 Andamani Goat Field Unit, ICAR-CIARI, Andaman & Nicobar Islands

The Andamani Goat Field Unit of ICAR-Central Island Agricultural Research Institute (ICAR-CIARI), Sri Vijaya Puram, has been functioning since 2014–15. This year a new cluster was established in the Rangat area, making total four clusters across South Andaman and North & Middle Andaman districts. A total of 157 farmers from 50 villages were registered. The opening and closing flock strengths were 4,272 and 4,707 goats, respectively. During the year, 2,162 goats were newly registered and 2,274 kids were born, while 171 deaths and 1,557 sales were recorded. Tattooing of animals was introduced for accurate identification and data recording. The overall least square means of body weights at birth, 3, 6, 9 and 12 months of age in farmers' flocks were 1.51 ± 0.01 , 6.10 ± 0.07 , 9.61 ± 0.20 , 12.20 ± 0.16 and 16.67 ± 0.09 kg, respectively. The mean age at first mating and first kidding was 242.96 ± 12.31 and 379.96 ± 17.20 days, respectively, and body weights at first mating and first kidding was 13.41 ± 0.43 and 17.56 ± 0.46 kg, respectively. The

average litter size was 1.57. A total of 11 training and awareness programmes and 4 field days were organized, benefiting 280 farmers, including 178 males and 108 females. Health management support included preparation and dissemination of a deworming calendar, deworming of approximately 2,900 goats, distribution of mineral mixture for 2,200 goats and supply of 100 kg of milk replacer. The overall mortality was 4.6%. Selection differential at 6 month body weights was 0.95 kg. Infrastructure improvements included installation of an automatic watering system, jet washer facility and manure pit in the nucleus flock, while 3 tribal farmers established goat sheds with a capacity of 25 goats each using materials supplied through the project. Another 5 farmers also extended this support under TSP. Use of common medicines and herbal preparations for diarrhoea, wound healing, fly repellence, indigestion and respiratory ailments promoted. More than two acres of land were maintained under tree fodder production with species such as agathi, moringa and jackfruit, while an additional acre was newly established. An artificial insemination and semen collection crate developed under the project was granted a design patent. One research article and 4 extension folders were published.

4.2.6 Black Bengal Goat Field Unit , ICAR-RECR, Patna, Bihar

AICRP on Goat Improvement for Black Bengal unit was started at ICAR Research Complex for Eastern Region, Patna in the year 2018-19. The program covered a total of 7,467 goats owned by 908 farmers across four villages. These villages were organized into four clusters and spread across four districts of Bihar, namely East Champaran, Katihar, Jamui, and Araria. During 2025–26, opening balance of nucleus flock was 117 and closing balance was 142 goats. Similarly, opening and closing balance in the field was 3,934 and 4,373. The average body weight of goats at nucleus flock was 1.36, 4.88, 7.20, 9.43 and 13.38 kg at birth, 3, 6, 9 and 12 months. Corresponding values were 1.35, 4.70, 7.13, 10.30, 12.79 kg. The nucleus flock recorded an average milk yield of 25.23 liters in 90 days, a total milk yield of 26.47 liters in 112 days lactation period. Corresponding values were 22.95 and 23.56 liters. In the nucleus flock, the average age at first mating and first kidding was 280 days and 423 days, respectively, while the average body weight at first mating and first kidding was 13.97 kg and 16.88 kg,

respectively. Corresponding values were 282 and 431 days, and 12.23 kg and 14.11 kg. The average litter size in the nucleus flock was 1.54, while 1.78 in farmers flock. The mortality rate in the nucleus flock and field flock was 11.8% 14.39%, respectively. During 2025–26, a total of 11 goats were sold from the Nucleus Flock, while 20 goats were transferred for further breeding and field-level interventions. In the Field Flock, a total of 4,235 goats were sold, 20 female goats were distributed to SC women farmers. The average income per adult doe was Rs. 5,409. The average sale price per goat was Rs. 3,039. Two training programs were organized under the project and 60 farmers benefited. 16 bamboo-based goat shelters (four in each cluster) were provided to farmers. A total of 3,135 goats were dewormed and 2,730 goats were vaccinated under the project. A total of 1,496 non-descript goats were upgraded with Black Bengal Bucks. Five multiplier flocks were established. In addition, one Commercial Goat Farm was developed in Jamui district. These units were provided regular technical and prophylactic support to ensure better goat health and productivity. Total Rs 70,835/- revenue generated from nucleus farm by selling elite Buck and goat.

4.2.7 Bundelkhandi Goat Field Unit, ICAR-IGFRI, Jhansi, Uttar Pradesh

The project on Bundelkhandi goats began in 2018 with activities in three villages, covering a modest population of 978 goats. Over the years, the initiative has steadily expanded, and today the AICRP unit operates in six villages, reaching 4,717 goats. Across the clusters of Datia (MP) and Jhansi (UP), a total of 244 farmers participated, comprising 229 males and 15 females. The opening and closing balance in nucleus flock was 103 and 161. In the nucleus herd, age at first mating, age at first kidding, weight at first kidding and kidding interval was 389.2 ± 15.8 days, 549.3 ± 17.5 days, 24.82 ± 0.8 kg and 265.25 ± 8.7 days. The litter size 1.33, respectively. The average body at birth, 3, 6, 9 and 12 month of ages were 2.45 ± 0.7 , 11.49 ± 0.52 , 17.81 ± 0.68 , 19.70 ± 0.62 and 23.95 ± 0.51 kg, respectively. The mortality rate in the nucleus flock and field flocks were 7.72 and 5.93%, respectively. The selection differential at 12 month body weigh was 4.55 kg. Seven buck distributed during the year. 4 training programs were organized and 129 farmers (including 93 from SC/ST communities) were benefited and 298 farmers were benefited through demonstrations and input distribution. During the

year, more than 5,500 vaccinations against FMD, PPR, and ET were administered, alongside 494 deworming treatments, 647 dipping operations, and 1,336 clinical interventions. Seven breeding bucks were distributed to households during the year. Feed and fodder storage facilities in the nucleus herd were repaired and modified, while multiplier flocks were supplied with compound feed, mineral mixtures, and BN hybrid root slips to enhance fodder production. TSP activities were carried out through the Krishi Vigyan Kendra of RVSKVV, Gwalior, in selected villages of Alirajpur district. The interventions focused on integrating improved technologies in crops, fodder, and livestock to promote sustainable livelihood enhancement. One popular article published.

4.2.8 Changthangi Goat Field Unit, University of Ladakh

The Changthangi Unit of All India Coordinated Research Project on Goat was started from 1st April 2014 at HMAARI, SKUAST-K Leh, presently known as School of Agriculture Science and Technology, Stakna Campus, University of Ladakh. The unit was operational across six clusters comprising nine villages. The opening and closing balance across all clusters was 18,288 and 29,526. The overall kidding percentage was 81.38%, while the overall mortality rate was 9.51%. This year around 9174 Does were used for breeding and conception rate was 79.5%. The mean pashmina yield across the three clusters was recorded at around 500gms/animal/year. The Changthangi goat of Ladakh produces the finest pashmina fibre in the world with a record of 12-micron fibre diameter in the past, but in the recent times the quality of this pashmina fibre in terms of fibre diameter has deteriorated. The result shows an overall average diameter of 15.23 micron with a fibre length of 60.28mm in all the project areas. The body weight at birth weight, 3 months, 6 months, 9 months and 12 months were 2.36 ± 0.06 , 6.61 ± 0.12 , 9.68 ± 0.04 , 13.51 ± 0.20 and 17.58 ± 0.18 kg, respectively. The overall pashmina yield in the selected areas comes to around 330 gms/animal. This year around 994 Male and 684 female goats were sold to butchers and government sectors. This year, 7 bucks and 57 does were sold to the government sector for breeding purposes and total of 987 castrated Male bucks and 627 females does were sold to butcher which is (6.45%) of the total population. Under the health management Programme of the project,

general treatment, dosing and dipping was done for all the adopted goats of the 9 clusters (approximately 22184 goats). Around 1345 goats were vaccinated against PPR, FMD and Clostridia infection. The unit has established a nucleus Herd of Pashmina goats at KVK-Leh Stakna, the males produced from this nucleus herd are distributed to the beneficiary farmers free of cost for breed improvement. 16 elite buck were distributed to three adopted cluster such as Gyaltsa nomad, Samad and Angkung. 13 trainings, health camps cum awareness programme were conducted. The total participants in all these training Programme comprised 109 male and 52 female participants/pastoralists. The unit has adopted 10 hectares of barren land for alfalfa fodder production at HMAARI- Leh for feeding the nucleus herd maintained at HMAARI-Leh. A trial was conducted on goat milk replacer at nucleus flock in 2024 and the result was impressive with low mortality and healthy kid. In 2025 the milk replacer has been distributed and provided to Samad and Gyaltsa nomad on trial basis in the field unit with very good result. A two-day National Seminar/Workshop on “Climate Resilient Sheep and Goat Farming in High Lands” was organized under the project in collaboration with Network Project on Sheep Improvement (NWPSI) on 24th & 25th September 2025 at, Leh.

4.2.9 Chaugarkha (Himalayan) Goat unit, ICAR-IVRI, Mukteswar, Nainital, Uttarakhand

AICRP (Himalayan goat unit) is located at ICAR-IVRI, Mukteswar, Nainital, Uttarakhand. A total of five villages—Natadole, Bhetadangi, Lamkote, Pitholi, and Aghariya—located in two districts, Nainital and Almora, were covered. A total of 150 farmers were registered, encompassing 1,313 goats under the project intervention during the reporting period. The opening and closing balance of the nucleus flock was 225 goats (72 male and 153 female) and 212 (83 male and 129 female), respectively. The opening and closing balance of the farm flock was 1248 goats (292 male and 956 female) and 1313 (332 male and 981 female), respectively. AFS, AFK and weight at age at first service of the nucleus flock was 390.28 ± 5.26 days, 536.42 ± 5.72 days and 23.15 ± 0.73 Kg, respectively. Overall mean body weights (kg) in nucleus flock at birth, 3, 6, 9 and 12 months were 1.88 ± 0.06 , 8.82 ± 0.31 , 12.56 ± 0.35 , 15.08 ± 0.50 , 19.52 ± 0.54 kg, respectively. For the field, the

overall mean body weights (kg) at birth, 3, 6, 9 and 12 months were 1.78 ± 0.20 , 5.74 ± 0.30 , 9.87 ± 0.87 , 13.89 ± 0.14 , 16.21 ± 0.29 kg, respectively. The mortality rate was 3.04%. Milk yield at 60 days was 25.34 ± 1.01 litre. The kidding percentage (litter size) at farm and field was 1.42 and 1.16, respectively. Selection differential for body weight (male) at 6 and 9 months at nucleus flock was 1.50 and 3.12 Kg, respectively. A total of 12 extension activities (animal health camps, exposure visit, input distribution programs etc.) were organized benefitting 1020 farmers. A revenue of ₹ 2,42,479/- was generated through the sale of 33 Chaugarkha goats (10 males and 23 females) from the nucleus flock. Ten sire lines were identified and maintained for breeding purpose. Three new village/clusters namely Pitholi, Kherada and Darima were surveyed. During this year a total of 17 goats (03 male and 14 female) were purchased to strengthen nucleus farm.

4.2.10 Gaddi Goat Field Unit, CSK-HPKV, Palampur, Himachal Pradesh

The All India Co-ordinated Research Project on Goat Improvement (Gaddi Field Unit) was sanctioned to this centre on 17th February 2009. The opening and closing balance in field flock was 1710 and 4205. Similarly, opening balance and closing balance in nucleus flock was 67 and 23. The age at first kidding and kidding interval in the nucleus and field flocks were recorded as 27.18 months and 21.25 months, respectively, while the corresponding values for kidding interval were 21.66 months and 13.2 months. During the year, the least square means for body weight at birth, 3, 6, 9, and 12 months of age were 3.20 ± 0.08 , 17.24 ± 0.84 , 22.72 ± 0.56 , 27.85 ± 0.24 , and 31.27 ± 0.72 kg, respectively. For breeding inputs, a total of 21 breeding bucks were finally distributed to 19 different farmers as a breeding input under AICRP. The total number of multiplier flocks is 5 in numbers and with 1460 animals i.e. flock strength. The overall population growth was observed to be 106.50%. The overall mortality incidence was found to be 5.28%. The incidence of twin birth recorded was 9.76% and litter size 1.18 respectively. The breeding efficiency or fertility percent on the basis of does available was 84.72% and on the basis of does tupped was 91.10% respectively. The kidding percent were on the basis of does available was 66.46 % and on the basis of does tupped was 78.58 % respectively. Three training, six gosthi, six health camp were

organized during the year. All selected animals were provided health coverage under migratory field conditions viz. vaccination against PPR, (7900), de-worming against endo-parasites after faecal sample analysis, periodic health check-ups etc. Strategic supplementary feeding was also provided in the form of concentrate feed (68qtls.) and mineral mixture (360kg). Collaboration with state Animal Husbandry Department was ensured while providing health coverage and other related activities. The income per goat per year was Rs.5300/- only.

4.2.11 Ganjam Goat Field Unit, OUAT, Bhubaneswar, Odisha

The project is operational at OUAT, Bhubaneswar from the year 2001-02. The field unit operated at 4 different clusters (28 villages) with 106 numbers of registered goat farmers at Chhatrapur, Rambha, Khallikote and Jirabadi in Ganjam district. The opening flock strength was 2779 and closing flock strength was 3116 for this year from Chhatrapur cluster, 574 from Rambha cluster, 978 from Khallikote cluster and 803 from Jirabadi cluster. Average age at first service (AFS), age at first kidding (AFK), weight at first kidding (WFK), first kidding interval (FKI) were 394.0 ± 2.21 days, 598.87 ± 5.05 kg, 22.72 ± 1.33 kg, 222.19 ± 2.54 days, respectively. The milk yield at 60 days was 15.18 ± 0.20 litre. The means of body weights of Ganjam goats were 2.89 ± 0.01 , 7.58 ± 0.04 , 10.98 ± 0.04 , 15.69 ± 0.04 and 19.41 ± 0.08 kg at birth, 3, 6, 9 and 12 month of age respectively. The improvement in body weights (selection differential) at 9 month age has been 3.63 kg as compared to the base year of 2001-02. The average income of goat farmers per Ganjam goat per year was Rs 4693. The litter size in Ganjam goat was 1.0. A total of 50 adult elite bucks were distributed to goat farmers. The mortality rate was 5.3%. Total three numbers of low-cost goat shed for farmers were constructed in field. Four farmers were provided with elevated plastic slatted floor for goats. The goat farmers of multiplier flock were supplied with elevated plastic slatted floor provided and elite breeding bucks. A total of sixteen training programmes were organized benefitting 419 farmers. Out of them 37 were SC, 69 were ST, 87 were women farmers. Total deworming doses of 9261 and vaccination doses of 5485 were provided as prophylactic measures. A total 4516 goats were treated. During the year two research paper published in >6 NAAS rating journals.

4.2.12 Malabari Goat Field Unit, KV&ASU, Mannuthy, Thrissur, Kerala

The AICRP on goat improvement (Malabari field unit) started functioning from April, 2001, at CVA, Mannuthy, Thrissur. Total of 271 farmers have been registered under the project including 190 women in six field clusters. Number of goats covered are 5208 including kids. There are 135 goats maintained at Nucleus Farm Mannuthy. Non-descript goat upgraded during the year was 140 through Artificial Insemination. The opening and closing balance were 4292 and 5208, respectively. Ten multiplier flocks are established at Thrissur, Palakkad and Malappuram districts with total flock strength of 737 goats. The opening and closing balance in the nucleus flock were 129 and 135, respectively. Total of 37 kids were distributed/sold to farmers from the nucleus flock. Total of 70 bucks including (33 bucks purchased) of Malabari breed was selected on the basis of 6/9 months body weight and distributed to farmers / multiplier flocks. During 2025-26, 1546 kids were born from 908 kidding, of which 776 were females. The mean body weight recorded in field was 2.14 ± 0.02 kg, 9.10 ± 0.20 kg, 15.43 ± 0.33 kg, 22.96 ± 0.15 kg and 24.84 ± 1.54 kg at birth, three, six, nine and twelve months of age, respectively. The corresponding body weights at nucleus flock was 2.10 ± 0.03 kg, 9.20 ± 0.20 kg, 15.70 ± 0.40 kg, 23.50 ± 0.55 kg and 24.80 ± 1.50 kg, respectively. The mean age at first kidding and inter-kidding interval were 396.10 ± 10.11 , 273.10 ± 10.70 days, respectively. Animals were attaining first service at an average age of 246.88 ± 8.14 days and first kidding at 396.10 ± 10.11 days. The corresponding body weights at first mating and first kidding were 22.12 ± 1.55 kg and 26.70 ± 2.40 kg, respectively. The mean kidding interval was 273.10 ± 10.70 . Kidding rate was 1.71. Percentage of singles, twins and triplets were 40.35, 49.73, 9.16 and 0.76 respectively. Multiple births were highest at Thalassery (79.81%) followed by Tanur (67.72%) and Vadakara (63.49%) cluster. The average daily milk yield recorded was 0.93 ± 0.05 litre. Mean lactation yield was 80.40 ± 5.52 litres with lactation length of 86.80 ± 4.85 days. The estimated selection differential for 9-month body weight and 90-day milk yield was 3.61kg and 5.10 litre, respectively. The mortality rate in field and nucleus flock was 3.81% and 5.20%. Organized 14 training programmes attended by 516 including 261 women. The estimated annual income/goat/year

was Rs. 17,688. Published four research papers in the peer reviewed International / national Journals. The effective linkages developed with NABARD and Fish FPO, State Agriculture & Animal Husbandry Department.

4.2.13 Marwari Goat Field Unit, RAJUVAS, Bikaner, Rajasthan

The Marwari field unit, is functioning at RAJUVAS, Bikaner from 1990. The opening and closing balances at the nucleus farm were 157 and 177, respectively, while it was 3,202 and 3,908 in the field flock. The Marwari unit is operational in 4 clusters, namely Daiya, Kalayansar, and Raisar in Bikaner district, and Kan Singh Ki Sird in Jodhpur district. In the field flock, age at first service, age at first kidding, weight at first service, weight at first kidding, and first kidding interval were 369 ± 2.48 , 527 ± 3.05 days, 24.0 ± 0.10 , 28.8 ± 0.28 kg, and 331 ± 2.11 days, respectively, while corresponding values in the nucleus flock were 364 ± 3.10 , 518 ± 4.32 days, 23.9 ± 0.65 , 29.0 ± 0.61 kg and 328 ± 3.80 days, respectively. The least square means for body weight in the nucleus flock at birth, 3, 6, and 9 months of age were 2.76 ± 0.014 , 9.35 ± 0.167 , 14.56 ± 0.358 , and 23.11 ± 0.357 kg, respectively. Similarly, the least square means for body weight in the field flock at birth, 3, 6, and 9 months of age were 2.71 ± 0.007 , 8.90 ± 0.016 , 15.11 ± 0.081 , and 18.61 ± 0.189 kg, respectively. The milk yield at 60 days, 90 days, total milk yield, and lactation length in the field unit were 63.51 ± 0.199 , 88.58 ± 0.279 , 95.09 ± 0.321 liters, and 109.56 ± 0.189 days, respectively. Similarly, in the nucleus flock, the corresponding values were 66.23 ± 0.31 , 90.02 ± 0.42 , 98.13 ± 0.56 liters, and 109.85 ± 0.48 days, respectively. The kidding percentage and kidding rate was 95.47% and 1.03, respectively. The mortality rate in farmer flock of field and nucleus flock was 5.81 and 6.26%, respectively. Total 599 animals supplied during the year. A total of 68 farmers have been registered under the unit. The 34 new bucks were distributed during year. Selection differential was 0.60 kg and 1.03, respectively. 3 Multiplier flocks with flock strength of 125 were developed. 7 training programs were conducted for capacity building of registered farmers in Marwari field unit with total farmer strength of 128 including 38 female farmers. The mineral supplementation, vaccination, deworming was done in more than 3000 goats during this financial year. As infrastructure development fodder store, kidding

pen, mating pen etc. constructed this year. Income per goat/year was found as 3780 Rs. Total revenue was 82753 during the year.

4.2.14 Osmanabadi Goat Field Unit, NARI, Phaltan, Maharashtra

The Osmanabadi goat field unit of the ICAR-AICRP Goat Improvement was started in June 2009 at the Nimbkar Agricultural Research Institute, Animal Husbandry Division, Phaltan, District Satara, Maharashtra, and is currently operational across six clusters in six districts. During the year 2025–26, 83 new goat keepers and their 635 goats were registered in five existing clusters, namely Ahilyanagar, Beed, Pune, Satara, and Solapur, while performance recording of a total of 3,541 goats belonging to 216 goat keepers was carried out across six clusters in six districts of Maharashtra. The opening and closing balances of the field flock were 1,259 and 2,530, respectively, while the opening and closing balances of the nucleus flock were 175 and 220, respectively. Age at first service, age at first kidding, weight at first service, weight at first kidding and kidding interval was 300 ± 5.0 days, 452 ± 5.0 days, 19.8 ± 0.80 kg, 25.1 ± 1.2 kg and 249.9 ± 12.2 days, respectively. During 1 April 2025 to 31 March 2026, in 924 kiddings, 1520 kids were born making the average litter size per kidding 1.65. The least squares mean for body weight at birth, 3, 6, 9 and 12-months were 2.8 ± 0.03 , 11.8 ± 0.10 , 16.2 ± 0.20 , 19.0 ± 0.40 and 23.0 ± 0.30 kg, respectively. The least squares mean 30, 60 and 90-day milk yield was 43.2 ± 1.3 , 91.3 ± 2.5 and 115.35 ± 4.4 litre, respectively. The heritability at birth, 3, 6, 9, and 12 Month ages was 0.13 ± 0.04 , 0.12 ± 0.03 , 0.15 ± 0.04 and 0.13 ± 0.06 , respectively. Similarly, heritability at 30, 60 and 90 days was 0.03 ± 0.16 , 0.06 ± 0.25 and 0.10 ± 0.16 , respectively. Total 9010 Straws (0.25 ml French mini straws) of frozen semen of 108 Osmanabadi bucks have been produced in NARI's Buck Semen Freezing Laboratory from 2012 to 31 March 2026. During 2025-26, 2,807 straws of 37 Osmanabadi bucks were frozen and 2,704 straws were supplied to Manndeshi Foundation and local A.I. technicians, farmers and entrepreneurs for breeding Osmanabadi goats. Conception rates reported by field AI technicians are 50-55%. The Osmanabadi field unit has established 11 multiplier flocks which have 195 adult does in total. One research paper published during the year.

4.2.15 Pantja Goat Field Unit, GBPUA&T, Pantnagar, U. S. Nagar, Uttarakhand

The AICRP-Pantja centre is operational at GBPUA&T, Pantnagar since Aug, 2014. There were 85 females and 38 males maintained at nucleus flock. The centre has adopted 229 households across 81 villages in 4 clusters viz. Bhimtal, Gadarpur, Kichha and Majhera in Nanital & U S Nagar districts of Uttarakhand. Presently, opening and closing balance of Pantja goats in adopted clusters were 3,615 and 4,037, respectively. The Age at first mating, Weight at first mating, Age at first kidding, Weight at first kidding and First kidding interval were 268.7 ± 1.76 days, 22.46 ± 0.09 kg, 418.80 ± 1.53 days, 26.57 ± 0.10 kg and 244.86 ± 3.79 , respectively in farmers flock. The litter size was 1.59. The body weights at birth, 3, 6, 9, and 12 month ages were 2.30 ± 0.01 , 11.39 ± 0.04 , 16.55 ± 0.05 , 20.61 ± 0.05 and 25.14 ± 0.07 kg, respectively in farmers flock. The milk yield at 30, 60, 90, 120 and 150 days were 13.19 ± 0.29 , 29.02 ± 0.07 , 49.88 ± 0.20 , 62.56 ± 0.18 and 69.48 ± 0.17 ltr, respectively in field flocks. The selection differentials for 12-month body weight and 90-day milk yield were 3.39 kg and 1.82 ltr respectively. The overall mortality rate was 5.74%. Total 1161 animals were sold during the year. The kidding rate was 1.59 (litter size) kids with higher number of twinning and triplets as 50.75 % and 3.45 % respectively. Pantja goats are quite prolific with multiple births of 54.73 %, breeding efficiency of 96.78 % & kidding efficiency of 144.88 %. The milk of Pantja goat was found to have 3.87 % fat and 9.13 % SNF. During the year, 34 bucks (total 264) were distributed in the project area with 141 functional bucks covering 1,593 does including 462 non-descript goats. Seven training programs were organized and 3817 farmers were trained. The 11 multiplier flocks was established. Various inputs like medicines (antibiotics, ant-helmentics, anti-diarrhoeals, analgesics, etc.), vaccines, feeding etc. have been distributed in the project area. The centre has published 01 abstracts, 01 thesis, 01 leaflets, and 01 training manual in the current year. Net income of goat farmers has increased tremendously from Rs 7,250 per doe per year in 2021-22 to Rs 10,150 in 2025-26. It was observed that use of elite Pantja bucks has resulted in additional gain of about 4.1 kg in 12-month body weight of kids as compared to local goats translating into about 6.2 kg additional live

weight per doe fetching an additional income of Rs 2418 per doe per year which is a significant financial gain for goat keepers under the project.

4.2.16 Sangamneri Goat Field Unit, MPKV, Rahuri, Maharashtra

The All India Co-ordinated Research Project on Sangamneri goat (field unit) is executed from 21.3.2002 at MPKV, Rahuri. Total 4842 goats of 1153 farmers from 67 villages in five clusters of 3 districts were covered under the programme. The opening & closing flock size of nucleus flock was 194 and 231 respectively, whereas for farmer flock it was 12163 and 12199, respectively. Total 32 goats were sold and 53 goats supplied for breeding from nucleus flock. The mortality rate was 8.10%, 12.58%, 9.37% in 0-3 month, 3-12 month and in adults whereas corresponding values were 4.79 %, 0.32 % and 0.36 % in adult goats. The overall least square means for birth, 3, 6, 9 and 12 month body weights were 2.30 ± 0.070 , 7.72 ± 0.427 , 10.80 ± 0.631 , 13.90 ± 0.671 and 18.65 ± 0.672 kg respectively in nucleus flock. The corresponding means were 2.36 ± 0.073 , 7.71 ± 0.451 , 10.69 ± 0.724 , 13.99 ± 0.782 and 18.66 ± 0.795 kg, respectively. The least squares means were 350.093 ± 20.983 , 490.558 ± 20.575 and 325.532 ± 40.219 days, respectively. The overall litter size was 1.80. The average 90 days milk yield during 2025-2026 was 121.03 litre. 16 group meeting (One day /207 Farmers), 2 SCSP trainings (One day /98 Farmers) and 11 general trainings (Three day / 109 Farmers, One day /208) were organized. Prophylactic measures were carried out by vaccinating 4900 goats against ET and PPR and deworming of 3100 goats were done with the help of Department of Animal Husbandry (MS). The selection differential for 9 month body weight was 9.36 kg. Population of Sangamneri goats increased by 10.25 per cent over the last year in registered clusters, however the population in breeding tract increased by 1497.26 per cent over base line (i.e. 3759 during 2006-07 to 56282 during 2025-26). Milk production is improved by 92.22% over baseline data and the reproduction performance has increased from 7 to 17%. Maximum male kids (95%) have been marketed at the age of 4-5 months @ Rs. 4500-6000. The net income generated goes to Rs.3500-4000. Five multiplier flocks and 04 Commercial flocks were established. Total 39 cubic meter of goat manure produced and 32 goats were sold and revenue of Rs. 217245.00 generated. Population of

Sangamneri goats increased by 10.25 per cent over the last year in registered clusters, however the population in breeding tract increased by 1497.26 per cent over base line (i.e. 3759 during 2006-07 to 56282 during 2025-26). Four research papers were published.

4.2.17 Sirohi Goat Field Unit, LRS, Vallabhnagar, RAJUVAS, Rajasthan

On-going AICRP on goat improvement (Sirohi field unit) came in to effect on 1st January 2001, with the main objective to bring about the improvement in the farmers flock. The opening and closing flock strength at nucleus flock was 336 and 432, corresponding values were 4927 and 3538, respectively in the farmer flock. During the year, a total of 5,518 goats were covered. Out of these, 2,976 goats were registered and 2,542 goats were unregistered. During report period, 1525 kids were born, out of which 727 were males. Age at first mating, weight at first mating, age at first kidding, weight at first kidding, service period, kidding interval and gestation period of test progenies were 486.19 ± 22.66 days, 23.89 ± 0.31 kg, 636.94 ± 22.77 days, 27.95 ± 0.56 kg, 208.63 ± 4.82 days 361.27 ± 4.67 days, and 150.88 ± 0.07 days, respectively. The kidding rate (litter size) was 1.27. The least square means for body weight at birth, 3, 6, 9, and 12 months of age in the field flock were 2.51 ± 0.04 , 12.38 ± 0.13 , 17.28 ± 0.26 , 20.19 ± 0.26 , and 24.38 ± 0.35 kg, respectively. Similarly, in the nucleus flock, the body weight at birth, 3, 6, and 9 months of age were 2.78 ± 0.35 , 15.24 ± 2.10 , 19.40 ± 3.11 , and 22.55 ± 1.55 kg, respectively. Cluster, sex of kid and year of birth had significant effect on the body weights. In the field flock, the least square means for milk yield at 60, 90, and 150 days, lactation yield, and lactation length were 51.43 ± 2.88 , 69.79 ± 3.11 , 94.37 ± 43.17 , 95.27 ± 5.85 liters, and 151.12 ± 2.37 days, respectively. Similarly, in the nucleus flock, milk yield at 60, 90, and 150 days, lactation yield, and lactation length were 57.95 ± 1.92 , 90.30 ± 2.14 , 135.45 ± 4.87 , 135.87 ± 4.34 liters, and 149.16 ± 1.08 days, respectively. The overall mortality was 2.98%. The selection differential at 9 month body weight and 90 days milk yield was 11.04 kg and 17.95 litre, respectively. Total 1537 non-descript goat was upgraded. Five multiplier flocks was established. Total 731 males were sold out of which maximum 490 males were sold from adult age group During report period 9337 animals were dewormed, and 9513 treated to control ecto-

parasite. Further, 3578, 2327 animals were vaccinated for ET, PPR, respectively.

4.2.18 Surti Field Unit, LRS, Kamdhenu University, Navsari, Gujarat

The project covers the goat owners from districts of southern Gujarat viz. Bharuch, Surat, Navsari, Tapi, Valsad and Dangs. The opening and closing balance of the Surti nucleus flock were 158 and 220, respectively. The litter size of nucleus and field flock was 1.61 and 1.34. Age at first service, age at first kidding, weight at first service, weight at first kidding and first kidding interval was 361.66 ± 32.05 days, 514.83 ± 31.66 days, 25.81 ± 0.32 kg, 30.76 ± 0.45 kg and 337.53 ± 12.02 days. The least squares mean for body weight of nucleus flock at birth, 3, 6, 9, and 12 month of age was 2.35 ± 0.03 , 12.07 ± 0.19 , 18.34 ± 0.39 , 22.25 ± 0.48 and 27.60 ± 0.58 kg, respectively. Similarly, least squares mean for body weight of field flock at birth, 3, 6, 9, and 12 month of age was 2.58 ± 0.20 , 10.33 ± 0.02 , 16.41 ± 0.02 , 20.67 ± 0.03 and 27.33 ± 0.03 kg, respectively. Substantial improvement has been observed in farmers flock for growth (body weight - kg) at BW3, BW6, BW9, BW12 by 8.62 %, 23.19 %, 24.96 % and 28.43 % respectively during year 2025-26 as compared to 2005-06. The milk yield at 60, 90, 140/150 days, total milk yield and lactation length was 80.01 ± 3.51 , 97.48 ± 5.98 , 147.65 ± 10.54 , 162.88 ± 19.01 litre and 196.14 ± 13.83 days, respectively. The mortality rate was 0.45%. Total 28 buck distributed to farmers. Total milk production during the year was 196.14 ± 19.01 , respectively. The income /adult goat was 631.3. Two research papers published during the year. Five training program organized and 115 farmers' benefitted. Farmers registered under the project are also regularly provided healthcare viz., deworming, vaccination, health tonics etc. and inputs like concentrate, mineral mixture, health tonics, licking blocks, milking jugs, measure taps, water bottles, cap, rain coat etc.

4.2.19 Anjori Goat Unit, DSVCKV, Durg, Chhatisgarh

This unit is established in the month of November 2025 under mandate of AICRP-Anjori goat Non-funding unit (Anjori goat registered with Accession Number India-Goat-2600Anjori-06038 in the year 2023). Now recognized as funding unit from 2026-27. To establish and develop germplasm resource centres, 20 cluster villages selected in 6 districts covering 48 farmers

who are rearing Anjori goat and covered required breedable population around 2500 animals. Before bringing this Anjori stock, old goat were sold and goat shed was repaired and white washing done. Opening and closing flock of Breedable animal upto 31st March 2026 at nucleus flock is 02 male and 28 female (Total 25) and 25 kids. No animal sold and mortality of flock is around 8%. Average birth weight is 1.82 kg and 3 month weight is 6.63 kg. Kidding percentage is 76.92% and twinning rate in nucleus herd is 35%. Four training programmes conducted under NRLM, Bihan and paid training fund generated for training is Rs. 5.10 lakh and total farmers benefitted is 193 out of which Sc-26, St-45, OBC-98, Women-91 farmers and entrepreneurs. Deworming was practiced in every 3 month, vaccination against PPR in Nov-Dec month and ET vaccination completed just before monsoon. I have created three Whatsapp group with 2000+ farmers since 2022-23, Nodal officer DEE, DSVCKV Extension advisory group, Co-Nodal officer Hamar Pashudhan U-tube channel for Extension and publicity activity and editor of publication committee of Hamar pashudhan half yearly magazine and Kamdhenu prasar Darpan Quarterly magazine published by DEE, DSVCKV, Durg (C.G.) for Extension and publicity activity. In the year 2025, commercial farms established with 200+10 Anjori goat unit (under NLM scheme) at farmers level by Shri D. Shrinivasan, Cluster village Achanakur, Block-Patan, Dist-Durg (C.G.) and helped in project preparation, regular monitoring and visit at farm. Worked as editor and worked as co-organizing secretary in two day national conference AMRCON 2025 during which Souvenir published on topic "Strengthening One Health Synergy: Combating AMR through Cross-Sectoral Innovation and Integration" AMRCON 2025 dated 6-7 October, 2025 organized by DSVCKV, Durg in collaboration with IVA(96/1967) and IMA at Veterinary College, Anjora. DSVCKV, Durg (C.G.) Souvenir; 2025 supported by NABARD, published by Content Vibes publishers, printer and Aggregators, Haryana. ISBN No: 978-93-6755-589-7.

4.2.20 Bidri Goat Unit, Bidar, Karnataka

The All India Coordinated Research Project on Goat Improvement (AICRP-G), Bidri Unit, functioning at Veterinary College, Karnataka Veterinary, Animal and Fisheries Sciences

University (KVAFSU), Bidar, continued its activities during 2024-26 with the objective of genetic improvement, conservation and scientific management of Bidri goats in their native tract. The project is maintaining a nucleus flock at the Department of Livestock Farm Complex, Veterinary College, Bidar, with dedicated infrastructure facilities including separate housing sheds for breeding bucks and does, insulated kid rearing units, fodder production area, feed storage facilities and sick animal sheds. During the reporting period, the nucleus flock strength reached 116 animals comprising 86 breedable does, 6 adult bucks, 3 buck kids and 21 kids. The nucleus flock was maintained as per AICRP technical programme guidelines with systematic performance recording and scientific management practices. The average twinning percentage recorded in the nucleus flock was 1.3, indicating the superior prolificacy of Bidri goats under organized management conditions. Field activities were implemented through three identified clusters located at Bagdal, Mogdal and Kerur villages covering 5 villages, 160 households and 525 goats across Bidar and Bhalki regions. Survey and baseline data collection activities were carried out in the breeding tract and cluster-based field recording systems were strengthened during the year. Systematic recording of growth and production traits was continued both in nucleus and field flocks. The overall mean body weights recorded in the nucleus flock were 1.72 ± 0.04 kg at birth, 6.67 ± 0.30 kg at 3 months, 11.37 ± 0.39 kg at 6 months, 15.23 ± 0.51 kg at 9 months and 19.37 ± 0.65 kg at 12 months. Mortality monitoring and flock management practices were strengthened during the year. Preliminary milk production recording was also initiated in the nucleus flock. Bidri goats continued to demonstrate their importance as a fast-growing, highly adaptable meat breed with higher twinning percentage and preferred meat quality among local consumers. A significant achievement during the year was the identification of superior does consistently producing 3–4 kids per kidding. An additional cluster was also formed at Bhalki taluka for expansion of field-level breed improvement activities. Capacity building programmes formed an important component of the project. Three training programmes benefiting 125 farmers and stakeholders, along with demonstrations and health camps covering 190 beneficiaries, were conducted to promote scientific goat farming

practices. Awareness and extension activities included publication of a leaflet, popular articles and organization of a quiz competition on Goat Day–2025 for undergraduate students. The project team comprised scientists from Animal Genetics & Breeding, Livestock Production Management, Animal Nutrition, Animal Reproduction and Veterinary Health disciplines working in an interdisciplinary manner. KVAFSU, Bidar extended continuous institutional and financial support to the programme with an allocation of Rs15 lakh during 2024–25 and 2025–26 for strengthening project activities and infrastructure development. Future thrust areas include intensified farmer training programmes in collaboration with the Department of Animal Husbandry & Veterinary Services, screening of goats for Brucellosis and Tuberculosis in field units under collaborative projects and initiation of superior buck distribution programmes for genetic improvement of Bidri goats in their native tract.

4.2.21 Black Bengal Goat Unit, ICAR-NDRI, Kalyani, Kolkata, West Bengal

The All India Coordinated Research Project (AICRP) on Goat Improvement (Black Bengal Unit) at ICAR-NDRI, Kalyani continued its genetic improvement, conservation, and farmer-support activities during 2025–26 across three districts of West Bengal, namely Nadia, North 24 Parganas, and Birbhum. The project covered 11 villages organized into three clusters and involved 743 goat-rearing farmers. A total of 1,908 goats were tagged and monitored in these 3 clusters under the program. The flock strength of nucleus flock at ICAR-NDRI increased from 131 animals (40 males and 91 females) to 164 animals (78 males and 86 females) during the year. Similarly, field flock populations increased from 995 to 1,138 animals in North 24 Parganas, 473 to 565 animals in Birbhum, and 275 to 396 animals in Nadia, indicating sustained growth of the breeding population. During the reporting period, 21 animals were sold and 19 breeding animals were distributed from the nucleus flock. Growth performance of Black Bengal goats was satisfactory across all clusters. Average birth weight ranged from 1.10 to 1.21 kg, while 12-month body weight reached 10.93 kg in the nucleus flock and 13.51 kg in the Birbhum cluster. The average litter size was highest in the nucleus flock (2.29), compared with 1.57, 1.62, and 1.68 in North 24 Parganas, Birbhum, and Nadia

clusters, respectively. Comprehensive health-care measures including deworming and vaccination against PPR and Goat Pox were implemented in all flocks. Three health camps and two vaccination camps were organized, benefiting 387 farmers through veterinary support and dissemination of improved management practices. Capacity-building initiatives included a three-day training programme on scientific goat farming for Scheduled Caste women farmers from Birbhum district and an off-campus training programme in North 24 Parganas, together benefiting 120 women goat rearers. To strengthen extension services, cluster-wise WhatsApp groups were established for rapid communication between scientists and farmers. Goat feed, mineral mixtures, and “Kidlife” milk supplement were distributed to beneficiary farmers. Infrastructure development included construction of a new goat shed and development of 2.5 hectares of pasture land for the nucleus flock. The project generated revenue of ₹1,03,618 from the nucleus flock and strengthened field implementation through linkages with KVKs and the State Veterinary Department. Overall, the project contributed substantially to the conservation, genetic improvement, health management and productivity enhancement of Black Bengal goats while strengthening the livelihoods of smallholder goat farmers in West Bengal.

4.2.22 Jakhrana Goat Unit, ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh

The Jakhrana unit has been functioning under the AICRP-G Project as a non-funded unit since 2023–24. It has now been included as a funded unit under AICRP for the period 2026–27 to 2030–31. This unit is operational at ICAR–Central Institute for Research on Goats, Makhdoom, Farah, Mathura. The opening balance of Jakhrana goats on the first day of the year was 272 which comprised of 75 males and 177 females and closing balance of 252 goats had a stock of 75 males and 177 females on 31.12.2025. The overall mortality was 6.28%. During this year, a total of 108 kids were born from 73 kidding. Out of total, 52 (54.7%) kids born as single and 43 (45.3%) born as multiples. Out of total, 52 (54.7%) kids born as single and 43 (45.3%) born as multiples. The kidding rate was recorded as 1.30. The replacement rate of the does was 32.7%. The annual tupping, kidding on available and bred basis were recorded as 96.7, 85.0 and 91.25%, respectively. The overall least-

squares means of body weights of kids at birth, 3, 6, 9 and 12 month age were $2.68.04 \pm 0.04$, 9.81 ± 0.12 , 14.73 ± 0.37 , 20.58 ± 0.45 and 25.71 ± 0.48 kg, respectively. The overall least-squares means of 90, 140 days, total milk yield and lactation length were 131.82 ± 3.01 , 164.28 ± 3.81 , 150.90 ± 7.28 litre and 151.42 ± 5.71 days, respectively. The h² estimates of birth, 3, 6, 9 and 12 month body weights were 0.202 ± 0.100 , 0.441 ± 0.126 , 0.175 ± 0.097 , 0.283 ± 0.109 and 0.061 ± 0.082 , respectively. The selection differential for 9 month body weight and 90 days milk yield of their dams were respectively 2.5 kg and 19.0 litre. During year 2025, a total of 66 superior germ plasm (31 males and 35 females) were supplied to various developmental agencies, Research organizations, Non-Government organizations and progressive farmers for genetic improvement of their flocks under field conditions. During reporting year, a total of 02 multiplier flocks were established.

4.2.23 Sojat Goat Field Unit, Vallabhnagar, Udaipur, Rajasthan

The All India Coordinated Research Project (AICRP) on Goat Improvement for Sojat Goat is being implemented at the Livestock Research Station, Vallabhnagar, Udaipur under Rajasthan University of Veterinary and Animal Sciences, Bikaner. The project aims to conserve, improve and evaluate the productive and reproductive performance of Sojat goats in their native breeding tract through nucleus and field flock programmes. During the year 2025–26, a total of 11 villages from Pali and Jodhpur districts were covered under the project through two field clusters. The programme covered 70 goat-rearing households and 2,898 Sojat goats. The flock composition revealed that does constituted 57.07 per cent, bucks 14.73 per cent and kids 28.19 per cent of the total field population. The nucleus flock maintained at the station recorded a closing strength of 39 animals during the year. Growth performance of the nucleus flock was satisfactory with average body weights of 3.12 ± 0.08 kg at birth, 11.96 ± 0.40 kg at 3 months, 15.82 ± 0.75 kg at 6 months, 23.05 ± 1.19 kg at 9 months and 29.59 ± 1.81 kg at 12 months of age. In field flocks, the corresponding body weights were 3.29 ± 0.09 kg, 11.72 ± 0.31 kg and 14.64 ± 0.70 kg at birth, 3 and 6 months of age, respectively. Milk production performance of the nucleus flock showed average yields of 38.45 ± 0.55 litres up to 60 days, 69.42 ± 0.74 litres up to 90 days and

115.33±0.75 litres up to 150 days of lactation with an average lactation length of 150 days. Similar trends were observed in field flocks where does producing multiple kids recorded higher milk yield than single-kidding does. The overall mortality recorded in the nucleus flock during the year was eight animals, comprising five males and three females. Capacity-building activities included one farmer training programme benefiting 25 participants, one health camp, one farmer meeting (Gosthi) and feed distribution activities covering 50 beneficiaries. The project also contributed to extension and research activities through publication of one leaflet, preparation of one technical document and continuation of M.V.Sc. research work. Overall, the project demonstrated satisfactory performance in terms of growth, milk production, flock management and farmer outreach, thereby contributing to the conservation and genetic improvement of Sojat goats in their native breeding tract.

4.2.24 Salem Black Goat Unit, Namakkal, Tamilnadu

The All India Coordinated Research Project on Salem Black Goats, implemented with a nucleus flock at the Veterinary College and Research Institute, Namakkal, and beneficiary flocks across Salem, Namakkal, Erode, and Dharmapuri, initiated the reporting period (01.04.2025 to 31.03.2026) with a nucleus herd of 232 animals, including 6 bucks, 131 does, 40 male kids, and 45 female kids, and closed with 170 animals, having sold 60 goats to 22 selected farmers across 17 villages within 4 clusters, thereby covering 604 adult females to promote breed improvement and disseminate superior genetic stock. The project's survey confirmed that Salem Black goats, a meat breed native to Tamil Nadu's north-western agro-climatic zone and named for their distinctive black coat, are primarily distributed across Salem, Dharmapuri, Krishnagiri, Erode, Karur, and Namakkal, with an estimated population of

840,199, which constitutes 10.32% of the state's goat population, and are managed in herds averaging 31 animals, with the majority (43.8%) maintaining 21–30 goats. Growth performance data from 675 nucleus flock observations recorded average birth weights of 2.19 ± 0.02 kg, with weights progressing to 9.29 ± 0.07 kg, 12.83 ± 0.10 kg, 16.08 ± 0.14 kg, and 19.30 ± 0.17 kg at 3, 6, 9, and 12 months, respectively, while farmer flocks (n=85) showed a slightly higher birth weight of 2.50 ± 0.10 kg but lower weights at 3, 6, and 9 months, though both achieved comparable 12-month weights (19.30 kg vs 19.60 kg), and adult males (38.5 ± 1.0 kg) were heavier than females (29.5 ± 0.6 kg). Reproductive assessment showed that nucleus does had a higher age at first kidding (15.23 ± 0.4 months) and significantly greater body weight at kidding (23.45 ± 0.38 kg) compared to farmer flocks (14.8 ± 0.2 months and 18.45 ± 0.23 kg), with nucleus herds predominantly producing singles (85%) while farmer flocks exhibited higher twinning (23% vs 14%) and tripling (10% vs 0.5%). Prophylactic support, including deworming and vaccination, was extended to both nucleus and farmer herds, and three one-day training programmes were conducted in Mecheri, Bargur, and Dharmapuri for 155 farmers (85 women and all SC/ST participants), covering animal health, scientific housing, nutrition, marketing, and vaccination, with farmers following grazing-based systems supplemented with Acacia pods, cassava leaves, and crop residues; however, the report notes that no significant improvements in performance traits, selection differentials, infrastructure development, or commercial multiplier flocks were achieved during this period, and mortality rates in the nucleus flock were low (young: 0.37%; adult: 0.12%) compared to farmer flocks (kid mortality: 7.5%; adult mortality: 2.3%), while informal marketing linkages were established through the trainings to enhance market access for live goats and goat products.



4.3 Animal Physiology and Reproduction Division

4.3.1 Project Title: All India Network Program on application of genome editing technology for improvement in livestock health and production (AINP-GETILHP formally known as NPGET Project)

Principal Investigator Dr. S. P. Singh
Co- Principal Investigators Dr. Y. K. Soni and Dr. R. Ranjan

The present study was undertaken to establish and optimize a CRISPR/Cas9-mediated genome editing platform targeting the myostatin (MSTN) gene in goats using both somatic cells and embryos. Caprine fetal fibroblast cell lines were established and used for optimization of genome editing and transfection studies. Two sgRNAs (sgRNA-4 and sgRNA-6) targeting

exon-1 of the MSTN gene were synthesized and screened through electroporation-based delivery of CRISPR/Cas9 RNP complexes in fibroblast cells. PCR amplification and agarose gel electrophoresis confirmed successful amplification of the target site, while T7E1 assay demonstrated detectable genome editing activity with sgRNA-4, whereas sgRNA-6

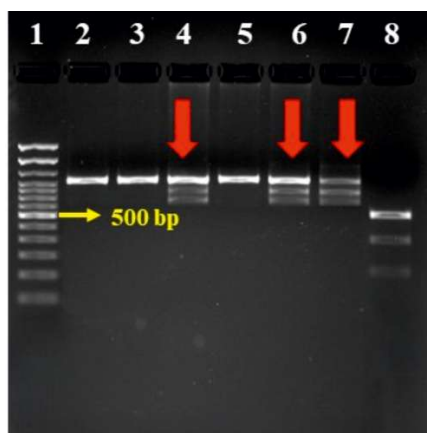


Fig. 1 : T7E1 assay of edited cell lines (Guide 4). Samples were resolved on 2% agarose gel alongside 100 bp DNA Ladder. Lane 1: 100 bp ladder, Lane 2: sample 1, Lane 3: sample 2, Lane 4: sample 3, Lane 5: sample 4, Lane 6: 5, Lane 7: sample 6, Lane 8: positive control.

Samples 3, 5, and 6 exhibited multiple cleavage bands, indicating genome editing.

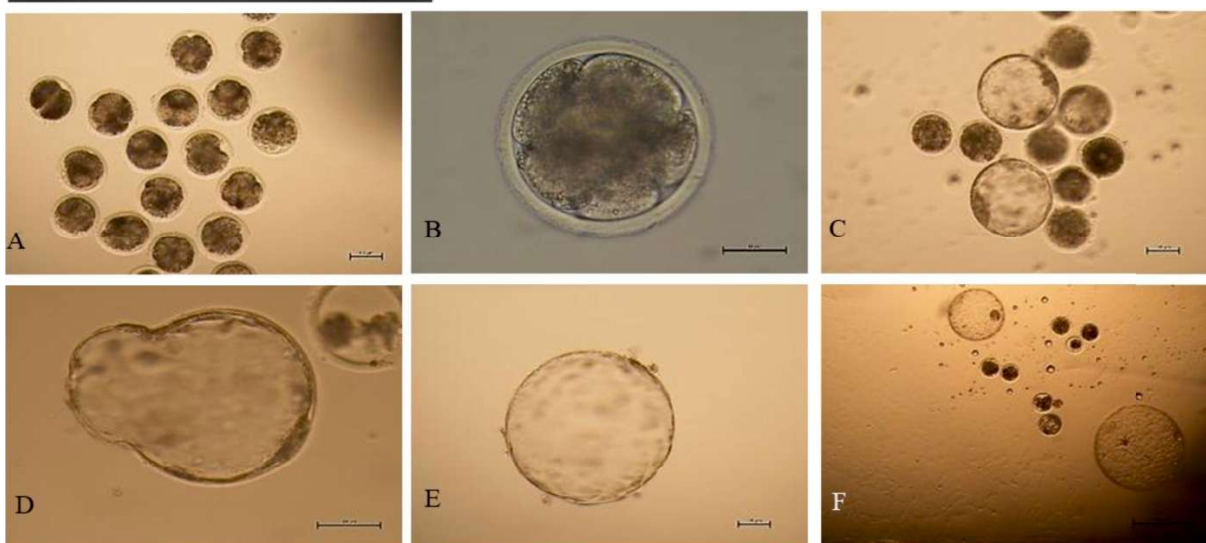


Fig. 2 : (A-F). Representative images of different stages of embryo development post electroporation in in vitro fertilized embryos. (A) Embryos at different stages under the microscope after 24 h of electroporation. (B) Morula stage embryo. (C) Expanded blastocysts. (D) Expanded blastocyst oozing out from zona pellucida. (E-F) Hatched blastocysts.

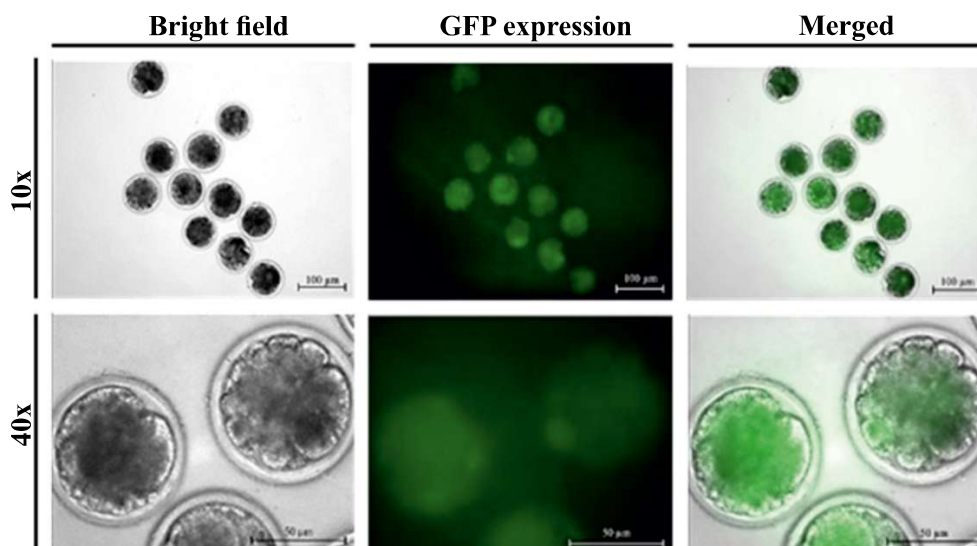


Fig. 3 : Representative fluorescence images of embryos after transfer of sgRNA-6/Cas9-GFP RNP complex, where Cas9 was tagged with GFP for visualization of transfection efficiency.



SE 900; before embryo transfer

Embryo transfer in SE 900; 06.10.2025

SE 900; after embryo transfer



Fig. 4 : USG image (d29) of twin pregnancy in the surrogate animal (SE 900), with two fetuses (indicated by arrows) confirming successful embryo implantation.



Fig. 5 : USG image (d47) of twin pregnancy in the surrogate animal (SE 900), confirming maintained pregnancy.

showed no detectable cleavage activity. Therefore, sgRNA-4 was selected for all subsequent experiments. Electroporation efficiency using Cas9-GFP based RNP complexes was comparatively higher in fetal fibroblast cells than adult fibroblasts, as confirmed by GFP expression. Single edited fetal fibroblast cells were isolated, clonally expanded, and established as independent

fibroblast cell lines. Genomic DNA isolated from edited clones was analyzed through PCR, agarose gel electrophoresis, T7E1 assay, and Sanger sequencing for confirmation of editing. Successfully edited fibroblast cell lines were cryopreserved for long-term preservation. Electroporation-mediated genome editing was further performed in one-cell zygotes produced through two approaches, namely IVF-derived

embryos from slaughterhouse ovaries and MOET-derived *in vivo* zygotes recovered through laparoscopic-assisted embryo flushing. Following electroporation with Cas9 and sgRNA-4 RNP complexes, embryos were cultured and monitored for cleavage and developmental competence. Genomic DNA from embryos was isolated, followed by whole genome amplification, PCR, agarose gel electrophoresis, T7E1 assay, and Sanger sequencing for confirmation of editing. Successfully edited embryos were cryopreserved for future applications and embryo transfer. Post embryo transfer, pregnancy was successfully established following transfer of edited *in vivo*-derived embryos. The recipient animal died at 57 days of pregnancy, resulting in recovery of two fetuses, of which one fetus was confirmed to be genome edited, demonstrating the feasibility of generating genetically edited goats through the optimized electroporation-mediated CRISPR/Cas9 workflow.

Summary of the Project

- Successfully established an CRISPR/Cas9-based genome editing workflow in goats by screening MSTN-targeting sgRNAs, optimizing electroporation-mediated delivery and developed fetal fibroblast cell lines (validated editing through T7E1 assay and Sanger sequencing). sgRNA-4 was identified as the most efficient guide and enabled reliable editing in both fibroblast cells and embryos.
- Demonstrated successful application of genome editing in IVF-derived and superovulation derived one-cell zygotes (validated editing through T7E1 assay and Sanger sequencing) followed by embryo culture, and embryo transfer. Post-transfer pregnancy was successfully established from edited embryos, resulting in the recovery of two fetuses, of which one fetus was confirmed to be genome edited.

4.3.2 Project Title: Development of herbal fortified diluter for buck semen cryopreservation (Funded by NLM)

Principal Investigator

Dr. Ravi Ranjan

Co- Principal Investigators

Dr. Ashok Kumar, Dr. K. Gururaj and Dr. Chetna Gangwar

- The specific concentration of particular herb and a particular combination showed 40% significant improvement in post thaw semen qualities (ABC). The exact concentration we are not disclosing here due to IPR issue. (68.75 ± 1.57 vs 55.62 ± 2.20)
- When mammalian sperm cells enter the female genital tract, many of them are attacked and phagocytosed by leukocytes and epithelial cells. Neutrophil count was 3.5% more in estrus goat than normal female goat.
- Sperm phagocytosed % by PMNs was significantly ($P < 0.05$) reduced in ABC group semen diluter (15.76 ± 1.39) compared to control group (22.79 ± 1.84) indicating it's immuno-protective property.
- Lipid peroxidation (MDA production) was significantly ($P < 0.05$) reduced in ABC group semen diluter (4.54 ± 0.86) compared to control group (9.55 ± 0.78)
- Antioxidant, fertility and apoptotic gene expression studies have been carried out as per

the timeline and work is on progress.

Combination of different concentration of herbal extract was added in in buck semen diluter and evaluation of post thaw qualities.

The specific concentration of particular herb and a particular combination showed significant improvement in post thaw semen qualities (ABC). The exact concentration we are not disclosing here due to IPR issue.

When mammalian sperm cells enter the female genital tract, many of them are attacked and phagocytosed by leukocytes and epithelial cells. Neutrophil count was 3.5% more in estrus goat than normal female goat.

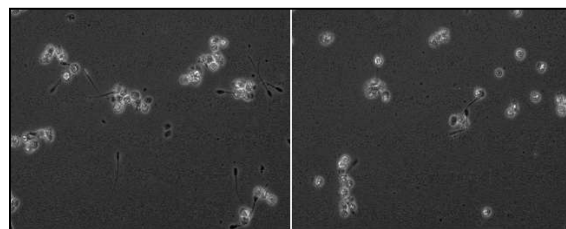


Fig. 1. Sperms are phagocytosed by PMN cells

Table 1. Effect of herbal extract in different concentration and combination on post thaw sperm qualities

Concentration	Motility %	Live %	HOS %	Acrosome %
Control	55.62 ^b ±2.20	58.32 ^{cd} ±2.73	56.68 ^c ±3.61	56.44 ^c ±2.15
AB	61.25 ^{bc} ±1.25	65.16 ^b ±1.46	63.91 ^b ±1.35	66.71 ^b ±1.07
ABC	68.75 ^a ±1.57	72.10 ^a ±1.26	74.61 ^a ±0.97	73.97 ^a ±2.06
ABD	58.12 ^{bcd} ±1.62	59.50 ^{cd} ±1.52	59.18 ^{bc} ±1.66	59.11 ^c ±1.68
BCD	58.55 ^{bcd} ±0.82	63.50 ^{bc} ±1.59	64.30 ^b ±1.84	65.83 ^b ±1.34
ACD	56.87 ^{bcd} ±1.62	59.13 ^{cd} ±2.11	56.70 ^c ±2.17	56.06 ^c ±1.76
ABCD	60.62 ^{cd} ±1.47	62.80 ^{bc} ±1.87	61.17 ^{bc} ±2.67	61.53 ^{bc} ±2.22

* Means value with different superscript differ significantly within a column (P< 0.05)

A-Ashwagandha; B-Satawari; C-Moringa; D-Gokhoru

Table 2. Effect of different concentration and combination of herbal extract on Sperm phagocytosed % and MDA (µm)

Concentration	Sperm phagocytosed %	MDA (µm)
Control	22.19 ^a ±1.55	20.74 ^a ±1.58
AB	19.72 ^b ±1.24	19.89 ^a ±1.42
ABC	15.21 ^c ±1.26	17.80 ^{ab} ±1.32
ABD	18.24 ^b ±1.28	13.45 ^b ±1.26
BCD	18.36 ^b ±1.22	14.69 ^b ±1.32
ACD	20.47 ^{ab} ±1.48	16.98 ^{ab} ±1.32
ABCD	19.16 ^b ±1.26	19.96 ^a ±1.44

* Means value with different superscript differ significantly within a column (P< 0.05)

A-Ashwagandha; B-Satawari; C-Moringa; D-Gokhoru

Table 3. Primers sequence

Gene of interest	Oligo sequence 5' to 3'
TGF beta	F: CCTTGGGTATCAGGGACAA R: GGGTATGGCTTTCTTTAGG
Bcl6	F: TCCAAGCAAAAACCTGAACC R: CAGCGTTTACTGTTGCATCATC
CuZnSOD	F: TGCAGGCCCTCACTTTAA R: CTGCCCAAGTCATCTGGTTT
Catsper	F: TTTACCTGCCTCTTCCTCTTCT R: ACCAGGTTGAGGAAGATGAAGT
Beta-defensin	F: TCCTGGCTGTTTCTAAGCCAC R: AAGGAGAGTCACTTATCAGAGGCA
Gpx	F: ACATTGAAACCCTGCTGTCC R: TCATGAGGAGCTGTGGTCTG
GAPDH	F: GGTGATGCTGGTGCTGAGTA R: TCATAAGTCCCTCCACGATG

Table 4. Nano-drop Spectrophotometer analysis of samples

RNA Samples	Conc. (ng/μl)	A260/A280
Ashwagandha-C	244.9	2.23
Ashwagandha-100 ug/ml	245.4	2.14
Shatavari-C	124.8	2.44
Shatavari-2.5 ug/ml	106.5	2.10
Gokhru-C	377.8	2.53
Gokhru-100 ug/ml	116.9	2.06
Moringa-C	94.5	2.36
Moringa- 75 ug/ml	82.9	1.93

Antioxidant, fertility and apoptotic gene expression studies have been carried out as per the timeline and work is on progress.

4.3.3 Project Title: Development and evaluation of efficient regimen for estrus synchronization in major Indian goat breeds (Funded by NLM)

Principal Investigator Dr. Y. K. Soni

Co- Principal Investigators Dr. S. P. Singh, Dr. Ravi Ranjan, Dr. Mukesh Bhakat and Dr. M. K. Singh

During the period under report, total 03 experiments were conducted in 112 anestrus females using different regimens during reproductive as well as non-reproductive seasons. The estrus induction response and pregnancy rates in goats ranged from 79% to 89% and 46.66% (liquid semen AI) to 55%, respectively. Whereas, in Muzaffarnagari ewes the corresponding values were 60% to 72% and 69% to 75%, respectively. Short term (9 days) progesterone-based protocol emerged as most

versatile and efficient regimen for estrus induction as well as synchronization in goats across the different seasons. Estrus induction and fertility response of up-to 90% could be achieved across most of the breeds, in farm as well as field conditions. The interval of almost 36 hrs. from end of synchronization protocol to first estrus exhibition was found to be most effective in establishment of successful pregnancy. The short term (8 days) regimen was also effective in ewes.

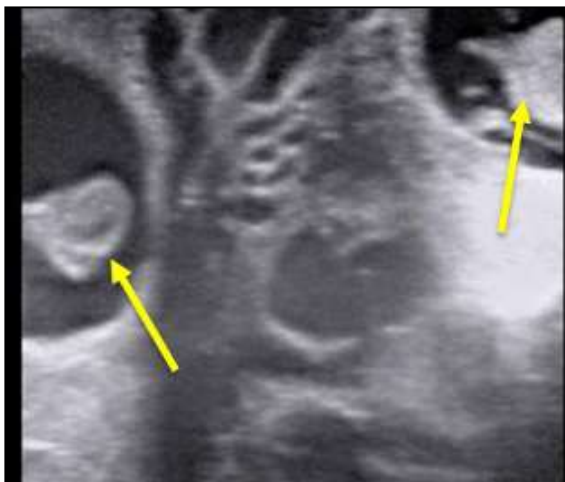


Fig 1. Day 32 twin pregnancy in Barbary goat following estrus synchronization



Fig 2: Field Validation of estrus synchronization in goats

4.3.4 Project Title: Evaluation of laparoscopic artificial insemination in goats for efficient utilization and conservation of Jamunapari buck germplasm (Funded by CST-UP)

Principal Investigator

Dr. Y. K. Soni

Co- Principal Investigators

Dr. S. P. Singh, Dr. Ravi Ranjan and Dr. Mukesh Bhakat

Total 15 adult breedable female Jamunapari Goats of 03 to 05 years and having body wt. between 30-40 kg were selected to optimize the technique of laparoscopic artificial insemination. Before the start of experiment, pregnancy status of all the female goats was checked using real-time ultrasonography and only non-pregnant, regularly cyclic and healthy goats were selected for Laparoscopic AI. Superior Jamunapari breeding bucks with proven fertility were selected for semen collection. All the Jamunapari female

goats were maintained at experimental shed of APR Division. The technique of LAI was successfully optimized, with successfully pregnancies in 02 Jamunapari goat out of 15 optimization trials. It was observed that best time of insemination is 24h after the onset of estrus for the successful pregnancy in this breed. For the first time the team could able to produce 03 Jamunapari kids through laparoscopic artificial insemination in Jamunapari goat breed.

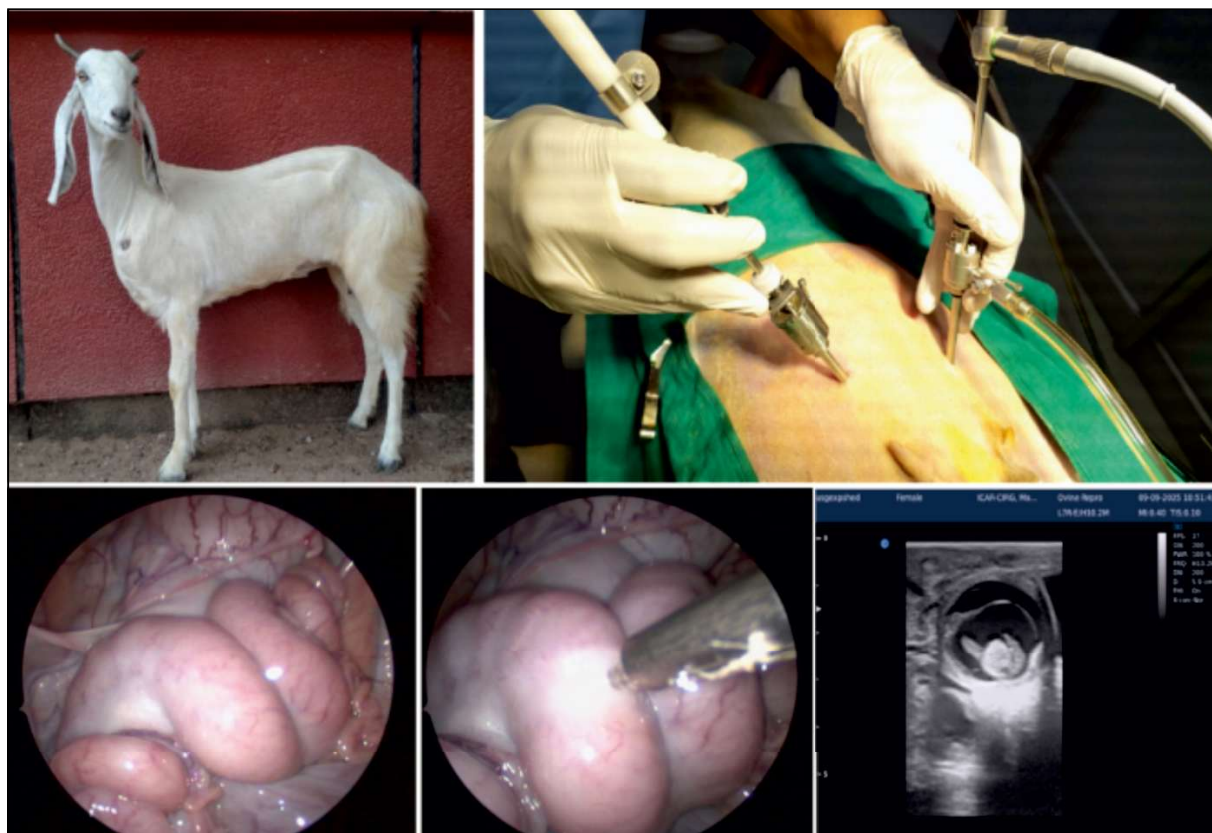


Fig. 1 : Establishment of successful pregnancy in Jamunapari goat following laparoscopic artificial insemination (LAI)

4.3.5 Project Title: Consortium research platform project (CRP) on agrobiodiversity (Funded by ICAR)

Principal Investigator Dr. S. P. Singh
Co-Principal Investigator Dr. Y. K. Soni

Isolation and cultivation of dermal fibroblasts from goats for the establishment of fibroblast cell lines are commonly used methods for the preservation of live tissue genetic materials. The preserved animal genetic resources in the form of dermal fibroblasts of animals of true to breed characteristics (this time goat breeds were Marwari, Surati, Bidri, Mehsana, and Kahmi) can be used for conservation, animal cloning to revive corresponding species, provide materials for experiments in the fields of stem cells, genetic engineering, cell engineering, cellular reprogramming, molecular biology applications.

Patent applied

Patent application has been submitted for 'A Low-Serum Culture Medium Composition for Fibroblast Cells'; Patent Application Number : 202611040324

Detailed progress report

Animal selection and skin biopsy

For the collection of skin samples, Bidri, Mehsana, Surti, Kahmi, and Marwari breeds were selected. Skin samples were taken from 2 males and 2 females of each breed for isolation of fibroblast cells and their cryopreservation. In this study, explant material (skin tissue samples; ~0.25 cm²) was taken from the base of the tail of animal. After shaving the area beneath the tail, 1.0 ml of 2% Lignocaine hydrochloride was infused near the site of the incision. Further, the area was properly disinfected using a 70% alcohol swab and precisely dissected before transporting the sample aseptically in Dulbecco's Phosphate Buffered Saline (DPBS) supplemented with antibiotics to the laboratory within 10 min.

Monitoring for contamination and the growth of primary cell cultures

An inverted microscope (10×) was used to examine the cultures every alternate day to evaluate for explant displacement and expansion of primary fibroblast cells around explants. The culture was also examined for any indications of microbial or fungal contamination at higher magnification (40×). On the fifth day, the culture media in the dishes was changed, and on the eighth day, the expansion of cells around the explants was noted. The cells were passaged after reaching 60–70% confluency around the explants.

Enrichment of fibroblasts

The enrichment of fibroblasts was performed after primary culture by immunomagnetic separation [magnetic-activated cell sorting (MACS)] method. This was performed using the MiniMACS separation unit and MS column.

Establishing secondary cultures

For the secondary culture, cultured cells were carefully rinsed once using DPBS. After gentle shaking of the cell culture plate, DPBS was discarded. This was followed by the incubation of a cell sheet (a complete layer of cells) with 1 ml 0.25% Trypsin-EDTA solution for 3–5 min in a CO₂ incubator at 38.5°C, 5% CO₂ in humidified conditions. When seen under a microscope after three min, fibroblasts rounded and started to separate from the culture flask's plastic surface. After complete detachment of cells, 2 ml of washing media (DMEM/F-12, supplemented with 10% FBS, 0.5% NEAA, 10 µg/ml Gentamycin and 10 µl/ml antibiotic-antimycotic solution) was dispensed on the cell culture plate, and the cells were gently spread out by pipetting up and down 2–3 times followed by



Marwari



Surati



Kahmi



Mehsana



Bidri

centrifugation at $2655 \times g$ for 10 min to form a pellet. After that, serial passaging was used to expand these cells. Cells from primary cultures were replicated in T-25 flasks for secondary culture, and further expansion was done in T-75 flasks. The fibroblast cells at P4–P6 were used for further experiments.

Cell cryopreservation

The cultured fibroblast upon reaching 70–80% confluency at P-4 were harvested for cryopreservation. For this, after preparing the cell palette, the cells were re-dissolved in a freezing medium [(DMEM/F-12 containing FBS (10.0%) and DMSO (10.0%)]. Before the cryopreservation of cells, the total cell count and cellular viability were determined using an automatic cell counter. Once determined, the cell suspension was normalized to $\sim 1 \times 10^6$ cells/ml by adding the required volume of freezing media, and 1 ml of cell suspension was transferred to the cryovials. The cryovials were then placed in the Freezing Container and equilibrated at -20°C for 4 h and then transferred into a -80°C freezer for 24 h. After 24 h, the cryovials containing Fibroblast were transferred into liquid nitrogen at -196°C for further analysis.

Thawing and post-thaw cell count

For the thawing of cells, the cryovials were taken out from the liquid nitrogen container and kept in a water bath at 37°C with constant gentle shaking until thawed completely (< 1 min). To eliminate the possibility of contamination outside of the vial was wiped with 70% ethanol. The cell suspension was then immediately transferred into a tube containing an equal volume of pre-warmed washing medium [DMEM/F-12 with FBS (10%), L-Glutamine (0.5%), NEAA (0.5%), antibiotic (Gentamycin, $10\ \mu\text{g/ml}$) and antibiotic-antimycotic solution ($10\ \mu\text{l/ml}$)]. After proper mixing, the tube was centrifuged at $2655 \times g$ for 10 min. for washing of cells. After centrifugation, the cell pellet was dissolved in 1.0 ml culture media for measuring post-thaw cell count and post-cryopreservation cell recovery.

For cell counting, an equal volume of trypan blue solution (0.4%) was added to $10.0\ \mu\text{l}$ cell suspension (1:2 dilution). After proper mixing through pipetting up and down, the blend of cell suspension with trypan blue solution was incubated at RT for 5 min before $10.0\ \mu\text{l}$ of it was placed between the edge of Countess™ cell counting chamber slides and cover slip. The outcomes were

evaluated immediately with the help of an automatic cell counter. The total number of live and dead cells was counted in triplicate.

Re-culture of post-thaw cryopreserved cells

The re-culturing of post-thaw cryopreserved cells was performed to obtain enough Fibroblast cells for electroporation experiments. For this, the thawed cells were re-seeded into T25 flasks in either DMEM/F-12 with FBS (15%), L-Glutamine (0.5%), NEAA (0.5%), antibiotics Gentamycin ($10\ \mu\text{g/ml}$), and antibiotic-antimycotic solution ($10\ \mu\text{l/ml}$) or fibroblast specific medium (Human dermal fibroblast growth media; CELL Applications). The culture medium was replaced with a respective fresh medium after the attachment of cells in 72 h.

A total of 440 cryovials from five breeds (22 vials/goat) were frozen and stored in liquid nitrogen. These vials were deposited to the Cell Bank at the Lead Centre ICAR-NBAGR, Karnal.

Trial: Comparative Evaluation of In-House Culture Media on Fibroblast Cell Proliferation in Changthangi Goat, Barbari Goat, Changthangi Sheep, and Double Hump Camel

Culture of fibroblast cells

For this experiment, adult dermal fibroblast cells from Changthangi goat, Barbari goat, Changthangi sheep, and double-hump camel were used. Among these, Changthangi goat, Changthangi sheep, and double-hump camel samples were obtained from NBAGR, Karnal, and were thawed and cultured prior to use.

For cell thawing, cryovials were removed from the liquid nitrogen container and kept in a water bath at 37°C with constant gentle shaking until thawed completely (< 1 min). To eliminate the possibility of contamination, the outside of the vial was wiped with 70% ethanol. The cell suspension was immediately transferred into a tube containing an equal volume of pre-warmed wash medium. After proper mixing, the tube was centrifuged at $2655 \times g$ for 10 min. for washing of cells. After centrifugation, the cell pellet was dissolved in 1 mL of culture media to measure post-thaw cell count and post-cryopreservation cell recovery.

For cell counting, an equal volume of trypan blue solution (0.4%, Gibco, Invitrogen, Carlsbad, CA, Catalog#15250-061) was added to $10\ \mu\text{L}$ cell suspension (1:2 dilution). After proper mixing

through pipetting up and down, the blend of cell suspension with trypan blue solution was incubated at room temperature for 5 min before 10 μ L of it was placed between the edge of Countess™ cell counting chamber slides and cover slip. The outcomes were evaluated immediately with the help of an automatic cell counter (Countess-II FL; Invitrogen). The total number of live and dead cells was counted in triplicate.

Proliferation assay

The post-thawed cadFibroblasts were directly

seeded into 6-well cell culture plates in different cell culture media (In-house media, Fibroblast growth media and DMEM culture media with 10% FBS) with a seeding density of 50,000 cells per well. The total live cells in each well obtained through trypsinization were counted 24 h and 48 h using a cell counter. The total number of cells in each group was used to generate a growth curve.

Results

The post-thawed cadFibroblasts were directly seeded into 6-well culture plates in different

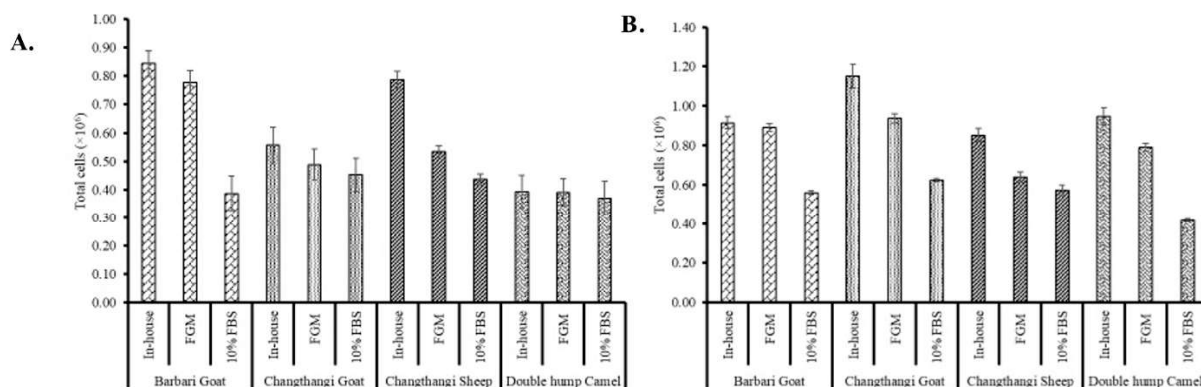


Fig. 1 : Effect of different culture media (In-house media, Fibroblast growth media and routine culture media with 10% FBS) on the proliferation of caprine dermal adult fibroblast cells derived from different species. Cell proliferation of fibroblast cells cultured in different media was observed after 24 h (A) and 48 h (B). Cell counting was assessed using an automatic cell counter (Countess II FL Automated Cell Counter; Thermo Fisher Scientific) and are presented as mean $\pm$ SEM from 5 independent replicates. Media-dependent differences in cell proliferation was observed over time.

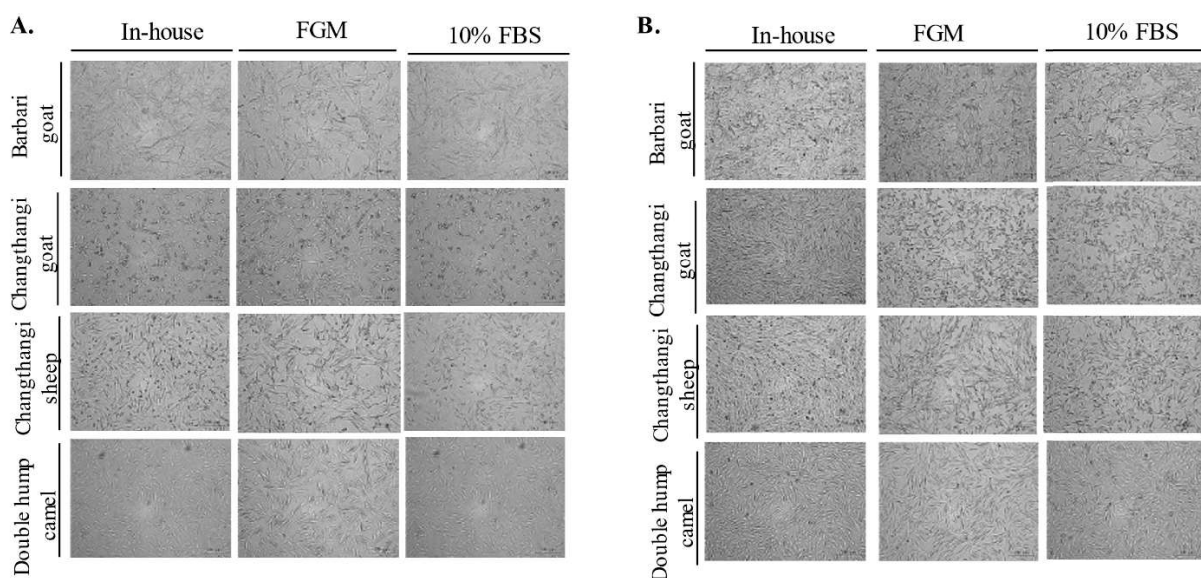


Fig. 2 : Representative microscopic images of fibroblast cell monolayers derived from different species cultured in In-house media, fibroblast growth media, and routine culture media supplemented with 10% FBS. Cell proliferation and morphology were observed at (A) 24 hours and (B) 48 hours post-seeding. Scale bar = 100 μ m.

media (in-house medium, fibroblast growth medium, and DMEM supplemented with 10% FBS) at a density of 50,000 cells per well. Cell proliferation was assessed at 24 h and 48 h by counting total live cells following trypsinization. The growth curve analysis revealed that cells cultured in the in-house medium exhibited significantly higher proliferation compared to those cultured in fibroblast growth medium and DMEM with 10% FBS at both time points.

Evaluation of in-house culture medium on adult and fetal fibroblast cell functionality using colony-forming unit (CFU), scratch wound healing, and transwell migration assays.

Culture of fibroblast cells

For this experiment, cryovials containing adult dermal fibroblast cells and fetal fibroblast cells were removed from the liquid nitrogen container and kept in a water bath at 37°C with constant gentle shaking until thawed completely (< 1 min). To eliminate the possibility of contamination, the outside of the vial was wiped with 70% ethanol. The cell suspension was immediately transferred into a tube containing an equal volume of pre-warmed wash medium. After proper mixing, the tube was centrifuged at $2655 \times g$ for 10 min. for washing of cells. After centrifugation, the cell pellet was dissolved in 1 mL of culture media to measure post-thaw cell count and post-cryopreservation cell recovery.

For cell counting, an equal volume of trypan blue solution (0.4%, Gibco, Invitrogen, Carlsbad, CA, Catalog#15250-061) was added to 10 μ L cell suspension (1:2 dilution). After proper mixing through pipetting up and down, the blend of cell suspension with trypan blue solution was incubated at room temperature for 5 min before 10 μ L of it was placed between the edge of Countess™ cell counting chamber slides and cover slip. The outcomes were evaluated immediately with the help of an automatic cell counter (Countess-II FL; Invitrogen). The total number of live and dead cells was counted in triplicate.

Colony-forming unit (CFU) assay

To assess the ability of the in-house culture medium to support colony formation from post-thaw fibroblast cells, a colony-forming unit (CFU) assay was performed. Briefly, approximately 50,000 fetal and adult fibroblast cells at passage 4 (P4) were plated per well in 6-well plates containing in-house medium, DMEM

supplemented with 10% FBS, or FGM. A relatively low seeding density was maintained to allow the formation and clear visualization of discrete colonies. The cultures were maintained at 37°C in a humidified incubator with 5% CO₂ for 48 h. After incubation, cells were gently rinsed with DPBS, stained using 1% crystal violet, and subsequently processed for absorbance measurement in each experimental group.

Scratch wound-healing assay

Approximately 50,000 post-thaw fetal and adult fibroblast cells were seeded in 6-well culture plates and allowed to grow until they reached near-confluent conditions. At this stage, a linear scratch was introduced across the cell monolayer using a sterile 10 μ L pipette tip to simulate a wound. The wells were gently rinsed with DPBS to eliminate detached cells, after which different culture media (in-house medium, DMEM supplemented with 10% FBS, and FGM) were added. The plates were then incubated in a 5% CO₂ atmosphere to monitor wound closure behavior under different conditions.

Cell migration into the scratched area was examined microscopically, and images were acquired at defined time points, including immediately after scratching (0 h) and at 2, 4, and 6 h. Imaging was performed using an inverted microscope (Zeiss Axiovert A1, Germany) equipped with a digital camera (AxioCam ICm 1). Quantitative analysis of wound closure was carried out by measuring the scratch area using ZEN 3.4 blue software (version 3.4.91.00000), and the reduction in wound area over time was expressed as fold change.

Transwell migration assay

Transwell inserts in 6-well plates were employed to evaluate cell migration. Following trypsinization, approximately 60,000 post-thaw fetal and adult fibroblast cells per well were resuspended in DMEM lacking FBS or any serum substitute, but supplemented with 1% non-essential amino acids, 10 μ g/ml gentamycin, and 10 μ L/ml antibiotic solution, and seeded into the upper chambers of the inserts. The lower chambers were filled with different culture media (in-house medium, DMEM supplemented with 10% FBS, and FGM). The plates were then incubated at 37°C in a humidified atmosphere with 5% CO₂ for 48 hours to allow cell migration. After incubation, non-migrated cells on the upper

surface of the inserts were gently removed using a cotton swab, while cells that had migrated to the underside were washed with DPBS. The migrated cells were subsequently fixed and stained using 1% crystal violet solution. Cell migration was assessed by observing the stained cells under low magnification (1×) using a bright-field microscope.

Result

Colony-forming unit (CFU) assay

In both fetal and adult fibroblast cultures, the number of colonies formed in the in-house medium was significantly higher ($p < 0.05$) than those observed in DMEM + 10% FBS and FGM indicating enhanced post-thaw clonogenic potential in in-house medium.

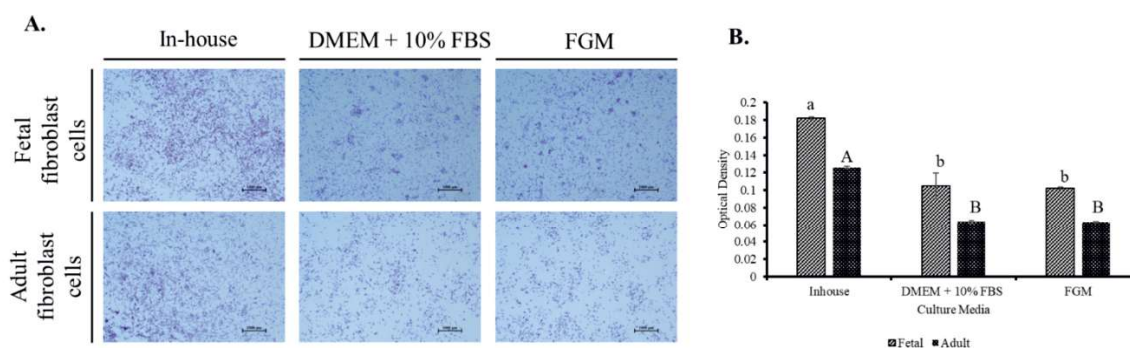


Fig. 3: Colony-forming ability of fibroblast cells in different culture media. Colony-forming unit (CFU) assay was performed to evaluate the efficiency of in-house culture medium in supporting colony formation from post-thaw fibroblast cells. Approximately 50,000 fetal and adult fibroblast cells (P4) were seeded per well in 6-well plates containing in-house medium, DMEM + 10% FBS, and FGM, and incubated at 37°C in 5% CO₂ for 48 h. Cells were then washed with DPBS and stained with 1% crystal violet.

(A) Representative microscopic images of stained colonies formed by fetal and adult fibroblast cells in different media. (B) Quantitative analysis of colony formation expressed as optical density measured after solubilization of crystal violet stain in 1% SDS.

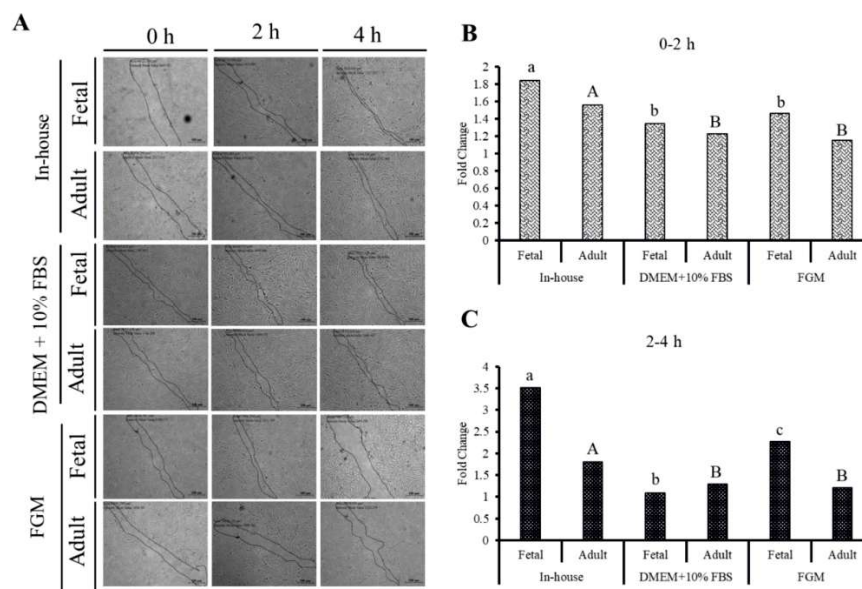


Fig. 4: Scratch wound-healing assay was performed using post-thaw fetal and adult fibroblast cells cultured in in-house medium, DMEM + 10% FBS, and FGM. (A) Representative microscopic images showing wound closure at indicated time points. (B) Fold change in wound area reduction during 0–2 h. (C) Fold change in wound area reduction during 2–4 h.

Scratch wound-healing assay

Analysis of wound closure revealed significantly higher ($p < 0.05$) reduction in wound area in cells cultured in the in-house medium compared to DMEM + 10% FBS and FGM. During the 0–2 h interval, fold change analysis showed a significantly higher decrease in wound area in the in-house medium ($p < 0.05$), indicating enhanced migratory activity. A similar trend was observed during the 2–4 h interval, where cells maintained in the in-house medium exhibited significantly faster wound closure than those cultured in DMEM and FGM. This pattern was consistent in both fetal and adult fibroblast cells, demonstrating the superior ability of the in-house medium to promote cell migration and wound healing ability.

Transwell migration assay

The results of the transwell migration assay

demonstrated that the type of culture medium significantly influenced the migratory capacity of fibroblast cells. In both fetal and adult fibroblast groups, cells cultured in the in-house medium exhibited a significantly higher ($p < 0.05$) number of migrated cells compared to those cultured in DMEM supplemented with 10% FBS and FGM.

Although migration was observed under all conditions, the in-house medium consistently promoted enhanced cell movement across the membrane, indicating its superior ability to support migratory behavior in both fetal and adult fibroblast cells. In contrast, comparatively fewer migrated cells were recorded in the DMEM and FGM groups. These findings suggest that the in-house medium provides a more favorable microenvironment for fibroblast migration irrespective of cell origin.

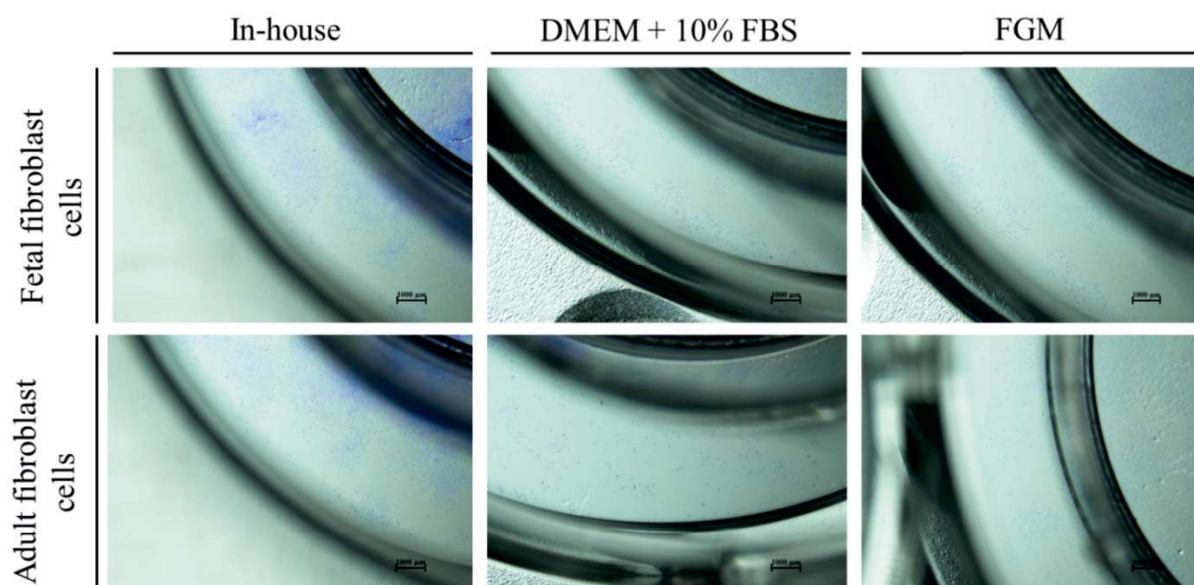


Fig. 5: Representative bright-field microscopic images of transwell migration assay showing migrated fetal and adult fibroblast cells in different culture media (in-house medium, DMEM supplemented with 10% FBS, and FGM). Cells that migrated to the lower surface of the membrane after 48 h were fixed and stained with crystal violet. Images depict comparative migration in in-house medium, DMEM supplemented with 10% FBS, and FGM, with a higher number of migrated cells observed in the in-house medium for both fetal and adult fibroblasts. Images were captured at low magnification (1 $\times$).

4.3.6 Project Title: Development of strategies for competent embryo production and efficient cryopreservation for faster propagation of superior goat germplasm (Funded by NLM)

Principal Investigator Dr. S. P. Singh
Co- Principal Investigators Dr. Y. K. Soni and Dr. M. K. Singh

Experiment 1: Cryopreservation of caprine embryos by vitrification method

This study was designed to evaluate the cryopreservation of in vitro fertilized caprine embryos using a vitrification approach. Following successful in vitro fertilization, embryos were subjected to stepwise equilibration and exposure to vitrification solutions and subsequently loaded onto Cryotop devices in minimal volumes for rapid cooling in liquid nitrogen. This method facilitated efficient dehydration and minimized ice crystal formation, thereby preserving embryo integrity. The vitrified embryos will be thawed and cultured in vitro to assess post-thaw survival and developmental competence, including cleavage and blastocyst formation.

Collection of oocytes

Goat ovaries were collected immediately after slaughter from local abattoirs and transported to the laboratory in a Thermos flask containing sterile warm (35–37 °C) physiological normal saline solution supplemented with antibiotics (100 IU/mL penicillin-G and 100 µg/mL streptomycin sulphate). In the laboratory, the ovaries were trimmed to remove adhering tissues and washed 5–6 times with warm saline containing antibiotics. All subsequent procedures were carried out under a sterile laminar airflow hood.

The ovaries were then placed in a sterile Petri dish containing pre-warmed collection medium consisting of Dulbecco's Phosphate Buffered Saline (with calcium and magnesium) supplemented with glucose (1 mg/mL), gentamycin (50 µg/mL), and BSA (1 mg/mL). Oocytes were isolated by puncturing visible surface follicles (2–6 mm in diameter) using a sterile 18-gauge needle, and the follicular contents were examined under a stereomicroscope to identify cumulus–oocyte complexes (COCs). The COCs were aspirated using a sterile fine-bore or mouth-controlled pipette and transferred into a sterile 35 mm Petri dish containing washing medium (Oocyte and Embryo Wash Medium, Vitrogen). Serial

washing was performed using 50–100 µL droplets of washing medium, followed by final washes in IVM medium, ensuring that the cumulus layers remained intact throughout the process. Prior to in vitro maturation, the COCs were graded under a stereo zoom microscope based on cumulus investment and cytoplasmic characteristics.

***In vitro* fertilization**

Preparation of IVF medium

The IVF medium was prepared by mixing the IVF base medium with appropriate aliquots of H and PHE according to the required final volume. For a final volume of 10 mL, 9.450 mL IVF medium was combined with 110 µL of H and 440 µL of PHE. The medium bottle was gently homogenized before use to ensure uniform distribution of components.

Preparation of IVF dish

The IVF medium was prepared one day prior to fertilization by adding H and PHE aliquots and mixing thoroughly. The prepared medium was stored under appropriate conditions until use. Approximately 100 µL of IVF medium was dispensed into each required well, and each well was overlaid with ~850 µL of mineral oil. The prepared dishes were kept ready overnight to allow proper equilibration before use.

Preparation of percoll gradient

The Percoll gradient was prepared by mixing 400 µL of diluted Percoll (prepared by combining 200 µL sperm and 200 µL Percoll) with 400 µL of undiluted Percoll in a centrifuge tube. The gradient was kept undisturbed in a rack on a warming table for at least 30 minutes prior to centrifugation to allow stabilization.

Handling of mature oocytes

After 24 hours of in vitro maturation, the oocytes were washed in 2–3 droplets (~50 µL each) of IVF medium. The washed oocytes were then transferred to the prepared IVF plate, maintaining approximately 20 oocytes per drop for fertilization.

Washing of semen

Frozen semen straws were thawed at 36°C for 20 seconds. The Percoll gradient was carefully layered in a centrifuge tube with undiluted Percoll at the bottom, followed by diluted Percoll, and the semen sample layered on top. The first centrifugation was carried out at $600 \times g$ for 6 minutes, after which the supernatant was carefully removed, leaving the sperm pellet. The pellet was transferred to a fresh Eppendorf tube, resuspended in 400 μ L of IVF medium, and gently homogenized. A second centrifugation was performed at $150 \times g$ for 3 minutes, and the supernatant was again removed to obtain the final sperm pellet. The processed sperm pellet was evaluated and subsequently used for fertilization of the oocyte-containing drops.

In vitro culture (IVC)

Preparation of IVC dish

Approximately 100 μ L of IVC medium was dispensed into each well of a sterile 4-well culture plate, and each well was overlaid with ~850 μ L of mineral oil. The prepared plates, along with wash medium and additional IVC medium intended for zygote washing, were placed in the incubator overnight to allow proper equilibration before use on the following day.

Washing of zygotes

Following fertilization, zygotes were removed from the IVF plate and transferred into a sterile 35 mm Petri dish containing wash medium. Serial drop dilution washing was performed using ~70 μ L droplets of wash medium, followed by final washes in IVC medium. Care was taken to handle the zygotes gently during washing to maintain their integrity. The washed zygotes were then transferred into the pre-equilibrated IVC culture plate for further development.

Embryo development

Embryo development was monitored during the culture period. After 48 hr, the number of cleaved

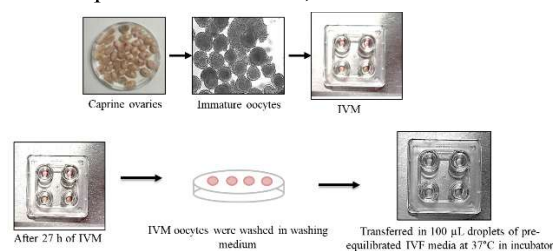


Fig. 1 : IVM and preparation of oocytes for IVF

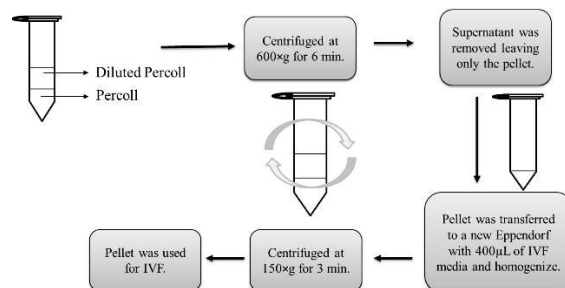


Fig. : Semen washing and preparation of sperms for IVF

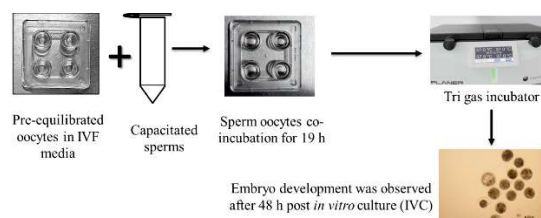


Fig. 2 : Steps involved in IVF and embryo development

embryos was recorded to assess cleavage rates. Further development was assessed on Day 7 by examining the formation of blastocysts under a stereomicroscope.

Cryopreservation of in vitro fertilized embryos

Cryopreservation was carried out using the Kitazato vitrification kit following the manufacturer's instructions. Approximately 300 μ L of each solution (ES, VS1, and VS2) was dispensed onto the plate using a micropipette, and the plate was immediately covered with its lid. The embryo was aspirated using a Pasteur pipette and transferred with minimal volume of medium to the top center of the ES droplet. A stopwatch was used to monitor the equilibration period, which lasted 10–15 minutes. During this time, the embryo initially shrank and subsequently regained its original size as the equilibration solution permeated, indicating completion of the equilibration process.

Following equilibration, the embryos were aspirated from ES using a Pasteur pipette and transferred to the surface of the VS1 droplet with minimal carryover of ES. Care was taken to avoid contamination of VS1 with residual ES by expelling any remaining ES outside the well and conditioning the pipette with fresh VS1 before handling the embryo. The embryo was then processed in VS1 within 0.5 minutes by repeated aspiration and gentle expulsion, accompanied by

stirring around the embryo five times. This procedure was repeated three times at different positions within the droplet to ensure complete replacement of ES with VS1.

Subsequently, the embryos were transferred to VS2 within 0.5 minutes. Residual VS1 in the pipette was expelled outside the well, and the pipette was preloaded with fresh VS2. The embryos were then aspirated and transferred into the VS2 droplet with minimal volume of VS1. Gentle stirring was performed around the embryos at different positions to facilitate complete exposure to VS2. Successful dehydration was confirmed by the characteristic flattening and shrinkage of the embryos.

For loading, the Cryotop was placed under a microscope with the logo facing upward, and focus was adjusted on the black mark of the Cryotop sheet. The shrunken embryos were aspirated at the tip of the Pasteur pipette and placed near the black mark on the Cryotop sheet with minimal volume of VS2 (less than 0.1 μ L). When handling multiple embryos, individual droplets were created for each embryo. After loading, excess vitrification solution was carefully removed from the Cryotop sheet using a pipette to ensure optimal vitrification conditions.

Results

These vitrified embryos will subsequently be thawed (warmed), cultured under appropriate *in vitro* conditions, and monitored for post-thaw survival and developmental competence. Embryo development will be assessed by evaluating re-expansion, cleavage, and progression to advanced stages such as blastocyst formation.

Experiment 2: Vitrification of *in vivo* collected embryos

This study was designed to evaluate the effectiveness of vitrification as a cryopreservation strategy for *in vivo* derived caprine embryos, with the aim of preserving their viability and developmental potential during long-term storage. It seeks to address the limitations associated with conventional freezing methods, particularly ice crystal formation and cryo-injury, by employing ultra-rapid cooling techniques that minimize cellular damage. Additionally, the study aims to optimize conditions for maintaining embryo quality post-thaw, thereby supporting efficient embryo transfer programs, genetic resource conservation, and wider application of

assisted reproductive technologies in goats.

Donor synchronization and embryo collection

Donor goats were synchronized for estrus and superovulated using follicle-stimulating hormone (FSH) in combination with prostaglandin F2 α (PGF2 α) according to the experimental schedule. Estrus was considered as Day 0, and animals were bred either by natural mating or artificial insemination. Embryos were recovered at the appropriate post-estrus stage by uterine flushing using sterile embryo collection medium under aseptic conditions. The recovered embryos were examined under a stereomicroscope, graded based on morphological quality, and only viable embryos were selected for further processing.

Preparation of vitrification solutions

Vitrification was performed using the Kitazato vitrification kit. Equilibration solution (ES) and vitrification solutions (VS1 and VS2) were brought to room temperature and gently mixed before use. Approximately 300 μ L of each solution was dispensed into designated areas of a sterile dish and covered immediately to prevent evaporation and contamination.

Equilibration of embryos

Selected embryos were transferred into the equilibration solution (ES) with minimal carryover of medium. The embryos were incubated in ES for 10–15 minutes, during which they initially shrank indicating adequate permeation of cryoprotectants and completion of equilibration.

Exposure to vitrification solutions

Following equilibration, embryos were transferred to VS1 with minimal volume of ES. Rapid mixing was performed by gentle aspiration and expulsion to ensure complete replacement of ES with VS1. This step was completed within 0.5 minutes. Subsequently, embryos were transferred to VS2 with minimal carryover of VS1 and gently mixed to facilitate final dehydration. Completion of this step was indicated by characteristic shrinkage and flattening of the embryos.

Loading and cryopreservation

The vitrified embryos were loaded onto Cryotop carriers with minimal volume of VS2 (less than 0.1 μ L) under microscopic guidance. Excess solution was carefully removed to ensure efficient vitrification. The loaded Cryotops were

immediately plunged into liquid nitrogen for ultra-rapid cooling and stored for long-term preservation.

Post-vitrification handling

The vitrified embryos were stored in liquid nitrogen until further use. These embryos will be subsequently warmed and either cultured in vitro or transferred into synchronized recipient goats to evaluate post-thaw survival and developmental competence.

Experiment 3: Laparoscopic-assisted embryo transfer in goats (IVF produced and *in vivo* derived embryos)

Healthy recipient goats were synchronized with donor animals to ensure uterine receptivity at the time of transfer. Both in vitro fertilized (IVF) embryos and in vivo collected embryos were maintained in sterile embryo holding medium prior to transfer. The procedure was carried out using a laparoscopic system equipped with a telescope, light source, camera, insufflation unit, and accessory instruments including trocars,

atraumatic grasping forceps, and a fine embryo transfer catheter.

Recipient animals were fasted and anesthetized following a standard protocol and positioned in dorsal recumbency. After aseptic preparation of the abdominal area, a laparoscope was introduced through a small incision, and pneumoperitoneum was established to visualize the reproductive organs. The ovary bearing a functional corpus luteum was identified, and the corresponding oviduct was gently manipulated using atraumatic forceps. Embryos were loaded into a fine transfer catheter in minimal volume and carefully introduced through the fimbrial end of the oviduct under laparoscopic guidance. Deposition of embryos was performed to ensure precise placement while minimizing handling and mechanical stress. Following transfer, instruments were withdrawn, pneumoperitoneum was released, and incisions were sutured. Animals received post-operative care including antibiotics and were monitored for recovery and establishment of pregnancy.

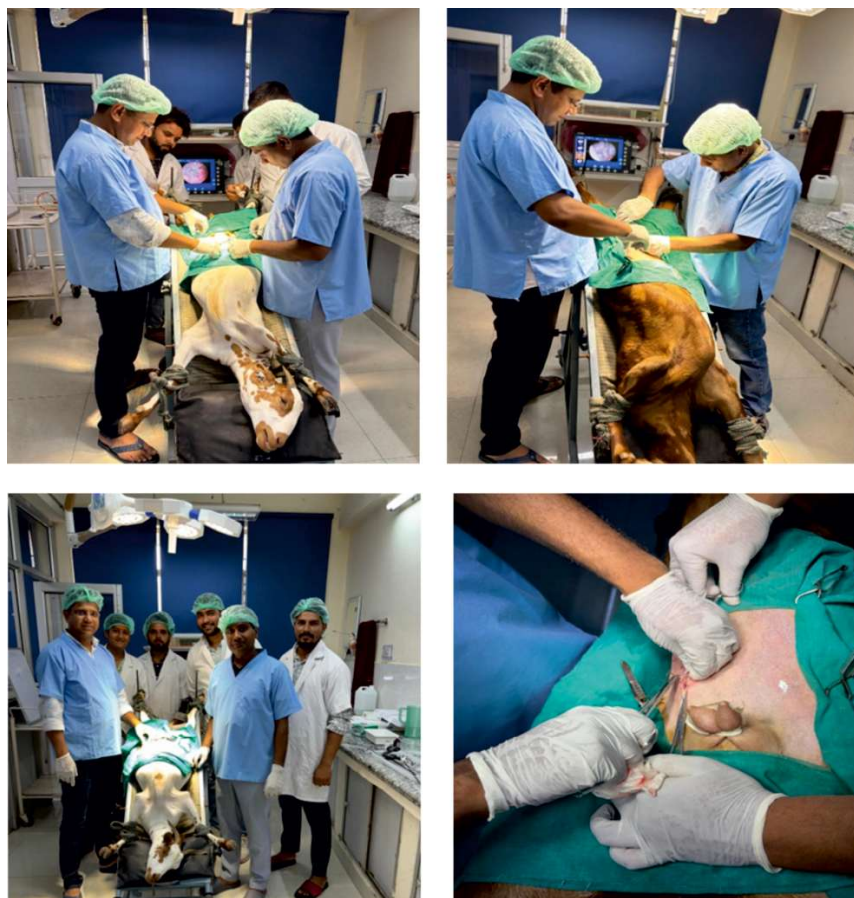


Fig. 3 : Laparoscopic assisted Embryo transfer into the surrogate animals

4.3.7 Project Title: AICRP on plastic engineering in agriculture and environment management (Funded by ICAR)

4.3.7.1 Development of renewal energy-based fodder dryer cum Winter protection shelter for goats

Principal Investigator Dr. B. Rai (till 16.04.2026), Dr. Mukesh Bhakat
Co- Principal Investigators Dr. Arvind Kumar, Dr. Y. K. Soni, Dr. R. Pourouchottamane and Dr. Mohd Arif

Air pocket polycarbonate sheet vs. sandwich foam plastic pannels

Weekly variation in minimum and maximum temperature recorded in solar dryer cum winter protection shelter in different protection materials Air Pocket Polycarbonate sheet (APPS) and Sandwich Foam Plastic Panels (SFPP) are as given below. Air Pocket Polycarbonate Sheets increased the minimum temperature upto 3 to 4 degrees Celsius more than using Sandwich Foam Plastic Panels. This increased comfort for kids at night and also benefited their physical growth. But in morning time maximum temperature upto 6 to 8 degrees Celsius is higher in air pocket polycarbonate sheet as compared to sandwich foam plastic panels.

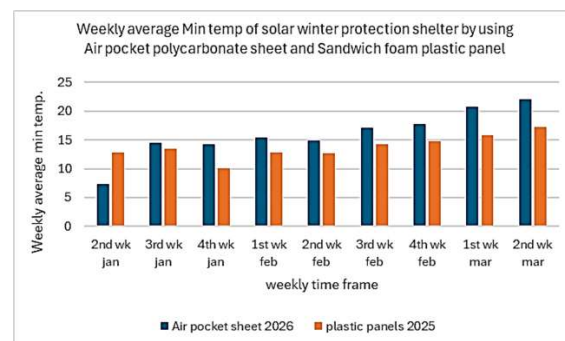
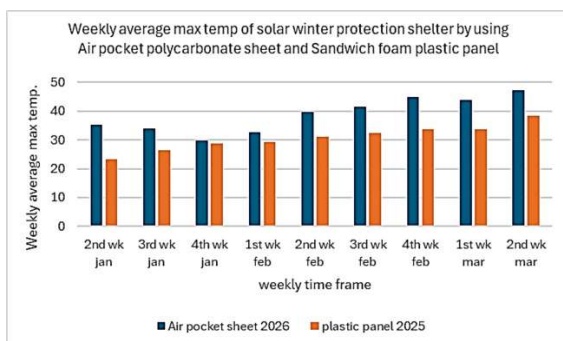
Growth rate comparable and results are non-significant. i.e, no adverse effect on growth of kids housed in solar dryer cum winter shelter. The growth rate of goat kids of Large and Medium Breed kept in an affordable, adjustable solar dryer combined with winter protection is similar to that of kids housed in expensive, permanent traditional kidding sheds. Additionally, this leads to improved use of resources, such as the solar dryer, which is only utilized for part of the year; with appropriate modifications, it can serve as shelter for goat kids during winter. The minimum temperature was noted to be significantly elevated in the winter protection combined with solar dryer structure, indicating that three-month-old kids residing in these enclosures experience minimal stress, thus ensuring their welfare.

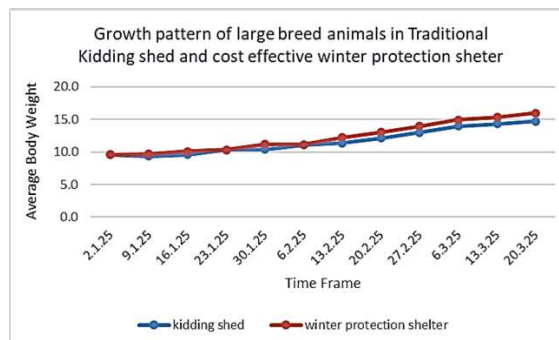
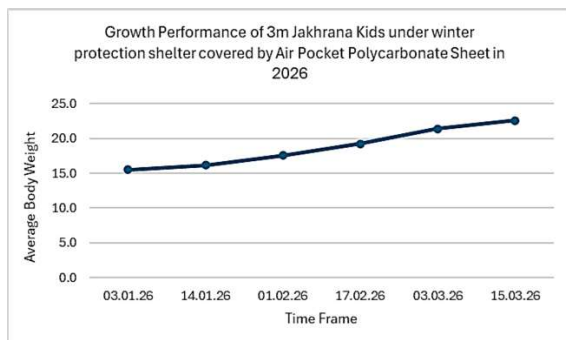


Covered with Air Pocket Polycarbonate Sheet



Covered with Sandwich Foam Plastic Panels





4.3.7.2 Development of plastic based multi species two tier shelter

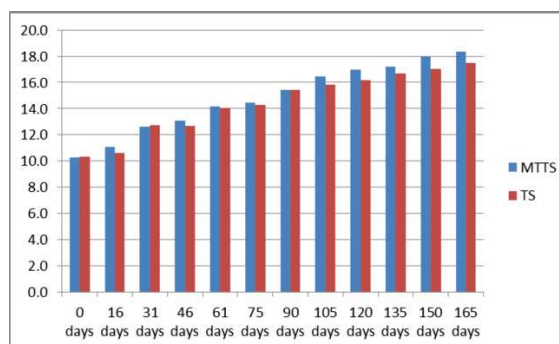
Principal Investigator

Dr. B. Rai (till 16.04.2026), Dr. Mukesh Bhakat

Co-Principal Investigators

Dr. Arvind Kumar, Dr. K. Gururaj and Dr. T.P. Singh

A total of ten female kids of average 3 months age of Barbari breed were housed in Multi-purpose Two Tier Animal Shelter and equal numbers of animals were reared in Traditional Animal Shelter as control group for study of growth performance in animal. Along with goats, 90 numbers of layer birds of Chabbro strain are also kept in Multi-purpose Two Tier Animal Structure for performance evaluation. The body weight of the kids was recorded fortnightly. The initial average body weight of kids kept in Multi-purpose Two Tier Animal Shelter was recorded to be 10.30 kg, which was increased to 18.33 kg after 165 days of rearing. The initial average body weight of kids kept in Traditional Animal Shelter was recorded to be 10.31 kg. After 165 days this was increased



to 17.48 kg in normal shed.

The growth trial shows that the goat kids housed in Multi-purpose Two Tier Animal Shelter had higher body weight gain.

Body weight changes in goat kids housed in two different housing shelters

Two tier housing	Traditional housing	Small Breed (Barbari female kids)
Initial Body weight (kg)	10.30 ± 0.93	10.31 ± 0.84
Body weight after 165 days (kg)	18.33 ± 1.66	17.48 ± 1.14
Change in Body weight (kg)	8.03 ± 0.92	7.17 ± 0.36
Average daily gain (g/day)	59.51 ± 6.84	53.09 ± 2.67



4.3.8 Project Title: Computer vision and artificial intelligence techniques for livestock body weight estimation, breed identification and disease diagnosis (Funded by Institute Corpus Fund)

Principal Investigator Dr. Mukesh Bhakat
Co- Principal Investigators Dr. Manish Kumar Chatli, Dr. G.S. Lal, Dr. Gopal Dass, Dr. Y.K. Soni, Dr. Ravi Ranjan, Dr. S.P. Singh and Dr. K. Gururaj
CC-Principal Investigator Dr. Satyendranath Mandal, Assistant Professor, KGE

Goat body weight estimation

A non-invasive image-based framework was explored for goat body weight estimation using artificial intelligence and data-driven analytical approaches. Digital images acquired under standardized conditions. Preliminary findings

indicated promising predictive performance under experimental conditions.

Image dataset creation of various goat breeds

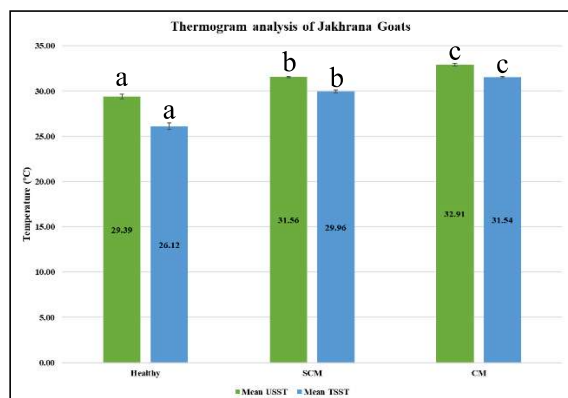
The 14 Goat breeds image dataset was captured for further image analysis.



Infrared thermography based udder and teat temperature recording for subclinical and clinical mastitis in Jakhrana and Jamunapari Goats

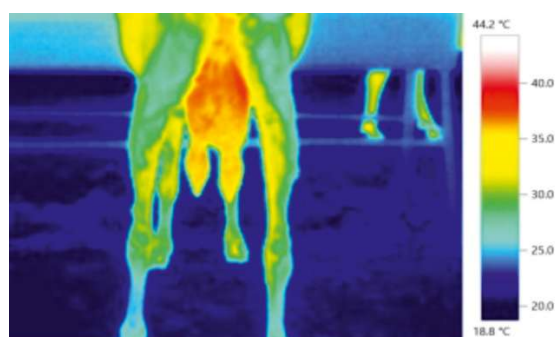
The study investigated the use of infrared thermography for detecting mastitis in Jakhrana and Jamunapari goats reared under a semi-intensive production system. The study was conducted on 50 udder quarters of lactating Jakhrana goats. Thermal imaging was performed using an infrared camera, while conventional diagnostic methods, including the California Mastitis Test (CMT), were used for confirmatory assessment of mastitis. Thermal images clearly

demonstrated that udder surface temperature increased progressively with the severity of infection. In healthy goats, the average udder skin temperature was approximately 29.39°C, which increased to around 31.56°C in subclinical mastitis and further rose to nearly 32.91°C in clinical mastitis. Similarly, the average teat temperature in healthy goats was about 26.12°C, which increased to approximately 29.96°C and 31.54°C in subclinical and clinical mastitis, respectively. Statistical analysis revealed that these differences were significant, confirming a strong association between inflammation and elevated surface temperature.

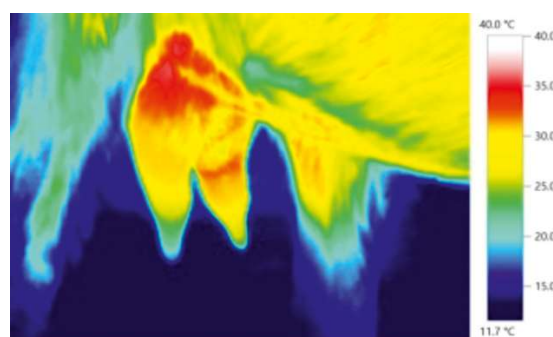


Means bearing different superscripts differ significantly (a, b, c $p < 0.05$) between the groups ; USST- Udder skin surface temperature, TSST- Teat skin surface temperature; Healthy (n= 31), Sub-clinical mastitis (n= 15), clinical mastitis (n=4)

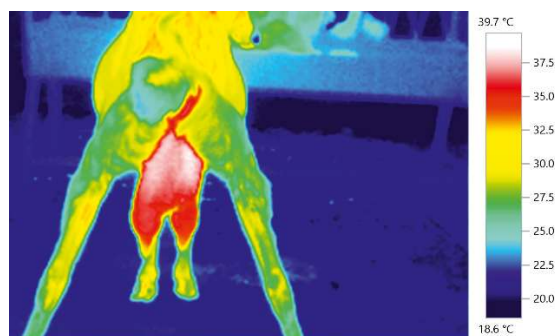
The study was conducted on 120 udder quarters of lactating Jamunapari goats. Thermal imaging was performed using an infrared camera, while conventional diagnostic methods, including the California Mastitis Test (CMT), were used for confirmatory assessment of mastitis. In healthy goats, the average udder surface temperature was approximately 27.97°C, which increased to 31.64°C in subclinical mastitis and further rose to 33.72°C in clinical mastitis. Similarly, the average teat temperature increased from 26.61°C in healthy animals to 30.75°C and 32.23°C in subclinical and clinical mastitis cases, respectively. Statistical analysis demonstrated that these differences were significant, confirming that inflammation is associated with a marked rise in localized surface temperature.



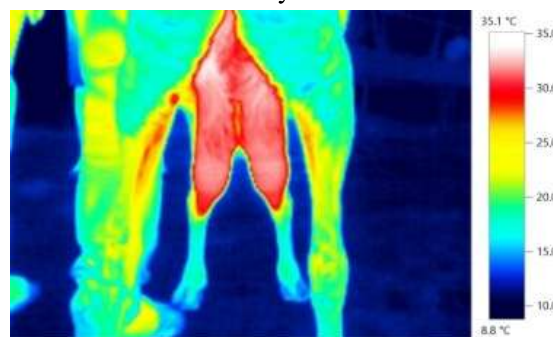
Healthy



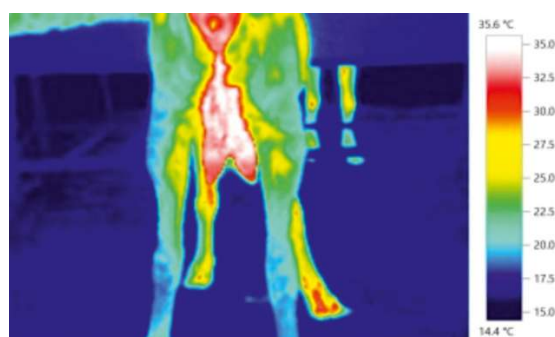
Healthy



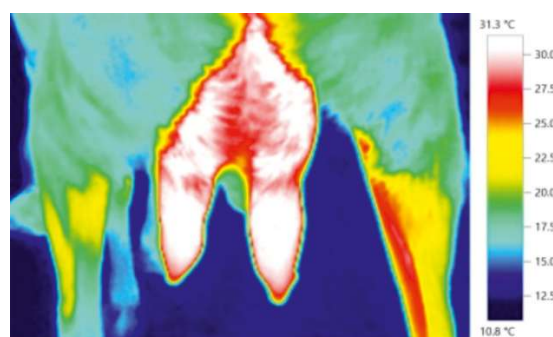
Sub-clinical mastitis



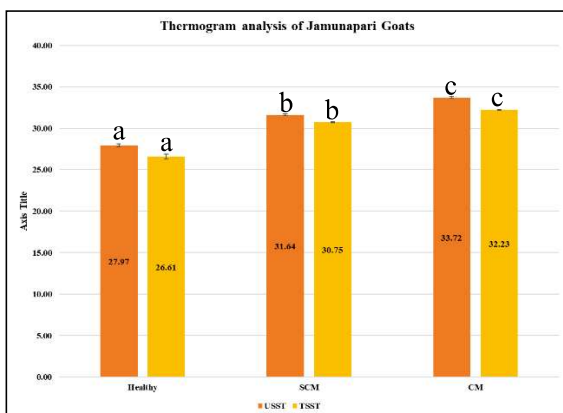
Sub-clinical mastitis



Clinical mastitis



Clinical mastitis



Means bearing different superscripts differ significantly (a, b, c $p < 0.05$) between the groups; USST- Udder skin surface temperature, TSST- Teat skin surface temperature; Healthy (n = 79), Sub-clinical mastitis (n= 34), clinical mastitis (n=7)

Identification of Diarrhoea and Ecthyma in Goat

Artificial intelligence-based image analysis model were developed for the identification of diarrhoea and ecthyma in goats using images collected from healthy and affected animals at institute. The developed frameworks demonstrated high diagnostic performance.



4.3.9 Project Title: Maximizing fertility in goats through strategic timing of artificial insemination and strengthening of goat semen bank (Funded by Institute Corpus Fund)

Principal Investigator

Dr. Ravi Ranjan

Co- Principal Investigators

Dr. Y. K. Soni, Dr. S. P. Singh, Dr. Mukesh Bhakat, Dr. M. K. Singh and Dr. Gopal Dass

Barbari goats selected for Estrus synchronization

Table. 1. Ovulation detection through ultrasonography

Sr. No.	BARBARI	Size (mm) of follicle			
		0hr estrus	12 hr estrus	24 hr estrus	36 hr estrus
1	BE 14068	3.94	4.78	5.88	Not seen
2	BE 14053	4.05	5.00	5.96	Not seen
3	BE 14418	3.86	4.75	5.92	Not seen
4	BE 14096	4.13	4.95	6.12	Not seen
5	BE 14418	4.15	4.86	6.02	Not seen
6	BE 14204	4.05	4.88	5.96	Not seen
7	BE 14220	3.98	4.82	5.98	Not seen
8	BE 14474	4.45	5.22	6.12	Not seen
9	BE 14639	3.98	5.10	6.24	Not seen
10	BE 14362	4.44	5.32	6.08	Not seen
11	BE 13119	4.68	5.14	6.06	Not seen
12	BE 13140	4.32	5.12	6.22	Not seen
13	BE 12761	3.82	4.88	6.18	Not seen
14	BE 14421	4.46	4.98	5.98	Not seen
15	BE 13891	3.98	4.96	5.96	Not seen
16	BE 14202	3.88	5.14	5.94	Not seen
17	BE 14007	3.96	5.16	6.14	Not seen
18	BE 13014	4.22	4.98	6.12	Not seen
19	BE 19683	4.12	4.88	6.14	Not seen
20	BE 13997	4.08	5.24	6.18	Not seen

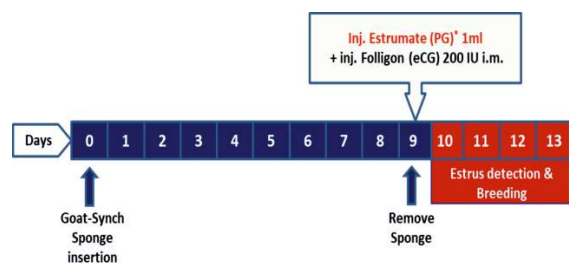


Fig. 1 : Estrus Synchronisation protocol in goat

Trans-rectal ovarian ultrasound scanning for the detection of ovulations by means of the disappearance of large follicles (5 to 6 mm) were seen up to 24 hr from the start of estrus. Hence preliminary data suggest that AI should be done after 24 hr of estrus detection. Blood Sampling for LH hormone measurement were carried out.

Blood Sampling for LH Measurement

Blood sampling started at the onset of behavioural estrus (detected via teaser bucks and observation). Collected 5 mL blood samples every 4 hours via

jugular venipuncture (n-160). Continued sampling for 36 hours. Serum is separated (centrifugation at 3000 rpm for 10 min) and stored at -20°C . LH concentration will be done by ELISA (Enzyme-Linked Immunosorbent Assay) kit.

Cryopreservation of superior goat germplasm

Cryopreservation of superior goat germplasm (14047 frozen semen dose) of different goat breeds (Jamunapari, Barbari, Jakhrana, Sirohi, Bundelkhandi, Mirzapuri, Beetal). Total-1410 semen straw sold, @ Rs.40 each Total- Rs. 56400.00; CIRG Dyl- 12 @ Rs.500, Total-Rs. 6000.00; Goat Speculum- 120 @ Rs. 150 Total-Rs. 18000; Training-7.92 lakhs- Total-Rs. 8,72,400.00 revenue generated.

Capacity building through training on semen freezing and AI in goat

06 Training Programme on Artificial Insemination in Goats were conducted and 140 Veterinary Officer, Para veterinarian and 12 progressive farmers were trained in this area.

Table. 2. Cryopreservation of superior goat germplasm in year

Sr. No.	Month	Breed	Total
1	JAN, 2025	JP, BE, JK, SR, BT, BK, MP	920
2	FEB, 2025	JP, BE, JK, SR, BT, BK, MP	1005
3	MARCH, 2025	JP, BE, JK, SR, BT, BK, MP	1010
4	APRIL, 2025	JP, BE, JK, SR, BT, BK, MP	1015
5	MAY, 2025	JP, BE, JK, SR, BT, BK, MP	1210
6	JUNE, 2025	JP, BE, JK, SR, BT, BK, MP	1040
7	JULY, 2025	JP, BE, JK, SR, BT, BK, MP	1179
8	AUG, 2025	JP, BE, JK, SR, BT, BK, MP	980
9	SEPT, 2025	JP, BE, JK, SR, BT, BK, MP	1096
10	OCT, 2025	JP, BE, JK, SR, BT, BK, MP	1025
11	NOV, 2025	JP, BE, JK, SR, BT, BK, MP	1250
12	DEC, 2025	JP, BE, JK, SR, BT, BK, MP	1120
Grand Total			12850

MP - Mirzapuri, BE - Barbari, BT - Beetal, JK - Jakhrana, SE - Sirohi, BK - Bundelkhandi, JP - Jamunapari



4.3.10 Project Title: Development and validation of a point-of-care pregnancy test for goats (Funded by Institute Corpus Fund)

Principal Investigator

Dr. S. P. Singh

Co- Principal Investigators

Dr. Y. K. Soni, Dr. Ravi Ranjan, Dr. Mukesh Bhakat and
Dr. Pawan Kumar Yadav

Experiment 1: Comparative analysis of precipitate formation in urine of pregnant and non-pregnant goats using barium chloride

Materials and methods

Urine samples were collected from both pregnant and non-pregnant goats under hygienic conditions. Analytical grade barium chloride (BaCl_2) was used to prepare aqueous solutions of three different concentrations: 0.5%, 1%, and 5% (w/v). Clean, sterile test tubes, micropipettes, and measuring cylinders were used for the assay.

Equal volumes of urine sample and barium chloride solution were mixed in clean test tubes for each concentration. Specifically, three sets of reactions were prepared.

Each mixture was gently shaken and allowed to stand at room temperature for a few minutes. The formation of precipitate was visually observed and recorded, noting the presence, intensity, and nature (e.g., turbidity or dense precipitate) of the reaction.

Results

Precipitate formation varied depending on the concentration of barium chloride and the physiological status of the animals.

At 0.5% BaCl_2 (A), minimal to no visible precipitate was observed in both pregnant and non-pregnant urine samples, with only slight turbidity in some cases.

At 1% BaCl_2 (B), moderate precipitate formation was observed, with a relatively more noticeable

Trial 1

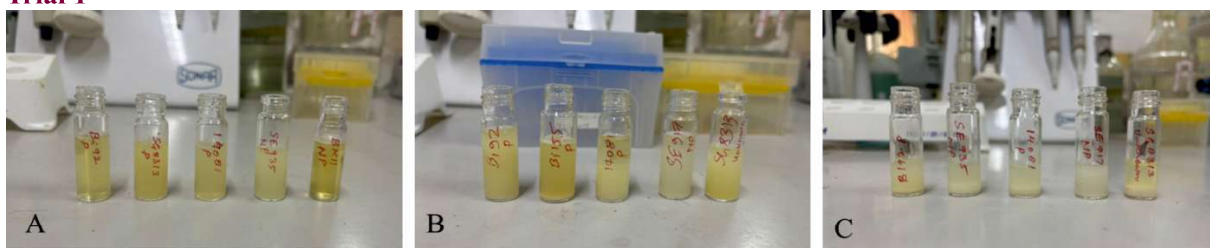


Fig. 1 : Formation of precipitate in urine samples from pregnant and non-pregnant goats following reaction with barium chloride solutions of different concentrations: (A) 0.5% barium chloride, (B) 1% barium chloride, and (C) 5% barium chloride, each mixed in equal volume with urine.

Trial 2



Fig. 2 : Representative results of different trials of Barium Chloride (BaCl_2) urine test for pregnancy detection in goats. Absence or minimal precipitate (clear or slightly hazy solution) indicates pregnant animals, whereas distinct white precipitate indicates non-pregnant animals. The intensity of precipitate reflects the degree of reaction between urinary components and BaCl_2 .

Trial 3

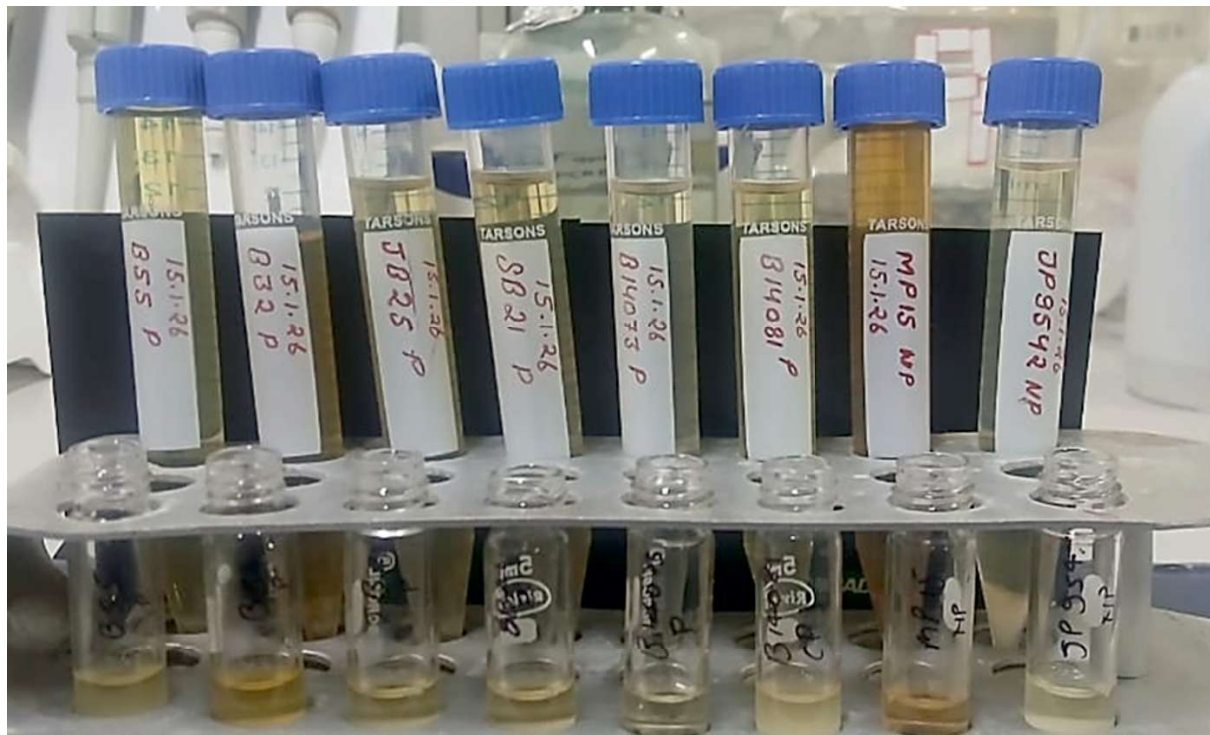


Fig. 3 : Representative results of different trials of the Barium chloride (BaCl_2) urine test for pregnancy detection in goats. For each assay, 100 μL of 1% barium chloride and 100 μL of 10% trypsin solution were added to 1 mL of urine sample and mixed gently. Absence or minimal precipitate (clear or slightly hazy solution) indicates pregnant animals, whereas formation of a distinct white precipitate indicates non-pregnant animals. The intensity of precipitate reflects the degree of reaction between urinary components and BaCl_2 .

reaction in urine samples from pregnant goats compared to non-pregnant ones.

At 5% BaCl_2 (C), a distinct and dense precipitate was formed in both groups; however, the intensity and volume of precipitate appeared comparatively higher in samples from pregnant goats.

These observations suggest that higher concentrations of barium chloride enhance precipitate formation, with potential differences between pregnant and non-pregnant urine samples.

Experiment 2: Improved detection of urinary precipitates in goats using HCl pretreatment and barium chloride assay

Urine samples from pregnant and non-pregnant goats were collected under hygienic conditions. Hydrochloric acid (HCl, 2M) and barium chloride (BaCl_2 , 1% w/v) solutions were prepared using analytical grade reagents. Clean test tubes, pipettes, and measuring cylinders were used for all procedures.

A fixed volume of urine sample was taken in clean test tubes. To each sample, a few drops of 2M HCl were added and mixed gently. The acidified samples were allowed to stand briefly to ensure complete reaction. Subsequently, an equal volume of 1% BaCl_2 solution was added to each tube. The mixtures were gently shaken and incubated at room temperature for a few minutes. Formation of precipitate was observed and recorded.

Results

Following acidification with HCl, urine samples showed a clearer background with reduced initial turbidity. Upon addition of 1% BaCl_2 , precipitate formation was observed:

- In pregnant goat urine, a more distinct and visible precipitate was formed.
- In non-pregnant goat urine, precipitate formation was comparatively lower or less intense.
- The clarity of the reaction mixture improved

- due to prior acid treatment, allowing better differentiation of precipitate formation between the two groups.
- Hydrochloric acid was used to eliminate non-specific interference in the assay. Urine naturally contains carbonate and bicarbonate ions, which can react with barium ions to form non-specific barium carbonate precipitates.
 - Acidification with HCl converts these carbonates and bicarbonates into carbon dioxide (CO_2) and water, thereby preventing their interaction with barium chloride. This ensures that any precipitate formed after the addition of BaCl_2 is more specific and not due to background interference, leading to more reliable and interpretable results.

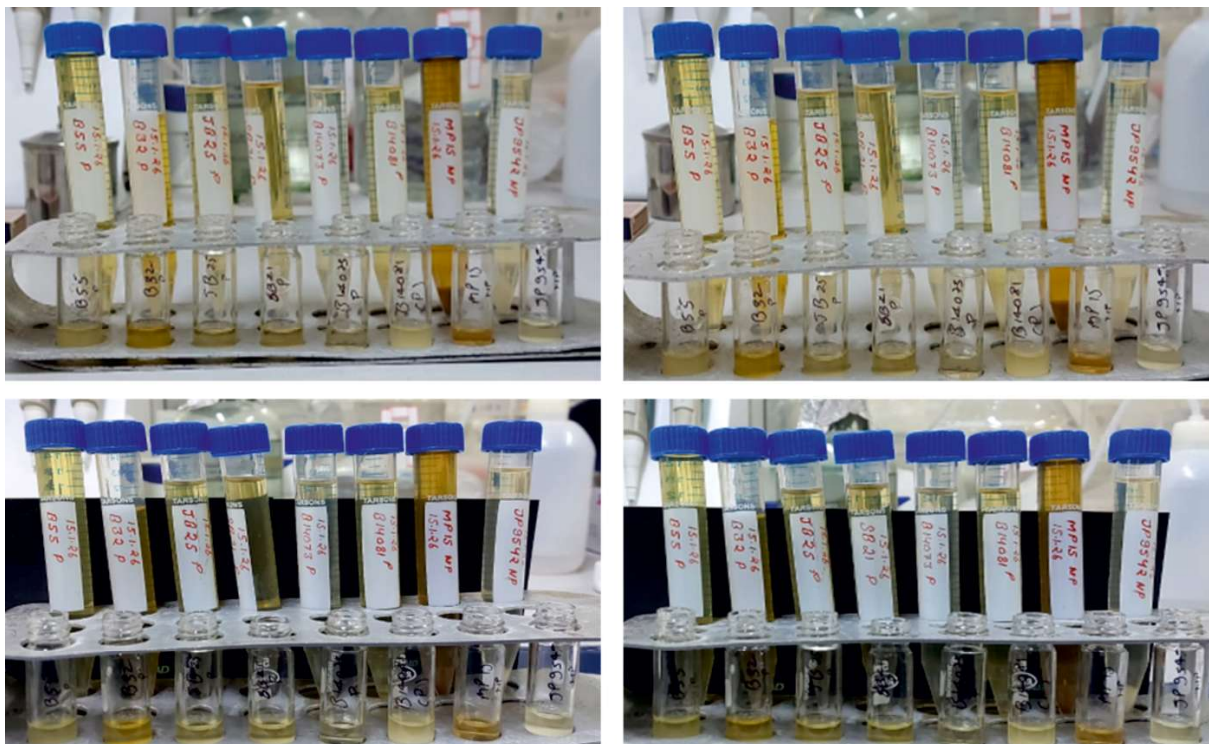


Fig. 4 : Effect of acidification on precipitate formation in urine samples from pregnant and non-pregnant goats. Urine samples were pre-treated with 2M HCl to eliminate carbonate and bicarbonate interference, followed by the addition of equal volume of 1% BaCl_2 . Acidification reduced non-specific turbidity and improved clarity of the reaction, enabling better visualization of precipitate formation. A comparatively more distinct precipitate was observed in urine samples from pregnant goats than non-pregnant goats.

4.3.11 Project Title: Development of novel alternative strategies for oestrus synchronization in goats (Funded by Institute Corpus Fund)

Principal Investigator Dr. Y. K. Soni

Co-Principal Investigators Dr. S. P. Singh, Dr. Ravi Ranjan, Dr. Mukesh Bhakat, Dr. M. K. Singh and Dr. Poornima Agarwal (GLA University)

During this period, using solvent evaporation method total 06 different formulations of various excipients were used for the optimization of making of transdermal films as; Polyisobutylene, ethyl cellulose, HPMC, Xanthan gum, PVP, and Eudragit as matrix polymers, ethyl cellulose as thickening agent, Poly-Ethylene-Glycol, Dibutyl-phthalate, and Glycerol as plasticizer.

Chloroform, acetone and methanol were used as organic solvent. We have optimized the film forming ability using various excipients with film thickness of 0.1 to 0.28 mm, however the tackiness or adhesive properties could not be achieved.

4.3.12 Project Title: Status of reproductive ailments in goats reared under field conditions (Funded by Institute)

Principal Investigator

Dr. Y. K. Soni

Co-Principal Investigators

**Dr. S. P. Singh, Dr. Ravi Ranjan, Dr. Mukesh Bhakat, Dr. A. K. Dixit,
Dr. Gopal Dass and Dr. A. K. Mishra**

During this period survey data of 13 villages with 132 households and 1204 goats were analysed and it has been observed that Repeat breeding/Short cycles (30%) and Anestrus (15%) were observed as major reproductive ailment in female goats. Further, non/poor availability of quality breeding bucks was major management issue in the surveyed villages. Accordingly, the goat farmers were advised for regular deworming and

vaccination, balanced nutrition with incorporation of mineral mixture supplements in the feed. Further, knowledge has also been disseminated regarding sharing of good breeding bucks among the community, proper record keeping and maintenance, and discourage the indiscriminate sale and slaughter of elite buck germplasm.



Fig. 1 : Glimpse of field survey regarding reproductive problems in goats and input distribution

4.4 Animal Nutrition Management & Product Technology Division

4.4.1 Project Title: ICAR-Network program on veterinary type culture collection (Rumen microbes) (Funded by ICAR)

Principal Investigator Dr. Ravindra Kumar

Co-Principal Investigator Dr. A. K. Mishra

The objective of this project is to isolate anaerobic superior cellulose degrading bacteria from goat rumen. Rumen liquor sample was collected from adult goats (2-3 years of age) maintained under semi-intensive system of feeding in Jakhrana and Barbari goat farms. Pure cultures of rumen bacteria were isolated by serial dilution method. Characterization of rumen bacteria was done on the basis of gene sequence using NCBI database.

Five isolates of rumen bacteria (Table 1) were identified and characterized on the basis of 16S rRNA gene amplification and sequencing of the amplified product. These bacterial cultures were studied for enzymatic and biochemical activities and submitted to coordinated unit at NIANP Bangalore for accession number. All the submitted cultures were provided with accession number as given in table no 1.

Table 1 : Rumen bacteria isolated from the goats

S.No	Bacteria name	Culture ID	Animal	Sample	VTCC Accession no.
1	<i>Prevotella strain W2052</i>	JK1	Goat	Rumen	VTCCRM0000806B
2	<i>Prevotella sp. RM17</i>	JK2	Goat	Rumen	VTCCRM0000807B
3	<i>Segatella strain M384 (Prevotella albensis)</i>	JK3	Goat	Rumen	VTCCRM0000808B
4	<i>Clostridium sporogenes strain A10</i>	BG1	Goat	Rumen	VTCCRM0000804B
5	<i>Clostridium sporogenes strain JCM7841</i>	BG2	Goat	Rumen	VTCCRM0000805B

Isolation, identification and characterization of tannin degrading microbes from wild ruminants

Sample collection and isolation of tannin degrading bacteria.

The faecal samples were collected from Lion Safari Park in Etawah from wild ruminants namely *Antelope cervicapra* (Blackbuck) and *Cervus unicolor* (Sambar Deer). Central portion of each faecal pellet was carefully extracted, triturated and transferred to centrifuge tubes wherein, 9 ml of dilution media was added with CO₂ gas gently passing to maintain anaerobic conditions. Samples were homogenized, centrifuged and clear supernatant was separated. 1 ml of supernatant was pipetted into fresh dilution tubes containing tannic acid designated for culturing tannin-degrading bacteria. Serial

dilutions were performed up to 10⁻¹ to 10⁻⁸ and dilution tubes were kept in incubator for 48 hours. Based on bacterial growth, 10⁻⁴ and 10⁻⁵ dilution levels were selected and shifted to agar bottles for isolating the single bacterial colonies and were kept in anaerobic chamber at 39° C. After 48 hours of anaerobic incubation, single bacterial colony was isolated from the agar bottle and transferred into the broth Bottles. Broth bottles were then incubated anaerobically in anaerobic chamber and later on subculture was made.

Morphological and biochemical characterization of isolated tannin degrading bacteria

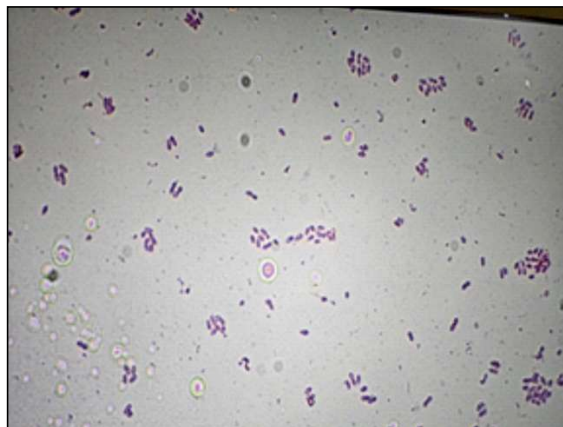
The cultures were screened through the gram staining for their morphology using microscope. They were tested for oxidase and catalase. The results are as follows:

Table 2: Morphological and biochemical characterises of isolated cultures

S. No.	Culture ID	Shape	Gram +/-	Oxidase +/-	Catalase +/-
1.	AT1	Cocci	Positive	Negative	Negative
2.	AT8	Cocci	Positive	Negative	Negative
3.	AT9	Rod	Negative	Negative	Negative
4.	SAMT2	Rod	Negative	Negative	Negative



Gram positive cocci



Gram negative rods

Molecular characterization of isolated tannin degrading bacteria

Pure cultures of different isolates of bacteria were subjected for extraction of DNA. The DNA was isolated by tradition PCI method and quality check was performed. DNA samples was used for amplification of 16S rRNA gene using universal bacterial primers (F-S*-univ-F8-S- 16 and R- S*-univ-1492-a-A-15) and amplified products (size 1.5kb) were subjected for sequencing of desired genes.

Characterization of these bacteria was done on the basis of gene sequence using EzBioCloud database https://www.ezbiocloud.net/resources/16s_download. These isolates were identified and characterized on the basis of 16S rRNA gene amplification and sequencing of the amplified product. These four (04) cultures (Table 2) of characterized bacteria in slants and glycerol



stocks, isolated from fecal sample of wild ruminants submitted to repository centre NIANP, Bangalore for accession number.

Table 3: List of cultures isolated from wild ruminants

1	<i>Streptococcus gallolyticus</i>	Fecal	AT1	Antelope
2	<i>Streptococcus lutetiensis</i>	Fecal	AT8	Antelope
3	<i>Pseudomonas aeruginosa</i>	Fecal	AT9	Antelope
4	<i>Pseudomonas aeruginosa</i>	Fecal	SAMT2	Sambar deer



4.4.2 Project Title: Global centre of excellence on millets (Global CoE on millets) (Funded by ICAR)

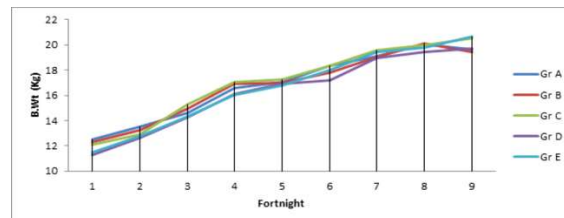
Principal Investigator Dr. Ravindra Kumar

Co- Principal Investigators Dr. Tarun Pal Singh, Dr. Arun Verma, Dr. Arvind Kumar and Dr. A. K. Dixit

Complete pellet feed using millet based stovers were evaluated in growing Barbari goats and effect on growth, dry matter intake, FCR blood and rumen metabolites were studied. Slaughter was conducted at the end of experimental feeding and carcass attributes and meat quality was also studied. Five types of complete pellet feed were formulated using roughage and concentrate ingredients in 50:50 ratio. The details are as follows:

1. Pellet A: containing Gram straw and concentrate ingredients (50:50).
2. Pellet B: containing Pearl millet stovers and concentrate ingredients (50:50).
3. Pellet C: containing Sorghum Stovers and concentrate ingredients (50:50).
4. Pellet D: containing Enzyme mixed Pearl millet stovers and concentrate ingredients (50:50).
5. Pellet E: containing Enzyme mixed Sorghum Stovers and concentrate ingredients (50:50).

These pellets were prepared at experimental feed unit of Animal nutrition experimental shed by mixing the ingredients in desired ratio and putting it in pellet making machine. The prepared pellets were stored till used in experimental feeding at dry place in godown. The chemical composition of these pellets was studied in lab. All the pellets were iso nitrogenous having approx. 12 % crude protein. The ether extract (EE) were around 1.5%. Total carbohydrate (%) varied from 71-79% being highest in sorghum stovers based complete pellet and lowest in Enzyme mixed Pearl millet stovers.



Feeding cum growth trial on feed formulations

Feeding cum growth trial was conducted on these complete pellet feeds in growing barbari goats to assess their impact on body weight gain, dry matter intake, feed conversion ratio, body condition score and overall production performance of animals.

Thirty growing Barbari goats (with mean body weight 11.81 kg and age approx. 5months) were divided into five groups (Gr A, B, C, D and E) containing 6 each (3M+3F) and fed with ad libitum respective category of pellet. The duration of the experimental feeding cum growth trial was one hundred twenty days. During the trial daily calculated quantities of respective pellets were offered to all the groups of goats at two times: morning (08:00AM) (half of amount) and afternoon (2.00 PM) (half of amount). Ad lib clean and wholesome drinking water was provided during the trial. To determine dry matter (DM) intake, fortnightly sampling of offered and residues pellets were sampled and subsequently analyzed for dry matter. Live weight changes were determined by recording body weight of each goat at 0hr post feeding using a digital weighing machine at fortnightly interval. The average growth rate was calculated on the basis of live weight changes during the feeding cum growth trial.

Table 1: Effect of feeding millet stovers based complete pellet on body weight changes, dry matter intake, feed conversion ratio

Attributes	GrA	GrB	GrC	GrD	GrE	SEM	Sig
Initial body weight (kg)	12.48	12.28	11.53	11.30	11.46	0.45	0.913
Final body weight (kg)	19.67	19.42	19.70	19.68	20.66	0.68	0.986
Average daily weight gain (g)	59.93	59.91	68.05	69.79	76.66	3.32	0.461
Average daily DM intake (g)	627.27	629.37	737.42	669.61	715.03		
Feed conversion ratio (FCR)	10.46	10.57	10.83	9.59	9.32		
Final Body condition score	2.66	3.16	3.16	3.16	3.33		

The growth performance of the growing goats is presented in table 1 and fortnightly body weight changes are presented in fig 1.

The average daily gain (adg) during the feeding trial was statistically similar in all the five groups showing that millet stovers can provide a comparable growth to the leguminous gram straw based diet in growing goats. The feed conversion ratio was 10.46 in Gr A, 10.57 in Gr B, 10.83 in Gr C, 9.59 in Gr D and 9.32 in Gr E. There was lower FCR after incorporation of enzyme in the millet stovers based complete pellet feed. Body condition score was also similar in all the five groups of growing animals at the end of feeding trial.

Blood collection and biochemical metabolites estimation

Blood was collected through jugular vein puncture at 75 days of experimental feeding from each animal of all the groups. Blood was collected in EDTA tubes for hematological parameters. For serum sample, blood was collected in 15 ml

falcon tubes and serum was separated and stored at -20°C to estimate blood biochemical metabolites. No significant difference was reported in the hematological parameters studied like blood cell counts, hemoglobin etc. The effect of feeding different type of pellet on blood metabolites is presented in table 2.

Rumen liquor was collected from the goats of all the groups using stomach tube at 0 hour of feeding. The pH of ruminal fluid was measured with the help of digital pH meter immediately and the collected samples were preserved for other metabolites estimation. The ruminal fluid pH was in between 6.5-7.0 showing no adverse effect of feeding millet stovers in goats on ruminal environment. There was no difference in nitrogenous fractions, total nitrogen and non-protein nitrogen and ammonia nitrogen between different groups. No statistically significant difference was reported in total volatile fatty acid and its fractions in different groups of goat.

After 4 months of experimental feeding (age of

Table 2: Effect of feeding millet stovers based complete pellet on serum metabolites in different group of growing goats

Parameters	Gr. A	Gr. B	Gr. C	Gr. D	Gr. E	Mean	SEM	Sig.
Glucose (mg/dl)	43.82b	44.79 b	57.83a	52.54ab	57.86a	51.37	1.88	0.021
Total protein (g/dl)	8.79	9.07	8.73	9.47	9.61	9.53	0.31	0.520
Albumin (g/dl)	3.24	3.46	3.23	3.05	3.19	3.23	0.669	0.495
Globulin (g/dl)	5.54	5.61	5.49	6.41	6.42	6.30	0.32	0.485
Cholesterol (mg/dl)	124.66	129.21	114.51	127.67	137.39	126.69	3.91	0.491
Triglycerides (mg/dl)	104.83	108.30	102.15	108.88	103.20	105.47	1.34	0.427
AST (IU/L)	64.98c	64.79c	67.62c	111.25b	148.39a	92.21	7.09	0.000
ALT (IU/L)	44.85b	30.02b	66.42b	44.11b	125.36a	62.15	8.10	0.000
Alkaline Phosphatase (IU/L)	5.23	3.16	5.19	4.19	3.17	4.19	0.40	0.278
Antioxidant (u/ml)	13.04	13.88	13.97	13.68	14.30	13.78	0.44	0.938

approximately 9 months) the male animals of all the groups were undergone for slaughter for study of meat quality attributes. The body conformation and carcass component in different group of growing goats is presented in table 3.

No significant difference was reported in live animal traits, carcass and non-carcass component of animals slaughtered from different groups. Meat from different group of goats fed on different type of complete pellet feed was studied for their composition. No difference was recorded in the percent pH, moisture, protein and ash of the meat from different group of goats. However a lower fat percent was reported in meat from goats

fed with enzyme incorporated pearl millet and sorghum stovers based complete pellet feed. For fatty acid analysis in meat fat fatty acid methyl esters (FAME) of meat samples were prepared and analysed in the GC-MS/MS analysis.

Fatty acids were identified by comparing their retention time with the fatty acid methyl standards (Supelco 37) and were expressed as a per cent of total fatty acids. Study on meat fatty acid profile revealed that, the fat from the animals fed with pearl millet stovers has significantly ($P < 0.05$) higher poly unsaturated fatty acids, N-6 PUFA and lower Index of atherogenicity. The meat fat from goats fed with pearl millet stovers had

Table 3: Effect of feeding millet stovers based complete pellet on body conformation and carcass component in different group of growing goats

Attributes	Gr. A	Gr. B	Gr. C	Gr. D	Gr. E	Mean	SEM	Sig.
Carcass Wt.(kg)	10.60	9.85	10.75	10.51	10.55	10.45	0.47	0.987
Carcass Yield%	45.22	44.15	45.10	46.64	45.44	45.40	0.48	0.680
Hind Quarter Wt	4.59	4.29	4.57	4.53	4.55	4.50	0.18	0.992
Fore Quarter Wt	6.01	5.56	6.17	5.98	5.33	5.81	0.33	0.949
Empty Body Wt	19.5	18.3	19.2	18.0	18.9	18.80	0.79	0.982
Chest Circumference (cm)	62.0	61.7	65.0	61.3	61.7	62.33	0.86	0.714
Loin width(cm)	12.6	12.3	13.0	12.6	13.3	12.80	0.28	0.874
Leg Circumference (cm)	25.3	24.0	28.0	26.6	28.0	26.40	0.76	0.435

significantly ($P < 0.05$) better Hypocholesterolemic/ Hypercholesterolemic ratio and Health-Promoting index.

Cultivation of finger millet (*Eleusine coracana*)

MR-6 variety of Finger millet (*Eleusine coracana*) was cultivated at Agriculture farm of the institute and stovers were produced.

S.No	Programmes	No. of Participants	State Covered
1.	Three days training program from 19-21 August was conducted on "Scientific goat farming along with utilization of millet stovers in the goat ration"	23 (ST goat farmers)	1 (Rajasthan)
2.	Kishan gosthi (Total:07)	205	02
1.	Scheduled Tribes farmers Kishan gosthi programmes Place-Mafi,Block-Weir,Dist.-Bharatpur(Raj.)	21	01
2.	Scheduled Tribes farmers Kishan gosthi programmes Place-Oolupura,Block-Bhusaber, Dist.-Bharatpur(Raj.)	36	01
3.	Scheduled Tribes farmers Kishan gosthi programmes Place-Reti Tehsil-Kathumer, Dist.-Alwar(Raj.)	24	01
4.	Kishan gosthi programmes Place-Rosu,Block-Farah, Dist.-Mathura(U.P.)	35	01
5.	Kishan gosthi programmes Place-Kolipura,Tehsil & Dist.-Bharatpur(Raj.)	25	01
6.	Kishan gosthi programmes Place-Rareh,Tehsil-Kumher, Dist.-Deeg(Raj.)	30	01
7.	Kishan gosthi programmes Place- Santrook,Tehsil-Kumher, Dist.-Deeg(Raj.)	34	01
3.	Demonstration (total: 26)	1277	14
4.	Hands on Training (total:02)	36	10





Training cum demonstration on utilization of Millets stovers in animal ration

4.4.3 Project Title: Development of natural farming based fodder production practices for goats (Funded by Institute)

Principal Investigator **Dr. Arvind Kumar**
Co-Principal Investigators **Dr. Ravindra Kumar and Dr. K. Gururaj**

Experiments on Natural Farming based fodder production practices for goats were conducted to assess the potential of goat faeces and urine. Trials were conducted on preparation of jeevamrit and beejamrit and to develop the package of practices of feed and fodder production through natural farming. During the Rabi season of 2025, fodder berseem and barley feed grain was cultivated using natural farming practices. Before sowing, seeds were treated with *beejamrit* and *Jeevamrit* (10 kg cow dung + 5 liters cow urine + 2 kg besan + 2 kg jaggery + hand full Soil + 200 liters water) was prepared and applied once in 15-20 days. The production of berseem fodder biomass and barley

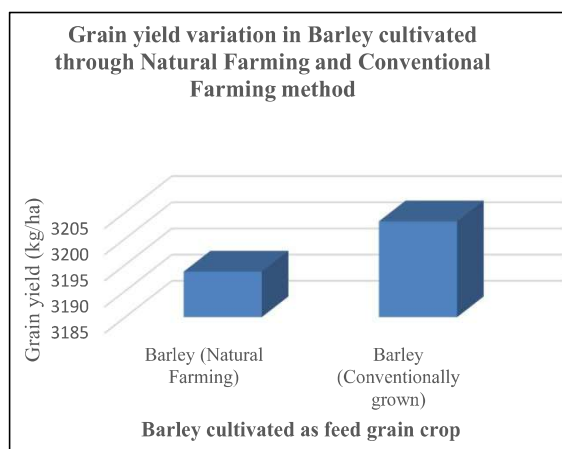


Table 1. Grain yield of barley (BH-393 variety) grown conventionally and naturally (kg/ha)

Sl. No.	Barley (Natural Farming)	Barley (Conventionally grown)
1.	3212.5	3185.5
2.	3184.8	3245.8
3.	3205.2	3186.2
4.	3174.7	3155.7
5.	3191.4	3243.4
Average	3193.7	3203.3

Table 2. Green fodder yield of berseem (Kavery variety) in 4 cuttings grown conventionally and naturally (kg/ha)

Sl. No.	Berseem (Natural Farming)	Berseem (Conventional Farming)
1.	45815.3	46312.9
2.	43855.8	44653.4
3.	45312.5	45890.5
4.	44352.6	45423.1
5.	43648.1	44762.6
Average	44596.8	45408.5

feed grain was recorded. Barley variety BH-393 was cultivated for feed grain following the Natural Farming Practice (*Jeevamrit*) and conventional practice keeping other agronomical practices identical in both the cultivation methods.

There is no significant difference in barley feed grain yield cultivated in both the methods. The grain production of barley in Natural Farming has slightly (0.29%) decreased than in Conventional method.

Berseem variety Kavery was cultivated for green fodder following the Natural Farming Practice (*Jeevamrit* spray 4 times at 15 days interval) and conventional practice keeping other agronomical practices identical in both the cultivation methods.

There is no significant difference in green fodder yield of berseem cultivated in both the methods. The fodder production of berseem in Natural Farming has slightly (1.8%) decreased than in conventional method.

Three formulations of *Jeevamrit* as detailed below have been prepared and it's nutritional and microbial composition analysis is going on.

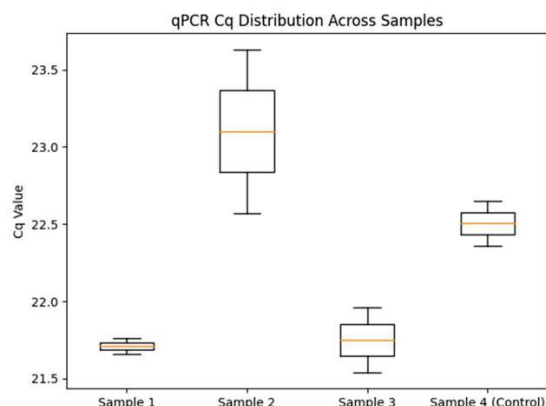
T_1 = 5L water + 125ML cow urine + 250g cow dung + 50g besan + 50g jaggery + soil

T_2 = 5L water + 125ml goat urine + 250g goat faeces/droppings + 50g besan + 50g jaggery + soil

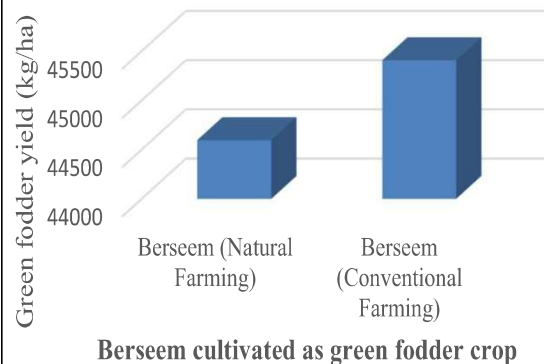
T_3 = 5L water + (62.5 ml cow urine & 62.5 ml goat urine) + (125g goat faeces & 125g cow dung) + 50g besan + 50g jaggery + soil

T_4 (Control) = 5L water + 125ML cow urine + 250g cow dung

Statistical interpretation (ANOVA-level insight)



Variation in Green fodder yield of Berseem cultivated through Natural Farming and Conventional Farming method



DNA	Concentration
T1	8.28 ng/κl
T2	7.91ng/μl
T3	10.9 ng/μl
T4 (Control)	7.0 ng/μl

Treatment 2 shows clearly higher Cq (lower bacterial load), Treatment 1 & 3 are nearly identical, whereas Treatment 4 (control) is intermediate.

Variability: Treatment 1: very tight → high precision, Treatment 2: high SD → biological/technical variability, Treatment 3 & 4: acceptable variation.

Demonstrations on preparation and use of *jeevamrit* as organic fertilizer and *beejamrit* for seed treatment of fodder crops were conducted to the goat farmers and different trainee participants of feed and fodder production, processing and ration formulation.



Fig. 1 : Demonstrations on preparation and use of *Jeevamrit* as organic fertilizer

4.4.4 Project Title: Agri-Drone Project: Use of drone in agriculture for spray of liquid fertilizer and chemicals (Funded by ICAR)

Principal Investigator

Dr. Arvind Kumar

Co-Principal Investigators

Dr. Ravindra Kumar and Dr. Gopal Dass

In this project a hexa-copter AGRIBOT Drone having 10 l liquid storage capacity, 25 kg max takeoff weight and 25 minutes hovering time (without payload) was procured for demonstration purposes. It can be used for spraying liquid fertilizer and other chemicals used in crop cultivation. During demonstration it is observed that the drone can spray at the flow rate of 1.2 to 4.0 l/min covering the spray width of 3.0-5.0 m.

During the reported period successfully completed Remote Pilot Certificate Training course at Flapone Aviation Private Limited, New Delhi. Demonstration of Drone for spray of liquid fertilizer was given to the 25 trainee participants

of self-financed training on “Feed-fodder production, processing and ration formulations for goats” during 08-12 December, 2025. Also demonstrated spray of Nano urea with drone in fodder berseem to the goat farmers of adopted villages of DAPSC project. Demonstration on spray of Nano urea in fodder berseem at our farm was conducted for the 11 Nos. of trainee participants sponsored by the Dept. of Sheep Husbandry, Leh attending training on “Feed-fodder production and processing for goats” during 09-13 March, 2026. AGRIBOT Drone was also demonstrated and explained to the farmers and trainee participants at CIRG through lecture and demonstrations.



Fig. 1 : Agri-Drone demonstration to the trainee participants and farmers

4.4.5 Project Title: Evaluation of sheep wool for improving forage crop productivity (Funded by Institute)

Principal Investigator Dr. Arvind Kumar
Co- Principal Investigators Dr. Ravindra Kumar and Dr. Gopal Dass

Study was conducted to assess the alternative use of Muzaffarnagari sheep wool as slow release fertilizer and as mulch due to high medullation and good hygroscopic and water holding capacity for feed and fodder production for goats. Pot experiments were conducted on barley cultivated during Rabi season for feed grain purpose. Treatments for barley included different quantity of sheep wool and fertilizer as detailed below.

Sheep wool: W1- Control (No wool), W2- 0.5 Mg/ha (4.0 g for pot), W3- 1 Mg/ha (8.0 g), W4- 2



Table 1 : Grain yield of barley (g) in pot experiment at different levels of wool and fertilizer dose used

% of Recommended Dose of Fertilizer (RDF) used	Quantity of sheep wool used in pot			
	0 g	4 g	8 g	16 g
0%	102.5	107.5	113.0	111.52
5%	116.0	121.0	129.0	139.0
50%	120.0	146.0	150.5	153.0
75%	141.5	154.0	169.0	166.5
100%	147.5	161.5	181.5	186.5

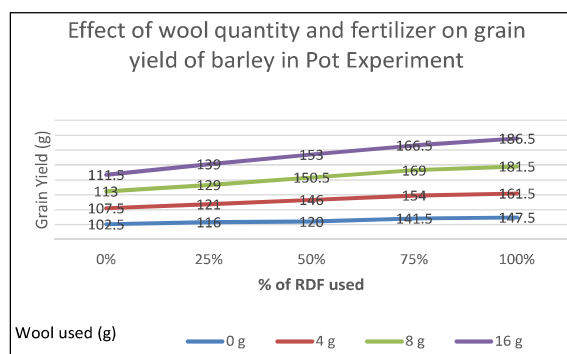


Fig. 1: Grain yield of barley in pot experiment

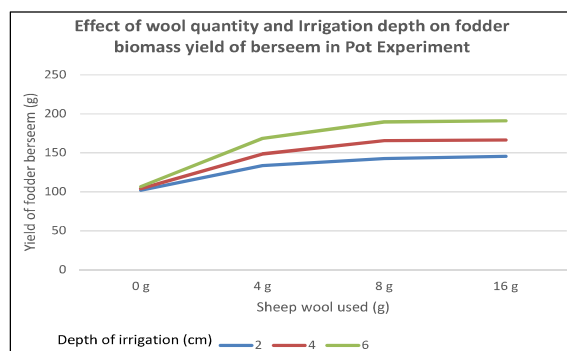


Fig. 2 :Fodder yield of berseem in pot experiment



Mg/ha (16.0 g). Fertilizer (RDF- 60:30 :: N:P): F1- 0% RDF, F2- 25% RDF, F3- 50% RFD, F4- 75% RFD, F5- 100% RFD.

Pot experiments were conducted on berseem cultivated for fodder biomass. It included treatments on different levels of sheep wool and irrigation as detailed below.

Wool: W1- Control (No wool), W2- 0.5 Mg/ha (4.0 g for pot), W3- 1 Mg/ha (8.0 g), and W4- 2 Mg/ha (16.0 g). Irrigation level: I1- 2 cm, I2- 4 cm, I3- 6 cm depth of water.

Table 3 : Percent increase in fodder biomass production of berseem at different levels of wool mulch and irrigation as compared with Control (no wool) in Pot Experiment

Depth of irrigation (cm)	% increase in fodder biomass production		
	0.5 Mg/ha wool mulch	1.0 Mg/ha wool mulch	2.0 Mg/ha wool mulch
2	30.88	39.70	42.64
4	42.78	59.13	60.00
6	58.21	77.93	79.34

4.4.6 Project Title: Standardization of goat milk cheese processing and value addition of its by-product (Funded by Institute)

Principal Investigator

Dr. Arun Kumar Verma

Co- Principal Investigators

Dr. V. Rajkumar, Dr. K. Gururaj and Dr. Tarun Pal Singh

Standardization and quality evaluation of goat milk kaladhi

In this study, the processing of an artisan cheese kaladhi was standardised, and its physicochemical, colour, textural, rheological and sensory properties were determined. Among

Table 1: Physicochemical and colour properties of kaladhi

Parameter	Value
Moisture (%)	36.71±0.31
Fat (%)	33.33±0.21
Protein (%)	24.11±0.15
Ash (%)	2.22±0.02
pH	5.38±0.01
TA (%)	0.63±0.01
^a w	0.95±0.003
Lightness	66.88±0.70
Redness	0.63±0.08
Yellowness	14.99±0.26

Table 2: Textural and sensory properties of goat milk kaladhi

Parameter	Value
Hardness (N/cm ²)	12.70±1.32
Adhesiveness (Ns)	-0.01±0.00
Springiness (cm)	0.82±0.03
Cohesiveness (ratio)	0.36±0.01
Gumminess (N/cm ²)	4.65±0.60
Chewiness (N/cm)	3.78±0.50
Appearance	7.99±0.13
Flavour	8.24±0.20
Texture	8.11±0.13
Juiciness	7.57±0.10
Sourness	7.97±0.13
Overall acceptability	8.27±0.12

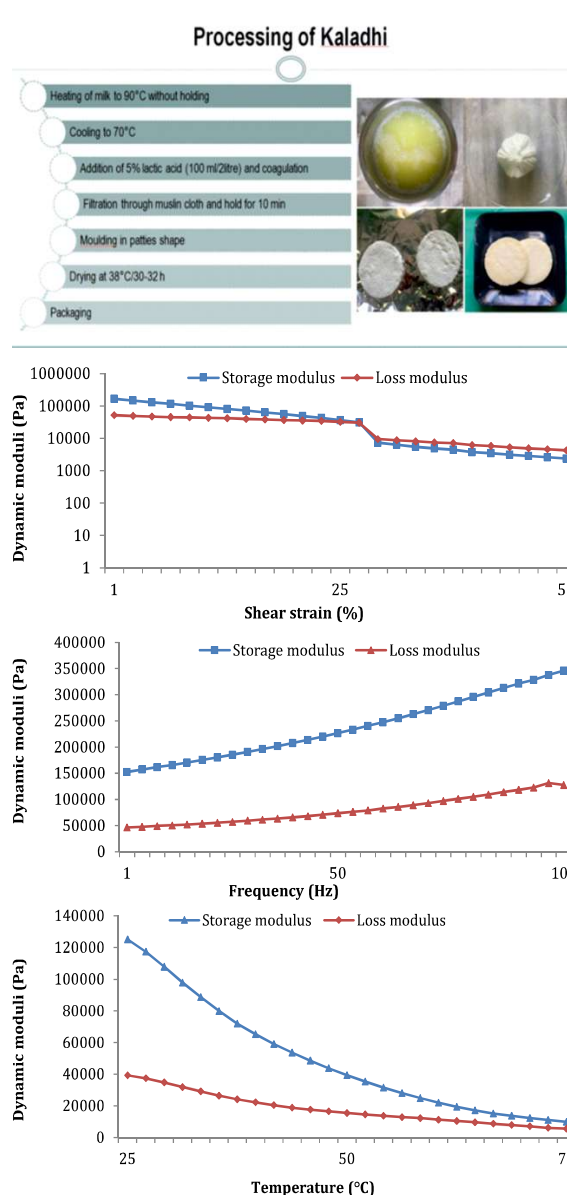


Fig. 1. Strain amplitude, frequency and temperature sweeps of kaladhi cheese

the nutritional profiles, the product contained moisture: 36.71%, fat: 33.33%, protein: 24.11% and ash: 2.22%. The pH, titratable acidity and water activity of the product were 5.38, 0.63% and 0.95, respectively. The respective values of lightness, redness and yellowness of the product were 66.88, 0.63 and 14.99. Hardness (N/cm²), springiness (cm), cohesiveness (ratio), gumminess (N/cm²) and chewiness (N/cm

values of the products were 12.70, 0.82, 0.36, 4.65 and 3.78, respectively. Rheological evaluation of the product showed an increase in the dynamic moduli with increasing frequency. However, an increase in temperature gradually decreased the dynamic moduli. Organoleptic evaluation of the product exhibited that the product was appreciated by the panellist and received various sensory scores ranging from 7.57 to 8.27.

4.4.7 Project Title: Bioactivities and health values of goat cheese peptides and goat milk oligosaccharides (Funded by Institute Corpus Fund)

Principal Investigator

Dr. Arun Kumar Verma

Co-Principal Investigators

**Dr. V. Rajkumar, Dr. Tarun Pal Singh, Dr. K. Gururaj,
Dr. Atul Prakash and Dr. B. Anukumar**

Isolation of goat milk oligosaccharides and its profiling

In this work, we isolated the goat milk oligosaccharides (GMOS) from Barbari and Jakhrana goats of similar parity and lactation length. This was followed by the profiling of isolated oligosaccharide samples using LC-MS. For the isolation of GMOS, first, the fat was removed from milk samples through refrigerated centrifugation. This was followed by treatment of fat-free samples with chloroform: methanol (2:1) to get the protein-free extract after centrifugation. The fat and protein-free extract was further treated with pure ethanol and incubated overnight under refrigeration. This was followed by centrifugation to separate the remaining protein fraction. The obtained crude oligosaccharide extract was concentrated using a rotary evaporator and lyophilised. The lyophilised OS sample was rehydrated using HPLC water and passed through a C8 solid phase extraction (SPE) column to remove peptides. The peptide-free extract was passed through non-porous graphitised carbon SPE to remove salt and get neutral and acidic oligosaccharides. The obtained neutral and acidic OS samples were lyophilised and then rehydrated using HPLC water and stored for further analysis. The profiling of the isolated OS samples using LC-MS revealed the presence of 12 components in Barbari samples, while 8 components in Jakhrana samples. 3'-N-glycolyl-neuraminylactose/6'-N-glycolyl-neuraminylactose (20%), 3'-Sialyllactose/6'-Sialyllactose (18.03%), Isoglobotriose/?3'-Galactosyllactose/?4'-Galactosyllactose/?6'-Galactosyll



Fig. 1: Key stages involved in the isolation of goat milk oligosaccharides

actose (12.06%), Tetragalactosyllactose a/ Tetragalactosyllactose b (9.99%) and Asialo-GM1/ Iso-Lacto-N-neo-tetraose/Lacto-N-neo-tetraose/Lacto-N-novo-tetrasyllactose/Lacto-N-tetraose (7.91%) were found to be the major components in Barbari milk samples. 3'-Sialyllactose/6'-Sialyllactose (70.78%), 3'-N-glycolyl-neuraminylactose/ 6'-N-glycolyl-neuraminylactose (22.97%), Isoglobotriose/β3'-Galactosyllactose/β4'-Galactosyllactose/ β6'-Galactosyllactose (3.19%) and Tetragalactosyllactose a/Tetragalactosyllactose b (1.48%) were found to be the major components in the Jakhrana samples.



Table 1: Identified components in Barbari goat milk extract

S. No.	Probable component	Formula	Identifications	m/z	%
1	Tetragalactosyllactose a	C24H42O21	2	667.2292	9.99
	Tetragalactosyllactose b				
2	2'-Fucosyllactose	C18H32O15	2	489.1818	2.30
	3-Fucosyllactose				
3	Asialo-GM2	C20H35NO16	4	546.202	2.78
	Iso-Lacto-N-triose II				
	Lacto-N-Triaose II				
	N-acetyl-galactosaminyllactose				
4	3'-Sialyllactose	C23H39NO19	2	634.2185	18.36
	6'-Sialyllactose				
5	Isoglobotriose	C18H32O16	4	505.1762	12.28
	?3'-Galactosyllactose				
	?4'-Galactosyllactose				
	?6'-Galactosyllactose				
6	3'-N-glycolyl-neuraminyllactose	C23H39NO20	2	650.2134	21.54
	6'-N-glycolyl-neuraminyllactose				
7	Asialo-GM1	C26H45NO21	5	708.2546	8.20
	Iso-Lacto-N-neo-tetraose				
	Lacto-N-neo-tetraose				
	Lacto-N-novo-tetrasyllactose				
8	3'-N-acetyl-neuraminyl-3'-galactosyllactose	C29H49NO24	3	796.2723	0.27
	3'-N-acetyl-neuraminyl-6'-galactosyllactose				
	6'-N-acetyl-neuraminyl-3'-galactosyllactose				
9	Galactosyl-Lacto-N-neo-tetraose a	C32H55NO26	3	870.308	0.009
	Galactosyl-Lacto-N-neo-tetraose b				
	Lacto-N-novo-pentasyllactose I				
10	N-acetyl-lacto-N-neo-hexaose	C42H71N3O31	1	1114.415	3.58
11	Lacto-N-hexaose	C40H68N2O31	4	1073.387	20.04
	Lacto-N-neo-hexaose				
	Para-lacto-N-hexaose				
	Para-lacto-N-neo-hexaose				
12	3'-Sialyllacto-N-neohexaose I	C51H85N3O39	7	1364.489	0.02
	3'-Sialyllacto-N-neohexaose II				
	6'-Sialyllacto-N-neohexaose I				
	6'-Sialyllacto-N-neohexaose II				
	Sialyllacto-N-hexaose I				
	Sialyllacto-N-hexaose II				
	Sialyl-para-lacto-N-neohexaose				
13	3'-Glycolyl-neuraminyl-lacto-N-neo-hexaose I	C51H85N3O40	4	1380.479	0.103
	3'-Glycolyl-neuraminyl-lacto-N-neo-hexaose II				
	6'-Glycolyl-neuraminyl-lacto-N-neo-hexaose I				
	6'-Glycolyl-neuraminyl-lacto-N-neo-hexaose II				

Table 2: Identified components in Jakhrana goat milk extract

S. No.	Probable component	Formula	Identifications	m/z	%
1	Tetragalactosyllactose a	C24H42O21	2	667.2	1.48
	Tetragalactosyllactose b				
2	Asialo-GM2	C20H35NO16	4	546.2	0.16
	Iso-Lacto-N-triose II				
	Lacto-N-Triose II				
	N-acetyl-galactosaminyllactose				
3	3'-Sialyllactose	C23H39NO19	2	634.2	70.88
	6?-Sialyllactose				
4	Isoglobotriose	C18H32O16	4	505.2	3.19
	β3'-Galactosyllactose				
	β4'-Galactosyllactose				
	β6'-Galactosyllactose				
5	3'-N-glycolyl-neuraminyllactose	C23H39NO20	2	650.2	23.57
	6'-N-glycolyl-neuraminyllactose				
6	Asialo-GM1	C26H45NO21	5	708.3	0.06
	Iso-Lacto-N-neo-tetraose				
	Lacto-N-neo-tetraose				
	Lacto-N-novo-tetrasyllactose				
7	3'-N-acetyl-neuraminyl-3'-galactosyllactose	C29H49NO24	3	796.3	0.06
	3'-N-acetyl-neuraminyl-6'-galactosyllactose				
	6'-N-acetyl-neuraminyl-3'-galactosyllactose				
8	3'-N-glycolyl-neuraminyl-3'-galactosyllactose	C29H49NO25	2	812.3	0.60
	6'-N-glycolyl-neuraminyl-3'-galactosyllactose				

4.4.8 Project Title: Development of goat milk-based designer cosmetics (Funded by Institute)

Principal Investigator Dr. Tarun Pal Singh

Co- Principal Investigators Dr. Arun Kumar Verma, Dr. V. Rajkumar, Dr. Manish K. Chatli, Dr. Shiva Pratap Singh and Dr. Ashok Kumar

Development and evaluation of different quality attributes of goat milk-based bathing bar

Three formulations of goat milk-based bathing bars (X, Y, and Z) were prepared and standardized using different oil combinations and additives. The bathing bars were evaluated during storage. Among the bathing bar formulations, Treatment X demonstrated superior physicochemical stability throughout the storage period. Although all treatments showed gradual declines in moisture, pH, foam height, and water activity during storage, Treatment X consistently maintained lower free fatty acid levels and lower water activity, indicating improved oxidative and microbial stability. Treatments Y and Z exhibited comparatively better pH and colour retention but

showed greater physicochemical changes over time. Texture profile analysis revealed a significant increase in hardness of Treatment X during storage, indicating improved firmness and structural integrity, whereas Treatments Y and Z remained softer. Colour analysis showed a reduction in lightness (L^*) and increases in redness (a^*) and yellowness (b^*) across all treatments, with more pronounced colour changes observed in Treatment Z. Overall, Treatment X exhibited superior mechanical strength and colour stability. All bathing bar formulations displayed comparable antioxidant activity in the DPPH assay, with no significant differences among treatments. FT-IR spectra confirmed successful saponification in Treatments X and Z through strong carboxylate absorption peaks

around 1560 and 1410 cm^{-1} and negligible ester carbonyl peaks near 1740 cm^{-1} . In contrast, Treatment Y showed a strong ester carbonyl peak, indicating the presence of unreacted triglycerides and incomplete saponification. The oil mixture provided a balanced composition of medium-chain and polyunsaturated fatty acids. Among the tested oils, tea tree oil (TTO) exhibited the strongest antimicrobial activity against *Staphylococcus epidermidis*, *Staphylococcus aureus*, and *Candida albicans*, with inhibition zones increasing significantly. The combination of oils showed synergistic antimicrobial effects, particularly against *Staphylococcus aureus* with an inhibition zone of 18.07 mm. Soap solutions

demonstrated concentration-dependent antimicrobial activity. The 10% soap solution showed the highest inhibition against *Candida albicans* (17.47 mm), followed by *Staphylococcus aureus* (10.07 mm) and *Staphylococcus epidermidis* (7.57 mm), indicating broad-spectrum antimicrobial potential, particularly against fungal pathogens. Cell culture studies demonstrated that goat milk supplementation at lower concentrations (0.1% and 0.01%) promoted dermal fibroblast cell growth and viability, while higher concentrations (1–10%) reduced live cell counts, indicating that lower levels of goat milk are more suitable for maintaining cellular compatibility.

Table 1 : Physicochemical properties of different variants of goat milk-based bathing bar (Mean $\pm$ S.D.)*

Treatments	Day 0	Day 30	Day 60	Day 90
Moisture (%)				
X	10.61 $\pm$ 1.40 ^{cA}	9.69 $\pm$ 1.06 ^{bcA}	9.02 $\pm$ 0.42 ^{bA}	7.67 $\pm$ 0.58 ^{aA}
Y	12.97 $\pm$ 1.81 ^{bb}	11.91 $\pm$ 0.61 ^{bb}	11.73 $\pm$ 0.83 ^{bb}	9.35 $\pm$ 0.26 ^{ab}
Z	13.87 $\pm$ 0.77 ^{db}	12.88 $\pm$ 0.29 ^{cC}	11.11 $\pm$ 0.34 ^{bb}	8.80 $\pm$ 0.71 ^{ab}
pH				
X	10.60 $\pm$ 0.21 ^{db}	10.19 $\pm$ 0.11 ^{cC}	9.03 $\pm$ 0.04 ^{bb}	8.76 $\pm$ 0.05 ^{ab}
Y	10.13 $\pm$ 0.22 ^{db}	9.41 $\pm$ 0.06 ^{cA}	8.76 $\pm$ 0.05 ^{bA}	8.47 $\pm$ 0.04 ^{aA}
Z	9.97 $\pm$ 0.16 ^{dA}	9.65 $\pm$ 0.15 ^{cB}	8.73 $\pm$ 0.04 ^{bA}	8.55 $\pm$ 0.07 ^{aA}
Foam Height (cm)				
X	14.28 $\pm$ 0.63 ^{cA}	13.14 $\pm$ 0.34 ^{bA}	12.06 $\pm$ 0.63 ^{aA}	11.47 $\pm$ 0.23 ^{ab}
Y	13.50 $\pm$ 0.44 ^{cA}	12.47 $\pm$ 0.70 ^{bA}	11.72 $\pm$ 0.62 ^{abA}	11.12 $\pm$ 0.33 ^{aAB}
Z	13.90 $\pm$ 0.10 ^{dA}	12.59 $\pm$ 0.13 ^{cA}	11.82 $\pm$ 0.14 ^{bA}	10.82 $\pm$ 0.10 ^{aA}
Water activity (³ w)				
X	0.705 $\pm$ 0.010 ^{bb}	0.693 $\pm$ 0.010 ^{bA}	0.677 $\pm$ 0.009 ^{aA}	0.668 $\pm$ 0.015 ^{aA}
Y	0.700 $\pm$ 0.021 ^{aAB}	0.700 $\pm$ 0.029 ^{aA}	0.688 $\pm$ 0.023 ^{aA}	0.701 $\pm$ 0.014 ^{ab}
Z	0.683 $\pm$ 0.018 ^{aA}	0.688 $\pm$ 0.019 ^{aA}	0.680 $\pm$ 0.013 ^{aA}	0.675 $\pm$ 0.013 ^{aA}
Free fatty acids				
X	0.97 $\pm$ 0.11 ^{aA}	1.41 $\pm$ 0.14 ^{bA}	2.26 $\pm$ 0.14 ^{cA}	2.35 $\pm$ 0.21 ^{cA}
Y	1.37 $\pm$ 0.36 ^{aAB}	1.65 $\pm$ 0.22 ^{aAB}	2.26 $\pm$ 0.14 ^{bA}	2.45 $\pm$ 0.16 ^{bA}
Z	1.55 $\pm$ 0.15 ^{ab}	2.03 $\pm$ 0.21 ^{bb}	2.35 $\pm$ 0.21 ^{bcA}	2.45 $\pm$ 0.21 ^{cA}

*Mean values with in a rows and columns with different superscript letters are significantly different ($p < 0.05$).

Development and evaluation of different quality attributes of goat milk-based hand wash

Different formulations of goat milk-based hand wash (HW-1, HW-2, HW-3 and HW-4) were successfully formulated, standardized, and evaluated for their physicochemical, rheological, microbiological, and cellular characteristics during storage study. All formulations were packed in amber-coloured PET round bottles and stored at 27°C to assess their stability and quality over time. The rheological analysis demonstrated

that all samples exhibited a well-defined linear viscoelastic region (LVR) at low strain values, where the storage modulus (G') remained nearly constant, indicating structural stability under mild deformation. However, the extent of the LVR varied among formulations, suggesting differences in internal structural organization. Beyond the LVR, all formulations showed a gradual decrease in G' , indicating progressive breakdown of the internal network structure with increasing strain. Frequency sweep analysis

Table 2 : Fatty acid profile of oils. (Mean±S.D.)*

Fatty acids as percentage of total fatty acids	CO	CS	OO	PO	OM
C6:0, Hexanoic acid (Caproic acid)	0.32±0.03 ^a	-	-	-	-
C8:0, Octanoic acid (Caprylic acid)	5.51±0.40 ^c	-	-	-	1.41±0.10 ^b
C10:0, Decanoic acid (Capric acid)	4.69±0.13 ^c	-	-	-	1.22±0.08 ^b
C12:0, Dodecanoic acid (Lauric acid)	47.42±0.74 ^d	2.25±0.78 ^b	-	0.32±0.08 ^a	12.10±0.20 ^c
C14:0, Tetradecanoic acid (Myristic acid)	21.85±0.42 ^c	2.47±0.36 ^c	0.55±0.06 ^a	1.11±0.21 ^b	6.02±0.09 ^d
C16:0, Hexadecanoic acid (Palmitic acid)	9.26±0.22 ^b	12.41±0.41 ^c	7.03±0.27 ^a	40.76±0.89 ^e	18.72±0.36 ^d
C16:1, 9-cis-Hexadecenoic acid (Palmitoleic acid)	-	-	-	0.13±0.03 ^a	-
C18:0, Octadecanoic acid (Stearic acid)	2.75±0.18 ^a	11.61±0.29 ^d	2.69±0.08 ^a	4.02±0.08 ^c	3.26±0.08 ^b
C18:1 (cis 9) (Oleic acid)	6.59±0.27 ^a	25.47±0.14 ^b	31.10±0.18 ^d	42.26±1.38 ^c	28.97±0.79 ^c
C18:2 (cis 9,12), (Linoleic acid, n-6)	1.61±0.13 ^a	39.60±0.14 ^b	44.22±0.50 ^c	10.68±0.18 ^b	22.47±0.33 ^c
C18:3 (cis 9,12,15) (α-Linolenic acid, n-3)	-	4.05±0.32 ^d	2.06±0.18 ^c	0.20±0.04 ^a	0.88±0.01 ^b
C18:3, (cis 6, 9, 12) (γ-Linolenic acid, n-6)	-	-	0.42±0.04 ^b	-	-
C20:0, n-eicosanoic acid, (Arachidic acid)	-	-	0.56±0.005 ^d	0.35±0.04 ^c	0.28±0.01 ^b
C20:1, Eicosenoic acid	-	2.14±0.28 ^d	1.68±0.03 ^c	0.18±0.06 ^a	0.76±0.02 ^b
C22:0, Docosanoic acid (Behenic acid)	-	-	0.57±0.01 ^c	-	0.26±0.02 ^b
C22:1, Cis-13-docosenoic acid (Erucic acid, n-9)	-	-	8.71±0.11 ^c	-	3.65±0.09 ^b
C24:1, Nervonic acid	-	-	0.39±0.02 ^b	-	-

*Mean values with in a rows with different superscript letters are significantly different (p<0.05).



revealed that all samples possessed time-dependent viscoelastic behaviour, with improved mechanical strength and elasticity at higher frequencies. Temperature sweep analysis further indicated that both storage modulus and loss modulus decreased significantly with increasing temperature, reflecting weakening of the elastic network and thermal sensitivity of the formulations. FTIR analysis carried out at day 0 showed highly similar spectra among all four formulations, confirming the compatibility and stability of ingredients used in the hand wash. No major incompatibility or undesirable chemical interactions were observed, indicating successful formulation development. Fatty acid profiling revealed variations in the distribution of saturated and unsaturated fatty acids among the formulations. HW-1 contained the highest proportion of saturated fatty acids, whereas HW-2 exhibited maximum oleic acid content. HW-3 showed the highest polyunsaturated fatty acid (PUFA) level, while HW-4 displayed a comparatively balanced fatty acid profile with appreciable n-3 fatty acid content, indicating superior nutritional and functional properties. Storage studies demonstrated only minor changes in moisture content across all formulations during

the period, indicating good product stability. The pH values exhibited formulation- and storage-dependent variations, with HW-1 and HW-4 maintaining mildly acidic pH values ranging from 5.48 to 5.99 throughout storage, which is considered suitable for skin application. Foam stability analysis revealed a general decline in foam height over time in most formulations; however, HW-4 maintained comparatively stable foam production during storage. Similarly, viscosity values decreased progressively in all formulations over time, indicating gradual structural changes during storage. Colour analysis revealed that HW-4 showed the greatest increase in lightness during storage. Redness values decreased in all treatments over time, while yellowness generally increased across formulations. Microbiological analysis confirmed that all developed hand wash formulations were microbiologically safe, with standard plate counts and coliform counts remaining within permissible limits and no pathogenic organisms detected. Cellular studies using dermal fibroblast cells indicated that control cells maintained normal morphology and proliferation. However, cells treated with higher concentrations of hand wash showed altered

Table 3 : Physicochemical properties of different variants of goat milk-based hand wash (Mean±S.D.)*

Treatments	Day 0	Day 30	Day 60	Day 90
Moisture (%)				
HW-1	84.02±0.02 ^{aC}	83.97±0.72 ^{aB}	83.25±0.18 ^{aA}	83.42±0.30 ^{aBC}
HW-2	82.35±0.04 ^{aA}	82.76±0.21 ^{abA}	83.16±0.65 ^{bA}	82.21±0.42 ^{aA}
HW-3	83.38±0.36 ^{aB}	83.27±0.16 ^{aAB}	83.22±0.11 ^{aA}	83.61±0.20 ^{aC}
HW-4	83.02±0.19 ^{abB}	83.62±0.23 ^{bB}	83.65±0.16 ^{bA}	82.44±0.95 ^{aAB}
pH				
HW-1	5.64±0.04 ^{abB}	5.60±0.02 ^{aA}	5.62±0.03 ^{abA}	5.67±0.02 ^{bA}
HW-2	5.78±0.01 ^{aC}	7.06±0.04 ^{bC}	7.26±0.04 ^{cC}	7.40±0.02 ^{dC}
HW-3	5.83±0.02 ^{aC}	7.14±0.02 ^{bD}	7.31±0.02 ^{cC}	7.39±0.03 ^{dC}
HW-4	5.48±0.03 ^{aA}	5.85±0.03 ^{cB}	5.73±0.04 ^{bB}	5.99±0.04 ^{dB}
Foam Height (cm)				
HW-1	20.50±0.50 ^{bB}	19.00±1.00 ^{aB}	19.50±0.50 ^{abC}	19.17±0.29 ^{aC}
HW-2	17.00±1.00 ^{aA}	16.00±1.00 ^{aA}	16.67±0.29 ^{aA}	16.00±0.50 ^{aA}
HW-3	20.00±1.00 ^{bB}	18.67±0.58 ^{aB}	18.17±0.29 ^{aB}	17.63±0.32 ^{aB}
HW-4	19.00±1.00 ^{aB}	19.50±0.50 ^{aB}	18.60±0.36 ^{aB}	18.17±0.76 ^{aB}
Viscosity (m.Pa.s)				
HW-1	4800.33±48.35 ^{aA}	4656.67±40.00 ^{bA}	4535.00±32.08 ^{aA}	4590.33±36.77 ^{abA}
HW-2	9870.00±43.59 ^{bD}	9770.33±199.23 ^{bB}	9069.00±25.12 ^{aC}	8894.00±30.81 ^{aB}
HW-3	9751.33±69.67 ^{bC}	9637.33±42.06 ^{bB}	8826.00±130.55 ^{abB}	8857.67±31.66 ^{aB}
HW-4	5069.67±25.42 ^{bB}	4932.00±360.60 ^{abA}	4607.00±88.07 ^{aA}	4650.00±156.12 ^{aA}

*Mean values with in a rows and columns with different superscript letters are significantly different (p<0.05).

Table 4 : Fatty acid profile of goat milk-based hand wash (Mean±S.D.)*

Fatty acids as percentage of total fatty acids	HW-1	HW-2	HW-3	HW-4
C4:0	33.19±0.46 ^c	12.96±1.72 ^a	26.28±2.04 ^b	23.86±1.95 ^b
C10:0	4.85±0.28 ^b	3.73±0.14 ^a	7.73±0.51 ^c	5.23±0.75 ^b
C12:0	14.66±0.34 ^d	8.16±0.08 ^a	13.75±0.18 ^c	13.26±0.34 ^b
C14:0	6.80±0.48 ^{ab}	8.95±0.27 ^c	6.47±0.37 ^a	7.37±0.34 ^b
C15:1	4.78±0.30 ^c	1.67±0.04 ^a	3.64±0.25 ^b	3.56±0.29 ^b
C16:0	3.45±0.26 ^a	22.27±0.24 ^d	5.79±0.38 ^b	8.23±0.35 ^c
C17:0	10.05±0.17 ^c	3.79±0.22 ^a	8.75±0.23 ^b	8.48±0.21 ^b
C18:0	3.69±0.51 ^a	9.30±0.31 ^c	4.97±0.87 ^b	5.65±0.25 ^b
C18:1	-	20.62±0.38 ^d	2.75±0.03 ^b	5.90±0.66 ^c
C18:2	3.73±0.59 ^b	-	3.26±0.33 ^b	3.03±0.40 ^b
C18:2	-	2.01±0.19 ^b	-	-
C18:3	3.56±0.12 ^b	1.94±0.02 ^a	5.15±0.44 ^c	4.49±0.64 ^c
C20:2	1.69±0.14 ^b	-	2.56±0.39 ^c	1.81±0.38 ^b
C20:3	5.61±0.10 ^b	2.37±0.37 ^a	5.07±0.22 ^b	5.33±0.87 ^b
C20:4	2.05±0.19 ^b	0.86±0.06 ^a	2.02±0.50 ^b	2.21±0.25 ^b
C21:0	-	0.66±0.09 ^b	-	-
C24:1	1.89±0.12 ^b	0.72±0.13 ^a	1.82±0.39 ^b	1.59±0.21 ^b
SFA	76.68±0.19 ^c	69.81±0.84 ^a	73.74±1.04 ^b	72.08±1.19 ^b
MUFA	6.67±0.23 ^a	23.01±0.38 ^d	8.21±0.45 ^b	11.05±0.52 ^c
PUFA	12.91±0.34 ^b	7.18±0.47 ^a	14.80±1.06 ^c	13.83±0.42 ^b

*Mean values with in a rows with different superscript letters are significantly different (p<0.05).

morphology, reduced density, cellular rounding, and debris formation, suggesting reduced cell viability. Lower concentrations (0.065–0.5%) supported gradual cell attachment and proliferation with maintenance of normal spindle-shaped morphology, whereas the highest concentration (1.0%) caused poor attachment and

minimal proliferation. Furthermore, higher hand wash concentrations induced oxidative stress, altered fibroblast marker expression, and activated antioxidant and apoptosis-related genes, indicating concentration-dependent cellular effects.

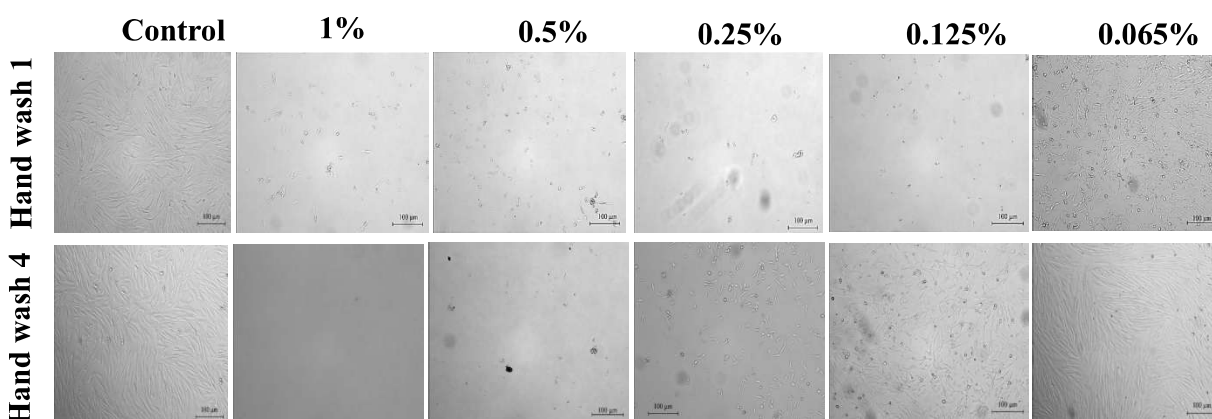


Fig. 1 : Representative images of the hand wash experiment. The cultured fibroblast cells were exposed to different concentrations of hand wash 1 and 4 added into the DPBS. The cells were washed and cells were grown for 48 h in culture media

4.4.9 Project Title: Production, characterization and evaluation of anti-aging collagen hydrolysate from goat skin (Funded by Institute Corpus Fund)

Principal Investigator

Dr. Tarun Pal Singh

Co-Principal Investigators

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Chemical composition of goat skin

Four types of fresh skin samples were collected from slaughter house. It was washed with running water until clean, removing all dirt and blood from the skin. All the skin coded i.e. Sirohi goat skin (S), Sheep skin (SH), Bleck Bengal goat skin (BB) & Barbari goat skin (BG). SH sample exhibited the highest moisture content (81.64%) and ash content (0.89%), followed by S sample. Fat content was generally low across all samples, with values below 1%. BG (26.24%) and BB (26.19%) samples containing significantly higher protein levels. Palmitic acid (C16:0) and stearic acid (C18:0) were the major long-chain SFAs identified. Sample S contained the highest proportion of C16:0 (22.13%), whereas SH sample showed the highest C18:0 content (12.01%). Total saturated fatty acids were significantly different ($p < 0.05$) among samples, decreasing in the order BG > SH > BB > S. Oleic

acid (C18:1) was the predominant MUFA in all samples, contributing substantially to total MUFA content. SH sample exhibited the highest PUFA content (16.79%), In contrast, S sample had the lowest PUFA proportion (4.62%). BB sample showed the highest levels of key essential amino acids, particularly leucine, methionine, and lysine, indicating superior protein quality. SH sample also exhibited improved amino acid content compared to S, especially for isoleucine and phenylalanine. BG sample was characterized by significantly higher glycine content, suggesting a collagen-rich protein profile. Non-essential amino acids like alanine, arginine, and glutamic acid were generally higher in BB, while BG showed lower values for most except glycine. Overall, BB sample is nutritionally superior for protein, whereas BG sample is more suitable for collagen-based functional applications.

Table 1 : Amino acid profile of different goat skins (Mean $\pm$ SD)*

	S	SH	BB	BG
Essential amino acids (g/100g of protein)				
Isoleucine	0.56 $\pm$ 0.02 ^a	0.91 $\pm$ 0.05 ^b	0.94 $\pm$ 0.15 ^b	0.66 $\pm$ 0.04 ^a
Leucine	2.01 $\pm$ 0.58 ^a	3.29 $\pm$ 0.20 ^{bc}	3.87 $\pm$ 0.21 ^c	2.47 $\pm$ 0.95 ^{ab}
Methionine	1.27 $\pm$ 0.08 ^a	1.17 $\pm$ 0.06 ^a	2.05 $\pm$ 0.72 ^b	1.17 $\pm$ 0.13 ^a
Phenylalanine	1.20 $\pm$ 0.14 ^a	1.80 $\pm$ 0.06 ^c	1.57 $\pm$ 0.14 ^b	1.61 $\pm$ 0.06 ^{bc}
Threonine	1.05 $\pm$ 0.78 ^b	0.55 $\pm$ 0.06 ^{ab}	-	-
Lysine	2.82 $\pm$ 0.40 ^a	3.96 $\pm$ 0.40 ^b	5.00 $\pm$ 0.34 ^c	3.19 $\pm$ 0.38 ^a
2-Aminobutyric acid	2.65 $\pm$ 0.35 ^a	2.83 $\pm$ 0.74 ^a	2.37 $\pm$ 0.94 ^a	1.58 $\pm$ 0.44 ^a
Non-essential amino acids (g/100g of protein)				
Alanine	7.83 $\pm$ 0.18 ^b	8.11 $\pm$ 0.36 ^{bc}	8.70 $\pm$ 0.50 ^c	6.27 $\pm$ 0.48 ^a
Arginine	5.70 $\pm$ 0.37 ^b	5.91 $\pm$ 0.47 ^b	6.07 $\pm$ 0.21 ^b	4.42 $\pm$ 0.07 ^a
Aspartic acid	16.01 $\pm$ 0.31 ^c	12.98 $\pm$ 1.33 ^b	12.35 $\pm$ 0.54 ^b	8.39 $\pm$ 0.71 ^a
Glutamic acid	7.79 $\pm$ 0.22 ^b	7.77 $\pm$ 0.58 ^b	9.14 $\pm$ 0.50 ^c	4.77 $\pm$ 0.95 ^a
Serine	1.98 $\pm$ 0.15 ^a	2.39 $\pm$ 0.33 ^{ab}	2.82 $\pm$ 0.27 ^b	2.33 $\pm$ 0.16 ^a
Glycine	49.14 $\pm$ 0.39 ^b	48.34 $\pm$ 0.04 ^b	45.12 $\pm$ 1.51 ^a	63.15 $\pm$ 1.38 ^c

n = 3; *Mean values with in a row with different superscript letters are significantly different ($p < 0.05$).

Table 2 : Chemical composition of different goat skins (Mean $\pm$ SD)*

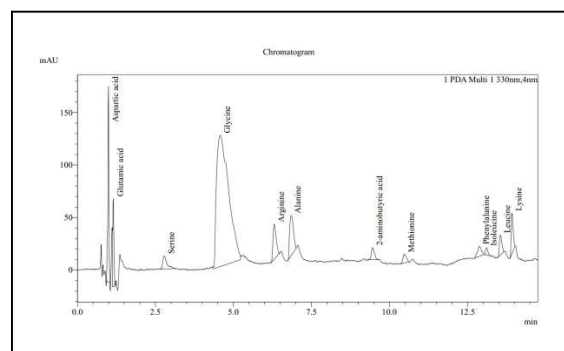
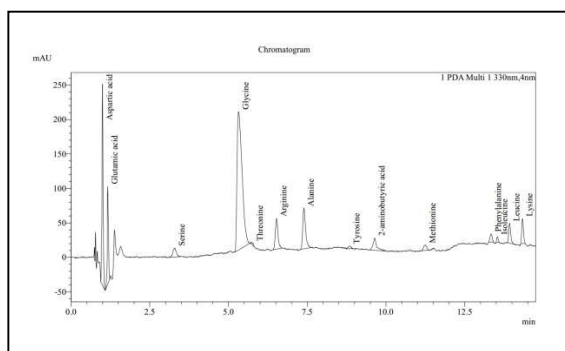
Chemical composition	BG	BB	S	SH
Moisture	72.71 $\pm$ 0.67 ^a	72.65 $\pm$ 0.20 ^a	77.28 $\pm$ 0.34 ^b	81.64 $\pm$ 0.17 ^c
Fat	0.57 $\pm$ 0.02 ^{cd}	0.54 $\pm$ 0.01 ^c	0.35 $\pm$ 0.01 ^a	0.39 $\pm$ 0.03 ^b
Protein	26.24 $\pm$ 0.67 ^c	26.19 $\pm$ 0.19 ^c	21.74 $\pm$ 0.36 ^b	17.06 $\pm$ 0.19 ^a
Ash	0.48 $\pm$ 0.01 ^a	0.61 $\pm$ 0.02 ^b	0.62 $\pm$ 0.02 ^b	0.89 $\pm$ 0.03 ^c

n = 6; *Mean values with in a row with different superscript letters are significantly different (p<0.05).

Table 3 : Fatty acid profile of different goat skins (Mean $\pm$ SD)*

Fatty acids as percentage of total fatty acids	BG	BB	S	SH
C4:0	39.80 $\pm$ 2.71 ^d	25.94 $\pm$ 1.72 ^b	12.32 $\pm$ 2.07 ^a	33.17 $\pm$ 2.90 ^c
C14:0	0.85 $\pm$ 0.18 ^b	1.10 $\pm$ 0.17 ^b	1.50 $\pm$ 0.16 ^c	0.53 $\pm$ 0.08 ^a
C15:0	0.91 $\pm$ 0.08 ^b	0.44 $\pm$ 0.16 ^a	0.38 $\pm$ 0.13 ^a	0.33 $\pm$ 0.02 ^a
C16:0	11.55 $\pm$ 1.22 ^b	15.47 $\pm$ 1.89 ^b	22.13 $\pm$ 0.20 ^c	10.51 $\pm$ 1.36 ^a
C16:1	1.33 $\pm$ 0.05 ^a	1.59 $\pm$ 0.19 ^{ab}	1.97 $\pm$ 0.20 ^b	1.41 $\pm$ 0.30 ^a
C17:0	0.81 $\pm$ 0.11 ^a	0.59 $\pm$ 0.09 ^a	0.46 $\pm$ 0.05 ^a	0.98 $\pm$ 0.53 ^a
C17:1	0.41 $\pm$ 0.05 ^a	0.54 $\pm$ 0.07 ^b	0.55 $\pm$ 0.04 ^b	0.35 $\pm$ 0.07 ^a
C18:0	8.42 $\pm$ 0.38 ^a	10.35 $\pm$ 0.66 ^{ab}	9.33 $\pm$ 0.89 ^b	12.01 $\pm$ 1.82 ^b
C18:1	23.26 $\pm$ 2.47 ^a	33.46 $\pm$ 4.26 ^b	46.38 $\pm$ 2.34 ^c	21.75 $\pm$ 2.04 ^a
C18:2	3.58 $\pm$ 0.42 ^b	3.78 $\pm$ 0.59 ^b	1.42 $\pm$ 0.17 ^a	6.00 $\pm$ 0.73 ^c
C18:3	0.37 $\pm$ 0.07 ^c	0.19 $\pm$ 0.02 ^b	0.23 $\pm$ 0.02 ^b	-
C20:0	0.50 $\pm$ 0.17 ^b	0.38 $\pm$ 0.08 ^b	-	0.58 $\pm$ 0.08 ^b
C20:1	0.42 $\pm$ 0.10 ^b	0.32 $\pm$ 0.10 ^b	-	0.62 $\pm$ 0.06 ^c
C20:2	1.94 $\pm$ 0.25 ^a	1.53 $\pm$ 0.49 ^a	1.43 $\pm$ 0.29 ^a	4.02 $\pm$ 0.34 ^b
C20:4(n-6)	4.34 $\pm$ 0.44 ^b	3.27 $\pm$ 0.95 ^b	1.36 $\pm$ 0.23 ^a	6.35 $\pm$ 0.89 ^c
C20:3 (n-6)	-	0.21 $\pm$ 0.06 ^b	-	0.42 $\pm$ 0.07 ^c
C20:5 (n-3)	0.52 $\pm$ 0.11 ^c	-	0.17 $\pm$ 0.06 ^b	-
C21:0	0.11 $\pm$ 0.10 ^b	0.20 $\pm$ 0.05 ^b	0.17 $\pm$ 0.03 ^b	-
C22:0	-	0.22 $\pm$ 0.08 ^b	-	0.27 $\pm$ 0.04 ^b
C22:6 (n-3)	0.30 $\pm$ 0.04 ^b	-	-	-
C24:0	0.57 $\pm$ 0.12 ^c	0.41 $\pm$ 0.09 ^{bc}	0.15 $\pm$ 0.07 ^a	0.37 $\pm$ 0.09 ^b
C24:1	-	-	-	0.31 $\pm$ 0.02 ^b
SFA	63.52 $\pm$ 1.42 ^d	55.11 $\pm$ 2.39 ^b	46.45 $\pm$ 1.67 ^a	58.75 $\pm$ 1.41 ^c
MUFA	25.43 $\pm$ 2.46 ^a	35.91 $\pm$ 4.34 ^b	48.90 $\pm$ 2.36 ^c	24.45 $\pm$ 1.79 ^a
PUFA	11.05 $\pm$ 1.31 ^b	8.99 $\pm$ 2.05 ^b	4.62 $\pm$ 0.74 ^a	16.79 $\pm$ 1.79 ^c

n = 3; *Mean values with in a row with different superscript letters are significantly different (p<0.05).



ICAR-CIRG Commercialized/Commercializable Technologies



Emulsion -based meat products



Retort processed goat meat products



Healthier goat meat products



Paneer



Nutrient rich Mozzarella cheese



Yoghurt



Biscuits



Ajas Soap



Fusion Beverages



Cheese whey beverage



Goat meat Snacks



Whey Wonders

4.5 Animal Health Division

4.5.1 Project Title: All India Network project on antimicrobial resistance (AINP-AMR) for fisheries and livestock, previously “Indian network for fisheries and animals antimicrobial resistance” (INFAAR) (Funded by ICAR, Fisheries Division)

Principal Investigator Dr. K. Gururaj

Co- Principal Investigators Dr. Anil Kumar Mishra, Dr. Ashok Kumar and Dr. Nitika Sharma

In the reporting period (2025), 288 samples were collected and processed according to the SOP. Four districts were targeted in the sampling plan: Agra (n=76), Mathura (n=51), Firozabad (n=51), and Etawah (n=110). Twenty-three villages from ten blocks across four districts in Uttar Pradesh were sampled. Bacteriological procedures were conducted according to SOPs for two specific microbial organisms in animal science (SMD): *Staphylococcus aureus* and *Escherichia coli*, for anti-microbial resistance studies. Additionally, the current year includes *Salmonella* species specifically for isolation from poultry cloacal swabs, following the SoP provided by the lead center. A total of 286 isolates were obtained: 198 *E. coli*, 80 *S. aureus*, 5 CONS, and 1 *Salmonella* spp. These were subjected to further AMR studies according to the SOP (Fig. 1).

Staphylococcus aureus and other *Staphylococcus* species isolated from biosamples and its AMR results

During the 2025–2026 surveillance period, 85 staphylococcal isolates (80 *S. aureus*; 5 *S. hemolyticus*) were recovered across four districts, with the highest prevalence in Etawah (n=46). Characterization followed INFAAR and CLSI guidelines, utilizing biochemical assays and molecular screening for *mecA* and *VanA/VanB* genes. Among *S. aureus* isolates, 81.25% were coagulase-positive, while significant resistance markers included MRSA (27.5%), beta-lactamase production (10%), and VRSA (3.75% in goat milk; MIC ≥ 16 $\mu\text{g/ml}$). The antimicrobial profile revealed high resistance to Penicillin (90%) and Cefoxitin (75%), contrasted by robust sensitivity

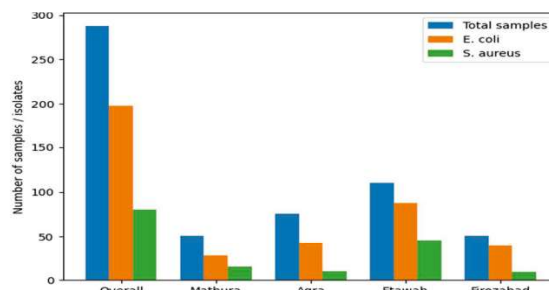


Fig.1. District-wise samples and Isolates taken for AMR study

to Gentamicin (87%) and SXT (83%).

Molecular validation via PCR confirmed *S. aureus* identity through 23S rRNA (894bp), *rdr* (130bp), and *nuc* (278bp) markers. Genotypic screening identified the *mecA* gene (162bp) in 11.25% (n=9) of isolates from goats, poultry, and swine, revealing a significant discrepancy compared to the 22 phenotypic MRSA cases. Additionally, 7.5% (n=6) of Mathura isolates carried vancomycin resistance genes, specifically

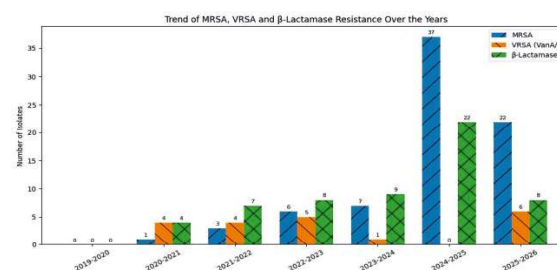


Fig.2. Proportion of phenotypic and genotypic resistance of *Staphylococcus* spp. during the reporting period (2024)

Table.1. AST profile of major resistance and susceptible antimicrobials for *Staphylococcus* spp. isolates from ruminant's milk and swine nasal isolates

Source	Penicillin (R)	Cefoxitin (R)	Primary Susceptibilities
Buffalo Milk	100%	75%	Linezolid/Chloramphenicol (95%)
Cow Milk	80%	67%	SXT (90%), Chloramphenicol (85%)
Goat Milk	85%	50%	Gentamicin (92%), Linezolid (85%)
Sheep Milk	88%	75%	Gentamicin (100%), SXT (88%)
Swine Nasal	100%	100%	SXT (87%), Gentamicin (80%)

the *VanB* gene (647bp) in all three phenotypic VRSA goat milk samples, despite negative confirmatory sequencing. The comparative trends of these AMR markers are illustrated in Figure 2.

***Escherichia coli* Isolation from Biosamples and Antimicrobial Resistance (AMR) Analysis**

In this study, 198 *E. coli* isolates were recovered from 288 diverse samples across Uttar Pradesh, with the highest prevalence in Etawah (n=88). Phenotypic screening revealed significant

enzymatic resistance, including AmpC-type β -lactamase (49.5%), ESBL (18.1%), and carbapenemase production (3.0%), validated via mCIM and Carba NP tests. The AST profile indicated high resistance to Cefotaxime (~56%) and Imipenem (~36%), whereas Tetracycline, Chloramphenicol, and SXT maintained peak efficacy. Notably, two pan-resistant clones from swine and poultry sources demonstrated resistance to all tested antibiotics except Cefoxitin.

Table.2. AST profile of major resistance and susceptible antimicrobials for *E.coli* isolates from milk samples, rectal and cloacal swabs from various livestock species

Source	Cefotaxime (R)	Imipenem (R)	Primary Susceptibilities
Cow Milk	54%	67%	TCY (95%), SXT (80%)
Buffalo Milk	70%	58%	TCY (95%), CHL (90%)
Pig Rectal Swabs	88%	—	Ceftazidime (95% R), SXT/CHL (70%)
Sheep Rectal	—	—	Ceftazidime (62% R), CHL (100%)
Poultry Cloacal	42%	—	Ceftazidime (42% R)

Molecular validation confirmed *E. coli* species identity through the amplification of *lacY* (289 bp) and *cydA* (389/398 bp) genes. Genotypic screening of 198 isolates revealed a significant burden of antimicrobial resistance genes (ARGs), dominated by the *AmpC* determinant (53.53%) and TEM (17.17%). Critical resistance markers also included CTX-MGP-1 (7.07%) and the high-risk carbapenemase gene NDM-1 (2.02%), alongside lower frequencies of SHV (1.51%), OXA (0.50%), and ACC (0.50%).

Surveillance of Antimicrobial Resistance in *Escherichia coli* from Water (2025–2026)

Targeted surveillance of poultry drinking water in Mathura (2025–2026) yielded *E. coli* in 100% (n=4) of samples, confirmed through characteristic growth on TBX, MacConkey, and EMB agars. Genotypic validation via *lacY* and *cydA* markers confirmed 50% (n=2) of these isolates, all of which exhibited a complete

absence of ESBL or ACBL phenotypes. Unlike livestock-derived strains, these waterborne isolates lacked high-level resistance patterns, precluding the need for a standalone resistance dataset for this subset.

Surveillance of Antimicrobial Resistance in *Salmonella* from Poultry (2025–2026)

Conversely, *Salmonella* recovery from poultry cloacal swabs remained low despite a rigorous multi-stage enrichment protocol using TTB, SC, and RV broths. Identification via H₂S-producing colonies on SS/XLD agar and PCR validation confirmed *S. Enteritidis* (n=2, *invA*) and *S. Typhimurium* (n=1, *spy*). While these isolates were ESBL-negative, they were phenotypically confirmed as ACBL producers and displayed concerning resistance to higher-tier carbapenems, despite maintaining sensitivity to traditional first-line penicillins.

Table.3. Antimicrobial profile of *Salmonella* isolates obtained from poultry cloacal swabs during 2025-26

Resistance Status	Antibiotics & Zone Diameters
Resistant (R)	Tetracycline (0 mm), Cefoxitin (12 mm), Imipenem (15 mm), Ceftazidime (16 mm)
Intermediate (I)	Cefotaxime (24 mm), Cefpodoxime (18 mm), Amikacin (15 mm), Co-trimoxazole (13 mm)
Susceptible (S)	Ceftriaxone (26 mm), Aztreonam (25 mm), Ampicillin (21 mm), Amoxicillin (18 mm)

Outreach programmes (organized under the AINP-AMR project)

ICAR-CIRG observed World Antimicrobial

Awareness Week (WAAW) from November 18–24, 2025, under the global theme: "Act Now: Protect Our Present, Secure Our Future"

Summary of Activities

Feature	Event 1: School Outreach	Event 2: Institutional Programme
Date	November 18, 2025	November 20, 2025
Venue	Upper Primary School, Jhudawai, Mathura	Dr. K.P. Pant Committee Room, ICAR-CIRG
Participants	School students	Students, Technicals (T-1s), Assistants, and YPs
Activities	Lecture, Drawing Competition, Rally and Pamphlet Distribution	AMR Awareness Lecture and Quiz Competition
Lead PI	Dr. K. Gururaj	Dr. K. Gururaj
Key Team	Dr. Gopal Das, Dr. Nisha Bisht, Sh. Shivkumar, Ms. Komal	Dr. Anil Kumar Mishra, Dr. Nitika Sharma, Dr. Nisha Bisht



4.5.2 Project Title: Development of epsilon toxin based novel vaccine against enterotoxaemia in goats: A bioinformatics assisted reverse vaccinology approach” under the 'Network project for Agricultural Bioinformatics and Computational Biology' of Centre for Agricultural Bioinformatics (CABin) Scheme (Funded by ICAR)

Principal Investigator Dr. K. Gururaj
Co- Principal Investigators Dr. Anil Kumar Mishra and Dr. Sunil Kumar (ICAR-IASRI)

Workflow for Multiepitope Vaccine (MEV) Design

Acquisition and Analysis of Toxin Sequences

The methodology begins with the in silico design of a multi-epitope vaccine (MEV) by extracting the complete coding DNA and protein sequences for three *C. perfringens* toxins (Toxin A, B and C) from the NCBI database. To minimize the risk of cross-reactivity, these sequences were screened via BLASTp against the caprine host proteome to ensure non-homology, and were subsequently analyzed for protective antigenicity using the Vaxijen server.

To build a comprehensive immune profile, B-cell,

CTL, and HTL epitopes were predicted using a multi-tool approach: structural B-cell epitopes were mapped via ElliPro using PDB or Phyre2-modeled structures, while linear epitopes were identified through BepiPred-2.0 and SVMTriP. For T-cell responses, ANN 4.0 forecasted MHC Class I (CTL) epitopes using bovine alleles as proxies, and NetMHCIIpan 4.0 predicted MHC Class II (HTL) epitopes by leveraging human HLA-DRB alleles as functional approximations for the caprine immune system. All candidate epitopes were strictly evaluated and filtered to ensure they were antigenic, non-allergenic, and non-toxic using specialized prediction tools like AllerTop, AllergenFP and ToxinPred.

Table1 : Final Selected Epitopes for Toxin A, B and C

Epitope Type	Start	End	Peptide/Epitope	Length	VaxiJen 2.0 server (threshold 0.5)	AllergenFP v.1.1 & Analysed via AllerTop v1.1	ToxinPred
MHC-I	1a	1b	Epitope 1	9	1.0308	NA*	NT**
MHC-II	2a	2b	Epitope 2	15	0.9296	NA*	NT**
MHC-II	3a	3b	Epitope 3	15	0.9516	NA*	NT**
MHC-II	4a	4b	Epitope 4	15	0.5386	NA*	NT**
B Cell	5a	5b	Epitope 5	23	1.0679	NA*	NT**
B Cell	6a	6b	Epitope 6	7	1.9942	NA*	NT**
B Cell	7a	7b	Epitope 7	20	0.6254	NA*	NT**
B Cell	8a	8b	Epitope 8	10	1.8738	NA*	NT**
B Cell	9a	9b	Epitope 9	9	1.5219	NA*	NT**

*NON-ALLERGEN; **NON-TOXIN

Construction of the Multiepitope Vaccine (MeV)
The carefully selected epitopes were linked together using specific amino acid spacers (spacer 1, 2 &3) designed to facilitate proper conformational folding, prevent steric hindrance, and preserve independent immunogenic activity. To enhance the overall immune response, a universal T-helper PADRE sequence was integrated as an adjuvant at the beginning of the construct.

Structural, Functional, and 3D Modeling Analysis
The vaccine candidate sequence underwent extensive physiochemical evaluation to determine properties such as molecular weight, theoretical isoelectric point (pI), stability, and solubility. The secondary structure was predicted using SOPMA, while its tertiary (3D) structure was built using the I-TASSER tool. This 3D model was subsequently refined and validated for stereochemical accuracy and structural stability

using GalaxyRefine, SAVESv6.1, and ProSA-web.

Molecular Docking with Immune Receptors To evaluate the vaccine's potential to successfully trigger a host immune response, *in silico* molecular docking was performed against two critical caprine receptors: Receptor X and Y.

- Docking with Receptor 'X' was used to assess the construct's ability to initiate innate immune signaling and inflammatory pathways.
- Docking with Receptor 'Y' (the principal host receptor for the Toxin 'A') evaluated how well vaccine-derived antibodies might competitively inhibit the Toxin A from binding to host tissues. Because experimental 3D structures for these caprine receptors were unavailable, we generated homology models for the docking simulations using the HawkDock server.

In-Silico Cloning and Codon Optimization To prepare the ET-MeV construct for real-world laboratory production, the protein sequence was reverse-translated into a DNA sequence. This sequence was then codon-optimized for maximal expression in the *Escherichia coli* (strain K12) host system using the JCAT tool. Finally, appropriate restriction enzyme sites and a polyhistidine tag (6×His tag) were added, allowing the construct to be *in silico* cloned into the standard expression vector.

Confirmation of clones with rpET28a with DNA insert for trivalent fusion protein

During the reporting period, a [X1] bp ultramer encoding a trivalent fusion protein of [Y1] interspaced by [L1], [L2], and [L3] linkers was constructed within a [V1] vector backbone for expression in the [S1] system. Recombinant clones were selected, and the plasmid containing the DNA insert for the trivalent fusion protein was extracted and confirmed. Expression of the [M1]

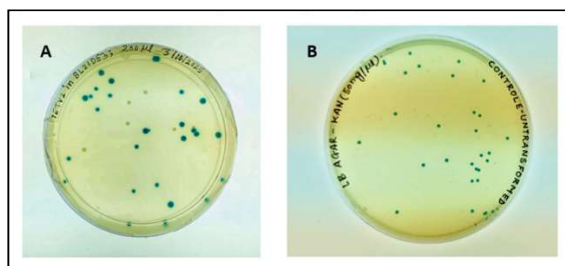


Fig.1: A. X1 Transformed in competent cells cultured on LB Agar Plate with Kanamycin, B. Control Untransformed Cells

kDa trivalent fusion protein was monitored using [A1] at different intervals post-induction, demonstrating successful protein production.

Molecular dynamics of the Multiepitope *Clostridium perfringens* vaccine candidate with A, B and C Toxins

Molecular dynamics of [P1] and [P2] complexes were simulated via [G1] using the [F1] force field and [W1] water model. Following solvation, ionic neutralization at [I1] M, and energy minimization (<1000 kJ/mol/nm), systems were equilibrated under [E1] and [E2] ensembles. Finally, [D1] ns production runs were analyzed for [A1], [A2], and [A3] to evaluate stability, flexibility, and compactness.

MD simulation for ET vaccine design

Interaction analysis of MAL-rETV and TLR4-rETV complex

The [P1] complex demonstrates superior interaction stability compared to [P2], characterized by a significantly higher density of hydrogen bonds. [P1] is stabilized by an extensive network of 12 primary residue pairings, including [R1], [R2], and [R3], whereas [P2] relies on fewer interactions such as [R4] and [R5]. While both complexes share minimal common sites—specifically [C1], [C2], and [C3]—and limited hydrophobic clusters around [H1], the overall binding affinity and structural robustness are markedly stronger in the [P1] system.

MD simulation of MAL-rETV and TLR4-rETV complex

[D1] ns MD simulations revealed that the [P1] complex achieves superior stability compared to [P2], with lower, more consistent RMSD values ([V1] nm vs. [V2] nm). RMSF analysis showed reduced flexibility in [P1], particularly within residue regions [Z1] and [Z2], where [P2] exhibited significant dynamic instability. While [P2] maintains a more compact structure ([G1] nm), [P1] exhibits an expanded conformation ([G2] nm) supported by a denser hydrogen bond network ([H1] vs. [H2]) and higher solvent accessibility ([S1] nm²). Ultimately, [P1] stability is driven by robust intermolecular interactions, whereas [P2] relies on compactness despite weaker binding.

Development of Goat Transcriptome Web Resource for Enterotoxaemia (GoaTWR-E)

During the reporting period, significant progress



Fig.2. Copyright certificate of GoaTWR-E database

was made on the Goat Transcriptome Web Resource for Enterotoxaemia (GoaTWR-E). The database can be accessed through <https://dslab.nbrc.res.in/goaTWR/>, and copyright has been obtained for GoaTWR-E© database: “Design and development of web-based software for Goat Transcriptome Web Resource on Enterotoxaemia (GoaTWR-E)” is registered with the Copyright Office, Government of India under Certificate No. SW-2025020553.

4.5.3 Project Title: Development of phage-based therapeutic against mastitis in goats with special reference to *Staphylococcus aureus* and *E. coli* mastitis (Funded by UPCST)

Principal Investigator

Dr. Anil Kumar Mishra

Co- Principal Investigators

Dr. Ashok Kumar (Retired on 31-08-25), Dr. K Gururaj and Dr. Nitika Sharma

Isolation of *S. aureus* and *E. coli* Bacteriophages

A total of 60 samples (sewage, feces, water, pus, and milk) were collected for the isolation of bacteriophages targeting *S. aureus* and *E. coli*. Among these, *S. aureus* phages were not detected in any of the samples (n=60), whereas 13 *E. coli* phages were isolated. Due to non-availability of *S. aureus* phages, four *S. aureus* bacteriophages

were procured from ICAR–National Research Centre on Equines, Hisar for further characterization and experimental studies. The image below illustrates the spot test, a preliminary screening method for detecting bacteriophage activity. The appearance of clear zones on the bacterial lawn signifies successful phage infection and subsequent bacterial lysis.



Fig. 1 : Clear zones on the bacterial lawn signifies bacteriophage activity



Fig. 2 : Clear circular plaques represent bacterial lysis caused by phage replication

Purification of *E. coli* Phages

E. coli bacteriophages (n=13) isolated from the samples were successfully purified using repeated parallel streaking and spot assay confirmation. The resulting purified phage stocks exhibited

consistent plaque morphology on subsequent plating, indicating removal of contaminating microorganisms and establishment of stable, clonal phage isolates suitable for downstream characterization.



Fig. 3 : Repeated parallel streaking for phage purification

Propagation of bacteriophages by liquid culture & soft agar wash method

All bacteriophage isolates were propagated in adequate quantity using conventional liquid culture method and soft agar wash method. The procedures resulted in consistent and stable phage lysates, confirming that all bacteriophages were

properly propagated in sufficient quantity.

Assessment of the Lytic Ranges of *E. coli* and *S. aureus* Bacteriophages

The spot assay test was employed to assess the lytic spectrum. Thirteen *E. coli* bacteriophage isolates (n=13) were evaluated against 154 *E. coli* bacterial isolates recovered from caprine milk, and their susceptibility patterns were recorded. Three *E. coli* phages (12, 13 & 4) demonstrated the broadest lytic activity and may therefore be considered the most promising candidates for further application-oriented studies. The detailed lytic ranges are presented below in the tabulated form:

Similarly, *S. aureus* specific bacteriophages were evaluated against 121 *S. aureus* bacterial isolates obtained from caprine milk. Comparative analysis revealed that only bacteriophage isolate number 1 produced biologically visible lysis, infecting 32 out of 121 isolates, which corresponds to a lytic activity of 26.44%. All other *S. aureus* bacteriophage isolates showed no detectable lytic activity (0% lysis) against the tested *S. aureus* isolates.

<i>E. coli</i> Phage Isolate	Lytic Range (%)	<i>E. coli</i> Phage Isolate	Lytic Range (%)
12	66.67 (88/154)	11	57.58 (76/154)
4	65.15 (86/154)	6	57.58 (76/154)
13	63.64 (84/154)	3	50.00 (66/154)
5	62.12 (82/154)	2	48.48 (64/154)
14	60.61 (80/154)	9	48.48 (64/154)
7	60.61 (80/154)	8	10.61 (14/154)
10	58.33 (77/154)	—	—

Multiplicity of Infection (MOI) of *S. aureus* and *E. coli* Phages

The multiplicity of infection (MOI) was calculated for selected bacteriophage–host combinations based on the ratio of total phage particles (PFU) to total bacterial cells (CFU)

present in the infection mixture. Overall, the calculated MOI values demonstrated variability among bacteriophage isolates and were used to select appropriate infection conditions for subsequent experiments. The details of the MOI calculations are provided below:

MOI Calculation (Total PFU ÷ Total CFU)			
Phage	Total CFU	Total PFU	MOI (Actual)
<i>S. aureus</i> phage	8.92×10^9	1.53×10^{10}	1.71
<i>E. coli</i> Phage 12	1.87×10^9	1.43×10^{10}	7.64
<i>E. coli</i> Phage 13	1.87×10^9	2.3×10^8	0.12
<i>E. coli</i> Phage 4	1.87×10^9	7.1×10^9	3.80

Efficiency of Plating (EOP) of Bacteriophages

The efficiency of plating (EOP) of the selected bacteriophages was determined by comparing the

phage titers obtained on the target host with those on the original propagation host. The details regarding EOP calculations are given below:

Table 1 : EOP calculation

Phage	Host (pfu/ml)	Target (pfu/ml)	EOP*	Efficiency
<i>S. aureus</i>	3.18×10^9	2.8×10^9	0.88	High
<i>E. coli</i> 12	1.56×10^9	1.21×10^9	0.78	High
<i>E. coli</i> 4	2.53×10^6	1.8×10^6	0.71	High
<i>E. coli</i> 13	1.73×10^6	1.25×10^6	0.72	High

*EOP = (phage titer on target host) ÷ (phage titer on original host)

Temperature Sensitivity of Bacteriophages

The temperature sensitivity of the selected bacteriophages was evaluated to assess their stability and lytic activity at different temperatures. Overall, the results indicate that the bacteriophages were thermally stable at

lower and moderate temperatures but became rapidly inactivated at higher temperatures, confirming their suitability for applications requiring stability under refrigeration and physiological temperature conditions. Further details are given in tabulated form:

Table 2 : Short-term (1 Hour) temperature exposure test

Temperature	<i>S. aureus</i>	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>
(°C)	Phage	Phage-12	Phage-4	Phage-13
4	Viable	Viable	Viable	Viable
25	Viable	Viable	Viable	Viable
37	Viable	Viable	Viable	Viable
45	Viable	Viable	Viable	Viable
55	Viable	Viable	Viable	Viable

Table 3 : Long-term temperature stability of *E. coli* & *S. aureus* bacteriophages

Temperature	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>	<i>S. aureus</i>
(°C)	Phage-12	Phage-4	Phage-13	Phages
4	Continue (>12 months)	Continue (>12 months)	Continue (>12 months)	Continue (>8months)
25	33 days	33 days	33 days	33 days
37	33 days	33 days	33 days	33 days
45	10 hours	10 hours	10 hours	12 hours
55	7 hours	7 hours	7 hours	7 hours
65	Inactivated within 15 mins	Inactivated within 15 mins	Inactivated within 15 mins	Inactivated within 15 mins
80	Inactivated within 15 mins	Inactivated within 15 mins	Inactivated within 15 mins	Inactivated within 15 mins

pH Stability of *S. aureus* and *E. coli* Bacteriophages

The pH stability of *S. aureus* and *E. coli* bacteriophages was evaluated using plaque assay and spot assay methods across a pH range of 3 to 12. Overall, the results demonstrate that both *S. aureus* and *E. coli* bacteriophages exhibit optimal

stability in the near-neutral pH range, with tolerance to mildly acidic and alkaline environments, while extreme pH conditions result in rapid inactivation. The detailed results are given below:

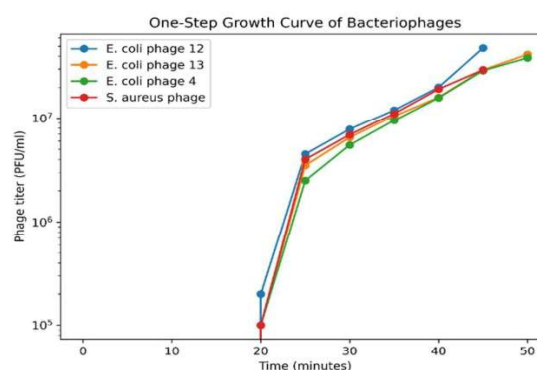
Table 4 : pH stability of phages by spot method

pH	Viability after 2 Hour	Viability Duration (Days)
3	Not Viable (No Spot)	0 days
4	Not Viable (No Spot)	0 days
5	Viable	9 days (Inactivation on Day 10)
6	Viable	31 days
7	Viable	29 days
8	Viable	29 days
9	Viable	29 days
10	Viable	29 days
11	Viable	9 days
12	Not Viable (No Spot)	0 days

One-step growth curve analysis of *S. aureus* and *E. coli* bacteriophages

The one-step growth curve analysis revealed distinct growth kinetics for both *S. aureus* and *E. coli* bacteriophages. All phages exhibited a latent period of approximately 20 minutes. Overall, the one-step growth curve demonstrated efficient phage replication characterized by short latent periods and high burst sizes. The observed differences in burst size and plateau phage titers among the phage isolates indicate variability in replication efficiency, with *E. coli* phage isolate 13 showing the highest burst size, while *S. aureus* phage exhibited stable and consistent growth characteristics. The detailed results are presented in form of table and graph below:

The growth kinetics of three *E. coli* phage isolates (12, 13, and 4) and one *S. aureus* phage isolate were determined via one-step growth curve analysis. The Y-axis represents the phage titer

**Fig. 4 :**

(pfu/ml) on a logarithmic scale, while the X-axis denotes time in minutes. All phages exhibited a synchronized latent period of 20 minutes. The subsequent rise period (20–50 min) shows a sharp increase in extracellular phage particles, leading to a plateau phase where the burst size was calculated.

Table 7 : Calculation of latent period & burst size

Phage	Latent Period	pfu/ml before Burst	pfu/ml at Plateau (≥ 45 min)	Estimated Burst Size
<i>E. coli</i> 12	20 min	2.0×10^5	4.8×10^7	240
<i>E. coli</i> 13	20 min	1.0×10^5	4.15×10^7	415
<i>E. coli</i> 4	20 min	1.0×10^5	3.85×10^7	385
<i>S. aureus</i>	20 min	1×10^5	2.95×10^7	295

4.5.4 Project Title: All India Network Programme on challenging and emerging diseases of animals (AINP-CEDA): goat and sheep mycoplasmosis (Funded by ICAR)

Principal Investigator

Dr. Anil Kumar Mishra

Co-Principal Investigators

Dr. Ashok Kumar (Retired on 31-08-25), Dr. K. Gururaj and

Dr. Nitika Sharma

Detection of *Mycoplasma* spp. in Biological Samples

A total of 696 biological samples (nasal swabs, preputial swabs, vaginal swabs, milk, eye swabs, lung tissues, tracheal lavages etc.) collected from goats and sheep were screened for the presence of *Mycoplasma* spp. using PCR. Out of these, 171 samples tested positive, indicating an overall positivity rate of 24.57%. Subsequent species-specific PCR assays revealed that *Mycoplasma capricolum* subsp. *capripneumoniae* was detected in 30 samples (4.31%), followed closely by *Mycoplasma capricolum* subsp. *capricolum* in 29 samples (4.17%). *Mycoplasma conjunctivae*, *Mycoplasma ovipneumoniae*, and *Mycoplasma arginini* were detected at lower frequencies, with positivity rates of 0.57% (4/696), 0.43% (3/696), and 0.29% (2/696), respectively. No samples were found positive for *Mycoplasma agalactiae*, *Mycoplasma mycoides* subsp. *capri*, or *Mycoplasma putrefaciens*. Overall, the findings indicate a considerable prevalence of *Mycoplasma* spp. in small ruminants, with *M. capricolum* subspecies being the most commonly detected pathogens among the tested samples.

Breed-wise analysis of *Mycoplasma* positivity revealed considerable variation among different goat and sheep breeds. The highest positivity was observed in Barbari goats, with 74.07% (20/27) of samples testing positive. This was followed by Muzaffarnagari sheep (47.62%; 20/42), Sojat goats (47.06%; 8/17), and Jamunapari goats (46.15%; 30/65), all showing relatively high infection rates.

When stratified by sex, males showed a slightly higher positivity rate of 38.50% (87/226), while females had a positivity rate of 36.02% (134/372). Overall, the findings indicate a moderate prevalence of mycoplasma infection in both sexes, with only minor variation between male and female animals.

Among the different age categories, kids exhibited a higher positivity rate of 43.20% (89/206), whereas adults showed a comparatively

lower positivity rate of 33.67% (132/392). These findings suggest that younger animals are more susceptible to mycoplasma infection compared to adults, indicating age as a potential risk factor in the studied population.

Differences in mycoplasmal infection were noted across the seasons. The highest positivity was recorded during the summer season at 39.29% (11/28), closely followed by the winter season with 39.04% (178/456). In contrast, the rainy season showed a comparatively lower positivity rate of 28.07% (32/114). These findings indicate that mycoplasma infections occur throughout the year, with relatively higher prevalence during the summer and winter seasons compared to the rainy season.

PCR analysis for *Mycoplasma* spp. across different sample types demonstrated the notable variations among sample sources. The highest positivity was observed in lung tissue samples at 70.18% (40/57), indicating a strong association of *Mycoplasma* infection with respiratory tissues. Nasal swabs also showed a relatively high positivity rate of 40.78% (104/255), followed by milk samples at 33.33% (2/6). In contrast, lower positivity rates were recorded in preputial swabs (28.04%, 30/107) and vaginal swabs (26.04%, 37/141), while eye swabs exhibited the lowest positivity at 25% (8/32). Overall, these findings suggest that *Mycoplasma* spp. is more frequently detected in respiratory-related samples, particularly lung tissue and nasal swabs, compared to other sample types.

When compared between species, sheep showed a higher positivity rate of 44.19% (57/129) than goats, which had a positivity rate of 34.97% (164/469). These findings suggest that sheep may be more susceptible to *Mycoplasma* infection than goats in the studied population.

Serosurveillance of mycoplasmosis in goats and sheep

Out of the 573 serum samples collected from goats and sheep across various geographical

locations, 54 samples exhibited positivity in the slide agglutination test employing a coloured antigen, confirming the presence of *Mycoplasma* antibodies. This corresponds to an overall seropositivity rate of 9.42% among the tested goat and sheep population. The detection of *Mycoplasma*-specific antibodies in 9.42% of serum samples indicates a moderate level of exposure to *Mycoplasma* infection among goat and sheep populations. The presence of antibodies suggests previous or ongoing infection, reflecting the circulation of *Mycoplasma* organisms within these herds.

Isolation of *Mycoplasma* spp. from biological samples

A total of 61 respiratory samples (lung tissue, tracheal lavage etc.) collected from goats were processed aseptically for the isolation of *Mycoplasma* species as per the standard protocol

procured from the lead centre (ICAR-IVRI). In addition, 15 vaginal swabs, 20 nasal swabs, 15 preputial swabs, and 11 ocular swabs collected from both sheep and goats were also aseptically processed for the isolation. A total of 12 samples exhibited the characteristic “fried-egg” colony morphology on PPLO agar, typical of *Mycoplasma* spp. observed under microscope. These presumptive isolates were further subjected to PCR using *Mycoplasma*-specific primers targeting the conserved regions of the 16S rRNA gene for molecular confirmation. The PCR results confirmed the presence of *Mycoplasma* DNA in these isolates, thereby establishing the occurrence of viable *Mycoplasma* organisms in goat respiratory tissues. Species-specific PCR further identified one sample positive for *Mycoplasma capricolum* subsp. *capricolum* and one for *Mycoplasma agalactiae*.

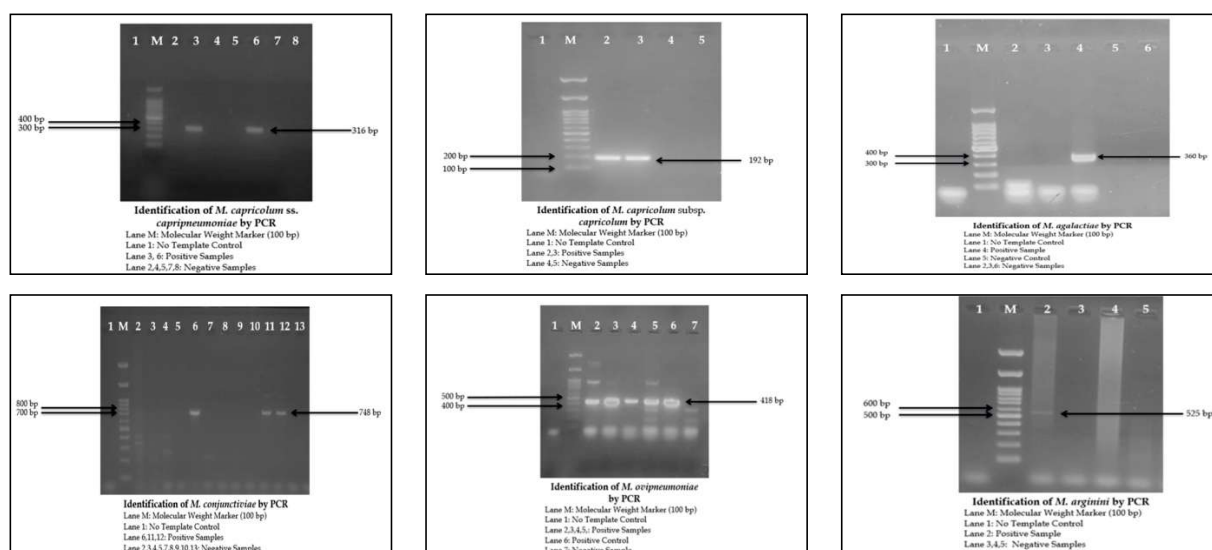


Fig 1 : Species-specific PCR for identification of mycoplasma

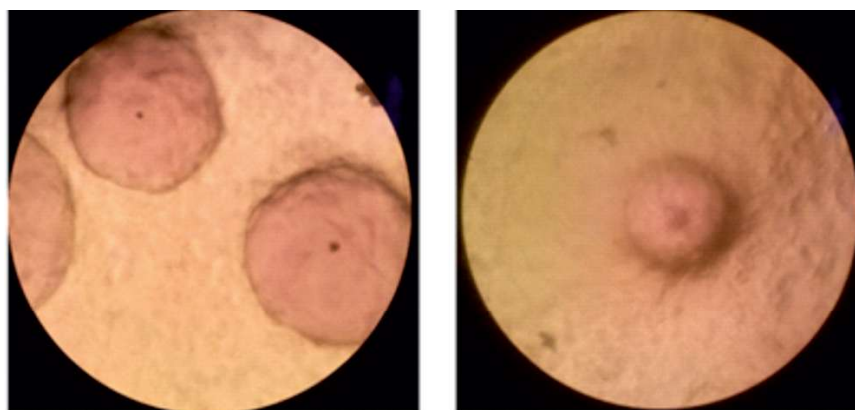


Fig 2 : Fried egg shaped (nipple shaped) colonies of *Mycoplasma* on PPLO agar

4.5.5 Project Title: All India Network Program on ethno-veterinary medicine-patho-epidemiological studies and development of polyherbal formulation for gastrointestinal parasitic infections-coccidiosis in animals

Principal Investigator Dr. Nitika Sharma

Co-Principal Investigators Dr. Ashok Kumar (upto 31.08.2025), Dr. Ravindra Kumar, Dr. K. Gururaj, Dr. Anu Rahal (upto 30.05.2025) and Dr. Anil Kumar Mishra

The study was aimed to evaluate plants for their anti-coccidial and growth promoting potential.

Salient Research Findings in ICAR-AINP-EVM_CIRG Centre

- Patho-epidemiological studies on the gastrointestinal parasitic infections-Coccidiosis in goats: A total of 2461 faecal samples were randomly collected directly from the rectum of healthy and diarrheic animals of different breeds and age groups, using examination gloves and were stored at 4°C until being processed for parasitological examination. Out of the 2461 faecal samples



Fig. 1: Stunted growth in goat kid affected with coccidiosis



Fig. 2: Numerous pale white foci of size few 2-3 mm in diameter, slightly raised on the mucosa (also called as "oocyst patches") are visible from serosa of the small intestine kid infected with *Eimeria* spp.

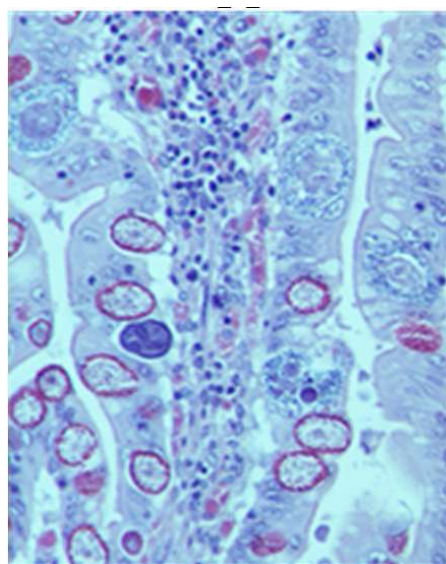


Fig. 3: Different stages of *Eimeria* spp replicating in intestinal villous epithelia of goat kids in natural infection

subjected for parasitological examination, 14.38% (354/2461) were positive for coccidian (Figure 1). Four kids received for necropsy, diagnosed as coccidiosis based on gross pathology of intestines (Figure 2). Tissue samples from different segments of intestines, collected from the necropsy cases in 10% buffered formalin, processed for histopathology and 4-5 µm paraffin sections were stained with haematoxylin and eosin (Figure 3).

- Screening of plants for their anti-coccidial potential : The anti-coccidial potential of twenty medicinal plants, selected based on ethno-veterinary literature, was evaluated using different plant extracts. Among the tested extracts, ethanolic and hydro-ethanolic preparations demonstrated the highest efficacy against clinical coccidiosis.

The study was conducted on weaned goat kids aged 3–6 months that were naturally infected with coccidiosis and exhibited faecal oocyst

counts (FOC) exceeding 3000–4000. The affected animals were orally administered a semi-liquid herbal extract formulation (15 mg/kg body weight mixed with inert material and water) for five consecutive days. Anti-coccidial efficacy was assessed 2–5 days post-treatment.

The hydro-alcoholic extracts prepared from the leaves of ICAR-CIRG Plant XVII and the pods of ICAR-CIRG Plant XVIII (plant names coded) showed promising anti-coccidial activity. Supplementation with these extracts resulted in reduced faecal oocyst counts (Figure 4) and improved production performance in weaned goat kids. Based on these findings, the two extracts were selected for further development of an herbal anti-coccidial formulation.

Comprehensive evaluation through haematological, biochemical, pathological, and clinical examinations revealed no adverse effects of the herbal extracts on the health status of the treated animals.

- Brine shrimp lethality test of the herbal extracts: The brine shrimp lethality assay (BSLA) was used for testing the efficacy of phytochemical present in the plant extracts. ICAR-CIRG Plant IX displayed highest mortality across all conc., reaching 95% at 10 mg/ml, with an LC₅₀ of 0.17 mg/ml.
- Phytochemical analysis of the herbal extracts

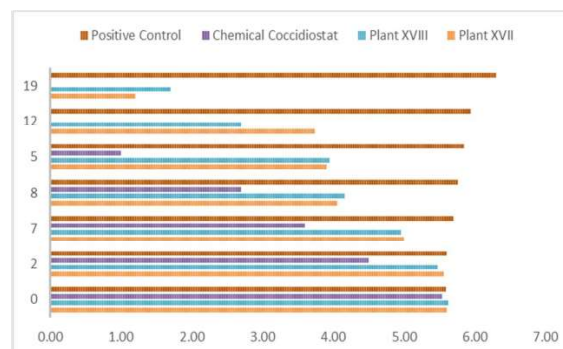


Fig. 4 : Effect of hydro-alcoholic extracts of leaves of ICAR-CIRG Plant XVII and pods of Plant XVIII on log-transformed coccidian oocyst per gram (OPG) values in weaned goat kids (3–6 months)

was carried out using various qualitative tests, along with GC–MS and FTIR analyses, to identify and characterize the bioactive phytoconstituents present in the extracts. Phytochemical screening of the examined plants revealed the presence of several secondary metabolites, including alkaloids, glycosides, flavonoids, terpenoids, steroids, saponins, tannins, and phenolic compounds (Table 1). Gas Chromatography–Mass Spectrometry (GC–MS) profiling of herbal extracts revealed highly potent, medicinally active volatile and semi-volatile compounds (Figure 5). FTIR spectroscopy further confirmed the presence of important functional groups, including C=O, C–H, and C–N stretches (Figure 6).

Table 1: Phytochemicals present in ICAR-CIRG Herbal extracts

S.no	Phytochemical Screened	Test performed	ICAR-CIRG Plant XV	ICAR-CIRG Plant XVI	ICAR-CIRG Plant XVII	ICAR-CIRG Plant XVIII
1	Alkaloids	Mayer's test	+	+	+	+
		Hager's test	+	+	+	+
2	Flavonoids	Alkaline reagent test	+	+	-	+
3	Glycosides	Legal's test	+	+	+	+
4	Carbohydrates	Benedict's test	+	+	+	+
		Fehling's test	+	+	+	+
5	Phenolic compounds	Ferric chloride test	+	+	+	+
6	Tannins	Gelatin test	+	+	-	+
7	Proteins and amino acids	Biuret test	+	-	-	-
		Ninhydrin test	-	-	-	-
8	Phytosterols	Salkowski's test	+	+	+	+
9	Saponins	Froth test	+	-	+	+

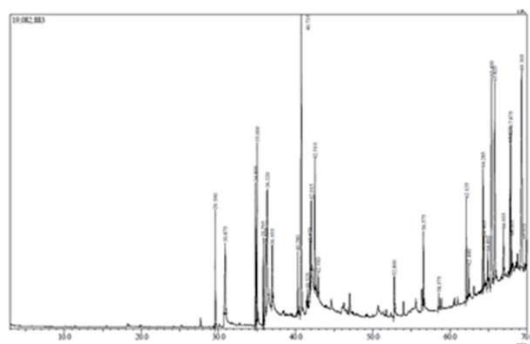


Fig. 5: The GC MS chromatogram of the leaf extract of ICAR-CIRG Plant XVIII

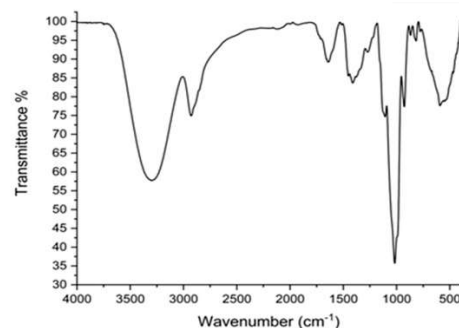


Fig. 6: The FTIR spectrum of the leaf extract of ICAR-CIRG Plant XVIII

- A Research Herbarium Atlas was prepared and published in collaboration with the AINP-

EVM Lead Centre, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly



- Creating awareness about the ethno-veterinary practices among the goat keepers and small ruminant stake holders through National Training, DAPSC sponsored and DAPSTC sponsored Training programmes

Exposure visits of farmers, goat keepers, and small ruminant stakeholders to the Medicinal Garden at ICAR-Central Institute for Research on Goats were organized during National Training, DAPSC-sponsored, and DAPSTC-sponsored training programmes on “Scientific Goat Farming” to create awareness about the use of ethno-veterinary practices in goat farming.



Fig. 7: Creating awareness about the ethno-veterinary practices among the small ruminant stakeholders

4.5.6 Project Title: Development of a nanoparticle-enhanced lateral flow assay for rapid field diagnosis of brucellosis in small ruminants (Funded by Institute Corpus Fund)

Principal Investigator

Dr. K. Gururaj

Co- Principal Investigators

Dr. Anil Kumar Mishra and Dr. Sunil Kumar (ICAR-IASRI)

1. Immunoinformatic Design of Protein A Diagnostic Construct

Significant progress was achieved in the computational design of a recombinant multi-epitope construct for *Brucella melitensis* detection.

Antigen Selection & Epitope Mapping

- **Target:** Protein A. Signal peptide analysis (SignalP 6.0) identified a 20-aa signal region, targeting the mature protein (residues 21–240) for design.
- **Epitope Profiling:** Using IEDB, VaxiJen 2.0, AllerTOP, and ToxinPred, high-confidence, non-toxic, and non-allergenic epitopes were identified.

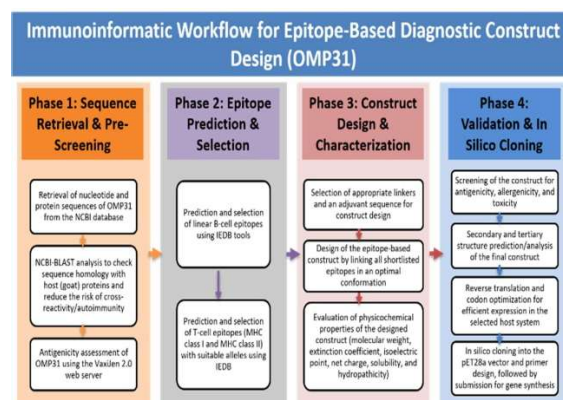


Fig.1. Workflow of immunoinformatic analysis for identification and selection of diagnostic epitopes from *Brucella melitensis* OMP31 protein

Table 1: Representative Top-Scoring Epitopes

Type	Sequence	VaxiJen Score	Function
MHC-I	Peptide 'A'	1.8024	T-cell recognition
MHC-II	Peptide 'B'	1.1246	Helper T-cell activation
B-cell	Peptide 'C'	1.3003	Antibody binding

Construct Architecture and Optimization

A chimeric construct was engineered by integrating a *Capra hircus* β -defensin-2 adjuvant with selected epitopes via peptide spacers. The resulting is characterized as a stable, hydrophilic candidate for purification based on an instability index of 20.69 and a GRAVY score of -0.449. To ensure high expression efficiency in *E. coli* K12, the sequence was codon-optimized with a CAI of 0.9 and a 53.3% GC content. Finally, *in-silico* cloning validated the successful insertion of the 756 bp fragment into the pET28a(+) vector at the XheI and NdeI sites, as confirmed by NEBcutter and virtual gel electrophoresis.

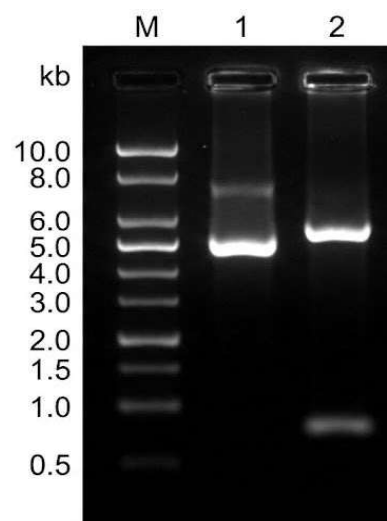


Fig.2. *In-silico* cloning of the optimized gene construct into the pET28a(+) expression vector showing insertion of the target gene fragment. Lane M: DNA ladder; Lane 1: undigested recombinant plasmid (~5–6 kb); Lane 2: double-digested plasmid showing vector backbone (~5–6 kb) and insert (~0.75 kb)

2. Systems Biology: Persistence vs. Latency in Small Ruminants

A long-term repository (10-year sera, 3-year PBMC DNA/RNA) was utilized to analyze infection dynamics in indigenous goat breeds.

Infection Dynamics & Diagnostic Trends

Surveillance of 100 goats (Jamunapari, Jakhrana, Barbari) revealed a progressive decline in detection rates across molecular levels: Exposure (15% SAT+) > Genome (9% qPCR+) > Transcription (6% qRT-PCR+).

Table 2: Breed-wise Distribution of Brucella Infection Detected by Serological and Molecular Methods (2022–2025)

Breed	Total Samples (n)	SAT Positive (n, %)	DNA qPCR Positive (n, %)	RNA qRT-PCR Positive (n, %)
Jamunapari	34	6 (17.65%)	4 (11.76%)	3 (8.82%)
Jakhrana	34	5 (14.71%)	3 (8.82%)	2 (5.88%)
Barbari	32	4 (12.50%)	2 (6.25%)	1 (3.13%)
Total	100	15 (15.0%)	9 (9.0%)	6 (6.0%)

Table 3 : Statistical Agreement (McNemar's & Kappa Analysis)

Comparison	Kappa value	Strength of Agreement
SAT vs. DNA qPCR	0.821	Almost Perfect
SAT vs. RNA qRT-PCR	0.467	Moderate
DNA vs. RNA	0.612	Substantial

Host Immune Interactome & LPA

Lymphocyte Proliferation Assays (LPA) and gene expression analysis identified stage-specific molecular signatures. The systems biology analysis revealed distinct stage-specific molecular signatures that define the host's immunological trajectory during *Brucella* infection. Active and persistent stages were characterized by a robust pro-inflammatory drive, evidenced by elevated IL-6 and IFN- γ , alongside a significant downregulation of IL-2 and TLR-4, suggesting a potential state of T-cell modulation or exhaustion (refer Fig.3.). In contrast, latent infections exhibited a shift toward immune evasion, marked by the downregulation of IL-8 and TLR-4, though the persistent elevation of IFN- γ and IL-6 remained as a critical molecular hallmark of chronic exposure (refer Fig.4). These transcriptional shifts were further validated through lymphocyte stimulation assays, where Concanavalin A (5 μ g/mL) served as a highly effective discriminator, successfully distinguishing infected cohorts from healthy animals based on their altered cellular "readiness." Conversely, Brucellin (10 μ g/mL) elicited comparable responses across both groups, indicating that while antigen-specific, it may lack the sensitivity required to differentiate between varying infection states compared to non-specific mitogenic stimulation in this caprine model.

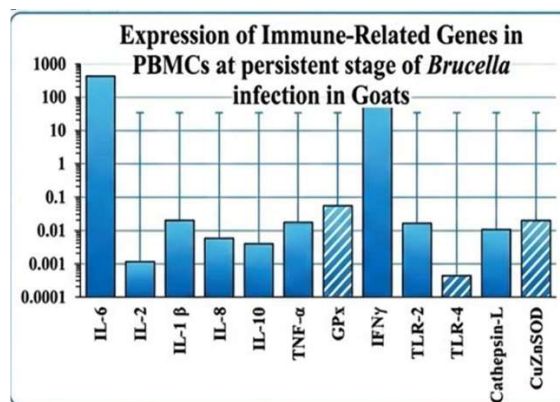


Fig.3. Gene expression of Immune related genes in persistent stage of Brucella infection in Goats

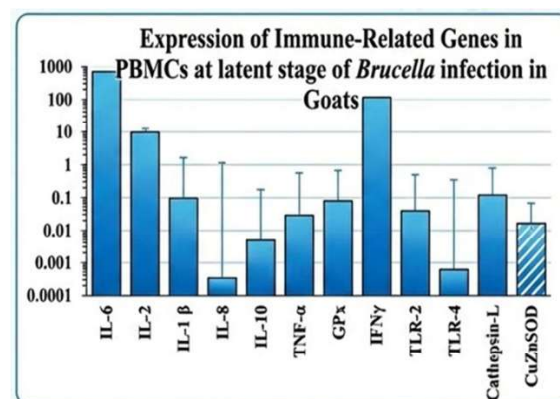


Fig.4. Gene expression of Immune related genes in latent stage of Brucella infection in Goats

Key Accomplishments

1. Validated Protein A as a potent diagnostic candidate for small ruminants.
2. Established a robust pipeline for multi-epitope recombinant protein expression.
3. Decoded infection stages via RNA-based
4. detection, identifying latent carriers missed by traditional serology.
4. Defined molecular signatures of persistence, providing a baseline for nanoparticle-enhanced lateral flow assay (LFA) development.

4.5.7 Project Title: Epidemiology of pneumonia and development of package-of-practices for its control in goats (Funded by Institute Fund)

Principal Investigator Anil Kumar Mishra

Co- Principal Investigators Dr. Ashok Kumar (Retired on 31-08-25), Dr. K Gururaj, Dr. Nitika Sharma, Dr. M.K. Singh and Dr. Vinay Chaturvedi

Molecular identification of bacterial isolates from caprine pneumonic lungs using 16S rRNA gene sequencing

Five bacterial isolates obtained from caprine pneumonic lungs were subjected to molecular identification through 16S rRNA gene sequencing. High-quality consensus sequences were generated by assembling bidirectional reads, followed by sequence similarity analysis using the BLASTn algorithm against the NCBI GenBank database. All isolates exhibited high sequence similarity (>99% identity with ~100% query coverage) with their closest reference sequences. Phylogenetic analysis further confirmed taxonomic placement, with each isolate clustering robustly with its respective reference strain. The isolates were identified as *Staphylococcus aureus* (2 isolates), *Bacillus velezensis*, *Enterococcus faecium*, and *Staphylococcus epidermidis* based on 16S rRNA sequencing, BLAST analysis, and phylogenetic validation.

Metagenomic sequencing of caprine pneumonic lung samples

The extraction of DNA/RNA from 70 pneumonic lung samples of goats was done followed by metagenomic sequencing to investigate the etiological agents involved in caprine pneumonia. The results revealed a highly diverse microbial population, indicating that the disease is not caused by a single pathogen but is instead polymicrobial in nature. The results demonstrated that bacterial pathogens constituted the dominant component of the lung microbiome in diseased animals. While classical respiratory pathogens such as *Mannheimia haemolytica* and *Pasteurella*

multocida were detected; several additional bacteria such as *Bibersteinia trehalosi*, *Fusobacterium necrophorum*, *Trueperella pyogenes*, *Pasteurella dagmatis*, *Mannheimia bovis* etc. of clinical importance were also identified. A significant observation in this study was the strong presence of anaerobic bacteria, including *Porphyromonas*, *Bacteroides*, *Prevotella*, *Parvimonas*, and *Fusobacterium gastrosuis*. These organisms are typically associated with chronic, advanced, or untreated infections. The sequencing data revealed the presence of several viruses, including Ovine Mastadenovirus A, Jaagsiekte Sheep Retrovirus, and Enzootic Nasal Tumour Virus. Among these, Ovine Mastadenovirus A was the most abundant. However, viral reads were significantly lower than bacterial reads. The low abundance of viral sequences suggests that viruses are not the primary causative agents in these cases. Instead, they likely act as predisposing factors, weakening the host and allowing bacterial pathogens to establish infection. This aligns with the concept of multifactorial respiratory disease, where viruses initiate the disease process and bacteria drive its severity.

Antimicrobial susceptibility profile of bacteria isolated from caprine pneumonic lungs

Antibiotic susceptibility testing (AST) was performed on 43 bacterial isolates obtained from caprine pneumonic lungs using the Kirby-Bauer disc diffusion method. A panel of common antibiotics namely amoxiclav, ceftriaxone, chloramphenicol, co-trimoxazole, enrofloxacin, erythromycin, gentamicin, and penicillin-G was used for the testing. The bacterial isolates

displayed diverse susceptibility patterns to the antibiotics tested. Among them, amoxiclav, chloramphenicol, and gentamicin emerged as the most effective, with 37, 34, and 38 isolates respectively showing sensitivity. These results suggest that these antibiotics could serve as strong therapeutic options for treating caprine respiratory infections. In contrast, high levels of resistance were observed against penicillin-G, co-trimoxazole, and enrofloxacin, with 43, 20, and 18 isolates respectively categorized as resistant, indicating limited effectiveness of these drugs. Ceftriaxone showed moderate efficacy, with 24 isolates classified as sensitive and 15 as resistant, reflecting variable performance against the isolates. Additionally, erythromycin and enrofloxacin exhibited a high number of intermediate responses, that is, 27 and 17 isolates respectively indicating inconsistent

susceptibility, which may be due to differences in drug pharmacokinetics or the presence of partial resistance mechanisms within the bacterial population.

Development of package of practices (PoP) for the prevention and control of caprine pneumonia

Based on the findings from the project and an extensive review of existing literature, a comprehensive “Package of Practices (PoP) for the Prevention and Control of Caprine Pneumonia” was developed. The implementation of this PoP is expected to significantly reduce the occurrence, incidence, and prevalence of caprine pneumonia in goat populations. Ultimately, this will contribute to improved livelihood security and the long-term sustainability of goat farming systems.

4.5.8 Project Title: Metabolic diseases and control strategies in goats in organized and free-range farming

Principal Investigator

Dr. Nitika Sharma

Co-Principal Investigators

Dr. Ashok Kumar (upto 31.08.2025), Dr. Ravindra Kumar, Dr. Anil Kumar Mishra, Dr. M.K. Singh and Dr. A.K. Dixit

Metabolic diseases in goats mainly caused by nutritional imbalance, stress, and increased physiological demands, significantly affect productivity and herd health. To assess disease prevalence under organized and free-range systems, a bilingual questionnaire (English and Hindi) was developed for goat keepers, veterinarians, para-veterinarians, and other stakeholders. Survey and project findings identified pregnancy toxemia/pregnancy ketosis as the major metabolic disorder in female goat, while urolithiasis was predominant in male goats (Fig 1).

Prevalence of Urolithiasis in bucks under organized farming system

Mortality pattern: During 2015-2025, 36 deaths due to urolithiasis were recorded at ICAR-CIRG livestock units, indicating its significance under organized farming conditions.

Age trend and breed susceptibility: Highest mortality was reported in adults 13/36 (36.1%) followed by 3–6 months age group 9/36 (25.0%) indicating a critical period for monitoring suggesting early life as a critical risk period due to an underdeveloped urinary system and improper



Fig.1: (a) Renal calculi with hydronephrosis in an adult buck; (b) Haemorrhages and rupture of the urinary bladder due to urinary obstruction by uroliths

Table: 1 Urolithiasis-associated mortality in bucks maintained under organized farming system at ICAR-CIRG Livestock Units (2015–2025)

Age Group	Barbari	Jamunapari	Jakhrana	Bundelkhandi	Total
1-3M	6	1			7 (7/36)
3-6M	2	5	2		9 (9/36)
6-9M	1	1	1		3 (3/36)
9-12M	1	1	1	1	4 (1/36)
Adult	2	5	5	1	13 (13/36)
Total	12	13	9	2	36

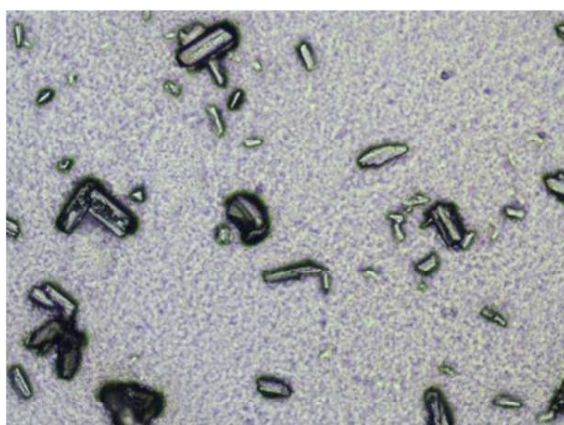
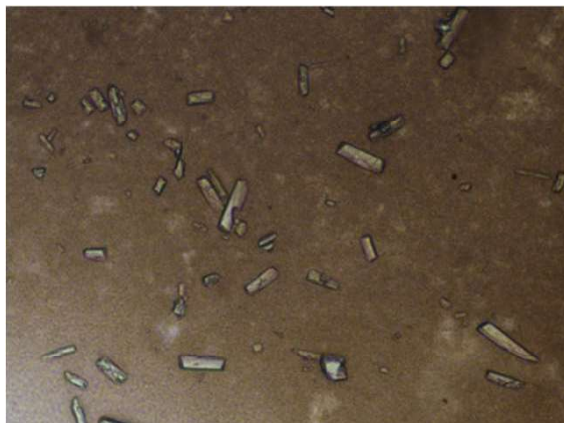


Fig. 2 a & b: Microscopic examination of urine showing urinary crystal clusters indicative of crystalluria associated with urolithiasis

concentrate feeding. Jamunapari: Most cases occur in the 3–6 months age group (5/13). Barbari: Notable cases in the 1–6 months age group (8/12). Jakhrana: Cases were more prevalent in older age groups, including adults (5/9). Bundelkhandi: Minimal cases overall, with occurrences in the 9–12 months and adult categories (Fig1) (Table 1).

Urine examination: Urine samples collected from urolithic goats showed highly alkaline pH (8.0–9.3), increased specific gravity, and presence of leukocytes, erythrocytes, and proteins, favoring phosphatic calculi formation (Table 2). Microscopic examination revealed struvite (“coffin-top”) crystals indicative of crystalluria (Fig2).

Increased BUN (36-54 mmol/l; Normal level; 3.6-7.5 mmol/l) and creatinine levels (720-1800 µmol/l; Normal level 60-135 µmol/l) were observed in the bucks suffering from urolithiasis (more than 10-fold increase was observed), indicating severe renal dysfunction. Higher urinary concentrations of Mg, Mn, Fe, Cu, and Zn were observed in affected goats. FTIR spectroscopy confirmed phosphate-based calculi. Findings suggest that concentrate feeding, mineral imbalance, low water intake, and alkaline urine contribute to urolithiasis.

Table 2: Physicochemical examination findings of urine samples collected from urolithic goats under organized system

Parameters	Urine samples											
	1	2	3	4	5	6	7	8	9	10	11	12
Ph	8.1	9.1	9.2	9.0	8.0	9.3	9.2	9.2	8.1	7.9	8.1	6.3
Specific gravity	1.003	1.005	1.020	1.015	1.010	1.020	1.020	1.020	1.015	1.005	1.003	1.040
Leukocytes	+	+	+	+	+	++	++	++	+	+	+	+
Erythrocytes	+	++	++++	++	++	+	+	++	+	++	+	++
Protein	++	++	++	++	+	+++	+	++	+	++	++	++

+ Mild, ++ Moderate, +++ High, ++++ Very high

Prevalence of urolithiasis in bucks under free range farming system

Under free range farming system, 360 goats (250 males, 110 females) belonging to Barbari, Jamunapari, Crossbred, and Local breeds were surveyed. The prevalence of urolithiasis in goat was found 5.0% (18/360) and in case of male the

prevalence was 7.2% (18/250) where the prevalence in female was 0%. Out of the 18 positive cases the highest prevalence of urolithiasis was found in Jamunapari goats (33.33%) and the lowest prevalence of urolithiasis was seen in Local/Non-descript goats (16.67%) (Table 3.)

Table 3: The prevalence of urolithiasis in goat according to breed under free range system

Breed	Frequency	Percentage (%)
Barbari	5	27.78 (5/18)
Jamunapari	6	33.33 (6/18)
Cross	4	22.22 (4/18)
Local	3	16.67 (3/18)
Total	18	100

Higher prevalence was observed in goats aged 0–6 months (66.67%) than other two age groups in all breeds (Table 4). Castration, one of the

major risk factors of urolithiasis showed 77.77% prevalence which was almost 3.5 times higher than the non-castrated one (22.22%) (Table 5).

Table 4: The Prevalence of urolithiasis in goats according to breed and age under free range system

Age (Months)	Barbari No. of animals	Barbari Prevalence (%)	Jamunapari No. of animals	Jamunapari Prevalence (%)	Cross No. of animals	Cross Prevalence (%)	Local/non-descript No. of animals	Local/non-descript Prevalence (%)	Overall Prevalence
0-6	2	40	2	33.33	2	50	2	66.67	44.44 (8/18)
7-12	1	20	2	33.33	0	0	0	0	16.67 (3/18)
>12	2	40	2	33.33	2	50	1	33.33	38.89 (7/18)
Total	5		6		4		3		100 (18/18)

Table 5: The Prevalence of urolithiasis in goats in relation to castration under free range system

Castration history	Frequency	Percentage (%)
Castrated	14	77.77
Not-castrated	4	22.22

Comparison of urolithiasis in goats under organized and free-range farming systems

In the present study, Urolithiasis prevalence was higher under organized concentrate-feeding systems (66.67%) (36/54) compared to free

grazing systems (33.33%) (18/54). Alkaline urine was more common in organized systems (91.67%) than in free-grazing goats (66.66%), suggesting that concentrate feeding and alkaline urinary pH predispose goats to phosphatic urolith formation (Table 6).

Table 6: The prevalence of urolithiasis in goat in relation to pH of urine under organized and free-range farming systems

Management system	pH	Frequency	Percentage (%)
Organised system with concentrate feeding	Acidic Below 7	1 (1/12)	8.33
	Alkaline Above 7	12 (11/12)	91.67
Free grazing	Acidic Below 7	6 (6/18)	33.33
	Alkaline Above 7	12 (12/18)	66.66

Pregnancy toxemia across management systems

Pregnancy toxemia prevalence varied considerably with management systems. The prevalence was comparatively low (around 5%) under well-managed organised and intensive production systems, whereas it increased substantially under poorly managed free-range extensive systems, reaching up to 80%, particularly in does carrying twin or triplet fetuses. Higher prevalence in free-range systems was associated with poor nutrition and inadequate late-gestation management, whereas balanced feeding reduced incidence under organized systems.

Prevalence of sub-clinical ketosis in goats under organized system

Total 108 blood samples from Barbari and Jamunapari does were analyzed for glucose, beta-hydroxybutyric acid (BHBA), and non-esterified fatty acid (NEFA) levels to assess negative energy balance (NEB). Does with glucose <2 mmol/L, BHBA >3 mmol/L, and NEFA >0.4 mmol/L were considered ketotic. During pregnancy and the peri-parturient period, BHBA and NEFA levels increased significantly, while glucose levels declined. The overall prevalence of subclinical ketosis was 23.15% (25/108), with a higher prevalence in Barbari goats (25.92%; 14/54) compared to Jamunapari goats (20.37%; 11/54) (Table 7).

Table 7. Details of samples collected and does identified with Negative Energy Balance (NEB)

Samples collected from Barbari does		Samples collected from Jamunapari does		Total Samples	
Samples Collected	Samples Positive	Samples Collected	Samples Positive	Samples Collected	Samples Positive
54	14	54	11	108	25
Percent Positive- 25.92%		Percent Positive- 20.37%		Percent Positive- 23.15%	

Metabolic profiling of goats maintained under organized and free-range systems was completed, and analysis of the generated data is in progress. An extension folder on metabolic, nutritional, and deficiency diseases in goats was prepared for dissemination among small ruminant stakeholders. Lectures and awareness programmes on metabolic diseases in goats were conducted for goat keepers and other small ruminant stakeholders.



4.6 EXTENSION EDUCATION AND SOCIO-ECONOMICS SECTION

4.6.1 Project Title: Development of goat value chain in Bundelkhand region of Uttar Pradesh (External Funded NLM Project)

Principal Investigator

Dr. A.K.Dixit

Co- Principal Investigators

Dr. M.K.Singh, Dr. Ravindra Kumar, Dr. K Gururaj and Dr. B.Rai

Bundelkhand region shares about 9 per cent of livestock population of the state. About 10 per cent of state goat population (15.59 million) resides in this region. Majority of goats reared under extensive management system. Keeping the importance of small holders' goat value chain development for sustainable livelihood, this study

has been planned to implement and disseminate goat technologies/programmes for productivity improvement and entire goat value chain development in the study area. The following project activities were carried out during the reporting period.



Extension activities

- Organized Forty (40) Kisan Gosthis/field days in different adopted villages of Banda and Mahoba District.
- Distribution of four multiplier flock (02 Barbari and 02 Jamunapari) to project beneficiary at College of Veterinary & Animal Science, BUAT Banda.
- One day training and input distribution program was organized for Banda and the project beneficiaries from Kabrai block of Mahoba district at BUAT Banda on 26 April 2025. Feedback received from the farmers on project journey so far
- Celebrated World Veterinary Day-2025 at College of Veterinary and Animal Science, BUA&T Banda with the theme Animal

Health Takes a Team. Farmers were sensitized on importance of veterinarian for the animal and farm family health. Goat feed, medicine kit, mineral mixture and buckets were distributed to the beneficiaries of NLM project.

- Organized ten (10) health camps with the support of veterinary college BUA&T Banda and Department of Animal Husbandry Banda. Door to door vaccination against PPR, ET disease and de-worming was performed and discussed preventive ideas for seasonal disease in adopted villages of Banda and Mahoba District. 1200 goats covered under these camps.
- Organised demonstration of goat paneer by Mundere Baba Goat Farmers Self Help Group at Sukora, Kabrai block of Mahoba under supervision project/CIRG team



4.6.2 Project Title: Value chain development of non-bovine milk for improving farmers' livelihood (External Funded NLM Project)

Principal Investigators Dr. Khem Chand and Dr. Anil Kumar (ICAR-NIAP, New Delhi)

Co- Principal Investigator Dr. A.K.Dixit

Goat Milk Supply Chain in Bundelkhand Region of Uttar Pradesh

A case study was conducted in Bundelkhand region of Uttar Pradesh to explore goat milk production and its marketing pattern. Only 23% of farmers reported selling goat milk. Of the 8 liters produced daily, around 4.5 liters was retained for kid suckling and household consumption, leaving a marketable surplus of 3.5 liters. Those selling milk typically sold it to local milkmen, who visited villages and offered a rate of Rs. 35 per liter. The total marketed surplus was estimated to be 595 liters considering adult females are in-milk for 170 days. Per household income from sale of milk was worked out to be about Rs. 21000.00. The prevailing supply chain in the region followed the route: Farmer → Milkman → Consumer. It was reported that milkmen often blended goat milk with cow and buffalo milk before distributing it to nearby towns and villages.



Pilot Study of Goat Milk Value Chain, ASPCL Dhaulpur Rajasthan

The goat milk value chain follows a well-structured and organized pathway from Farmer → Milk Collection Centre (MCC) → ASPCL (FPO) → Katori Foods → Consumers, ensuring efficient collection, processing, and reliable market linkages for producers. ASPCL manages the collection and processing of approximately 100–120 litres of goat milk per day, maintaining product quality through chilling facilities, systematic record-keeping, and adherence to quality standards, while enhancing value addition through the production of ghee, paneer, and flavoured milk. A transparent payment



mechanism is followed, with farmers receiving a fixed price of Rs. 45 per litre based on minimum quality parameters, and payments are made regularly within a 10-day cycle. Under this model, a farmer supplying 10 litres of milk per day can earn approximately Rs. 4,500 in 10 days, while aggregation of 1,000 litres results in a payout of Rs. 45,000, demonstrating substantial income-generation potential. Overall, the ASPCL–Katori Foods model provides assured pricing, timely payments, quality-based procurement, and efficient market access, making it a scalable and economically beneficial value chain model for smallholder goat farmers.



Pilot Study of Goat Milk Value Chain, Panchal Dairy, Sayla, Gujarat

The specialized artisanal goat cheese unit at Sayla, Gujarat, represents an innovative public-private-NGO partnership that integrates traditional pastoral knowledge with technical expertise and market support from Kirke Cheese Pvt. Ltd. and Sahjeevan. Operating at a processing capacity of 100 litres of goat milk per day with an average 13% cheese recovery, the enterprise produces more than 10 premium cheese varieties, highlighting strong value addition and product diversification in the goat dairy sector. The products are marketed in Chennai through an established cold-chain logistics system, fetching a premium price of approximately Rs. 1,250 per kg, with total sales of 1,120 kg during 2022–2024, indicating robust urban demand and commercial viability. Led by a Rabari pastoralist entrepreneur, the enterprise has

received notable recognition, including accolades at the World Cheese Awards 2023, underscoring its quality and innovation. With plans to establish a Cheese Learning Centre for skill development and knowledge dissemination, the model demonstrates strong scalability and replication potential for promoting entrepreneurship and sustainable livelihoods in goat-based dairy value chains.

Pilot Study of Sabitri Bai Phule Goat Farming Producer Company Limited Sinnar, Nashik (Maharashtra)

As per discussion with the field staff and officials of Yuwa Mitra, about 14,300 families across 160 villages with 1.06 lakhs goats were covered under livelihood and skill development programme. Under the value addition of goat milk, this FPC is adding value to the goat milk into Cheese. The price spread analysis (based on feedbacks) of the goat milk cheese value chain indicates a relatively



organized but moderately concentrated marketing structure. The analysis indicated that the production of 1 kg of goat milk cheese requires approximately 14 litres of goat milk farmers receive Rs. 630 at a sale price of Rs.45 per litre, accounting for 42% of the final consumer price of Rs. 1500/kg. Milk collection and transportation costs together contribute Rs. 98 (6.53%), while processing add Rs.182 (12.14%), bringing the cumulative production cost to Rs. 910 (60.67%). The remaining Rs. 590 (39.33%) is absorbed at the company and marketing stage through

packaging, branding, cold storage, distribution, and retail margins, highlighting the premium positioning of goat cheese in niche markets. The analysis indicates that although farmers receive a relatively fair share compared to conventional dairy chains, significant downstream margins suggest scope for improving producer profitability through direct marketing, producer-owned processing, and stronger Farmer Producer Company (FPC) integration to enhance value chain efficiency.

4.6.3. Project Title: Unlocking the potential of meat goat value chains : a supply chain mapping approach (Institute Corpus Fund)

Principal Investigator **Dr. A.K.Dixit**
Co- Principal Investigator **Dr. M.K.Chatli**

Uttar Pradesh and Rajasthan together constitute about 24% of total goat population of the country. Rajasthan is considered to a goat production hub of the country and catering the demand from Punjab, Haryana, Delhi, Part of Uttar Pradesh, Madhya Pradesh and Maharashtra. Animals from Rajasthan are also reaching to Jammu and Kashmir (particularly sheep) and plain districts of Uttarakhand. Similarly, Uttar Pradesh is home to about 14.5 million goats and being a highly populated state, it is also a major consumption center of the country. The emerging value chains is expected to improve marketing efficiency and induce a shift in goat production from subsistence to a commercial venture. This needs an integration of small scale producers on the supply chain as majority of goats are reared by the poor farmers. Keeping the importance of goat marketing in view, this study has been planned to explore the present status, mode of operation and opportunities in goat marketing. A price spread study was conducted in Rajasthan and Uttar Pradesh to explore the producers share in consumer rupee and major challenges faced by the functionaries involved in trade.

Price spread for a 20 kg live weight meat goat in Jaswantnagar and Balahedi markets reveals clear differences in efficiency, cost structure, and value transmission across the marketing chain. In Jaswantnagar, the producer receives Rs.5200, whereas in Balahedi the producer realizes a significantly higher Rs.7000, indicating better primary price realization in Rajasthan, largely due to superior breed quality and stronger market demand. At the itinerant trader level,

Jaswantnagar shows a higher trader margin (₹685) with lower cost (Rs.115) compared to Balahedi where cost is higher (Rs. 200) but margin is much lower (Rs. 300), resulting in a higher producer's share in trader's rupee in Balahedi (93%) than Jaswantnagar (86%). This suggests greater competition and efficiency at the primary trading stage in Balahedi, while Jaswantnagar reflects higher intermediary capture due to weaker producer bargaining power.

At the wholesale stage, Jaswantnagar has a moderate marketing cost (Rs. 350) and higher margin (Rs.650), whereas Balahedi exhibits a much higher marketing cost (Rs.929) due to inclusion of transport, labour, feed, and commission charges, but a relatively lower margin (Rs.571). Despite higher costs, the producer's share in wholesaler's rupee remains higher in Balahedi (77%) than in Jaswantnagar (74%), indicating better value transmission efficiency. At the retail level, both markets show comparable cost structures, though Balahedi commands a higher consumer price (Rs.10,000 vs Rs.8000) due to better meat quality and higher-end market linkages. Consequently, the producer's share in consumer rupee is higher in Balahedi (70%) compared to Jaswantnagar (65%), even though the absolute price spread is slightly higher in Balahedi (Rs.3000 vs Rs.2800). Study conclude that Jaswantnagar is characterized by lower costs but disproportionately higher intermediary margins, reflecting inefficiencies, informal pricing, and fragmented supply chains. In contrast, Balahedi demonstrates a high-cost but relatively low-

margin structure, indicating more organized trade, competitive intermediation, and better integration with distant markets. Thus, Balahedi goat market has a larger price spread in absolute

terms, it is more efficient in distributing value across stakeholders, whereas Jaswantnagar reflects more inefficiency and reduced producer share due to higher margin capture by middlemen.



4.7 Service Projects

4.7.1 Project Title: Income improvement of resource poor scheduled caste beneficiaries through skill development and scientific goat production

Principal Investigator

Dr. Gopal Dass

Co- Principal Investigators

**Dr. Arvind Kumar, Dr. Mukesh Bhakat, Dr. Ravi Ranjan,
Dr. A.K.Dixit and Dr. Nitika Sharma**

The socio-economic development and protection of scheduled caste from discrimination and exploitation has been a high priority from the very start of the planning process. The Government of India has adopted a multi-pronged approach for the socio-economic development of the Scheduled Castes: social empowerment through educational development, economic empowerment through income and employment enhancing avenues and

integrated development of scheduled caste (SC) majority villages. The formation of this project is in accordance with the instructions and guidelines of Government of India vide its “A centrally sponsored scheme for the development of scheduled castes living below the poverty line. This project aims at increasing the income and reducing the poverty of scheduled caste beneficiaries through their skill development and agricultural production.

A. Input distribution and farmers benefitted

S.No.	Input	Quantity	Beneficiaries		
			Male	Female	Total
1.	Goat feed	428.5 Q.	497	316	813
2.	Goat Feeder	125 Nos.	85	40	125
3.	Medicine kits	368 Nos.	114	254	368
4.	Mineral Mixture	3310 Kg.	288	375	663
5.	Weighing balance	08 Nos.	-	08	08
6.	Blanket	634 Nos.	457	177	634
7.	Goats	86 Nos.	48	38	86
8.	Wheat seed	99.6 Q.	216	33	249
9.	Solar torch	172 Nos.	108	64	172
10.	Rain coat	566 Nos.	331	235	566
11.	Dettol hand wash	50 Nos.	-	50	50
12.	Carry bags	308 Nos.	197	111	308
13.	Umbrella	774 Nos.	370	404	774
14.	CIRG Soap	157 Nos.	38	119	157
15.	Milk Can	343 Nos.	156	187	343
16.	Sewing Machine	06 Nos.	-	06	06
17.	Unnat Bakri Palan Books	256 Nos.	97	159	256
18.	Other literature	1454 Nos.	747	470	1217





Distribution of inputs to the project beneficiaries

Organization of trainings/ Demonstrations/ Health camps/Exposure visits

Trainings

Organized a total of 11 trainings during the year 2025. Out of total, two were of five days and nine were of one day duration. In these training programmes, a total of 1148 scheduled caste

beneficiaries participated which constituted 636 male and 512 female participants. The training programmes were on use of artificial insemination in scientific goat farming and Scientific Goat farming in which participants were given the lecture on goat breeding, feeding, health management and also on marketing by the faculty of ICAR-CIRG, Makhdoom.



Demonstration

A total of 10 demonstrations were organized during year 2025. Out of total, 07 Demonstrations at livestock units, ICAR-CIRG, Makhdoom for 369 beneficiaries (274 males and 95 females) of 18 villages adopted under DAPSC Project. During demonstrations, participants were explained and shown day to day activities of animal sheds and scientific management of

goats/sheep. 03 demonstrations were organized on Natural Farming for 166 DAPSC beneficiaries (120 males and 46 females) of 18 villages of Agra & Mathura district of Uttar Pradesh. All participants were shown the preparation of Jeevamrit and Beejamrit and advantages of natural farming in human life.



Health camps

During reporting period, a total of 07 Health camps were organized in the Institute for 620 project beneficiaries (265 males and 355 females) of 18 villages of Agra & Mathura district of Uttar Pradesh. During these camps, participants were



Exposure Visits

During this year, a total of 11 Exposure Visits were organized for 719 project beneficiaries (464 males and 255 females) of 14 villages of Agra & Mathura district of Uttar Pradesh. During visits, participants showed interest and asked many



given the demonstration on vaccination of goats, how to take temperature of goats in fever, drenching of goats etc. and overall health management of flocks to reduce the mortality. The participants were also provided medicine kits during health camps.



queries regarding selection of breed & breeding stock for starting goat farming, treatment of animals, housing of animals, feeding of animals and marketing of produce. Participants also saw the fodder crops grown by using jeevamrit and beejamrit.



Celebration of Institute Foundation Day

Under DAPSC project activity, 46th Institute Foundation Day was celebrated in the institute on 12.07.2025. In this celebration, a total of 65 DAPSC beneficiaries consisting of 38 males and 27 females were brought to the institute from 10 villages of Mathura district. The programme was also attended by scientific, technical,



Preparation and distribution of Varshik Bakri Palan Vivranika

Prepared Varshik Bakri Palan Vivranika 2026 which contained month wise activities of scientific goat farming. This Vivranika is having advisory to the farmers about goat farming for



Impact analysis of high yielding Mustard & wheat seed

During reporting year, a total of 99.6 quintals of wheat high yielding varieties seed was distributed to 249 project beneficiaries for Rabi crop. Out of total, 100 wheat seed beneficiaries were

administrative and other staff of the institute. On this day, farmer participants were also given one day training on scientific goat farming in which they were taught about selection of goat breeds & breeding management, nutrition management, health management and marketing of goats. In addition to training on scientific goat farming, the farmers participants were also provided Rain coat.



increasing productivity and reducing mortality. Honorable Member of Parliament, Mathura, Smt. Hema Malini released this Vivranika on 05.02.2026 at New Delhi and by Honorable Minister of Agriculture, Shri. Shiv Raj Singh, Chairman on 09.02.2026. After release, it was distributed to DAPSC Project beneficiaries.



contacted, interviewed and recorded data of wheat seed production in their land. Based on data, the improvement in wheat production from 20.0 to 25.0%, respectively over the local seed varieties sown in the same villages.

4.7.2 Project Title: Goat based livelihood improvement through scientific interventions in tribal districts under DAPST scheme

Principal Investigator

Dr. A.K.Dixit

Co- Principal Investigators

Dr. M.K. Singh, Dr. Gopal Dass, Dr. Ravindra Kumar,

Dr. Ravi Ranjan, Dr. Khushyal Singh and Dr. Nitika Sharma

Goat farming has become an important livelihood intervention for poverty alleviation and promotion of social equity, particularly among Scheduled Castes and Scheduled Tribes. ICAR–Central Institute for Research on Goats (ICAR-CIRG), Makhdoom, has been actively promoting sustainable livelihood enhancement through the dissemination of scientific goat production technologies, capacity building, and skill development among target communities. Under the Development Action Plan for Scheduled Tribes (DAPST), improved goat production technologies and essential inputs were disseminated across Uttar Pradesh, Madhya Pradesh, Rajasthan, and Uttarakhand through structured extension interventions. During 2025–26, the institute organized 23 one-day training programmes on scientific goat farming, benefiting 1,173 Scheduled Tribe participants, including 458 men and 715 women, from Madhya Pradesh, Rajasthan, and Uttarakhand. Training kits, medicine kits, mineral mixtures, goat feed, and technical literature were distributed to support technology adoption. In addition, a three-day specialized training programme on scientific

goat farming and utilization of millet by-products in goat ration was conducted for 23 tribal goat farmers, alongside another specialized training on Artificial Insemination in Goats conducted during 14–16 October 2025, which also benefited 23 participants. Further strengthening outreach efforts, ICAR-CIRG conducted nine Front Line Demonstrations (FLDs) in Rajasthan and Uttarakhand, along with 11 awareness camps on season-specific goat management and exposure visits to CIRG farms, integrated farming system models, and Kisan Melas at BUA&T Banda and GBPUA&T, Pantnagar. Seven animal health camps were organized in collaboration with Manjari Foundation in Rajasthan, covering approximately 1,000 goats through deworming interventions against ecto and endoparasites in adopted villages of Dholpur and Bharatpur districts. Farmers were sensitized on preventive health management during rainy and winter seasons. The institute also promoted awareness and community engagement through observance of important events such as World Goat Day, International Women's Day, Pradhan Mantri Dhan Dhanya Krishi Yojana (PMDDKY), and



Vistar Bharat: Kisan ke Bhavishya ka Sathi, further reinforcing scientific goat farming and inclusive rural development.

Observance of Janjatiya Gaurav Varsh Pakhwada-2025

During the observance of Janjatiya Gaurav Varsh Pakhwada-2025, ICAR-Central Institute for Research on Goats (ICAR-CIRG), Makhdoom, implemented a series of capacity-building, extension, and livelihood-oriented programmes aimed at empowering tribal communities through scientific goat farming and allied enterprises. The initiative achieved extensive outreach across four states Rajasthan, Madhya Pradesh, Uttarakhand, and Uttar Pradesh benefiting a total of 1,035 participants, including tribal goat farmers, women self-help group (SHG) members, students, and rural youth. The programme witnessed strong women's participation, with over 450 women beneficiaries, reflecting its inclusive and gender-responsive approach. Participation from trainees across multiple states enhanced inter-regional learning and knowledge exchange.

A wide range of scientific interventions were suggested, including scientific training programmes, field demonstrations, awareness campaigns, exposure visits, and farmer-scientist interactions focused on improved goat husbandry, health care, feeding, breeding, and hygienic management practices. Essential production inputs such as goat feed, medicines, mineral mixtures, and technical literature were distributed to support adoption of scientific practices at the field level. Special emphasis was placed on entrepreneurship development, adoption of scientific and livelihood diversification through

value addition activities such as goat milk product preparation and organic composting from goat manure, thereby promoting sustainable income generation and tribal livelihood enhancement.

Input distribution programme

The Development Action Plan for Scheduled Tribes (DAPST) implemented by ICAR-CIRG adopted an integrated input support strategy to strengthen the livelihoods of ST goat farmers by addressing critical constraints related to nutrition, animal health, milk handling, extension, and climate resilience. A total of 556 bags of goat feed, 1,180 kg of mineral mixture (982 packs of 1 kg and 198 packs of 5 kg), 1,546 bottles of liver tonic, and 290 medicine kits were distributed to improve nutritional status, reproductive performance, immunity, disease prevention, and overall productivity of goats. Additionally, 182 milk cans were provided to promote hygienic milk collection and handling, while 156 solar lanterns enhanced livestock management in villages with limited access to electricity.

To facilitate knowledge dissemination and promote scientific goat husbandry, beneficiaries received 579 Goat Activity Calendars and 600 copies of the Bakri Palan Nirdeshika containing season-specific recommendations on breeding, feeding, health care, and management practices. Supportive materials, including 284 bags, 660 writing pads, 668 pens, 492 water bottles, 117 umbrellas, 673 raincoats, and 319 lunch boxes, encouraged effective participation in training and extension programmes. Further, 400 plant saplings were distributed to promote fodder development, agroforestry, and environmental sustainability.

4.7.3 Project Title: NEH component programme

Nodal Officer

Dr. Arvind Kumar

Associated Members

Dr. Ravi Ranjan and Dr. T.P. Singh

Organization of training cum input distribution programme in collaboration with ICAR-NRC on Yak

Training cum input distribution programme on “Empowering tribal farmers for alternative income generation through goat farming in Arunachal Pradesh” was organized for the goat farmers of Dirang (Arunachal Pradesh) on 25.06.2025 at ICAR-NRC on Yak. During this one-day training programme the farmers were

sensitized about local feed and fodder resources for proper nutrition, health management and vaccination schedule. On this occasion 29 numbers of goat kids produced at FLD unit established by ICAR-CIRG, Makhdoom at ICAR-NRC on Yak, Dirang were distributed to the local farmers for rearing and livelihood improvement. Also distributed 5 Tons of goat feed to the tribal goat farmers of Dirang, Arunachal Pradesh.



Fig. 1 : Distribution of goat kids and feed to the tribal farmers of Dirang, Arunachal Pradesh

A Training cum awareness programmes was also organized on 04/09/2025 for the goat farmers of West Kameng District, Arunachal Pradesh and



distributed 10 Tons of pellet feed and 100 veterinary medicine kits to the participants.



Fig. 2: Input distribution programme organized at ICAR-NRC on Yak, Dirang, Arunachal Pradesh

Organization of Input distribution cum awareness programme in collaboration with ICAR-NRC on Mithun

Collaborated with ICAR-NRC on Mithun for the organization of input distribution cum awareness programme on the occasion of celebration of 3rd Mithun Day on 1st September 2025 at Thenzawl, Mizoram. On this occasion the tribal farmers of Mizoram were interacted and sensitized about goat rearing for income enhancement. The



Director, ICAR-CIRG, Dr. Manish Kumar Chatli addressed the gathering and emphasized on goat based integrated farming system for livelihood improvement of tribal farmers. On this occasion the Honorable Chief Minister of Mizoram Shri Pu Lalduhoma and Honorable Agriculture, Animal Husbandry & Veterinary Minister of Arunachal Pradesh, Shri Gabriel D. Wangsu distributed 200 chicks to the Mizoram tribal farmers.



Fig. 3 : Dr. Manish Kumar Chatli, Director CIRG addressing the gathering during Mithun Day celebration



Fig. 4 : Distribution of chicks to the tribal farmers

CHAPTER 5

RESEARCH PROJECTS



5

RESEARCH PROJECTS

A. Institute funded Project			
1.	ANSC CIRG SIL 2024 004 00328	Genetic Improvement of Sojat Goat for economics traits and its utilization for entrepreneur models development	PI- Dr. M.K. Singh Co-PI (s): Drs. Mukesh Bhakat, Ravi Ranjan, Nitika Sharma, Manish Kumar Chatli
2.	ANSC CIRG SIL 2021 004 00306	Income improvement of resource poor scheduled caste beneficiaries through skill development and scientific agricultural and goat production (DAPSC Programme) Sub Project: TOT for income improvement and comprehensive development of resource poor scheduled caste (SC) beneficiaries of SC dominated selected villages of Mathura district	PI- Dr. Gopal Dass Co-PI (s): Drs. Arvind Kumar, Mukesh Bhakat, Nitika Sharma, A.K. Dixit, Vijay Kishore PI – Dr. Khushyal Singh Co-PI (s): Drs. M.K. Singh, Ashok Kumar, V Raj Kumar
3.	ANSC CIRG SIL 2025 001 00332	Genetic Improvement of Jakhrana Goats for milk and meat production under farm and field conditions	PI- Dr. Gopal Dass Co-PI (s): Drs. M.K. Singh, Mukesh Bhakat, Ravindra Kumar, Tarun Pal Singh, Vinay Chaturvedi
4.	ANSC CIRG SIL 2025 002 00333	Status of reproductive ailments in goats reared under field conditions	PI- Yogesh Kumar Soni Co -PI(s) - Drs. S P Singh, Ravi Ranjan, Mukesh Bhakat, A K Dixit, Gopal Dass, A.K Mishra
5.	ANSC CIRG SIL 2023 004 00322	Development of Natural Farming based fodder production practices for Goats.	PI-Dr. Arvind Kumar Drs. Ravindra Kumar, K. Gururaj
6.	ANSC CIRG SIL 2020 011 00295	Standardization of goat milk cheese processing and value addition of its by- product	PI-Dr. A K Verma Co- PI(s)- Drs. V. Raj Kumar, K. Gururaj, Tarun Pal Singh
7.	ANSC CIRG SIL 2022 004 00315	Development of millet –based goat milk products with enhanced functionality.	PI-Dr. Tarun Pal Singh Co- PI(s)- Drs. Arun Verma, V. Raj Kumar, Ashok Kumar, A K Dixit
8.	ANSC CIRG SIL 2023 005 00323	Development of goat milk based designer cosmetics	PI-Dr. Tarun Pal Singh Co-PI(s) Drs. Manish Kumar Chatli, Arun Kumar Verma, V. Raj Kumar, Ashok Kumar, S P Singh
9.	ANSC CIRG SIL 2020 009 00293	Pathological and epidemiological investigation of goat disease.	PI- Dr. Ashok Kumar Co- PI(s)- Drs. Anu Rahal, K. Gururaj, A.K. Mishra, Nitika Sharma, Vinay Chaturvedi
10.	ANSC CIRG SIL 2023 006 00324	Epidemiology of pneumonia and development of package of practices for its control in goats.	PI- Dr. Anil Kumar Mishra Co-PI – Drs. Dr. Ashok Kumar, K. Gururaj, Nitika Sharma , M K Singh, Vinay Chaturvedi
11.	ANSC CIRG SIL 2021 008 00310	Herbal adjunct for increasing efficacy of commonly used antibiotics in animal practices.	PI- Dr. Anu Rahal Co-PI – Dr. K. Gururaj
12.	ANSC CIRG SIL 2021 006 00308	Goat based livelihood Improvement through Scientific Interventions in Tribal Districts.	PI-Dr. A.K. Dixit Co- PI(s)- Drs. Gopal Dass, Ravindra Kumar, Ravi Ranjan, Nitika Sharma, Khushyal Singh

12.	ANSC CIRG SIL 2022 005 00316	Impact Assessment of ICAR Technologies sub-group : Livestock & Poultry (Mineral)	PI-Dr. A.K. Dixit
13.	ANSC CIRG SIL 2024 005 00329	Metabolic diseases and control strategies in goats in organized and free range farming system.	PI- Dr. Nitika Sharma Co- PI(s)- Drs. Ashok Kumar, Ravindra Kumar, Anil Mishra, Manoj Kumar Singh, Anupam Krishna Dixit
B. External funded projects			
1.	ANSC CIRG SOL 2023 002 00320	NLM: Development of strategies for competent embryo production and efficient cryo preservation for faster propagation of superior goat germplasm	PI- Dr. S.P. Singh Co -PI(s) - Drs. Y. K. Soni, M K Singh
2.	ANSC CIRG SOL 2023 001 00319	NLM: Development of herbal fortified diluter for buck semen cryopreservation	PI- Dr. Ravi Ranjan Co -PI(s)- Drs. Ashok Kumar, K. Gururaj
3.	ANSC CIRG SOL 2022 003 00314	NLM: Development and evaluation of efficient regimen for estrus synchronization in major Indian goat breeds.	PI- Yogesh Kumar Soni Co -PI(s) - Drs. S P Singh, Ravi Ranjan, M K Singh
4.	ANSC CIRG SOL 2024 006 00330	UPCST: Evaluation of Laparoscopic Artificial Insemination in goats for efficient and conservation of Jamunapari buck germplasm	PI- Yogesh Kumar Soni Co -PI(s) - Drs. Mukesh Bhakat, Ravi Ranjan, S P Singh
5.	ANSC CIRG SOL 2024 001 00325	UPCST: Development of phage based therapeutic against mastitis in goats with special reference to <i>Staphylococcus aureus</i> and <i>E- coli</i> mastitis	PI- Dr. Anil Kumar Mishra Co-PI(s) – Drs. Ashok Kumar, K. Gururaj, Nitika Sharma ,
6.	ANSC CIRG SOL 2022 001 00312	NLM: Development of Goat Value Chain in Bundelkhand Region of Uttar Pradesh.	PI - Dr. A K Dixit
7.	ANSC CIRG COP 2025 003 00334	Value Chain Development of non-Bovine Milk For Improving Farmer's Livelihood	PI - Dr. A.K. Dixit
C. ICAR funded projects			
1.	ANSC CIRG COL 2012 021 00232	ICAR AICRP (G): Improvement and Sire evaluation of Jamunapari goats for milk production.	PI- Dr. M. K. Singh Co-PI (s): Drs. M.K Chatli, Gopal Dass, K. Gururaj, Ravi Ranjan, T.P Singh, Vinay Chaturvedi, M.S. Dige
2.	ANSC CIRG COP 2015 001 00243	Component IV- Development of renewal energy based fodder dryer cum winter protection shelter for goats. Development of plastic based multi-purpose animal shelter for housing goat and poultry	PI-Dr. B. Rai Co-PI (s): Drs. Arvind Kumar, Y.K. Soni PI-Dr. B. Rai Co-PI (s): Drs. Arvind Kumar, K. Gururaj, T. P Singh
3.	ANSC CIRG COP 2024 002 00326	All India Network Programme on Challenging and emerging Diseases of Animals (AINP-CEDA): Goat and Sheep Mycoplasmosis	PI- Dr. Anil Kumar Mishra Co-PI – Drs. Dr. Ashok Kumar, K. Gururaj, Nitika Sharma
4.	ANSC CIRG COL 2012 022 00233	ICAR AICRP (G): Genetic improvement of Barbari goats for milk and meat production.	PI- Dr. M.K. Singh Co-PI (s): Drs. M.K Chatli, A.K. Dixit, S. P. Singh, Ravi Ranjan, Ravindra Kumar, V. Raj Kumar, M.S. Dige, Anu Rahal
5.	ANSC CIRG COP 2012 023 00234	ICAR Network: Sheep Improvement – Muzaffarnagari Unit	PI- Dr. Gopal Dass Co-PI (s): Drs. Nitika Sharma, Vinay Chaturvedi, Y. K. Soni
6.	ANSC CIRG COP 2021 009 00311	ICAR- NBAGR: Coordinated Research Project (CRP) Agrobiodiversity.	PI- Dr. S.P. Singh Co-PI (s): Dr. Y K Soni

7.	ANSC CIRG COP 2024 007 00331	National Programme : Application of Genome Editing Technology for Improvement in Livestock Health and Production (NPGET)	PI- Dr. S.P. Singh Co-PI (s): Dr. Y K Soni, Ravi Ranjan
8.	ANSC CIRG COP 2012 030 00242	ICAR: Veterinary Type Culture-Microbes (NAINP Bangalore, CIRG Makhdoom Collaboration)	PI-Dr. Ravindra Kumar Co -PI(s) - Dr. A.K Mishra
9.	ANSC CIRG SOL 2024 003 00327	ICAR Funded : Strategic utilization of pearl- millet by- products in goat rations for their improved production performance	PI- Ravindra Kumar Co -PI(s) - Drs. Arvind Kumar, A K Dixit
10.	ANSC CIRG COP 2022 006 00317	ICAR : Agri Drone Project	PI-Dr. Arvind Kumar Co-PI(s) Drs. Ravindra Kumar, Gopal Dass
11.	ANSC CIRG CIL 2019 002 00284	ICAR-FAO: Joint project network- All India Network Project on Antimicrobial Resistance (AINP-AMR) in fisheries and Livestock	PI- Dr. K. Gururaj Co-PI (s): - Drs. Ashok Kumar, A.K. Mishra, Nitika Sharma
12.	ANSC CIRG SIL 2020 002 00286	ICAR CABIN: Development of epsilon toxin based novel vaccine against enterotoxaemia in goats: A bioinformatics assisted reverse vaccinology approach.	PI- Dr. K. Gururaj Co-PI – Dr. Anil Kumar Mishra
13.	ANSC CIRG COP 2022 007 00318	All India Network Programme on Ethno Veterinary Medicine.	PI- Dr. Nitika Sharma Co-PI – Drs. Ashok Kumar, K. Gururaj , A K Mishra, Anu Rahal, Ravindra Kumar
D. PBB (Institute corpus Fund) project			
1.	ANSC CIRG SIL 2025 004 00336 Corpus	Institute/Corpus Funded: Computer Vision and Artificial Intelligence Techniques for Livestock Body Weight Estimation, Breed Identification, Disease and Pregnancy Diagnosis (ICAR-CIRG and KGEC) -(Institute)	PI - Dr. Mukesh Bhakat Co-PI- (Drs.) Manish Kumar Chatli, Gopal Dass, Y.K. Soni, Ravi Ranjan ,S.P Singh, Gayathri S Lal, K.Gururaj Team (KGEC) Co-PI- Dr. Satyendra Nath Mandal
2.	ANSC CIRG SIL 2025 005 00337 Corpus	Institute/Corpus Funded: Development and validation of a point-of-care pregnancy test for goats-(Institute)	PI - Dr. S.P Singh Co-PI- (Drs.) Y.K. Soni, Ravi Ranjan ,Mukesh Bhakat, Pawan Kumar Yadav
3.	ANSC CIRG SIL 2025 006 00338-Corpus	Institute/Corpus Funded: Development of novel alternative strategies for estrus synchronization in goats-(Institute)	PI-Dr. Dr. Yogesh Soni Co-PI- S.P Singh, Mukesh Bhakat, M.K. Singh, Poornima Agrawal
4.	ANSC CIRG SIL 2025 007 00339 Corpus	Institute/Corpus Funded: Maximizing Fertility in Goats through Strategic Timing of Artificial Insemination and Strengthening of Goat Semen Bank-(Institute)	PI-Dr. Ravi Ranjan Co-PI- (Drs.) Y.K. Soni, S.P.Singh, Mukesh Bhakat, Ravi Ranjan, M.K. Singh, Gopal Dass
5.	ANSC CIRG SIL 2025 008 00340-Corpus	Institute/Corpus Funded: Bioactivities and health values of Goat cheese peptides and goat milk oligosaccharides-(Institute)	PI-Dr. Arun Kumar Verma Co-PI- (Drs.) V. Raj Kumar, Tarun Pal Singh, K.Gururaj, B. Anu kumar, Atul Prakash
6.	ANSC CIRG SIL 2025 009 00341-Corpus	Institute/Corpus Funded: Production, Characterization and Evaluation of Anti-aging Collagen Hydrolysate from Goat Skin-(Institute)	PI-Dr. Tarun Pal Singh Co-PI- (Drs.) Arun Verma, Rituparna Banerjee, S.P Singh, Ravindra Kumar, Manish Kumar Chatli
7.	ANSC CIRG SIL 2025 010 00342-Corpus	Institute/Corpus Funded: Development of a Nano particle-Enhanced Lateral Flow Assay for Rapid Field Diagnosis of Brucellosis in Small Ruminants" under the Project based budgeting-(Institute)	PI- Dr. K. Gururaj Co-PI- Anil Kumar Mishra, Sunil Kumar
8.	ANSC CIRG SIL 2025 011 00343-Corpus	Institute/Corpus Funded: Unlocking the Potential of Meat Goat Value Chains : A Supply Chain Mapping Approach-(Institute)	PI - Dr. Anupam Krishna Dixit Co-PI- Dr. Manish Kumar Chatli

CHAPTER 6

ITMU (NAIF SCHEME)



6

ITMU (NAIF SCHEME)

Service Project : ITMU Project under NAIF ICAR
Principal Investigator : Dr. Ravi Ranjan
Co-Principal Investigators : Dr. Tarun Pal Singh and Dr. Anil Kumar Mishra

Achievements: During the reporting period, two patents, two copyright, and two trademarks were filed. Additionally, one copyright was successfully registered, and a copyright search certificate was obtained for another. Five technologies had their prices finalized by AgIn, New Delhi, for commercialization. Furthermore,

one technology was certified by ICAR. Ten lectures on “Institute Goat Production Technologies” were delivered under the National Training Program with reference to Intellectual Property and Technology Management.

The below are listed IPR during 2025:

8.1. Patent under Process: 03

Sr. No	Application/ Registration No.	Name of Innovation/Technology/ Product/ Plant Variety	Date of Filed/ submitted	Status
1.	202311067997	Herbal drug to control brucellosis and prevent shedding of <i>Brucella mellitensis</i> in sheep and goats	10.10.2023	Application Awaiting Examination [Publication date (U/S 11A) on 18.04.2025]
2.	202511072553	Composition, production protocol, storage and utilization of potato-paddy straw silage for ruminants feeding.	30.07.2025	Applied
3.	202511090443	An Adjunct Composition for Improving Therapeutic Potential of Antibiotics and a Process of Preparation Thereof.	22.09.2025	Applied

Copyright: 03

Name of Copyright	Application/ Registration No.	Name of Innovation/ Technology/ Product	Date of Filed/ submitted	Status	Contributors
Artistic Work	Diary No. AT-28296/2025-CO	Goat breeding Calender	16.07.2025	Registered Certificate No. AT-20250162761, 05.12.2025	Dr. M.K Singh, Dr. Manish K. Chatli, Dr. Ravi Ranjan, Dr. M.S. Dige, Dr. S.P. Singh, Mr. Akhilesh kumar and Dr. Nitika sharma
Literary Work	Diary No. LD-28301/2025-CO	Goat breeding Calender	16.07.2025	Registered Certificate No. LD-20260182170, 17.02.2026	
Web based software	5934/2025-CO/SW	Design and development	20/02/2025	SW-2025020553	Dr. K. Gururaj (Principal Scientist,

of web-based
software for
Goat
Transcriptome
Web
Resource on
Enterotoxaemia
(GoaTWR-E)

Animal Health Division,
ICAR-CIRG), Dr. Sunil
Kumar (Pr.Sci., DABin,
ICAR-IASRI), Dr. Girih
Kumar Jha (Head,
DABin, ICAR-IASRI),
Dr. RVS Pawaiya
(Head, Division of
Pathology, ICAR-IVRI),
Dr. Rahul Kumar
(MVSc Scholar, ICAR-
IVRI), Dr. Mahendra
Kumar Singh
(Information Scientist,
National Brain research
centre, Gurugram), Dr.
Jyotika Bhati (Research
Associate, DABin,
ICAR-IASRI)

Trademark: 02

Application/ Registration No.	Date of Filed/ submitted	Name of Innovation/ Technology/ Product/ Plant Variety	Status
6818795 (3)	23.01.2025	Whey Wonders Goat	Formalities Chk Pass
6818796 (5)	23.01.2025	Synch Intra Vaginal sponge	Formalities Chk Pass

Technology approved by ICAR: 01

Name of Technology/ Product/ Model	Year	Lead Developer	Associate Developer
Technology: Round the Year fodder production modal for small goat herd.	2024	Dr. M. Arif	Dr. Arvind Kumar, Dr. R. Pourouchottamane, Dr. Ravindra Kumar, Dr. B. Rai and Dr. M. K. Chatli

8.2 ITMU Meetings: Four ITMU meetings were organized to present the Institute's commercializable technologies and matters related to intellectual property rights (IPR).

S.No.	Meeting organized for Technology Commercialize/ Transfer & IPR filed	Number of Participants	Major Decision taken
1.	09.04.2025 (ITMU Meeting)	10 (Scientists, ITMU Members and staff)	❖ The unit cost (including packaging) for the following technologies shall be submitted for commercialization: Goat milk yoghurt (100 ml), Fermented milk-millet fusion beverage (100 ml), Goat frozen yoghurt (100 ml) and Whey Wonder soap (50 gm) ❖ Moringa-based feed proposal to be revised with detailed data, technical inputs, and updated costing. ❖ The copyright application for <i>Interactive Preventive Health Calendar for Goats</i> shall be filed as two separate applications (literary and artistic), along with submission of NOCs from all authors through an authorized attorney.

			❖ The patent application on “<i>Synergistic herbal adjunct to augment antimicrobial efficacy of conventional allopathic antibacterial agents</i>” shall be processed further after submission of all required documents, including Form-III for NBA approval, to ITMU. ❖ A proposal shall be prepared for the inclusion of an IP expert as an external member of ITMU and submitted to the competent authority for approval.
2.	23.05.2025 Techno-commercial Assessment committee (TCAC) Meeting	10 (Scientists, officers and staff)	❖ All technologies shall be licensed on a non-exclusive basis for a period of 5 years with a license fee of ₹1.5 lakh (plus applicable taxes), including provision for concessions to MSMEs as per applicable norms, and a royalty of 5% on net invoice value; ICAR-CIRG shall retain rights for periodic quality assessment and may cancel the license in case of non-compliance, while providing limited training and technical handholding support to licensees, who shall ensure adherence to all statutory and regulatory requirements. ❖ It was also decided to promote value addition and commercialization of goat milk-based technologies (yoghurt, fermented beverages, frozen yoghurt, and bathing bar) and Moringa-based feed formulation, considering their market potential and applicability.
3.	19.08.2025 (ITMC Meeting)	15 (Scientists, ITMC Members and staff)	❖ Patent filing to be prioritized before commercialization of technologies, with mandatory submission of NOCs from all co-inventors. ❖ Commercial value and titles of technologies to be revised in line with market potential and applicability ❖ All Patent applications to be strengthened through refinement of claims, abstracts, protocols, and demonstration of novelty and commercial viability to be submitted to ITMU for further processing through the authorized attorney. ❖ Certain technologies to undergo validation and institute-level price fixation prior to commercialization. ❖ Copyright applications to be revised (title/SOP) and submitted with requisite NOCs through attorney
4.	05.01.2026 (ITMU Meeting)	15 (Scientists, ITMU Members and staff)	❖ Prices of technologies shall be revised based on market potential, with necessary modification of titles for clarity. ❖ ITMU shall coordinate with Agrinnovate India Ltd. (AgIn) for finalization of technology pricing. ❖ Suitable technologies shall be filed under design patents, with provision for commercialization and resale as per guidelines. ❖ Copyright and trademark applications shall be refined through revision of titles and alignment with legal provisions.

- ❖ Related technologies, particularly feed-based, shall be appropriately clubbed for better management and protection.
- ❖ All innovators shall submit requisite documents within the stipulated timeline for further processing.



Fig. 1: ITMC Meeting was held on 19.08.2026 at ICAR-CIRG

8.3. Capacity Building in IP Management:

8.3.1 Training/workshop/Seminar etc.: Organized with respect to IP& Tech. Management

S. No	Name of Programme (Training/workshop/Seminar etc.) Organized	Date of Programme	Participants (No)	Participation category
1.	Industry-Scientists-Farmers Interface as part of ISSGPU Conference 2025	05-07 March, 2025	250	Industry personals/ Scientists/ Progressive farmers
2.	Webinar on “Practical Guidance for Patents: Drafting, Filing, and Processing.” under World IP Day 2025	01.05.2025	42	Scientists, Scholars & Professional
3.	Delivered lectures on “Institute goat production technologies” in National Training Program with respect to IP&Tech. Management.	11-17 February,2025 24 Feb.-02March,2025 18-24March, 2025 06-12 May, 2025 15-21 July, 2025 05-11August ,2025 09-15September,2025 07-13October,2025 11-17 November,2025 02- 08 December,2025	91 109 88 59 93 68 70 70 99 65	Farmers/entrepreneu rs from 14 States

8.3.2 Training/workshop/Mela etc. Attended with respect to IP & Tech. Management

S No	Name of Programme (Training/workshop/Seminar etc.) attended	Organized By (Name of Institute)	Days of programme (Date from-to)	Participants
1.	Showcasing technologies CIRC-ITMU (Stall) in ISSGPU Conference 2025	ICAR-CIRG, Makhdoom	05-07 March, 2025	250 Approx. Industry personals/ Scientists/ Progressive farmers
2.	Showcasing of CIRC-ITMU technology in NASC complex at ICAR foundation day at New Delhi	ICAR, Delhi	New 15-16 July, 2025	300 Approx. Farmers/Entrepreneurs/ Students



Fig. 2 : Showcased CIRC technologies (Stall) in ISSGPU Conference: More than 250 industry professionals, scientists, and progressive farmers participated in the ISSGPU Conference 2025. Distinguished experts, including Dr. A.K. Gahlot, Dr. Raghvendra Bhatta (DDG, Animal Science), Dr. K.M.L. Pathak, Dr. G.K. Gaur (ADG, Animal Production & Breeding), Dr. A.K. Tomar, and others, commended CIRC's efforts in supporting goat farmers

8.4 World Intellectual Property (IP) Day Celebrations at ICAR-Central Institute for Research on Goats (CIRG), Mathur

ICAR-Central Institute for Research on Goats (CIRG), Mathura celebrated World Intellectual Property Day on May 1, 2025, in accordance with the WIPO theme “IP and Music: Feel the Beat of IP.” The event was organized by the Intellectual Property and Technology Management Unit (ITMU) under the leadership of Director Dr. Manish K. Chatli, with coordination by Dr. Ravi Ranjan, Dr. Anil Kumar

Mishra, and Dr. Tarun Pal Singh.

The program featured a keynote lecture by Dr. Pinki Chakraborty, Patent Associate, United & United, New Delhi, who delivered an informative session on patent drafting, filing, and processing. The event witnessed active participation from scientists, students, and staff members.

In his address, the Director highlighted the vital role of intellectual property in promoting creativity, particularly in the music industry. The webinar witnessed the enthusiastic participation of over 42 attendees and concluded with a vote of



thanks by Dr. Anil Kumar Mishra, Member of ITMU-CIRG, who acknowledged the contributions of the organizing team, guest speaker, and all participants.

8.5 Commercializable Technologies

B. (i) Technologies certified by ICAR- (10 technologies)

1. PARACHEK CARD - An eye mucosa colour based targeted selective treatment chart for goats.
2. Aja Sanjeevani - Herbal Immunomodulatory Formulation for Amelioration of Weaning Stress in Goat kids.
3. mRNA multiplex TaqMan® probe PCR for detection of live mycobacterium avium subspecies paratuberculosis in goat faces.
4. Duplex real-time PCR for quick detection of cryptosporidiosis in goats.
5. Peptide based ETX iELISA for assessing protective antibody titer against enterotoxaemia in goats.
6. Peptide Based Indirect ELISA for early detection of coenurosis in goats.
7. Product: CIRG-Dyl: A ready to use semen dilutor and preservation medium for fresh and cooled goat semen.
8. Product: Goat Cervix Visualization Glass speculum (Goat Speculum)
9. Design and layout plan of rural goat shelters or high and mid hill regions of Uttarakhand
10. Round the Year fodder production modal for small goat herd.

B. (ii) Technologies available for Commercialization

Theme: Housing, Feed & Fodder Technologies

1. Plastic based hanging type feeders suited for all breeds of goats.
2. Plastic flooring based two tier housing for goats.
3. Sandwiched portable plastic panel for protecting goat kids from cold stress.
4. Goat feeders for better feed utilization.
5. Power weeder for improving economic fodder production.



Fig. A webinar on Intellectual Property and Technology was organized on May 1, 2025, as part of the celebrations for World IP Day 2025.

6. Pelleted complete feed technologies for sustainable goat production under intensive feeding system.
 7. Area Specific Mineral Mixture for Uttar Pradesh
 8. ECOAZO: Economic complete pellet feed formulation with Azolla for ruminant feeding.
 9. COCCICHECK-H Herbal anticoccidial complete pellet feed formulation for goats.
 10. METHLOW-H: Low methane producing herbal complete pellet feed for goats.
 11. Local Resource based Pellet Feed Formulation for Goats in Gharwal Region of Uttarakhand State.
 12. Moringa based complete feed for dairy Goats.
- Theme: Reproductive & Artificial Insemination Technologies
13. Goat-Synch-Intra vaginal sponge for estrus induction and Synchronization in Goats.
 14. Goat Semen diluent composition (TCFEYG) and cryopreservation Protocol.
 15. Goat Cervix Visualization Glass speculum.
 16. CIRG-DYL.

Goat Meat and Milk Products

17. Emulsion based Goat meat products.
18. Snacks type Goat meat/milk Products.
19. Retort processed shelf stable Goat meat products.
20. Healthier Goat meat products.
21. Goat Milk Mozzarella cheese.
22. Goat milk yoghurt

23. Goat Frozen yoghurt
24. Whey Wonders
25. Fermented milk-millet fusion beverage

Drug and Diagnostic Technologies

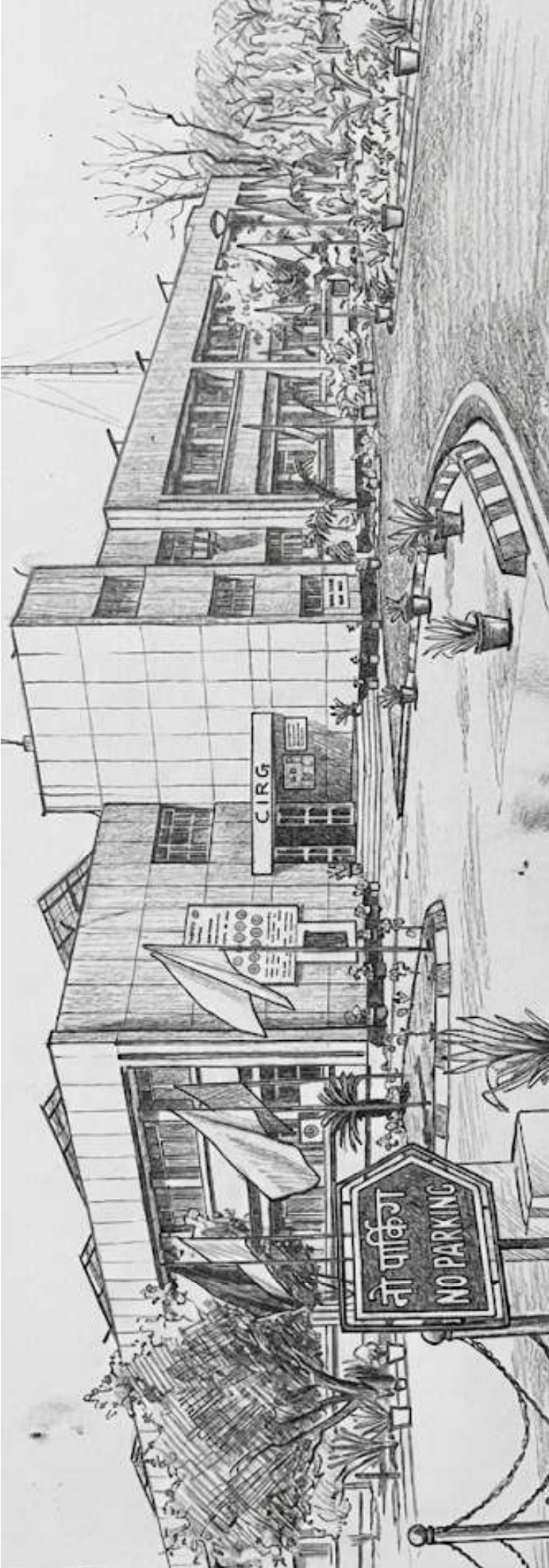
26. BRUCHECK: A Dot- ELISA KIT for detection of brucellosis in goats and sheep
27. iELISA kit for diagnosis of paratuberculosis (Serum and Milk) in domestic animals
28. Stressol–G: an Herbal antistress formulation
29. PARACHEK CARD- An eye mucosa color based targeted selective treatment (TST) chart for goats
30. Sanjeevani- Herbal immunomodulatory formulation for amelioration of weaning stress in goat kids
31. EASY KIDDER-A herbal formula to minimize parturition problems
32. BRUCLEAR- Herbal drug to prevent abortion and shedding of Brucella
33. iELISA and Sandwich ELISA kits for Enterotoxaemia detection in small ruminants
34. Peptide based DIVA ELISA kit for Johne's disease

35. Colour based Molecular test for detection of *Brucellosis* in farm Animals
36. A Quick molecular assay for specific detection of *Brucella melitensis* in goats
37. Peptide based iELISA for early detection of coenurosis in goats
38. Molecular test for detection of active MAP shedding in Johne's disease affected Goats
39. A molecular assay for Quick detection of active cryptosporidial infection in Goat kids
40. Alquit
41. Diarrionex- HS powder: Antidiarrhoeal powder
42. AJAS GREEN- Goat milk based natural herbal beauty soap
43. AJAS-Goat milk based natural beauty soap.
44. AJAS- Goat milk based antiseptic soap.
45. Healex gel: Skin antiseptic for animals
46. Wormolex: Anthelminthic bolus.
47. Megatex spray: Herbal acaricidal liquid /spray.
48. IMU-4: Immunomodulatory bolus



CHAPTER 7

स्वच्छता पखवाड़ा



7

स्वच्छता पखवाड़ा

स्वच्छता ही सेवा अभियान 17 सितंबर से 1 अक्टूबर 2025 तक पूरे देश में 'स्वच्छोत्सव' थीम के साथ मनाया गया था। इस उपलक्ष्य में हमारे संस्थान में निम्नलिखित कार्यक्रमों का आयोजन किया गया।

18 सितम्बर, 2025

दिनांक 18.09.2025 को केन्द्रीय बकरी अनुसंधान संस्थान में स्वच्छता ही सेवा अभियान 2025 के अंतर्गत सफाई जागरूकगता अभियान रैली का आयोजन संस्थान के निदेशक डा. मनीष कुमार चेटली के नेत्रत्व में किया गया। संस्थान के निदेशक ने सफाई के महत्व को

समझाते हुए बताया कि स्वच्छता का अर्थ है अपने आसपास की जगह को गंदगी से मुक्त रखना और खुद को साफ सुथरा रखना। लेकिन सिर्फ अपने घर की और खुद की सफाई, स्वच्छता नहीं होती है। बल्कि स्वच्छता का मतलब हमारे घर से आस-पड़ोस में भी मौजूद गंदगी जैसे धूल, मिट्टी, खुला कचड़ा, जमा हुआ गंदा पानी, गद्दे, आदि इन सब से भी मुक्त होना जरूरी है। अगर हमारे चारों तरफ सफाई बनी रहेगी तो हमारा स्वास्थ्य भी बेहतर रहेगा। इस अवसर पर संस्थान के वैज्ञानिकों, अधिकारियों, कर्मचारियों, यंग प्रोफेशनल ने भाग लिया।



24 सितम्बर, 2025

दिनांक 24.09.2025 को केंद्रीय बकरी अनुसन्धान संस्थान में स्तम्भ चौराहे पर श्रमदान किया गया, जिससे



25 सितम्बर, 2025

दिनांक 25.09.2025 को केंद्रीय बकरी अनुसन्धान संस्थान में 'स्वच्छ भारत कला प्रतियोगिता' का आयोजन किया गया जिसके



आस पास की जगह को स्वच्छ बनाया। इस अवसर पर संस्थान के सभी अधिकारियों एवं कर्मचारियों ने सहभागिता कर कार्यक्रम को सफल बनाया।



अंतर्गत प्राथमिक विद्यालय समेलमपुर के कक्षा 3 से 5 तक के छात्र छात्राओं ने प्रतियोगिता में भाग लिया। अपनी सोच और रचना के माध्यम से छात्र छात्राओं ने स्वच्छता के प्रति अपनी भावनाओं को कला के माध्यम से कागज पर जीवंत किया साथ ही



स्वच्छता के प्रति सबको अपनी रचना के माध्यम से प्रेरित किया। साथ ही साथ प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं सातवना पुरस्कार से पुरस्कृत किया गया। इस अवसर पर डॉ रवींद्र कुमार (विभागाध्यक्ष) जी ने बच्चों को स्वच्छता के बारे में प्रेरित करते हुआ बताया कि 'जहां सफाई, वहीं सेहत की परछाई। बचपन से ही बच्चों को स्वच्छता की आदतें सिखाना उनके बेहतर भविष्य की पहली सीढ़ी है। उन्हें समझाएं कि हाथ धोना, साफ-सुथरा रहना और आसपास सफाई बनाए रखना न सिर्फ अच्छी आदत है, बल्कि बीमारियों से बचाव का सरल तरीका भी है।'

इस अवसर पर संस्थान के डॉ रवींद्र कुमार (विभागाध्यक्ष), श्याम सुन्दर (वरि.प्रशा.अधि.), डॉ मुकेश

भक्त (प्रधान वैज्ञानिक), डॉ के. गुरुराज, श्री जगवीर सिंह (प्रशा.अधि), श्री अरविंद चौहान (प्रशा.अधि.), श्री सतीश चन्द्रा (स.मु.त.अधि.) और नीतू चौधरी (अध्यापिका, प्राथमिक विद्यालय समेलमपुर) ने अपनी मौजूदगी में प्रतियोगिता सफल रूप से सम्पन्न कराई।

26 सितम्बर, 2025

दिनांक 26.09.2025 को केंद्रीय बकरी अनुसन्धान संस्थान में पुस्तकालय के पास स्वच्छता अभियान चलाया जिसका नेतृत्व डॉ अनुपम कृष्ण दीक्षित (प्रधान वैज्ञानिक) द्वारा किया गया जिनके साथ ही श्री अरविंद चौहान (प्र.अधि), श्री सतीश चन्द्रा (स.प्र.अधि.) और अन्य कर्मचारियों और अधिकारियों ने भाग लिया और कार्यक्रम को सफल बनाया।



30 सितम्बर, 2025

दिनांक 30.09.2025 को केंद्रीय बकरी अनुसन्धान संस्थान में प्रयोगशाला परिसर स्थित पार्क में स्वच्छता अभियान चलाया गया जिसके अंतर्गत वहाँ पर खड़ी

बड़ी-बड़ी घास को पूर्णतः काट कर पार्क को स्वच्छ बनाया। जिसका नेतृत्व डॉ मुकेश भक्त (प्र.वैज्ञा एवं विभागाध्यक्ष) द्वारा किया गया जिनके साथ श्री सतीश चन्द्रा (स.प्र.अधि) और अन्य कर्मचारियों व अधिकारियों ने भाग लिया तथा कार्यक्रम को सफल बनाया।



CHAPTER 8

हिन्दी राजभाषा



8

हिन्दी राजभाषा अनुभाग

1. गतिविधियाँ

प्रत्येक तिमाही में एक त्रैमासिक बैठक का आयोजन किया गया एवं वित्तीय वर्ष 2025-26 में कुल 04 बैठकों का सफल आयोजन किया गया व राजभाषा विभाग द्वारा वर्ष 2025-26 के लिए जारी वार्षिक कार्यक्रम की बिंदुवार विस्तृत रूप से निर्धारित लक्ष्यों सहित जानकारी राजभाषा अनुभाग द्वारा बैठक में सभी सदस्यों को दी गयी तथा अनुरोध किया गया कि सभी

विभागों व अनुभागों के निर्धारित लक्ष्यों को समय सीमा के अन्तर्गत प्राप्त करने हेतु अपने स्तर से सकारात्मक प्रयास करें। संस्थान में हिंदी पत्राचार का प्रतिशत निर्धारित 100 प्रतिशत करने पर विशेष ध्यान दिया गया एवं राजभाषा अधिनियम की धारा 3(3) के अंतर्गत आने वाले सभी दस्तावेजों को द्विभाषी रूप में जारी करने के लिये निर्देश जारी किए गये।

त्रैमासिक बैठक के छायाचित्र नीचे दिये गये हैं -



- संस्थान में दिनांक 16 सितम्बर, 2025 से 30 सितम्बर, 2025 तक 'हिंदी पखवाड़ा' का गरिमायुयी आयोजन किया गया, जिसके अंतर्गत कार्मिकों में राजभाषा के प्रति अभिरुचि बढ़ाने हेतु विभिन्न साहित्यिक एवं सांस्कृतिक कार्यक्रम आयोजित किए गए। इस दौरान हिंदी निबंध, हिंदी टिप्पणी एवं प्रारूप लेखन, वाद-विवाद, प्रश्न मंच, आओ बताओ इनाम पाओ/अंताक्षरी, हिंदी कार्यशाला/कवि सम्मेलन, हिन्दी शोध पत्र जैसी विविध प्रतियोगिताओं के माध्यम से अधिकारियों एवं

कर्मचारियों को अपनी प्रशासनिक भाषा-क्षमता प्रदर्शित करने का अवसर प्राप्त हुआ। पखवाड़े के अंतिम दिन आयोजित समापन समारोह में सभी विजेता प्रतिभागियों को संस्थान के निदेशक महोदय द्वारा पुरस्कार एवं प्रशस्ति पत्र देकर सम्मानित किया गया। आयोजित की गयी प्रतियोगिताओं का विवरण निम्नानुसार है :

- हिंदी विचार गोष्ठी (विषय: 'राष्ट्र विकास में राजभाषा हिंदी का महत्व') के छायाचित्र



• राजभाषा से सम्बन्धित वृत्तचित्रधर्मा फिल्म का प्रदर्शन आयोजन के छायाचित्र



• हिंदी निबन्ध प्रतियोगिता आयोजन के छायाचित्र



• हिंदी टिप्पणी एवं प्रारूप लेखन प्रतियोगिता



• वाद-विवाद प्रतियोगिता



• प्रश्न मंच प्रतियोगिता



• हिन्दी शोध पत्र प्रतियोगिता



• एक दिवसीय हिंदी कार्यशाला / कवि सम्मेलन



2. अर्धवार्षिक बैठकों एवं राजभाषा में उपलब्धियाँ

वर्ष में दो बार नराकास, मथुरा द्वारा आयोजित छमाही बैठकों में संस्थान के निदेशक व प्रभारी, राजभाषा अनुभाग ने सहभागिता की। इन बैठकों में राजभाषा नीति के प्रभावी क्रियान्वयन, प्रगति की समीक्षा तथा हिंदी के

उपयोग को बढ़ाने के उपायों पर चर्चा की गई। कार्यालय में हिंदी में पत्राचार, नोटिंग एवं रिपोर्टिंग में उल्लेखनीय प्रगति दर्ज की गई तथा निर्धारित लक्ष्यों की प्राप्ति सुनिश्चित की गई।

CHAPTER 9

LIBRARY



9 LIBRARY

पुस्तकालय अनुभाग

संस्थान में पुस्तकालय को दिनांक 12.05.1981 को स्थापित किया गया था। स्थापना के समय से ही पुस्तकालय संस्थान के वैज्ञानिकों, शोधार्थियों, छात्र-छात्राओं एवं पशुपालकों को ज्ञान एवं सूचना सेवाएं प्रदान करते हुए निरंतर सुचारु रूप से संचालित हो रहा है।

विषयों से जुड़ी विविध प्रकार की पुस्तकें शोध-पत्रिकाएँ (जर्नल्स), संदर्भ सामग्री हैं। वार्षिक प्रतिवेदन एवं वैज्ञानिक प्रकाशन पुस्तकालय में बकरी पालन, पशुपोषण, पशु प्रजनन, पशु स्वास्थ्य जैव प्रौद्योगिकी, कृषि विज्ञान एवं संबंधित पुस्तकें भी उपलब्ध हैं। संस्थान के वैज्ञानिकों हेतु नवीनतम राष्ट्रीय एवं अंतरराष्ट्रीय जर्नल्स तथा शोध सामग्री अध्ययन एवं अनुसंधान कार्यों के लिए नियमित रूप से उपलब्ध कराई जाती है। शोधार्थियों एवं छात्र-छात्राओं के लिए पुस्तकालय में अध्ययन एवं शोध कार्य हेतु आवश्यक पाठ्य सामग्री संदर्भ पुस्तकें तथा शोध प्रकाशन सुलभ हैं जिनका

उपयोग वे अपने शैक्षणिक एवं अनुसंधान कार्यों में करते हैं। पुस्तकालय में शांत एवं अध्ययन-अनुकूल वातावरण उपलब्ध कराया गया है जिससे विद्यार्थियों एवं शोधकर्ताओं को लाभ प्राप्त होता है।

इसके अतिरिक्त किसानों एवं पशुपालकों के हितों को ध्यान में रखते हुए पुस्तकालय में बकरी पालन एवं संबंधित तकनीकों पर आधारित हिन्दी एवं अंग्रेजी भाषा की उपयोगी पुस्तकों एवं प्रकाशनों की बिक्री व्यवस्था भी उपलब्ध है। इन प्रकाशनों के माध्यम से पशुपालकों को उन्नत बकरी पालन तकनीकों, प्रबंधन, पोषण एवं रोग नियंत्रण संबंधी जानकारी प्राप्त होती है, जिससे आजीविका संवर्धन एवं पशुपालन विकास को प्रोत्साहन मिलता है।

इस प्रकार संस्थान का पुस्तकालय ज्ञान संसाधन केंद्र के रूप में अनुसंधान, शिक्षा एवं विस्तार गतिविधियों को सशक्त समर्थन प्रदान कर रहा है।



CHAPTER 10

WOMEN CELL



10

WOMEN CELL

The Internal Complaints Committee (ICC) renamed as Internal Committee (IC) is constituted to address and redress gender-related grievances of women employees of ICAR-CIRG in accordance with the provisions of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013. The Committee also strives to ensure a safe, secure, and congenial work environment that promotes dignity, equality, and mutual respect for all women employees.

The Internal Committee of ICAR-CIRG was reconstituted on 10 April, 2023. The following members served on the Committee up to 9 June, 2025:

1. Dr. Anu Rahal, Principal Scientist, ICAR-CIRG: Chairperson
2. Dr. Nitika Sharma, Senior Scientist, ICAR-CIRG: Member
3. Dr. V. Rajkumar, Principal Scientist, ICAR-CIRG, Member (SC/ST Liaison Officer)
4. Mr. P.K. Sharma, SO & Nodal Officer, ICAR-CIRG, Member Secretary
5. Dr. Archana Pathak, DUVASU: External Member

The Internal Committee of ICAR-CIRG was reconstituted again on 10 June, 2025 due to the transfer of Dr. Anu Rahal. The following members served on the Committee up to 31 December, 2025:

- 1: Dr. Nitika Sharma, Senior Scientist, ICAR-CIRG: Chairperson
2. Dr. V. Rajkumar, Principal Scientist, ICAR-CIRG, Member (SC/ST Liaison Officer)
3. Dr. Archana Pathak, DUVASU: External Member
4. Mrs Anjali Singh, T-3: Member
5. Mr. P.K. Sharma, SO & Nodal Officer, ICAR-CIRG, Member Secretary

No complaints were received during the current Year 2025

One meeting was conducted on 25 July, 2025 to discuss measures for improving the working

conditions and welfare of female employees at ICAR-CIRG. The meeting was attended by all members of the Internal Committee, 12 female employees (Scientists, Technicians, Administrative Staff, Research Associates, and Young Professionals), and students. Deliberations focused on creating a supportive, inclusive, and gender-sensitive work environment and addressing issues related to the well-being and professional development of women employees.

The second meeting was conducted on 12 December, 2025, to create awareness and enhance understanding of the provisions of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 and its effective implementation. The meeting was attended by four members of the Internal Committee, Administrative staff and 10 female employees (Scientists, Technicians, Administrative Staff, Research Associates, and Young Professionals), as well as students. The programme focused on sensitizing participants to their rights and responsibilities, promoting a safe and respectful workplace, and strengthening awareness of the mechanisms available for prevention and redressal of workplace sexual harassment.



CHAPTER 11

EDUCATION AND ACADEMIC COLLABORATIONS



11

EDUCATION AND ACADEMIC COLLABORATIONS

11.1 Education

During the academic year 2025–26, a total of 06 Ph.D. students conducted research at ICAR-CIRG under the mentorship of the Institute's scientists. These students were registered at:

- GLA University, Mathura –04

- Sanskriti University, Mathura –01

- Amity University, Gwalior –01

These students were guided across various divisions and research programs. The Institute also supported final-year B.V.Sc., M.Sc, B.Tech & A.H. students of various affiliated institutions for internship and training.

11.2 list of student completed the research project/dissertation/Internship

S. No	Name of Student	Name of the Veterinary College/University	Gender	Degree/ Course
1.	Ms. Devki Sharma	Dr. Bhim Rao Ambedkar University	Female	M.Sc.
2.	Mr. Nishant Saraswat	Dr. Bhim Rao Ambedkar University	Male	M.Sc.
3.	Ms. Saswati Barman	Sanskriti University	Female	M.Sc.
4.	Ms. Alia Khan	Hindustan College of Science and Technology	Female	B. Tech
5.	Ms. Sakshi	Hindustan College of Science and Technology	Female	B. Tech
6.	Ms. Sruteedhara Sarmah	Hindustan College of Science and Technology	Female	B. Tech
7.	Ms. Aastha Singh	Hindustan College of Science and Technology	Female	B. Tech
8.	Mr. Sujal Kushwaha	Hindustan College of Science and Technology	Male	B.Tech
9.	Mr. Shubh Gupta	DUVASU	Male	B.Sc.(Hon)
10.	Mr. Mohammad Adil Abbas	DUVASU	Male	B.Sc.(Hon)
11.	Ms. Vaishnavi Dixit	UPES, Dehradun	Female	B.Sc.
12.	Ms. Prachi Kumari	UPES, Dehradun	Female	B.Sc.
13.	Ms. Reena	BSA College	Female	B.Sc.
14.	Ms. Ruchi	BSA College	Female	B.Sc.

List of student Enrolled/completed Ph.D.

S. No	Name of Student	Name of the Veterinary College or University	Supervisor	Status
1.	Mrs. Nikita Mittal	GLA University, Mathura	Dr. Ravi Ranjan	Enrolled
2.	Dr. Manish Kumar	GLA University, Mathura	Dr. Ravi Ranjan	Completed
3.	Mr. Vijay Dubey	GLA University, Mathura	Dr. Ravindra Kumar	Enrolled
4.	Ms. Shradha Gemini	GLA University, Mathura	Dr. K Gururaj	Enrolled
5.	Mrs. Shilpa Mahajan	GLA University, Mathura	Dr. Gopal Dass	Enrolled
6.	Mr. Mayank Pratap Singh	Sanskriti University, Mathura	Dr. K Gururaj	Enrolled

S. No	Name of the Veterinary College or University	Total number of students who undertook internship at ICAR-CIRG	Days of Internship	Duration/Batches
1.	BHU, Varanasi	46 students	15 days	13 Sep, 2024 to 28 Feb, 2025 (4 Batch)
2.	RGSC-BHU, Mirzapur	36 Students	15 days	9.12.25 to 9.12.25 (6 Batch)
3.	International Institute of Veterinary Education & Research (IIVER), Bahu Akbarpur, Rohtak	70 Students	15 days	01 May to 16 Sep 2025 (5 Batch)

Present Academic Collaborations (MoUs)

The Institute has active academic collaborations with the following institutions for education, training, and joint research activities:

1. DUVASU, Mathura
2. GLA University, Mathura
3. Rajiv Gandhi Institute of Veterinary Education & Research (RIVER), Puducherry
4. Chhattisgarh Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh
5. Rama University, Kanpur
6. Nanaji Deshmukh Veterinary Science University, Jabalpur
7. Rajasthan University of Veterinary and Animal Sciences (RAJUVAS), Bikaner
8. Sanskriti University, Mathura
9. BSA College, Mathura
10. Uttaranchal University, Dehradun, Uttarakhand
11. Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, Uttar Pradesh
12. Animal Husbandry Department, Government of Uttar Pradesh
13. Kalyani Government Engineering College, Nadia, West Bengal
14. Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar, Haryana
15. MANAGE, Hyderabad
16. NARRM a-IDEA, Hyderabad
17. Sardar Vallabhbhai Patel University of

Agriculture & Technology (SVPUAT), Meerut, Uttar Pradesh

18. R.B.S. Engineering Technical Campus, Bichpuri, Agra
19. GBPUAT, Pantnagar
20. Maharashtra Animal & Fishery Sciences University (MAFSU), Nagpur
21. ITM University, Gwalior
22. Hindustan College of Science & Technology, Mathura, Uttar Pradesh
23. Sharda University, Agra, Uttar Pradesh

Collaborations with NGOs (MoUs)

ICAR-CIRG continues to collaborate with several NGOs and foundations to promote goat-based livelihood enhancement and sustainable rural development. The Institute has signed Memoranda of Understanding (MoUs) with the following organizations:

1. ICICI Foundation for Inclusive Growth, Mumbai
2. Manjari Foundation, Dholpur, Rajasthan
3. Mera Farm House (MFH), Chandigarh
4. Dalmia Bharat Foundation, GB Nagar, Noida



5. Bundelkhand Naturals, Banda
6. Tara Blooms Pvt. Ltd., Coimbatore, Tamil Nadu
7. Annasaheb Shinde Foundation, Mumbai, Maharashtra
8. Bal Raksha Bharat (Save the Children), New Delhi
9. Heifer Project International, Noida, Uttar Pradesh
10. Anitra Tech Pvt. Ltd., Hyderabad
11. Goat & Sheep Farmers Welfare Association, Madhya Pradesh (Letter of Support: Mr. Upneet Rajoria)
12. Brooke Hospital for Animals, Delhi
13. Society of Digital Entrepreneurs (SODES), Delhi
14. IG Foundation, Batadu, Rajasthan (Dr. Devaram Pawar)
15. The Goat Trust, Lucknow
16. Sustainable Agriculture Integrated Livelihood Institute, Lucknow, Uttar Pradesh
17. Ecolivelihood Creations Pvt. Ltd., Beawar, Rajasthan
18. Lupin Human Welfare and Research Foundation, Pune, Maharashtra
19. Bharat Agro Foundation, Churu, Rajasthan
20. Yuva Mitra, Nasik, Maharashtra
21. Reliance Foundation
22. Gramin Vikas Sansthan Dungurpur, Rajasthan
23. Shunya Agritech Fodder and Forage Pvt. Ltd.
24. Yuvaan Agro Farm and Research Institute, Agra
25. Girinand Agro Private Limited (GAPL)



CHAPTER 12

ICAR-CIRG IMPORTANT MEETINGS



12

ICAR-CIRG IMPORTANT MEETINGS

Prioritization, Monitoring And Evaluation Cell

Research Management and Coordination

In 2025, ICAR-CIRG effectively coordinated 42 research projects, including 13 institute-funded, 8 Institute corpus Fund and 21 externally funded. The unit ensured strategic direction and scientific oversight by organizing key meetings such as the Institute Research Committee (IRC), Research Advisory Committee (RAC), and Quinquennial Review Team (QRT).

Human Resource Development (HRD) and Training

The HRD cell focused on capacity building for staff and stakeholders through multiple training programs conducted under the Annual Training Plan (ATP). It also organized national-level trainings for farmers, rural youth, and field workers, with emphasis on goat-based technologies. All staff was encouraged to register on the iGOT Karmayogi portal for domain-specific training.

Institute Technology Management Unit (ITMU)

Functioning under the NAIF scheme, ITMU managed intellectual property rights and promoted the commercialization of innovations.

In 2025, it facilitated patent filings, technology transfers, and strengthened industry partnerships, contributing to the institute's innovation ecosystem.

Academic Activities and Collaborations

The Institute actively supported postgraduate and doctoral training programs and collaborated with universities, NGOs, and progressive farmers. These partnerships enhanced knowledge exchange and strengthened the academic-extension interface.

Research Advisory Committee (RAC)

The 31st meeting of the Research Advisory Committee (RAC) was held on 05 May 2025 in the Dr. K.P. Pant Committee Room at ICAR-Central Institute for Research on Goats (CIRG) under the chairmanship of Dr. R.K. Singh. The meeting comprehensively reviewed the Institute's research progress, evaluated ongoing scientific programmes, and provided strategic recommendations for strengthening research outcomes and institutional impact. Special emphasis was laid on biotechnological interventions, translational research, and the development of farmer-oriented goat-based technologies aimed at enhancing productivity, sustainability, and livelihood support.



The following members attended the meeting:

Composition of Committees

Research Advisory Committee (RAC), 2025

Designation	Name	Affiliation / Email
Chairman	Dr. R.K. Singh	Former Director, ICAR-IVRI; Email: rks_virology@rediffmail.com, Raj.singh@fao.org
Member	Dr. V.K. Saxena	Director (Research), BASU, Patna; Email: drbasu2017@gmail.com, visheshmeeta@gmail.com
Member	Dr. Ravindera K. Sharma	Former Director Research, LUVAS, Hisar; Email: rsharma698@gmail.com, rajks.virology@gmail.com
Member	Dr. S.K. Agarwal	Former Principal Scientist (Reproduction) & Former Director, CIRG; Email: skadr@rediffmail.com
Member	Dr. Ramachandra B.	Professor & Head, Dept. of Animal Nutrition, Veterinary College, Bidar; Email: ramsangam@rediffmail.com
Member	Dr. S. Ram Kumar	Former Dean, RIVER, Kurumbapet; Email: suku.ramkumar@gmail.com
Member	Dr. Manish Kumar Chatli	Director, ICAR-CIRG, Mathura, U.P.
Member (ICAR)	Dr. Gyanendra Kumar Gaur	ADG (AP&B), ICAR HQ, New Delhi
Member	Dr. K. Gururaj	Principal Scientist & I/c, PME Cell; Email: pmecirg@gmail.com, k.gururaj@icargmail.com
Secretary		

31st RAC Meeting Highlights



Quinquennial Review Team (QRT)

The second meeting of the Quinquennial Review Team (QRT) for the period 2019–2024 was organized at ICAR-Central Institute for Research on Goats (CIRG) on 07–08 April 2025 following the initial meeting held in October 2024. The Committee reviewed action points, evaluated ongoing research programmes, visited research divisions and laboratories, and interacted with scientists regarding technologies and products developed by the Institute.

The meeting was chaired by Dr. H. Rahman and inaugurated by Dr. Manish Kumar Chatli. Dr. K. Gururaj presented the agenda and objectives of the meeting. The final QRT review was subsequently conducted on 03 November 2025 at ICAR-Central Sheep and Wool Research Institute (CSWRI). The Committee provided recommendations to strengthen research priorities, innovation dissemination, and institutional impact in alignment with national livestock development goals.

Designation	Name	Affiliation
Chairman	Dr. H. Rahman	Former DDG (AS), ICAR & Ex-Regional Representative, ILRI
Member	Dr. S. M. K. Naqvi	Former Director, ICAR-CSWRI
Member	Dr. R. S. Gandhi	Former ADG (AP&B), ICAR
Member	Dr. Kusumakar Sharma	Former ADG (HRD), ICAR
Member	Dr. Gopal Dhinakar Raj	Former Director, TANUVAS
Member	Dr. S. M. Shivaprakash	Former Director of Extension, KVAFSU

Second QRT Meeting 7-8 April, 2025 at ICAR-CIRG



Final QRT Meeting 3 November, 2025 at ICAR-CSWRI



Submission of Final QRT report of ICAR-CIRG to Hon. Dr. M.L. Jat, DG ICAR and Sec., DARE, Govt. of India.



The final, duly signed Quinquennial Review Team (QRT) report for the period 2019–2024 was formally presented to Dr. M. L. Jat, Hon'ble Secretary, DARE and Director General, ICAR, on February 24, 2026. The presentation was conducted in the august presence of Dr. H. Rahman, Hon'ble Chairman, QRT; Dr. Manish Chatli, Director, ICAR-CIRG; and Dr. K. Gururaj, Member Secretary, QRT. Furthermore, the revised Vision and Mandate framework for the Institute, as proposed by the Committee and specifically desired by the Hon'ble DG (ICAR) & Secretary (DARE), has been successfully integrated into the final document and is detailed

below.

Institute Research Council (IRC)

The Annual Institute Research Council (IRC) meetings held during 08–09 May 2025, along with the Special IRC meeting convened on 23 July 2025 for evaluation of Project-Based Budgeting (PBB) project proposals, were chaired by the Director and coordinated by the PME Cell. The meetings reviewed scientific progress, evaluated research proposals, and aligned ongoing and proposed projects with the institutional research priorities and strategic objectives.



Institutional Meetings Held (25)

SNo.	Meeting	Chairman	Member Secretary	Date(s)	Purpose/Remarks
1.	Annual IRC	Dr. Manish Kumar Chatli	Dr. K. Gururaj	08–09 May 2025	Annual review of research projects
2.	Special IRC	Dr. Manish Kumar Chatli	Dr. K. Gururaj	3 July 2025	Evaluation of Project-Based Budgeting (PBB) project proposals
3.	Research Advisory Committee (RAC)	Dr. R.K. Singh, Former Director, ICAR-IVRI	Dr. K. Gururaj	05 May 2025	31 st RAC Meeting; project evaluation & strategy
4.	Second QRT Meeting	Dr. H. Rahman	Dr. K. Gururaj	7-8 April, 2025	Review of institutional performance (2019–24)
5.	Final QRT Meeting	Dr. H. Rahman	Dr. K. Gururaj	3 November, 2025	Review of institutional performance (2019–24)

CHAPTER 13

SHOWCASED GOAT TECHNOLOGIES AT KISAN MELA & EXHIBITIONS



13

SHOWCASED GOAT TECHNOLOGIES AT KISAN MELA & EXHIBITIONS

- ICAR-CIRG showcased ICAR-CIRG goat technologies at "कृषि मेला" RLVAUT Jhansi on 14-16 February 2025. Farmers visited CIRG stall and seen goat technologies exhibited. Technical literature on scientific goat farming was distributed to the visitors and farmers.



- ICAR-CIRG showcased CIRG goat technologies at 17th Agricultural Science Congress and Agri-Expo- GBPUAT, Pant Nagar, Udham Singh Nagar, Uttarakhand. On 20-22 February 2025. Dr. Trilochan Mahapatra Hon'ble Ex DG of ICAR visited CIRG stall and appreciated efforts being made by the institute for the upliftment of goat farmers of Uttarakhand.



- ICAR-CIRG showcased ICAR-CIRG goat technologies at "कृषि उन्नति मेला" IARI (Pusa), New Delhi on 22-24 February 2025. Farmers visited CIRG stall and seen goat technologies exhibited. Technical literature on scientific goat farming was distributed to the visitors and farmers.



- ICAR-CIRG showcased CIRG goat technologies on the occasion of ISSGPUCON-2025 on 05-07 March 2025. Dr. A. K. Gahlot, Dr. Raghvendra Bhatta, Dr. K. M. L. Pathak, Dr. G. K. Gaur, Dr. A. K. Tomar and other participant visited CIRG stall and appreciated efforts being made by the institute for the upliftment of goat farmers of India.



- ICAR-CIRG showcased CIRG goat technologies at Deen Dayal Dham on the occasion of Viksit Krishi Sankalp Abhiyan program on 05 June 2025. Smt. Hema Malini Hon'ble MLA and Brand Ambassador of CIRG visited CIRG stall and appreciated efforts being made by the institute for the upliftment of goat farmers of India.



- Showcased technologies at the 97th ICAR Foundation Day, Award Ceremony and Vikshit Krishi Exhibition at Bharat Ratna C Subramaniam Auditorium, NASC Complex, Pusa Auditorium, New Delhi.



Agricultural farms. These farmers/students also visited National Goat Fair in large numbers. Scientists explained them all the technologies/activities of the institute in the service of goat farmers.

More than 2000 students of Govt Schools and Universities visited ICAR-CIRG. Visitors were shown Institute movie, livestock units, Technology Information Center (TIC) and



ICAR-CIRG-Bakri Palan Pathshala on All India Radio (AIR)

ICAR-Central Institute for Research on Goats (ICAR-CIRG) organized the CIRG Bakri Palan Pathshala in collaboration with All India Radio (AIR) as an outreach initiative to disseminate scientific goat farming knowledge to livestock farmers. Scientists from various divisions of the institute recorded expert lessons at the All-India Radio Mathura Station, covering key aspects of scientific goat husbandry, health management,

breeding, feeding, and enterprise development. The programme was broadcast as a 10-episode series twice through four AIR stations—AIR Mathura, AIR Jhansi, AIR Varanasi, and AIR Najibabad, ensuring wide regional outreach and accessibility. The initiative witnessed enthusiastic participation from a large number of goat farmers, serving as an effective platform for technology dissemination, capacity building, and promoting improved goat production practices among rural farming communities



CHAPTER 14

OBSERVANCE CELEBRATION OF DAYS & EVENTS



14

OBSERVANCE CELEBRATION OF DAYS & EVENTS

Celebrated International Goat Day and organized Workshop on “Goat Farming: A Way Forward to Prosperity”

On the occasion of International Goat Day, a one-day workshop on “Goat Farming: A Way Forward to Prosperity” was successfully organized to highlight the socio-economic significance of goat farming as a sustainable livelihood enterprise, particularly for smallholder and marginal farmers. The event also featured an Input Distribution Ceremony under the DAPSC and DAPST programmes, aimed at strengthening

livelihood support and enhancing productive capacity among beneficiary farmers through the provision of essential goat farming inputs. The workshop served as an interactive platform for disseminating scientific knowledge on improved breeding, feeding, health management, housing, and value addition in goat farming, while emphasizing entrepreneurship development and income generation opportunities in the small ruminant sector. Hon'ble Union Minister Prof. S.P. Singh Baghel, Animal Husbandry, Fisheries and Dairy and Panchayati Raj, Government of India, New Delhi graced the occasion as Chief Guest and addressed to large number of farmers.



ICAR-Viksit Krishi Sankalp Abhiyan (VKSA)-2025

The Vikshit Krishi Sankalp Abhiyan (VKSA) was implemented by ICAR–CIRG, Makhdoom, Mathura, from 29th May to 12th June 2025, covering the districts of Mathura and Hathras. The campaign was executed through six teams each day, each comprising one scientist or technical officer, and involved a total of 270 field visits across nine tehsils and 270 villages. Approximately

30,000 farmers were directly reached during the programme through interactive visits and extension activities, and one exhibition was also organized as part of the campaign to disseminate scientific agricultural and livestock management practices. On this occasion a Kisan Gosthi and Kisan Mela was organised at Deen Dayal Dham, Nagla Chandrabhan, Chief Guest Smt Hema Malini, Member of Parliament, Mathura grace the occasion and addressed to the large number of farmers.



National Goat Summit- 2025: Organised by Heifers International with the collaboration ICAR-CIRG and GIZ

Herding Hope: National Goat Summit 2025, organized by Heifer International in collaboration with ICAR-Central Institute for Research on Goats (ICAR-CIRG) and GIZ at the India Habitat Centre, New Delhi, served as a significant national platform for deliberating on strategies to transform the goat sector into a resilient and profitable livelihood enterprise for smallholder farmers. The summit brought together policymakers, researchers, development practitioners, industry stakeholders, and farmer representatives to discuss critical challenges and opportunities in the goat value chain. Three

focused panel discussions addressed key thematic areas, including policies and financing mechanisms for smallholder goat farmers, improving access to technology, quality feed resources, and skilled veterinary and extension service delivery, and enhancing productivity through strengthened goat value chains, Farmer Producer Organizations (FPOs), and market linkages. The summit emphasized collaborative approaches for inclusive sectoral growth, improved productivity, sustainable market integration, and strengthening the economic empowerment of rural goat-rearing communities in India. Ms Alka Upadhyay Secretary DAHDF, and Dr Abhjit Mitra Animal Husbandry Commissioner were present in this programme.



Goat Conclave with Collaboration of Reliance Foundation & State Animal Husbandry, Rajasthan

The Goat Conclave on “Sustainable Goat Farming in Rajasthan: Present Status and Future Pathways”, organized by the Reliance Foundation in collaboration with ICAR-Central Institute for Research on Goats (ICAR-CIRG) and the Department of Animal Husbandry, Rajasthan, was held on 12 March 2025 at Hotel Classic Sapphire, Ajanta, Bundi, Rajasthan. The conclave served as an important platform for discussing the current status, challenges, and future opportunities for

sustainable goat farming in Rajasthan, with a focus on improving productivity, resilience, and livelihood outcomes for goat-rearing communities. The event brought together researchers, policymakers, development practitioners, and sector stakeholders to deliberate on sustainable production systems, technological interventions, and market-led growth strategies. Active participation in the panel discussion on “Breaking Barriers & Innovations in Sustainable Goat Farming” contributed to the exchange of insights on innovative approaches, institutional support mechanisms, and practical solutions for strengthening the goat sector in the region.



Pradhan Mantri Kisan Utsav Divas

ICAR-CIRG celebrated Pradhan Mantri Kisan Utsav Divas in the month of November 2026. Hon'ble Minister of State in the Ministry of Fisheries, Animal Husbandry and Dairying, Govt of India Prof S P Singh Baghel ji and Shri Sonpal



ji Director Deendayal Shodh Sansthan participated in the Live Viewing of 'Pradhan Mantri Kisan Utsav Divas' and Release of 21st Instalment of Kisan Samman Nidhi program at ICAR CIRG Makhdoom Farah Mathura. Large number of goat farmers participated in this program.



Celebration of National Farmers' Day

ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, celebrated the birth anniversary of former Prime Minister Chaudhary Charan Singh Ji as National Farmers' Day. The key highlights of the programme included: a dignified inauguration with Vande Mataram; a detailed presentation by Dr. Manish, Director of

the Institute, on the new VB-GRAM-G scheme, under which beneficiaries will now receive 125 days of guaranteed employment; Under input distribution programme of DAPSC project, blankets were given to 200 beneficiaries under the DAPSC project. The Chief Guest, Shri Sonpal Ji, Director, Deendayal Dham, appreciated the invaluable contributions of farmers to the nation's development.



National Unity Day (Rashtriya Ekta Diwas)

National Unity Day (Rashtriya Ekta Diwas) was observed at the Central Institute for Research on Goats (CIRG). The birth anniversary of the Iron Man of India, Sardar Vallabhbhai Patel, is

commemorated every year on 31st October across the country as National Unity Day to remember his invaluable contribution to the unity, integrity, and security of India. On this occasion, the institute also organized a Run for Unity and a quiz competition to mark the celebration.



Parthenium Awareness Week Observance, 2025

ICAR- CIRG, Makhdoom observed “Parthenium Awareness Week” during 16th - 22nd August, 2025 and organized number of activities. The main objective of this programme was to create awareness among the staff, nearby villagers and goat farmers about the harmful effects of parthenium and to motivate them to eradicate this noxious weed. Awareness was created by uprooting the parthenium grass from agriculture farm and different experimental sheds of the Institute. All the supporting staff of sheds and agriculture farm were

explained about the allergic effects of parthenium grass in human & animals and its allelopathic effects in crop plants. The techniques of chemical and mechanical control of parthenium grass was also demonstrated to the staff and farmers. During the observance about 180 farmers from adopted villages of DAPSC project were invited to observe the parthenium awareness week. On this occasion Dr. Manish Kumar Chatli, Director, CIRG addressed the gathering and told about the allergic effects of parthenium grass and urged all the farmers and employees to control and eradicate this harmful weed and do not allow this grass to grow in the agriculture field and near residential area.



Seed distribution programme organized

A total of 99.6 quintals of high yielding variety seed of wheat was distributed on 16th and 17th November, 2025 under Development Action Plan for Scheduled Caste (DAPSC) to 249 project beneficiaries for Rabi crop. The aim of the distribution was to increase the wheat productivity in the farmers' field and ultimately increase their income. After harvesting the crop, these beneficiaries were contacted for feedback and recording of crop yield. The beneficiaries reported 20- 25.0% increase in the productivity over local seed varieties of wheat.



Organization of Live Viewing of PM-KISAN

LIVE viewing of the 20th and 21st instalment release of PM-KISAN was organized on 02.08.2025 and 19.11.2025. This live program was attended and viewed by 250 farmers from five adopted villages of DAPSC project. The 20th instalment of the PM-KISAN scheme was officially released by Honourable Prime Minister Shri Narendra Modi in which eligible farmers received ₹2,000 directly in their bank accounts via Direct Benefit Transfer (DBT). Prof. S. P. Singh Baghel, Minister of State of Fisheries, Animal Husbandry and Dairying, Government of India was also present on this occasion.





CHAPTER 15

TRAININGS



15

TRAININGS AND SKILL DEVELOPMENT

National Training Programme (January to December 2025)

organized on Scientific Goat farming, which were attended by farmers, unemployed youth, retired professionals and entrepreneurs.

Nine (9) national training programmes were

S. No.	NTP	Date	Male	Female	Total Participants	State
1.	116	24 Feb.- 02 March 2025	104	05	109	14
2.	117	18-24 March 2025	84	04	88	10
3.	118	06-12 May 2025	56	03	59	09
4.	119	15-21 July 2025	86	07	93	12
5.	120	05-11 August 2025	64	04	68	08
6.	121	09-15 Sep. 2025	67	03	70	10
7.	122	07-13 Oct. 2025	68	02	70	12
8.	123	11-17 Nov. 2025	94	05	99	11
9.	124	02-08 Dec. 2025	59	06	65	13
Total Participant			682	39	721	



Sponsored Training Programme

Eight (8) sponsored training programmes were organized in which goat farmers from various states

were participated and learned good goat management practices

S. No.	Name Of Sponsored Agency	Date	Duration	Male	Female	Participants
1.	ATMA, Bharatpur Rajasthan	09-13 March 2025	05 Days	40	-	40
2.	ATMA, Ajmer Rajasthan	17-21 March 2025	03 Days	40	-	40
3.	DAPST and CoE Project	19-21 August 2025	3 Days	23	-	23
4.	Yuva Mitra, Nasik, MH	17-19 Sep. 2025	03 Days	18	-	18
5.	DAPST (AI Special)	14-16 October 2025	03 Days	23	02	25
6.	VIRBAC Animal Health India Pvt. Ltd.	19-21 Nov. 2025	03 Days	32	-	32
7.	ATMA, Jamui, Bihar	11-13 Dec. 2025	03 Days	20	-	20
8.	ATMA, Darbhanga, Bihar	15-19 Dec. 2025	05 Days	18	-	18
Total Participant				214	02	216

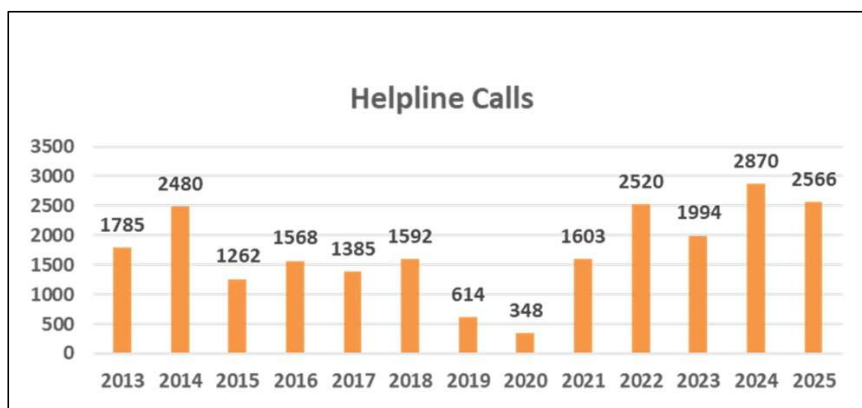


Activities at Farmers' Single Window

- In total 9192 visitors registered at ICAR-CIRG Farmers' Single Window during the reporting period.
- Large number of farmers, students, research scholars and other stakeholders visited CIRG

followed by farmers from NGOs and other line departments.

- The Institute received 2870 helpline calls. Majority of calls were pertaining to training programmes followed by animal purchase and other goat-related problems.



Capacity building through Training on Animal Cell Culture

were conducted and 41 participants were trained in this area.

04 Training Programme on Animal Cell Culture

Sr. No.	Name Of Sponsored Agency	Title of the Training Program	Date	Duration	Male	Female	Total Participants
1.	DAPSC	Animal Cell Culture Techniques” from (3 days) with 10 participants.	28 th to 30 th October, 2024	03 Days	7	3	10
2.	ICAR (NPGET Project)	Advancements in Animal Cell Culture: Techniques and Molecular Approaches	18 th to 21 st February, 2025	4 days	8	2	10
3.	ICAR (NPGET Project)	Animal Cell Culture and Molecular Tools in Assisted Reproduction:	28 th July to 01 st August, 2025	5 days	6	4	10

		From Fundamentals to Applications”					
4.	ICAR (NPGET Project)	Integrating Cell Culture, Molecular Tools, and Genome Editing for Translational Research”	27 th to 31 st October, 2025	5 days	7	3	10

Capacity Building Through Training on Semen Freezing and AI in Goat

Insemination in Goats were conducted and 140 Veterinary Officer, Para veterinarian and 12 progressive farmers were trained in this area.

06 Training Programme on Artificial

Sr. No.	Name of training	Total participants	Participants	Date of training	Type
1	Scientific goat management and Artificial Insemination in Goats	20	Veterinary Officer	05-09 May, 2025	Sponsored-AHD-Bihar
2	Hands on Training on Artificial Insemination in Goats	20	Veterinary Officer	22-24 September 2025	Sponsored-VOTI, Odisha-AHD
2	Hands on Training on Artificial Insemination in Goats	20	Veterinary Officer	04-06 October 2025	Sponsored-VOTI, Odisha-AHD
3	Hands on Training on Artificial Insemination in Goats	20	Para Veterinary Officer	27-29 October 2025	Sponsored-VOTI, Odisha-AHD
4	Training Programme on Artificial Insemination in Goats	20	Para Veterinary Officer	15-17 Nov, 2025	Sponsored-VOTI, Odisha-AHD
5	Training Programme on Artificial Insemination in Goats	20	Para Veterinary Officer	24-26 Nov, 2025	Sponsored-VOTI, Odisha-AHD
6	Training Programme on Artificial Insemination in Goats	20	Para Veterinary Officer	15-17 Nov, 2025	Sponsored-VOTI, Odisha-AHD



Internship Training

Sr. No.	Name Of Sponsored Agency/ Name of the organization	Date	Duration	Male	Female	Total Participants
1.	RGSC-BHU, Mirzapur	27.5. 2025-10.6. 2025	15 Days	-	-	6
	RGSC-BHU, Mirzapur	11.6. 2025-25.6. 2025	15 Days	-	-	6
	RGSC-BHU, Mirzapur	26.6. 2025-10.7. 2025	15 Days	-	-	6
	RGSC-BHU, Mirzapur	15.7. 2025-29.7. 2025	15 Days	-	-	6
	RGSC-BHU, Mirzapur	17.9. 2025-1.10. 2025	15 Days	-	-	6
	RGSC-BHU, Mirzapur	25.11. 2025- 9.12. 2025	15 Days	-	-	6
2.	BHU, Varanasi	14.02.2025 - 28.02.2025	15 Days	8	-	8
	BHU, Varanasi	14.02.2025 - 28.02.2025	15 Days	4	2	6
3.	IIVER, Bahu Akbarpur, Rohtak	01.05.2025 – 15.05.2025	15 Days	-	-	14
	IIVER, Bahu Akbarpur, Rohtak	01.07.2025– 15. 07.2025	15 Days	-	-	14
	IIVER, Bahu Akbarpur, Rohtak	22.07.2025– 5.08.2025	15 Days	-	-	14
	IIVER, Bahu Akbarpur, Rohtak	12.8.2025-26.08.2025	15 Days	-	-	14
	IIVER, Bahu Akbarpur, Rohtak	2.09.25– 16.09.2025	15 Days	-	-	14

Participation of Women in various event and activities organized by ICAR-CIRG during 2025

S.No.	Name of Event/Activity	Total Participants	Women Participants
1	Training Programmes	435	129
2	Input/ Material Distribution Program and Demonstration cum Exposure Visit	1535	541
3	Workshop	120	29
4	Discussions/ Kisan Gosthis	1076	644
5	Awareness Programmes	390	157
		3809	1512

A total of 3,809 participants attended various extension and outreach activities organized by ICAR-CIRG during 2025, of which 1,512 were women, representing 39.7% of the total participation.





CHAPTER 16

HUMAN RESOURCE DEVELOPMENT



16

HUMAN RESOURCE DEVELOPMENT

Table 1 : Capacity building of officers through Knowledge Exchange Programme

S.No.	Name of employee	Designation	Discipline /Section	Name of training programme attended
1	Dr. Mukesh Bhakat	PS & Head	LPM	ICMR-DHR Long Term International Fellowship from 24.06.2024 to 23.06.2025 at University of Technology, Sydney, Australia
2	Dr. Arvind Kumar	PS	FMP	DGCA-approved Remote Pilot Certificate Course conducted by Flapone Aviation Pvt. Ltd., New Delhi during 16.09.2025 to 20.09.2025
3	Dr. Nisha Bisht	Scientist	Veterinary Parasitology	114 th FOCARS at ICAR-NAARM, Hyderabad from 07.07.2025 to 16.10.2025
4	Dr. Nisha Bisht	Scientist	Veterinary Parasitology	Professional Attachment Training at NIVEDI, Bengaluru 01.12.2025 to 27.02.2026
5	Dr. Gayathri S.Lal	Scientist	LPM	115 th FOCARS at ICAR-NAARM Hyderabad from 11.08.2025 to 25.11.2025
6	Dr. Mukesh Bhakat	PS & Head	LPM	Management Development Programme on Leadership Development at ICAR-NAARM, Hyderabad from 11.12.2025 to 22.12.2025



CHAPTER 17

AGRICULTURE FARM AND AGROFORESTRY SECTION



17

AGRICULTURE FARM AND AGROFORESTRY SECTION

(Arvind Kumar, B. Rai and Sugad Singh)

Table 1: Major achievements in terms of fodder and grain/seed production and revenue generation (January to December, 2025)

Cultivation and supply of green fodder (Metric Ton)		
Through fodder crops	542.22	805.72
Through tree lopping (including Moringa)	263.50	
Production of seeds /grains (Metric Ton)		
Barley	17.37	20.40
Mustard	3.03	
Production and supply of straw (Bhoosa) (Metric Ton)		
Ragi	6.00	6.00
Agro-Forestry		
Plantation and gap filling	2,700 Nos. of plant saplings of Sahjan, Pakhar, Neem, Peepal, Bargad, Gular, Jamun, Desi babool, Sahtoot, Subabool, Sheesam, Neebu, Bel, Aam etc. were planted/gap filled in the agriculture farm area and other places of the institute. 10,000 Nos. of Napier bajra vegetative cuttings were prepared and planted in Ardu plot. 400 Nos. of plant saplings of Imali, Neem Amrood, Amla, Pakhar etc. distributed to different goat sheds.	
Plant saplings produced	Produced 12,000 Nos. of plant saplings of Sahjan, Pakhar, Neem, Bargad, Gular, Jamun, Desi babool, Sahtoot etc. in the farm nursery.	
OTHERS		
Renovation of farm land	12 Acres of unused land was developed for Agro-forestry model.	
Revenue generated	Rs. 2,20,205/- (Rs 1,54,105/- sale of mustard, Rs. 19,500/- sale of mustard straw (toori), Rs. 40,000/- sale of thatch grass and Rs 6,600/- from sale of fish)	

CROP WISE GREEN FODDER SUPPLY

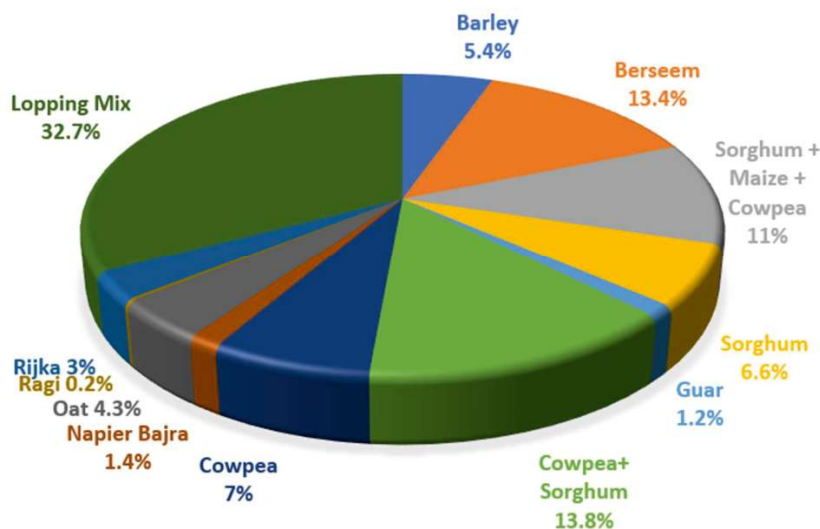


Fig. 1 : Crop wise green fodder supply to different livestock units

Table 2: Status of crops sown during January to December, 2025

SNo. Crops	Area in acres			
	Zaid	Kharif	Rabi	Total area
1. Bajra	2.00	6.00	-	8.00
2. Sorghum+ Maize+ Cowpea	3.50	-	-	3.50
3. Sorghum	2.00	1.70	-	3.70
4. Guar	-	45.10	-	45.10
5. Cowpea (Lobia)	5.70	5.00	-	10.70
6. Cowpea + Sorghum	1.70	-	-	1.70
7. Moringa Gap filling (with seeds)	-	1.00	-	1.00
8. Maize	-	2.00	-	2.00
9. Barley	-	-	62.30	62.30
10. Oats	-	-	1.50	1.50
11. Rijka	-	-	0.50	0.50
12. Berseem	-	-	3.90	3.90
13. Mustard	-	-	15.00	15.00
14. Napier Bajara	-	10.00	-	10.00
15. Taramira (Eruca sativa)	-	-	3.00	3.00
16. Wheat	-	-	1.90	1.90
17. Ragi	-	1.50	-	1.50
Total Area	14.90	72.30	88.10	175.30

Status of supply of feed grain and dry fodder (bhoosa) to different livestock units

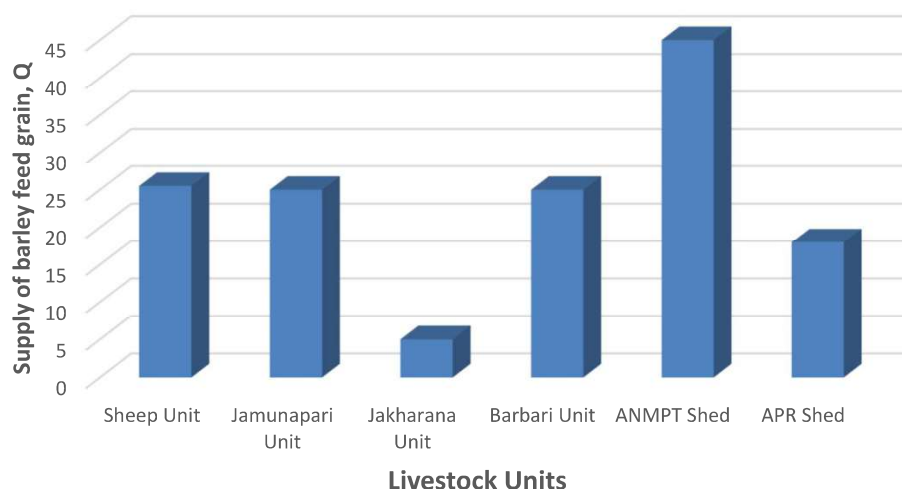
A) Feed grain

During Rabi season of reported year, barley was cultivated for grain with a total production of 17,375 kg. Out of which 14,350 kg was supplied

for feed grain purpose to different livestock units as detailed in Fig. 2 and remaining 3,025 kg was stored for seed purpose.

B) Dry fodder (Bhoosa)

About 6,000 kg of Ragi Bhoosa was produced and supplied to Animal Nutrition shed for experimental feeding under Global Centre of Excellence (CoE) on Millet project.

**Fig. 2 : Supply of Barley feed grain to different livestock units**

OTHER ACTIVITIES

- **Establishment of pasture land :** Developed and established pasture land for goat grazing in about 12 Acre area near solar plant and Ardu plot. The land was divided into sub plots by bunding for better rain water conservation and



irrigation purposes. Hybrid Napier, pakhar and other shrubs are planted and being established in the area. In the strips seasonal fodder crops like barley and some grass seeds were sown as feed resources for grazing of the goats. Fencing the area was done to safeguard against stray and wild animals.



Fig. 3 ; Establishment of pasture area in Ardu plot

- **Demonstration of natural farming unit :** Natural farming unit for fodder cultivation has been established in about one Acre land at agriculture farm. Seasonal fodder crops are cultivated in the natural farming area without using any chemical fertilizers, insecticides, pesticides and seed treatment formulations. Preparation and use of natural formulations such as jeevamrit as natural fertilizer and beejamrit for seed treatment are being followed. Other techniques such as mulching

with plant residue and intercropping of leguminous and non-leguminous fodder crops are also practiced. During the reported year several demonstrations were given on cultivation of forage crops through Natural Farming practices, preparation of jeevamrit and beejamrit. The technique of mulching and intercropping was also demonstrated and explained to the goat farmers and trainee participants.



Fig. 4 : Demonstration of natural farming techniques of fodder cultivation

- **Organization of parthenium awareness week :** Parthenium Awareness Week was organized during 16-22 August, 2025 to create awareness about the harmful effects of parthenium among the CIRG staff and farmers of nearby villages. During this organization the activities on educating the health hazards of parthenium grass and its eradication methods were conducted for the farm workers

of agriculture farm and livestock units and the farmers of nearby villages. Awareness programme was also organized for the DAPSC project beneficiaries in which they were explained about the chemical and mechanical control of parthenium grass, its effect on reduction of productivity of crops and health hazards on animals and human beings. Demonstration was also given on how to

control parthenium emerging in the agriculture land and dwelling areas. During inauguration of the programme the Director of the institute Dr. Manish Kumar Chatli explained about the

allergic effects of parthenium grass and urged the farmers and employees to eradicate this harmful weed.



Fig. 5 : Organization of parthenium awareness week 2025

- **Developmental activities at the agriculture field :** To reduce the water conveyance loss during irrigation of field crops, installation of 150 m length PVC pipe line was under taken during this period. It has reduced water conveyance loss and time required to watch the irrigation channel as in case of earthen open channels. A small fish hatchery pond was created near the main pond for fish farming. It is difficult to irrigate the undulating field, hence the bunding of washed-out cultivated field was

undertaken for better soil and water conservation. To improve the fertility level and organic content of agriculture land, 500 trolley goat manure was incorporated in the field. It has enhanced the fertility level of the soil. To enhance the fertilizer use efficiency, Nano urea and Nano DAP was used instead of granular fertilizers. Already installed drip irrigation system was made operational in about 7.0 Acres of agroforestry area for saving of irrigation water and increasing water use efficiency.



Fig. 6 : Use of drip irrigation system in agroforestry field and land development

Medicinal Garden

(Nitika Sharma, Arvind Kumar and Sugad Singh)

A Medicinal Garden has been established at the Agriculture Farm Section of ICAR-CIRG, Makhdoom for collection, documentation, and conservation of indigenous medicinal plant species of the semi-arid agro-climatic zone with ethno-veterinary significance. The garden currently maintains approximately 54 plant species, comprising 27 trees, 18 shrubs, 8 herbs, and 1 climber. The Medicinal Garden serves as a

repository for conserving traditionally used medicinal plants, promoting the productive utilization of wastelands and sandy soils for cultivating medicinal trees and shrubs, and creating awareness among farmers, students, and other stakeholders about local medicinal plants and their ethno-veterinary applications. Particular emphasis has been placed on identifying, conserving, and maintaining plant species traditionally used for the prevention and treatment of diseases in goats. Some of the important medicinal plants maintained in the

Medicinal Garden are:

Acacia nilotica (Babool), *Aloe barbadensis* (Aloe vera), *Annona squamosa* (Seethaphal), *Azadirachita indica* (Neem), *Calotropis procera* (Aak), *Casia fistula* (Amaltas), *Catharanthes roseus* (Sadabahar), *Adhatoda vasica* (Adusa), *Moringa oleifera* (Sahjan), *Murraya koenigi* (Meethi neem), *Ficus glomerata* (Gular),

Nyctanthus arbotritis (Har-Shringar), *Ocimum sanctum* (Tulsi), *Phyllanthus emblica* (Amla), *Punica granatum* (Anar), *Ricinus communis* (Arandi), *Saraca indica* (Ashok), *Syzygium cumini* (Jamun), *Terminalia arjuna* (Arjun), *Tinospora cordifolia* (Giloy, Guduchi), *Feronia limonia* (Kaith), *Terminalia bellirica* (Baheda), *Tamarindus indica* (Imli) and *Balanites aegyptiaca* (Hingota).



Fig. 7 : Plantation Drive in the Medicinal Garden



Fig. 8 : Awareness and Dissemination of Ethno-Veterinary Knowledge among Stakeholders through the Medicinal Garden



CHAPTER 18

METEOROLOGICAL REPORT



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METEOROLOGICAL REPORT

ICAR-CENTRAL INSTITUTE FOR RESEARCH ON GOATS

Meteorological Observations											
Mean Monthly Meteorological Observations (January to December 2025)											
Month	Max.	Min	Mean values at 7.30 AM			Mean values at 2.30 PM			Total monthly rainfall (mm)	Total monthly sunshine hours	Number of rainfall days
	Temp (°C)	Temp (°C)	Temp (°C)	Vapour pressure (mm Hg)	R.H (%)	Temp (°C)	Vapour pressure (mm Hg)	R.H (%)			
January	20.1	7.2	9.4	8.4	92.5	20.9	10.6	57.8	5.5	132.0	1
February	27.7	10.1	13.9	10.2	83.9	26.9	10.8	39.3	0.0	211.7	0
March	34.6	13.8	20.8	11.7	62.1	34.1	11.6	28.2	0.0	283.2	0
April	41.9	20.7	29.1	15.4	49.9	40.4	17.1	29.9	0.0	259.2	0
May	40.1	24.6	30.9	23.0	69.6	38.3	26.6	51.24	0.9	248.4	2
June	40.5	26.7	32.4	24.5	68.9	38.5	23.1	47.65	1.9	209.7	4
July	34.5	26.3	29.8	26.7	85.0	33.2	27.0	71.3	119.7	130.01	4
August	34.4	26.2	29.1	26.0	87.0	33.4	25.8	68.1	79.7	135.81	1
September	35.2	25.4	29.4	24.1	77.8	34.7	23.8	57.8	60.9	208.3	7
October	32.2	19.5	24.0	17.6	77.1	31.9	18.0	51.0	26.9	206.0	3
November	28.6	11.0	15.3	10.8	79.6	28.2	10.6	35.5	0.0	196.3	0
December	22.8	7.2	10.6	8.7	89.1	22.6	10.4	51.8	0.0	160.7	0

Maximum temperature of 49.0°C recorded on 13th June 2025

Minimum temperature of 3.0°C recorded on 28th January 2025

Annual rainfall of 385.5mm in 42 days (highest rainfall of 37.1mm recorded on 26th July 2025)

(Contributors: APR Division; Dr. Mukesh Bhakat, Dr. Y. K. Soni and Mr. Ranjeet Singh YPI)



CHAPTER 19

PARTICIPATION IN WORKSHOPS, SEMINARS, SYMPOSIA, CONFERENCE, WEBINARS AND VARIOUS OTHER ACTIVITIES



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PARTICIPATION IN WORKSHOPS, SEMINARS, SYMPOSIA, CONFERENCE, WEBINARS AND VARIOUS OTHER ACTIVITIES

- Dr. Arvind Kumar attended XXI Annual Workshop of AICRP on Plastic Engineering in Agriculture Structure and Environment Management held at ICAR-VPKAS, Almora during 30 October 2025 to 1st November 2025 and presented progress report of our Centre.
- Dr. T.P. Singh attended the XIII Conference of the Indian Meat Science Association and National Symposium on “Leveraging Frontier Technologies in the Meat Sector towards Protein Security in Viksit Bharat” during November 19-21, 2025 at ICAR-IVRI, Bareilly, Uttar Pradesh.
- Dr. T.P. Singh attended the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh.
- Dr. T.P. Singh attended the webinar on “Intellectual Property Rights for Institute Technologies” held at ICAR-CIRG, Makhdoom on May 1, 2025.
- Dr. T.P. Singh attended the brainstorming session on "Animal shelter structures and animal-base products" under AICRP on PEASEM Project in collaboration with ICAR-CIPET, Ludhiana during 21-22 July 2025 at ICAR-CIRG, Makhdoom.
- Dr. Y. K. Soni participated and presented the research abstract in “National Conference on transforming small ruminant production: empowering precision farming and genomic innovations for enhanced productivity and sustainable development”- ISSGPUCON-2025, 05-07 March, 2025 held at ICAR-CIRG, Makhdoom, Farah, Mathura (U. P.).
- Dr. Y. K. Soni participated and presented the research abstract in 40th Annual convention of ISSAR and International Symposium on “Animal Reproduction in a Changing World: Addressing Challenges & Embracing Opportunities”- ISSARCON-2025, 10-12 December, 2025 held at RIVER, Puducherry.
- Dr. Nitika Sharma attended Seventh International Conference in Hybrid Mode on Innovative and Current Advances in Agriculture and Allied Sciences ICAAAS-2025 from 15-16 December, 2025 organised by SSDA&T.
- Dr. Nitika Sharma attended National on-line seminar on "Sustainable ethnoveterinary approach for mitigating antimicrobial resistance" on 22nd November, 2025.
- Dr. Nitika Sharma attended webinar on “Intellectual Property Rights for Institute Technologies” held at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on May 1, 2025.
- Dr. Nitika Sharma attended Nutrition-Health Synergy for Sustainable Small Ruminant Productivity” held at ICAR-Central Institute for Research on Goats, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on July 11, 2025.
- Dr. Nitika Sharma delivered a Radio talk on Bakriyon ke sankramak rog bachav aur tikaran in Radio Krishi Pathshaala Programme.
- Dr. Nitika Sharma delivered a Radio talk on Navjaat Memnon mein swasthay prabhandhan evam bakriyon ke garelu upachar (ethno-veterinary practices) in Radio Krishi Pathshaala Programme.
- Dr Ravindra Kumar attended 21st Biennial Animal Nutrition Society of India (ANSI), International Conference on “Global Resilience in Animal Nutrition: Innovations for Sustainable future” organized at ANDUAT, Kumarganj, Ayodhya from 19-21 November 2025.
- Dr Ravindra Kumar attended 9th International Greenhouse Gas and Animal Agriculture Conference 2025 (9th GGAA 2025) held at

Nairobi, Kenya from 5-9 October 2025.

- Dr. T.P. Singh acted as an external examiner to conduct annual practical examination-2024 of B.V.Sc. & A.H. (3rd year) students for the course of Livestock Products Technology at MGVC, Bharatpur from Feb 27-28 & March 01, 2025.
- Dr. T.P. Singh acted as “rapporteur” in XIII Conference of the Indian Meat Science Association and National Symposium on “Leveraging Frontier Technologies in the Meat Sector towards Protein Security in Viksit Bharat” during November 19-21, 2025 at ICAR-IVRI, Bareilly, Uttar Pradesh.
- Dr. T.P. Singh acted as a "Judge" in Hindi Pakhwara-2025 competition organised from Sept 16-30, 2025 at ICAR-CIRG, Makhdoom.
- Dr. T.P. Singh acted as a “Member of Journal of Meat Science” published by Indian Meat Science Association, Hyderabad.
- Dr. T.P. Singh served as an ISO Internal Auditor at the Institute during the year ensuring compliance with ISO 9001:2015 certification.
- Dr. T.P. Singh served as a Hindi cell in-charge, and tried to promote the use of Hindi in official communications, conducted workshops and Hindi Pakhwara, and ensured compliance with language policies.
- Dr. T.P. Singh acted as a HRD in-charge, coordinated and monitored all the activities related with HRD and also Coordinated Karmayogi program.
- Dr. T.P. Singh exhibited the Institute Technologies in the “ICAR Foundation Day” on July 16, 2025 at NAS complex, New Delhi.
- Dr. T.P. Singh exhibited the Institute Technologies in the 'कृषि एवं ग्राम विकास प्रदर्शनी' from September 18-21, 2025 at दीनदयाल धाम, फरह, मथुरा
- Dr. T.P. Singh guided Ms. Prachi Kumari, BSc. Food Nutrition and Dietetics, School of Health Sciences and Technology, UPES, Dehradun for 01 Month in the area of Insights into nutritional value, perception of goat meat: A questionnaire-based report.
- Dr. T.P. Singh guided Ms. Vaishnavi Dixit,

BSc. Food Nutrition and Dietetics, School of Health Sciences and Technology, UPES, Dehradun for 01 Month in the area of Assessment of goat milk perception and market dynamics in selected region of India”.

- Dr. T.P. Singh enrolled as a Faculty in the Department of Livestock Products Technology (LPT) and taught the course “Processing of Milk and Milk Products” to M.V.Sc. students of ICAR–IVRI, Bareilly.
- Dr. T.P. Singh enrolled as a Faculty in the Department of Livestock Products Technology (LPT) and taught the course “Egg and egg products Technology” to M.V.Sc. students of ICAR–IVRI, Bareilly.
- Dr. T.P. Singh enrolled as a Faculty in the Department of Livestock Products Technology (LPT) and taught the course “Current trends in processing of milk and milk products” to Ph.D. students of ICAR–IVRI, Bareilly.
- Dr. T.P. Singh participated as a “Resource Person” at the Outreach Campaign under the “Viksit Krishi Sankalp Abhiyan” (VKSA) on May 31, June 6, June 7 & June 10, 2025 covering 6 villages in Hathras district and 6 villages in Mathura district, Uttar Pradesh.
- Dr. Mukesh Bhakat has acted as a mentor and scientist In-charge of the orientation training of Dr. G.S. Lal, scientist, LPM, Animal Physiology and Reproduction Division, during 07.07.2025 to 07.08.2025.
- Dr. K. Gururaj has acted as a mentor and scientist In-charge of the orientation training of Dr. Nisha Bisht, scientist, Veterinary Parasitology, Animal Health Division, during November 2025
- Dr Anil Kumar Mishra served as an expert evaluator for four R & D proposals submitted to the Council of Science & Technology, Uttar Pradesh, in May 2025.
- Dr Anil Kumar Mishra delivered the radio talk on “नवजात भेड़ों में स्वास्थ्य प्रबंधन एवं बकरियों के घरेलू उपचार” at All India Radio, Mathura, Uttar Pradesh (India) on 09-07-2025.
- Dr Anil Kumar Mishra acted as Rapporteur during the Panel Discussion of the National Seminar on “Nutrition-Health Synergy for Sustainable Small Ruminant Productivity”

held at ICAR-Central Institute for Research on Goats, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on July 11, 2025.

- Dr Anil Kumar Mishra Acted as Judge for “प्रश्न मंच प्रतियोगिता” held at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on 22-09-2025.
- Dr Anil Kumar Mishra acted as a Judge for the quiz competition titled “Act Now: Protect Our Present, Secure Our Future” conducted as part of the World Antimicrobial Awareness Week (WAAW 2025) celebrations at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India), from 18–24 November 2025.
- Dr Anil Kumar Mishra acted as reviewer of the manuscript entitled “*Prosopis juliflora* leaves extract disrupts cell wall and cell membrane of *E. coli* isolated from uterine infections in bovines to exerts its bactericidal action” submitted to Exploratory Animal and Medical Research in April, 2025.
- Dr Anil Kumar Mishra acted as reviewer of the manuscript (TROP-D-25-00396) for Tropical Animal Health and Production in April, 2025.
- Dr Anil Kumar Mishra acted as reviewer of the manuscript (FOLM-D-25-00392) entitled “Isolation, molecular characterization and optimization of commercially important bacterial pectinase enzyme from agro-industrial waste” submitted to Folia Microbiologica in August, 2025.
- Dr Anil Kumar Mishra taught the course “General Bacteriology” (VMC 501, Credit Hours: 2+1) to MVSc students of ICAR-IVRI, Izatnagar, Bareilly, Uttar Pradesh, India.
- Dr Anil Kumar Mishra taught the course “Systemic Bacteriology” (VMC 502, Credit Hours: 2+1) to MVSc students of ICAR-IVRI, Izatnagar, Bareilly, Uttar Pradesh, India.
- Dr Anil Kumar Mishra co-organized webinar on “Intellectual Property Rights for Institute Technologies” held at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on May 1, 2025.
- Dr Anil Kumar Mishra co-organized Awareness Programme on “World Antimicrobial Awareness Week (WAAW-2025)” at the ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India)

during 18–24 November 2025.

- Dr Anil Kumar Mishra acted as Coordinator of the National Training Programme on 'Scientific Goat Farming' held on Sept 9-15, 2025 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India).
- Dr Anil Kumar Mishra acted as Coordinator of the National Training Programme on 'Scientific Goat Farming' held on Nov 11-17, 2025 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India).
- Dr Anil Kumar Mishra acted as Knowledge Disseminator/Resource Person at the Outreach Campaign under the Viksit Krishi Sankalp Abhiyan (VKSA) on May 31, June 4, June 5 & June 8, 2025 covering 3 villages in Hathras district and 9 villages in Mathura district, Uttar Pradesh (India).
- Dr Anil Kumar Mishra acted as Knowledge Disseminator/Resource Person at ICAR-CIRG Stall in the 'Agriculture and Village Development Exhibition' organized by Deendayal Dham on 21-09-25 at Deendayal Dham, Farah, Mathura, Uttar Pradesh (India).
- Dr Anil Kumar Mishra coordinated the Internship Programme of Group A of BVSc & AH students of RGSC-BHU, Mirzapur, Uttar Pradesh (India) from 26-06-2025 to 10-07-2025 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India).
- Dr Anil Kumar Mishra coordinated the Internship Programme of Group E of BVSc & AH students of International Institute of Veterinary Education & Research, Bahu Akbarpur, Rohtak, Haryana (India) on 2 Sep–16 Sep 2025 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India).
- Dr. G S Lal Organised a one-day village seminar that was successfully conducted on 13th October 2025 at Ratatal village, Bhopal, under the guidance and coordination of KVK, Bhopal, part of the FET- 115 FOCARS.
- Dr. T.P. Singh सह समन्वयक-उत्तर प्रदेश में पायी जाने वाली बकरी का सतत आनुवंशिकी सुधार एवं संरक्षण पर प्रायोजित प्रशिक्षण कार्यक्रम, 29-30 Jan, 2025.
- Dr. T.P. Singh सह समन्वयक-उत्तर प्रदेश में पायी जाने वाली बकरी का सतत आनुवंशिकी सुधार एवं संरक्षण पर प्रायोजित प्रशिक्षण कार्यक्रम, 27-28 Jan, 2025.

- Dr. T.P. Singh acted as “Moderator” in the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom. Mathura, Uttar Pradesh.
- Dr. T.P. Singh acted as “Technical secretary” in the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom. Mathura, Uttar Pradesh.
- Dr. T.P. Singh acted as Co-Organizing secretary for a brainstorming session on "Animal shelter structures and animal-base products" under AICRP on PEASEM Project in collaboration with ICAR-CIPET, Ludhiana during 21-22 July 2025.
- Dr. T.P. Singh acted as Organizing secretary for Institute foundation day-2025 on July 12, 2025 at ICAR-CIRG, Makhdoom.
- Dr. T.P. Singh acted as Coordinator for 120th National Training Programme on “Scientific goat farming” from Aug 05-11, 2025 at ICAR-CIRG, Makhdoom, Farah, Mathura, U.P.
- Dr. T.P. Singh acted as Coordinator for 124th National Training Programme on “Scientific goat farming” from Dec 02-08, 2025 at ICAR-CIRG, Makhdoom, Farah, Mathura, U.P.
- Dr. T.P. Singh acted as Co-Organizing secretary for a webinar on “Intellectual Property Rights for Institute Technologies” held at ICAR-CIRG, Makhdoom on May 1, 2025.
- Dr. T.P. Singh acted as Coordinator for conduction of Internship program (August 12-26, 2025) in the Institute for final year B.V.Sc & A.H. students of IIVER, Rohtak.
- Dr. T.P. Singh acted as Coordinator for conduction of Internship program (Nov 25-Dec 09, 2025) in the Institute for final year B.V.Sc & A.H. students of FVAS, RGSC, BHU, Varanasi.
- Dr. Nitika Sharma, Dr K.Gururaj and Dr A.K. Dixit attended a Disease Investigation cum health camp at Kherali, Alwar, Rajasthan, on 6 December, 2025 where advisory services on flea control in goats were also provided to goat keepers.
- Dr. Nitika Sharma coordinated Seven days 124th National Training Programme on "Scientific Goat Farming" 63 Farmers from 02-08 December, 2025 at ICAR- CIRG, Makhdoom.
- Dr. Nitika Sharma coordinated the Training Programme cum input distribution program under DAPSC project for 80 SC from 16-20 march, 2026 at ICAR- CIRG, Makhdoom.
- Dr. Nitika Sharma coordinated the Sponsored Training Programme on scientific Goat farming for 20 farmers of the East Chamaparan, Motihari, Bihar from 20-24 January, 2026 sponsored by NGO AATMA at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP). (4 Days).
- Dr. Nitika Sharma coordinated the Internship Programme of Batch-II of BVSc & AH students of IIVER Rohtak from 05-20 July 2025 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP). (15 Days).
- Dr. Nitika Sharma coordinated the Internship Programme of Group C (2020-21) of BVSc & AH students of Veterinary College RGSC, Banaras Hindu University (BHU), Barkachha, Mirzapur, Uttar Pradesh from 27 May-10 June, 2025 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP). (15 Days).
- Dr. A.K. Verma acted as Coordinator, Internship programme “Goat breeding, nutritional, reproductive and health management of goats, and value addition of the products” of BVSc & AH students from BHU, Varanasi, January 11-25, 2025.
- Dr. A.K. Verma acted as Coordinator, Internship programme “Goat breeding, nutritional, reproductive and health management of goats, and value addition of the products” of BVSc & AH students from IIVER, Rohtak, July 22-August 05, 2025.
- Mr. Manish Kushwah, YP-I, AINP-CEDA Project (Goat & Sheep Mycoplasmosis) presented the paper (oral) on 'Molecular detection of Mycoplasma infections in goats & sheep' in the International Conference on “Advancement of Science and Technology for Environment, Society and People” organized by Society for Technology, Environment,

Science & People, Kozhikode, Kerala (India) on June 27-28, 2025.

- Mr. Manish Kushwah, YP-I, AINP-CEDA Project (Goat & Sheep Mycoplasmosis) presented the paper (oral) on 'Seroprevalence of Mycoplasmosis in Goats' in the International Conference on "Recent Technologies and Interventions for Drug and Vaccine Development" organized by Department of Biotechnology, GLA University, Mathura, Uttar Pradesh (India) on July 7-8, 2025.
- Mr. Ashish Kumar Churamani, JRA, UP-CST Project presented the paper (oral) on 'Antibiogram profiles of Staphylococcus aureus and Escherichia coli isolates of animal' in the International Conference on "Advancement of Science and Technology for Environment, Society and People" organized by Society for Technology, Environment, Science & People, Kozhikode, Kerala (India) on June 27-28, 2025.
- Mr. Ashish Kumar Churamani (Junior Research Assistant) presented the oral paper on "Morbidity due to caprine pneumonia in Jamunapari, Barbari, and Jakhrana goat breeds reared under semi-intensive farming system" in the International Conference on "Advancement of Science and Technology for Environment, Society and People" organized by Society for Technology, Environment, Science & People, Kozhikode, Kerala (India) on June 27-28, 2025. Abstract, pp. 4-5.
- Mr. Ashish Kumar Churamani (Junior Research Assistant) presented the oral paper on "Epidemiological insights into pneumonia-associated mortality in Barbari, Jakhrana, and Jamunapari goats" in the International Conference on "Recent Technologies and Interventions for Drug and Vaccine Development" organized by Department of Biotechnology, GLA University, Mathura, Uttar Pradesh (India) on July 7-8, 2025.
- Mr. Ashish Kumar Churamani (Junior Research Assistant) presented the oral paper on "Fifteen-year retrospective analysis of pneumonia-associated morbidity and mortality in milking and pregnant goats at organized farms" presented at the 7th International Conference on Advancement of Science and Technology for Environment,

Society and People (ICASTESP-VII) organized by the Society for Technology, Environment, Science & People, Kozhikode, Kerala (India), held during December 19–20, 2025.

- Mr. Manish Kumar (Young Professional) presented the oral paper on "Antimicrobial sensitivity profile of bacterial isolates recovered from caprine pneumonia" presented at the 7th International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-VII) organized by the Society for Technology, Environment, Science & People, Kozhikode, Kerala (India), held during December 19–20, 2025.
- Dr. T.P. Singh presented Poster presentation on "Culture viability, fatty acids, amino acid composition and qualities of fermented milk-millet fusion beverages during storage" In the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom. Mathura, Uttar Pradesh.
- Dr. T.P. Singh presented Oral presentation "Oxidative stability and culture viability of goat frozen yoghurt during extended storage" in the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom. Mathura, Uttar Pradesh.



CHAPTER 20

AWARDS



20 AWARDS

Awards/ Recognition/ Prizes/ Honours

1. Dr. A. K. Dixit received the Executive Committee of Society of Extension Education confers its SEE Fellow Award for notable contribution to Academics, Research and Extension Education.



2. Dr. A. K. Dixit received the Team Award-Extension Education and Socio-Economics Section received Best Section Award of ICAR-CIRG foundation day.



3. Dr. A. K. Dixit received the Team Award-Janjatiya Bakri Palak Sewa Samman from



Manjari Foundation for collective efforts towards improving the lives and livelihoods of ST goat farmers.

4. Dr. A. K. Dixit received the Certificate of Appreciation received in Nirmatee Progame at Dhaulpur, Rajasthan.



5. Dr. A. K. Dixit received the Certificate of Appreciation from the CEO Yuwan Agro, Agra



6. Dr. A. K. Dixit received the Certificate of Appreciation from Yuwa Mitra, Nashik Maharashtra for support in shaping livelihood development of goat farmers.



7. Dr. S. P. Singh received the Prof. M. N. Razdan Memorial Mid-Career Award by the Society of Animal Physiologists of India (SAPI), 2025.



8. Dr. S. P. Singh Received Best Oral Presentation Award during International Symposium and XXXIII Annual Conference of Society of Animal Physiologists of India (SAPICON 2025) organized at Department of Veterinary Physiology, Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry from February 25 - 27, 2026.



9. Dr. Mukesh Bhakat Received Second Best Research Article in the category of "Dairy Economics, Extension and Management" for the year 2025 for research paper entitled "Adaptation strategies to climate change followed by the Murrah Buffalo farmers of Haryana" by



Manjunath KV, Sanjit Maiti, Sanchita Garai, D Anilkumar Reddy, Siddesh Zade, Gautam Mondal, Mukesh Bhakat and Anjali Aggarwal, published in the Indian Journal of Dairy Science.

10. Dr. Mukesh Bhakat received the Second Best Presentation Award for Hindi Shodh Patra Pratiyogita at ICAR-CIRG entitled "तस्वीर के आधार पर बकरी का वजन अनुमान".

11. Dr. Mukesh Bhakat received the Best Division Award as the Head of APR Division at ICAR-CIRG on the foundation day, along with the divisional scientists Dr. Ravi Ranjan, Dr. Gayathri S Lal, Dr. S. P. Singh and Dr. Y. K. Soni.



12. Dr. Mukesh Bhakat received ICMR-DHR Long Term International Fellowship for training at the School of Biomedical Engineering, University of Technology, Sydney, Australia, from 24.06.2024 to 23.06.2025.

13. Dr. Mukesh Bhakat was the Chairman, Technical session III, Sub-Theme: Multidisciplinary approaches for enhancing sustainability in livestock production in International Conference cum Workshop on "Climate Resilient Livestock Production: Emerging Concepts and Technologies for Sustenance" scheduled to be held on 23rd-24th November, 2025 at ICAR-NIANP, Bengaluru; during November, 23 to 24, 2025.

14. Dr. Mukesh Bhakat was Nominated as Chairman of Editorial Committees for printing of Annual Report-2025 in English & Hindi (combined).

15. Dr. Mukesh Bhakat was the Member of the Editorial Committee of the Hindi Newsletter (Ajamukh).

16. Dr. Mukesh Bhakat was Nominated as expert to provide technical guidance, scientific inputs and advisory support to Krishi Vigyan Kendra (KVK), Anta, Baran, Rajasthan for implementation of the goat-based integrated farming demonstration unit and farmer capacity building programme.

17. Dr. Mukesh Bhakat Acted as expert for Revolving Fund Projects Review Meeting, UPCAR on September 26, 2025.

18. Dr. Mukesh Bhakat was Nominated as expert

in UP State Workshop on “Transforming Food, Land, and Water (FLW) Systems to Combat the Climate Crisis” organized by ICAR–Indian Institute of Farming Systems Research, Modipuram, Meerut on August 13, 2025

19. Dr. Mukesh Bhakat Presented expert lecture as resource person on Assisted Reproduction Technologies vis-à-vis behavioural and welfare needs of breeding farm animals in one week national training programme on “Recent advances to alleviate farm animal welfare issues for enhancing productivity in intensive farming systems” held at LPM Department, CVS, Rampur Phul (Bathinda, GADVASU from 4 to 10 October, 2025.

20. Dr. Ravi Ranjan Received NAVS Associate Fellow Award during XXII NAVS Convocation Cum National Scientific Convention on “Challenges and Priorities for Optimal Production of Livestock, Poultry, Healthcare and



Nutrition of Pets” from 8-9 March, 2025 at Veterinary College, Hebbal, Bengaluru Karnataka Veterinary Animal and Fisheries Sciences University, India.

21. Dr. Ravi Ranjan Received Best Scientist Award by ICAR-CIRG, Makhdoom 2025.

22. Dr. Ravi Ranjan Received Best oral presentation Award for Kumar M and Ranjan R. Tribulus terrestris Extract Enhances Post-Thaw Sperm Quality and Antioxidant Status in Goat. ISSGPUCON-2025 National conference held at ICAR-CIRG, Makhdoom on 5-7 March 2025.

23. Dr. Ravi Ranjan Received Lead Paper Presentation Award- Ranjan R, Kumar M and Chatli M. K. Status of artificial insemination in goats: Indian perspective. ISSGPUCON-2025 National conference held at ICAR-CIRG, Makhdoom on 5-7 March 2025.

24. Dr. Ravi Ranjan Received Janjatiya Bakari Palak Sewa Samman under DAPST Project activities in tribal area.

25. Dr. Ravi Ranjan Received Guest of Honour in MPSO-2026, Bhubaneswar, Odisha

26. Dr. Ravi Ranjan Received Guest of Honour in One day Workshop-Climate-friendly goat farming and management, Patna, Bihar.

27. Dr. Ravi Ranjan Received Guest of Honour Technology Awareness Day- DUVASU, Mathura

28. Dr. M K Singh received appreciation Award (Best farm management and development) for Barbari Goat Breed Farm Complex 2025.

29. Dr. Gopal Dass (2025) as Organizing Secretary organized National Conference on precision farming and genomic innovations for enhanced productivity and sustainable development, (ISSGPUCON), at Makhdoom from 05-07 March.

30. Dr. A.K. Verma received the Associate Fellowship from the National Academy of Veterinary Sciences (NAVS), India, for the year 2024.

31. Dr. T. P. Singh received Best Poster Presentation award in the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom. Mathura, Uttar

Pradesh.

32. Dr. T. P. Singh received Best Oral presentation award in the National conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, March 05-07, 2025, at ICAR-CIRG, Makhdoom. Mathura, Uttar Pradesh.

33. Dr. T. P. Singh received Best Research Publication Award-2025 on Institute foundation day-2025 on July 12, 2025 at ICAR-CIRG, Makhdoom.

34. Dr. T. P. Singh received the 3rd position award in “Hindi Shodh Pratiyogita” during Hindi Pakhwara-2025 from September 16-30, 2025 at ICAR-CIRG, Makhdoom.

35. Dr. T. P. Singh received the 2nd position for publishing book chapter प्रयोगशाला जनित मांस: भविष्य का भोजन. In अर्पिष राजभाषा पुस्तिका (3rd Edn), Published by Director, ICAR-NMRI, Hyderabad (500076), Telangana. Pp: 53-60. ISBN- 978-93-5913-497-0.

36. Dr. K. Gururaj received the certificate of appreciation for the recognition and valuable contribution as a resource person in seven days Hand-on training on 'Advanced recombinant protein bioprocessing' organized by Dept. of Veterinary Microbiology, College of Veterinary science and Animal Husbandry, DUVASU, Mathura, from 3-9 Jan 2026

37. Dr. K. Gururaj, received the 'Award of recognition' for acting as Organizing secretary for the ISSGPU one day seminar on 'Nutrition -health Synergy for sustainable small ruminant productivity' which was held at ICAR-CIRG on 11 July 2025

38. Dr. K. Gururaj, received the 'Certificate of recognition' for acting as Moderator during the panel discussion of the ISSGPU one day seminar on 'Nutrition -health Synergy for sustainable small ruminant productivity' which was held at ICAR-CIRG on 11 July 2025

39. Dr. K. Gururaj, Principal Scientist at ICAR-CIRG, was honored with the 'Award of Recognition' for his distinguished leadership as Organizing Secretary for the successful execution of the National Conference of the Indian Society for Sheep and Goat Production and Utilization

ISSGPUCON 2025 titled “Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development”, held at ICAR-Central Institute for Research on Goats, Makhdoom, from March 5–7, 2025.

40. Dr. K. Gururaj has been invited as an expert resource person for an ICAR-sponsored 10-day short course on “Physiological and Genomic Approaches to Climate Resilience in Farm Animals” and delivered a lecture titled “Climate-change Driven Alterations in Host–Microbiome Interactions and Livestock Disease Dynamics” on February 13, 2026, organized by the Department of Veterinary Physiology, College of Veterinary Science & Animal Husbandry, DUVASU, Mathura (U.P.) 281001

41. Dr. K. Gururaj has been invited as an expert resource person for an UPCAR-sponsored 10-day short course on “Integrating Molecular and Advanced Clinical Diagnostic Tools for Early Detection and Control of Emerging Animal Diseases in a Globalized World” and delivered a lecture titled “Antimicrobial Resistance (AMR): Mechanisms, Detection, and Global Impact” on November 13, 2025, organized by the Department of Veterinary Clinical Complex, College of Veterinary Science & Animal Husbandry, DUVASU, Mathura (U.P.) 281001

42. Dr. K. Gururaj has served as the Nodal Officer and Management Representative for the implementation and attainment of ISO 9001:2015 for Research & Development and Capacity Building aimed at enhancing Goat Productivity, as per ICA/QMS/C25/4895 registration date. Accredited by UAF, USA, through M/s Saara Management System Pvt Ltd on March 19, 2025.

43. Dr. Anil Kumar Mishra received “Appreciation Award” from the Director of ICAR–Central Institute for Research on Goats (ICAR-CIRG), Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on the occasion of the Pearl (46th) ICAR-CIRG Foundation Day and the 1st National Goat Day (July 12, 2025).

44. Mr. Manish Kushwah, YP-I, AINP-CEDA Project (Goat & Sheep Mycoplasmosis) received certificate of appreciation for outstanding poster presentation titled 'Seroprevalence of Mycoplasmosis in Goats' in the International Conference on “Recent Technologies and Interventions for Drug and Vaccine

Development” organized by Department of Biotechnology, GLA University, Mathura, Uttar Pradesh (India) on July 7-8, 2025.

45. Mr. Manish Kushwah, YP-I, AINP-CEDA Project (Goat & Sheep Mycoplasmosis) received 'First Best Oral Presentation Award' on 'Molecular detection of Mycoplasma infections in goats & sheep' in the International Conference on “Advancement of Science and Technology for Environment, Society and People” organized by Society for Technology, Environment, Science & People, Kozhikode, Kerala (India) on June 27-28, 2025.

46. Mr. Ashish Kumar Churamani, JRA, UP-CST Project received 'Second Best Oral Presentation Award' on 'Antibiogram profiles of Staphylococcus aureus and Escherichia coli isolates of animal' in the International Conference on “Advancement of Science and Technology for Environment, Society and People” organized by Society for Technology, Environment, Science & People, Kozhikode, Kerala (India) on June 27-28, 2025.

47. Mr. Manish Kumar (Young Professional) received 'Best Oral Presentation Award (First)' for the oral paper entitled “Antimicrobial sensitivity profile of bacterial isolates recovered from caprine pneumonia” presented at the 7th International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-VII) organized by the Society for Technology, Environment, Science & People, Kozhikode, Kerala (India), held during December 19–20, 2025.

48. Mr. Ashish Kumar Churamani (Junior Research Assistant) received 'Best Oral Presentation Award (First)' for the oral paper entitled “Fifteen-year retrospective analysis of pneumonia-associated morbidity and mortality in milking and pregnant goats at organized farms” presented at the 7th International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-VII) organized by the Society for Technology, Environment, Science & People, Kozhikode, Kerala (India), held during December 19–20, 2025.

49. Dr. Aravind Kumar received first prize in the competition of “Research Paper presentation in Hindi” during celebration of Hindi Pakhawada (16-30 September 2025) at ICAR- CIRG,

Makhdoom.

50. Dr. Gayathri S Lal received Certificate with A Grade for successful completion of Foundation Course 2025, comprising Foundation Training (three months), Orientation Training (one month) and Professional Attachment Training (three months)- Part of 115 FOCARS batch- ARS probationer-ICAR-NAARM, Hyderabad.

51. Dr. Y. K. Soni received First Oral Presentation Award for the paper Laparoscopic Ovum Pick-Up response in goats following hormonal pre-stimulation during 40th Annual convention of ISSAR and International Symposium, ISSARCON-2025, 10-12 December, 2025 held at RIVER, Puducherry.

52. Dr. Y. K. Soni received Second Best Oral Presentation Award for the Paper; Effect of single versus multiple dosage of FSH-P on Laparoscopic Ovum Pick-Up (LOPU) in Goats during ISSGPUCON 2025 held at ICAR-CIRG, Makhdoom, 05-07 March, 2025.

53. Dr. Y. K. Soni received Certificate of appreciation from the Director, ICAR-CSWRI. For lecture delivered during a training program on 20th November 2025 (Thursday) during the Winter School on "Biotechnological protocols in Augmenting Small Ruminant production".

54. Dr. Y. K. Soni received Certificate of appreciation from the Dean, COVAS Datia, RLBCAU, Jhansi. Expert speaker to deliver guest lecture in Certificate Course on "Commercial Goat Farming" organized from 17th September to 16th October, 2025, at the College of Veterinary and Animal Sciences, Nauner, Datia (M.P.).

55. Dr. Y. K. Soni Invited as guest speaker for delivering the two lectures on "Reproduction management in goat" and "estrus synchronization and AI in goats" during six days training (offline) programme on EDP Training cum Workshop on "Profitable Goat Farming for aspiring entrepreneurs, FPOs and Farmers organized by ABIC, ICAR-IGFRI Jhansi from 22-27 Sept. 2025.

56. Dr Nitika Sharma received Fellow Award in the Seventh International Conference in Hybrid Mode on Innovative and Current Advances in Agriculture and Allied Sciences ICAAAS-2025 from 15-16 December, 2025 organised by SSDA&T.

57. Dr Nitika Sharma received Best Oral

Presentation Award for presentation of abstract: Nitika Sharma, Ashok Kumar, A. K. Mishra, Anu Rahal, K. Gururaj, M.K.Singh, Vinay Chaturvedi and T.K. Gautam. 2025. Urolithiasis in Barbari goats. In: Souvenir and conference book of ISSGPUCON-2025 on "Transforming small ruminant production empowering precision farming and genomic innovations for enhanced productivity and sustainable development" organized by ISSGPU Society at ICAR-CIRG, Makhdoom, Mathura on 3-5 March, 2025, pp234.

58. Dr. Nitika Sharma received Janjatiys Bakri Palak Sewa Samman as a member of DAPSTC team from Manjari Foundation on 12 July, 2025 ICAR-CIRG foundation Day.

59. Dr Nitika Sharma acted as Rapporteur during the Panel Discussion of the National Seminar on "Nutrition-Health Synergy for Sustainable Small Ruminant Productivity" held at ICAR-Central Institute for Research on Goats, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India) on July 11, 2025.

60. Dr Nitika Sharma is nominated as External Expert for Institutional Biosafety Committee of DUVASU, Mathura.

61. Dr Nitika Sharma was nominated as External Member WGC/POSCH (Women Grievance Committee) DUVASU, Mathura.

62. Dr Nitika Sharma (Senior Scientist, Animal Health Division) acted as an external examiner for the MVSc thesis on-line viva-voce examination of Miss Disha Sanwal enrolled at RAJUVAS Bikaner, Rajasthan (India) on 28 March, 2025.

63. Dr Nitika Sharma (Senior Scientist, Animal Health Division) acted as an external examiner for the MVSc thesis viva-voce examination of Dr Nisha Chaudhary (Enrolment Number: V-1789/17) at DUVASU, Mathura, Uttar Pradesh (India) on 23 January, 2025.

64. Dr Nitika Sharma acted as Moderator Secretary in ISSGPUCON-2025 on "Transforming small ruminant production empowering precision farming and genomic innovations for enhanced productivity and sustainable development" in Technical Session Goat Health organized by ISSGPU Society at ICAR-CIRG, Makhdoom, Mathura on 3-5 March, 2025.

65. Dr Nitika Sharma acted as Technical Secretary in ISSGPUCON-2025 on

“Transforming small ruminant production empowering precision farming and genomic innovations for enhanced productivity and sustainable development” in Technical Session Goat Nutrition organized by ISSGPU Society at ICAR-CIRG, Makhdoom, Mathura on 3-5 March, 2025.

66. Dr Nitika Sharma acted as Course Instructor for the course: Prevention and Control of Infectious Diseases of Ruminants (VMD 615) Credit Hours: 2+0 and VMD 501 ruminant Medicine Credit Hours: (3+0); PhD course: "Dermatology and Endocrinology (VMD-609)" Credit Hours: (1+0) as Inducted Faculty Member of ICAR-IVRI.

67. Dr Nitika Sharma acted as Knowledge Disseminator/Resource Person at the Outreach Campaign under the Viksit Krishi Sankalp Abhiyan (VKSA) on May-June, 2025 covering 12 villages in Mathura district, Uttar Pradesh (India).

68. Dr. R. Kumar received the Highest Cumulative NAAS Score Award (2024-25) on the occasion of the ICAR-CIRG, Institute Foundation Day, 2025.

69. Dr. R. Kumar chaired a technical session at the

21st Biennial International Conference of the Animal Nutrition Society of India (ANSI), organized at Acharya Narendra Deva University of Agriculture and Technology (ANDUAT), Kumarganj, Ayodhya, during 19–21 November 2025.



70. Dr. R. Kumar served as a Subject Matter Expert for examination and thesis evaluation in various universities and academic institutions.

71. Dr. Gopal Dass received the Appreciation Award–2025 from the Director, ICAR–Central Institute for Research on Goats (ICAR-CIRG), Makhdoom, on 12 July 2025 during the Institute Foundation Day celebrations.

CHAPTER 21

PUBLICATIONS



21

PUBLICATIONS

Research Publications

1. Arif, M., Kumar, A., Kumar, R. and Gupta, D.L., 2025. Evaluation of productivity and profitability of summer season forage cowpea at varying jeevamrit formulations and their application interval. *Range Management and Agroforestry*, 46(1), pp.95–103.
2. Arif, M., Kumar, R. and Kumar, A., 2025. Assessment of yield and quality of moringa (*Moringa oleifera*) as a perennial forage crop under varying sowing patterns and cutting heights. *Range Management and Agroforestry*, 46(1), pp.176–181.
3. Arif, M., Kumar, R., Kumar, A., Rai, B., Sannagoudar, M.S. and Pradhan, A., 2025. Optimizing crop geometry and cutting height for enhancing yield, quality, and energy use efficiency in perennial forage moringa (*Moringa oleifera*) production. Indian Journal of Agronomy (1st International Farming Systems Conference 2025, Special Issue), 70, pp.S117–S122. <https://doi.org/10.59797/ija.v70.spl.5572>
4. Arif, M., Pourouchottamane, R., Kumar, A., Kumar, R., Rai, B., Gangwar, C., Kumar, R., Singh, M. K., Dixit, A. K., & Gururaj, K. (2025). Optimizing year-round fodder production for sustainable goat-based integrated farming systems in the Yamuna ravines of Uttar Pradesh. *Indian Journal of Agricultural Sciences*, 95(3), 310–315.
5. Abrar, P. F., Maiti, S., Jha, S. K., Garai, S., Bhakat, M., Dixit, A. K., & Roy, S. K. (2025). Farmers' willingness to pay for climate-resilient agriculture technologies: A case study from the coastal low-lying region of Kerala. *Journal of Community Mobilization and Sustainable Development*, 20(2), 539–546.
6. Bhargavi, P. K., Banerjee, R., Md, R., Maheswarappa, N. B., Verma, A. K., Govindaiah, P. M., & Lalthanmawii, J. (2025). Sustainable gelatin extraction from poultry skin-head-feet blend: An ultrasound-assisted approach. *Poultry Science*, 104975.
7. Bisht, N., Fular, A., Ghosh, S., & Nanyiti, S. (2025). Systematic review and meta-analysis of acaricidal properties of plant-derived products against ixodid tick populations. *Discover Applied Sciences*, 7(3).
8. Chatley, K. K., Bhakat, M., Mohanty, T. K., Kumar, R., Sinha, R., & Rahim, A. (2025). The impact of *Moringa oleifera* leaf extract on microbial load in bovine semen at refrigerated temperatures. *Bhartiya Krishi Anusandhan Patrika*.
9. Chouksey, S., Shukla, S. N., Dubey, A., Soni, Y., Mandal, S., & Chourasia, A. (2025). Detection of mitochondrial-derived peptide humanin in semen and reproductive tract of caprine along with its relation to seasonality. *Reproduction in Domestic Animals*. <https://doi.org/10.1111/rda.70113>
10. Dige, M. S., Gurao, A., Mehrotra, A., Singh, M. K., Kumar, A., Kaushik, R., Kataria, R. S., & Rout, P. K. (2025). Comparative transcriptomic and co-expression network analysis identifies key gene modules involved in heat stress responses in goats. *International Journal of Biological Macromolecules*, 305, 140975. <https://doi.org/10.1016/j.ijbiomac.2025.140975>
11. Dixit, A. K., Rai, B., Kumar, R., Singh, S., & Kumar, S. (2025). Goat husbandry practices in Bundelkhand region of Uttar Pradesh. *Indian Journal of Small Ruminants*, 31(1), 80–83.
12. Dixit, A. K., Singh, N., Sinha, A. K., Kumar, R., Singh, M. K., & Gururaj, K. (2025). Impact of socio-economic determinants on goat farmers' adaptations to climate change: A multivariate probit approach. *Indian Journal of Animal Sciences*, 95(10), 933–939.

13. Gaur, V., Kashyap, P., Chera, J. S., Josan, F., Patel, A., Karanwal, S., & Kumar, R. (2025). Lectin-based differential profiling of sperm membrane glycans for assessment of buffalo (*Bubalus bubalis*) bull fertility. *International Journal of Biological Macromolecules*, 313, 143955.
14. Gayathri, S. L., Bhakat, M., & Mohanty, T. K. (2025). Metritis in dairy cattle: Diagnostic challenges, economic impacts, and emerging insights. *Current Journal of Applied Science and Technology*, 44(1), 87–101. <https://doi.org/10.9734/cjast/2025/v44i14478>
15. Gayathri, S. L., Bhakat, M., & Mohanty, T. K. (2025). Seasonal dynamics of mastitis in Gir cows: A comprehensive thermographic assessment. *The Veterinary Journal*, 106400.
16. Gayathri, S. L., Bhakat, M., Mohanty, T. K., Kumar, R. R., Chaturvedi, K. K., & Kumar, S. (2025). Advanced mastitis detection in *Bos indicus* cows: A deep learning approach integrated with infrared thermography. *Journal of Thermal Biology*, 131, 104173.
17. Gayathri, S. L., Bhakat, M., Mohanty, T. K., Kumar, R. R., Chaturvedi, K. K., & Kumar, S. (2025). Deep learning enhanced thermographic modeling for early and precise mastitis detection in Sahiwal cows. *Research in Veterinary Science*, 196, 105899.
18. Gupta, V. K., Mohanty, T. K., Bhakat, M., Baithalu, R. K., Kumar, N., Dewry, R. K., Arunkumar, R., et al. (2025). Meloxicam and levamisole administration ameliorates FMD vaccination stress on frozen semen attributes in Sahiwal bulls. *Scientific Reports*, 15(1), 11863.
19. Gupta, V. K., Mohanty, T. K., Bhakat, M., Kumaresan, A., Baithalu, R. K., Kumar, N., & Soe, A. (2025). Effect of age-associated oxidative stress on sperm viability, acrosomal integrity, sperm apoptosis, and DNA fragmentation in Sahiwal breeding bulls. *Veterinary Research Communications*, 49(2), 71.
20. Jena, D., Kharche, S. D., Singh, S. P., Gururaj, K., Rani, S., Pathak, J., Gangwar, C., Kumar, R., Dige, M. S., Behera, S., & Singh, S. K. (2025). Establishment of safe and efficient infertile goat model using cyclophosphamide and its implications at the cellular and molecular level. *Beni-Suef University Journal of Basic and Applied Sciences*, 14(1), 128.
21. Kaushik, R., Nikita, Lugani, Y., Kumaresan, G., Gupta, S., Arya, A., Chatli, M. K., Dass, G., & Rishabh. (2025). Epidemiological insights and case fatality analysis of SARS-CoV-2 in Indian states during the first wave. *Online Journal of Biological Sciences*, 25(1), 219–231. <https://doi.org/10.3844/ojbsci.2025.219.231>
22. Kumar, M., Ranjan, R., Bharadwaj, A., & Gururaj, K. (2025). Goat-specific synthesized antimicrobial peptide β -defensin improves post-thaw sperm fertility. *Indian Journal of Animal Sciences*, 95(4), 360–362.
23. Kumar, R. and Gupta, D.L., 2025. Evaluation of *Moringa oleifera* and other tree leaves-based complete pellets on growth, nutrient utilization and serum metabolites in growing Barbari goats. *Indian Journal of Animal Sciences*, 95(3), pp.239–245.
24. Kumar, R., Kumar, A., Ranjan, R., & Chand, D. (2025). Effect of feeding berseem fodder grown using natural farming practices on growth, serum metabolites, interleukins, and semen qualities in Barbari goats. *Indian Journal of Animal Nutrition*, 42(3), 337–342.
25. Kuraichya, P., Nair, P. M., Srivastava, R., Dhaigude, V., Chaudhary, P., Bhakat, M., & Mondal, G. (2025). Effect of dietary micronutrient supplementation on growth and reproductive parameters in bull calves. *Journal of Thermal Biology*, 104225.
26. Lakhanpal, D., Mohanty, T. K., Bhakat, M., Arunkumar, R., Nain, D., & Baithalu, R. (2025). Testicular thermoregulation and blood perfusion score as markers of sperm quality in summer-stressed breeding bulls. *Tropical Animal Health and Production*, 57(8), 419.
27. Madan, A., Gururaj, K., Rekha, B., Andani, D., Mishra, A. K., Kumar, A., Jacob, T., & Vasudevan, K. (2025).

- Serological and molecular study on caprine brucellosis in Puducherry (India) and its public health significance. *Veterinaria Italiana*, 60(3). <https://doi.org/10.12834/VetIt.3201.25494.2>
28. Manjunath, K. V., Maiti, S., Garai, S., Reddy, D. A., Zade, S., Mondal, G., Aggarwal, A., et al. (2025). Adaptation strategies to climate change followed by the Murrah buffalo farmers of Haryana. *Indian Journal of Dairy Science*, 78(4), 364–369.
 29. Medhi, D., Paul, V., Singh, T. P., Hussain, M., Jatana, M. S., Bhatt, N., & Sarkar, M. (2025). Performance of lactating yaks based on feeding normal vis-à-vis quality protein maize. *Indian Journal of Animal Research*. <https://doi.org/10.18805/IJAR.B-5484>
 30. Mittal, N., Ranjan, R., & Bharadwaj, A. (2025). Withania somnifera: A remarkable herb to improve animal infertility. *Indian Journal of Animal Reproduction*, 45(1), 24–29.
 31. Moovendan, M., Vivek, S., Rajkumar, K., Gururaj, K., Devadevi, N., Selvi, D., Abiramy Prabavathy, A., & Vijayalakshmi, P. (2025). Economic impact of an ORF outbreak in Puducherry region. *International Journal of Veterinary Sciences and Animal Husbandry*, 10(5S), 10–15. <https://doi.org/10.22271/veterinary.2025.v10.i5Sa.2282>
 32. Nain, D., Mohanty, T. K., Bhakat, M., Kumar, N., Baithalu, R. K., Yadav, R., & Yadav, R. K. (2025). Sephadex filtration in conjunction with preputial washing: A strategy to minimize bacterial load and enhance cryo-survival in Murrah buffalo bull semen. *Journal of Microbiological Methods*, 107365.
 33. Pal, A., Karanwal, S., Habib, M. A., Josan, F., Gaur, V., Patel, A., & Kumar, R. (2025). Extracellular vesicles in seminal plasma of Sahiwal cattle bulls carry a differential abundance of sperm fertility-associated proteins for augmenting the functional quality of low-fertile bull spermatozoa. *Scientific Reports*, 15(1), 3587.
 34. Panghal, A., Singh, M., Bidhan, D. S., Ghanghas, A., Magotra, A., Sharma, V., & Bhakat, M. (2025). Comprehensive assessment of udder health in dairy goats using thermography and immune gene expression approaches. *Small Ruminant Research*, 250, 107560.
 35. Pathak, J., Singh, S. P., Pathak, M., Goel, A., Soni, Y. K., & Singh, M. K. (2025). Enhanced post-thaw functional characteristics of cryopreserved caprine dermal fibroblasts through adhesion to extracellular matrix proteins. *Molecular Biology Reports*, 52(1), 116. <https://doi.org/10.1007/s11033-025-10227-6>
 36. Pathak, J., Singh, S. P., Pathak, M., Khandelwal, V., Soni, Y. K., & Singh, M. K. (2025). Adhesion extracellular matrix proteins improve in vitro cellular and functional properties of enriched caprine adult dermal fibroblast. *In Vitro Cellular & Developmental Biology—Animal*, 61(9), 1039–1045. <https://doi.org/10.1007/s11626-025-01065-8>
 37. Pathak, M., Singh, S. P., Pathak, J., Goel, A., Soni, Y. K., & Singh, M. K. (2025). Growth factors and culture media dependent in vitro expansion and characteristics of enriched spermatogonial stem cells derived from adult caprine testis. *Indian Journal of Experimental Biology*, 63(5), 389–400. <https://doi.org/10.5604/2/ijeb.v63i05.15249>
 38. Pourouchottamane, R., Arif, M., Dixit, A. K., Singh, M. K., Gangwar, C., Kumar, A., Kumar, R., Gururaj, K., & Rai, B. (2025). Goat-based integrated farming circular economy model for doubling farmers' income. *Indian Farming*, 75(3), 59–62.
 39. Ranjan, A., Sankhala, G., Jha, S. K., Maiti, S., Bhakat, M., & Singh, P. (2025). An exploratory study on existing bovine breeding and management practices in Jharkhand State. *Indian Journal of Dairy Science*, 78(3), 285–290.
 40. Ranjan, R., Kumar, M., Swain, D. K., Singh, S. P., Kharche, S. D., Singh, M. K., & Chauhan, M. S. (2025). Iodixanol fortification in freezing extender protects sperm DNA damage and improves antioxidant capacity. *CryoLetters*, 46(3), 207–212.

41. Shafi, B. and Kumar, R., 2025. Nano zinc supplementation affects blood profile, antioxidant status and immunological response in periparturient does. *Indian Journal of Small Ruminants*, 31(2), pp.168–174.
42. Sharma, M., Sharma, N., Gururaj, K., & Kaushik, S. (2025). Evaluation of cellulase enzyme on pre-formed and postformed *Staphylococcus aureus* biofilms. *Journal of Experimental Zoology India*, 28(2).
43. Sharma, M., Sharma, N., Gururaj, K., Kumar, A., & Kaushik, S. (2025). Screening, analysis, and purification of unique cellulase from *Bacillus subtilis* R2A derived from agricultural fields and waste dump sites. *Journal of Pure and Applied Microbiology*, 19(4).
44. Singh, R., Maiti, S., Garai, S., Bhakat, M., & Kadian, K. S. (2025). Bovine and bubaline milk production in changing climatic scenario: A panel data analysis. *The Haryana Veterinarian*, 64(1), 15–20.
45. Singh, R., Maiti, S., Garai, S., Bhakat, M., Jha, S. K., Dixit, A. K., & Aggarwal, A. (2025). Assessment of climate resilience index: Insight from Murrah buffalo-based livestock production system of Western India. *Agricultural Systems*, 228, 104390.
46. Singh, S. P., Pathak, J., Pathak, M., Ranjan, R., Soni, Y. K., & Singh, M. K. (2025). Functional assessment and comparison of different methods of genomic DNA extraction from fresh ejaculated and cryopreserved caprine sperms for enhanced quality and long-term DNA banking. *Small Ruminant Research*, 251, 107565.
47. Singh, S., Goswami, M., Pathak, V., Verma, A. K., Rajkumar, V., & Vivekanand. (2025). Quality attributes of hurdle technology-based shelf-stable chicken pickle fried for different durations. *Journal of Meat Science*, 20(1). <https://doi.org/10.48165/jms.2025.20.01.3>
48. Singh, T. P., Verma, A. K., Rajkumar, V., Kumar, R., & Chatli, M. K. (2025). Study on the oxidative stability and culture viability of goat frozen yoghurt during extended storage. *Journal of Food Science and Technology*, Advance online publication.
49. Singh, T. P., Verma, A. K., Rajkumar, V., Kumar, R., Dixit, A. K., & Chatli, M. K. (2025). Effect of fermentation with sprouted millet flours on the amino acid and fatty acid composition and storage stability of goat milk beverages. *Journal of Food Science and Technology*. Advance online publication. <https://doi.org/10.1007/s13197-025-06489-4>
50. Somnath, M. N., Moovendan, M., Vivek, S., Rajkumar, K., Gururaj, K., Devadevi, N., Selvi, D., Abiramy Prabavathy, A., & Vijayalakshmi, P. (2025). Epidemiology, clinical features, and molecular detection of contagious ecthyma (ORF) virus in naturally infected goats of Puducherry (India) and adjoining areas of Tamil Nadu. *International Journal of Veterinary Sciences and Animal Husbandry*, 10(5), 312–316. <https://doi.org/10.22271/veterinary.2025.v10.i5e.2278>
51. Srivastava, A., Kumar, A., Sharma, N., Tripathi, A. K., Singh, M. K., Pawaiya, R. V. S., & Mishra, A. K. (2025). Risk factors associated with preweaning mortality of Barbari, Jamunapari, and Jakhrana goat kids. *Indian Journal of Animal Research*, 59(8), 1428–1432. <https://doi.org/10.18805/IJAR.B-4952>
52. Tripathi, P., Tripathi, M.K., Dutta, T.K. and Kumar, R., 2025. *Boerhavia diffusa* (Punarnava): A non-conventional feed resource for Indian goats in semi-arid ravines of Uttar Pradesh, India. *Range Management and Agroforestry*, 46(2), pp.1–7.
53. Vasu, M., Ahlawat, S., Arora, R., Sharma, R., Mohan, N. H., Mir, M. A., & Singh, M. K. (2025). Identification and validation of stable reference genes for quantitative PCR in small ruminants under high-altitude hypoxic and tropical conditions. *Small Ruminant Research*, 253, 107651.
54. Verma, A. K., Rajkumar, V., Kumar, R., Gururaj, K., Singh, T. P., Kushwah, T., & Chatli, M. K. (2025). Impact of dietary mineral and vitamin supplementation on meat quality, nutritional profile, and gene expression in goats. *European Journal of*

Lipid Science and Technology, 127(3), e70005.

55. Verma, A. K., Singh, T. P., Rajkumar, V., Chatli, M. K., Kushwah, T., Nanda, P. K., Curros, B., Lorenzo, J. M., & Das, A. K. (2025). Goat milk: A versatile dairy alternative with unique health benefits and functional properties. *Food Reviews International*. <https://doi.org/10.1080/87559129.2025.2479122>
56. Vihan, V., Verma, A. K., Rajkumar, V., & Singh, C. (2025). Goat milk: Composition, health benefits, and product development. *Indian Journal of Animal Health*, 64(2), 292–305.

Book, Training Manuals, Reports Compiled and Edited

1. Kumar, R. (2025). *Natural Goat Husbandry*. NIPA, GENX Electronic Resources & Solutions Pvt. Ltd. ISBN 978-93-5887-807-3.
2. Singh, S. P., Soni, Y. K., Ranjan, R., & Chatli, M. K. (2025). *Animal cell culture and molecular tools in assisted reproduction: Principles and practices* (pp. 1–101). ICAR-CIRG.
3. Singh, S. P., Soni, Y. K., Pathak, J., & Chatli, M. K. (2025). *Cell culture and molecular tools for translational research: Principles and applications* (pp. 1–88). ICAR-CIRG.
4. Singh, T. P., Sharma, H., Goswami, M., & Soni, A. (2025). *Biotechnological interventions in meat science* (pp. 1–319). Elite Publishing House. ISBN 978-93-58998-99-3.
5. Kumar, R., Dixit, A. K., Kumar, A., Mishra, A. K., Soni, Y. K., & Singh, T. P. (Eds.). (2024). *ICAR-CIRG Newsletter* (Vol. XXVI, July–December 2024). ICAR-Central Institute for Research on Goats.
6. Kumar, R., Dixit, A. K., Kumar, A., Mishra, A. K., Soni, Y. K., & Singh, T. P. (Eds.). (2025). *ICAR-CIRG Newsletter* (Vol. XXVII, January–June 2025). ICAR-Central Institute for Research on Goats.
7. Ranjan, R., Bhakat, M., Dass, G., & Chatli, M. K. (2025). *Labhkari bakari palan mai kritim garbhadhan ka yogdan*

[Extension publication in Hindi]. ICAR-Central Institute for Research on Goats. ISBN 978-93-343-7723.

8. Ranjan, R., Dass, G., Kumar, A., & Chatli, M. K. (2025). *Bakariyon mai kritim garbhadhan ka mahatava* [Extension publication in Hindi]. ICAR-Central Institute for Research on Goats.
9. Ranjan, R., Dixit, A. K., Bhakat, M., & Chatli, M. K. (2025). *Kritim garbhadhan adharit aay vridhi, rojgar awsar evam ajivika suraksha*. ICAR-Central Institute for Research on Goats. ISBN 978-93-344-0521-7.
10. Singh, M. K., Dass, G., Kaushik, R., & Chatli, M. K. (2025). *Production performance and evaluation of goat breeds under AICRP: 2024–25*. ICAR-Central Institute for Research on Goats. ISBN 978-93-341-7947-7.
11. Singh, S. P., Singh, M. K., Dixit, A. K., & Chatli, M. K. (Eds.). (2025). *Goat sector blueprint: Insights and spectrum*. ICAR-Central Institute for Research on Goats. ISBN 978-93-341-9143-1.

Book Chapters

1. Bhakat, M., Gayathri, S. L., Mondal, S. N., Chatli, M. K., & Dass, G. (2025). Precision goat farming. In G. Dass, K. Gururaj, T. P. Singh, & M. K. Chatli (Eds.), *Precision Farming and Genomic Innovation in Small Ruminant Sector: ISSGPUCON 2025 Lead Papers & Abstracts Book*. ICAR-CIRG. ISBN: 978-93-342-3060-4.
2. Bhakat, M., Lal, G. S., & Pathbandha, T. (2025). Assisted reproduction technologies vis-à-vis behavioural and welfare needs of breeding farm animals. In *Farm Animal Welfare vis-à-vis Intensive Production System: Resolving Paradox* (pp. 87–103). Department of Livestock Production Management, College of Veterinary Science, GADVASU, Rampura Phul, Punjab. ISBN: 978-93-344-4563-3.
3. Bhakat, M., Lal, G. S., & Ranjan, R. (2025). Microfluidics: An emerging technology in assisted reproduction. In S. P. Singh, Y. K. Soni, R. Ranjan, & M. K.

- Chatli (Eds.), *Animal Cell Culture and Molecular Approaches in Assisted Reproduction: Principles and Practices* (pp. 54–59). ICAR-CIRG Publication. ISBN: 978-93-343-4782-1.
4. Bhakat, M., Lal, G. S., Dass, G., Ranjan, R., & Kumar, A. (2025). Bakri palan me veerya himsanrakshan evam kritim garbhadhan prayogshala ke mahatvapoorna pahloo. In *Labhkari Bakri Palan me Kritim Garbhadhan ka Yogdan* (pp. 110–121). ICAR-CIRG, Makhdoom. ISBN: 978-93-343-7723-1.
 5. Bhakat, M., Lal, G. S., Dass, G., Ranjan, R., & Kumar, A. (2025). Bakri veerya ke himsanrakshan se sambandhit mahatvapoorna mudde. In *Labhkari Bakri Palan me Kritim Garbhadhan ka Yogdan* (pp. 122–126). ICAR-CIRG, Makhdoom. ISBN: 978-93-343-7723-1.
 6. Chatli, M. K., Kumar, A., Lalawmpuii, H., & Arif, M. (2025). Livestock-based integrated farming system: A sustainable approach for the North-Eastern hill region. In S. K. Singh, H. Kumar, & G. Patil (Eds.), *Integrated Farming Systems: A Pathway to Sustainable Food and Nutrition Security* (pp. 70–81). ICAR-NRC on Mithun, Medziphema, Nagaland. ISBN: 978-93-5759-581-0.
 7. Chatli, M. K., Ranjan, R., Bhakat, M., Kumar, A., Dixit, A. K., & Dass, G. (2025). Bakri ki utpadakta badhane me kritim garbhadhan ki bhumika. In R. Ranjan, A. K. Dixit, M. Bhakat, & M. K. Chatli (Eds.), *Kritim Garbhdhan Adharit Bakri Palan: Aay Vridhi, Rojgar Awsar Evam Ajivika Suraksha*. ICAR-CIRG, Makhdoom. ISBN: 978-93-344-0521-7.
 8. Chatli, M. K., Verma, A. K., Singh, T. P., & Rajkumar, V. (2025). Strategies for sustainable development of goat products industry. In *Training Manual of ICAR Sponsored Winter School on Quality Assurance for Production of Wholesome and Safe Livestock Products* (pp. 13–22). DUVASU, Mathura. ISBN: 978-93-67552-44-5.
 9. Dass, G., Singh, M. K., Kaushik, R., & Chatli, M. K. (2025). Bharat me Bakri Naslen Evam Upyogita. In *Bakari Palan: Vigyan Evam Labhkari Vyavasay*. ICAR-CIRG, Makhdoom. ISBN: 978-93-342-5384-9.
 10. Dixit, A. K., & Ranjan, R. (2025). Unnat Bakri Palan ka Arthik Vishleshan. In R. Ranjan, A. K. Dixit, M. Bhakat, & M. K. Chatli (Eds.), *Kritim Garbhdhan Adharit Bakri Palan: Aay Vridhi, Rojgar Awsar Evam Ajivika Suraksha*. ICAR-CIRG, Makhdoom. ISBN: 978-93-344-0521-7.
 11. Gururaj, K. (2025). Recombinant technology-based vaccines: Application, challenges, and strategies for future improvement. In A. P. Singh, R. Tiwari, A. Arun, & S. N. Prabhu (Eds.), *Bioprocessing of Recombinant Proteins for Veterinary Application* (pp. 3–18). COVS&AH, DUVASU, Mathura. ISBN: 978-81-989037-7-8.
 12. Gururaj, K., & Mishra, A. K. (2025). Brucellosis in sheep and goats: Evidence, economics and the omics edge. In G. Nagarajan, R. Kumar, A. S. Mahla, & A. Kumar (Eds.), *Biotechnological Approaches for Small Ruminant Production* (pp. 61–99). ICAR-CSWRI, Avikanagar. ISBN: 978-81-955679-1-1.
 13. Jairath, G., Singh, T. P., & Chatli, M. K. (2025). Poultry meat quality, shelf-life and safety standards. In P. K. Shukla & A. Bhattacharyya (Eds.), *Indian Poultry Sector: Road Map to Viksit Bharat 2027* (pp. 393–428). Poultry Punch Publications Pvt. Ltd., New Delhi. ISBN: 978-81-985505-9-0.
 14. Kumar, A., Pourouchottamane, R., Rai, B., & Chatli, M. K. (2025). Shelter management in small ruminants. In S. K. Singh, H. Kumar, & G. Patil (Eds.), *Integrated Farming Systems: A Pathway to Sustainable Food and Nutrition Security* (pp. 99–108). ICAR-NRC on Mithun, Medziphema, Nagaland. ISBN: 978-93-5759-581-0.
 15. Rai, B., Kumar, A., Dixit, A. K., & Bhakat, M. (2025). Bakri Awas Prabandhan. In R. Ranjan, A. K. Dixit, M. Bhakat, & M. K. Chatli (Eds.), *Kritim Garbhdhan Adharit Bakri Palan: Aay Vridhi, Rojgar Awsar Evam Ajivika Suraksha*. ICAR-CIRG, Makhdoom, Mathura. ISBN: 978-93-

- 344-0521-7.
16. Ranjan, R., Bhakat, M., & Kumar, M. (2025). Himikrit Veerya Dwara Bakriyon Me Kritrim Garbhadhan: Ek Uttam Takneek. In *Labhkari Bakri Palan Me Kritim Garbhadhan Ka Yogdan*. ICAR-CIRG, Makhdoom. ISBN: 978-93-343-7723-1.
17. Ranjan, R., Chatli, M. K., Dass, G., Singh, M. K., Kumar, A., & Dixit, A. K. (2025). Bharat Me Bakri Palan Se Gramin Aabadi Ki Aay Dugani: Paridrashya Evam Sambhavanayen. In R. Ranjan, A. K. Dixit, M. Bhakat, & M. K. Chatli (Eds.), *Kritim Garbhadhan Adharit Bakri Palan: Aay Vridhi, Rojgar Awsar Evam Ajivika Suraksha*. ICAR-CIRG, Makhdoom. ISBN: 978-93-344-0521-7.
18. Ranjan, R., Kumar, M., & Bhakat, M. (2025). Semen preparation for in vitro fertilization. In S. P. Singh, Y. K. Soni, R. Ranjan, & M. K. Chatli (Eds.), *Animal Cell Culture and Molecular Approaches in Assisted Reproduction: Principles and Practices*. ICAR-CIRG Publication. ISBN: 978-93-343-4782-1.
19. Ranjan, R., Kumar, R., Gangwar, C., & Kumar, P. (2025). Estrus synchronization and mating system in goats. In T. Rana (Ed.), *Elements of Reproduction and Reproductive Diseases of Goats*. Wiley-Blackwell.
20. Sharma, N., Pawaiya, R. V. S., Kumar, A., Gururaj, K., & Mishra, A. K. (2025). Health management in goats in the North-Western Himalayan region of India: Vaccination, drenching, deworming and dipping schedule. In R. Tiwari, R. Sharma, M. Saminathan, A. K. Yadav, M. Bhatt, & T. Dutt (Eds.), *Package of Practices for Livestock Management in the North-Western Himalayan States* (pp. 189–190). ICAR-IVRI, Izatnagar, Bareilly. ISBN: 978-93-340-9289-9.
21. Singh, T. P., Verma, A. K., Rajkumar, V., & Chatli, M. K. (2025). प्रयोगशाला जनित मांस: भविष्य का भोजन. In अर्पिष राजभाषा पुस्तिका (3rd ed., pp. 53–60). ICAR-NMRI, Hyderabad. ISBN: 978-93-5913-497-0.
22. Soni, Y. K., Singh, S. P., Kharche, S. D., Pathak, J., & Pathak, M. (2025). Reproductive laparoscopy in goats with special reference to ovum pick-up. In *Cell Culture and Molecular Tools for Translational Research: Principles and Applications* (pp. 24–36). ICAR-CIRG Publication. ISBN: 978-93-344-3263-3.
23. Soni, Y. K., Singh, S. P., Ranjan, R., Pathak, J., Pathak, M., & Bhakat, M. (2025). An insight into reproductive laparoscopy with special reference to ovum-pick-up in goats. In S. P. Singh, Y. K. Soni, R. Ranjan, & M. K. Chatli (Eds.), *Animal Cell Culture and Molecular Approaches in Assisted Reproduction: Principles and Practices* (pp. 46–53). ICAR-CIRG Publication. ISBN: 978-93-343-4782-1.
24. Verma, A. K., Singh, T. P., & Rajkumar, V. (2025). Double muscling in food animals: Origin and its effect on meat quality. In T. P. Singh, H. Sharma, M. Goswami, & A. Soni (Eds.), *Biotechnological Interventions in Meat Science* (pp. 13–35). EPH Publishing and Distributor, New Delhi.
25. मनीष कुमार चेटली, रवि रंजन, मुकेश भक्त, मनीष कुमार, अरविंद कुमार एवं गोपाल दास. 2025. बकरी की उत्पादकता बढ़ाने में कृत्रिम गर्भाधान की भूमिका. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
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27. भुवनेश्वर राय, अरविंद कुमार एवं मुकेश भक्त. 2025. बकरी आवास प्रबंधन. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.

28. रवि रंजन, मुकेश भक्त, मनीष कुमार, भुवनेश्वर राय, कोमल राजपूत एवं प्रवीण कुमार. 2025. वीर्य संग्रह के लिए बकरों का चयन और प्रशिक्षण. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
29. रवि रंजन, मुकेश भक्त, मनीष कुमार, कोमल राजपूत, निकिता मित्तल एवं प्रवीण कुमार. 2025. कृत्रिम गर्भाधान प्रयोगशाला स्थापित करने के लिए आवश्यक उपाय. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
30. रवि रंजन, मुकेश भक्त, मनीष कुमार, प्रवीण कुमार एवं कोमल राजपूत. 2025. वीर्य संग्रह विधियाँ और आवृत्ति. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
31. रवि रंजन, मुकेश भक्त, मनीष कुमार, कोमल राजपूत, निकिता मित्तल एवं प्रवीण कुमार. 2025. वीर्य का संरक्षण एवं सिद्धांत. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
32. रवि रंजन, मुकेश भक्त, मनीष कुमार, निकिता मित्तल, कोमल राजपूत एवं प्रवीण कुमार. 2025. फार्म और प्रयोगशाला स्तर पर वीर्य मूल्यांकन तकनीकें. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
33. रवि रंजन, मुकेश भक्त, मनीष कुमार, निकिता मित्तल, कोमल राजपूत एवं प्रवीण कुमार. 2025. बकरियों में कृत्रिम गर्भाधान तकनीक. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
34. रवि रंजन, मुकेश भक्त एवं मनीष कुमार. 2025. हिमीकृत वीर्य द्वारा बकरियों में कृत्रिम गर्भाधान: एक उत्तम तकनीक. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
35. मुकेश भक्त, गायत्री एस. लाल, गोपाल दास, रवि रंजन एवं अरविंद कुमार. 2025. बकरी पालन में वीर्य हिमसंरक्षण एवं कृत्रिम गर्भाधान प्रयोगशाला के महत्वपूर्ण पहलू. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.
36. मुकेश भक्त, गायत्री एस. लाल, गोपाल दास, रवि रंजन एवं अरविंद कुमार. 2025. बकरी वीर्य के हिमसंरक्षण से संबंधित महत्वपूर्ण मुद्दे. लाभकारी बकरी पालन में कृत्रिम गर्भाधान का योगदान। ISBN: 978-93-343-7723.

Lead Papers

1. Ahlawat, S., Arora, R., Sharma, R., Singh, M. K., & Mir, M. A. (2025). Harnessing omics approaches to unlock the genetic potential of small ruminants in Ladakh. In *National Conference on Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development (ISSGPUCON 2025)* (pp. 109–113). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, India.
2. Dixit, A. K. (2025). Goat farming and social ecology in the digital landscape: Opportunities, challenges, and way

- forward. In *Proceedings of the 2nd International Extension Education Congress 2025: Rethinking Social Ecology in a Digital Landscape* (November 24–26, 2025, Bhubaneswar, Odisha, India).
3. Dixit, A. K. (2025). Goat production and supply chain mapping: A value chain analysis. In *Proceedings of the Regional Workshop on Supply Chain and Post-Harvest Management in Agricultural Commodities in the Western Region of India* (August 6–7, 2025, Anand, Gujarat, India). International Agri-Business Management Institute, Anand Agricultural University, Anand, Gujarat, India, in association with Agricultural Economics Research Association (AERA), New Delhi.
4. Kumar, R. and Arif, M. (2025). *Moringa (Moringa oleifera) – A Sustainable Perennial Fodder Resource for Small Ruminants*. In: 21st Biennial Animal Nutrition Society of India (ANSI) International Conference on *Global Resilience in Animal Nutrition: Innovations for Sustainable Future*, ANDUAT, Kumarganj, Ayodhya, India, 19–21 November 2025.
5. Sheikh, F. D., Singh, M. K., Dar, K. A., & Dorjey, S. (2025). Pashmina goat herders of Changthang: An overview of the threatened nomadic culture of Ladakh. In *Compendium of National Seminar-cum-Workshop on Climate-Resilient Sheep and Goat Farming in High Lands* (pp. 21–26). Leh, Ladakh, India.
6. Singh, M. K., Barwar, R., Ahmad, S. F., & Gaur, G. K. (2025). Breeding strategies for goat improvement in India: Key issues and road map. In *National Conference on Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development (ISSGPUCON 2025)* (pp. 13–18). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, India.
7. Singh, M. K., Chatli, M. K., & Sheikh, F. D. (2025). Goat resources of India and road map for their genetic improvement. In *Compendium of National Seminar-cum-Workshop on Climate-Resilient Sheep and Goat Farming in High Lands* (pp. 11–20). Leh, Ladakh, India.
8. Chatli, M. K., Jairath, G., & Singh, T. P. (2025). Transforming the Indian meat industry for Viksit Bharat: Status, challenges and way forward. In *Compendium of the XIII Conference of the Indian Meat Science Association and National Symposium on “Leveraging Frontier Technologies in the Meat Sector towards Protein Security in Viksit Bharat”* (pp. 6–10), ICAR-Indian Veterinary Research Institute, Bareilly, Uttar Pradesh, India, 19–21 November 2025.
9. Chatli, M. K., Singh, T. P., & Verma, A. K. (2025). Precision livestock farming: Smart tools for enhanced meat productivity. In *Compendium of the XIII Conference of the Indian Meat Science Association and National Symposium on “Leveraging Frontier Technologies in the Meat Sector towards Protein Security in Viksit Bharat”* (pp. 147–152), ICAR-Indian Veterinary Research Institute, Bareilly, Uttar Pradesh, India, 19–21 November 2025.
10. Chatli, M. K., Singh, T. P., Verma, A. K., & Dixit, A. K. (2025). Enhancing community livelihoods through value-added goat products technologies: Driving socio-economic growth and sustainability. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (pp. 293–296). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India, 5–7 March 2025. ISBN: 978-93-342-3060-4.
11. Das, A. K., Nanda, P. K., Verma, A. K., Rajkumar, V., & Singh, T. P. (2025). Innovative technologies in goat and sheep meat flavour profile study: Components, importance, and strategies for manipulation and preservation. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced*

Productivity and Sustainable Development (pp. 270–275). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India, 5–7 March 2025. ISBN: 978-93-342-3060-4.

Popular/Technical articles

1. Churamani, A. K., Mishra, A. K., & Kushwah, M. (2025). Staphylococcus aureus and Escherichia coli induced mastitis in goats. *Science World*, 5(8), 8383–8386.
2. Churamani, A. K., Mishra, A. K., Kushwah, M., & Gururaj, K. (2025). Mycoplasmosis in goats and sheep. *AgroScience Today*, 6(12), 1194–1198.
3. Gayathri, S. L., & Bhakat, M. (2025). Thermal imaging for mastitis detection in goats. *The Science World*, August 15, 2025. <https://doi.org/10.5281/ScienceWorld.16883264>
4. Singh, S., & Kumar, A. (2025). Bakari poshan evam paryavaran sanrakshan me khejadi briksh ki upyogita. *Ajamukh* (Hindi Newsletter of ICAR-CIRG), Issue 47, pp. 5–6.

Research/Extension Folders

1. Kumar, R., Kumar, A., Dixit, A. K., & Dubey, V. K. (2025). *Millets awashed adharit sampoon pellet aahar*. Global Centre of Excellence on Millets Project. ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, Uttar Pradesh, India.
2. Kumar, R., Kumar, A., Dixit, A. K., & Dubey, V. K. (2025). *Millet stovers based complete pellet feed*. Global Centre of Excellence on Millets Project. ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, Uttar Pradesh, India.
3. Sharma, N., Singh, M. K., Dixit, A. K., Kumar, R., & Dass, G. (2025). *Bakri swasthya prabandhan evam rogon se bachav*. ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, India.
4. Sharma, N., Kumar, A., Kumar, R., Mishra, A. K., Singh, M. K., & Dixit, A. K.

(2025). *Bakriyon mein utpadan sambandhit, chayapachayi evam vibhinn avayon ki kami se hone wale rogon ka prabandhan*. ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, India.

Publication in National and International Conference (Abstract)

1. Bisht, N., Sankar, M., Fular, A., Chigure, G., & Ghosh, S. (2025). Effect of amitraz and ivermectin on reproductive and neural structures of *Rhipicephalus microplus* ticks. In *34th National Congress of Veterinary Parasitology and National Symposium on “Parasitology in the Digital Era: Innovations for One Health and Farmer's Prosperity”*, College of Veterinary and Animal Sciences, Udgir, Maharashtra, India, 17–19 December 2025.
2. Churamani, A. K., Mishra, A. K., Kushwah, M., Gururaj, K., Kumar, A., & Sharma, N. (2025). Antibigram profiles of *Staphylococcus aureus* and *Escherichia coli* isolates of animal origin. In *Conference Book of the International Conference on Advancement of Science and Technology for Environment, Society and People*, Kozhikode, Kerala, India, 27–28 June 2025 (pp. 6–7).
3. Dabiri, M., Bhakat, M., de Graaf, S., & Warkiani, M. E. (2025). A user-friendly microfluidic device for isolating high-integrity DNA ram spermatozoa. Presented at the *29th International Conference on Miniaturized Systems for Chemistry and Life Sciences (μTAS 2025)*, Adelaide Convention Centre, Adelaide, South Australia, Australia, 2–6 November 2025.
4. Dixit, A. K. (2025). Goat farming as a pathway to tribal women's empowerment: A socio-economic and policy perspective from Rajasthan. In *Compendium of Abstracts, 33rd Annual Conference of the Agricultural Economics Research Association (India): Innovations in Agribusiness, Empowering Women, and Climate-Resilient Agriculture*, ICAR-NAARM, Hyderabad, Telangana, India,

1–3 December 2025.

5. Dixit, A. K., Chand, K., Kumar, A., Tiwari, A., & Singh, A. (2025). Goat milk value chain and marketing in Bundelkhand region, Uttar Pradesh: A pilot study. In *Compendium of Abstracts, 33rd Annual Conference of the Agricultural Economics Research Association (India)*, Hyderabad, Telangana, India, 1–3 December 2025.
6. Gupta, N., Sharma, N., & Dass, G. (2025). Successful therapeutic management of pregnancy toxemia in ewe: A case report. In *Souvenir and Conference Book of ISSGPUCON-2025: Transforming Small Ruminant Production—Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (p. 230), ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh, India, 5–7 March 2025.
7. Kumar, M., & Ranjan, R. (2025). *Tribulus terrestris* extract enhances post-thaw sperm quality and antioxidant status in goat. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development*, ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh, India, 5–7 March 2025.
8. Kumar, R., Kumar, A., Vaswani, S., Singh, T. P., Kushwaha, T., & Chand, D. (2025). Evaluation of different commercial sorghum stover varieties for nutrients and in vitro fermentation parameters using goat rumen microflora. In *ANSICON-2025: International Conference on Global Resilience in Animal Nutrition—Innovations for Sustainable Future*, ANDUAT, Ayodhya, Uttar Pradesh, India, 19–21 November 2025.
9. Kumar, R., Rajkumar, V., Verma, A. K., Singh, T. P., & Kushwah, T. (2025). Influence of millet stover-based complete pelleted feed on carcass and meat quality of Barbari goats. In *Compendium of the XIII Conference of the Indian Meat Science Association and National Symposium on “Leveraging Frontier Technologies in the Meat Sector towards Protein Security in Viksit Bharat”* (p. 168), ICAR-Indian Veterinary Research Institute, Bareilly, Uttar Pradesh, India, 19–21 November 2025.
10. Kushwah, M., Mishra, A. K., Churamani, A. K., Gururaj, K., Kumar, A., & Sharma, N. (2025). Molecular detection of *Mycoplasma* infections in goats and sheep. In *Conference Book of the International Conference on Advancement of Science and Technology for Environment, Society and People*, Kozhikode, Kerala, India, 27–28 June 2025 (pp. 5–6).
11. Kushwah, M., Mishra, A. K., Churamani, A. K., Gururaj, K., Kumar, A., & Sharma, N. (2025). Seroprevalence of mycoplasmosis in goats. In *Conference Book of the International Conference on Recent Technologies and Interventions for Drug and Vaccine Development*, GLA University, Mathura, Uttar Pradesh, India, 7–8 July 2025 (p. 34).
12. Lakhanpal, D., Mohanty, T. K., Bhakat, M., Kumar, B., Anjali, Baithalu, R. K., & Kumar, V. (2025). Testicular temperature gradient and vascularity scores as indicators of semen quality in summer-stressed Murrah bulls. Poster presented at the *National Conference on Buffalo Production and Health in a Changing Climate: Innovations for a Resilient Future (ISBD-IVRI 2025)*, Division of Physiology and Climatology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India, 15–16 December 2025.
13. Mishra, A. K., Singh, A., Churamani, A. K., Kumar, A., Gururaj, K., & Sharma, N. (2025). Morbidity due to caprine pneumonia in Jamunapari, Barbari, and Jakhrana goat breeds reared under semi-intensive farming systems. In *Conference Book of the International Conference on Advancement of Science and Technology for Environment, Society and People*, Kozhikode, Kerala, India, 27–28 June 2025 (pp. 4–5).
14. Ranjan, R. (2025). *Empowering precision farming and genomic innovations for*

- enhanced productivity and sustainable development.* Presented at the National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development, ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India, 5–7 March 2025.
15. Ranjan, R., Kumar, M., Bhakat, M., Soni, Y. K., Singh, S. P., & Chatli, M. K. (2025). Herbal fortified diluter for buck semen cryopreservation. In *Proceedings of the 40th Annual Convention and International Symposium of the Indian Society for Study of Animal Reproduction (ISSAR 2025): Animal Reproduction in a Changing World—Addressing Challenges and Embracing Opportunities*, Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry, India, 10–12 December 2025.
 16. Ranjan, R., Kumar, M., Gururaj, K., Kumar, A., Rai, B., Singh, M. K., & Chatli, M. K. (2025). Development of herbal-based novel goat semen extender. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development*, ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh, India, 5–7 March 2025.
 17. Sharma, N., Kumar, A., Kumar, R., Mishra, A. K., & Singh, M. K. (2025). Changes in energy biochemical metabolites in periparturient Barbari goats. In *Souvenir and Conference Book of ISSGPUCON-2025: Transforming Small Ruminant Production Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (p. 238), ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh, India, 5–7 March 2025.
 18. Sharma, N., Kumar, A., Mishra, A. K., Rahal, A., Gururaj, K., Singh, M. K., Chaturvedi, V., & Gautam, T. K. (2025). Urolithiasis in Barbari goats. In *Souvenir and Conference Book of ISSGPUCON-2025: Transforming Small Ruminant Production—Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (p. 234), ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh, India, 5–7 March 2025.
 19. Sharma, N., Rahal, A., Mishra, A. K., Gururaj, K., & Bharati, S. (2025). Epidemiology and pathology of caprine coccidiosis in Northern India and its management through herbal extracts. In *Souvenir and Conference Book of the Seventh International Conference on Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2025)*, organized by SSDA&T, 15–16 December 2025.
 20. Singh, T. P., Verma, A. K., Rajkumar, V., Kumar, R., Dixit, A. K., Kumar, A., & Chatli, M. K. (2025). Culture viability, fatty acid profile, amino acid composition and quality attributes of fermented milk–millet fusion beverages during storage. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (pp. 280–281). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India, 5–7 March 2025. ISBN: 978-93-342-3060-4.
 21. Singh, T. P., Verma, A. K., Rajkumar, V., Kumar, R., Rai, B., Singh, M. K., & Chatli, M. K. (2025). Oxidative stability and culture viability of goat frozen yoghurt during extended storage. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (p. 279). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India, 5–7 March 2025. ISBN: 978-93-342-3060-4.
 22. Sinha, R., Bhakat, M., Mohanty, T. K., Rahim, A., Khosla, K., & Dewery, R. K.

- (2025). Effect of thermal stress on semen quality of Murrah bulls in tropical regions. Poster presented at the *XXIII Convocation-cum-National Scientific Convention of the National Academy of Veterinary Sciences (India)* on “Strategic Framework for Transformation of India's Livestock, Poultry and Meat Sector for *Viksit Bharat @2047*”, Bihar Animal Sciences University, Patna, Bihar, India, 22–23 December 2025.
23. Soni, Y. K., Singh, S. P., Kharche, S. D., Pathak, J., Pathak, M., & Ranjan, R. (2025). Laparoscopic ovum pick-up response in goats following hormonal pre-stimulation. In *Compendium of Abstracts, ISSARCON 2025*, Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry, India, 10–12 December 2025 (p. 180).
 24. Soni, Y. K., Singh, S. P., Pathak, J., Pathak, M., Ranjan, R., & Kharche, S. D. (2025). Effect of single versus multiple dosage of FSH-P on laparoscopic ovum pick-up (LOPU) in goats. In *Book of Lead Papers and Abstracts, ISSGPUCON 2025*, ICAR-CIRG, Makhdoom, Mathura, Uttar Pradesh, India, 5–7 March 2025 (p. 156).
 25. Verma, A. K., Rajkumar, V., Singh, T. P., Gururaj, K., Kushwah, T., Singh, S. P., Singh, A., Kumar, S., & Chatli, M. K. (2025). Quality characteristics and storage stability of vacuum-packed goat milk Gouda cheese under refrigeration. In *National Conference on Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development* (pp. 278–279). ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India, 5–7 March 2025. ISBN: 978-93-342-3060-4.
- Economics and Policy Research (NIAP), New Delhi, India.
2. Chatli, M. K., Rahal, A., Gururaj, K., & Verma, A. K. (2025). *Goat sector towards Viksit Bharat 2047: Strategy paper* (pp. 1–64). Department of Animal Husbandry and Dairying (DAHD), Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, and ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, India. ISBN: 978-93-343-1341-3.

Others

1. Dass, G., Gururaj, K., Singh, T. P., & Chatli, M. K. (Eds.). (2025). *Precision farming and genomic innovation in small ruminant sector: ISSGPUCON 2025 lead papers and abstracts book. National Conference on “Transforming Small Ruminant Production: Empowering Precision Farming and Genomic Innovations for Enhanced Productivity and Sustainable Development,” 5–7 March 2025, ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India* (pp. 1–316). Published by the Convener, ISSGPUCON 2025 and Director, ICAR-CIRG. ISBN: 978-93-342-3060-4.
2. Gururaj, K., & Chatli, M. K. (2025). *Quinquennial Review Team (QRT) Report, 2019–2024*. ICAR-Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura, Uttar Pradesh, India.

Policy papers

1. Bardhan, D., Das, A. K., Kumar, S., Dixit, A. K., Banik, S., Kumar, V., Gurjar, L. R., Jain, R., & Kandpal, A. (2025). *Economic impact of improved livestock and poultry germplasm in India* (Policy Paper No. 57). ICAR-National Institute of Agricultural

CHAPTER 22

STAFF POSITION, FINANCIAL STATEMENT AND REVENUE GENERATION



22

STAFF POSITION, FINANCIAL STATEMENT AND REVENUE GENERATION

23.1 Staff Position

S. No.	Class of posts	Total Posts Sanctioned	Total employees in position	Vacant Posts
1	Scientific Posts			
	RMP	01	01	00
	HOD	04	03	01
	Pr. Scientist	00	00	00
	Sr. Scientist	08	01	07
	Scientist	32	17	15
	Total	45	22	23
2.	Administrative Posts			
	Sr. Admn. Officer	01	00	01
	Admn. Officer	01	01	00
	Sr. Finance & Accounts Officer/F&AO	01	00	01
	Assistant Director (OL)	01	00	01
	Security Officer	01	01	00
	Astt. Admn. Officer	03	01	02
	Private Secretary	01	00	01
	Personal Assistant	01	00	01
	Assistant	11	06	05
	UDC	05	02	03
	LDC	07	04	03
	Total	33	15	18
3.	Technical Posts			
	T-6	03	03	00
	T-5	00	00	00
	T-4	00	00	00
	T-3	03 (02 STA adjusted)	03	00
	T-2	03	01	02
	T-1	46	17	29
	Total	55	24	31
2.	Skilled Supporting Staff	101	53	48
	Grand Total	234	114	120



23.2 Staff Joining, Promotion, Superannuation and Transfer

S. No.	Class of posts	Employees Promoted/ Technical & CAS Assessment	Employees Retired	Employees Transferred/ Resigned	Employees Joined
1.	Scientific Posts				
	RMP				
	HOD		1		
	Pr. Scientist			1	
	Sr. Scientist	2			
	Scientist				
2.	Administrative Posts				
	Sr. Admn. Officer			1	
	Admn. Officer				
	Sr. Finance & Accounts Officer				
	Finance & Accounts Officer				
	Assistant Director (OL)				
	Security Officer				
	Astt. Admn. Officer			1	
	Private Secretary				
	Personal Assistant				
	Assistant			4	1
	UDC				
	LDC		2		
3.	Technical Posts				
	T-6, T-7-8, T-9	1	1		
	T-5				
	T-4				
	T-3				
	T-2				
	T-1				
4.	Skilled Supporting Staff		21		
	Total	3	25	7	1

23.3 Employees Promoted/Technical & CAS Assessment

1. Dr. K. Gururaj promoted to the Post of Pr. Scientist under CAS Assessment.
2. Dr. S.P. Singh promoted to the Post of Pr. Scientist under CAS Assessment.
3. Sh. Suraj Pal promoted to the post of CTO under technical services assessment scheme.

23.4 Employees Transferred/Resigned/reallocated

1. Dr. Anu Rahal, PS transferred to ICAR- DKMA, New Delhi on 30.05.2025
2. Sh. Pushpendra Yadav, AAO transferred assistant to his parent Institute on 11.08.2025.
3. Sh. Shyam Sunder, SAO transferred to ICAR-IARI, New Delhi on 01.11.2026.
4. Sh. Ankit Kumar, Assistant has transferred/reallocated to ICAR-NIPB, New Delhi on 26.08.2025.
5. Sh. Harsh Rohilla, Assistant has transferred/reallocated to ICAR-IASRI, New Delhi on 26.08.2025.
6. Sh. Shivam Gupta, Assistant has transferred/reallocated to ICAR-DRMR, Bharatpur on 26.08.2025.
7. Ms. Vijayalaxmi Sharma, Assistant has transferred/reallocated to ICAR-IARI, New Delhi on 13.08.2025.

23.5 List of Employees Joined in ICAR-CIRG, Makhdoom

S.No.	Name of Candidate	Designation	Date of Joining
1.	Sh. Jagbir Singh	Admin Officer	01.05.2025
2.	Dr. Gayathri S. Lal	Scientist	07.07.2025
3.	Dr. Nisha Bisht	Scientist	07.07.2025
4.	Dr. Varsha Vihan	STO (T-6)	01.08.2025
5.	Sh. Arvind Singh Parihar	Assistant	12.08.2025

23.6 List of Employees Retired during 2025

S.No.	Name of Employee	Designation	Date of Superannuation
1.	Dr. Ashok Kumar	Pr. Scientist & HoD	31.08.2025
2.	Dr. Vijay Kishore	ACTO	31.01.2025
3.	Shri Yogendra Kumar S/o Shri Radheshyam	SSS (MTS)	31.01.2025
4.	Shri Kailash S/o Shri Gariba	SSS (MTS)	31.03.2025
5.	Shri Dayachand S/o Shri Tamoli	SSS (MTS)	31.03.2025
6.	Shri Gulab Singh S/o Shri Kanhaiya	SSS (MTS)	31.03.2025
7.	Shri Manohar Singh	SSS (MTS)	31.03.2025
8.	Shri Angad Singh S/o Shri Puran	SSS (MTS)	31.03.2025
9.	Shri Munna S/o Shri Soran Singh	SSS (MTS)	31.03.2025
10.	Shri Lal Singh S/o Shri Ratan Singh	SSS (MTS)	30.04.2025
11.	Shri Chandan Singh S/o Shri Rambabu	SSS (MTS)	30.04.2025
12.	Shri Kunwarpal	SSS (MTS)	30.04.2025
13.	Shri Ranveer Singh S/o Shri Kalicharan	SSS (MTS)	31.05.2025
14.	Shri Rajveer Singh S/o Shri Bhopat	SSS (MTS)	31.05.2025
15.	Shri Hakim Singh S/o Shri Rambabu	SSS (MTS)	31.05.2025
16.	Shri Omprakash S/o Shri Kailash	SSS (MTS)	30.06.2025
17.	Shri Rameshwar S/o Shri Ramji Lal	SSS (MTS)	31.07.2025
18.	Shri Om Jagdish S/o Shri Megh Singh	Junior clerk (LDC)	31.08.2025
19.	Shri Rajpal S/o Shri Natthi Singh	SSS (MTS)	31.10.2025
20.	Shri Chunna S/o Shri Dimani	SSS (MTS)	31.10.2025
21.	Shri Bhagwan Singh S/o Shri Lakhan	SSS (MTS)	30.11.2025
22.	Shri Mohar Singh S/o Shri Maluka	SSS (MTS)	30.11.2025
23.	Shri Omprakash S/o Shri Bhopat	Junior clerk (LDC)	31.12.2025
24.	Shri Ranveer Singh S/o Shri Arab Singh	SSS (MTS)	31.12.2025
25.	Shri Roshan Lal	SSS (MTS)	31.12.2025

23.7 Budget and Utilization for the Year 2025–26 (Rs. in Lakhs)

S. No.	Head	RE 2025–26	Utilization during the year 2025-26				Total Utilization
			Other than NEH/TSP/SCSP	TSP	NEH	SCSP	
1	GIA – Capital	102.43	99.09	1.32	0.00	2.02	102.43
2	GIA – Salary	1,924.83	1,884.83	0.00	0.00	0.00	1,884.83
3(i)	GIA General – Others	877.40	775.92	20.43	17.07	63.98	877.40
3(ii)	GIA General – Pension	712.48	652.48	0.00	0.00	0.00	652.48
	Grand Total	3,617.14	3,412.32	21.75	17.07	66.00	3,517.14

23.8 Budget and Utilization for AICRP Goat Improvement, Makhdoom(Rs. in Lakhs)

S. No.	Head	RE 2025–26	Utilization during the year 2025-26				Total Utilization
			Other than NEH/TSP/SCSP	TSP	NEH	SCSP	
1	GIA – Capital	33.72	33.09	0.63	0.00	0.00	33.72
2	GIA – Salary	0.00	0.00	0.00	0.00	0.00	0.00
3(i)	GIA General – Others	481.90	352.89	20.96	66.68	41.37	481.90
3(ii)	GIA General – Pension	0.00	0.00	0.00	0.00	0.00	0.00
	Grand Total	515.62	385.98	21.59	66.68	41.37	515.62

23.9 Financial Statement for the Year 2025–26 (Rs. in Lakhs)

A. Recurring Expenditure

Particulars	RE 2025–26	Expenditure				Total Expenditure
		Other than NEH/TSP/SCSP	TSP	NEH	SCSP	
Establishment Charges	1,890.70	1,850.70	0.00	0.00	0.00	1,850.70
Wages	34.13	34.13	0.00	0.00	0.00	34.13
Pension	712.48	652.48	0.00	0.00	0.00	652.48
OTA	0.00	0.00	0.00	0.00	0.00	0.00
TA	15.56	15.56	0.00	0.00	0.00	15.56
Other Charges	852.96	741.52	20.43	17.07	63.98	843.00
HRD	5.85	5.85	0.00	0.00	0.00	5.85
Total Recurring (A)	3,511.68	3,300.24	20.43	17.07	63.98	3,401.72

B. Non-Recurring Expenditure

Particulars	RE 2025–26	Expenditure				Total Expenditure
		Other than NEH/TSP/SCSP	TSP	NEH	SCSP	
Equipments	17.17	13.83	1.32	0.00	2.02	17.17
Information & Technology	3.52	3.52	0.00	0.00	0.00	3.52
Furniture	2.29	2.29	0.00	0.00	0.00	2.29
Vehicle & Vessels	24.90	24.90	0.00	0.00	0.00	24.90
Library Books & Journals	0.00	0.00	0.00	0.00	0.00	0.00
Livestock	0.00	0.00	0.00	0.00	0.00	0.00
Work	54.54	54.54	0.00	0.00	0.00	54.54
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total Non-Recurring	102.42	99.08	1.32	0.00	2.02	102.42

23.10 Revenue Generation for the Year 2025–26

23.10.1 Revenue Generation (As per Usual Format)

S. No.	Particulars	Amount (Rs.)
1	Sale of farm produce	95,93,263
2	Sale of fish & poultry	7,56,208
3	Sale of publication and advertisement	3,62,547
4	Licence fee	16,12,527
5	Interest earned on loans & advances	59,844
6	Leave salary and pension contribution	0
7	Application fee from candidates	0
8	Diploma charges	3,29,000
9	Unspent balance of grants of previous years	53,50,731
10	Training receipts	52,50,000
11	Other miscellaneous receipts (Water/Electricity/Others)	56,47,162
	Total Revenue Generated	2,89,61,282

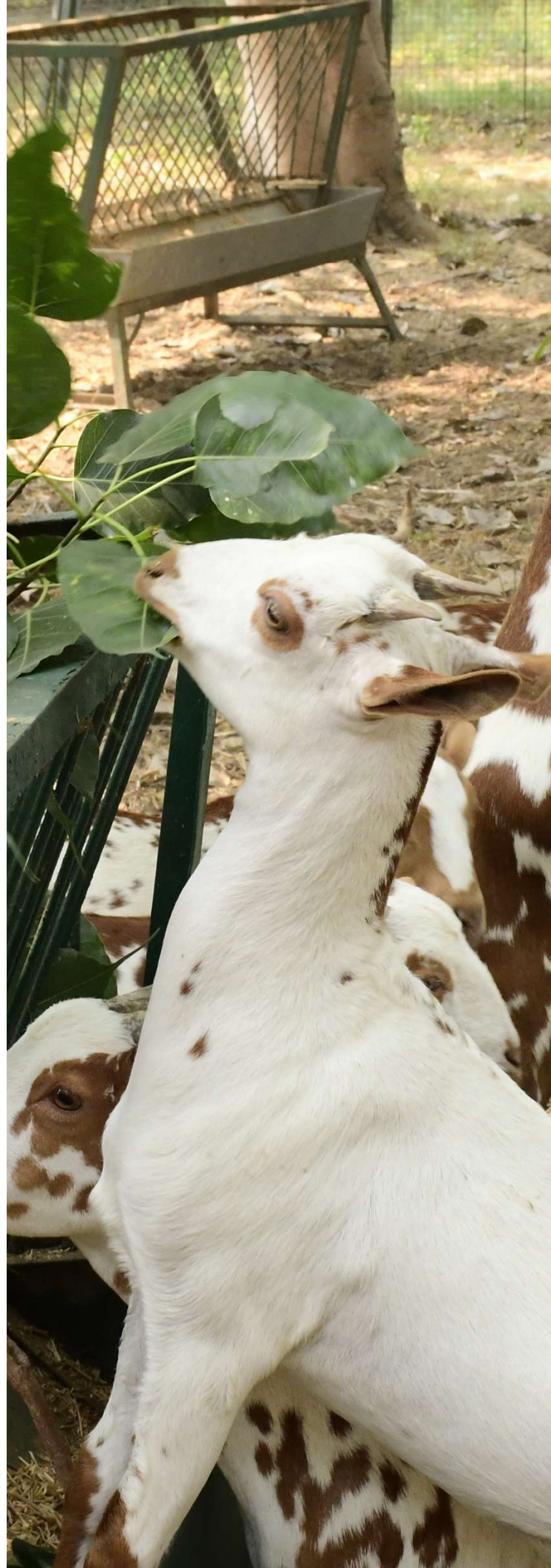
23.10.2 Revenue Generation (As per New ICAR Guidelines)

S. No.	Particulars	Amount (Rs.)
1	Income from Sale & Services	1,19,61,998
2	Income from Fee / Subscription	3,29,000
3	Income from Royalty/Publication Sale	3,62,547
4	Others	90,01,376
	Grand Total	2,16,54,921



CHAPTER 23

ICAR-CIRG IN NEWS



**प्रधानमंत्री किसान सम्मान निधि की
21वीं किस्त के हस्तांतरण कार्यक्रम**



जो खेती हेतु
जरूरतों को पूरा
महत्वपूर्ण आर्थिक
प्रदान करती है। उन
को फसल बी
आयुष्मान भारत
कृषक दुर्घटना क
जैसे अन्य
योजनाओं का
लिए भी प्रेरित
प्रधानमंत्री नरे
देशभर के
18000 करो

[illegible]

सीआईआरजी में मनाया 46 वाँ स्थापना दिवस,
देश भर से आए पशुपालकों को किया सम्मानित

प्रा. केशरी बालाजी का कहना है कि राज्य सरकार ने 44 वें संवैधानिक संशोधन के अन्तर्गत एक प्रमुख प्रावधान के तहत एक सम अधिकारों के तहत प्रतिनिधित्व करने की व्यवस्था की है। उन्होंने सरकार को आलोचना करते हुए कहा कि राज्य सरकार को अनुसूचित जातों को प्रतिनिधित्व करने के लिए जिन प्रावधानों को लागू करने की आवश्यकता है, वे नहीं लागू कर रही हैं। उन्होंने कहा कि प्रतिनिधित्व करने के लिए जिन प्रावधानों को लागू करने की आवश्यकता है, वे नहीं लागू कर रही हैं। उन्होंने कहा कि प्रतिनिधित्व करने के लिए जिन प्रावधानों को लागू करने की आवश्यकता है, वे नहीं लागू कर रही हैं।

केंद्रीय कृषि मंत्री ने गोवर्धन- वृंदावन का किया दौरा

[illegible]

सीआईआर
समीक्षा बैठक
शामिल

व्यक्तिगत प्रतिवेदन पर 2026 पैर विचारित में संघान्वित विचारित नवाचारों जानकरी दी: मेरी विचार में संघान्वित समकक्ष का केवल मुद्रा पत्रालयों के अंतर्गत इनके सौलक्षण को: पूरे देश के दौरान मुर अधिकारों को, के, एक समकक्ष प्रदान किया:

बकरी अनुसंधान केन्द्र में तीन दिवसीय अंतर्राष्ट्रीय कांग्रेस शुरू

महाराष्ट्र सरकारच्या राजधानीत, महाराष्ट्र मंडळाने ०३ दिवसांनी होणारा आंतराष्ट्रीय महोत्सव कायदापूरत होऊन आहे.

केन्द्रीय भेड एवढं ऊन अनुसूचित जातींच्या राजधानीत के परमरा सहयोग से किया गया। इस अवसरपर विभिन्न क्षेत्रों, विभिन्न कला से बचती और भेड उपाचार के क्षेत्र में नवीनता सहयोग लेते हैं।

केन्द्रीयकी नवागमन और उन्नत खोजी की जा रही है पर कौशल ही। इस अवसर पर विभिन्न क्षेत्रों में सहयोग खोजी, भूगु, पोषण, स्वास्थ्यवर्धन, व्यायामकी युक्ति और प्रत्यक्ष विकास से जुड़े पाठ्यक्रम पर अपने विचार प्रस्तुत किया। मुख्य आतिथ्य राजावेन्द्र भट्ट ने अपने सहयोग से जुगुनाती भवनों के पर्यटन में सहयोग करने के लिए आतिथ्य के पद पर सहयोग लेते हैं।

डॉ. जयदेव नारायण मीर ने बचती एव पानत को सामाजिक अर्थव्यवस्था को गल्लवृत्ती करके बताया और, केन्द्रीय बचती एवं भेड के प्रबंधन, प्रत्यक्ष पोषण से संबंधित विभिन्न तकनीकी क्षेत्रों पर, डॉ. ए.के. गल्लेगी और के.एफ.एल. पाठक ने अपने विचारों को प्रस्तुत किया। पद पर सहयोग के रूप में हो रहे तकनीकी बलवर्ती को विभिन्न क्षेत्रों की भाषा की है।

CIRG Scientific Goat farming Calendar released by MP Hema Malini

Narendra Bhardwaj
info@impressivetimes.com

MATHURA: The CIRG Scientific Goat Farming Calendar was released in a grandiose and memorable occasion by Hema Malini, Member of Parliament, Minister of Agriculture and Food, Government of India. Her release added great significance to the occasion and reflected her continued support for agriculture, livestock, and rural development initiatives.

The CIRG Scientific Goat Farming Calendar provides month-wise guidance on various aspects of scientific goat rearing, including breeding, farming, feeding, and disease management. Designed as a practical tool for farmers, it helps call for timely planning and improving production losses,

THE RELEASE FUNCTION WAS ATTENDED BY DR. MANISH KUMAR CHATLI, DI RECTOR, CHIRGA, DR. RUKESH BHAKAT, HEAD, APR DIVISION, DR. GOPAL DAS, PRINCIPAL SCIENTIST, A DIVISION; AND DR. ARY KUMAR, PRINCIPAL SCIENTIST, ANMPT.

and promoting sustainable and profitable goat rearing throughout the year.

The release was attended by

विश्व बकरी दिवस पर आयोजित की कार्यशाला



आपदेवक लोगकी के साथ बकरी पालक, अतिथि और अतिथिनी।

■ वैज्ञानिक और आधुनिक विध अपनाने का आह्वान

कार्यक्रम में किसानों और बका
पालन के सतत विकास के लि
सुधान एग्री आर्गन च एग्री डेव
के साथ संस्थान ने तकनीकी
सहयोग सम्प्रेषित। हस्ताक्षरित किय
कार्यशाला के दौरान अग्र
जाति एवं जनजाति के
योजना के अंतर्ग
को आवश्यक
भी लि

फरी पालन का सुरक्षा तकनीक अपनाएं पालक- प्रा. ए. ए. ए.

त्य बकरी अनुसंधान
थान में मनाया गया
व बकरी दिवस
त्यशाला के दौरान किसान
की पालक किए गए

आरक्षण का मतलब है किसी व्यक्ति को विशेष अधिकार देने का प्रयत्न। यह अधिकार किसी व्यक्ति को उसके वर्ग के आधार पर देना होता है। वर्ग का अर्थ है एक समूह के लोग जो एक ही विशेषता के कारण एक साथ आते हैं। यह विशेषता हो सकती है जाति, धर्म, लिंग, अंगविकलता, आयु, आदि।

आरक्षण का अर्थ

आरक्षण का अर्थ है किसी व्यक्ति को उसके वर्ग के आधार पर विशेष अधिकार देने का प्रयत्न। यह अधिकार किसी व्यक्ति को उसके वर्ग के आधार पर देना होता है। वर्ग का अर्थ है एक समूह के लोग जो एक ही विशेषता के कारण एक साथ आते हैं। यह विशेषता हो सकती है जाति, धर्म, लिंग, अंगविकलता, आयु, आदि।

आरक्षण का उद्देश्य

आरक्षण का उद्देश्य है किसी व्यक्ति को उसके वर्ग के आधार पर विशेष अधिकार देने का प्रयत्न। यह अधिकार किसी व्यक्ति को उसके वर्ग के आधार पर देना होता है। वर्ग का अर्थ है एक समूह के लोग जो एक ही विशेषता के कारण एक साथ आते हैं। यह विशेषता हो सकती है जाति, धर्म, लिंग, अंगविकलता, आयु, आदि।

आरक्षण का प्रकार

आरक्षण को दो प्रकार में बांटा जा सकता है। पहला, जाति आधारित आरक्षण। दूसरा, धर्म आधारित आरक्षण।

जाति आधारित आरक्षण

जाति आधारित आरक्षण का अर्थ है किसी व्यक्ति को उसके जाति के आधार पर विशेष अधिकार देने का प्रयत्न। यह अधिकार किसी व्यक्ति को उसके जाति के आधार पर देना होता है। जाति का अर्थ है एक समूह के लोग जो एक ही विशेषता के कारण एक साथ आते हैं। यह विशेषता हो सकती है जाति, धर्म, लिंग, अंगविकलता, आयु, आदि।

धर्म आधारित आरक्षण

धर्म आधारित आरक्षण का अर्थ है किसी व्यक्ति को उसके धर्म के आधार पर विशेष अधिकार देने का प्रयत्न। यह अधिकार किसी व्यक्ति को उसके धर्म के आधार पर देना होता है। धर्म का अर्थ है एक समूह के लोग जो एक ही विशेषता के कारण एक साथ आते हैं। यह विशेषता हो सकती है जाति, धर्म, लिंग, अंगविकलता, आयु, आदि।

सिखों पर तो सदाकं खेरी, पशु पोषण,
स्वास्थ्य प्रबंधन, उत्पादनका खातिर और
सतत विकास से जुड़े कलनों पर अपने

विचार और आधुनिक ज़करी एवं मेड पालन
में ही रहें तकनीकी बदलावों को विकसित
कर पहचानें की बात करी।

एएस. पी. सिंह बघेल, उपस्थित हैं

चटर्ली जी भी उपस्थित हैं





भा.कृ.अ.प.-केन्द्रीय बकरी अनुसंधान संस्थान

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