भाकृअनुप
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CIRG
1979
MATHURA

वार्षिक प्रतिवेदन
ANNUAL REPORT
2024








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

मखदूम, फरह–281 122, मथुरा (उ.प्र.) भारत

ICAR-Central Institute for Research on Goats

(An ISO 9001:2015 Certified Organization)

Makhdoom, Farah, Mathura - 281 122 (U.P.) INDIA

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GoatResIndia

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Goat - Future animal

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CONTENTS

PREFACE

Goat farming has become a vital component of rural development, offering sustainable livelihood and entrepreneurship opportunities to farmers and rural youth across the country. The demand for goat meat and milk is steadily increasing, making the sector highly promising, particularly for small and marginal farmers. Owing to their resilience to diverse climates and diseases, goats are well positioned to play a vital role in ensuring nutritional and livelihood security for the rapidly growing global population.

Since its establishment in 1979, ICAR-CIRG has been at the forefront of research, technology dissemination, extension activities, and capacity building in scientific goat farming. The Institute has contributed significantly through its work on superior germplasm selection, reproductive technologies, pellet feed development, Moringa-based feeding systems, goat disease diagnostics and drug formulations, as well as value-added goat milk products. These efforts have strengthened the commercial goat farming ecosystem and enhanced returns to the farmers.

Currently, the Institute is engaged in more than 40 research projects exploring emerging areas such as gene editing, herbal formulations, diagnostic kits, methane mitigation, reverse vaccinology, and CRISPR-based innovations. These cutting-edge initiatives aim to make goat farming more resilient, productive, and profitable in the long term.

ICAR-CIRG also remains committed to inclusive development, with focused efforts to uplift SC/ST communities and women farmers. Through the adoption of 22 villages, the Institute has actively conducted training programs, demonstrations, and awareness campaigns to promote scientific goat farming practices and improve livelihoods within goat-rearing communities.

Institute has witnessed several important events in 2024 namely; Industry- Scientist- Farmer's interface meeting, National goat fair and Agro-industry exhibition, 21st review meet of All India Coordinated Research Project on Goat Improvement. Besides this, some specialized training programmes on Molecular and bioinformatics analysis, Value added goat milk product processing and ICAR sponsored short course on "Assisted reproductive technologies" were also conducted successfully. One of the most notable milestones was the organization of the Bakri Mahakumbh / National Goat Conclave on November 18-19, supported by the Department of Animal Husbandry and Dairying, Government of India. A national Goat Fair and Agro-industrial exhibition "Bakri Mahakumbh" was the vital gathering point for more than 3000 progressive goat farmers, entrepreneurs, industry personnel, innovator researchers, policy makers, veterinary officer for collaboration and sharing of expertise, emerging technologies policy frameworks and market strategies which will have the potential to transform the sector. The presence of multiple Union and State ministers, along with top ICAR officials, signified the importance of goat husbandry at both policy and grassroots levels. Impacting national stakeholders, CIRG has signed MoU's with A-IDEA NAARM, MANAGE Hyderabad and LUVAS Hisar. An important meeting was also conducted with the Principal Secretary, Animal Husbandry, Government of Uttar Pradesh in order

to plan the collaborative road map for research, training and extension in goat husbandry in the state.

Institute has witnessed visits of important dignitaries as Hon'ble Union Minister of State Prof. S.P. Singh Baghel Padma Bhushan Dr. R.S. Paroda Dr. Raghvendra Bhatta , Hon'ble Deputy Director General, (Animal Science) ICAR, Dr. Sanjay Kumar, Chairman, ASRB, New Delhi, Dr. M. S. Chauhan, Hon'ble VC, GBPUAT, Pantnagar; Dr. A. K. Gahlot, Former Vice-Chancellor, RAJUVAS, Bikaner, , Dr. G. K. Gaur, ADG (AP&B) ICAR, Dr. Ashok Kumar, ADG (AH) ICAR, Dr. H.S Gupta, Chairman, Agriculture Commission, Assam during various occasions with bountiful discussions.

From policy-level dialogue to grassroots training, ICAR-CIRG remains at the forefront of every initiative that strengthens goat farming in India. I extend heartfelt thanks to our dedicated scientists, staff, and all stakeholders for their tireless efforts. Your commitment is the cornerstone of every success story that emerges from CIRG. Let us continue our journey with even greater vigor, embracing innovation and inclusivity to ensure that goat farming remains a cornerstone of rural prosperity in India and beyond.

(Manish K. Chatli)

CHAPTER 2

EXECUTIVE SUMMARY

2. EXECUTIVE SUMMARY

Goat production plays a vital role in India's rural economy, particularly benefiting smallholder farmers, landless laborers, and marginalized communities. With over 150 million goats and 41 goat breeds, India ranks among the top producers globally, contributing significantly to meat, milk, skin, and fiber production. Goats are adaptable to diverse agro-climatic conditions, require low initial investment, and provide regular income and nutritional security through milk and meat. Their ability to thrive on sparse vegetation makes them ideal for sustainable livestock farming in arid, semi-arid, and hilly regions. The ICAR-Central Institute for Research on Goats, Makhdoom, Uttar Pradesh, has been at the forefront of goat research and development in the country. Established with the aim of improving goat productivity and farmer livelihoods, the institute has played a crucial role in indigenous breed conservation and improvement through selective breeding and conservation under the aegis of AICRP on goats; in development of innovative technologies for health management, nutrition, reproduction, and value-added product development; repeated in appropriate capacity building of farmers, veterinarians, and entrepreneurs through training and extension activities; sustainable farming models like goat-based integrated systems and circular economy frameworks; and policy support and strategic planning for enhancing goat sector contribution to doubling farmers income and ensuring food and nutritional security. Through its research and outreach, ICAR-CIRG continues to drive innovation, productivity, and resilience in the Indian goat sector. There is an ever-increasing and renewed interest for goat farming and goat-based entrepreneurship at a commercial level among diverse segments of stakeholders as witnessed by their heavy footfall in our training programmes. ICAR-CIRG executes its mandated work through four divisions, viz., Animal Genetics and Breeding, Animal Physiology and Reproduction, Animal Nutrition management & products technology and Animal Health. An Extension Education and Socio-economic Section of the Institute looks after the extension related assignments.

2.1 Genetic Improvement of Goats and Sheep

In 2024, the Animal Genetics and Breeding Division focused on maintaining and improving nucleus flocks of Jamunapari, Barbari, and Jakhrana goats, as well as Muzaffarnagari sheep, with an emphasis on genetic improvement. The Jamunapari goat unit had 404 animals by year-end, with 184 kids born and multiple births accounting for 49%. Key reproductive and growth parameters were recorded, with elite males selected based on body weight and dam's milk yield. Average lactation yield was 116.88 litres, and the flock generated ₹23.27 lakh through animal and milk sales. The Barbari goat unit grew from 476 to 552 animals, producing 308 kids with a high multiple birth rate of 69.16%. Growth and reproductive traits were favourable, with moderate heritability estimates for body weights. Average lactation yield reached 140.38 litres, with revenue of ₹25.14 lakh, and 150 goats were supplied to agencies. In the Jakhrana goat unit, the flock expanded from 244 to 274, producing 102 kids. Growth and milk production traits were documented, with heritability estimates ranging from low to moderate. Average lactation yield was 178.8 litres, and revenue generation was ₹5.79 lakh. Fourteen superior animals were distributed. The Muzaffarnagari sheep unit maintained 459 animals at year-end. Lamb growth, fleece yield, and reproductive traits were recorded, with males showing superior growth. A total of 114 superior sheep were supplied, generating ₹17.66 lakh revenue. Additionally, molecular genetics research explored growth-related markers. Genomic studies on the GH and IGF-1 genes in sheep identified novel SNPs and genotype variations, while expression analysis showed age-dependent IGF-1 activity, peaking at 9 months. These results underscore the breed's genetic diversity and potential for targeted selection to improve productivity and adaptability. Overall, the division achieved progress in flock improvement, germplasm dissemination, revenue generation, and molecular insights supporting long-term breeding strategies.

2.2 Goat Physiology, Reproduction and Artificial Insemination

Buck semen diluter supplemented with specific concentration of *A. racemosus* (2.5 µg/mL) *withania somnifera* (100 µg/mL), *Moringa oleifera* (75 µg/mL) and *Tribulus terrestris* (100 µg/mL) has been shown very effective for long term preservation of buck spermatozoa in terms of post thaw sperm motility (> 65%), live percent (70%), membrane integrity, acrosomal intactness and antioxidant status. 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% higher in oestrus goat than normal female goat. When different combination of different concentrations of herbal extract were added in buck semen diluter and post thaw qualities were evaluated. The specific concentration of particular herb and a particular combination showed significant improvement in post thaw semen qualities (ABC). The exact concentration is not disclosed here due to IPR issue.

A questionnaire was developed to conduct the doorstep survey of reproductive problems in goats under field conditions. A total 8 villages of Mathura district were included to cover 101 households. Anoestrus, repeat breeder (Short cycles 10-15 days), abortion (2-3 months) were the major reproductive problems in female goats with incidence of 15%, 30.17% and 3.10%, respectively. Overall, repeat breeders / Short cycles, Anoestrus and Non/poor availability of quality breeding bucks were the major reproductive concerns under field conditions.

The majority (58%) of goats irrespective of breed exhibits 3 waves and 29% exhibited 4 waves oestrous cycles. Follicular growth and regression rates were nearly 1 mm/day in both the breeds. Average diameter of ovulatory follicle was 5.73 and 5.97 mm, whereas diameter of largest ovulatory follicle was 6.81 and 6.98mm in Barbari and Jamunapari goats, respectively. Two technologies were developed: Laparoscopy assisted embryo transfer in goats and efficient regimen for oestrus synchronization in goats.

The feasibility of using enriched dermal fibroblast cell lines as a cellular resource for genetic conservation and advanced biotechnological applications was effectively demonstrated. The use of ECM proteins significantly enhanced the post-thaw functionality of the fibroblasts, suggesting their potential utility in downstream applications such as somatic cell nuclear transfer (SCNT), gene editing, and regenerative therapies. All cryopreserved cell lines are safely deposited at the ICAR-NBAGR Cell Bank, where they are available for future scientific studies aimed at genetic improvement, biodiversity conservation, and biotechnology-based interventions in livestock.

In-house systems for oocyte maturation, cryopreservation, and embryo development in goats were successfully established. The in-house IVM medium outperformed or matched commercial media in maturation and blastocyst yield. Melatonin emerged as a promising antioxidant additive for oocyte vitrification. The choice of incubation environment and vitrification carrier significantly impacted embryo development and cryosurvival.

NP-GET project has significantly advanced the platform technologies required for applying genome editing in goats by creating optimized fibroblast cell systems**,** transfection protocols**,** and clonal cell line resources**.** These outcomes provide a critical foundation for future gene-editing applications in livestock health, productivity, and biotechnology innovation.

2.3 Goat Nutrition, Feed Formulation and Products Value-addition

The Animal Nutrition Management and Product Technology Division is working in line with the Institute's mandate to undertake basic and applied research programme to improve goat production and product technology. In the year 2024-25, there were nine research projects in the division, of which three were funded by the Department of Biotechnology (1) and ICAR (2). Under the project ICAR network programme on veterinary type culture collection, the division isolated 13 superior cellulose-degrading organisms and received accession numbers. Under the prestigious Global CoE on Millets project, we have characterized the nutritional profile (CP, EE, Ash, organic matter, ADF, NDF, cellulose, lignin, total carbohydrates, and minerals) of stovers from nine pearl millet varieties. These millet stovers were used to develop complete feed pellets, and the effect of these pellets when fed to lactating goats on the rumen fermentation metabolites, milk production performance, physicochemical properties, and fatty acid profile of goat milk was studied. The chemical composition of sorghum and bajra cultivated through natural farming was determined under the project development of natural farming-based fodder production practices for goats. This was followed by an assessment of growth performance in goats fed with berseem grown through traditional and natural farming. Under the project on Agri-Drone, an application of the drone in goat fodder production was demonstrated to various trainees and veterinary students, and sponsored candidates. The wool produced by Muzaffarnagari sheep was evaluated for its chemical composition and further used as a mulching material for fodder production. The results showed dose-dependent improvement in fodder production due to added sheep wool.

Under the project on goat cheese standardization, we assessed the quality characteristics and storage stability of goat milk gouda cheese during vacuum refrigeration for five months. We also standardized the development of goat milk chevre and kaladhi cheeses and evaluated their quality and acceptability. In a DBT-funded project, we investigated the effect of dietary minerals and vitamin supplements on the fatty acid profile of goat milk and milk products. Further, we determined the economics of producing designer goat meat and milk through a partial budgeting approach. We determined the oxidative stability and culture viability of goat frozen yoghurt added with mango powder during storage under the project on goat milk yoghurt. Here, we evaluated the antioxidant potential of mango powder by colorimetric and chromatographic means and determined its effect in frozen yoghurt on physico chemical, rheological, sensory, and microbiological properties. We developed goat milk and multi-millet-based cookies under the project on the development of millet-based goat milk products and evaluated physicochemical and rheological properties as well as fatty acid profiles. The division developed the technologies of a package of practices to produce designer goat meat and milk with enhanced trace minerals and vitamins, goat milk chevre and kaladhi cheeses, frozen yoghurt, and multi-millet-based goat milk biscuit in the year 2024-25. The division has generated revenue of ₹ 1001340.00 through the sale of milk products (₹ 549900.00) and meat, as well as meat products (₹ 451440.00).

2.4 Goat Health Management

A total of 2,369 bio-samples were tested for various diseases from multiple sources. Brucellosis screening of 184 serum samples from goats and sheep revealed zero positivity in goats and a single positive case (0.66%) in sheep. Additionally, no brucellosis was detected in samples from aborted females. Parasitological analysis of 2,145 faecal samples showed 7.64% positivity for bursate worms and 5.08% for coccidian infections. The herbs show time as well as concentration dependent potentiation of antibacterial killing. ATR-FTIR can be used to detect antibiotic resistance in E. coli. Pregnancy toxaemia and ketosis were identified as the main metabolic disorders in female goats, whereas urolithiasis was the most commonly observed disorder in males. Under the AIN Project on Ethno-veterinary Medicine, the prototype formulations were developed for an anti-coccidial herbal bolus and a medicated herbal pellet. In 2024, bacteriological examination of 201 biosamples from three districts of Uttar Pradesh resulted in 201 bacterial isolates (*Escherichia coli and Staphylococcus aureus*), which then underwent antimicrobial resistance analysis, identifying extended-spectrum beta-lactamase producing *E. coli*, methicillin-resistant *Staphylococcus aureus*, and a decline in vancomycin resistance. A multiepitope vaccine targeting *Clostridium perfringens* toxins was designed and successfully expressed as a tetravalent fusion protein, while the Goat Transcriptome Web Resource for Enterotoxaemia was developed to advance genomic research and vaccine strategies. The overall prevalence of clinical mastitis in goats was found to be 3.17% over a 14-year period, from April 1, 2010, to March 31, 2024. Among 420 milking goats examined, 23 (5.47%) tested positive for subclinical mastitis based on the California Mastitis Test and Somatic Cell Count. Presence of Mycoplasma spp. was detected in five samples using genus-specific PCR in 10 pneumonic lungs from goats. Of the 2,654 post-mortem cases analysed over a 19-year period (April 1, 2005–March 31, 2024), pneumonia was identified as the cause of death in 27.84% of cases. The overall mortality rate due to pneumonia in goats during this period was estimated at 2.00%. Additionally, the overall morbidity rate due to pneumonia over the 14-year period (April 1, 2010–March 31, 2024) was found to be 4.16%. To develop a clinical scoring system, a format has been designed for recording relevant clinical parameters. Among 70 suspected biological samples (including deep nasal secretions and pneumonic lungs) of caprine origin, Staphylococcus aureus was the most frequently isolated pathogen (eight isolates), followed by Mannheimia haemolytica (seven isolates) and Streptococcus spp. (six isolates).

2.5 Technology Dissemination, Capacity Building and Economic Goat Farming

Goat farming is playing an important role in livelihood and nutritional security of goat rearing households in Bundelkhand region of Uttar Pradesh. Organized the Thirty *Kisan Gosthis*/field days in different adopted villages of Banda and Mahoba Districts. The project beneficiaries were encouraged to adopt good management practices in their goat farming for better returns. To improve farmers access to market and other government schemes / programme, 15 goats based Self Help Groups (SHGs) were developed.

Under Development Action Plan for Schedule Tribes (DAPST), extension activities were organized in four states namely Rajasthan (Bharatpur, Karoli, Dhaulpur, Boondi districts), Madhya Pradesh (Tikamgarh, Shivpuri and Datia districts), Uttar Pradesh (Lalitpur & Chitrakoot districts) and Uttarakhand (Rudrapur district). Training programme on scientific goat farming and input distribution programmes were organized in these states. About 1300 goat farmers (majority of women goat farmers) were received inputs and get benefitted. Central Institute for Research on Goats, Makhdoom is making efforts for income enhancement through scientific goat production and poverty reduction among the target population by capacity building/skill development. Under the Development Action Plan for Schedule Tribe (DAPST), identified goat technologies and input distribution was made.

Section organised National Goat Conclave-2024 with the collaboration of Department of Animal Husbandry and Dairying. Under this conclave, *Bakri Maha Kumbh-2024* National Goat Fair and Agro-Industrial Exhibition was organised at CIRG Campus on 18th November 2024. More than three thousand farmers participated and visited 45 stalls exhibiting different technologies on crop and animal production. Under Developmental Action Plan for Schedule Tribes (DAPST) organised the one-day training program on scientific goat farming, exposure visit and input distribution on the occasion of World Goat Day 21st August 2024.

Section organized Eight (8) national training programmes on "Scientific Goat farming", in which 725 goat farmers (38 women), unemployed youth, retired professionals and entrepreneurs from 15 states / participated. Ten (10) sponsored training programmes were organized in which 232 (59 women) were participated and learned good goat management practices. A total 4832 visitors registered at ICAR-CIRG Farmers' Single Window during the reporting period. It was 13% higher than the previous year's number (4269). More than 2500 students of Govt Schools of Agra, Mathura, Firozabad, Mainpuri, Etah and Aligarh visited ICAR-CIRG. Large numbers 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. Showcased goat technologies in six *kisan melas* and exhibitions.

कार्यकारी सारांश

बकरी उत्पादन भारत की ग्रामीण अर्थव्यवस्था में महत्वपूर्ण भूमिका निभाता है, विशेष रूप से छोटे किसानों, भूमिहीन मजदूरों और हाशिए पर पड़े समुदायों को लाभान्वित करता है। 15 करोड़ से ज़्यादा बकरियों और 41 बकरी नस्लों के साथ, भारत दुनिया भर में शीर्ष उत्पादकों में से एक है, जो मांस, दूध, त्वचा और रेशे के उत्पादन में महत्वपूर्ण योगदान देता है। बकरियाँ विविध कृषि-जलवायु परिस्थितियों के अनुकूल होती हैं, कम प्रारंभिक निवेश की आवश्यकता होती है, और दूध और मांस के माध्यम से नियमित आय और पोषण सुरक्षा प्रदान करती हैं। वनस्पतियों, पेड़-पौधों से पोषण और पैदावार करने की उनकी क्षमता उन्हें शुष्क, अर्ध-शुष्क और पहाड़ी क्षेत्रों में स्थाई पशुपालन के लिए आदर्श बनाती है। भाकृअनुप-केंद्रीय बकरी अनुसंधान संस्थान, मखदूम, उत्तर प्रदेश, देश में बकरी अनुसंधान एवं विकास में अग्रणी रहा है। बकरी उत्पादकता और किसानों की आजीविका में सुधार लाने के उद्देश्य से स्थापित, इस संस्थान ने अखिल भारतीय बकरी अनुसंधान परियोजना (एआईसीआरपी) के तत्वावधान में चयनात्मक प्रजनन और संरक्षण के माध्यम से स्वदेशी नस्लों के संरक्षण और सुधार में; स्वास्थ्य प्रबंधन, पोषण, प्रजनन और मूल्यवर्धित उत्पाद विकास हेतु नवीन तकनीकों के विकास में; प्रशिक्षण और विस्तार गतिविधियों के माध्यम से किसानों, पशु चिकित्सकों और उद्यमियों के क्षमता निर्माण में; बकरी-आधारित एकीकृत प्रणालियों और चक्राकार अर्थव्यवस्था ढाँचों जैसे स्थाई कृषि मॉडल में एवं किसानों की आय दोगुनी करने तथा खाद्य एवं पोषण सुरक्षा सुनिश्चित करने हेतु बकरी क्षेत्र के योगदान को बढ़ाने में महत्वपूर्ण भूमिका निभाई है।

अपने अनुसंधान और बकरी पालकों तक पहुँच के माध्यम से केन्द्रीय बकरी अनुसंधान संस्थान बकरी क्षेत्र में नवाचार और उत्पादकता को बढ़ावा दे रहा है। विभिन्न बकरी पालकों के बीच व्यावसायिक स्तर पर बकरी पालन और बकरी-आधारित उद्यमिता के प्रति निरंतर बढ़ती और नवीनीकृत रुचि देखी जा रही है, जैसा कि हमारे प्रशिक्षण कार्यक्रमों में उनकी भारी उपस्थिति से स्पष्ट है। केन्द्रीय बकरी अनुसंधान संस्थान अपने अधिदेशित कार्य को चार विभागों, अर्थात पशु आनुवंशिकी एवं प्रजनन, पशु शरीरक्रिया विज्ञान एवं प्रजनन, पशु पोषण प्रबंधन एवं उत्पाद प्रौद्योगिकी और पशु स्वास्थ्य विभाग के माध्यम से निष्पादित करता है। संस्थान का एक विस्तार शिक्षा एवं सामाजिक-आर्थिक अनुभाग विस्तार संबंधी कार्यों का कार्यभार संभालता है।

2.1 बकरियों और भेड़ों का आनुवंशिक सुधार

वर्ष 2024 में पशु आनुवंशिकी एवं प्रजनन विभाग ने आनुवंशिक सुधार पर ज़ोर देते हुए, जमुनापारी, बरबरी और जखराना बकरियों के साथ-साथ मुज़फ़्फ़रनगरी भेड़ों के मूल झुंडों के रखरखाव और सुधार पर ध्यान केंद्रित किया। वर्ष के अंत तक जमुनापारी बकरी इकाई में 404 पशु थे, जिनमें से 184 बच्चे पैदा हुए और 49% बहु-जन्मों का योगदान था। प्रमुख प्रजनन और सुधार के आँकड़े दर्ज किए, जिसमें शरीर के वजन और मादा की दूध उत्पादन क्षमता के आधार पर श्रेष्ठ नरों का चयन किया गया। औसत दुग्ध उत्पादन 116.88 लीटर था जिससे झुंड से पशु और दूध की बिक्री के माध्यम से ₹ 23.27 लाख की राजस्व प्राप्ति हुई। बरबरी बकरी इकाई 476 से बढ़कर 552 पशुओं की हो गई, जिससे 69.16% की उच्च बहु जन्म दर के साथ 308 बच्चे पैदा हुए। शरीर के वजन के लिए मध्यम आनुवंशिकता अनुमानों के साथ विकास और प्रजनन लक्षण अनुकूल थे। औसत दुग्ध उत्पादन 140.38 लीटर तक पहुंच गया, जिससे ₹25.14 लाख का राजस्व प्राप्त हुआ, और 150 बकरियां बकरी पालकों व विभिन्न संस्थाओं को आपूर्ति की गईं। जखराना बकरी इकाई में, झुंड 244 से बढ़कर 274 हो गया, जिससे 102 बच्चे पैदा हुए। विकास और दूध उत्पादन संबन्धित आँकड़े एकत्रित किए, जिसमें आनुवंशिकता अनुमान निम्न से मध्यम तक थे। औसत दुग्ध उत्पादन 178.8 लीटर था और राजस्व प्राप्ति ₹ 5.79 लाख थी। 14 श्रेष्ठ पशु किसानों को वितरित किए गए।

मुज़फ़्फ़रनगरी भेड़ इकाई पर रिपोर्ट किए गए वर्ष के दौरान 459 पशुओं को पाला गया। मेमने की वृद्धि, ऊन की उपज और प्रजनन संबंधी आँकड़े दर्ज किए गए, जिनमें नर भेड़ों में बेहतर वृद्धि देखी गई। वर्ष के दौरान कुल 114 भेड़ों की आपूर्ति की गई, जिससे ₹17.66 लाख का राजस्व प्राप्त हुआ। इसके अतिरिक्त, आणविक आनुवंशिकी अनुसंधान ने वृद्धि-संबंधी संकेतकों का पता लगाया। भेड़ों में GH और IGF-1 जीन पर किए गए जीनोमिक अध्ययनों ने नए SNP और जीनोटाइप विविधताओं की पहचान की, जबकि अभिव्यक्ति विश्लेषण ने आयु-निर्भर IGF-1 गतिविधि दिखाई, जो 9 महीनों में चरम पर थी। ये परिणाम नस्ल की आनुवंशिक विविधता और उत्पादकता एवं अनुकूलनशीलता में सुधार हेतु लक्षित चयन की क्षमता को रेखांकित करते हैं। इस प्रकार मुजफ्फरनगरी भेड़ों मे सुधार, जर्मप्लाज्म प्रसार, राजस्व सृजन और दीर्घकालिक प्रजनन रणनीतियों का समर्थन करने वाली आणविक अंतर्दृष्टि में प्रगति हासिल की।

2.2 बकरी शरीरक्रिया विज्ञान, प्रजनन और कृत्रिम गर्भाधान

ए. रेसमोसस (2.5 µg/mL), व्हिटानिया सोम्नीफेरा (100 µg/mL), मोरिंगा ओलीफेरा (75 µg/mL) और ट्रिबुलस टेरेस्ट्रिस (100 µg/mL) की विशिष्ट सांद्रता से पूरित बक वीर्य तनुकारक, शुक्राणुओं की विगलन के बाद गतिशीलता (> 65%), जीवित प्रतिशत (70%), झिल्ली अखंडता, एक्रोसोमल अक्षुण्णता और एंटीऑक्सीडेंट स्थिति के संदर्भ में बकरों के शुक्राणुओं के दीर्घकालिक संरक्षण के लिए बहुत प्रभावी पाया गया है। जब स्तनधारी शुक्राणु कोशिकाएँ मादा जननांग पथ में प्रवेश करती हैं, तो उनमें से अनेक पर ल्यूकोसाइट्स और उपकला कोशिकाओं द्वारा आक्रमण किया जाता है और उन्हें भक्षणित कर दिया जाता है। सामान्य मादा बकरी की तुलना में ओस्ट्रस बकरी में न्यूट्रोफिल की संख्या 3.5% अधिक थी। जब विभिन्न सांद्रता वाले हर्बल अर्क के विभिन्न संयोजनों को बकरे के वीर्य तनुकारक में मिलाया गया और विगलन के बाद के गुणों का मूल्यांकन किया गया। विशेष जड़ी-बूटी और विशेष संयोजन की विशिष्ट सांद्रता ने विगलन के बाद के वीर्य गुणों में उल्लेखनीय सुधार दिखाया।

बकरियों में प्रजनन संबंधी समस्याओं का ग्रामीण क्षेत्रों में घर-घर जाकर सर्वेक्षण करने के लिए एक प्रश्नावली तैयार की गई। मथुरा जिले के कुल 8 गाँवों को शामिल करके 101 परिवारों को शामिल किया गया। मादा बकरियों में प्रजनन संबंधी प्रमुख समस्याएँ क्रमशः 15%, 30.17% और 3.10% थीं, जिनमें प्रजनन संबंधी समस्याएँ (एनोस्ट्रस), पुनरावर्ती प्रजनक (10-15 दिन का छोटा चक्र), गर्भपात (2-3 महीने) थीं। कुल मिलाकर ग्रामीण परिस्थितियों में प्रजनन संबंधी प्रमुख चिंताएँ पुनरावर्ती प्रजनक/लघु चक्र, एनोस्ट्रस और गुणवत्तापूर्ण प्रजनन बकरों की कमी थीं। सभी बकरियाँ अधिकांशतः (58%) 3 वेब और 29% 4 वेब कामोत्तेजना चक्र प्रदर्शित करती हैं। दोनों नस्लों में कूपिक वृद्धि और प्रतिगमन दर लगभग 1 मिमी/दिन थी। अण्डोत्सर्गी कूप का औसत व्यास क्रमशः 5.73 और 5.97 मिमी था, जबकि बरबरी और जमुनापारी बकरियों में सबसे बड़े अण्डोत्सर्गी कूप का व्यास क्रमशः 6.81 और 6.98 मिमी था। दो प्रौद्योगिकियाँ विकसित की गईं: बकरियों में लैप्रोस्कोपी सहायता प्राप्त भ्रूण स्थानांतरण और बकरियों में कामोत्तेजना समन्वयन के लिए कुशल व्यवस्था। आनुवंशिक संरक्षण और उन्नत जैव-प्रौद्योगिकी अनुप्रयोगों के लिए कोशिकीय संसाधन के रूप में समृद्ध त्वचीय फाइब्रोब्लास्ट कोशिका रेखाओं के उपयोग की व्यवहार्यता को प्रभावी ढंग से प्रदर्शित किया गया। ईसीएम प्रोटीन के उपयोग ने फाइब्रोब्लास्ट की विगलन-पश्चात कार्यक्षमता में उल्लेखनीय वृद्धि की, जिससे दैहिक कोशिका नाभिकीय स्थानांतरण (एससीएनटी), जीन संपादन और पुनर्योजी चिकित्सा जैसे अनुप्रवाह अनुप्रयोगों में उनकी संभावित उपयोगिता का संकेत मिलता है। सभी क्रायोप्रिजर्व्ड कोशिका रेखाएँ आईसीएआर-एनबीएजीआर सेल बैंक में सुरक्षित रूप से जमा हैं, जहाँ वे आनुवंशिक सुधार, जैव विविधता संरक्षण और पशुधन में जैव-प्रौद्योगिकी-आधारित हस्तक्षेपों पर केंद्रित भविष्य के वैज्ञानिक अध्ययनों के लिए उपलब्ध हैं। बकरियों में अंडकोशिका परिपक्वता, क्रायोप्रिजर्वेशन और भ्रूण विकास के लिए आंतरिक

प्रणालियाँ सफलतापूर्वक स्थापित की गईं। आंतरिक IVM माध्यम ने परिपक्वता और ब्लास्टोसिस्ट उत्पादन में व्यावसायिक माध्यम से बेहतर प्रदर्शन किया या उसके बराबर रहा। मेलाटोनिन, अंडकोशिका विट्रीफिकेशन के लिए एक आशाजनक एंटीऑक्सीडेंट योज्य के रूप में उभरा। ऊष्मायन वातावरण और विट्रीफिकेशन वाहक के चुनाव ने भ्रूण विकास और क्रायोसर्वाइवल को महत्वपूर्ण रूप से प्रभावित किया। एनपी-जीईटी परियोजना ने अनुकूलित फ़ाइब्रोब्लास्ट कोशिका प्रणालियों, ट्रांसफ़ेक्शन प्रोटोकॉल और क्लोनल कोशिका रेखा संसाधनों का निर्माण करके बकरियों में जीनोम संपादन के लिए आवश्यक प्लेटफ़ॉर्म तकनीकों को उल्लेखनीय रूप से उन्नत किया है। यह परिणाम पशुधन स्वास्थ्य, उत्पादकता और जैव प्रौद्योगिकी नवाचार में भविष्य के जीन-संपादन अनुप्रयोगों के लिए एक महत्वपूर्ण आधार प्रदान करते हैं।

2.3 बकरी पोषण, आहार निर्माण और उत्पाद मूल्यवर्धन

पशु पोषण प्रबंधन एवं उत्पाद प्रौद्योगिकी विभाग संस्थान के उद्देश्य के अनुरूप, बकरी उत्पादन और उत्पाद प्रौद्योगिकी में सुधार हेतु एक बुनियादी और अनुप्रयुक्त अनुसंधान कार्यक्रम चलाने के लिए कार्य कर रहा है। वर्ष 2024-25 में विभाग में नौ अनुसंधान परियोजनाएँ चलायी गयी थीं, जिनमें से तीन को जैव प्रौद्योगिकी विभाग और दो को आईसीएआर द्वारा वित्त पोषित किया गया था। पशु चिकित्सा प्रकार संवर्धन संग्रह पर आईसीएआर नेटवर्क कार्यक्रम के अंतर्गत, विभाग ने 13 उत्कृष्ट सेल्यूलोज़-अपघटनकारी जीवाणुओ को पृथक किया और उसके लिए एक निर्दिष्ट संख्या प्राप्त की। प्रतिष्ठित "ग्लोबल सीओई ऑन मिलेट्स" परियोजना के अंतर्गत हमने नौ बाजरा किस्मों के स्टोवर्स (कुट्टी) के पोषण प्रोफ़ाइल (सीपी, ईई, राख, कार्बनिक पदार्थ, एडीएफ, एनडीएफ, सेल्यूलोज़, लिग्निन, कुल कार्बोहाइड्रेट और खनिज) का विश्लेषण किया। इन बाजरा स्टोवर्स का उपयोग संपूर्ण आहार पेलेट विकसित करने के लिए किया गया था, और दुधारू बकरियों को खिलाए गए इन पेलेटों के रुमेन किण्वन मेटाबोलाइट्स, दूध उत्पादन प्रदर्शन, भौतिक-रासायनिक गुणों और बकरी के दूध के फैटी एसिड प्रोफ़ाइल पर प्रभाव का मूल्यांकन किया गया था।

बकरियों के लिए प्राकृतिक खेती-आधारित चारा उत्पादन पद्धतियों के विकास परियोजना के अंतर्गत, प्राकृतिक खेती से उगाए गए ज्वार और बाजरे की रासायनिक संरचना का निर्धारण किया गया। इसके बाद पारंपरिक और प्राकृतिक खेती से उगाई गई बरसीम से पोषित बकरियों के विकास प्रदर्शन का आकलन किया गया। एग्री-ड्रोन परियोजना के अंतर्गत, विभिन्न प्रशिक्षुओं और पशु चिकित्सा छात्रों को बकरी चारा उत्पादन में ड्रोन के उपयोग का प्रदर्शन किया गया। मुज़फ़्फ़रनगरी भेड़ों द्वारा उत्पादित ऊन का उसकी रासायनिक संरचना के लिए मूल्यांकन किया गया और उसका चारा उत्पादन के लिए मल्चिंग सामग्री के रूप में उपयोग किया गया। परिणाम में भेड़ के ऊन के मिश्रण के कारण चारा उत्पादन में पैदावार आधारित सुधार देखा गया।

बकरी पनीर मानकीकरण परियोजना के अंतर्गत पाँच महीनों तक निर्वात प्रशीतन के दौरान बकरी के दूध से बने गौडा पनीर की गुणवत्ता विशेषताओं और भंडारण स्थिरता का आकलन किया गया। बकरी के दूध से बने शेवर और कलाधी पनीर के विकास का भी मानकीकरण किया गया और उनकी गुणवत्ता एवं स्वीकार्यता का मूल्यांकन किया गया। डीबीटी द्वारा वित्त पोषित एक परियोजना में, बकरी के दूध और दूध उत्पादों के फैटी एसिड प्रोफाइल पर आहार खनिजों और विटामिन पूरकों के प्रभाव की जाँच की गई। इसके अलावा, आंशिक बजटीय दृष्टिकोण के माध्यम से डिज़ाइनर बकरी के मांस और दूध के उत्पादन के आर्थिक पहलुओं का निर्धारण किया गया। बकरी के दूध से बने दही पर परियोजना के तहत भंडारण के दौरान आम पाउडर के साथ मिलाए गए बकरी के जमे हुए दही की ऑक्सीडेटिव स्थिरता और संस्कृति व्यवहार्यता निर्धारित की गई। यहां, हमने रंगमिति और क्रोमैटोग्राफिक तरीकों से आम पाउडर की एंटीऑक्सीडेंट क्षमता का मूल्यांकन किया और जमे हुए दही में इसके मिश्रण को भौतिक-रासायनिक, रियोलॉजिकल, संवेदी और

सूक्ष्मजीवविज्ञानी गुणों पर निर्धारित किया। हमने बाजरा आधारित बकरी के दूध उत्पादों के विकास पर परियोजना के तहत बकरी के दूध और बहु-बाजरा आधारित कुकीज़ विकसित की और भौतिक-रासायनिक और रियोलॉजिकल गुणों के साथ-साथ फैटी एसिड प्रोफाइल का मूल्यांकन किया। इस विभाग ने वर्ष 2024-25 में उन्नत ट्रेस खनिजों और विटामिनों के साथ डिजाइनर बकरी के मांस और दूध, बकरी के दूध से बने शेवरले और कलाधी चीज, जमे हुए दही और बहु-बाजरा आधारित बकरी के दूध के बिस्कुट का उत्पादन करने के लिए अभ्यास के पैकेज की तकनीकें विकसित कीं। प्रभाग ने दुग्ध उत्पादों (₹ 549900.00) और मांस, साथ ही मांस उत्पादों (₹ 451440.00) की बिक्री के माध्यम से ₹ 1001340.00 का राजस्व उत्पन्न किया है।

2.4 बकरी स्वास्थ्य प्रबंधन

विभिन्न स्रोतों से प्राप्त कुल 2,369 जैव-नमूनों का विभिन्न रोगों के लिए परीक्षण किया गया। बकरियों और भेड़ों के 184 सीरम नमूनों की ब्रुसेलोसिस जाँच से बकरियों में शून्य सकारात्मकता और भेड़ों में एक सकारात्मक मामला (0.66%) पाया गया। इसके अतिरिक्त, गर्भपात हुई मादाओं के नमूनों में कोई ब्रुसेलोसिस नहीं पाया गया। 2,145 मल नमूनों के परजीवी विश्लेषण से बरसेट कृमियों के लिए 7.64% और कोक्सीडियन संक्रमणों के लिए 5.08% सकारात्मकता देखी गई। ये जड़ी-बूटियाँ समय के साथ-साथ सांद्रता पर निर्भर जीवाणुरोधी मारक क्षमता दर्शाती हैं। एटीआर-एफटीआईआर का उपयोग ई. कोलाई में एंटीबायोटिक प्रतिरोध का पता लगाने के लिए किया जा सकता है। मादा बकरियों में गर्भावस्था विषाक्तता और कीटोसिस मुख्य चयापचय विकारों के रूप में पहचाने गए, जबकि नर बकरियों में यूरोलिथियासिस सबसे आम विकार था। एथनो-वेटरनरी मेडिसिन पर एआईएन परियोजना के तहत, एक एंटी-कोक्सीडियन हर्बल बोलस और एक औषधीय हर्बल पेलेट के लिए प्रोटोटाइप फॉर्मूलेशन विकसित किए गए। 2024 में, उत्तर प्रदेश के तीन जिलों से 201 जैव नमूनों की जीवाणु विज्ञान संबंधी जांच के परिणामस्वरूप 201 जीवाणु पृथक (ई. कोली और स्टैफिलोकोकस ऑरियस) प्राप्त हुए, जिनका रोगाणुरोधी प्रतिरोध विश्लेषण किया गया, जिसमें विस्तारित स्पेक्ट्रम बीटा-लैक्टामेज उत्पादक ई. कोली, मेथिसिलिन प्रतिरोधी स्टैफिलोकोकस ऑरियस की पहचान की गई, और वैनकोमाइसिन प्रतिरोध में गिरावट देखी गई। क्लोस्ट्रीडियम परफ्रिंजेंस टाक्सिन को लक्षित करने वाला एक मल्टीएपिटोप टीका डिज़ाइन किया गया और इसे टेट्रावैलेंट फ़्यूज़न प्रोटीन के रूप में सफलतापूर्वक व्यक्त किया गया, जबकि जीनोमिक अनुसंधान और टीका रणनीतियों को आगे बढ़ाने के लिए एंटरोटॉक्सिमिया के लिए बकरी ट्रांसक्रिप्टोम वेब संसाधन विकसित किया गया। 1 अप्रैल, 2010 से 31 मार्च, 2024 तक, 14 वर्षों की अवधि में बकरियों में नैदानिक थनैला का समग्र प्रसार 3.17% पाया गया। कैलिफ़ोर्निया स्तनदाह परीक्षण और सोमैटिक सेल काउंट के आधार पर, 420 दुधारू बकरियों की जाँच की गई, जिनमें से 23 (5.47%) में उप-नैदानिक थनैला पाया गया। बकरियों के 10 न्यूमोनिक फेफड़ों में जीनस-विशिष्ट पीसीआर का उपयोग करके पाँच नमूनों में माइकोप्लाज़्मा प्रजाति की उपस्थिति का पता चला। 19 वर्ष की अवधि (1 अप्रैल, 2005-31 मार्च, 2024) में विश्लेषण किए गए 2,654 पोस्टमार्टम मामलों में से 27.84% मामलों में निमोनिया को मृत्यु का कारण बताया गया।

इस अवधि के दौरान बकरियों में निमोनिया के कारण समग्र मृत्यु दर 2.00% अनुमानित की गई। इसके अतिरिक्त, 14 वर्ष की अवधि (1 अप्रैल, 2010-31 मार्च, 2024) में निमोनिया के कारण कुल रुग्णता दर 4.16% पाई गई। एक नैदानिक स्कोरिंग प्रणाली विकसित करने के लिए, प्रासंगिक नैदानिक मापदंडों को दर्ज करने हेतु एक प्रारूप तैयार किया गया है। बकरी मूल के 70 संदिग्ध जैविक नमूनों (गहरे नासिका स्राव और न्यूमोनिक फेफड़ों सहित) में, स्टैफिलोकोकस ऑरियस सबसे अधिक बार पृथक किया गया रोगजनक (आठ पृथक) था, उसके बाद मैनहेमिया हेमोलिटिका (सात पृथक) और स्ट्रेप्टोकोकस प्रजाति (छह पृथक) थे।

2.5 प्रौद्योगिकी प्रसार, कौशल विकास एवं आर्थिक बकरी पालन

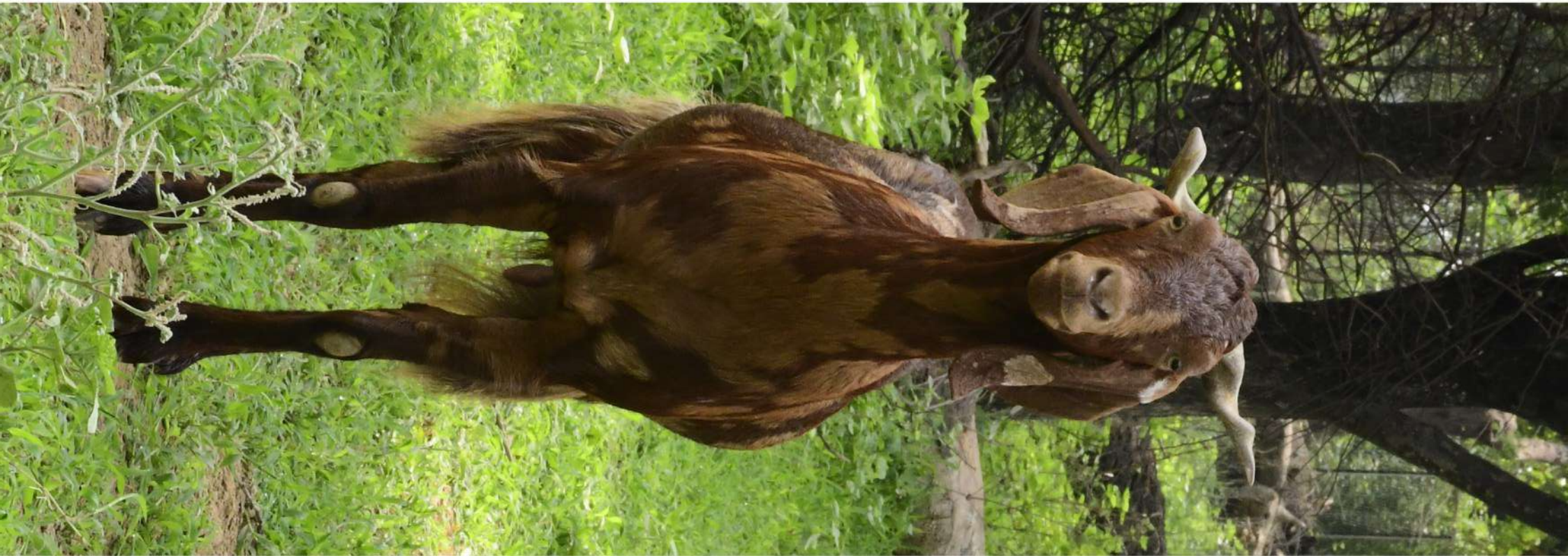
उत्तर प्रदेश के बुंदेलखंड क्षेत्र में बकरी पालन करने वाले परिवारों की आजीविका और पोषण सुरक्षा में बकरी पालन महत्वपूर्ण भूमिका निभा रहा है। बांदा और महोबा जिलों के विभिन्न गोद लिए गए गाँवों में तीस किसान गोष्ठियाँ/क्षेत्र दिवस आयोजित किए गए। परियोजना के लाभार्थियों को बेहतर लाभ के लिए बकरी पालन में अच्छी प्रबंधन पद्धतियाँ अपनाने के लिए प्रोत्साहित किया गया। किसानों की बाज़ार और अन्य सरकारी योजनाओं/कार्यक्रमों तक पहुँच में सुधार के लिए, 15 बकरी आधारित स्वयं सहायता समूह (SHG) विकसित किए गए। अनुसूचित जनजाति विकास कार्य योजना (DAPST) के अंतर्गत चार राज्यों, राजस्थान (भरतपुर, करोली, धौलपुर, बूंदी जिले), मध्य प्रदेश (टीकमगढ़, शिवपुरी और दतिया जिले), उत्तर प्रदेश (ललितपुर और चित्रकूट जिले) और उत्तराखंड (रुद्रपुर जिला) में विस्तार गतिविधियों का आयोजन किया गया। इन राज्यों में वैज्ञानिक बकरी पालन पर प्रशिक्षण कार्यक्रम और सामग्री वितरण कार्यक्रम आयोजित किए गए। लगभग 1300 बकरी किसानों (अधिकांश महिला बकरी किसानों) को सामग्री प्रदान कि जिससे वे लाभान्वित हुए। केंद्रीय बकरी अनुसंधान संस्थान, मखदूम, क्षमता निर्माण/कौशल विकास द्वारा लक्षित आबादी के बीच वैज्ञानिक बकरी उत्पादन और गरीबी में कमी के माध्यम से आय वृद्धि के प्रयास कर रहा है। अनुसूचित जनजाति विकास कार्य योजना के अंतर्गत, बकरी प्रौद्योगिकियों की पहचान की गई और उपयोगी सामग्री का वितरण किया गया।

पशुपालन एवं डेयरी विभाग के सहयोग से, अनुभाग ने राष्ट्रीय बकरी सम्मेलन-2024 का आयोजन किया। इस सम्मेलन के अंतर्गत, 18 नवंबर 2024 को सीआईआरजी परिसर में बकरी महाकुंभ-2024 राष्ट्रीय बकरी मेला एवं कृषि-औद्योगिक प्रदर्शनी का आयोजन किया गया। तीन हज़ार से अधिक किसानों ने इसमें भाग लिया और फसल एवं पशु उत्पादन की विभिन्न तकनीकों को प्रदर्शित करने वाले 45 स्टॉलों का अवलोकन किया। अनुसूचित जनजाति कार्य योजना (डीएपीएसटी) के अंतर्गत, विश्व बकरी दिवस, 21 अगस्त 2024 के अवसर पर वैज्ञानिक बकरी पालन, भ्रमण एवं आदान वितरण पर एक दिवसीय प्रशिक्षण कार्यक्रम का आयोजन किया गया।

इस वर्ष अनुभाग ने वैज्ञानिक बकरी पालन पर आठ (8) राष्ट्रीय प्रशिक्षण कार्यक्रम आयोजित किए, जिनमें 15 राज्यों के 725 बकरी किसानों (38 महिलाओं), बेरोजगार युवाओं, सेवानिवृत्त पेशेवरों और उद्यमियों ने भाग लिया। दस (10) प्रायोजित प्रशिक्षण कार्यक्रम आयोजित किए गए, जिनमें 232 (59 महिलाओं) ने भाग लिया और वैज्ञानिक बकरी प्रबंधन प्रथाओं को सीखा। रिपोर्टिंग अवधि के दौरान आईसीएआर-सीआईआरजी किसानों की एकल खिड़की में कुल 4832 आगंतुकों ने पंजीकरण कराया। यह पिछले वर्ष की संख्या (4269) से 13% अधिक था। आगरा, मथुरा, फिरोजाबाद, मैनपुरी, एटा और अलीगढ़ के सरकारी स्कूलों के 2500 से अधिक छात्रों ने आईसीएआर-सीआईआरजी का दौरा किया। बड़ी संख्या में किसानों, छात्रों, अनुसंधान विद्वानों, बकरी पालकों, गैर सरकारी संगठनों और अन्य विभागों के किसानों ने दौरा किया। संस्थान को 2870 हेल्पलाइन कॉल प्राप्त हुए। बकरी पालन से संबन्धित शोध लेख एवं तकनीकी साहित्य प्रकाशित किए।

CHAPTER 3

CIRG: CHARTER



3. CIRG: CHARTER

VISION

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

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.

CHAPTER 4

CIRG: AN INTRODUCTION

4. CIRG: AN INTRODUCTION

The Indian Council of Agricultural Research established a National Goat Research Centre at Makhdoom, Farah in Mathura district of Uttar Pradesh on 12th July, 1976. The Centre got the status of a full-fledged Institute on 12th July, 1979 and was named as Central Institute for Research on Goats. The Institute is located at equidistance from two famous places–Mathura (25 Km), the birthplace of Lord Krishna, and Agra (32 Km) the abode of world-famous Taj Mahal. Director is the head of the Institute and its apex bodies like IMC, RAC and QRT guide research and other activities. This institute has four research divisions and one section including a well-equipped Library, AKMU, PME cell, Agricultural farm, ITMU, Livestock farm and Health Section to fulfill the mandate and responsibilities. The Coordinating unit of All India Coordinated Research Project on goat improvement is also located at CIRG. The project aims at improving production performance of different breeds of goats distributed in different regions of the country under farm and field conditions. The Institute is well connected with modern information and communication facilities comprising landline phones 0565-2970995 and helpline 0565-2970999. The profile of the Institute can be visited at www.cirg.res.in.

Highlights of Achievements

The institute has developed number of pro farmer packages of practices technologies as well as commercially viable technologies for goat improvement in the country. 20 patents have been filed; twelve technologies have been commercialized for larger production. Other important technologies such as Value-added goat meat and milk products, diagnostics for brucellosis and JD, herbal formulation, intravaginal pessaries etc. are the process of commercialization. Some of the major achievements are as follows:

- Multiplication and conservation of elite germ plasm of Jamunapari, Barbari, Sirohi and Jakhrana breed of goats for genetic improvement of indigenous goats.
- Established germplasm resource improvement and conservation centers (multiplier flocks) of Barbari goat breed in fields.
- Analyzed milk composition traits such as protein, fat and SNF in different breeds and association of protein percentage with different allelic combinations.
- Positive genetic improvement trend in body weight at birth, at 3, 6, 9, and 12 months of age in Jamunapari and Barbari goats.
- Significant improvement in milk yield in Jamunapari, Barbari and Jakhrana goats compared to their base population performance.
- Refined semen freezing protocol involving 7.5% (v/v) egg yolk and glycerol 5.4% (v/v) with 100 million sperms/dose of 0.25 ml French mini straw resulted in overall post thaw motility of 50.55%, irrespective of four breeds viz. Jamunapari, Barbari, Jakhrana and Sirohi goats.
- Artificial Insemination (A.I.) with Frozen Semen in 149 goats of different breeds resulted in successful conception in 52 goats with a success rate of 35.32% on actual kidding basis.
- Developed a new method for isolation of mesenchymal stem cells (MSCs) from goat bone marrow.
- Established genetic origin of Indian goat breeds and genetic variation in Myf, leptin, Pit I, FecB, SCD gene and HSP genes in Indian goats.
- Developed complete feed pellet for efficient growth (80g/d) in finisher kids. Strategic supplementation of concentrate mixture @ 1.2% of the body weight for better growth and meat quality of Barbari goats.
- Standardised Moringa cultivation practices for fodder production.
- Developed Moringa based complete pellet / silage for meat & dairy goats.
- Better dressing percentage and meat quality by supplementation of area specific mineral mixture under intensive goat rearing system.
- Enriched goat meat nuggets and goat meat sausages with omega 3 fatty acids.
- Standardized retort processing of goat meat curry and goat milk paneer curry which has a non refrigerated shelf life at room temperature.
- Identified anti-methanogenic feed resources for goat production system.
- Developed higher bio-mass producing fodder system (Guar+Lobia+Sunhamp) for goats under rain fed conditions and Morus alba-based cost effective agro-forestry system for sustainable goat husbandry in semi-arid and rain fed areas.
- Developed package of practices and dynamic health calendar for goat farmers.

- Developed highly sensitive indigenous molecular diagnostic tests for Brucellosis and Johne's disease in goats.
- Developed database repertoire for *Clostridium perfringens* strains prevalent in causing Enterotoxaemia in goats.
- Developed sensitive and specific diagnostic assay (purified toxin based iELISA and peptide based iELISA) for detection of anti-epsilon antibodies in order to assess protective antibody titer against enterotoxaemia post-vaccination.
- Developed Johne's disease vaccine using native strain of JD organism.
- In an attempt to develop phage-based therapeutic agent against neonatal colibacillosis in goat-kids, three phages viz. *E. coli* Phage/CIRG/11, *E. coli* Phage/CIRG/3 and *E. coli* Phage/CIRG/12 showed highly encouraging lytic activity against pathogenic *E. coli* isolates.
- Developed herbal medicine formulations for diarrhoea, septic wound, acaricide, anthelminitic and stress management.
- Developed prebiotic (Mannan oligosaccharide) and herbal based formulation (IMU-4 bolus) for enhancement of immunity in goat kids.
- Created baseline data on commercial goat farming.
- Developed base-line data from farmers of selected districts of Bihar and Uttar Pradesh for goat meat/milk value chain analysis in order to improve socio-economic conditions of goat rearers, traders, butchers and other stakeholders under ICAR-ILRI collaboration programme.

Following technologies have been commercialized/ under commercialization:

Commercialized Technologies

1. **Alquit®** - An eco-parasiticidal product for the control of ecto-parasites *viz* Ticks and Lice in animals has been commercialized with M/S Natural Remedies Private Limited, Bengaluru (Karnataka)
2. **GMIN®**- an area specific mineral mixture for Uttar Pradesh commercialized to M/S Girraj Industries, Sirsaganj, U. P.
3. **HEALEX-FR®**- An ointment/gel for external injuries, and wounds for animals, commercialized to M/S Girraj Industries, Sirsaganj, U.P.
4. **Diarrionex-HS®**- This is an extract base herbal anti-bacterial anti-diarrhoeal powder for management of diarrhea in animals commercialized to M/S Girraj Industries, Sirsaganj, U. P.
5. **Goat milk-based soap (Ajas)** – three variants of soap i.e. Ajas's beauty, Ajas green and Ajas's antiseptic soaps have been commercialized to M/S BVG Life sciences, Pune (M.S.).
6. **Johne's disease Vaccine (Bio JD gel®)**: This Killed vaccine is developed using native strain of Mycobacterium avium subspecies paratuberculosis for animals transfer to M/s Biovet, Bengaluru for vaccine production.
7. **IMU-4®** Herbal immunomodulatory bolus: This herbal formulation is developed to improve the immunity in animals. This bolus reduces the pregnancy stress and improves the immunoglobulins in pregnant dam and colostrum quality for protection against neonatal infection. This product was developed under ICAR-AINP on 'neonatal mortality in farm animals' project. This product is commercialized and available in Indian market by Brands Name of "IMU-4" Bolus by M/S Girraj Industries, Sirsaganj, U. P.
8. **Wormolex® bolus and liquid** (Herbal anthelmintic bolus): Herbal dewormer in bolus and liquid form, commercialized by M/S Girraj Industries, Sirsaganj, U. P.
9. **Meggatex® Herbal acaricidal liquid**: This formulation effectively eliminates 90-100% ticks/lice in naturally infected animals in single topical application. This drug is commercialized by M/S Girraj Industries, Sirsaganj, U. P.
10. **Semen freezing technology and Artificial insemination in goats:** Goat Semen Diluent Composition (TCFEYG) and Cryopreservation Protocol technology transferred to M/S Aegipan Animal Biocare Pvt. Ltd. Hooghly, West Bengal India
11. **Herbal anticoccidial complete pellet feed formulation for goats:** Transferred to M/s Indrakshi Vetcare Pvt. Ltd., Dewas Noka, Indore, M. P. - 452001

Under Commercialization

- BRUCHEK: A Dot-ELISA Kit for detaction of brucellosis in goats and Sheep
- Diagnosis of para tuberculosis ELISA KIT (Serum and Milk)
- Stressol-G: An Herbal Antistress Formulation
- Helmokil: Herbal anthelminitic bolus
- IMU-4: Herbal immunomodulatory bolus
- Ectofree: Herbal Acaricidal liquid / Sprey
- Intra vaginal pessaries for oestrus synchronization in goats.
- Goat meat Pickle
- Goat meat Nuggets
- Herbal Goat meat Nuggets
- Goat meat Sausage
- Goat meat Patties
- Meat Shami Kebab
- Meat Murukku
- Meat Nimkee
- Meat/Milk Biscuits
- Goat Feeders for Better Feed Utilization
- Pelleted Complete Feed Technologies for Sustainable Goat Production under intensive feeding system
- Moringa based complete feed for dairy goats

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.

CHAPTER 5

ORGANIZATIONAL SETUP

5. ORGANIZATIONAL SETUP

CHAPTER 6

RESEARCH ACHIEVEMENTS

6. RESEARCH ACHIEVEMENTS

6.1 Genetic Improvement of Goats and Sheep

6.1.1 AICRP Project: Genetic Improvement and Sire Evaluation of Jamunapari Goats for Milk Production

Principal Investigator: Dr. M. K. Singh

Co-Investigators: Dr. Gopal Dass, Dr. Ravi Ranjan, Dr. Ravindra Kumar, Dr. V. Rajkumar, Dr. A. K. Dixit, Dr. S. P. Singh, Dr. M. S. Dige, Dr. M. K. Chatli

Jamunapari goat is one of the large sized goat breeds of India, and known for milk production in the subcontinent. These goats are also known as "***Etawa Goat"*** abroad and the queen of goats due to their majestic look. The natural habitat of this breed is ravine locked Chakarnagar block of Etawah and Auraiya districts in Uttar Pradesh. These goats are more adapted to those semi-arid areas which are rich in shrubs and trees-based vegetation. These 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.

The opening and closing flock strength of the nucleus flock of Jamunapari goats was 378 and 404 on 1st January 2024 and 31st December 2024. During the period 184 kids were born from 139 kidding out of which 97 kids were male and 79 were female (ten kids were crossbred thus not added for growth analysis). The litter size was 1.32. Multiple born kids were 49%. The average age at first conception, age at first kidding, weight at first service, weight at first kidding and first kidding interval of females born in 2022-23 and kidded in 2024 were 577.47±29.10, 726.29±26.18 days, 31.08±0.92, 33.88±1.02 Kg and 406.51±16.05 days, (Table 1). The year and season of birth had significant effect ($P<0.05$) on age at first service and kidding. Females born in season-1 (spring) had low age at first service and kidding, similarly multiple born females also have higher age at first kidding.

There was a consistent decline (desirable improvement) in age at first service and kidding. Data revealed that >22 kg body weight and >12 months of age is ideal for the first the service in Jamunapari females. Oestrous detection studied over the months in last three years revealed large fluctuation in heat exhibition pattern. Majority of goats exhibited oestrus in April, May, June in summer and September, October and November in autumn seasons which is a normal pattern (Fig-2).

Jamunapari goats are relatively sensitive to climatic fluctuations and showed a strong genotype x environment interaction for sexual behaviour.

The least square means of body weights for kids at birth, 3, 6, 9 and 12 months of age were 3.25±0.04, 10.86±0.18, 16.34±0.29, 21.39±0.40 kg and 27.26±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 body weights. Males have 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 of ages.

Nine males were selected on the basis of their 9 month weight, their dams total milk yield and individual body score. The selection differential for 9 months body weight was 3.06 kg and dam's total milk yield was 107 litres (Table-3). More emphasis was given to milk yield in selection index from last few years.

Ten males and ten females at the age of 5 months were put for stall feeding management in different sheds. They were kept in cages during feeding otherwise kept in shed and not sent for grazing. The average daily weight gain of male kids from 6 to 9 and 6 to 11 months were 85.5 and 120.3 gm/day. Whereas, daily weight gain of female kids from 6 to 9 and 6 to 11 months were 48.8 and 59.1 gm/day (table-4). The weight gain and growth in male and female kids kept under intensive feeding were higher than those kept in semi-intensive management. The average slaughter weight, Carcass weight and dressing% in Jamunapari kids at 11 months of age were 27.72 kg, 13.51 kg and 55%, respectively under intensive feeding management.

Least squares means of lactation milk yield in 90, 140 days, total milk yield and Lactation Length (LL) were 90.51±3.40, 121.06±6.57, 116.88±8.31 and 159.83±4.87 days, respectively (Table-5). Year and season of kidding had significantly (P<0.01) affected all lactation traits with high magnitude. Goat kidded in spring season significantly yielded more milk than those which kidded in other seasons. The effect of type of birth was also significant on 90 days and total milk yield. Significantly lesser milk yield was obtained from first kidders. Twenty-three goats yielded more than 250 litre milk ranging up to 378 litres in lactation. However, fluctuation in lactation performance in this flock over the years has been frequently observed and attributed to variation in feed-fodder, browsing quality-quantity and climatic parameters. During the year 89 purebred and 65 Jamunapari type goats were supplied for field improvement. The Total milk produced was Total milk produced in the year was 9313.0 litre. Overall mortality and culling in the flock were 3.06 and 7.68%. Animals died during birth to 3 months, 3 to 6, 6 to 12 months, adult and overall category were 2.61, 6.85, 1.56, 4.37 and 7.68 of respective population size. Higher mortality in 3-6 month age group is mainly attributed to acute diarrhoea.

One hectare of undulating land which was developed in previous year for agro-forestry was equipped with irrigation facility. Buck station shed created to keep elite bucks of different breeds for their semen collection, evaluation and subsequently Cryo-preservation. Technology demonstration cum training hall located at farm is improvised for better adoption in field. Total revenue generated in the year was Rs. 23, 27167, mainly due to sale of animals, sale of milk, supply of animals for slaughter and culling which has contributed 15.90, 3.26, 3.09 and 1.07, lakhs respectively.

Table 1: Reproductive performance in Jamunapari goats over the years

Factor	First parity Reproductive performance				
Overall mean	WFS (kg)	WFK (kg)	AFS (days)	AFK (days)	GP (days)
	29.41±0.43 (221)	32.39±0.47 (221)	634.75±12.35 (221)	792.58 ± 12.21 (221)	
Year of Birth	**	**	**	**	**
2019	30.60±0.66 (54)	33.24±0.73 (54)	690.73±18.96 (54)	840.35±18.75 (54)	
2020	27.67±0.63 (58)	29.64±0.69 (58)	644.26±18.02 (58)	780.09±17.81 (58)	
2021	29.06±0.93 (29)	33.78±1.03 (29)	626.74±26.78 (29)	771.29±26.48 (29)	
2022	28.46±0.66 (57)	31.51±0.72 (57)	613.56±18.91 (57)	754.89±18.69 (57)	
2023	31.08±0.92 (23)	33.88±1.02 (23)	577.47±26.48 (23)	726.29±26.18 (23)	
***P<0.01, *P<0.05*					

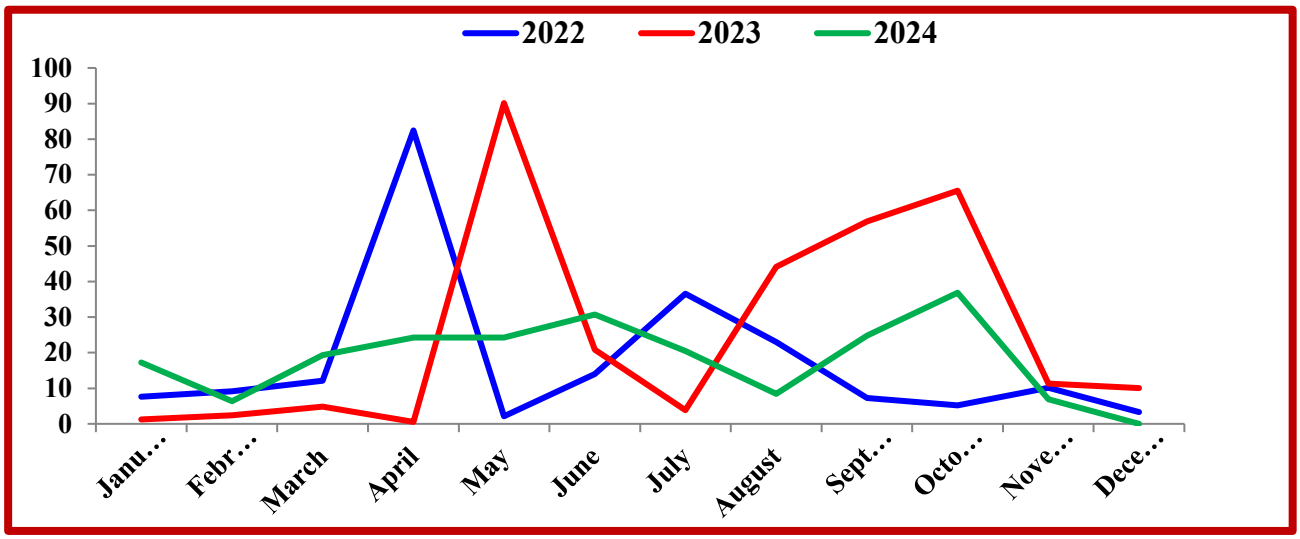


Fig. 1. Oestrus expression patterns in Jamunapari goats during 2022 to 2024

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

Factor	Body weight at different ages				
Overall Mean	Birth	3 Month	6 Month	9 Month	12 Month
	3.40±0.02 (1029)	10.37±0.08 (944)	14.87 ±0.10 (800)	19.78±0.13 (749)	25.45±0.40 (638)
Year of birth	** **	**	**	**	
2020	3.63^{c}±0.03 (265)	9.90^{b}±0.13 (254)	13.73^{b}±0.16 (224)	19.04^{b}±0.20 (208)	24.05^{b}±0.25 (203)
2021	3.46^{d}±0.04 (228)	11.41^{b}±0.14 (222)	17.32^{a}±0.16 (213)	21.91^{c}±0.21 (203)	25.37^{b}±0.27 (166)
2022	3.70^{e}±0.03 (274)	10.74^{b}±0.13 (260)	14.41^{b}±0.16 (160)	18.39^{b}±0.30 (213)	22.66^{b}±0.27 (178)
2023	3.00^{d}±0.06 (87)	9.16^{b}±0.22 (84)	12.76^{a}±0.26 (75)	18.16^{c}±0.33 (72)	24.06^{b}±0.43 (65)
2024	3.25^{e}±0.04 (175)	10.86^{b}±0.18 (124)	16.34^{b}±0.29 (64)	21.29^{c}±0.40 (53)	27.26^{b}±0.73 (26)
Season of birth	** *	*	**		
1	3.57±0.03 (454)	10.14^{a}±0.12 (424)	14.92^{a}±0.14 (383)	19.39^{a}±0.18 (351)	24.53±0.43 (262)
2	3.24±0.02 (575)	10.61^{b}±0.09 (520)	14.82^{b}±0.13 (417)	20.17^{b}±0.17 (398)	26.37±0.42 (371)
Sex of kid	** **	**	**	**	
Male	3.50^{a}±0.02 (537)	10.74^{a}±0.10 (493)	15.55^{a}±0.13 (415)	20.19^{a}±0.17 (385)	26.00^{a}±0.42 (318)
Female	3.31^{b}±0.03 (492)	10.01^{b}±0.10 (451)	14.19^{b}±0.13 (385)	19.07^{b}±0.17 (364)	24.90^{b}±0.43 (320)
Type of birth	** **	**	**	*	
1	3.62^{a}±0.03 (516)	10.80^{a}±0.11 (474)	15.28^{a}±0.14 (391)	20.22^{a}±0.18 (368)	25.74^{a}±0.44 (311)
≥2	3.19^{b}±0.02 (513)	9.95^{b}±0.10 (470)	14.46^{b}±0.13 (409)	19.33^{b}±0.16 (381)	25.17^{b}±0.41 (327)
Parity	** *	*	*	*	
1	3.18^{a}±0.03 (334)	9.83^{a}±0.12 (306)	14.65^{a}±0.15 (250)	19.54^{a}±0.19 (238)	25.30^{a}±0.44 (188)
2	3.43^{b}±0.03 (252)	10.47^{b}±0.13 (232)	15.04^{b}±0.16 (197)	19.73^{b}±0.21 (184)	25.21^{b}±0.47 (154)
3	3.36^{c}±0.04 (184)	10.10^{a}±0.15 (173)	14.61^{b}±0.19 (150)	19.39^{c}±0.25 (137)	24.82^{a}±0.49 (126)
4	3.48^{c}±0.05 (125)	10.85^{a}±0.18 (114)	15.18^{b}±0.22 (100)	20.49^{b}±0.29 (91)	26.61^{b}±0.53 (84)
5	3.41^{c}±0.06 (75)	10.53^{b}±0.25 (69)	15.04^{a}±0.30 (56)	19.98^{b}±0.38 (54)	25.39^{b}±0.59 (49)
Parity ≥ 6	3.55^{c}±0.07 (59)	10.48^{b}±0.26 (56)	14.70^{a}±0.32 (47)	19.54^{b}±0.41 (45)	25.38^{b}±0.66 (37)
***P<0.01, *P<0.05*					

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

Table 3: Selection differential (9 months body weight and 90/total milk yield)

Year	9-M weight (Selected male)	Population Mean (Body Weight)	140-d MY (Selected Male's doe yield)	140-d MY Population Mean	Selection differential	
					Body Weight (kg)	Doe's Milk (litre)
2020	30.40* (15)	21.08	86.2 (15)	74.02	9.32	12.16
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	TMY 207.5 (9)	TMY 117.5	5.1	90
2024	24.35 (10)	21.29	TMY 223.8 (10)	TMY 116.9	3.06	106.9

* Males started selected on 140 d milk yield from 2023-24 instead of 90 days

Table 4: Growth parameters of Jamunapari kids in stall feeding

Performance of kids (kg) under feed lot (Exp.)						
Sex	No. of animals	Birth wt.	3 M wt.	6 M wt.	9 M wt.	11 M wt.
Male	10	2.76 (2.0-3.3)	10.24 (9.3-11.5)	14.08 (13.0-15.8)	25.63 (23.5-28.2)	32.13 (28.0-37.5)
Female	10	2.96 (2.4-3.2)	9.34 (7.0-11.0)	13.82 (10.2-17.2)	20.97 (17.6-27.0)	24.01 (19.5-32.3)
ADWG (g/d)		0-3 M (g/d)	3-6 M (g/d)	3-9 M (g/d)	6-11 M (g/d)	
Male	10	83.1 (73.3-94.4)	42.7 (27.8-58.9)	85.5 (72.2-100.0)	120.3 (81.3-150.0)	
Female	10	70.3 (47.8-87.8)	49.8 (33.3-98.9)	64.6 (47.2-91.7)	67.9 (44.0-117.3)	
Performance of kids (kg) under Semi-intensive (Control)						
Male	10	2.94 (2.3-3.3)	9.22 (8.3-10.2)	13.32 (12.0-15.0)	19.49 (16.8-22.8)	24.51 (20.8-30.0)
Female	10	2.96 (2.7-3.2)	8.50 (7.5-10.0)	11.71 (10.0-13.5)	17.29 (15.1-19.5)	20.58 (18.0-23.6)
ADG (g/d)		0-3 M (g/d)	3-6 M (g/d)	3-9 M (g/d)	6-11 M (g/d)	
Male	10	69.8 (61.1-81.1)	45.6 (33.3-72.2)	57.1 (43.3-66.7)	74.6 (52.0-100.0)	
Female	10	61.5 (47.8-81.1)	35.7 (22.2-61.1)	48.8 (36.1-62.8)	59.1 (48.7-77.3)	

Table 5: Least Square mean of Lactation Traits in Jamunapari Goats

Factor	Lactation Performance of Goats			
Overall Mean	90d milk yield (L)	140dmilk yield (L)	Total milk yield (L)	Lactation length (d)
	84.04±1.80 (709)	118.62±3.10 (519)	114.88±3.50 (664)	162.14±2.04 (664)
Year of Kidding	**	**	**	**
2020	76.79^{a}±2.96 (173)	111.52^{a}±5.56 (98)	90.29^{a}±5.36 (185)	142.54^{a}±3.12 (185)
2021	102.29^{b}±3.15 (158)	145.19^{b}±4.76 (146)	154.63^{b}±5.86 (159)	175.04^{b}±3.42 (159)
2022	92.64^{c}±2.97 (177)	132.25^{c}±4.57 (150)	134.59^{c}±5.52 (178)	168.24^{b}±3.22 (178)
2023	73.99^{a}±4.66 (67)	109.07^{a}±7.40 (55)	103.00^{d}±8.61 (68)	165.03^{b}±5.02 (68)
2024	90.51^{c}±3.40 (134)	121.06^{d}±6.57 (70)	116.88^{e}±8.31 (74)	159.83^{c}±4.87 (74)
Season of Kidding	**	**	**	
1 (Spring)	86.70^{a} ±2.58 (301)	125.83^{a}±4.29 (221)	122.19^{a}±4.79 (310)	160.78±2.79 (310)
2 (Autumn)	81.39^{b} ±2.01 (408)	113.40^{b}±3.49 (298)	109.56^{b}±4.18 (354)	165.50±2.44 (354)
Type of Kidding				
Single	81.33±2.98 (366)	116.00±5.27 (257)	108.61±6.30 (324)	158.81±3.67 (324)
≥ Twin	86.76±2.72 (343)	123.24±4.68 (262)	123.14±5.42 (340)	165.47±3.16 (340)
Parity	*	**	**	*
1	68.84^{a}±3.17 (253)	98.08^{a}±5.46 (183)	98.08^{a}±6.48 (236)	159.37^{a} ±3.78 (236)
2	87.42^{b}±3.29 (171)	126.75^{b}±5.79 (126)	117.34^{b}±7.05 (157)	163.39^{a} ±4.11 (157)
3	86.77^{b}±3.94 (118)	124.72^{b}±6.69 (86)	116.79^{b}±7.84 (115)	162.73^{a} ±4.57 (115)
4	91.00^{c}±4.15 (79)	126.01^{b}±6.34 (67)	134.90^{c}±7.95 (74)	173.69^{a} ±4.63 (74)
5	89.13^{b}±5.52 (46)	136.16^{c}±9.60 (30)	129.46^{b}±10.95 (40)	166.31^{a} ±6.37 (40)
Parity ≥ 6	79.10^{c}±5.67 (42)	103.98^{a}±10.07 (27)	98.68^{a}±10.52 (42)	150.34^{b} ±6.13 (42)
3 ***P<0.01, *P<0.05*				

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

6.1.2 AICRP Project: Genetic Improvement of Barbari Goats for Meat and Milk Production

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Barbari goats have occupied a significant place in SAARC countries due to high prolificacy-fecundity, delicious meat, good milk yield and adaptability over a wide range of agro-climatic conditions and feeding management. Barbari goat is native of the Agra-Aligarh division of Uttar Pradesh however its breeding tract has extended to almost all Northern states and sub-humid regions of southern and eastern regions of India.

The opening balance of flock on 1st January 2024 was 476 and closing balance was 552 on 31st

December 2024. Conception rate through natural services in Ist and IInd and IIIrd services was 82, 13 and 5%. Incidence of abnormal kidding was 1.51%. There were 308 kids born from 194 does with a litter size of 1.57. Kids born as multiples were 69.16% (single, twin and triplet kidding were 50.4, 35.9 and 13.7%, respectively (fig-1). Averages age at first service, weight at first service, age at first kidding, weight at first kidding and first kidding interval in 2024 were 393.94±10.41days, 20.37±0.38kg, 533.81±13.25 days, 24.51±0.43 kg and 298.41±9.81 days, respectively (Table-1). Females born as single have significantly less age at first kidding than their counterparts. There has been consistent improvement in reproductive traits over the years in the flock (table-1). Kidding interval also significantly declined after IInd kidding onwards Barbari females attain sexual maturity at early ages (200 days), slightly more (10-15%) age at first service and first kidding is due to restriction of breeding in summer and autumn seasons for efficient management, kid's growth and survivability. Fertility status of bucks was very good as >82% females conceived through natural service in first service by bucks (Table-2). Oestrous exhibition pattern during this year showed that in summer season maximum goats (82.9%) exhibited oestrus in the month of May, however, surprisingly very high (>82%) oestrus recorded in late August and September months (Fig-2).

An average litter size/kidding was 1.57 and annual kidding rate was 2.09 this year. Breeding efficiency (%) on the basis of doe's available and doe's tupped were 96.6 and 97%. Kidding efficiency (%) on the basis of does available and doe's tupped were 152 and 119%, respectively.

The least squares means of body weight of kids born in the year 2024 were 2.02±0.02, 8.92±0.09, 12.51±0.18, 17.72±0.26 and 21.82±0.64 kg, respectively at birth, 3, 6, 9 and 12 months of age (Table-3). Champion male kid (14457) born as a 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. 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 declined with the advancement of age. Data revealed significant improvement in growth traits over the previous years. The selection differential for 9 months body weight was 7.0 kg and for dam's 140 days milk yield was 34.5 litres. Flock revealed moderate h^2 estimates (0.13±0.03 to 0.31±0.04) for growth traits in this flock. Average inbreeding coefficient was 2.16% from 1993 to 2020.

Ten males and ten females at the age of 5 months were put for stall feeding management for a period of 120 days in different sheds. Six males were slaughtered at the age of 10 months. The average body weight of male kids at 9 months of age under semi-intensive and stall feeding were 17.84 and 23.64 kg whereas, average daily weight gain from 6 to 9 months age group in semi-intensive and stall feeding were 63.1 and 87.7g/d. The body weight and weight gain in above mentioned corresponding female age groups were 15.5 Vs. 18.3 kg and 53.6 Vs. 59.5 g/d (table-5). The average slaughter weight at 339 days, carcass weight and dressing percent were 25.61 kg, 11.40 kg and 52.84%. The higher weight gain and growth in male kids as compared to females indicates to their inherent better growth potential and might also indicate their better response under stall feeding. Five females out of 10 attained 18 kg body weight at the age of 7 months, thus were allowed for breeding. None of them showed any reproductive disorder. Data revealed that weight gain (ADWG), carcass yield and dressing percent were much higher in intensive feeding as compared to non-intensive.

The least square means for 90, 140 days, total lactation yield and lactation length in 2024 were 84.74±1.15, 126.54±1.64, 140.38±2.53 litres, 177.27±2.09 days, respectively (Table-6). There was a consistent improvement in lactation performance in the herd from 2017 onwards (Fig-4). Many goats

(30) yielded more than 200 litre milk/lactation with highest record of 310 litres. Doe Number 12941 has declared as *champion goat* with a record yield of 310 litres of milk in a lactation period of 258 days. Lactation traits were significantly affected by year, season of kidding, type of kidding and parity orders. Goats kidding in spring season yielded relatively more milk than those kidded in autumn season. Multiparous goats yielded more milk than primiparous goats. Heritability for lactation traits was moderate (0.15 to 0.20) in this flock. Incidence of mortality in Birth-1M, 1-3M, 3-6 M, 6-12 m and in adults (>12 month) were 1.94, 1.34, 4.85, 0.82 and 0.98% with an overall mortality and culling rate of 4.59 and 5.35% of flock strength. Growing kids (3-6 month age group) observed to be most vulnerable with respect to mortality rates.

A total of 150 goats (122 purebred and 28 Barbari type) were provided to farmers and development agencies for improvement in field and livelihood. A record milk yield of 15964 litre from 194 kidding's was obtained from the unit. Barbari unit has generated (table 6) revenue of Rs. 25,14,095, primarily by sale of animals and milk.

This year attention was given to improvement of Barbari Farm premises which includes repair and renovation of feed lot cages, dry fodder (bhusa) store, sick ward, fencing of boundary wall to protect plants from wild animals, goat drinking water channel, facilities created in 5 hectare agro-forestry area for drip irrigation, installation of submersible pump and a small size tractor to perform multifarious farm works. Training cum demonstration room was equipped with different photos and models to improve knowledge and skill of farmers. A Prasan Manch Program at AICRP Barbari goat Farm on 6 March 2024 was organized in which more than 100 farmers of different states participated.

Technology Development and Validation

Three multiplier flocks were established this year for sustainable genetic improvement, in-situ conservation, technology transfer and development of goat-based business / entrepreneurship models. Currently 47 Barbari goat-based multiplier flocks are in progress with flock strength from 25 to 300 in 6 states of India. These units are also acting as seed unit and supporting nearby farmer flocks in community goat genetic improvement and in business model development. Analysis revealed that the cost benefit ratio in goat farming through sale of pure-bred animals was 1:1.66 to 1:2.42 and 1:1.50 to 1:2.22 through sale of well-fed castrated male. Seven research papers were published in high rated journals, one technology and one model were developed, validated and transferred to farmers flock. Development of intensive and semi-intensive goat production models for arid and semi-arid regions is in progress.

Table 1: Reproductive performance 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)	Kidding Interval (2nd to 7 parity)
	436.59±5.54 (269)	585.63±5.86 (229)	19.06±0.16 (269)	22.52±0.20 (229)	356.58±7.37 (229)	297.25±3.37 (813)
Year of birth	**	*	**	**	**	**
2019	422.04[a]±10.45 (49)	568.22[a] ±10.47 (49)	18.93[a] ±0.41 (49)	22.68[a] ±0.44 (49)	382.94[a] ±19.68 (49)	308.23[a] ±6.43 (176)
2020	409.48[b] ±6.74 (67)	554.99[b] ±6.59 (67)	18.49[a] ±0.19 (67)	21.96[b] ±0.33 (67)	386.74[a]±11.24 (67)	309.71[a] ±4.86 (216)
2021	413.40[b] ± 10.34 (53)	560.23[a] ±14.11 (53)	19.14[b] ±0.39 (53)	22.61[a]±0.47 (53)	373.80[b]±13.64 (53)	295.83[b] ±4.47 (126)

2022	410.30[b] ± 13.30 (46)	554.75[b] ±11.61 (44)	18.38[a] ±0.43 (46)	22.38[a] ±0.43 (44)	348.25[c] ±15.92 (44)	287.08[c] ±7.54 (122)
2023	393.94[c] ±10.41 (54)	533.81[c] ±13.25 (54)	20.37[c] ±0.38 (54)	24.51[c] ±0.43 (54)	298.41[d] ±9.81 (29)	265.97[d] ±6.65 (173)
***P<0.01, *P<0.05*						

Table 2: Conception rate through natural service and incidences of abnormal kidding

Year	Conception Rate Over Services (%)				Abnormal kidding
	I	II	III	Not Conceived	
2019	92	6	2	0.9	1.5
2020	93	5	2	1.72	1.72
2021	95.5	4.5	-	1.51	1.50
2022	95	3.5	1.5	1.46	3.41
2023	95.6	3.4	1	0.44	11.62
2024	82	14	4	2.0	1.51

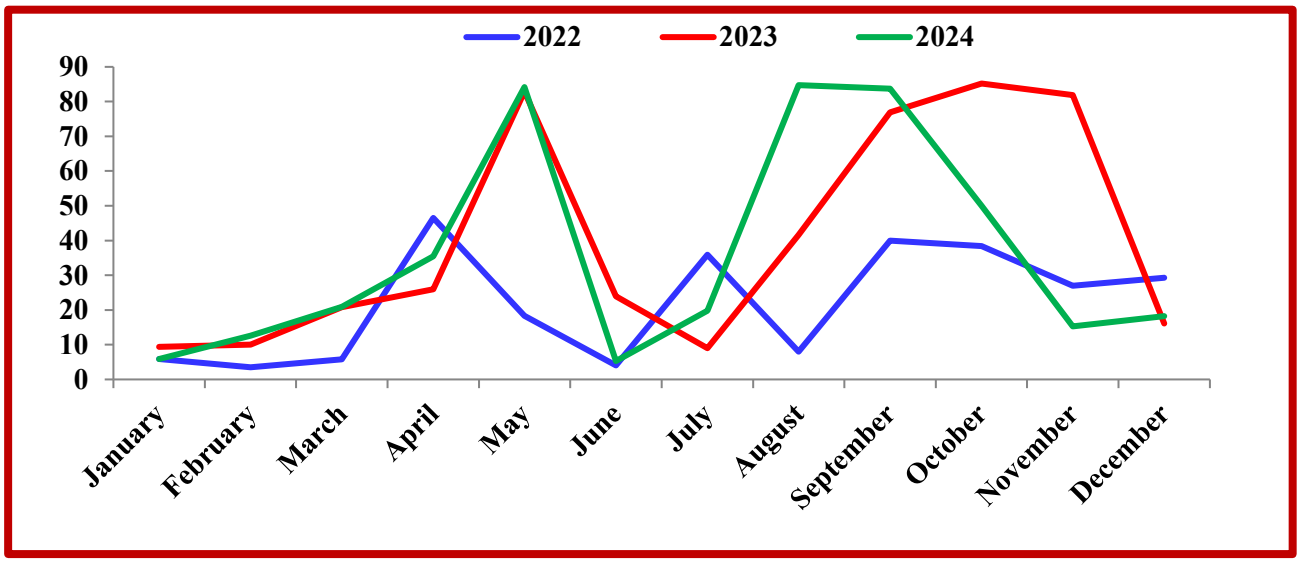


Fig. 1. Oestrus pattern in Barbari goats

Table 3: Selection differential (9 months body weight and 90 days & 140 days milk yield)

Year	9-M weight (kg) of Selected male	Population Mean (Body wt.)	90/140-d MY (Selected Male's doe yield)	90/140-d MY Population Mean	Selection differential Body Weight (kg)	Selection differential Doe's Milk (lit.)
2019-20	22.70 (10)	16.90	81.5	71.75	5.80	9.75
2020-21	24.06 (12)	17.67	85.91	73.89	6.39	12.02
2021-22	22.46 (4)	14.85	92.8	79.0	7.61	13.8
2022-23	19.27 (10)	15.82	140 DMY: 134.0	140 DMY:116.0	3.45	17.94
2023-24	24.0 (10)	17.00	140 DMY: 159.0	140 DMY:124.5	7.00	34.5

* Males started selected on 140 d milk yield from 2023-24 instead of 90 days

Table 4: Least square means of body weight (kg) in Barbari goats

Factor	Body weight at different ages (Growth Performance)				
Overall Mean	Birth	3M	6M	9M	12M
	1.85±0.01 (1640)	7.84±0.05 (1559)	11.50 ±0.09 (1256)	15.98±0.13 (1149)	20.27±0.20 (816)
Year of birth	**	**	**	**	**
2020	1.76[a]±0.02 (363)	7.81[a]±0.09 (353)	12.34[a]±0.14 (310)	16.64[a]±0.21 (284)	21.21[a]±0.26 (253)
2021	1.84[b]±0.01 (458)	7.80[a]±0.08 (449)	11.45[b]± 0.12 (411)	15.85[b]±0.18 (391)	19.75[b]±0.23 (283)

2022	1.82[b]±0.02 (249)	7.18[b]±0.10 (228)	10.02[c]±0.18 (166)	14.16[c]±0.27 (145)	18.31[c]±0.34 (112)
2023	1.81[b]±0.02 (262)	7.54[c]±0.10 (235)	11.51[b]±0.16 (198)	16.25[a]±0.24 (169)	20.53[b]±0.28 (142)
2024	2.02[c]±0.02 (308)	8.92[d]±0.09 (294)	12.51[d]±0.18 (171)	17.72[d]±0.26 (160)	21.82[a]±0.64 (26)
Season of birth		**	**	**	**
1	1.86±0.01 (809)	8.27[a]±0.07 (784)	12.42[a]±0.11 (691)	16.62[a]±0.16 (640)	20.11[a]±0.23 (419)
2	1.84±0.01 (831)	7.42[b]±0.06 (775)	10.58[b]±0.11 (565)	15.34[b]±0.17 (509)	19.58[b]±0.24 (397)
Sex of kid					
Male	1.93[a]±0.01 (834)	8.18[a]±0.06 (789)	12.24[a]±0.11 (631)	17.61[a]±0.16 (572)	22.16[a]±0.23 (386)
Female	1.76[b]±0.01 (806)	7.51[b]±0.06 (770)	10.76[b]±0.11 (625)	14.66[b]±0.15 (577)	18.37[b]±0.22 (430)
Type of birth	**	**	**	**	**
1	2.05[a]±0.01 (476)	8.77[a]±0.08 (455)	12.59[a]±0.12 (375)	17.06[a]±0.18 (349)	21.24[a]±0.25 (245)
2	1.83[b]±0.01 (1030)	7.52[b]±0.05 (984)	11.27[b]±0.08 (787)	15.71[b]±0.12 (715)	20.33[b]±0.18 (519)
≥3	1.66[c]±0.02 (134)	7.34[b]±0.13 (120)	10.75[c]±0.22 (94)	15.27[b]±0.32 (85)	19.42[b]±0.45 (52)
Parity	**	**	*	*	*
1	1.71[a]±0.02 (404)	7.27[a]±0.09 (379)	10.82[a]±0.15 (305)	15.17[a]±0.23 (281)	19.57[a]±0.31 (209)
2	1.80[b]±0.01 (411)	7.82[b]±0.08 (386)	11.48[b]±0.14 (330)	16.08[b]±0.20 (304)	19.87[b]±0.28 (223)
3	1.87[c]±0.02 (307)	7.84[b]±0.09 (298)	11.47[b]±0.16 (237)	16.17[c]±0.23 (206)	20.28[b]±0.30 (154)
4	1.90[d]±0.02 (214)	8.16[c]±0.11 (201)	11.72[c]±0.18 (160)	16.18[d]±0.26 (152)	20.41[b]±0.36 (99)
5	1.87[d]±0.02 (133)	7.93[b]±0.13 (130)	11.55[b]±0.20 (111)	15.92[c]±0.29 (103)	20.48[b]±0.42 (60)
Parity ≥ 6	1.92[d]±0.02 (171)	8.02[b]±0.12 (165)	11.96[b]±0.21 (113)	16.36[c]±0.30 (103)	20.98[b]±0.40 (71)
***P<0.01, *P<0.05*					

Table 5: Performance of Barbari kids under stall feeding

Performance of kids (kg) under feed lot (Exp.)						
Sex	No. of animals	Birth wt.	3 M wt.	6 M wt.	9 M wt.	11 M wt.
Male	10	1.92 (1.2-2.2)	8.76 (7.2-10.0)	14.05 (12.5-15.5)	23.64 (22-26)	27.2 (25.5-33.5)
Female	10	1.81 (1.2-2.5)	8.03 (6.4-9.8)	12.4 (11-14.5)	18.31 (16.5-20.2)	21.32 (19.0-23.5)
ADWG (g/d)		0-3 M (g/d)	3-6 M (g/d)	3-9 M (g/d)	6-11 M (g/d)	
Male	10	76.0 (57.8-101.1)	58.8 (44.4-72.2)	82.7 (77.8-93.3)	87.7 (67-120)	
Female	10	69.1 (56.7-87.8)	48.6 (35.6-61.1)	57.1(50.0-63.9)	59.5 (47-71)	
Performance of kids (kg) under Semi-intensive (Control)						
Male	10	1.85 (1.4-2.4)	8.15 (7.0-9.0)	12.25 (11.0-4.5)	17.84 (15.1-22)	20.36 (16.6-24.0)
Female	10	1.67 (1.2-1.3)	7.25 (5.0-7.2)	10.37 (9.5-11.5)	15.5 (13.5-17.6)	18.19 (16.2-20.0)
ADG (g/d)		0-3 M (g/d)	3-6 M (g/d)	3-9 M (g/d)	6-11 M (g/d)	
Male	10	72.8 (60.0-82.2)	52.3 (27.8-68.9)	59.5 (39.4-76.1)	61.3 (41-74)	
Female	10	61.0 (40.2-62.2)	44.4 (31.1-55.6)	51.4 (44.4-57.8)	53.6 (41-67)	

Table 6: Least square mean of lactation traits in Barbari goats

Factor	Milk yield of different lactation traits			
Overall Mean	90-d milk yield (L)	140dmilk yield (L)	Total milk yield (L)	Lactation length (d)
	78.95±0.77 (996)	123.47±1.01 (907)	135.61±1.47 (940)	173.72±1.22 (940)
Year of Kidding	**	**	**	**
2020	75.55[a]±1.18 (205)	116.96[a]±1.55 (188)	123.13[a]±2.24 (205)	164.88[a]±1.85 (205)
2021	76.00[a]±1.04 (282)	119.23[b]±1.35 (277)	135.69[b]±1.99 (282)	181.50[b]±1.65 (282)
2022	84.10[b]±1.29 (157)	134.09[c]±1.69 (147)	151.30[c]±2.46 (157)	179.29[b]±2.03 (157)
2023	75.67[a]±1.21 (162)	113.52[d]±1.58 (151)	121.54[a]±2.29 (162)	165.67[a]±1.89 (162)
2024	84.74[b]±1.15 (190)	126.54[e]±1.64 (144)	140.38[b]±2.53 (134)	177.27[b]±2.09 (134)
Season of Kidding	**	*		
1	82.58[a]±0.92 (471)	129.45[a]±1.21 (443)	138.32±1.76 (471)	172.49±1.45 (471)
2	76.33[b]±0.86 (525)	118.48[b]±1.16 (464)	131.90±1.71 (469)	174.96±1.41 (469)
Type of Kidding	**	*	*	
Single	80.06[a]±0.77 (470)	121.71[a] ±1.03 (434)	132.76 [a] ±1.49 (440)	172.41±1.24 (440)
Twin	75.92[b]±0.65 (483)	117.91[b] ±0.88 (433)	128.78[b]±1.27 (458)	173.70±1.05 (458)
≥ Triplet	80.87[a]±2.08 (43)	123.80 [a] ±2.72 (40)	137.28[a]±3.98 (42)	175.06±3.29 (42)
Parity	**	**	**	**
1	61.80[a]±1.13 (298)	105.66[a]±1.47 (287)	119.84[a]±2.20 (280)	171.48[a] ±1.82 (280)
2	76.98[b]±1.08 (239)	116.84[b]±1.41 (223)	131.87[b]±2.09 (229)	179.11[b] ±1.73 (229)

3	81.60^{c}±1.22 (174)	122.15^{c}±1.61 (157)	135.07^{b}±2.35 (165)	174.64^{c} ±1.95 (165)
4	81.36^{c}±1.38 (126)	122.61^{c}±1.83 (113)	136.87^{c}±2.69 (117)	174.33^{c} ±2.23 (117)
5	84.58^{d}±1.66 (72)	130.78^{d}±2.27 (60)	142.75^{d}±3.22 (67)	172.33^{c} ±2.67 (67)
Parity ≥ 6	82.39^{cd}±1.57 (87)	127.77^{d}±2.23 (67)	133.24^{c}±3.07 (82)	165.44^{d} ±2.54 (82)
***P<0.01, *P<0.05*				

6.1.3 AICRP Project: Genetic Improvement of Jakhrana Goats for Milk and Meat Production under Farm and Field Conditions

Principal Investigator: **Dr. Gopal Dass**

Co-Investigator: **Dr. M. K. Singh, Dr. B. Rai, Dr. Ravindra Kumar, Dr. Mukesh Bhakat, Dr. Vinay Chaturvedi, Dr. T. P. Singh**

Jakhrana is one of the large sized and high milk producing goat breeds of the country. It has very limited breeding tract in Alwar district of Rajasthan and it derived its name from the name of the village "Jakhrana" where it is found in its most pure forms. The pure breed Jakhrana goats are distributed in Jakhrana and its adjoining villages viz. Naisarana, Neemrana, Naghaudi etc. in Behror 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 nearby cities and rearing mainly for milk production. The animals of this breed have the 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 gm concentrate in various stages and age groups 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 kids 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 anthelmintics 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 244 which comprised of 70 males and 174 females and closing balance of 274 goats had a stock of 77 males and 144 females. During this year the addition was 121 animals and overall mortality was recorded 9.04%.

Production Performance

The overall least-squares means of body weights of kids at birth, 3, 6, 9 and 12 month age were 2.77.04±0.04, 10.19±0.11, 15.04±0.37, 21.45±0.47 and 25.30±0.54kg, respectively (Table 1). 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 and 12 month weights, season on 3 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 singles. On comparison of body weights of kids in different years it was found that kids born in year 2024 gained comparatively higher weights.

The average daily gain of Jakhrana kids during 0-3, 3-6, 6-12 and 3-12 months were 69.38±0.62, 58.21±0.19, 53.78±1.06 and 55.47±0.79 under semi-intensive feeding management. Sex, year of kiddingand type of birth had highly significant effect on all ADGs except non-significant effect of type of birth on ADG during 3-6, 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 kids had higher ADG during all age intervals.

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

	BWT	3M	6M	9M	12M
Overall	2.94±0.02(465)	9.13±0.05(419)	14.31±0.14 (311)	19.68±0.18(272)	24.07±0.20(235)
Year	**	**	**	**	**
2020	3.00±0.05(73)	9.14±0.13(69)	13.78±0.31(66)	19.24±0.36(64)	23.10±0.39(64)
2021	3.19±0.04(101)	9.57±0.11(97)	14.78±0.29(76)	18.48±0.34(74)	21.69±0.47(48)
2022	2.90±0.04(89)	7.42±0.12(75)	13.68±0.29(62)	17.73±0.37(50)	24.17±0.40(47)
2023	2.85±0.04(94)	9.33±0.11(87)	14.30±0.29(65)	21.93±0.37(50)	26.11±0.40(47)
2024	2.76±0.03(108)	10.18±0.11(91)	15.04±0.36(42)	21.45±0.47(34)	25.29±0.54(29)
Sex	**	**	**	**	**
Male	3.02±0.02(240)	9.46±0.07(212)	14.79±0.19(150)	21.10±0.24(125)	25.38±0.28(104)
Female	2.86±0.02(225)	8.79±0.07(207)	13.84±0.19(161)	18.26±0.23(147)	22.76±0.25(131)
Parity	**				*
Parity 1	2.77±0.03(150)	9.10±0.08(136)	14.38±0.23(101)	19.56±0.27(91)	23.92±0.30(77)
Parity 2	2.91±0.03(115)	9.19±0.09(106)	14.39±0.25(77)	19.62±0.30(66)	24.32±0.34(58)
Parity 3	3.03±0.04(93)	9.18±0.11(77)	14.10±0.28(65)	19.43±0.34(57)	24.24±0.39(50)
Parity 4	2.95±0.05(66)	9.01±0.13(62)	14.35±0.35(42)	20.26±0.43(36)	24.90±0.48(30)
Parity 5	3.03±0.06(41)	9.16±0.17(38)	14.34±0.44(26)	19.54±0.54(22)	22.97±0.60(20)
Birth Season		**			
Feb-March	3.00±0.03(206)	8.95±0.08(188)	14.08±0.22(134)	18.94±0.28(112)	22.81±0.34(91)
Octo-Nov	2.88±0.02(259)	9.30±0.07(231)	14.55±0.19(177)	20.43±0.24(160)	25.34±0.27(144)
Birth Type	**				
Single	3.11±0.03(191)	9.20±0.09(166)	14.38±0.23(116)	19.81±0.28(94)	24.22±0.32(78)
Twins	2.77±0.25(274)	9.05±0.06(253)	14.25±0.16(195)	19.55±0.20(178)	23.92±0.22(157)

(*Significant at 5% level, **Significant at 1% level)

The overall least-squares means of 90, 140 days, total milk yield and lactation length were 133.79±3.03, 168.75±6.93, 178.75±8.78 litre and 170.49±5.73days, respectively (Table 2). The year of birth had highly significant (P<0.01) effect on all milk production traits. Type of birth showed significant influence on total milk yield and parity had a highly significant effect on 90 and 140 days milk yield. On comparison, it was found that does kidded with multiple birth produced more milk and had longer lactation length than those kidded with single birth. On comparison of milk production in different parities, it was found that the milk production was increased with the increase in the parities and highest milk yield was recorded in the parity.

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

Traits	90D MY	140D MY	TMY	LL (days)
Overall mean	106.28±2.48(187)	161.54±4.38(266)	165.46±5.01(322)	164.25±3.28(32)
Year	**	**	**	**
2020	105.45±4.53(39)	156.64±10.93(33)	183.24±12.09(46)	198.06±7.96(45)
2021	133.32±3.65(60)	180.51±8.95(52)	167.91±10.12(68)	149.11±6.60(68)
2022	82.47±3.73(50)	135.87±9.52(39)	117.56±10.01(61)	132.48±6.54(61)
2023	125.36±3.27(67)	165.96±7.45(66)	179.86±9.58(67)	171.10±6.25(67)
2024	133.79±3.02(78)	168.75±6.93(76)	178.75±8.78(80)	170.48±5.73(80)
Type of birth			*	
Single	108.68±2.47(171)	150.20±5.97(152)	148.14±6.81(188)	157.23±4.45(188)
Multiple	123.47±2.40(123)	172.89±5.64(114)	182.79±6.70(134)	171.27±4.39(133)
Season	NS	NS		
1	116.98±2.73(126)	169.03±6.61(112)	170.86±7.65(136)	164.30±4.99(136)
2	115.18±2.14(168)	154.06±5.02(154)	160.07±5.93(186)	164.20±3.88(185)

Parity	**	**		
1	95.57±2.68(98)	134.90±6.56(83)	139.68±7.44(111)	163.42±4.86(111)
2	118.56±2.94(80)	172.31±6.98(74)	181.81±8.46(83)	169.74±5.52(83)
3	119.20±3.49(55)	162.47±8.25(51)	164.00±9.78(60)	162.35±6.45(59)
4	122.36±4.49(36)	166.07±10.33(35)	168.69±12.38(40)	163.52±8.08(40)
5	124.69±5.33(25)	171.97±12.57(23)	173.15±14.66(28)	162.19±9.57(28)

Reproduction Performance

The annual tupping, kiddings on available and bred basis were recorded as 90.0, 83.5 and 93.8%, respectively. During this year, a total of 102 kids were born from 68 kidding. Out of 102, 47 (46.08%) were males and 55.0 (53.92%) were females. Out of total, 50 (65.8%) kids born single and 26 (34.2%) kids born as multiples. The kidding rate was recorded as 1.34. The replacement rate of the does was calculated to be 29.0%.

Genetic Parameters

The h^2 estimates of birth, 3, 6, 9 and 12 month body weights was 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 foetus. The heritability estimates of 3, 6 and 9 month body weights were recorded as moderate. The heritability estimates of body weights increased with the age up to 3 month age then 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 the correlations. In general, the phenotypic of particular body weight with other body weights decreased with the increase in age and it was reversed 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 08 were selected for breeding purpose. The selection differential for 9 month body weight and 90 days milk yield of their dams was respectively 2.3 kg and 23.0 litre (2022). The population mean and the average of sire selected were for 9 month body weight and 90 days milk yield 21.4kg & 125 litre and 23.7kg & 148.0litre, respectively.

Distribution of Elite Germ Plasm and Introduction of New Germplasm

A total of 14 superior germ plasm (11 males and 03 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 08 (02 bucks and 06 does) Jakhrana goats were selected from the breeding tract, procured and added in the institute flock to create genetic variability in to the flocks for economic traits.

Revenue Generation and Milk Supply

During reporting year 2024, a revenue of Rs. 5,78,731/- **was** generated which comprised of Rs. 1,57,500/- from sale of breeding animals, Rs. 53,636/- from sale of culled animals, Rs. 1,36,000 from internally transferred animals and Rs. 2,31613 from sale of milk. During this year a total of 6,117.5 litres of milk was produced and supplied to GPT section of the institute for sale and preparation of various milk products.

6.1.4 Genetic Evaluation and Improvement of Muzaffarnagari Sheep for Body Weight

Principal Investigator: Dr. Gopal Dass

Co-Investigators: Dr. Nitika Sharma, Dr. Vinay Chaturvedi, Dr. Y. K. Soni, Dr. Arvind Kumar

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 grams concentrate in various stages and age group of the animals. Dry and green fodder was also offered as per the requirement. Controlled breeding was practiced to improve the managemental efficiency. Ewes were bred during May-June and October-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 543 which comprised of 139 males and 404 females and closing balance of 459 sheep had a stock of 133 males and 326 females. During this year a total of 179 lamb born and overall mortality was recorded 4.9%.

Production Performance

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age were 3.61±0.02, 15.39±0.09, 25.00±0.14, 30.12±0.16 and 36.58±0.16kg, 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 48.96 and 41.98kg respectively.

Table 1: Growth performance of Muzaffarnagari lambs (kg)

	Body weight at different ages				
Particulars	**Birth Wt.**	**3M Wt.**	**6M Wt.**	**9M Wt.**	**12M Wt.**
Overall mean	3.61±0.01(1293)	15.38±0.090(1136)	25.00±0.13(953)	30.12±0.15(864)	36.57±0.15(807)
Year	** **	**	**	*	
2020	3.48±0.03(266)	15.30±0.16(244)	24.62±0.23(225)	30.88±0.26(205)	37.15±0.26(184)
2021	3.63±0.03(258)	14.79±0.16(246)	24.22±0.27(172)	29.73±0.30(158)	36.71±0.29(151)
2022	3.71±0.02(298)	16.20±0.15(276)	25.68±0.23(244)	30.37±0.26(208)	36.60±0.26(196)

2023	3.69±0.02(292)	15.45±0.18(198)	25.31±0.28(162)	29.51±0.31(152)	35.91±0.31(137)
2024	3.53±0.03(179)	15.17±0.19(172)	25.17±0.29(150)	30.09±0.32(141)	36.50±0.31(139)
Sex	**	**	**	**	**
Male	3.69±0.02(642)	16.08±0.11(565)	26.87±0.17(459)	32.30±0.20(407)	39.94±0.20(367)
Female	3.53±0.02(651)	14.69±0.11(571)	23.13±0.17(494)	27.93±0.19(457)	33.21±0.19(440)
Type of Birth	**	**	**	**	**
Single	3.95±0.01(993)	16.26±0.08(886)	26.09±0.12(755)	31.07±0.13(696)	37.38±0.13(651)
Twins	3.26±0.02(300)	14.51±0.16(250)	23.91±0.24(198)	29.17±0.28(168)	35.76±0.28(156)
Parity	**	*			
I	3.44±0.03(295)	15.27±0.17(248)	24.67±0.27(198)	29.64±0.30(181)	35.95±0.29(172)
II	3.65±0.03(251)	15.46±0.17(223)	25.08±0.26(195)	30.53±0.29(175)	36.77±0.29(156)
III	3.70±0.03(250)	15.46±0.17(220)	25.55±0.26(183)	30.42±0.29(168)	37.10±0.28(160)
IV	3.63±0.03(230)	15.52±0.17(209)	24.96±0.25(181)	30.24±0.29(159)	36.82±0.28(151)
≥V	3.62±0.03(267)	15.22±0.16(236)	24.74±0.25(196)	29.75±0.28(181)	36.22±0.28(168)
***P<0.01, *P<0.05*					

The average daily gain of Muzaffarnagari lambs during 0-3, 3-6, 6-12 and 3-12 months were 130.68±0.96, 103.36±1.12, 61.18±0.78 and 76.23±0.54 under semi-intensive feeding management (Table 2). Sex, year of lambing and type of birth had highly significant effects 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 ADG during 0-3 and 3-6 month age groups, thereafter lambs born as multiples ad higher average daily weight gain during 6-12 and 3-12 months duration.

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

	ADG(0-3M)	ADG(3-6M)	ADG(6-12M)	ADG(3-12M)
Overall	130.68±0.9(1136)	103.36±1.11(953)	61.18±0.78(807)	76.22±0.53(807)
Year	**	**	**	**
2020	131.38±1.75(244)	102.22±1.88(225)	64.88±1.33(184)	78.59±0.91(184)
2021	123.86±1.78(246)	96.69±2.19(172)	66.47±1.49(151)	77.73±1.02(151)
2022	138.61±1.67(276)	102.22±1.84(244)	57.60±1.32(196)	73.10±0.90(196)
2023	130.26±1.99(198)	106.04±2.29(162)	55.98±1.58(137)	73.66±1.08(137)
2024	129.27±2.11(172)	109.61±2.34(150)	60.95±1.55(139)	78.03±1.06(139)
Sex	**	**	**	**
Male	137.49±1.23(565)	116.55±1.44(459)	68.82±1.03(367)	85.82±0.70(367)
Female	123.87±1.25(571)	90.16±1.40(494)	53.53±0.95(440)	66.62±0.65(440)
Type of Birth	**	**		
Single	136.53±0.90(886)	106.67±1.00(755)	60.13±0.68(651)	76.40±0.46(651)
Twins	124.83±1.71(250)	100.04±1.99(198)	62.22±1.41(156)	76.04±0.96(156)
Parity				
I	131.04±1.89(248)	100.89±2.19(198)	59.96±1.50(172)	74.47±1.02(172)
II	131.18±1.90(223)	103.01±2.11(195)	60.93±1.49(156)	76.43±1.02(156)
III	130.60±1.85(220)	106.77±2.10(183)	61.44±1.43(160)	77.23±0.98(160)
IV	131.87±1.85(209)	102.38±2.05(181)	63.39±1.42(151)	77.09±0.97(151)
V	128.71±1.80(236)	103.73±2.06 (196)	60.16±1.42(168)	75.91±0.97(168)
***P<0.01, *P<0.05*				

The overall least squares means for lambs 1st and 2nd six monthly and adult annual clips were calculated to be 366.48±5.11, 439.35±5.08 and 1094.42±113.51g, 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.

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

Particulars	Lambs Clip		Adult annual
	First season	Second season	
Overall mean	366.48±5.10(929)	439.34±5.07(744)	1094.42±13.51(1277)
Sex	*	**	**
Male	376.46±7.34(441)	477.61±7.60(319)	1395.94±26.33 (66)

Female	356.50±7.03(488)	401.08±6.65(425)	792.54±6.13(1211)
Year	**	**	**
2020	368.47±10.44(216)	483.49±10.28(174)	1326.12±17.60 (270)
2021	341.98±12.10(161)	344.10±11.64(135)	963.66±18.04 (268)
2022	376.40±10.18(228)	367.54±9.86(189)	890.45±17.67 (275)
2023	307.18±11.64(174)	521.74±11.89(129)	1029.69±19.02 (237)
2024	438.40±12.52(150)	479.86±12.51(117)	1261.28±17.84(227)
***P<0.01, *P<0.05*			

Reproduction Performance

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. 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, 34.93±0.68, 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.

Growth Performance in Field

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 months age were 3.10±0.04, 13.84±0.13, 20.67±0.21 and 27.74±0.23 kg, respectively (Table 8) 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 ages

Selection of Rams, Selection Differential and Responses

All the male lambs born during the year 2022 were ranked on the basis of their 6 month body weight and out of total, top 12 were selected for breeding purpose. The selection differential for the trait under selection was 5.2 kg (2024).

The population means and the average of sire selected was 25.7 & 30.9kg, respectively. The selection differential for 6 month body weight was 5.2 kg.

Breeding rams (12) were selected based on their 6 month body weight and then evaluated for various semen characteristics before using in breeding program.

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. Except for 12 month body weight, all the observed response to selection was positive. The positive observed responses indicated that there is genetic improvement in the body weights of Muzaffarnagari sheep over the years and present selection program is in right direction for further genetic improvement of the flocks through selective breeding.

Distribution of Elite Germplasm and Revenue Generation

A total of 114 superior animals (71 males and 43 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 the year 2024, a revenue of Rs. 17,65,606/- was generated which comprised of Rs. 12,84,000/- from sale of breeding animals, Rs. 1,01,606/- from sale of culled animals and Rs. 3,80,000 from internally transferred animals.

6.2 AICRP on Goat Improvement

Background of the Scheme

AICRP on Goat Improvement is a unique long term, structured programme aimed to bring about genetic improvement and conservation of goat genetic resources of the country in their respective habitats and development of germ-plasm resource centres. The programme explores genetic variations in local breeds through systematic 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 flocks. ICAR in the year 1971's under Vth Five Year Plan started a network programme later called *All India coordinated Research Project on Goat (*AICRP) to achieve rapid increase of genetic potential of indigenous goat for improved milk, meat and mohair yield by cross-breeding indigenous breeds with high yielding exotic breeds (milk and mohair) and other better-producing indigenous breeds for meat component. The head quarter of the project was made NDRI, Karnal from 1970 to1974 thereafter, CSWRI, Avikanagar from 1974 to1976 and CIRG Makhdoom from 1977 onwards. Alpine, Saanen, Anglo-Nubian and Toggenburg were identified as exotic dairy breeds whereas; Beetal and Malabari goats as indigenous breeds. Gaddi and Sangamneri were used as native breeds and Russian Angora as exotic breed of goats for mohair. Chegu in 1971 and Changthangi in 1973 goats were added to improve pashmina quality and quantity through selection. Later on in VIth plan (1976) three units namely Marwari Sirohi, Kutchi were added for improving meat potential through selective breeding and 3 more breeds namely Black Bengal in 1976 at BAU, Ranchi, Assam local goat in 1977 at AAU, Bernihat and Shingari in 1983 at Jorethang, Sikkim through crossbreeding with Beetal and Jamunapari as indigenous improver breeds. The crossbreeding with temperate breeds was found to be invariably unsuccessful and unsustainable in the long term. The crossbreeding with indigenous breeds was also terminated due to increase in age first kidding and decrease in multiple births in crossbreds and unsustainable in the long term.

The All India Coordinated Research Project on Goat was phased out with effect from 31st March 1990 with the experience gained and information generated, it was decided to abandon crossbreeding and follow selective breeding in the VIIth five-year. plan (1992–97) and improve meat and milk production through selective breeding in indigenous breeds**.** The "Network project on Goat Improvement" was launched with effect from 1 April 1990 with the aim to define, characterize and improve the productivity of indigenous breeds through selective breeding in their respective breeding tract and natural habitat. Presently, the 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 the farm unit at Institutional nucleus flock, 100-150 goats of nucleus flock under field units and 2500-3500 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 skills 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 disadvantaged regions through cluster approach.

The details of funding and non-funding units of AICRP on Goat Improvement are presented below

Table 1: Coordinating Centres of AICRP on Goat Improvement

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

AICRP is also working in remote region such as Gaddi breed at Palampur, Himalayan Goat (Chaugharka) at Mukestswar and Andamani Goat at Andaman & Nicobar Island.

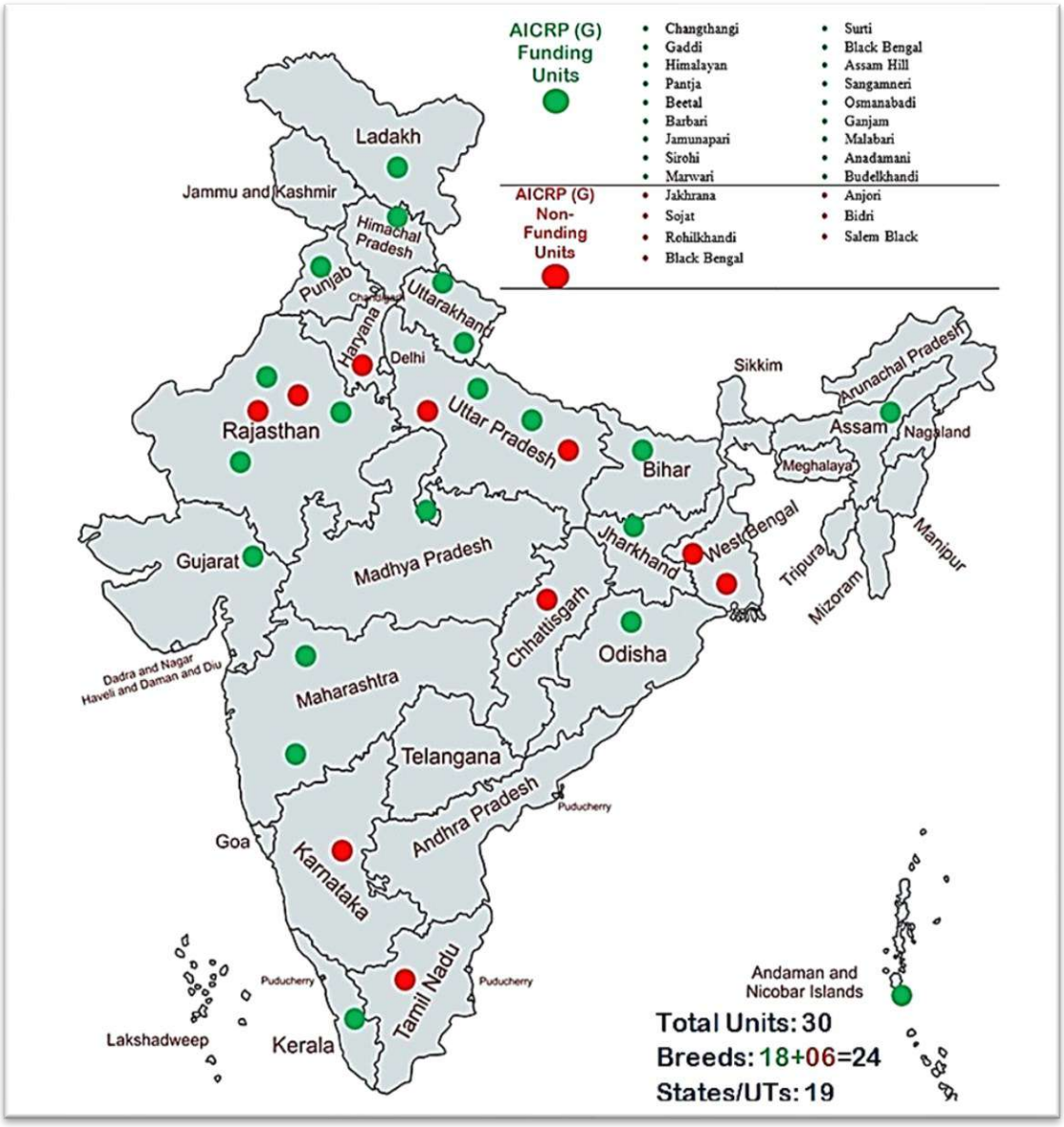


Fig. 1. Distribution of 30 AICRP (G) centres in different Agro-climatic Regions

Funding Units (AICRP): Farm Units

6.2.1 Barbari Goat Unit

The opening and closing balance of flock on 01-04-2024 and 31-03-2025 was 479 and 596. During the period 380 kids were born from 248 kidding and kids born as multiples were 66.6%. The litter size was 1.53% and 48.79% doe's delivered multiple births. 26 goats kidded twice in the year 2024. 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 was 422.79±18.81 days, 21.97±0.53 kg, 24.51±0.58 kg, 586.29±12.69 days and 282.56±13.41 days, respectively. Conception rate through natural service was 99.7% and 90% goats conceived in 1st attempt of natural service. Maximum number of open goats exhibited oestrus 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 2024 were 2.02±0.02, 8.88±0.09, 13.80±0.16, 17.16± 0.25 and 21.86±0.28 kg at birth, 3, 6, 9 and 12 months of ages, respectively. 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 of birth, season of birth

and parity were significant at almost all ages of growth. The average body weight of male and females kid under feed lot at 11 months of age (after 6 month treatment) were 27.61 and 21.52 kg. Corresponding body weights of kids under control (semi-intensive) were 20.34 and 18.19 kg. Male and females kids under feedlot attained 35.74 and 18.30% higher body weights than controlled kids. The h^2 estimates were 0.425±0.07, 0.254±0.057, 0.270±0.048, 0.234±0.045 and 0.122±0.042 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 2024 were 84.43±1.25 (FKI), 123.44±1.68, 138.96±2.33 litre and 177.60±1.85 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 litres for dam's 140 days milk yield. The h^2 estimates were 0.149±0.057, 0.194±0.056, 0.218±0.048 and 0.111±0.045 0.122±0.049 for 90-D, 140-D, TLMY and LL. A total 164 goats (116 male and 48 females) were provided to farmers and other stakeholders for field improvement. Whereas, multiplier flock owners are also sold 474 kids and adult goats to other farmers. Milk produced was 17146 litres from 204 goats. Three multiplier flocks were established in the year. Annual culling and mortality rate was 5.35 and 3.60%. Fodder trees and fodder plants are also maintained in 4.5-hectraes land. One sick ward, one small size shed (30 goats) and fencing of 3 acre agro-forestry area also completed this year. Two technologies were developed, validated and disseminated in farmers flock. Four research papers were published in international and national journals. Nearly 2200 farmers were trained on goat management through 20 trainings on scientific goat farming. Total revenue generated was Rs. 32.38 lakhs.

6.2.2 Jamunapari Goat Unit

The opening and closing balance of flock on 01-04-2024 and 31-03-2025 were 383 and 447 respectively. During the reported period 164 kids were born from 131 kidding, 48 goats were sold, 48 died, 20 were culled and 10 were slaughtered. The litter size was 1.25%. Kids born as multiples of total birth were 40.3%. Doe's delivered multiple births were 25.2%. Breeding efficiency on the basis of doe's tupped were 77.06% and kidding efficiency on the basis of does doe's tupped was 96.5%, respectively. Least squares means for average age at first service (AFS), weight at first service (WFS), weight at first kidding (WFK), age at first kidding (AFK) and first kidding interval (FKI) were 511.47±26.48 days, 31.28±0.92 kg, 33.78±1.02 kg, 664.29±26.18 days and 369.54±15.80 days, respectively. Conception rate through natural service was 89.5%. The least squares means for body weight of kids born during 2024 were 3.21±0.04, 10.86±0.17, 16.11±0.21, 21.02±0.32 and 28.36±0.45 kg, at birth, 3, 6, 9 and 12 months of ages, respectively. Males and single born kids were heavier than the females and twin born kids at all stages of growth. The effects of sex, type of birth, year of birth, season of birth and parity were significant at almost all ages of growth. The h2 estimates were 0.32±0.04, 0.35±0.04, 0.31±0.04, 0.28±0.04 and 0.32±0.04 for birth, 3, 6, 9 and 12 month weight. Twenty-seven goats (male and female) introduced in the nucleus flock which were purchased from its home tract (Chakarnagar, Etawah, UP). The least square means for 90 days milk yield, 140 days milk, total lactation yield and lactation length of goats kidded in were 90.23±2.99 litre, 132.05±4.79 litre, 133.12±6.54 litre and 181.43±4.09 days, respectively. The year and season of kidding, type of birth and parity have significantly affected lactation performance. Goat kidded in autumn season significantly yielded more milk than those kidded in spring. Goat that kidded twins yielded more milk. There was significantly lesser milk yield was obtained from first kidders. The selection differential for 9 months body weight was 1.25 kg and 106.9 litres for dam's 140 day milk yield. A total of 98 goats (21 male and 27 females of Jamunapari breed) and (16 male and 34 females of Jamunapari type) were provided to farmers and other stakeholders for field improvement. Whereas, Multiplier flocks Jamunapari breed also supplied (sold) 122 purebred goats to other farmers for improvement in field. Overall culling and mortality in the flock were 3.65 and 8.23% in the year. Total milk produced by unit was 8798 litres from 131 kidding. One multiplier fkock (MFU) of Jamunapari goat breed were established for genetic improvement, conservation, promoting scientific goat farming and development of goat based business models. Four research papers were published. Growing fodder plants were maintained on nearly 2 hectare land. Work has been initiated for the construction of Bhusa store. Nearly 1850 farmers, students, professionals and other stakeholders were trained on goat management

through 20 trainings on scientific goat farming. Total revenue generated was Rs. 16.37 lakh.

6.2.3 Sirohi Goat Unit

The opening balance of flock strength on 01.04.2024 was 192 males and 374 females totalling 566 animals. The additions were due to birth of 254 (143 male and 111 female) kids. The reductions were due to the death of 45 animals, the culling of 42 animals and the sale of 159 animals. The closing balance as on 31.03.2025 was 183 males and 333 females totalling 566 animals. The least squares means for live weights of kids born at birth, 3, 6, 9 and 12 months of age were 3.02±0.03, 13.19±0.15, 20.14±0.27, 25.62±0.42 and 30.78±0.43 kg, respectively. The males and single born kids were heavier than the females and multiple born kids, respectively, at all stages of growth. The effects of year, sex, type of birth and regression of dam weight were significant for all the traits, except regression of dam weight on post weaning average daily gain (3-12 month; PDG3-12). The 2024-25 born kids achieved growth rates of 112.70±1.66 and 61.07±1.38 g for PDG0-3 and PDG3-12, respectively. The least squares means for milk yield of does kidded during 2024-25 at 90 days, 150 days, Total lactation (TLMY) and Lactation length (LL) were 89.38±0.88, 125.36±1.21 and 129.73±2.03 litres, and 167.90±2.53 days, respectively. The effects of year of kidding and lactation order were significant on all the traits. Out of 183 does available for breeding during 2024 major season, 167 were tupped and 105 kidded with 17 giving birth to twins. The tupping percentage was 91.26. The breeding efficiency was 68.60 and 75.64%, on the basis of does available and does tupped, respectively. The kidding percentage was 69.77 and 76.92 on the basis of does available and does tupped, respectively. The litter size was 1.14. The mortality rates in 0-3, 3-6, 6-12 month age groups and in adults were 8.37, nil, 0.33 and 4.04 percent, respectively. The overall mortality rate was 3.69%. The culling rates in 0-3, 3-6, 6-12 month age group and in adults were NIL, 1.58, NIL and 6.62% , respectively. The overall culling rate was 3.45 % . A total of 159 Sirohi goats 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 animals, milk etc. during the year was Rs. 26, 34,157.00.

Field Unit

6.2.4 Andamani Goat Unit

Andamani goat unit is operational at ICAR-Central Island Agricultural Research Institute, A&N Islands since 2014-15. The Andamani goat is now officially recognized and registered as new goat breed from Andaman & Nicobar Islands (INDIA_GOAT_3300_ANDAMANI_ 06039). Three clusters were established in South, Middle, and North Andaman districts. 124 goats were also maintained at the nucleus flock. During the reporting year, the opening and closing flock balance were4109 and 4272, respectively. A total of 291 farmers from 39 villages were registered. New registrations and births were 1020 and 902, respectively, while 207 goats died and 1492 were sold. Least square means of body weights at birth, 3, 6, 9 and 12 months were 1.50±0.01, 6.10±0.07, 9.58±0.10, 12.98±0.10 and 16.13±0.07 kg, respectively. Breeding efficiency and kidding percentage were 154.85 and 152.15. Multiple births occurred in 58.09% of kiddings. Least square means of age at first mating, weight at first mating, age at first kidding, and weight at first kidding were 237.01±1.71 days, 11.41±0.06 kg, 392.86±5.63 days recorded, 16.23±0.29 kg, respectively. Lactation length and yield were 94.2±1.5 days and 40.61±0.73 litres. Nine bucks were distributed, and 77 male kids were selected based on performance. Deworming and mineral mixture were provided to 2190 and 2400 goats, respectively. Mortality rate was 4.38%. Fourteen training programmes benefited 346 farmers. Semen technology was standardized and 260 AIs were performed with 38.5% success. Net income per animal/year was Rs. 5706. Published two research articles in a journal of high repute and prepared one technical manual on goat farming.

6.2.5 Assam Hill Goat Unit

The Assam Hill Goat Field Unit under ICAR-AICRP on Goat Improvement began in 2009 and now operates across six clusters, including the newly adopted Nalbari. The opening and closing balances of flock on 01-04-24 and 31-03-2025 were 3725 and 4996. The nucleus herd grew from 84 to 176, and the field flocks from 2,235 to 4,996 goats. Average body weights (kg) at 12 months were 14.82±0.33 in the field flock and 14.88±0.15 in the nucleus herd. Reproductive traits such as AFS, AFK, and kidding interval showed improvement, with litter sizes of 1.67 (field) and 1.69 (nucleus). Multiple births were observed in 51.68% and 62.06%, respectively. Milk

yields (90-day) were 12.78 kg (field) and 14.10 kg (nucleus). Mortality rates were 2.30% (nucleus), 5.28% (field), and 2.88% (multiplier). Eight multiplier flocks with 227 goats were established. 36 elite bucks were distributed, and 32 selected bucks from field flocks were used for breeding. The unit conducted 55 training programs, 25 animal health camps, and several awareness events, with support from SITA, NGOs, and the State AH Department. Income per goat/year was Rs. 909 (nucleus), Rs. 3,723 (field), and Rs. 4,297 (multiplier). The project has published 4 research papers, 3 articles, 9 abstracts, and documented 4 success stories. 57 entrepreneurs were trained, and Rs. 30,500 revenue was generated. Farmers received state-level awards, and the team won national accolades at ISSGPUCON 2025.

6.2.6 Black Bengal Unit

AICRP on Goat Improvement was started at ICAR Research Complex for Eastern Region, Patna in the year 2018-19. The centre continued its activities in four clusters in Bihar (E. Champaran, Araria, Jamui and Katihar), based on the Bengal goat population density. The opening and closing balances of flock on 01-04-24 and 31-03-2025 were 4651 and 3934. During the year, the population growth in the selected villages expanded to the tune of 152.29 % with the new addition of breedable does and new births. A total of 1939 does were available for breeding. Tupping percentage was recorded at 92.72% while breeding efficiency was recorded at 99.24% on the basis of does tupped. The overall mortality was 3.97 %. The average kid's body weight at birth, 3, 6, 9 and 12 month of age was 1.35 ± 0.25, 4.05 ± 0.81, 6.67±1.20, 9.16 ± 1.35 and 11.68±1.97kg, respectively. Average lactation milk yield was recorded as 17.71± 0.12 kg at 60 day and 22.78 ±0.13 kg at 90 d of lactation. Institute has added six (06) multiplier flocks in reported period. Significant increase in the socio-economic conditions of goat farmers has been registered under the project was also observed.

6.2.7. Beetal Goat Unit

The Beetal Goat Field Unit was established in 2020 at GADVASU, Ludhiana, and recognized as a funded unit in 2022. A total of 1198 goats were covered under the project during 2024-25, for breed improvement (498) and grading up (700). The litter size ranges from 1-3 with average of 1.55. The percentage of single births, twins and triplets was 43%, 52% and 5% respectively. The least square mean of body weight (kg) of kids at birth, 3 months, 6 months, 9 months and 12 months was 4.12 ± 0.021, 13.39 ± 0.024, 18.39 ± 0.367, 23.79 ± 0.367 and 26.44 ± 0.110. The average of body length, heart girth and height (cm) at birth, 6 months and 12 months was 34.01±1.74, 35.25±1.85, 32.94±2.08; 58.57±0.43, 57.58±0.40, 59.08±0.53 and 67.15±0.27, 70.05±0.25, 69.54±0.86 respectively. The average milk yield of the goats recorded in 90 days was 110.02±1.51 (kg).

6.2.8 Bundelkhandi Goat Unit

The Bundelkhandi Goat Field Unit was initiated in May 2018 at the ICAR–IGFRI, Jhansi (U.P). A significant achievement was marked when the Bundelkhandi goat was officially registered as a distinct breed by the Breed Registration Committee of the ICAR on January 6, 2025, under Accession Number INDIAN_GOAT_2010_BUNDELKHANDI_06041. The opening and closing balance of Nucleus flock on 01-04-24 and 31-03-2025 were 106 and 102. Currently, the AICRP unit on Bundelkhandi goat is active in six clusters. During the year 2024–25, a total of 135 households were enrolled under the project, with 3180 goats registered to date. The flock size ranged from 5 to 70 animals, with an average size of 23.73. To strengthen the breeding program, 21 selected breeding bucks were distributed among goat-keeping households in the adopted villages, while 5 does were provided to multiplier flocks. The average body weights at birth, 3, 6, 9 and 12 months of age were 2.28±0.05, 9.18±0.18, 13.40±0.44, 17.62±0.15, and 19.66±0.26 kg, respectively. The average daily milk yield recorded was 477.42±12.49 ml, and the average kidding percentage was 89.57%. Additionally, Kisan Gosthi-cum-Animal Health Camps were conducted to raise awareness among farmers about the scientific goat rearing and health management practices.

6.2.9 Changthangi Goat Unit

The AICRP on Goat Improvement (Changthangi) was initiated on 1st April 2014 at HMAARI, SKUAST-K Leh, now operating under Krishi Vigyan Kendra (KVK), SKUAST-Leh. The project aims to improve pashmina fibre quality and meat traits in Changthangi goats. Currently, nine villages viz. Gia, Kharnak, Samad, Nidder, Chumathang, Gyaltsa Nomad, Demchok, Koyul, and Hanle are included under the project, covering a total of 18,288 goats managed by 83 beneficiaries. The opening balance for the year was 15171 and the

closing balance was 18288. During 2024–2025, the goat population increased by 11.33%, driven by the inclusion of three new villages. Kidding percentage stood at 69.4%, with 2,408 kids born. The average body weight at birth, 3 months, 6 months, 9 months and 12 months were 2.38±0.09, 6.60±0.11, 9.78±0.13, 13.43±0.25 and 17.56±0.30 respectively. Pashmina yield averaged 337.7 g/goat/year across villages, ranging from 200g to 500g. Quality analysis of 325 samples showed an average fibre diameter of 15.23 microns and length of 60.28 mm. A nucleus herd of elite bucks has been established at KVK-Leh, and 12 bucks were distributed to three clusters in 2024 for breed improvement. Additionally, 6175 animals were adopted under the multiplier flock system. Under the fodder development program, 10 hectares of land were cultivated with alfalfa, and silage production using local crops was successfully standardized. Over 23,000 goats were treated and dosed under the health management program, and 9,464 were vaccinated against major diseases. Sixteen training and awareness programs were conducted, benefiting 190 pastoralists. Capacity building initiatives included 7-day training on pashmina spinning in collaboration with MSME and a hands-on program on pashmina goat management held in Srinagar. Women's groups and local entrepreneurs have also been actively linked to value-added pashmina initiatives. Qualitative milk analysis showed that 100 ml of Changthangi goat milk contains 4.6g carbohydrates, 4.82g protein, 4g fat, and 140.8mg calcium. Faecal examination of 366 samples across project villages revealed Eimeria spp. (45%) as the most prevalent gastrointestinal parasite, followed by Nematodirus, Strongyloides, Moniezia, and mite eggs. The project continues to promote sustainable goat production and value addition in the high-altitude, climate-challenged region of Ladakh through community-based genetic improvement, fodder innovation, health interventions, and capacity building.

6.2.10 Gaddi Goat Unit

The AICRP on Goat Improvement (Gaddi Unit) was sanctioned to this centre on 17th February 2009. During the period under report (April 2024 to March, 2025), the performance of five field units belonging to different migratory routes were monitored. The opening balance as on 01.04.2024 was 1692 goats including 1189 breedable does. During the year, a total of 1077 young kids were added into selected flocks by way of birth, 207 animals of different age groups died and 927 animals pertaining to different age groups were sold by the owners. The opening balance of stock as on 31.03.2024 was 1723 and the closing balance as on 31.03.2025 was 3067 animals under different age groups. The average growth with least square means during the year under report for body weights at birth, 3 month, 6 month, 9 month and 12 months of age were 3.12±0.22, 16.18±0.19, 21.84±0.20, 25.90±0.27 and 29.76±0.16 Kg., respectively. For breeding inputs, a total of 13 males were finally distributed to 13 different farmers as a breeding input under AICRP. Further we supplied 20 Gaddi goat units (1M: 3F) (80 animals) from AICRP adopted multiplier flocks, under Capacity building and Income enhancement of Schedule Caste Farmers through Technological and entrepreneurial interventions project (ICAR-SCSP), for grading up and genetic improvement non-descript animals. All selected animals were provided health coverage under migratory field conditions viz. vaccination against PPR, (9861), 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 (71qtls.) and mineral mixture (3qtls). The total number of multiplier flocks was 3 in numbers and with 520 animals i.e., flock strength. The income per goat per year was Rs.8,000/- only. The overall population growth was observed to be 107.04%. The overall mortality incidence was found to be 6.74%. The incidence of twin birth recorded was11.6% and litter size 1.42 respectively. The overall abortion incidence in the flocks was observed to be 5.8%. The breeding efficiency or fertility percent on the basis of does available was 70.24% and on the basis of does tupped was 89.60% respectively. The kidding percent were on the basis of does available was 57.03 % and on the basis of does tupped was 81.16 % respectively.

6.2.11 Ganjam Goat Unit

The Ganjam Goat unit was initiated in 2001 and operates across four clusters: Chatrapur, Rambha, Khallikote, and Jirabadi, covering 100 farmers from 28 villages with a goat population of 2775. The average body weights (kg) of kids at birth, 3, 6, 9, and 12 months were 2.93, 7.30, 10.96, 15.33, and 19.01, respectively. Milk yield during the first two months of lactation was 8.61 kg and 15.17 kg. Means of age at first heat, age at first kidding, weight at first kidding and a kidding interval were 396 days, 599 days, 22.11kg, and 224 days, respectively. Kidding percentage was 88.88%, with

mostly single births. Fifty-seven elite bucks (selection differential +4.0 kg at 9 months) were distributed, covering around 950 does. Kid mortality was 5.9%. Breeding efficiency was 1.63, and kidding efficiency 1.00. Health interventions included 4000 vaccinations, 9238 deworming doses, and treatment of 2591 goats. Capacity-building activities benefited 328 farmers through 13 programs. The average income per goat/year was Rs. 6000, with a farmer income increase of 8.43%. The project follows pure breeding among the migratory Golla community and collaborates with state departments, KVKs, CIWA, and NBAGR. An ice flaker unit was procured under infrastructure development.

6.2.12 Chaugarkha (Himalayan) Goat Unit

AICRP (Chaugarkha goat unit) is located at ICAR-IVRI, Mukteshwar, Nainital, Uttarakhand. Recently, Chaugarkha has been registered by ICAR-NBAGR with Accession number 'INDIA_GOAT_2400_CHAUGARKH A_06040'. Chaugarkha goat is medium size meat breed, reared mainly by landless, small and marginal farmers of the Kumaon region of Uttarakhand. New villages/clusters were adopted and some old villages/clusters were dropped as per proceedings of the 21st Annual Review Meet. The opening and closing balance of Field flock on 01-04-24 and 31-03-2025 was 788 and 672. For the farm, the overall mean body weights (kg) at birth, 3, 6, 9 and 12 months were 1.92±0.03, 9.17±0.27, 12.97±0.45, 16.96±0.49, 18.14±0.76, respectively. For the field, the overall mean body weights (kg) at birth, 3, 6, 9 and 12 months were 1.65±0.12, 6.02±0.32, 10.24±0.87, 14.17±0.11, 17.05±0.24, respectively. Three animal health camps were organized under AICRP (total 710 animals benefited). The overall mortality was 3.89%. A five-day training programme was organized in which 21 farmers from Nata Dol village, Lamgara block, Almora district was trained under AICRP (Name of the training programme- "Scientific Rearing and Management of Goats", Duration: 24-02-2025 to 28-02-2025). Following inputs were supplied during the reporting year-pea-3 quintals, fawdas-513, lime-89 bags of 25 kg each, gardening kit-50, Agrimin forte-70 bags of 1kg each, electronic weighing balance-02, anthelmintic and medicines. A revenue of Rs 154282.5 was generated from the sale of Chaugarkha goats from the nucleus flock.

6.2.13 Malabari Goat Unit

Malabari goat field unit under AICRP on Goat Improvement was initiated in April 2001 with the objective of improving the productivity of Malabari goats in their native tract. The unit operates through six clusters: Taliparamba, Thalassery, Vadakara, Perambra, Kottakkal, and Tanur located in Kannur, Kozhikode, and Malappuram districts of northern Kerala. The opening and closing balance of field flock on 01-04-24 and 31-03-2025 was 2524 and 3075. A nucleus flock of 130 goats is maintained at Goat and Sheep Farm, Mannuthy, Thrissur. Additionally, five multiplier flocks have been established in Thrissur, Palakkad, and Malappuram. A total of 261 farmers (178 women) have been registered and supported with breeding inputs, feed supplements, and health coverage. The total flock strength is 4918 including 3742 females; opening and closing balances were 3548 and 4023, respectively. In 2024-25, 1150 kids were born from 724 kiddings with 582 female kids. Overall population growth was 92.5%, and 21.13% of animals were sold. Body weights (kg) at birth, 3, 6, 9, and 12 months were 2.69±0.20, 8.99±0.30, 16.90±0.60, 23.98±0.30, and 24.99±1.30, respectively. Total lactation yield and lactation length were 85.50±5.10 litres and 87.20±4.60 days. Age at first kidding was 389.30±12.70 days; inter-kidding interval was 261.50±28.30 days. Kidding rate was 1.68. Multiple births were highest at Kottakkal (72.58%). Mortality rate was 3.1%. A total of 73 bucks were distributed and 24800 kg of concentrate feed and 1056 kg supplements were provided. Seven TSP villages were covered. Seven trainings benefited 446 farmers. Five research papers and two theses were completed. Net return per goat/year was Rs. 16,520.

6.2.14 Marwari Goat Unit

The Marwari Field unit, as a part of the AICRP goat improvement project is functioning at RAJUVAS, Bikaner since 1988 to improve the productivity of Marwari goats in the farmers' flock through selection within the breeding tract of this breed. Opening and closing stock at Nucleus farm were 157 and 177; and in field flock it was reported as 3744 and 3251. Operational clusters are located at Daiya, Kalayansar, Raisar (Bikaner district) and Kan Singh Ki Sird (Jodhpur district) with a distance of 10, 20 and 120 km away from headquarter, respectively. A total of 78 farmers have been registered under the unit. The 21 new bucks were distributed to registered farmers in adopted areas

for breeding improvement. The overall body weights at different stages of growth were 2.53±0.01 at birth, 8.50±0.05 at 3 month, 14.53±0.21 at 6 month and 18.66±0.60 at 9 month of age. The average milk yield was 57.32±0.50 litres in 60 days 77.73±0.68 litres in 90 days and 87.72±0.71 litres in lactation yield and lactation length 108.66±0.22 days during 2024-25. The kidding percentage and kidding rate was 97.62% and 1.05, respectively. Mortality rate was recorded below 5% mark (3.56%). 2 Multiplier flocks with flock strength of 156 was developed. Income per goat/year was found as Rs. 3631 The capacity building of the goat keepers was done with the help of trainings, Goshti and meetings. Four trainings were conducted for capacity building of registered farmers in Marwari field unit with total farmer strength of 107 including 10 female farmers. Revenue generation during this year was 193466 Rs. As infrastructure development fodder store, kidding pen, mating pen etc. are under construction.

6.2.15 Osmanabadi Goat Unit

The Osmanabadi goat field unit was established in April 2009 at NARI, Phaltan, Maharashtra under the AICRP on Goat Improvement. The unit functions across five drought-prone districts of Maharashtra Ahmednagar, Beed, Pune, Satara, and Solapur with one cluster in each district. Performance recording was carried out on 3,424 goats belonging to 123 goat keepers. The average age at first kidding (AFK) was 432±8 days. The average litter size per kidding and per doe per year were 1.62 and 1.81, respectively, with 56.9% multiple births. The least squares mean weights (kg) at 3, 6, 9, and 12 months were 11.4, 16.0, 18.5, and 20.2 kg, respectively. The average 90-day milk yield was 109.9 kg, with does having singles, twins, and triplets yielding 70.2, 114.4, and 133.6 kg respectively. The heritability estimate for 90-day milk yield was 0.10±0.16. The unit also maintained dispersed nucleus flocks across four locations and multiplier flocks in eight locations. The total closing balance of goats across clusters was 1,259 (303 males and 956 females). Mortality rates were exceptionally low at 0.4% for both kids and adults. During 2024–25, 14 Osmanabadi bucks were distributed. Additionally, 2,740 semen straws were provided for AI. Health and management initiatives included vaccination of 1,385 goats (HS) and 633 goats (ET), deworming across four clusters, and disinfection using sodium hypochlorite. Income per doe/year was estimated at Rs. 10,500. Capacity building included 24 training programs benefiting 248 farmers, including 50 women. Four research publications and multiple success stories were documented, highlighting innovation and community-based breeding approaches.

6.2.16 Pantja Goat Unit

The Pantja goat unit came into existence in the year 2014 at GBPUA&T, Pantnagar, Uttarakhand. Presently, the unit is operational in four clusters namely Bhimtal, Tilpuri, Bara, and Majhera spread across Nainital and Udham Singh Nagar districts. The unit has adopted 250 households across 85 villages. The goat population under the project showed a significant increase with an opening and closing balance of 3,527 and 3,973 goats, respectively. The survey revealed a rise in Pantja goat share from 23.7% in 2014–15 to 31.5% in 2024–25 in the project area. The average age and weight at first mating were 269.89±1.47 days and 22.41±0.06 kg, respectively. Average body weights (kg) at birth, 3, 6, 9, and 12 months were recorded as 2.29±0.01, 11.32±0.04, 16.40±0.06, 20.40±0.06, and 24.86±0.08 kg, respectively. The average 12-month weight improved from 20.0 kg in 2016–17 to 24.86 kg in 2024–25. Milk yield at 30, 60, 90, 120, and 150 days stood at 13.10, 28.96, 49.81, 62.51, and 69.42 litres, respectively. Lactation length and yield were 123.08 days and 61.34 litres, respectively. During the reporting period, 1,744 kids were produced using 81 Pantja bucks and 1,543 does. Kidding rate (litter size) was 1.58 with 50.32% twins and 3.36% triplets. Pantja goats demonstrated high prolificacy with 54.13% multiple births, breeding efficiency of 96.71%, and kidding efficiency of 143.50%. The overall flock mortality was 5.95%. Twenty-two bucks were distributed this year. A total of 118 functional bucks covered 1,543 does (including 312 non-descript). Seven training programs were conducted in 2024–25, benefiting 348 farmers (total 3,445), and the Centre continues collaboration with two NGOs and four SHGs. Eight multiplier flocks (ranging from 51 to 205 goats) were established to scale up Pantja germ-plasm multiplication. The centre has documented 08 success stories, developed 05 technologies, and published 03 research papers, 01 leaflet, and 01 training manual in the year.

6.2.17 Sangamneri Goat Unit

The All India Coordinated Research Project on Sangamneri Goat was initiated in 2002 with the goal of improving the genetic performance in growth, reproduction, and production in farmers' flocks.

Initially, 500 does were registered, and the program has since expanded to 5,097 breedable does, covering six clusters across three districts—Ahmednagar, Nasik, and Pune. In 2020-21, Nandurbar was added as a new cluster under the TSP, registering 1,342 goats from 351 farmers. By 2022, 1,162 goat keepers and 4,572 goats were registered, and in 2023-24, the program transitioned to SCSP. During 2024-25, 51 breeding bucks were rotated across the field units, resulting in 2,751 births. The least square means for body weights at birth, 3, 6, 9, and 12 months were 2.48 kg, 11.07 kg, 15.71 kg, 19.65 kg, and 24.73 kg, respectively. Body weight improvements over baseline data were 10.04% at birth, 29.65% at 3 months, 25.61% at 6 months, 17.80% at 9 months, and 28.41% at 12 months. The average number of kids per kidding was 1.78. Factors such as village cluster, year, and season of birth significantly affected pre-partum traits. The overall 90-day milk yield for 2024-25 was 120.45 L, influenced by similar non-genetic factors. The program organized 19 group meetings, 2 health camps, 4 SCSP trainings, and 9 general trainings. Additionally, 11 male and 25 female goats were introduced to the nucleus flock to improve genetic material.

6.2.18 Sirohi Goat Unit

The Sirohi goat field unit under the AICRP on Goat Improvement was established on 1st January 2001 with the primary objective of genetic improvement in the farmers' flocks. Presently, the unit operates across five field clusters, covering [add name] villages and benefiting a large number of farm households. The data on growth, lactation and reproductive performance of Sirohi goats under field conditions have been analysed using least square techniques. The closing balance of the registered flock was 2580 animals including 1542 adult females. During report period, 1082 kids were born, out of which 534 were males. Total 475 males were sold out of which maximum 190 males were sold from adult age group. The average body weights (kg) at birth, 3, 6, 9, and 12 months were recorded as 2.46±0.02, 11.58±0.10, 15.18±0.16, 19.39±0.27, and 23.98±0.20, respectively. Growth performance was significantly influenced by cluster, sex of kid, and year of birth, with male kids being consistently heavier than female kids at all ages. Milk yield over 60, 90, and 150 days stood at 41.23±1.44, 59.75±2.14, and 84.92±4.87 litres, respectively. The overall lactation yield and lactation length were 85.64±4.84 litres and 153.66±1.08 days. Significant effects of cluster, type of kidding, period, and lactation order were observed on milk production traits. Reproductive performance of test progenies showed an average age and weight at first mating of 487.90±23.67 days and 24.49±0.51 kg, and at first kidding, 637.74±23.72 days and 27.93±0.36 kg, respectively. The service period, kidding interval, and gestation length were 207.69±3.79, 358.26±3.79, and 150.57±0.05 days, respectively. The average litter size (kidding rate) was 1.18. Health and management interventions during the year included deworming of 6,338 animals and ectoparasite treatment in 8,036 goats. Vaccination efforts covered 2,117 animals against Enterotoxaemia (ET) and 1,466 against PPR. The overall flock mortality was recorded at 4.95%.

6.2.19 Surti Goat Unit

The project was operational across four clusters namely Navsari, Bilimora, Vapi, and Dang (Vaghai)—covering 24 villages and 85 farmers. A total of 228 males and 1066 females maintained by farmers were covered, in addition to a nucleus flock of 170 Surti goats maintained at the research station. The least squares mean of kids body weights at birth, 3, 6, 9 and 12 months of age were 2.42 ± 0.05, 9.37 ± 0.37, 18.22 ± 0.35 kg, 22.90 ± 0.53, and 25.31 ± 0.66 kg. Milk yield in the farmers' flock averaged 1.07 ± 0.15 litres per day per doe, with cumulative 60-day and 90-day yields of 64.20 ± 1.15 and 92.34 ± 2.69 litres, and a lactation length of 93.23 ± 3.64 days. In the nucleus flock, the 60-day, 90-day, 150-day, and total milk yields were 73.93 ± 3.45, 108.52 ± 4.39, 142.78 ± 11.25, and 116.05 ± 8.11 litres, respectively, with a lactation length of 129.92 ± 16.52 days. The mortality rate was 10.95% in the field and 9.9% in the nucleus flock. Kidding rates were 1.49 in the field and 1.63 in the nucleus flock. A total of 10 trainings were conducted, including one three-day program attended by 296 goat keepers. Exposure visits and six health camps were organized, along with 4 Goshthi meetings and 25 awareness programs. To support genetic improvement, 46 breedable bucks and 34 females from the nucleus flock and three bucks from multiplier flocks were distributed to farmers. Research outputs included 11 published articles and one presented abstract by PG/PhD scholars and faculty from the Veterinary College, Navsari. No formal success stories were reported during the period.

Non-Funding Units (AICRP)

6.2.20 Anjori Goat Unit

The All India Coordinated Research Project (AICRP) on Anjori goats has been initiated at the Dau Shri Vashudev Chandrakar Kamdhenu Vishwavidhyalaya, Durg, as a non-funded unit from the year 2024–25. Anjori goat germplasm resource centres have been established in Chhattisgarh through the selection of 18 cluster villages across 6 districts, involving 48 farmers and a total goat population of 2,106. The initiative is designed to conserve and improve the Anjori goat breed while simultaneously enhancing the livelihood opportunities of rural communities. A baseline survey conducted in all project villages has generated comprehensive data on breed traits, flock size, production, and farmer income. Key performance indicators include: average birth weight of 3.1 kg, body weights of 11.68, 14.45, 16.18, and 24.72 kg at 3, 6, 9, and 12 months respectively, an average milk yield of 32.29 litres, a kidding rate above 90%, kid mortality of 10%, and adult mortality ranging between 5–10%. Farmers generally maintain flocks of 10–15 goats, earning an average annual income of about ₹40,000. Capacity building formed an important component of the programme, with four training sessions held between August 2024 and March 2025 under NRLM/paid initiatives. Focused on "Goat Farming and Entrepreneurship Development," these trainings benefitted 196 participants, including farmers, entrepreneurs, Pashu Sakhi workers, and women SHGs from Dantewada, Bijapur, and neighbouring districts. Infrastructure development is in progress with the creation of an Anjori nucleus herd at DRS Farm, Anjora, in collaboration with Durg Veterinary College and KVK, Anjora. The herd currently houses 169 Osmanabadi goats and 143 Anjori goats, forming the foundation for systematic breed improvement and multiplication. Looking ahead, the project will emphasize selective breeding, buck distribution, and community-based breeding programmes, long with the active involvement of SHGs. These efforts are expected to ensure the sustainable development and genetic improvement of the Anjori goat breed, while contributing to rural income generation, women's empowerment, and entrepreneurship in goat farming.

6.2.21 Bidri Goat Unit

The All India Coordinated Research Project (AICRP) on Bidri goats has been initiated at the Veterinary College, Bidar from the year 2024–25. As part of the initial groundwork, a comprehensive baseline survey was conducted in three talukas of Bidar district—namely, Bidar, Bhalki, and Basava Kalyan—owing to their comparatively higher goat populations. The objective of this survey was to collect detailed information on various aspects of goat farming practices, including the prevailing animal husbandry systems, socio-economic background of the goat rearers, awareness levels regarding scientific interventions such as deworming and vaccination, and the extent of support received from the state animal husbandry department. The findings revealed that the majority of goat keepers in these villages possess small to medium land holdings. Most of them are either illiterate or have attained only a basic level of education. Consequently, traditional and unscientific goat farming practices continue to dominate. Based on the goat population density and the willingness of local farmers to participate, two villages—Bhagdal Tanda in Bidar taluk and Kerur in Bhalki taluk—

were identified and selected as primary clusters for the implementation of the project. In Bhagdal Tanda, 80 farmers owning a minimum of four breedable does were selected, and their animals were tagged and registered. In Kerur village, 30 farmers with at least eight breedable does each were enrolled. Efforts are currently underway to establish a third cluster in Basava Kalyan taluk. To strengthen the nucleus flock at the Livestock Farm Complex of Veterinary College Bidar, 40 adults does and 4 bucks were procured from the breeding tracts. Regular data collection and monitoring on parameters such as birth weight, weekly weight gain, twinning percentage, and weaning weight are being carried out. Additionally, one-day training and feed distribution programmes have been successfully conducted at the cluster locations to enhance farmer awareness and participation.

6.2.22 Black Bengal Unit

The All India Coordinated Research Project (AICRP) on Black Bengal goats has been initiated at the ICAR-NDRI, Kalyani, West Bengal from year 2024–25. A total of 09 villages (03 villages each in 3 districts of West Bengal) were selected under the AICRP on Black Bengal Unit. A total of 655 farmers from 9 villages of 3 districts, 149 farmers from Nadia district, 186 farmers from Birbhum district and 320 farmers from North 24PGS district, who are having at least two breedable Black Bengal goats, were considered for this project work. Most of the farmers in all villages are low to marginal type, have small to medium land holdings and they are either illiterate or having low educational level and follow the traditional goat farming practices. Most of the farmers possess goats having flock size of 4 to 8 goats in each household in all these villages. A total of 230, 396 and 616 breedable females were tagged in the selected villages of Nadia, Birbhum and North 24 PGS districts of West Bengal. So far, 25 breedable tagged bucks from Nucleus herd of NDRI, Kalyani was distributed in the selected project areas. Besides, 7 village healthy bucks were also selected and tagged and used for breeding purposes. Farmers are advised to breed their female goats with these selected males of each village. The flock strength in the nucleus flock, situated at NDRI, Kalyani was 196 where females and male animals were 147and 49, respectively. The average body weights of kids at birth, 3-, 6-, 9- and 12-months of age were 1.05±0.01, 3.13±0.05, 6.16±0.13, 9.12±0.46 and 11.28±0.40 kg, respectively. The twinning and triplet rate for this breed in the flock is 56 and 12%, respectively. On the other hand, average body weights of kids at birth and 3- months of age ranged from 1.20 to 1.50 kg and 4.21 to 7.09 kg, respectively in the farmers' flocks of selected districts of West Bengal.

A total of 16 awareness camps in different villages of these 3 districts were conducted. So far, 85, 165 and 100 adult females were distributed in the adopted villages of Nadia, Birbhum and North 24 PGS districts of West Bengal.

During the period of report, 8 animal health camps, 4nos. vaccination camp and 5 nos. of training programs were also organized in different villages of study area. Other inputs like veterinary medicine kits, mineral mixture, vitamins, goat feed and kid milk replacer were also distributed among farmers.

6.2.23 Black Bengal Unit

The project was implemented at the ICAR-Indian Veterinary Research Institute, Eastern Regional Campus located at Kalyani, Nadia, West Bengal. The initial stock as on 01.04.2024 was a total of 53 that consisted of 31 adult does, 10 bucks, 7 female kids and 5 male kids. As on 01.04.2025, the nucleus flock comprises 214 animals, which include 130 adult does, 32 bucks, 23 female kids and 29 male kids after incorporation of new animals from different districts. A total of 50 superior genetic stock of Black Bengal goats have been distributed from the nucleus herd to farmers of the selected clusters under Institute flagship programme to improve the productivity of animals among the farmers. Three cluster of Black Bengal Unit are operational in three different districts. A total of 500 breedable does were selected in each cluster and covered under the program. Herd sizes in the breeding tract ranges widely from small group 2-5 goats to 30-40 goats, with an average herd size of 5.2 animals. Large herd size is very less in number in those areas. The growth performance of animals was evaluated under both nucleus as well as farmers' herds. In the nucleus flock the average birth weight was 1.09 ± 0.01 kg (n=58) observations. The average body weights at 3 and 6 days or months were 2.96 ± 0.15 kg, 5.78 ± 0.28 kg, respectively. In comparison, goats in the farmers' flocks (n =50) recorded with average birth weight 0.850 ± 0.20 kg, while the average body weights at 3 and 6 months were 2.50 ± 0.20 kg and 5.55 ± 0.45 kg, respectively. The reproductive performance of Black Bengal goats was assessed in Institute herd. The age at first puberty (days) and age at first kidding (days) were 181.56 ± 21.25 days (n=35) and 395.85 ± 35.15 days (n=34) respectively. The average litter size of nucleus herd was 1.84 with single, twin and triplet percentages was 31.51, 53.42 and 15.07, respectively.

As part of the All-India Co-ordinated Research Project on Black Bengal Goat, a series of 3 capacity-building programs like training for up scaling the farmers, awareness cum vaccination programs, Black Bengal Promotional program and input distribution programs under Development Action Plan for Scheduled Caste (DAPSC) were conducted to empower farmers at Bongaon, Canning-I, and Polba blocks.

6.2.24 Black Bengal Goat Unit

The Black Bengal goat improvement program under the AICRP on Goat Improvement operates across four centres: Chamguru (Ranchi), Palajori (Deoghar), Barabanki (Jamshedpur), and Tiko (Lohardaga). The opening balance was 4401 and closing balance was 5936. The centre-wise flock strength was Chamguru (1,697), Palajori (1,572), Barabanki (1,478), and Tiko (1,243). The body weight at birth, 3, 6, 9, and 12 months of age were 1.24±0.03 kg, 5.67±0.03 kg, 8.46±0.04 kg, 11.43±0.08 kg, and 14.17±0.11 kg, respectively. The kidding rate was 1.59, and 527 kids were castrated during the year. Mortality was reduced to 3.02% in

farmer flocks through regular health interventions, including vaccination, deworming, dipping, and supplementary feeding. Selection differential in males at 12 months was 1.42 kg. Capacity building included two three-day training batches (25 ST male and 25 ST female farmers) and advisories to 246 farmers through health camps and Kishan Gosthis. A total of 5 bucks were distributed, 1,896 goats were vaccinated, and 581 goats underwent dipping. Over the last five years, the project supplied and sold significant numbers of animals, with 306 males and 110 females in 2024–25. The project has contributed to genetic improvement, with heritability estimates (h^2) for body weights ranging from 0.77 to 0.90 across age groups, highest at 6 months (0.8993). The seven Publications and three awards were achieved during the year. The program covered 472 farmers and demonstrated sustainable genetic progress, improved management practices, and enhanced livelihood support through training, health care, and selective breeding initiatives in the Black Bengal goat population of Ranchi and adjoining districts. Three success stories were documented during the year.

6.2.25 Jakhrana Goat Unit

The All India Coordinated Research Project (AICRP) on Jakhrana goats has been initiated at the LUVASU, Hisar in the year 2024–25. The project activities during 2024 were carried out in selected villages of Mahendragarh district, Haryana in first stage. Nine goat farmers and their 150 Jakhrana goats were collected from three villages (Chelawas, Bhagdana, Gudha Kemla) of Mahendragarh district of Haryana. Most farmers were marginal landholders rearing 25-30 goats. Similarly, the project team surveyed the region on 19th march 2025 and covered seven goat farmers and their 130 goats from two villages (Chelawas and Majra Khurd) of Mahendragarh district of Haryana. Pure Jakhrana animals from the field and thus identified 20 Jakhrana goats were identified from those seven goat farmers. The project team also carried out survey of two additional goat farmers from Narnaul tehsil of Mahedragarh district during their third and fourth visits. Thus, a total of 18 farmers across 5 villages of Mahendragarh district were engaged during the reporting period. Total of 330 goats were covered under the program, out of which a substantial proportion were breedable does. Average body weight at six and twelve months in surveyed animals was 18 and 24 kg, respectively. The average milk production (90days) among covered does was 136 kg. In the second stage, the new cluster from Bhiwani district was identified through survey on 10.06.2025 by project team and the data collection of identified farmers is in progress. Also, the Jakhrana goat farmers are being identified from another cluster of Hisar district. The data collection of these two clusters is expected to be completed by July 2025. One day “Kisan Goshti” on modern goat farming for Scheduled caste goat farmers was organized on 13th June 2025 at LUVAS, Hisar. In this event a total seventy farmers participated from different villages. The participants were provided with 100 kg goat feed which was provided by Project co-ordinator (NFU), ICAR-CIRG, Makhdoom.

6.2.26 Jakhrana Goat Unit

The unit is operational at ICAR-CIRG, Makhdoom, Farah, Mathura (UP). The unit has two components viz. farm unit and field unit. At farm, the Jakhrana goats are being maintained since year 2005. Breeding bucks are selected based on 9 month body weight and 90 days milk yield of their dams in first parity. Flocks are maintained under semi-intensive feeding management and restricted breeding is in practice. Under field component, two clusters viz. Jakhrana and Naghaudi consisting each of four villages have been formed. In nucleus flock at farm, the opening balance of Jakhrana goats on the first day of the year was 244 which comprised 70 males and 174 females and closing balance of 274 goats had a stock of 77 males and 144 females. The overall mortality was 9.04%. During this year, a total of 102 kids were born from 68 kidding. Out of 102, 47 (46.08%) were males and 55.0 (53.92%) were females. Out of total, 50 (65.8%) kids were born as single and 26 (34.2%) were born as multiples. The kidding rate was recorded as 1.34. The replacement rate of the does was 29.0%. The annual tupping, kidding on available and bred basis were recorded as 90.0, 83.5 and 93.8%, respectively. The overall least-squares means of body weights of kids at birth, 3, 6, 9 and 12 month age were 2.77.04±0.04, 10.19±0.11, 15.04±0.37, 21.45±0.47 and 25.30±0.54kg, respectively. The overall least-squares means of 90 and 140-days milk yield, total milk yield and lactation length were 133.79±3.03, 168.75±6.93, 178.75±8.78 litres and 170.49±5.73days, respectively. Doe Number 1668 has declared as champion goat with a record yield of 190 litre milk in 90 days. 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 2.3 kg and 23.0 litre. During year 2024, a total of 14 superior germ plasm (11 males and 03 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 08 (02 bucks and 06 does) Jakhrana goats were selected from the breeding tract, procured and added in the institute flock to create genetic variability in the flocks for economic traits.

6.2.27 Rohilkhandi Goat Unit, ICAR-IVRI, Izatnagar

The AICRP on Rohilkhandi goats has been initiated at ICAR-IVRI, Izatnagar in the year 2024–25. A nucleus flock of 150 Rohilkhandi goats was maintained at the Livestock Production and Management Section of ICAR–IVRI, Izatnagar to evaluate the performance of the breed and generate benchmark data for future improvement programs. The study focused on key growth and production parameters under both farm and field conditions. At the institute farm, the average birth weight of kids was 2.12 ± 0.13 kg (N=5). Their mean body weights

at 3, 6, and 12 months of age were 8.71 ± 0.62 kg (N=50), 12.69 ± 0.4 kg (N=50), and 23.64 ± 0.8 kg (N=50), respectively. To avoid inbreeding and increasing the genetic base of the nucleus flock, 30 additional Rohilkhandi goats were procured and introduced into the herd. To assess performance under field conditions, cluster-based interventions were launched in two major areas—Alampur Jaffrabad and Majhgawa. The Alampur Jaffrabad cluster covered the villages of Khera, Kudda, and Makrandpur, whereas the Majhgawa cluster included Kishanpur, Ismailpur, and Kanderpur. Under these field conditions, the average birth weight of kids was 2.11 ± 0.18 kg (N=40), while the mean body weights at 3, 6, and 12 months were 8.10 ± 0.92 kg (N=40), 11.89 ± 0.70 kg (N=40), and 22.47 ± 1.10 kg (N=40), respectively.

6.2.28 Salem Black Goat Unit

The All India Coordinated Research Project on Salem Black Goats is being implemented with a nucleus flock located at the Veterinary College and Research Institute, Namakkal. As of 01.04.2025, the nucleus flock comprised 232 animals, which includes 6 bucks, 131 does, 40 male kids, and 45 female kids. A total of four clusters were selected across the districts of Erode, Salem, Dharmapuri, and Namakkal. A total of 22 farmers were registered and 604 adult female goats were covered under the scheme. Herd sizes in the breeding tract vary widely—from small groups of two to five animals to larger herds ranging from 50 to 70 goats, with an average herd size of 31 animals. The distribution of herd sizes among farmers is as follows: 1.8% keep 0–10 goats, 24.6% have herds of 11–20 goats, 43.8% maintain 21–30 goats, 10.5% manage 31–40 goats, and 19.3% rear more than 40 goats. The estimated population of Salem Black goats within the breeding tract was 8,40,199, accounting for 10.32% of the total goat population in Tamil Nadu. The growth performance of Salem Black goats was evaluated under both nucleus and farmers' herds. In the nucleus flock the average birth weight was 2.19 ± 0.02 kg (n=675) observations. The average body weights at 3, 6, 9, and 12 months were 9.29 ± 0.07 kg, 12.83 ± 0.10 kg, 16.08 ± 0.14 kg, and 19.30 ± 0.17 kg, respectively. In comparison, goats in the farmers' flocks (n = 85) recorded a slightly higher birth weight of 2.50 ± 0.10 kg, while the average body weights at 3, 6, 9, and 12 months were 8.60 ± 0.20 kg, 12.10 ± 0.30 kg, 14.00 ± 0.20 kg and 19.60 ± 0.50 kg, respectively. The data indicate that while birth weights were higher in the farmers' flocks, the overall postnatal growth rates were relatively better in the nucleus flock, particularly during the early growth stages. The age at first kidding was slightly higher in the nucleus herd at 15.23 ± 0.4 months, compared to 14.8 ± 0.2 months in the farmers' herds. Weight at first kidding was 23.45 ± 0.38 and 18.45 ± 0.23 kg, respectively in nucleus and farmers flock. The incidence of single births was nucleus herd and farmers' herd was 85% and 67%, respectively.

In contrast, twin and triple births were more frequently observed in farmers' herds, accounting for 23 and 10%, respectively, compared to 14 and 0.5% in the nucleus herd. Capacity-building programs were conducted for farmers in Mecheri, Bargur, and Dharmapuri districts of Tamil Nadu.

6.2.29 Sojat Goat Unit

AICRP on Goat Improvement – Sojat Goat Unit was sanctioned to the University as Non-Funding Unit till 26.03.2026 in May 2024. Following activities were undertaken in the project since sanction of the project Presently we have a nucleus flock of 15 adult does and 3 adult bucks at the farm. The recording of observations with respect to growth, productive and reproductive performance of the nucleus flock will be initiated soon. However, there is a need to induct few more pure animals (kids / adult animals) from the field to the nucleus flock to get more purity in the flock. The survey was completed at the time of registration, the adult body weights in the field ranged between 42 to 58 kg in males and 34 to 40 kg in females at 12 months of age. The milk yield ranged between 0.8 to 1.5 litres per day with mean lactation length of 232.92 days. The age first mating was 397.92 and 517.40 in males and females respectively while age at first conception and kidding were 519.29 and 708.58 days. The service period ranged between 170 to 202.5 days. The work on initial selection of clusters and farmers has been initiated, few clusters namely Sojat, Bagri, Bilara and Jaitaran were visited to finalize cluster based on the goat keepers and sojat goats in the area. A two days training, health camp and input distribution programme was organized at Siyat. A total of 85 scheduled caste and other farmer beneficiaries were trained on various aspects of scientific goat rearing. A health camp in which deworming and other medications were provided to beneficiary farmers. Furthermore, a total of 70 quintal balanced feed was also distributed to beneficiary farmers depending upon number of animals reared by them.

6.2.30 SOJAT GOAT

The nucleus flock maintained 34 goats in the campus. A total of 11 villages (05 villages in Pali and 6 villages in Jodhpur districts of Rajasthan) were selected under the Non-Funding Unit (NFU) Sojat Unit, LRS, Vallabhnagar, Udaipur (RAJUVAS, Bikaner) to carry out project work. Based on the initial survey interaction with the goat farmers, 06 villages namely Khangta, Sangin, Papidcity, Sindhipura, Jawasia, Pipad from Jodhpur district, 05 villages Pachunda Khurd, Pachunda Kala, Siyat, Dhandhedi, Alawas from Pali district of Rajasthan were considered for the study with total of 70 farmers from 11 villages of 2 districts. Baseline survey was conducted in each village for collection the baseline information about the goat rearing practices and to know the socio-economic conditions of the goat farmers of these villages. In survey area 21% of the farmers belonged to the age group (46-55 years) out of 70 total farmers of two districts. The survey results show that most of the farmers (36%) belong to MBC category. Farmer's main occupation was Animal Husbandry (20%) the family member's statics was 5-8 members maximum 33% in survey

area. Most of the farmers belongs to the land less category (60%). Family head education qualification was maximum (41%) Secondary level followed by illiterate. Flock composition 57.05% does followed by kid (28.19%) in survey area. The survey results show that maximum (59%) family is nuclear type. Their house of residence were pakka (47%) among survey area. Kids were weighed at birth, 3- and 6-month of age. Most of the goats produce twine at farmers' flock. The flock strength in the nucleus flock, situated at LRS, Vallabhnagar, Udaipur, was 34 where females and male animals were 25, 9, respectively. The average body weights of kids (Farm) at birth, 3 and 6 months of age were 3.57±0.72, 12.42±4.16 and 15.32±0.81 kg, respectively. The average body weights of kids (Field) at birth, 3 and 6 months of age were 3.29±0.09, 11.72±0.31 and 14.64±0.70 kg, respectively in the farmers' flocks of selected districts of Rajasthan.

6.3 Techniques for Augmenting Fertility and Physiological Adaptation in Goats

6.3.1 NLM Project: Development of Herbal Fortified Diluter for Buck Semen Cryopreservation

Principal Investigator: Dr. Ravi Ranjan

Co-Investigators: Dr. Ashok Kumar, Dr. K. Gururaj, Dr. Chetna Gangwar

The most essential ingredients of artificial insemination (AI) programs are semen processing which generally needs diluents with additives that protect spermatozoa against cold shock stress during cryopreservation. Selection of cryoprotectant and composition of extenders is of great importance for sperm survival during and after cryopreservation. The chemical additives in the currently used diluters cause inflammatory/immune reactions in the female reproductive tracts which further reduce the effectiveness of AI. Hence there is a need to develop herbal fortified buck semen diluter to improve the post thaw semen quality and to alleviate the adverse reactions in female animals for achieving higher fertility for improvement of production efficiency in goats. For developing herbal fortified diluter, various concentrations of aqueous extract of *A. racemosus, Whithania somnifera, Moringa oleifera and Tribulus terrestris* were supplemented in buck semen diluter and evaluated for post thaw qualities. Aqueous extract was prepared in Medicine laboratory ICAR-CIRG, Makhdoom following standard protocol. Ejaculates (30) from healthy adult Barbari bucks were collected, pooled and divided into groups supplemented with different concentrations of aqueous extract in semen extenders. The procedure for semen processing and cryopreservation followed the standard protocol used at Male Reproduction Laboratory, ICAR-CIRG, Makhdoom. Buck semen diluter supplemented with a specific concentration of *A. racemosus* (2.5 µg/mL) *Whithania somnifera* (100 µg/mL), *Moringa oleifera* (75 µg/mL) and *Tribulus terrestris* (100 µg/mL) has been shown to be very effective for long term preservation of buck spermatozoa in terms of post thaw sperm motility (> 65%), live percent (70%), membrane integrity., acrosomal intactness and antioxidant status.

Table 1: Effect of different herbal aqueous extract on post thaw sperm antioxidant status (Mean ± SEM)

Asparagus racemosus		*Withania somnifera*		*Tribulus terrestris*		*Moringa oleifera*	
Conc (µg/mL)	MDA (µm)	Conc (µg/mL)	MDA (µm)	Conc (µg/mL)	MDA (µm)	Conc (µg/mL)	MDA (µm)
0	$5.01^{a}\pm0.19$	0	$9.55^{a}\pm0.78$	0	$8.57^{a}\pm0.72$	0	$9.07^{a}\pm0.82$
1.25	$3.26^{b}\pm0.18$	50	$6.72^{b}\pm0.84$	25	$6.05^{c}\pm0.70$	25	$7.86^{b}\pm0.76$
2.5	$2.98^{b}\pm0.17$	100	$4.54^{c}\pm0.86$	50	$6.57^{c}\pm0.68$	50	$6.63^{c}\pm0.72$
5	$3.54^{b}\pm0.19$	200	$6.38^{b}\pm0.82$	75	$6.12^{c}\pm0.66$	75	$5.40^{d}\pm0.70$
				100	$5.10^{d}\pm0.64$	100	$8.03^{b}\pm0.68$
				125	$7.32^{b}\pm0.72$	125	$9.34^{a}\pm0.82$

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

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 oestrus goat than normal female goat.

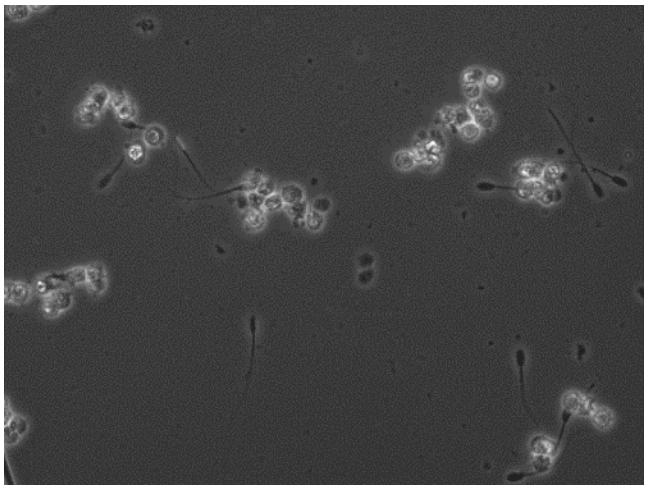


Fig. 1. Sperms are phagocytosed by PMN cells

Table 2: Effect of different herbal aqueous extract on sperm phagocytosis (Mean ± SEM)

Asparagus racemosus		*Withania somnifera*		*Tribulus terrestris*		*Moringa oleifera*	
Conc (µg/mL)	Sperm phagocytosed %	Conc (µg/mL)	Sperm phagocytosed %	Conc (µg/mL)	Sperm phagocytosed %	Conc (µg/mL)	Sperm phagocytosed %
0	20.16^{a}±1.69	0	22.79^{a}±1.84	0	18.67^{a}±1.18	0	19.84^{a}±1.62
1.25	18.67^{a}±1.24	50	20.83^{a}±1.34	25	18.10^{a}±1.24	25	18.49^{a}±1.18
2.5	14.78^{c}±1.14	100	15.76^{c}±1.39	50	20.27^{a}±1.42	50	18.80^{a}±1.12
5	16.82^{b}±1.18	200	17.27^{b}±1.18	75	19.26^{a}±1.28	75	13.95^{b}±1.18
				100	15.96^{b}±1.22	100	14.89^{b}±1.22
				125	17.21^{ab}±1.12	125	16.89^{ab}±1.14

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

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

Table 3: 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

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.

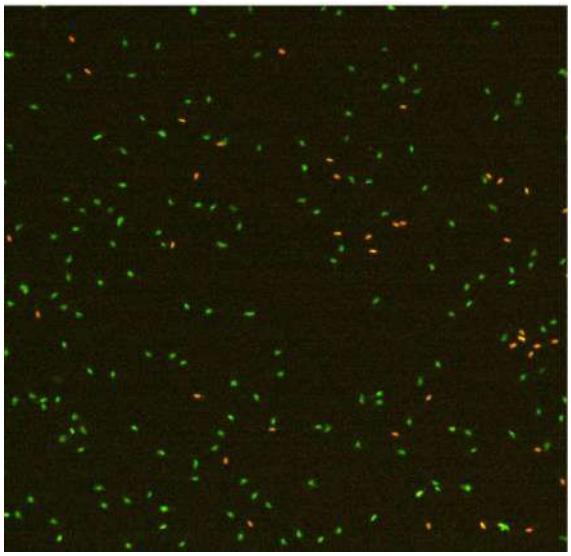


Fig.2. Live and dead sperm under Fluorescence microscope

Table 4: 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 5: 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.

Technology Developed

1. Portable Goat AI Crates

Cattle and buffaloes are inseminated in standing position inside the travice. But in case of sheep and goat, it is totally different as these animals' hind legs need to be lifted approximately two feet above the ground for insemination. Cervix is straight in cattle and buffaloes but in the goats the cervix is tortuous having 3 to 4 cervical folds which hinders the passage of the AI gun. Further, goats are seasonal breeders and in a goat farm with a herd size of 500, at least 10-15 goats come to oestrus per day which requires lot of manpower to do AI. The traditional method requires at least three manpower's to perform AI in goat and it is difficult to lift large breed of the goats. So, portable AI crate will reduce the drudgery.

Plastic based Artificial insemination crate for goats was designed and fabricated using hydraulic jack to lift the crate and 8 mm FRP sheet as base material. It is also easy to handle and animal will feel less pain compare to lifting method. It is not available in market and only at our Institute it is used during Artificial Insemination in Goat. The success rate terms of kidding percentagewas 55% by using AI crate compared to 45% without using AI crate (Lifting method).

2. CIRG-FSD: A ready to use Extender for Goat Semen Cryopreservation

The ICAR-Central Institute for Research on Goat, Mathura, U.P. developed a product CIRG- Frozen Semen Diluent (CIRG-FSD), which is a ready to use goat semen dilutent for cryopreservation of goat semen for Artificial Insemination and conservation. It is a Tris-based semen dilutor, which maintains the functional parameters of goat semen The post thaw semen qualities in terms of sperm motility, live sperm count, acrosome integrity, hypo osmotic swelling (HOS) positive spermatozoa, Trans membrane mitochondrial membrane potential (MMP), TUNEL positive sperm (DNA), malondialdehyde (MDA) and in vivo fertility through AI based on kidding per cent were significantly higher. The specific concentration of IGF-1, Iodixanol and beta defensin showed additive effect on post thaw sperm qualities. These properties keep the sperm storage and transport and enable it to be used in AI, *in vitro* fertilization (IVF), intracytoplasmic sperm injection (ICSI), breed conservation and research studies.

Established a separate buck station and semen collection centre at AICRP Jamunapari unit for cryopreservation and conservation of elite germplasm of Jamunapari, Barbari and Jakhrana bucks semen.

6.3.2 Institute Project: Status of Reproductive Ailments in Goats Reared under Field Conditions

Principal Investigator: Dr. Y.K. Soni

Co-Investigators: Dr. S. P. Singh, Dr. Ravi Ranjan, Dr. Mukesh Bhakat, Dr. A. K. Dixit, Dr. Gopal Dass, Dr. A. K. Mishra

Salient Achievements:

During the period, a questionnaire was developed to conduct the door step survey of reproductive problems in goats under field conditions.

- Total 8 villages of Mathura district namely; Makhdoom, Lahrauli ghat, Salempur, Nagla Vanjara, Daulatpur, Shahpur, Khairat and Farah were included in the study to cover 101 house-holds.
- Data on a total of 825 goats were collected and analysed; 580 were adult female breedable goats and 67 were adult breeding bucks.
- Anoestrus, Repeat breeding (Short cycles 10-15 days), Abortion (2-3 months) were the major reproductive problems in female goats with incidence of 15%, 30.17% and 3.10%, respectively.
- Non-availability of quality breeding bucks was major problem (39.31%) followed by Poor libido /infertility in bucks (22.38%).
- Overall, repeat breeding/Short cycles, Anoestrus and Non/poor availability of quality breeding bucks were the major reproductive concerns under field conditions.

Fig. 1. Survey of reproductive problems in goats under field condition

6.3.3 NLM Project: Development and Evaluation of Efficient Regimen for Oestrus Synchronization in Major Indian Goat Breeds

Principal Investigator: Dr. Y. K. Soni

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

Characterization of Ovarian Follicular Dynamics in Barbari and Jamunapari Goats

In this study, adult female cyclic Barbari (n=6) and Jamunapari (n=6) goats were selected and they were given two intramuscular injections of $PGF_2\alpha$ at 11 days interval. The animals were then subjected to recording of dynamics of follicular growth for 40 days, on alternate occasions, along with blood collection, estimation of plasma progesterone levels and analysis of almost ultrasonograms to study the dynamics of ovarian follicles.

Table 1: Ovarian follicular wave characteristics in Barbari Goats

Day of Wave Emergence (DOWE)				
	W1 (n=12)	**W2 (n=12)**	**W3 (n=10)**	**W4 (n=3)**
Mean	-0.2	5.25	11.6	16
SD	0.39	0.97	0.84	1
SEM	0.11	0.28	0.27	0.58

Inter-wave interval (IWI) in days			
	W1-W2 (n=12)	**W2-W3 (n=10)**	**W3-W4 (n=3)**
Mean	5.42	6.6	5
SD	1.08	1.35	0
SEM	0.31	0.43	0

Diameter of largest follicle (mm)				
	W1 (n=12)	**W2 (n=12)**	**W3 (n=10)**	**W4 (n=3)**
Mean	4.39	4.34	5.33	5.8
SD	0.27	0.27	0.75	0.07
SEM	0.08	0.08	0.24	0.04

Growth rate of follicles (mm/day)		
	3 waves (n=21)	**4 waves (n=12)**
Mean	1.01	0.96
SD	0.09	0.07
SEM	0.02	0.02

Regression rate (mm/day) (n=36)	
Mean	0.98
SD	0.1
SEM	0.02

Table 2: Ovarian follicular wave characteristics in Jamunapari Goats

Day of Wave Emergence (DOWE)				
	W1(n=12)	**W2(n=12)**	**W3(n=11)**	**W4(n=4)**
Mean	-0.25	6.75	13.7	16.3
SD	0.45	0.87	1.56	0.96
SEM	0.13	0.25	0.47	0.48

Inter-wave interval (IWI) in days			
	W1-W2(n=12)	**W2-W3(n=11)**	**W3-W4(n=4)**
Mean	6.75	7.09	4.25
SD	0.87	1.51	0.5
SEM	0.25	0.46	0.25

Diameter of largest follicle (mm)				
	W1 (n=12)	**W2 (n=12)**	**W3 (n=11)**	**W4 (n=4)**
Mean	4.45	4.44	5.46	6.32
SD	0.19	0.29	0.45	0.54
SEM	0.05	0.08	0.14	0.27

Growth rate of follicles (mm/day)		
	3 waves (n=21)	4 waves (n=16)
Mean	1	0.96
SD	0.08	0.08
SEM	0.02	0.02

Regression rate (mm/day) (n=48)	
Mean	0.99
SD	0.08
SEM	0.01

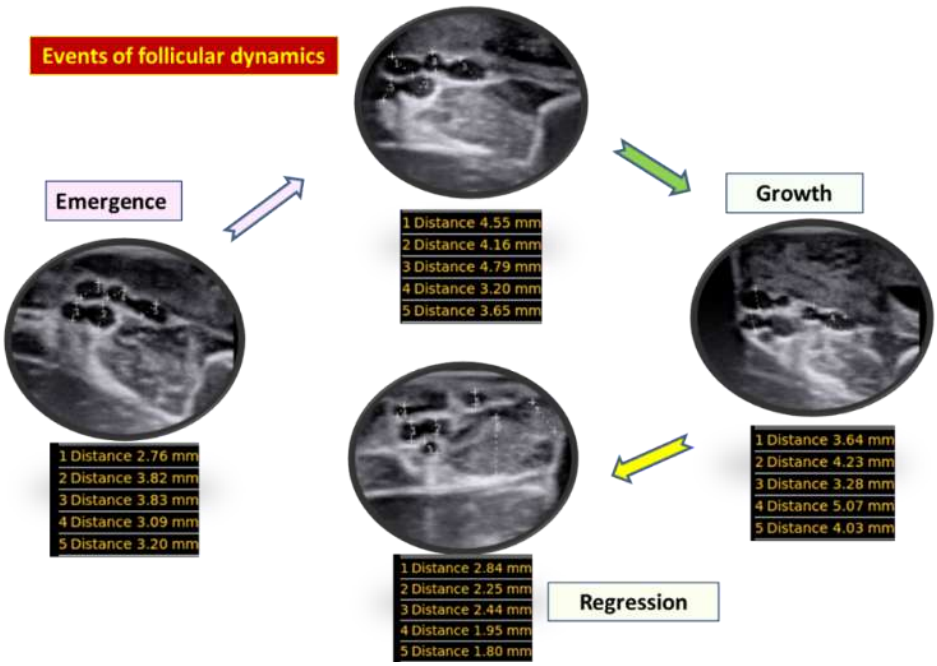


Fig. 1. Events of follicular growth and regression in goats

Majority (58%) of goats irrespective of breed exhibit 3 wave and 29% exhibited 4 wave oestrous cycles. Follicular growth and regression rates were nearly 1mm/day in both breeds. Average diameter of ovulatory follicle was 5.73 and 5.97 mm, whereas diameter of largest ovulatory follicle was 6.81 and 6.98mm in Barbari and Jamunapari goats, respectively.

Technologies developed

1. **Laparoscopy assisted embryo transfer in goats**: We have developed a minimally invasive technique for embryo transfer in goats. In this technique goat embryos can be transferred through fimbrial end of the oviduct to achieve successful pregnancy. This avoids post-operative complications that otherwise may occur after conventional surgical embryo transfer through laparotomy.
2. **Efficient regimen for oestrus synchronization in goats**: We have successfully developed and validated an efficient regimen for oestrus synchronization in goats with up to 90% oestrus induction and fertility response.

Intellectual Property Generation: Successfully filed a trademark for Goat-Synch Intra-vaginal sponge

6.3.4 CRP Project: Consortium Research Project on Agrobiodiversity

Principal Investigator: Dr. S. P. Singh

Co-Investigator: Dr. Y. K. Soni

This study was undertaken with the aim of conserving valuable genetic resources from indigenous goat breeds through the development and preservation of caprine adult dermal fibroblast (cadFibroblast) cell lines. Fibroblast cells were isolated and cryopreserved from Attappady Black, Sumi-Ne, Andamani, and Barbari goats, enabling long-term conservation of their genetic material. Skin biopsies were collected aseptically from 2 males and 2 females of each breed. Tissue samples from the base of the tail were dissected under sterile conditions and transported in DPBS supplemented with antibiotics to the laboratory. Explant cultures were established, and primary fibroblast outgrowth was observed within 5–8 days under standard incubation conditions. Cell passaging commenced at 60–70% confluency. To enrich fibroblast populations, Magnetic-Activated Cell Sorting (MACS) was employed. The enriched cells were then expanded through secondary culture and confirmed for identity and purity using double immunofluorescence staining (dIF). Immunostaining for vimentin and FSP-1 (Fibroblast Specific Protein-1) verified the fibroblastic nature of the cultured cells. Once fibroblasts reached 70–80% confluency (P-3 to P-5), they were cryopreserved using a freezing medium containing DMEM/F-12, 10% FBS, and 10% DMSO. The cryopreservation process followed a step-wise cooling protocol: initial freezing at -20°C, followed by -80°C for 24 hours, and final storage in liquid nitrogen at -196°C. A total of 352 cryovials (22 vials/goat) were preserved and submitted to the Cell Bank at ICAR-NBAGR, Karnal. Post-thaw analysis showed excellent recovery, with cell viability ranging from 85% to 95% within 96 hours. Cells maintained typical spindle-like morphology, and no microbial contamination was reported. To assess the functional viability of cryopreserved fibroblasts, cells were subjected to several assays on culture plates coated with extracellular matrix (ECM) proteins, including collagen IV, rat tail collagen (RTC), laminin, fibronectin, and vitronectin.

Major Experiments and Findings

Cell Adhesion Assay

Cells grown on ECM-coated plates exhibited enhanced resistance to trypsinization compared to uncoated controls. Collagen IV and RTC significantly improved cell attachment, which was quantified using a crystal violet stain and spectrophotometric analysis.

Colony-Forming Unit (CFU) Assay

ECM proteins supported superior colony formation, with large, compact colonies observed under fibronectin and collagen IV coatings. This confirmed improved clonogenic potential of post-thawed cells.

Proliferation Assay

Cells cultured on ECM-coated plates displayed a faster growth rate and shorter population-doubling time (PDT). Consistent spindle-shaped morphology was retained across all groups, with notable enhancement in the collagen IV and fibronectin groups.

Scratch Wound-Healing Assay

To assess cell migration, a scratch assay was performed. Wound closure was significantly faster on ECM-coated plates, with fibronectin and collagen IV again showing superior outcomes.

Gene Expression Analysis (qRT-PCR)

Relative gene expression profiling showed upregulation of key fibroblast markers (vimentin, FSP-1), adhesion molecules (β-integrin, β-tubulin, E-cadherin), antioxidative enzymes (GPx, CuZnSOD), and the anti-apoptotic gene BCL-6 in ECM-treated groups versus uncoated controls.

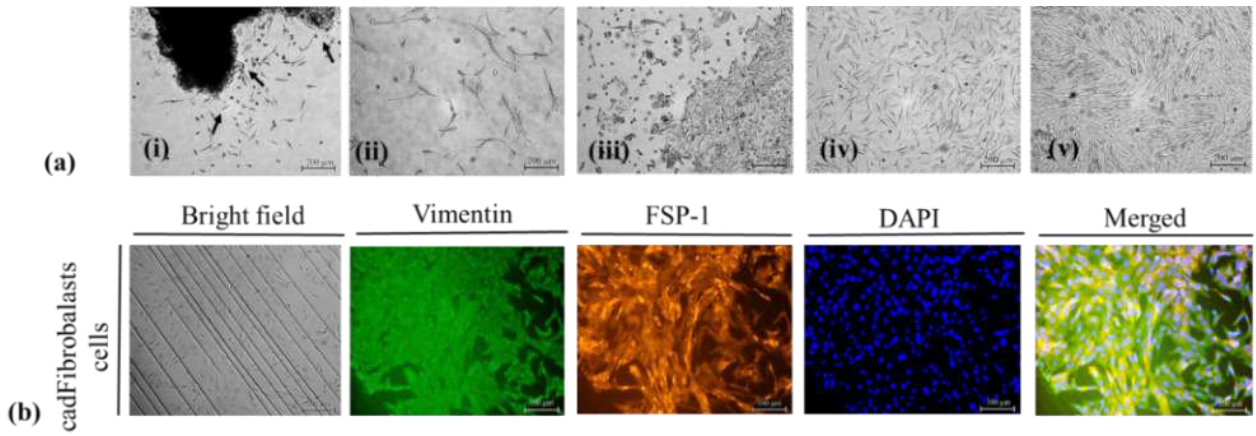


Fig. 1. (a-b). Representative images for Caprine tissue explant culture, outgrowth, expansion, and characterization of cryopreserved caprine adult dermal fibroblasts (cadFibroblast) by immunostaining.

[a(i)] Illustrates a caprine skin explant with the migration of spindle-shaped cadFibroblast cells (black arrows) at day (d) 5 of culture (P-0). Dark-shaded areas in the image are the skin explants. Caprine skin explants after mincing in culture media were transferred in 6 well cell culture plates and incubated at 38.5°C, 5% CO2 in humidified conditions for tissue adherence and attachment. **[a(ii-iv)]** Attachment and expansion of cadFibroblasts at d 6, d 8, and d 10, respectively. (b) Representative images for characterization of cryopreserved cadFibroblasts by double immunofluorescence staining. Relative fluorescence positivity with anti-vimentin and anti-Fibroblast specific protein (FSP-1) antibodies was observed when the cryopreserved enriched cadFibroblasts were cultivated in the optimized culture media.

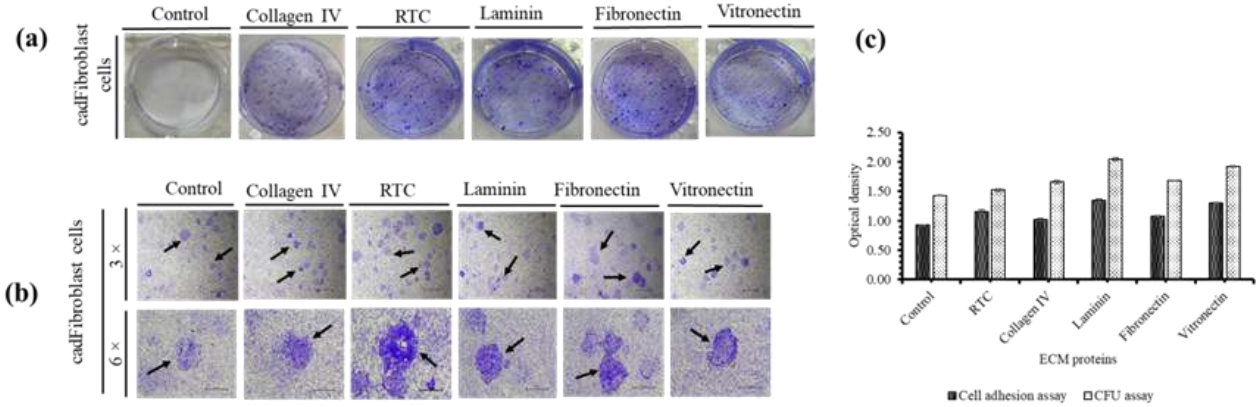


Fig. 2 (a-c). Representative pictures demonstrating effect of different structural [collagen IV, rat tail collagen (RTC)] and adhesion (laminin, fibronectin, and vitronectin) extracellular matrix (ECM) proteins on cell adhesion and colony forming unit (CFU) efficiency. (a) The coated dishes (6 well culture plates) were seeded with 1×105 cells cultivated at the standard conditions described above. On attaining 70% confluence (after 48 h), the level of cell resistance to trypsinization, treatment with 0.25% trypsin-EDTA was used and the attachment of cells to the ECM protein-coated plates versus control cell culture plate was evaluated. Trypsin was inactivated by the addition of 2 mL of washing media and fixation of attached cells with Citrate-Acetone-Formaldehyde fixative solution for 30 min at RT. The attached cells were stained with 1% crystal violet solution and optical density was compared. (b) Approximately 50,000 cells per well were cultured on 6-well cell culture plates coated with different ECM proteins in culture media with 5% CO_2 at 38.5 °C in a CO_2 incubator for 48 h. Large, round, and compact colonies were observed in all the groups after staining with 1% crystal violet, and optical density was compared. Arrows indicate individual colonies. (c) Comparison of optical densities showing the effect of different ECM proteins on cell adhesion and CFU efficiency of cadFibroblasts. Optical density was measured after solubilization of the stain (crystal violet) with 1% SDS solution.

Impact and Outcome

This project effectively demonstrated the feasibility of using enriched dermal fibroblast cell lines as a cellular resource for genetic conservation and advanced biotechnological applications. The use of ECM proteins significantly enhanced the post-thaw functionality of the fibroblasts, suggesting their potential utility in downstream applications such as

somatic cell nuclear transfer (SCNT), gene editing, and regenerative therapies. All cryopreserved cell lines are safely deposited at the ICAR-NBAGR Cell Bank, where they are available for future scientific studies aimed at genetic improvement, biodiversity conservation, and biotechnology-based interventions in livestock.

6.3.5 NLM Project: Development of Strategies for Competent Embryo Production and Efficient Cryopreservation for Faster Propagation of Superior Goat Germplasm

Principal Investigator: Dr. S. P. Singh

Co-Investigators: Dr. Y. K. Soni, Dr. M. K. Singh

This project aimed to develop and standardize protocols for in vitro maturation (IVM), fertilization, embryo production, and cryopreservation in goats to promote rapid propagation of superior germplasm. It covered comparative evaluations of IVM media, optimization of melatonin concentrations for cryopreservation, vitrification carriers, and culture conditions for improving embryo hatching and survival.

Comparative Evaluation of In-House and Commercial IVM Media

A comparative analysis was conducted to evaluate the effect of customized in-house IVM medium and four commercially available media (BO-IVM™, BO-HEPES IVM™, Vitrogen IVM, and Stroebech IVM) on caprine oocyte developmental competence. Cumulus-oocyte complexes (COCs) were collected from abattoir-derived goat ovaries and graded (A to D) based on cumulus layer investment.

Each media group was further split into two subgroups:

a: Grade A and B COCs

b: Grade C and D COCs

After 24 hours of maturation, IVM oocytes were evaluated morphologically for cumulus expansion, fertilized via IVF, and assessed for cleavage and blastocyst formation.

In-house medium demonstrated the highest maturation rate (97.7%), cleavage (83.3%), and blastocyst formation (28.8%). Among commercial media, Vitrogen IVM also showed comparable outcomes (94.3% maturation, 76.2% cleavage, 27.3% blastocyst). Gene expression analysis targeting reproductive (GDF9, BMP15), oxidative (SOD1, GPX4), and apoptotic markers (BAX, BCL2) is underway. This suggests the in-house IVM medium is an effective, low-cost alternative to commercial formulations.

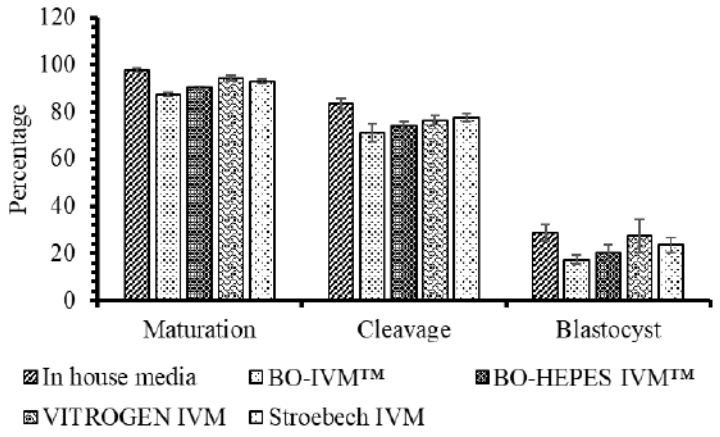


Fig. 1. Comparison of different commercially available IVM media (BO-IVM™, BO-HEPES IVM™, VITROGEN IVM, and Stroebech IVM) with in-house IVM media showing the effect of IVM media on IVM and development potency of oocytes and embryos.

Effect of Melatonin on Cryopreservation of COCs and IVM Oocytes

This experiment evaluated the effect of melatonin supplementation at different concentrations (10^{-5} to 10^{-11} M) in vitrification media on the mitochondrial function and developmental competence of COCs and IVM oocytes. COCs and oocytes were vitrified in 0.25 ml straws using rapid cooling in liquid nitrogen after equilibration. Melatonin groups were compared to a control (no melatonin) for oocyte recovery and vitrification efficiency. The highest number of COCs was recovered in the 10^{-5} M melatonin group (100 A/B grade oocytes from 28 ovaries). Preliminary results indicate better oocyte preservation in melatonin-supplemented groups. Further analysis post-thaw is planned to evaluate fertilization and development. This study is significant in optimizing antioxidant-enriched cryopreservation media for goat oocytes.

Vitrification Carriers and Gene Expression in IVF Embryos

This experiment compared the effects of two vitrification carriers—Cryotop® and 0.25 ml straws—on post-thaw gene expression and survival of IVF-derived embryos. Standard IVF protocols were followed using in vitro matured oocytes and frozen-thawed semen. After co-incubation, presumptive zygotes were cultured, and embryos were vitrified using both carriers. Embryos will be thawed after 1 year for survival analysis. Gene expression differences related to viability, stress, and implantation competence will be evaluated using qPCR. This experiment will help identify the best vitrification method for long-term storage of goat embryos.

Culture Conditions and Embryo Hatching

This study assessed the impact of incubation environment on blastocyst hatching rates. IVF-derived embryos were cultured in either a CO_2 incubator or a Tri-gas incubator. Tri-gas incubator showed significantly better performance: Cleavage: 93.5%; Expanded blastocyst: 7.6%; Hatched blastocyst: 8.3%. In contrast, the CO_2 incubator group had no hatched blastocysts. The tri-gas incubator, providing a lower oxygen tension environment, mimics physiological conditions better and promotes embryonic development and hatching.

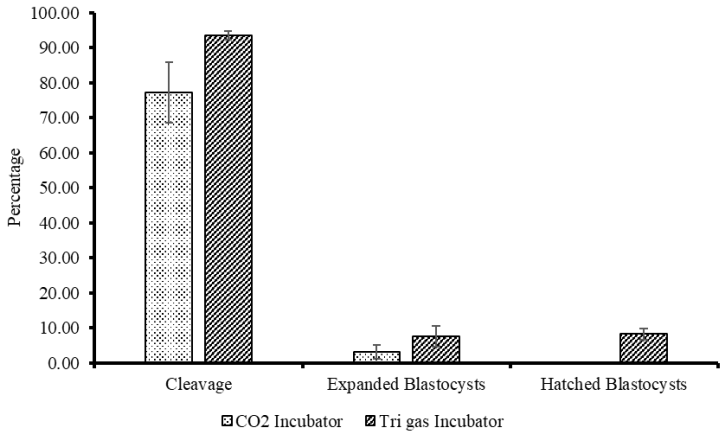


Fig. 2. Graphical representation of effect of incubator on developmental potency of embryos.

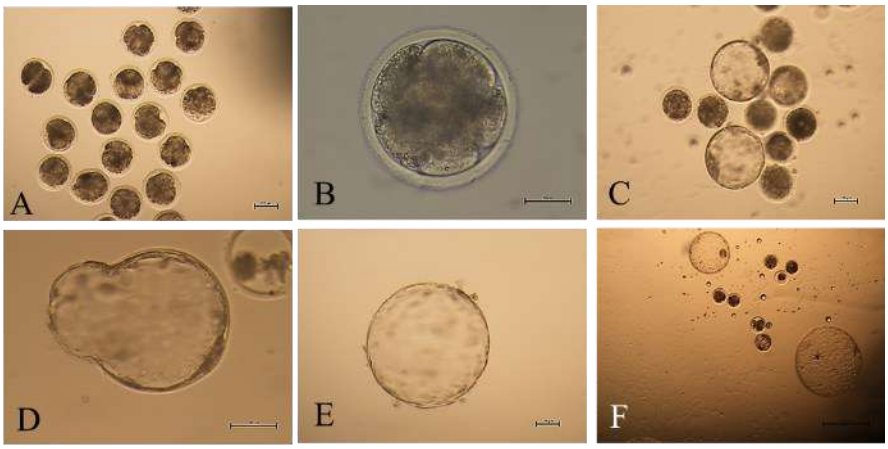


Fig. 3 (A-F). Representative images of different stages of embryo development post in vitro fertilization (IVF). (A) Embryos at different stages under the microscope after 24 h of IVF. (B) Morula stage embryo. (C) Expanded blastocysts. (D) Expanded blastocyst oozing out from zona pellucida. (E-F) Hatched blastocysts.

A laparoscopic-assisted embryo transfer was carried out in a surrogate goat (Animal No. B32) on 12.12.2024, transferring 4 IVF embryos through the fimbrial end of the oviduct. This project successfully established in-house systems for oocyte maturation, cryopreservation, and embryo development in goats. The in-house IVM medium outperformed or matched commercial media in maturation and blastocyst yield. Melatonin emerged as a promising antioxidant additive for oocyte vitrification. The choice of incubation environment and vitrification carrier significantly impacted embryo development and cryosurvival. These achievements will contribute to improved cryobanking of elite goat germplasm, enhanced protocols for IVF and embryo transfer and accelerated propagation of superior genetics in goats under the NLM framework

6.3.6 NP-GET Project: Network Programme on Genome Editing Technology for Improvement in Livestock Health and Production

Principal Investigator: Dr. S. P. Singh

Co-Investigators: Dr. Y. K. Soni, Dr. Ravi Ranjan

The NP-GET project aims to develop foundational tools and protocols required for applying genome editing in livestock, particularly goats, by utilizing somatic cell-based platforms. The project focuses on establishing enriched caprine dermal fibroblast (cadFibroblast) cell lines, optimizing cryopreservation and electroporation techniques, and evaluating the effects of extracellular matrix (ECM) proteins and silver nanoparticles on these cells. These efforts are intended to support future applications in genome editing, functional genomics, and cell-based biotechnology in small ruminants.

Enrichment and Characterization of Cadfibroblast Cells

Primary fibroblast cultures were derived from caprine skin explants and enriched via magnetic-activated cell sorting (MACS) using anti-FSP-1 antibodies. Enriched cadFibroblast cells were characterized through double immunofluorescence (dIF) staining using markers such as vimentin and FSP-1, confirming the fibroblastic nature of the cultures. Fluorescence microscopy validated successful marker expression and cell purity.

Cryopreservation and Post-Thaw Viability

Cryopreservation was performed using DMEM/F-12 medium supplemented with 10% FBS and 10% DMSO. The protocol involved slow freezing at -20°C followed by -80°C storage for 24 hours and long-term preservation in liquid nitrogen (-196°C). Post-thaw viability was evaluated using the trypan blue exclusion method with an automated cell counter. The results showed excellent cell viability (up to 99%), validating the effectiveness of the cryopreservation protocol. Re-culturing of thawed

cells confirmed their ability to regain proliferative capacity and maintain fibroblast morphology, indicating retained functional integrity after cryopreservation.

Electroporation and Optimization for Gene Delivery

Electroporation was performed using Gene Pulser Xcell Total System with GFP (Green Fluorescent Protein) as a reporter to optimize gene delivery conditions. Parameters such as voltage (150–400V), number of pulses (1 or 2), and pulse duration (10 or 20 ms) were systematically evaluated. The best results were achieved at 300 V, 1 pulse, 20 ms, providing optimal transfection efficiency and post-electroporation viability. GFP fluorescence confirmed successful gene delivery and expression after 48 hours.

Single-Cell Isolation and Cell Line Establishment

Single GFP-positive cells were manually isolated using the limiting dilution method and seeded into 96-well plates in fibroblast-specific media. This approach allowed the establishment of single-cell-derived clones, enabling long-term maintenance of genetically modified cell lines. This is a **crucial step** for downstream applications such as genome editing and nuclear transfer, where clonal uniformity is critical.

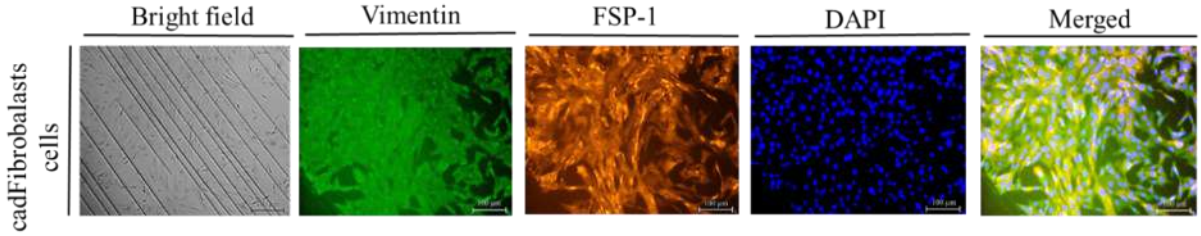


Fig. 1. Immunocytochemical characterization of cadFibroblast monolayer obtained from single cell cultures of cryopreserved and thawed cells with vimentin and fibroblast specific protein-1 (FSP-1). Scale bar 100 µm.

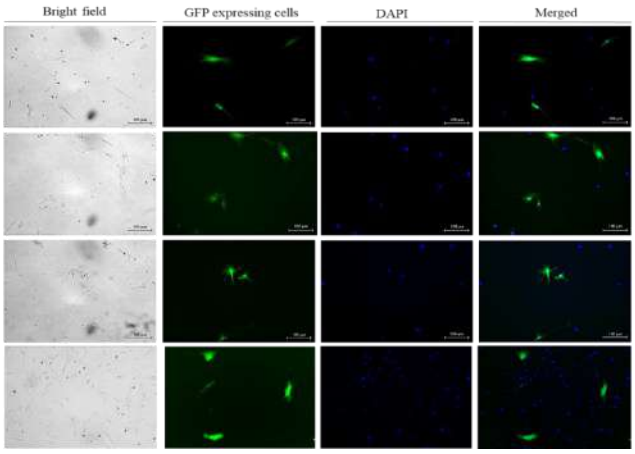


Fig. 2. Representative images of electroporation of caprine adult dermal fibroblasts (cadFibroblast) with GFP. Images were obtained after 48 h post-electroporation. The electroporation conditions were a 4 mm electroporation cuvette, 1 pulse, 300 V, 20 ms and RT handling. Scale bar, 100 µm

Key Outcomes and Impact

- Established fibroblast cell enrichment, cryopreservation, and recovery protocols, ensuring high viability and functionality.
- Optimized electroporation protocol for gene delivery in fibroblast cells, laying the groundwork for genome editing approaches.
- Generated stable single-cell-derived fibroblast clones, useful for genetic manipulation and nuclear transfer.
- Demonstrated beneficial effects of ECM proteins in enhancing fibroblast performance, applicable to cell therapy and tissue engineering.
- Initiated evaluation of nanoparticle interactions with fibroblasts, supporting safe integration of nanotech in livestock biotech.

This NP-GET project has significantly advanced the platform technologies required for applying genome editing in goats by creating optimized fibroblast cell

systems, transfection protocols, and clonal cell line resources. These outcomes provide a critical foundation for future gene-editing applications in livestock health, productivity, and biotechnology innovation.

6.3.7 AICRP Project: Plastic Engineering in Agriculture Structure and Environment Management

Principal Investigator: **Dr. B. Rai**

Co-Investigators: **Dr. Arvind Kumar, Dr. Ravi Ranjan, Dr. K. Gururaj, Dr. T.P. Singh**

Sub-Project 1. Development of Renewable Energy-Based Fodder Dryer cum Winter Protection Shelter for Goats

The minimum temperature observed was significantly higher in winter protection shelter inferring that 3 months old kids housed are least stressed and growth rate is comparable to the growth of the kids housed in traditional kidding sheds which are costly and permanent structure. However, kids kept in winter protection shelter attained higher body weight in last phase of trial.

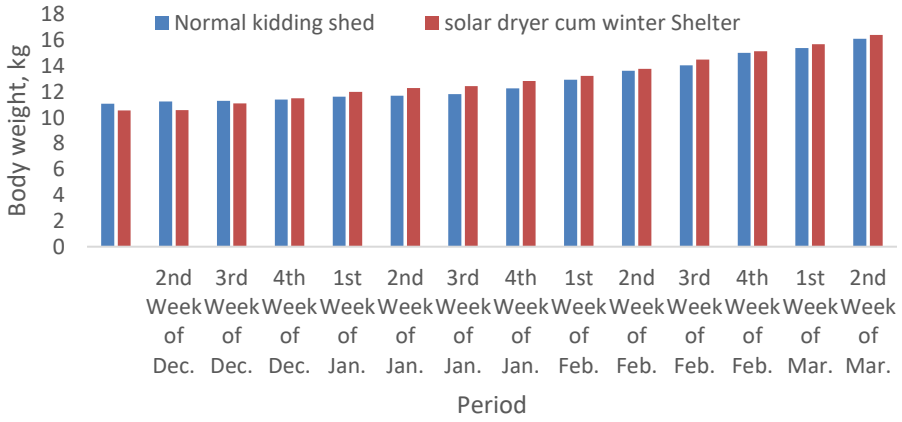


Fig. 1. Growth trial during December 2023 to February 2024

Fig. 2. Structure used as winter protection shelter for kids

Evaluation of use of structure as polyhouse solar dryer (PSD) was conducted during September, 2024. The trial was conducted on drying of green biomass (*Cenchrus spp.*), grass of monsoon season. Initial MC= 83.46%, dry matter content = 16.54% (oven dried sample), S1- Sample dried in polyhouse dryer, S2- Sample dried in open air, S3- Sample dried in shade. The maximum temperature rise in polyhouse

solar dryer was 17^0C higher than ambient air temperature. After drying for 59 hrs of day drying the moisture content of biomass was reduced to 9% in polyhouse solar drying. During this period the moisture content of biomass was reduced to 26.5% and 24 % of the sample dried in open sun and shed area respectively.

Fig. 3. Drying of green grass inside solar dryer and open area

Sub-Project 2. Development of Plastic Based Multi-Purpose Animal Shelter for Housing Goat and Poultry

A plastic based multi-purpose animal shelter for housing goat and poultry has been developed with the idea that double the number of goats can be housed in given space along with birds without affecting the growth and any incidence of diseases. The trial conducted on growth indicated that the average body weight gain in goats at the end of 90 days and 135 days were 5.13 & 6.91 kg in multi-purpose two tier animal shelter and 5.12 & 6.34 kg in traditional housing system respectively. There is no significant difference in total body weight gain in different groups. In addition to goats 40 birds in modified area below stairs, 30 birds in first floor, 40 birds in 15 x 5 ft space in two tier ground floor, 25 birds in colony cages in 4 ft. high platform on two tier ground floors are also reared successfully.

Table 1: Faecal examination report of goat/chicken for disease infection

Category	No. of samples	Bacterial isolates	Positive samples	Am PC-B-L	ESBL
Goat	10	E. coli	10	01	01
Chicken kept on upper floor	05	E. coli	02	00	00
Chicken kept on ground floor	10	E. coli	06	06	04

The goats / chicken kept on upper floor of plastic based multi-purpose animal shelter are less prone to E. coli infection.

Fig. 4. Plastic based composite multi-purpose animal structure

6.4 Nutrition, Feed Formulation and Product's Value Addition

6.4.1 ICAR-Network Program on Veterinary Type Culture Collection (Rumen Microbes)

Principal Investigator: Dr. Ravindra Kumar

Co-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 goats which were maintained under different system of rearing like grazing and stall fed with subabool, pakkad, green moringa ration and straw based ration. Pure cultures of rumen bacteria were isolated by serial dilution method. Pure cultures of different isolates of bacteria were subjected for extraction of DNA. DNA samples were used for amplification of 16S rRNA gene using relevant primers (F-S*-univ-F8-S- 16 and R- S*-univ-1492-a-A-15) and amplified products (Fig 1) were subjected for sequencing of desired genes.

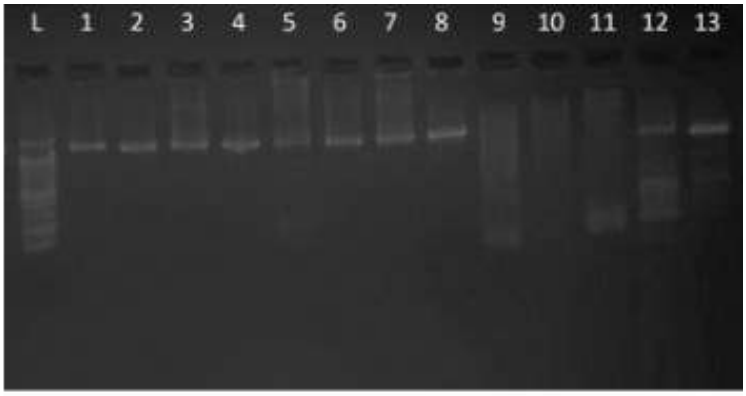


Fig. 1. PCR product of bacterial cultures with 1 kb DNA ladder

Characterization of rumen bacteria was done on the basis of gene sequence using EzBioCloud database https://www.ezbiocloud.net/resources/16s_download . Thirteen isolates of rumen bacteria (table 1) were identified and characterized on the basis of 16S rRNA gene amplification and sequencing of the amplified product. Bacterial cultures were submitted to coordinated unit at ICAR-NIANP Bangalore for allotment of accession number.

Table 1: Accessioned bacteria isolated from the goat rumen in 2024

S. No.	Name of the organism*	VTCC Accession Number	Origin of the species	Geographical location of the sample
1.	*Anaerosalibacter*	VTCCRM0000730B	Goat rumen	ICAR-CIRG, Makhdoom
2.	*Thermoanaerobacterium*	VTCCRM0000729B	Goat rumen	-do-
3.	*Sporanaerobacter*	VTCCRM0000728B	Goat rumen	-do-
4.	*Sporanaerobacter*	VTCCRM0000731B	Goat rumen	-do-
5.	*Clostridium*	VTCCRM0000727B	Goat rumen	-do-
6.	*Acetanaerobacter*	VTCCRM0000726B	Goat rumen	-do-
7.	*Streptococcus lutetiensis*	VTCCRM0000736B	Goat rumen	-do-
8.	*Streptococcus infantarius*	VTCCRM0000735B	Goat rumen	-do-
9.	*Streptococcus ruminicola*	VTCCRM0000733B	Goat rumen	-do-
10.	*Streptococcus lutetiensis*	VTCCRM0000734B	Goat rumen	-do-
11.	*Streptococcus equines*	VTCCRM0000725B	Goat rumen	-do-
12.	*Aeromonas encheleia*	VTCCRM0000724B	Goat rumen	-do-
13.	*Streptococcus gallolyticus*	VTCCRM0000732B	Goat rumen	-do-

*Characterization of rumen bacteria was done on the basis of gene sequence (16S rRNA gene amplification and sequencing of the amplified product) using EzBio Cloud database https://www.ezbiocloud.net/resources/16s_download.

6.4.2 Global Centre of Excellence on Millets (Global CoE on Millets)

Principal Investigator: Dr. Ravindra Kumar

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

Millets are a dual-purpose crop which provides stovers for animals and grain for human consumption. The farmers can grow this millet, can sell the grain for human consumption and the byproducts can be utilized for the goat feeding after suitable processing. Nutrient content of commercial pearl millet varieties grown in semi arid region of north India was evaluated for their nutrient and mineral composition. Stovers of commonly grown pearl millet varieties from Mathura and adjoining regions were collected. Stovers of nine varieties of pearl millet (Shri ram 8860, Pioneer 86M35, Krisna 7711, Shri ram 8850, Pioneer 86M90, Nath Biogene Super 27, Pioneer 86M95, Pioneer 86M90 and Shri ram 8866) were analysed for their nutrient composition. The stovers were analysed for their proximate composition as per AOAC (2006). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were discerned by the methods of Van Soest et al. (1991) and expressed inclusive of ash. Cellulose was calculated as ADF minus Acid detergent lignin (ADL) while hemicellulose was calculated as NDF minus ADF. The minerals were analysed by the inductively coupled plasma-optical emission spectroscopy (5800 ICP- OES, Agilent, CA, SA) after triple acid (HNO_3, H_2SO_4, HCl in 4:2:1) digestion. The wavelengths (nm) used for analysis of calcium, chromium, copper, iron, potassium, magnesium, manganese, sodium, zinc, were 396.847nm, 267.716nm, 327.395nm, 238.204nm, 766.491nm, 279.533nm, 257.610nm, 589.592nm, 213.857nm, respectively. The instrument conditions were 12 L/min plasma gas flow, 0.7 L/min nebulizer gas flow, 1 L/min Aux flow and the viewing mode was radial and axial (multiple condition set) at 8 mm height for analysis of the minerals. All the samples were run in triplicate. Analysis of proximate and fibre fractions revealed a difference in the nutritive value of stovers of different varieties. Crude protein content (%) varied from 4.61 to 7.38. Ether extract was around 2%. Among fibre fractions, NDF (%) and ADF (%) varied from 70.12 - 78.01 and 41.55-48.0, respectively (Table 1). The mineral content of different varieties of pearl millet stovers studied revealed a difference in the mineral content of different varieties.

Table 1: The chemical composition of different varieties of pearl millet stovers

Pearl millet varieties	CP%	EE%	ASH%	OM%	NDF%	ADF%	Cellulose %	Lignin %	TCOH%
Shri Ram (8860)	4.61	1.85	9.40	90.60	78.02	47.54	30.32	17.23	84.14
Pioneer (86M35)	5.62	2.10	18.19	81.81	76.64	47.98	21.01	26.97	74.10
Krishna (7711)	6.30	1.32	11.53	88.47	74.37	45.11	25.91	19.20	80.86
Shri Ram (8850)	5.29	1.71	11.05	88.95	71.44	41.55	34.51	7.03	81.95
Pioneer (86M90)	4.72	1.74	11.71	88.29	76.61	46.59	36.67	9.92	81.83
Nath Bio-gene (Super-27)	6.64	1.88	11.35	88.65	73.99	42.41	34.61	7.81	80.12
Pioneer (86M95)	6.64	1.35	12.79	87.21	70.07	45.57	36.10	9.47	79.22
Pioneer (86M95)	7.02	1.10	14.13	85.87	70.51	43.14	32.85	10.29	78.11
Shri Ram (8866)	7.38	2.43	12.95	87.05	70.12	43.16	34.16	9.00	79.67

Feeding cum Lactation Trial

Effect of utilization of millet stovers in the ration of lactating goats was studied. Four types of complete pellet feed were formulated using different roughage sources and concentrate mixture (1:1 ratio) such as gram straw based (GS), pearl millet stovers based (PS), sorghum stovers (SS) and enzyme mixed pearl millet stovers (PSE). Lactating Barbari goats with mean body weight of 30.93±1.23 kg were divided into four groups (Gr GS, Gr PS, Gr SS and Gr PSE) and fed with corresponding complete pellet feed. The lactation trial was conducted after 60 days of kidding. The duration of experimental feeding was 90 days.

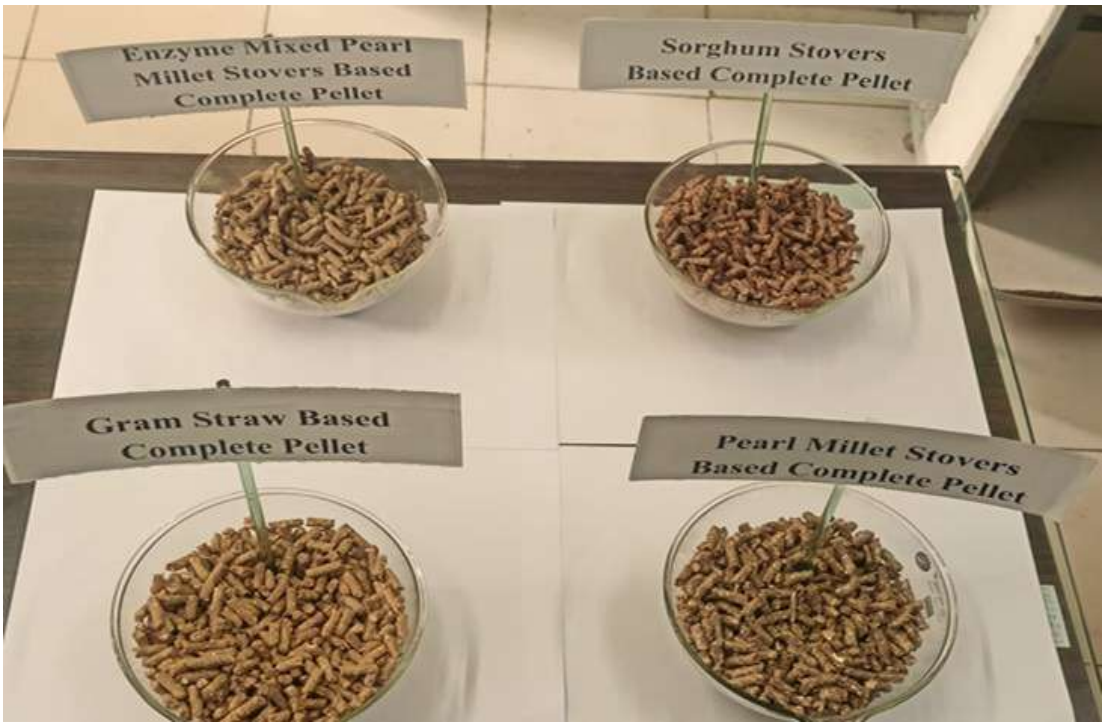


Fig. 1. Millet stovers based complete pellet feeds

Daily dry matter intake, fortnightly body weight change, milk yield, milk composition fatty acid and amino acid profiles were studied. The mean body weight (kg) in Gr GS was 30.4, Gr PS 31.3, Gr SS 30.0 and Gr PSE 32.5 which changed to 33.0, 34.31, 28.11 and 30.92, respectively after feeding the corresponding complete pellet feed. The average dry matter intake (g/day) during trial was 1675.82 for Gr GS; 1619.90 for Gr PS; 1284.18 for Gr SS and 1610.82 for Gr PSE. The intake was significantly lower in does fed with sorghum stovers based complete pellet feed. The average milk yield (g/day) recorded during feeding trial was 883.20 for Gr GS; 888.26 for Gr PS; 696.99 for Gr SS and 811.34 for Gr PSE. Overall milk yield was lower in goats fed on sorghum stovers based complete pellet as compared to other groups. The milk yield and composition in different groups of goats at 60 days of experimental feeding are presented in Table 2.

Table 2: Milk yield and composition in different groups of lactating goats at 60 days of experimental feeding

Attributes	Gr GS	Gr PS	Gr SS	Gr PSE	Significance
Milk Yield(g/day)	1003.67±157.00	872.50±161.48	648.33±133.99	922.50±58.83	0.350
PH	6.32±0.03	6.40±0.07	6.37±0.03	6.28±0.03	0.386
Moisture (%)	85.21±0.34	84.18±0.43	83.84±0.64	85.74±0.35	0.053
TS (%)	14.79±0.34	15.82±0.43	16.16±0.64	14.26±0.35	0.053
Fat (%)	5.40^{ab}±0.41	6.20^{a}±0.39	6.47^{a}±0.48	4.45^{b}±0.38	0.027
Total Protein (%)	3.68±0.05	3.77±0.08	3.70±0.08	3.53±0.18	0.419
SNF (%)	10.13±0.13	10.40±0.21	10.15±0.23	10.13±0.09	0.677
Density	34.22±0.63	34.38±0.86	33.32±0.86	33.85±1.11	0.799
Ash (%)	0.83±0.03	0.78±0.05	0.80±0.02	0.64±0.17	0.331

^{ab} means with different superscript in a row differ significantly at (P<0.05)

Table 3: Fatty acid profile of milk from different groups at sixty days of experimental feeding

Milk fatty acid (%)	Gr GS	Gr PS	Gr SS	Gr PSE	P value
Butyrate (C4:0)	0.29+0.03	0.29+0.05	0.28+0.00	0.32+0.02	0.853
Hexanoate (C6:0)	0.78+0.08	0.89+0.12	0.79+0.01	0.90+0.02	0.553
Octanoate (C8:0)	1.61+0.10	1.86+0.19	1.68+0.07	1.89+0.08	0.332
Decanoate (C10:0)	8.96+0.14	9.56+0.41	8.58+0.28	9.50+0.31	0.121
Laurate (C12:0)	5.65+0.33	5.70+0.18	5.03+0.18	5.16+0.27	0.201

Myristate (C14:0)	12.70+0.39	13.59+0.92	11.79+0.28	11.58+0.34	0.082
Myristoleate (C14:1)	0.23+0.03	0.26+0.06	0.22+0.03	0.20+0.02	0.738
Pentadecanoate (C15:0)	1.09+0.10	1.09+0.10	1.10+0.08	1.13+0.06	0.982
Cis-10 Pentadecenoate (C15:1)	0.29+0.04	0.23+0.02	0.33+0.04	0.28+0.03	0.229
Palmitate (C16:0)	34.96 ^{a} +2.12	31.65 $^{a\ b}$+0.49	28.84 ^{b}+0.65	30.97 ^{b}+1.00	0.030
Palmitoleate (C16:1)	0.89+0.04	0.77+0.15	0.61+0.09	0.67+0.10	0.269
Heptadecanoate (C17:0)	0.96+0.03	0.89+0.02	0.90+0.00	0.95+0.02	0.116
CIS-10 Heptadecenoate (C17:1)	0.27+0.05	0.21+0.01	0.25+0.01	0.20+0.00	0.195
Stearate (C18:0)	6.43+0.38	7.12+0.97	8.35+0.32	7.50+0.36	0.175
trans-Vaccenic acid (TVA)	1.22 ^{b}+0.14	1.61 ^{ab} +0.19	1.70 ^{a} +0.05	1.83^{a}+0.14	0.048
Cis-9 Oleate (C18:1c)	19.18 ^{b}+1.43	19.85 ^{b}+0.79	24.24 ^{a} +0.31	21.54 ^{b}+0.38	0.006
Linoleate (C18:2Cn6)	3.09 ^{b}+0.30	2.92 ^{b}+0.19	3.62 ^{ab}+0.15	3.82 ^{a} +0.22	0.046
Linolelaidate (C18:2Tn6)	0.03+0.00	0.03+0.00	0.02+0.00	0.05+0.04	0.780
Arachidiate (C20:0)	0.22+0.00	0.19+0.03	0.27+0.03	0.20+0.00	0.138
Cis-11-Eicosanoate(C20:1)	0.09 ^{a} +0.01	0.10 ^{a} +0.01	0.06 ^{a} +0.21	0.00 ^{b}+0.00	0.001
Linolenate (C18:3n3)	0.13+0.02	0.13+0.01	0.17+0.01	0.18+0.01	0.172
Heneicosanoate (C21:0)	0.39 ^{b}+0.05	0.56 ^{a} +0.05	0.62 ^{a} +0.03	0.66 ^{a} +0.07	0.014
Gamma-linolenate (C18:3n6)	0.07+0.02	0.06+0.00	0.05+0.02	0.04+0.03	0.795
Behenate (C22:0)	0.14+0.00	0.11+0.02	0.07+0.04	0.05+0.04	0.152
Cis-8, 11, 14-Eicosatrienoate C20:3n6)	0.02+0.00	0.02+0.00	0.02+0.01	0.00+0.01	0.519
Cis-5, 8, 11,14-Eicosatetraenoate (C20:4n6)	0.31+0.04	0.33+0.03	0.41+0.03	0.36+0.01	0.141

^{ab} means with different superscript in a row differ significantly at (P<0.05)

Milk samples from the goats at 60 days of experimental feeding were analysed for different milk constituents using automatic milk scanner. For fatty acid analysis in milk method of O'Fallon *et al*. (2007) was followed for the preparation of fatty acid methyl esters (FAME) of milk samples. One ml milk sample was taken and placed in 50ml centrifuge tubes to which 0.7 ml of 10N KOH in water and 5.3 ml of methanol (Sigma Aldrich) were added. The tubes were incubated in a 55 °C water bath for 90 min with vigorous shaking for 5 sec every 20min. After cooling to room temperature in tap water, 0.58 ml of 24N H_2SO_4 was added. The tubes were again incubated at 55 °C for 90 min in a water bath with shaking for 5 sec every 20 min. The tubes were cooled in tap water. Three millilitres of hexane (Sigma Aldrich) was added and the tubes were vortexed for 5 min on a multi-tube vortex. The tubes were centrifuged for 10 min at 2000g and the hexane layer was taken out and placed into Eppendorf tubes stored at -20ºC till analysis in the GC-MS/MS analysis.

The fatty acid composition of the FAME was determined using GC-MS triple quadrupole (GC-MS TQ8030, Shimadzu Corp., Japan) attached with RestekStabilwax®-MS capillary column (30m× 0.25mm ID × 0.25 µm) and flame ionization detector (FID). The initial oven temperature was 120ºC, held for 5 min, subsequently increased to 240 °C at a rate of 2 ºC min^{-1} and held for 60 min. Helium was used as a carrier gas at a flow rate of 1ml/min. Both the injector and detector were set at 260 °C. The split ratio was 30:1. GC-Real time Analysis software was used to run the sample for analysis. Fatty acids were identified by comparing their retention time with the fatty acid methyl standards (Supelco 37) and were expressed as a percent of total fatty acids. The fatty acid profile in milk of different groups of lactating goats at 60 days of experimental feeding is presented in Table 3.

There was significant (P<0.05) increase in trans-vaccenic acid (TVA), cis-9 oleate (C18:1c), linoleate (C18:2Cn6) and heneicosanoate (C21:0) in milk of goats fed with millet stovers based complete pellet feed as compared to milk from goats fed with gram straw based complete pellet feed. Trans-vaccenic acid (TVA) is a specifically a trans -11 isomer of oleic acid and a dietary precursor of cis-9, trans-11 conjugated linoleic acid (c9,t11-CLA) which is an isomer of conjugated linoleic acid (CLA). This TVA promotes tumor-infiltrating and cytotoxic functions of CD8 T cells, potentially enhancing anti-tumor immunity.

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.

Table 4: Rumen fermentation metabolites in different groups of lactating goats

Attributes	Gr GS	Gr PS	Gr SS	Gr PSE	Significance
pH	6.76±0.06	6.67±0.02	6.65±0.00	6.65±0.01	0.100
Ammonia nitrogen (mg/dl SRL)	13.44 ^{c}±1.04	17.17 ^{b} ±0.24	24.45 ^{a} ±1.02	24.36 ^{a} ±1.54	0.000
Total nitrogen (mg/dl SRL)	127.87^{b}±9.64	182.93^{a}±14.36	112.00 ^{b} ±8.18	103.60 ^{b} ±8.40	0.000
TCA-ppt nitrogen (mg/dl SRL)	38.27±4.89	51.33±6.85	55.07±3.94	39.20±2.29	0.075
NPN(mg/dl SRL)	89.60 b ±10.53	131.60 ^{a}±10.99	56.93 ^{c} ±5.68	64.40 ^{bc} ±7.41	0.000
TVFA (mmol/dl SRL)	3.47±0.32	3.73±0.18	3.22±0.30	3.96±0.57	0.20
Acetic acid %	67.79±0.92	69.15±1.56	72.39±2.14	67.82±2.57	0.245
Propionic acid (%)	16.66±2.07	15.74±1.75	15.35±0.91	16.52±2.46	0.944
Butyric acid (%)	15.55±1.18	15.11±0.41	12.26±1.94	15.65±1.61	0.277

^{ac} means with different superscript in a row differ significantly at (P<0.05)

The ruminal fluid pH was in between 6.5-7.0 showing no adverse effect of feeding millet stovers in goats on ruminal environment. Rumen fermentation metabolites in different groups of goat are presented in Table 4. Among nitrogenous fractions, total nitrogen and non –protein nitrogen was significantly higher (P<0.05) in Gr PS as compared to Gr GS. Significantly (P<0.05) higher ammonia –N (mg/dl SRL) was reported in Gr PS (17.17), Gr SS (24.45) and Gr PSE (24.36) as compared to Gr GS (13.44). No statistically significant difference was reported in total volatile fatty acid and its fractions in different groups of goat.

A total of 191 (91 in Jan 2025 and 100 in March 2025) farmers were demonstrated with complete pellet feed preparation using pearl millet and sorghum stovers. Goat and feed entrepreneur (11 in number) was trained and demonstrated with preparation of complete pellet feed with utilization of millet stovers.

Fig. 2. Demonstration of preparation of millet stovers based complete pellet

6.4.3 Institute Project: Development of Natural Farming based Fodder Production Practices for Goats

Principal Investigator: **Dr. Arvind Kumar**

Co-Investigators: **Dr. Ravindra Kumar, Dr. K. Gururaj**

Project was started to assess the potential of goat faeces and urine for preparation of *jeevamrit* and *beejamrit* and to develop the package of practices of fodder production for goats through natural farming. During the Kharif season of 2024-25, fodder sorghum and bajra was cultivated using natural farming practices and feeding trial was conducted on goats. Foliar spray of jeevamrit (200 lit water+10 kg cowdung+5 lit cow urine+ 2 kg jaggery+2 kg besan+ 1 hand full soil) was done at 15-20 days interval on cultivated fodder. Sorghum and bajra green fodder cultivated using natural farming practices was used for feeding trial on Barbari goats.

Table 1: Chemical composition of sorghum and bajra fodder cultivated through natural farming

Chemical composition	Sorghum	Bajra
Dry matter (%)	26.26± 0.14	19.10± 0.41
Moisture (%)	73.73±0.21	80.89±0.40
Ash (%)	8.177±0.10	16.48±0.25
Insoluble ash (%)	4.260±0.067	8.412±0.49
Organic matter (%)	91.82±0.062	83.51±0.254
Crude protein (%)	6.625±0.351	8.02±0.00
Ether extract (%)	1.536±0.038	1.750±0.065
Neutral detergent fibre (%)	70.09±0.37	67.26±0.37
Acid detergent fibre (%)	41.93±1.29	39.38±0.94
Lignin (%)	7.67±0.74	5.37±0.40
Cellulose (%)	34.09±1.09	31.86±0.85
Hemicellulose (%)	28.16±1.13	27.88±0.68

Table 2: Average body weight gain (%) of Barbari goats on feeding of traditionally cultivated (T1) Vs naturally cultivated (T2) berseem fodder

Method of fodder cultivation	No. of feeding days									
	15	30	45	60	75	90	105	120	135	150
T1 (Traditional)	5.28	11.24	18.51	24.53	33.84	38.89	43.54	56.23	62.48	68.46
T2 (Natural)	5.05	12.51	16.06	23.53	31.71	37.52	44.54	55.83	64.57	71.69

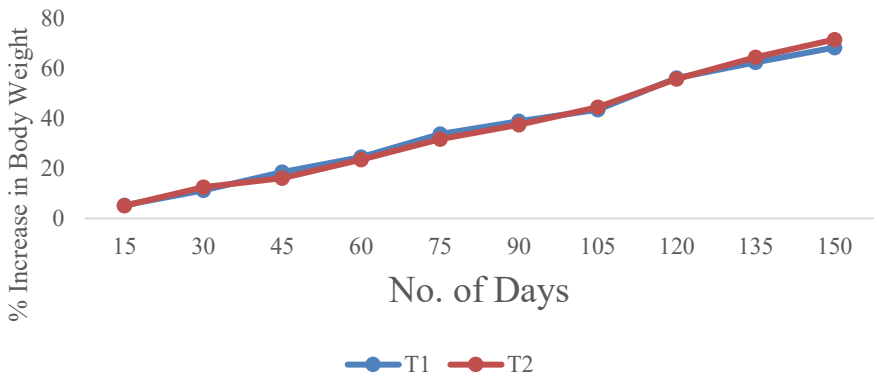


Fig. 1. Effect on body weight increase in feeding of traditionally (T1) and naturally (T2) cultivated berseem fodder to Barbari goats

The above graph indicates that there is no significant difference in feeding naturally and traditionally cultivated fodder on body weight gain of Barbari goats.

To popularize the technique of natural way of fodder cultivation, number of trainings and demonstrations are organized for the goat farmers of nearby villages and other trainee participants. Five demonstrations on preparation and use of *jeevamrit* as organic fertilizer and *beejamrit* for seed treatment of fodder crops was demonstrated to the goat farmers and students visiting CIRG.

Fig. 2. Demonstrations on preparation and use of *jeevamrit as organic fertilizer*

6.4.4 Agri-Drone Project: Use of Drone in Agriculture for Spray of Liquid Fertilizer and Chemicals

Principal Investigator: **Dr. Arvind Kumar**

Co-Investigators: **Dr. Ravindra Kumar, Dr. Gopal Dass**

This project was sanctioned under Rastriya Krishi Vikas Yojana (RKVY) for demonstration and popularization of Drone in agriculture. Under this scheme a hexa-copter AGRIBOT Drone having 10 litre liquid storage capacity, 25 kg max take-off 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 was observed that the drone can spray at the flow rate of 1.2 to 4.0 *litre*/min covering the spray width of 3.0 -5.0 m. Spray efficiency varies from 5-8 ha/h. It works on artificial intelligence-based spray application with core GIS and logical calculation. During the reported period it was demonstrated to the trainee participants of "Feed-fodder production, processing and ration formulation for goats, 19-23 August, 2024" and "Use of plastics in scientific goat farming, 27-31 January, 2025" trainings. It was also demonstrated to veterinary students, sponsored candidates by different organizations and others on exposure visit to CIRG. Field demonstration on spray of nano urea

was conducted in the DAPSC adopted village Nagla Rithali, Baldeo block, Mathura.

Fig. 1. Agri-Drone demonstration to the trainee participants and farmers of Nagla Rithali village

6.4.5 Institute Project: Evaluation of Sheep Wool for Improving Forage Crop Productivity

Principal Investigator: **Dr. Arvind Kumar,**

Co-Investigators: **Dr. Ravindra Kumar, Dr. Gopal Dass**

Muzaffarnagari sheep produces around 1.4 kg wool annually. The quality of the wool produced is rough having fibre diameter around 44 µ m with approximate 70% medullation. Due to this it is less remunerative, therefore alternative uses of this wool needs to be explored. Due to more diameter and high medullation it has good hygroscopic and water holding capacity. It can be explored for use in agriculture as mulch material or can be mixed in soil as slow-release fertilizers due to higher N and S content. Experiment revealed that coarse wool provided significantly higher quantity of available nitrogen, phosphorus and potash for plants.

Table 1: Chemical composition of sheep wool

Parameter	Value
Water holding capacity	8-9 times
Dry matter (%)	85.75 – 86.29
Nitrogen (%)	13.34 – 14.30
Potassium (%)	0.35 – 0.40
Sodium (%)	0.32 – 0.36
Total ash (%)	6.33 – 6.92

Experiment was started during kharif season to assess the potential of sheep wool as slow-release fertilizer in fodder guar with 3 levels of sheep wool used. The treatments were T_1 (0.5 Mg/ha), T_2 (1.0 Mg/ha), T_3 (2.0 Mg/ha) and compared with Control (No wool used).

Fig. 1. Randomized wool treatment in different plots

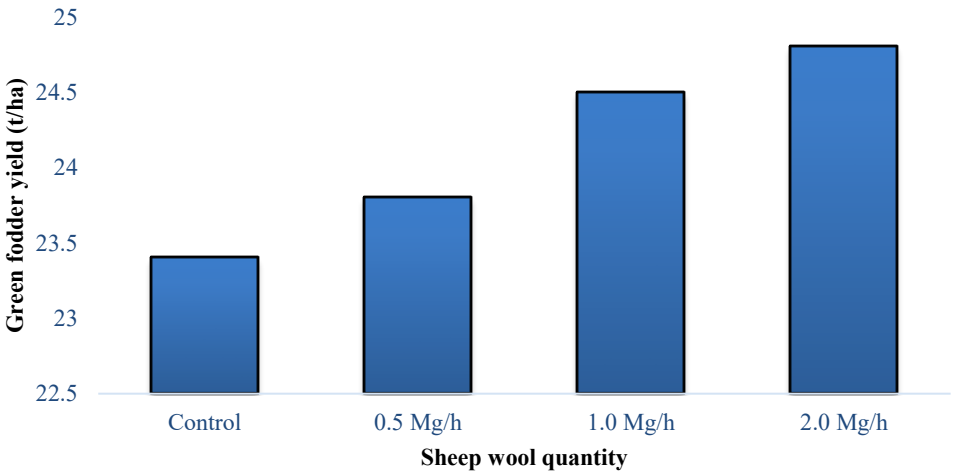


Fig. 2. Effect of quantity of sheep wool used on green fodder production of guar

6.4.6 Institute Project: Standardization of Goat Milk Cheese Processing and Value Addition of its By-product

Principal Investigator: Dr. Arun Kumar Verma

Co-Investigators: Dr. V. Rajkumar, Dr. K. Gururaj, Dr. Tarun Pal Singh

Quality characteristics and storage stability of goat milk gouda cheese during vacuum refrigeration: In this work, we determined the physicochemical, colour, textural, rheological, sensory and microbiological properties along with fatty acid and amino acid profiles of goat milk gouda cheese under vacuum refrigeration for 150 days. There was an increase in the values of pH, titratable acidity (%), fat, protein and ash percentages, while a decline in the moisture percent and water activity of gouda cheese with the progression of storage. Free fatty acids (µm/g), peroxide value (meq O_2/kg), and tyrosine value (µg/g) showed significant increments with the advancement of the storage period. Similarly, soluble proteins (%) and ripening index increased significantly during refrigerated storage. There was a significant increase in the antioxidant activity of cheese in terms of percent DPPH and ABTS radical scavenging activities with the progress of storage. The texture profile of analysis of gouda cheese showed a significant decline in hardness and an increase in springiness and

cohesiveness values on day 75 of storage and thereafter these values remained stable. There was a significant decrease in hunter colour lightness value and an increase in the redness value of cheese on different evaluation days. There was an increase in the scores of various sensory parameters on day 75. On subsequent evaluation days, these scores were decreased with a significant effect on flavour, saltiness and overall acceptability.

Rheological evaluation of goat milk gouda cheese revealed that the dynamic moduli i.e., storage modulus and loss modulus values increased with an increase in the angular frequency. On the other hand, these values were gradually decreased when the applied temperature increased from 30°C to 90°C. In both cases, the values of dynamic moduli decreased with the advancement of the storage period. The storage of the gouda cheese resulted in a significant increase in histidine, alanine, tyrosine, methionine, phenylalanine, isoleucine, lysine and finally the essential amino acids. The fatty acid profile of gouda cheese during storage showed changes in short and medium-chain fatty acids, C16:0, and C18:2 fatty acids during storage. Further, there was an increase in polyunsaturated fatty acids (PUFAs), n – 6 PUFA and n – 6/n – 3 ratio. Microbiological evaluation of gouda cheese showed yeast and mould counts only after 30 days of storage and then the count increased significantly as the storage progressed. No coliform counts were recorded in the gouda cheese during storage.

Table 1: Physicochemical properties of goat milk gouda cheese during vacuum refrigeration

Storage days	Parameters							
	aw	FFA (µm/g)	PV (meq O_2/kg)	TV (µg/g)	SP (%)	RI	DPPH (%)	ABTS (%)
0	0.99±0.00^{a}	2.00±0.09^{f}	7.00±0.20^{b}	11.68±0.54^{i}	1.75±0.07^{i}	9.62±0.47^{i}	6.76±0.10^{i}	19.71±0.23^{h}
15	0.97±0.00^{b}	2.37±0.10^{e}	7.83±0.12^{a}	15.24±0.44^{h}	2.20±0.07^{h}	11.97±0.49^{h}	7.36±0.09^{h}	30.57±0.28^{g}
30	0.97±0.00^{b}	2.60±0.07^{de}	4.42±0.15^{g}	19.82±0.41^{g}	2.68±0.07^{g}	14.76±0.51^{g}	8.43±0.10^{g}	34.91±0.06^{f}
45	0.97±0.00b^{c}	2.67±0.07^{cd}	5.08±0.17^{f}	22.15±0.37^{f}	3.11±0.08^{f}	16.95±0.42^{f}	9.18±0.07^{f}	42.18±0.13^{e}
60	0.96±0.00^{c}	2.70±0.09^{cd}	6.17±0.08^{d}	25.12±0.42^{e}	3.54±0.05^{e}	19.34±0.37^{e}	10.01±0.09^{e}	48.68±0.11^{d}
75	0.96±0.00^{c}	2.90±0.09^{bc}	6.63±0.11^{bc}	27.65±0.24^{d}	4.96±0.09^{d}	26.11±0.46^{d}	10.99±0.10^{d}	52.14±0.12^{c}
90	0.96±0.00^{c}	3.00±0.12^{b}	6.67±0.14^{bc}	32.62±0.36^{c}	5.60±0.12^{c}	28.67±0.49^{c}	12.39±0.09^{c}	57.61±0.12^{a}
120	0.96±0.00^{cd}	3.40±0.09^{a}	6.33±0.08^{cd}	37.46±0.44^{b}	8.07±0.07^{b}	40.22±0.80^{b}	15.04±0.13^{b}	53.99±0.09^{b}
150	0.95±0.00^{d}	3.47±0.04^{a}	5.75±0.09^{e}	44.21±0.48^{a}	9.04±0.09^{a}	43.45±0.61^{a}	17.19±0.17^{a}	35.21±0.22^{f}

Means bearing different superscript in a column differ significantly (P<0.05)

Table 2: Texture profile analysis and Hunter colour parameters of goat milk gouda cheese during vacuum refrigeration

Parameters	Storage days		
	0	75	150
	Texture profile analysis		
Hardness (N/cm^{2})	48.74±2.81^{a}	31.07±1.58^{b}	28.47±1.16^{b}
Adhesiveness (Ns)	-0.01±0.09^{a}	-0.42±0.05^{b}	-0.33±0.06^{b}
Springiness (cm)	0.77±0.02^{b}	0.87±0.01^{a}	0.85±0.01^{a}
Cohesiveness (ratio)	0.31±0.04^{b}	0.58±0.01^{a}	0.65±0.00^{a}
Gumminess (N/cm^{2})	17.51±1.87	17.97±0.66	18.45±0.68
Chewiness (N/cm)	13.40±1.49	15.55±0.55	15.65±0.52
	Colour coordinates		
Lightness	77.90±0.83^{a}	70.92±1.26^{b}	65.89±0.89^{c}
Redness	-2.09±0.37^{c}	1.04±0.19^{b}	2.49±0.34^{a}
Yellowness	12.60±0.31	13.30±0.17	12.58±0.21

Means bearing different superscript in a row differ significantly (P<0.05)

Table 3: Amino acid profile of goat milk gouda cheese during vacuum refrigeration

Amino acids (g/100g)	Storage days		
	0	75	150
Aspartic acid	8.19±0.22^{a}	5.82±0.16^{b}	4.10±0.10^{c}
Glutamic acid	5.94±0.03^{a}	4.93±0.07^{b}	3.12±0.04^{c}
Serine	8.17±0.05^{b}	9.58±0.06^{a}	9.52±0.03^{a}
Histidine	6.63±0.13^{c}	6.91±0.04^{b}	7.62±0.07^{a}
Glycine	6.56±0.31^{a}	6.08±0.03^{a}	4.09±0.05^{b}
Threonine	4.82±0.05^{c}	5.15±0.03^{b}	6.23±0.03^{a}
Arginine	6.84±0.03^{a}	6.53±0.08^{b}	5.46±0.09^{c}
Alanine	2.95±0.02^{c}	4.03±0.04^{b}	5.64±0.04^{a}
Tyrosine	6.50±0.06^{b}	6.17±0.09^{c}	7.10±0.07^{a}
Methionine	2.46±0.02^{b}	2.60±0.02^{a}	2.65±0.04^{a}
Phenylalanine	4.39±0.06^{b}	4.47±0.06^{b}	4.88±0.04^{a}
Isoleucine	5.32±0.09^{b}	5.49±0.09^{b}	6.22±0.04^{a}
Leucine	15.54±0.23^{a}	14.95±0.10^{b}	15.05±0.18^{ab}
Lysine	14.42±0.46^{b}	16.99±0.23^{a}	17.69±0.12^{a}
EAA	60.42±0.80^{c}	63.09±0.10^{b}	65.78±0.17^{a}
NEAA	38.31±0.65^{a}	36.61±0.11^{b}	33.57±0.06^{c}

Means bearing different superscript in a row differ significantly (P<0.05)

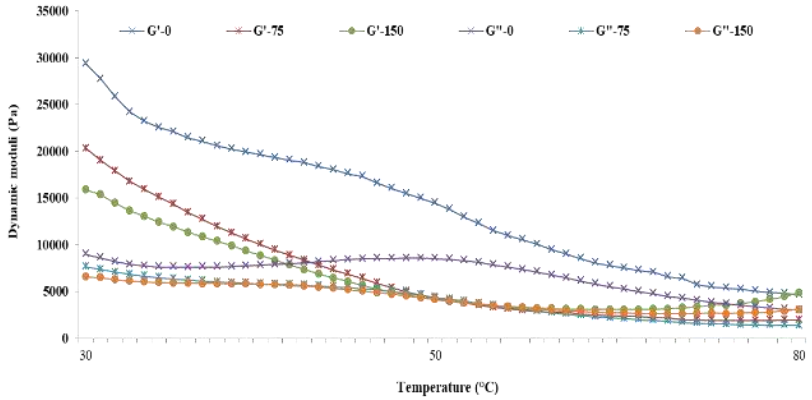


Fig. 1. Dynamic moduli of goat milk gouda cheese as a function of temperature during vacuum refrigeration

Quality characteristics of goat milk chevre with added herbs: In this work, we standardized the processing of goat milk chevre, a spread type cheese and observed the effects of added herbs (Betel and Tulsi leaves) on the physicochemical, colour, rheological and sensory characteristics of the product. The moisture content in chevre increased significantly due to the added Tulsi leaves, while the addition of betel leaves resulted in increased ash content. Hunter colour redness and yellowness values decreased significantly due to added betel and Tulsi leaves. Organoleptic evaluation of the goat milk chevre revealed significantly higher body and texture scores for cheese with added leaves. However other sensory scores remained statistically similar among treatments. Rheological analysis of the cheese showed the highest values of dynamic moduli for chevre with betel leaves followed by chevre with Tulsi leaves and control. The values of dynamic moduli for all the cheeses increased with an increase in angular frequency, while these values decreased when the temperature was increased from 10°C to 30°C.

Table 4: Physicochemical, colour and sensory properties of goat milk chevre with added betel and tulsi leaves

Parameters	Chevre_C	Chevre_B	Chevre_T
pH	4.13±0.02^{b}	4.19±0.02^{a}	4.21±0.02^{a}
Moisture (%)	69.22±0.13^{b}	69.36±0.36^{b}	70.21±0.14^{a}
Fat (%)	14.17±0.21	14.33±0.14	14.00±0.17
Protein (%)	10.32±0.12	10.27±0.10	10.32±0.09
Ash (%)	2.23±0.04^{ab}	2.27±0.03^{a}	2.16±0.02^{b}
Lightness	78.83±2.19	77.38±0.31	77.68±0.36
Redness	-0.79±0.12^{a}	-0.99±0.09^{a}	-1.30±0.09^{b}
Yellowness	12.35±0.09^{a}	11.78±0.07^{b}	11.50±0.15^{b}
Colour & appearance	8.03±0.12	8.18±0.15	8.08±0.15
Flavour	7.71±0.10	8.04±0.15	7.85±0.12
Body & texture	7.67±0.16^{b}	8.33±0.11^{a}	8.21±0.11^{a}
Mouthfeel	7.71±0.16	8.02±0.18	7.70±0.11
Overall acceptability	7.92±0.13	8.09±0.15	7.85±0.12

Chevare:- Control cheese; Chevre_B: Cheese with added betel leaves; Chevre_T: Cheese with tulsi leaves
Means bearing different superscript in a row differ significantly (P<0.05).

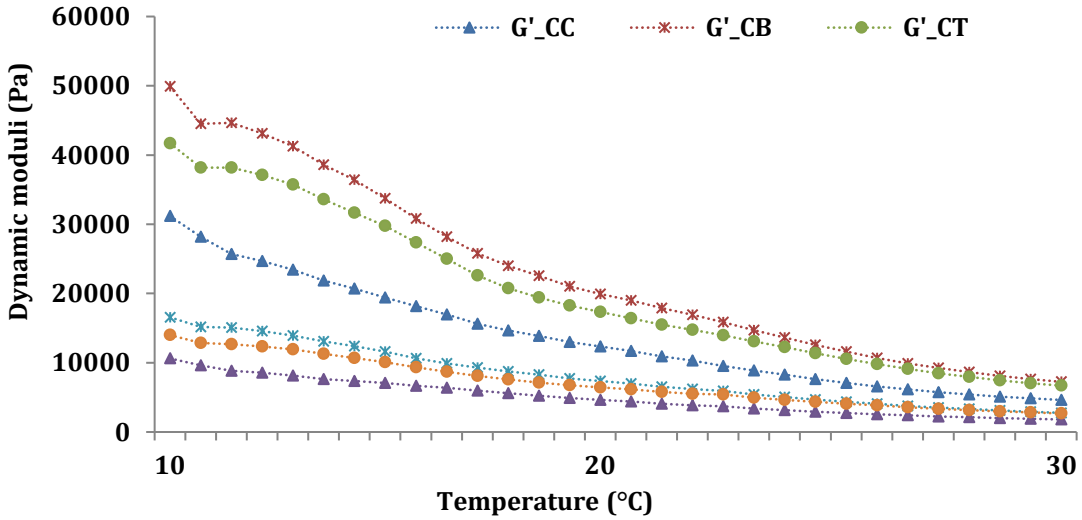


Fig. 2. Temperature sweep of goat milk chevre as influenced by added herbs

6.4.7 DBT Project: Improved Goat Animal Production for Healthier Products through Guided Nutrients and Bio-Actives

Principal Investigator: Dr. Arun Kumar Verma

Co-Investigators: Dr. V. Rajkumar, Dr. Ravindra Kumar, Dr. K. Gururaj

Effect of dietary minerals and vitamins supplementation on the fatty acid profile of goat milk and milk products: In this work, we evaluated the fatty acid profile of goat milk and milk products viz., cheese, paneer and yoghurt obtained from animals supplemented with vitamins and trace elements (Fe, Zn, Se) from different sources (inorganic, organic, nano) against control. The supplementation of different sources of trace elements to lactating goats affected the fatty acid profile. The major changes were observed in fatty acids C8:0, C10:0, C12:0 and C14:0 which were decreased significantly in milk from goats supplemented with organic and nano trace elements. In addition, supplementation of organic and nano trace elements significantly decreased medium-chain triglycerides, saturated fatty acids and polyunsaturated fatty acids. Supplementation of vitamins and trace elements increased palmitic acid (C16:0). Further, stearic acid (C18:0) content in milk

significantly increased due to organic and nano trace elements. As regards the health and metabolic indices of milk fat, supplementation of organic trace minerals along with vitamins resulted in significantly better atherogenic, thrombogenic and saturation indices as well as lower hypercholesterolaemic fatty acids.

The fatty acid profiles of value-added goat milk products, like cheese, paneer and yoghurt were also influenced by supplementation of vitamins and trace elements. Mozzarella cheese and paneer from animals that received organic and nano minerals had better fatty acid profiles as well as health and metabolic indices. Goat milk yoghurts from supplemented groups had significantly better fatty acid profiles and health as well as metabolic indices in terms of lower saturated fatty acids (SFA), higher mono-unsaturated (MUFA), polyunsaturated (PUFA), and unsaturated fatty acids (UFA). The yoghurt from these groups also had better atherogenic index (AI), thrombogenic index (TI), saturation index (SI), desirable fatty acids and lower hypercholesterolaemic fatty acids.

Table 1: Effect of minerals and vitamins supplements on health indices of goat milk fat

Parameters	Group A	Group B	Group C	Group D
n – 6 PUFA (%)	2.55±0.01^{a}	2.50±0.01^{b}	2.34±0.02^{c}	2.33±0.02^{c}
n – 3 PUFA (%)	0.66±0.00^{b}	0.68±0.00^{a}	0.66±0.01^{b}	0.63±0.01^{c}
U/S	0.42±0.01^{b}	0.39±0.01^{c}	0.44±0.00^{a}	0.42±0.00^{b}
n – 6/*n* – 3	3.90±0.02^{a}	3.66±0.01^{c}	3.53±0.02^{d}	3.72±0.02^{b}
Atherogenic index (AI)	2.67±0.07^{bc}	2.93±0.04^{a}	2.55±0.02^{c}	2.75±0.02^{b}
Thrombogenic index (TI)	2.89±0.05^{b}	3.11±0.04^{a}	2.87±0.03^{b}	3.02±0.02^{a}
Saturation index (SI)	1.63±0.03^{bc}	1.77±0.03^{a}	1.62±0.02^{c}	1.70±0.01^{b}
Desirable fatty acid (%)	36.86±0.43^{b}	35.34±0.33c	38.91±0.06^{a}	36.99±0.17^{b}
Hypercholesterolemic fatty acid (%)	46.04±0.52^{bc}	48.08±0.18^{a}	45.52±0.46^{c}	46.85±0.14^{b}
Hypocholesterolemic/hypercholesterolemic ratio (h/H)	0.68±0.02^{ab}	0.62±0.01^{c}	0.70±0.01^{a}	0.65±0.01^{b}
Δ9-DI (18): Δ9-(18) desaturase index	77.46±0.30^{a}	76.75±0.37^{ab}	75.12±0.18^{c}	76.44±0.22^{b}
Δ9-DI (16): Δ9-(16) desaturase index	2.03±0.13	2.15±0.11	2.20±0.02	2.12±0.15
Total Δ9-desaturase index	40.46±0.47^{a}	38.38±0.43^{b}	40.40±0.33^{a}	39.61±0.20^{a}
Elongase index (EI)	0.24±0.01^{b}	0.22±0.00^{c}	0.28±0.00^{a}	0.24±0.00^{b}
Thioesterase index	2.73±0.03^{b}	2.71±0.00^{b}	2.81±0.03^{a}	2.73±0.02^{b}

Group A: Control/Basal diet; Group B: Basal diet + Inorganic Fe, Zn, Se + Vitamin A & E; Group C: Basal diet + Organic Fe, Zn, Se + Vitamin A & E; Group D: Basal diet + Nano Fe, Zn, Se + Vitamin A & E

Economics of designer goat meat and milk production through nutritional intervention: The good things always come with additional costs and the same applies for the production of healthier or designer goat meat and milk. We assessed the economics in terms of the additional cost needed to produce designer goat meat and milk compared to control goat meat and milk based on a partial budgeting approach. Here, we calculated the number of components of the oil blend (sunflower oil, linseed oil, NV1810), vitamins (vitamin A and vitamin E) and trace elements (Fe, Zn, Se) consumed by individual animals of supplemented groups. This was followed by the cost calculation of individual ingredients and whole supplements consumed by each animal in different groups reared for meat and milk production. Finally, the additional cost incurred for producing per kilogram of meat and milk was calculated. The additional cost needed to produce per kilogram of designer meat and milk having healthier fatty acid configuration ranged from ₹ 101.09-157.34 and 11.48-20.26, respectively. Similarly, the additional cost required to produce per kilogram of designer goat meat and milk rich in vitamins and trace elements ranged from ₹68.80-71.59 and 19.15-19.75, respectively. These extra-economic bearing on the production of designer goat meat and milk can be compensated in terms of better production performance, higher vital nutrients – fatty acids, vitamins and trace elements, and improved animal, consumer and environmental health.

Table 2: Additional cost to produce unit mass/volume of designer goat meat and milk with healthier fatty acids and CLA

Particular	Group A	Group B	Group C
	Kids		
Cost of SF oil/animal (₹)	-	385.31	730.38
Cost of linseed oil/animal (₹)	-	344.03	652.13
Cost of NV1810/animal	-	600.00	600.00
Total (₹)	-	1329.33	1982.51
Cost/ kg meat (₹)	-	**101.09**	**157.34**
	Lactating animals		
Cost of SF oil/animal (₹)	-	295.47	624.96
Cost of linseed oil/animal (₹)	-	263.81	558.00
Cost of NV1810/animal (₹)	-	300.00	300.00
Total (₹)	-	859.28	1482.96
Cost/ kg milk (₹)	-	**11.48**	**20.26**

Group A: Control; Group B: Goats received 3% oils + NV1810; Group C: Goats received 6% oils + NV1810

Table 3: Additional cost to produce unit mass of designer goat meat and milk rich in trace elements and vitamins

	Group A	Group B	Group C	Group D
	Kids			
Cost of Iron/animal (₹)	-	11.97	7.22	2692.31
Cost of zinc/animal (₹)	-	2.41	2.53	322.71
Cost of selenium/animal (₹)	-	3.12	60.00	88.92
Cost of vitamin A/animal (₹)	-	109.25	109.25	113.96
Cost of vitamin E/animal	-	454.02	461.95	473.60
Total (₹)	-	**566.38**	**631.20**	**676.48**
Cost/kg meat (₹)	-	**64.80**	**71.40**	**71.59**
	Lactating animals			
Cost of Iron/animal (₹)	-	13.67	8.10	2946.98
Cost of zinc/animal (₹)	-	2.75	2.84	353.24
Cost of selenium/animal (₹)	-	1.56	3.00	44.46
Cost of vitamin A/animal (₹)	-	124.74	124.74	124.74
Cost of vitamin E/animal (₹)	-	518.40	518.40	518.40
Total (₹)	-	**644.70**	**646.14**	**687.60**
Cost/ kg milk (₹)	-	**19.15**	**18.61**	**19.75**

Group A: Control/Basal diet; Group B: Basal diet + Inorganic Fe, Zn, Se + Vitamin A & E; Group C: Basal diet + Organic Fe, Zn, Se + Vitamin A & E; Group D: Basal diet + Nano Fe, Zn, Se + Vitamin A & E

6.4.8 Institute Project: Development and Characterization of Goat Milk Yoghurt with Enhanced Health Attributes and Storage Stability

Principal Investigator: Dr. Tarun Pal Singh

Co-Investigators: Dr. Arun Kumar Verma, Dr. V. Rajkumar, Dr. B. Rai

Study on the oxidative stability and culture viability of goat frozen yoghurt during extended storage: In this study, goat frozen yoghurt (GFYM) with 3% mango powder (MP) was evaluated in comparison to the control product without mango powder (GFYC) over 6 months storage at freezing temperature (−20±2ºC). GC-MS/MS analysis of the mango powder extract (MPE) identified 5-hydroxymethylfurfural, maltol, and valeric anhydride as the primary compounds. Multiple reaction monitoring of MPE against 16 reference phytochemicals detected eight phenolic compounds with concentrations ranging from 1.49 to 10.52 ppm. The total phenolic content, DPPH and ABTS activities ranged from 0.10 to 1.07 mg GAE/g, 2.52 to 52.99%, and 5.98 to 32.84%, respectively at concentrations ranging from 100 to 2000 µg/ml of MPE. The dynamic rheological analysis showed that the addition of MP significantly improved the storage modulus (G′) and loss modulus (G″), resulting in better dynamic moduli in GFYM. The presence of MP markedly ($p<0.05$) affected the

moisture, pH, titratable acidity, tyrosine value, melting resistance, viscosity, colour values, antioxidant, and sensory properties of GFY. At the end of storage period, *S. thermophilus* count of GFYC and GFYM samples decreased significantly ($p<0.05$) with a range of 2.80 and 2.84 log whereas *L. bulgaricus* with a range of 2.50 and 2.63 log, respectively.

Table 1: Physicochemical properties of goat frozen yoghurt with mango powder during storage (Mean±S.D.) *

Treatments	Storage days						
	Day 0	Day 30	Day 60	Day 90	Day 120	Day 150	Day 180
Moisture (%)							
GFYC	72.25±1.02^{bB}	72.28±0.04^{bB}	71.04±0.08^{aB}	70.91±0.13^{aB}	70.75±0.27^{aB}	70.66±0.21^{aB}	71.03±0.62^{aB}
GFYM	70.04±0.27^{cA}	69.75±0.42^{bcA}	69.55±0.14^{abcA}	69.11±0.24^{abA}	69.27±0.23^{abA}	69.09±0.12^{abA}	68.82±0.85^{aA}
pH							
GFYC	4.73±0.02^{fB}	4.72±0.01^{efB}	4.66±0.03^{cdB}	4.68±0.03^{deA}	4.64±0.04^{cB}	4.55±0.03^{bB}	4.47±0.04^{aB}
GFYM	4.77±0.02^{eA}	4.77±0.02^{eA}	4.72±0.02^{dA}	4.71±0.03^{cdA}	4.69±0.02^{cA}	4.64±0.03^{bA}	4.59±0.05^{aA}
Titratable acidity (% lactic acid)							
GFYC	0.55±0.04^{aA}	0.60±0.03^{bA}	0.63±0.03^{bA}	0.67±0.03^{cA}	0.72±0.02^{dA}	0.74±0.01^{dA}	0.79±0.04^{eA}
GFYM	0.55±0.04^{aA}	0.57±0.04^{abA}	0.59±0.04^{bB}	0.64±0.03^{cB}	0.70±0.03^{dA}	0.72±0.02^{deB}	0.75±0.04^{eB}
Tyrosine value (mg/g)							
GFYC	38.76±2.27^{aA}	41.54±2.84^{abA}	43.87±3.67^{bcA}	46.43±0.54^{bcdA}	47.81±4.51^{cdA}	48.09±0.54^{deA}	50.93±2.58^{eA}
GFYM	38.04±3.18^{aA}	44.54±3.25^{abA}	47.87±0.98^{bB}	52.15±5.24^{bcA}	49.54±6.03^{bcA}	48.09±0.13^{bA}	55.98±1.84^{cB}
Melting resistance (%)							
GFYC	17.88±0.55^{fA}	17.27±0.05^{efA}	16.63±0.04^{deA}	15.69±0.24^{dA}	13.57±0.07^{cA}	11.46±1.06^{bA}	9.61±0.88^{aA}
GFYM	18.18±0.51^{dA}	18.43±0.25^{dB}	17.22±0.57^{cB}	16.67±0.04^{cB}	17.02±0.21^{cB}	13.52±0.10^{bB}	11.58±0.76^{aB}
Viscosity (m.Pa.s.)							
GFYC	3102.33±88.64^{aA}			3351.67±170.43^{aA}			5110.00±205.26^{bA}
GFYM	4683.33±183.47^{aB}			5098.67±185.28^{aB}			6119.00±761.07^{bB}

n=6, *mean with different superscript letters with in each row and column indicate statistically significant differences in the respective parameters ($p<0.05$).

Table 2: GC–MS/MS analysis for the mango powder.

S.No.	Name of compounds	Mango powder	
		Area (%)	R. time (min.) *
1.	Maltol	10.13	4.027
2.	2-Furoylacetonitrile	0.56	4.210
3.	Pentanal	1.53	4.340
4.	2-Propanamine, N-methyl-N-nitroso-	0.34	4.925
5.	2,3-dihydro-3,5-dihydroxy-6-methyl-4H-Pyran-4-one	5.92	5.141
6.	Valeric anhydride	13.21	6.752
7.	5-Hydroxymethylfurfural	52.29	6.982
8.	1,2,3-Propanetriol, 1-acetate	6.26	7.268
9.	6-oxo-Heptanoic acid	1.57	8.493
10.	Pentadecanoic acid	1.10	30.726
11.	cis,cis,cis-7,10,13-Hexadecatrienal	0.56	36.101
12.	Furane-2-carboxylic acid, (2-chloro-5-furanoyloxy)phenyl ester	0.92	4.195
13.	1,3-Dioxolane, 2-ethenyl-2,4-dimethyl-, trans-	0.57	8.470
14.	5-(Hydroxymethyl)-2-(dimethoxymethyl)furan	0.28	8.565
15.	Glutamine, N-methyl-	1.69	9.235
16.	2-hydroxy-2-methyl-Butanedioic acid	4.99	10.177
17.	3-hex-4-ynyl 3-methylbutyl ester-succinic acid	1.43	11.415
18.	cis-Vaccenic acid	0.18	30.057

*R. time- retention time

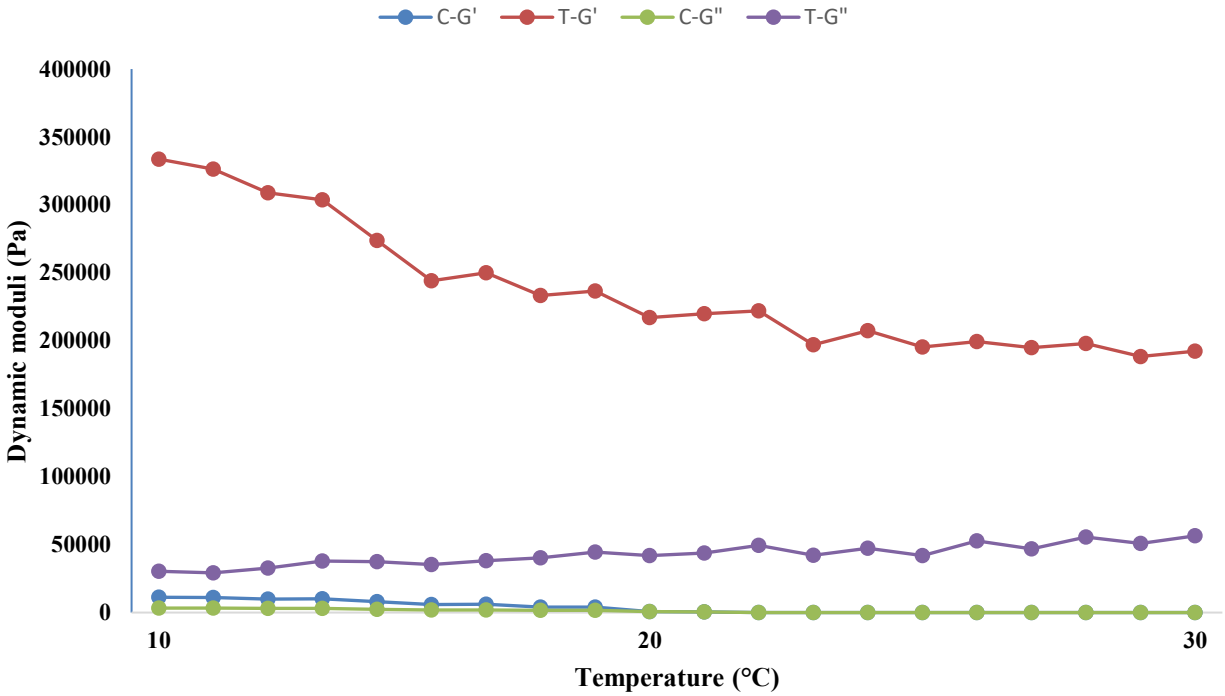


Fig. 1. Storage (G`) and loss modulus (G``) of goat frozen yoghurt as a function of temperature.

6.4.9 Institute Project: Development of Millet-based Goat Milk Products with Enhanced Functionality

Principal Investigator: Dr. Tarun Pal Singh

Co-Investigators: Dr. Arun Kumar Verma, Dr. V. Rajkumar, Dr. A.K. Dixit, Ashok Kumar

Formulation and storage evaluation of multi-millet cookies enriched with goat milk: This study investigated the effects of a modified cookies formulation (T1) compared to a control sample, focusing on chemical composition, physicochemical, colour values *(L*,a*,b*)*, textural, rheological, microbiological and sensory properties over a 150-day storage period. The results demonstrated that T1 exhibited significantly improved physical characteristics, such as higher weight (10.60 g vs. 9.89 g), diameter (3.79 cm vs. 3.58 cm), and spread ratio (2.80 vs. 2.60), indicating enhanced bulk, structural expansion, and product quality. Proximate composition analysis showed a reduction in fat content in T1 (21.69% vs. 27.99%) and an increase in protein (8.65% vs. 7.91%) and carbohydrate (64.25% vs. 59.71%) content, which may be attributed to ingredient modification or processing. Fatty acid profiling showed a healthier lipid composition in T1, with increased medium-chain and unsaturated fatty acids. Over a 150-day storage period, T1 demonstrated better moisture retention, a more stable pH, and lower free fatty acid accumulation, suggesting improved oxidative stability. Colour analysis indicated that T1 maintained higher lightness *(L*)* and exhibited controlled changes in redness *(a*)* and yellowness *(b*)*. Texture analysis showed a gradual softening trend, similar to the control. Antioxidant activity, measured through DPPH and ABTS assays, remained consistently higher in T1, indicating prolonged oxidative stability. Microbiological assessment revealed lower yeast and mould counts in T1, supporting its potential for extended shelf life. Sensory evaluation confirmed superior retention of colour, aroma, texture, and overall acceptability in T1. These findings suggest that the modified formulation enhances nutritional quality, stability, and sensory appeal, making T1 a promising alternative for improved cookies formulations.

Table 1: Effect of fat type on physical properties, proximate composition, and fatty acids profile of goat milk-millet biscuits (Mean±S.D.) *

Physical properties	Control	T_1
Weight (g)	9.89±0.58[a]	10.60±0.37[b]
Diameter (cm)	3.58±0.14[a]	3.79±0.07[b]
Hight (cm)	1.38±0.04[a]	1.36±0.04[a]
Spread ratio	2.60±0.06[a]	2.80±0.05[b]
Proximate composition		
Fat (%)	27.99±1.27[b]	21.69±1.37[a]
Protein (%)	7.91±0.18[a]	8.65±0.45[b]
Ash (%)	1.65±0.02[a]	1.75±0.02[b]
Carbohydrate (%)	59.71±1.32[a]	64.25±1.70[b]
Fatty acids as percentage of total fatty acids		
C4:0, Butyric acid	1.39±0.06[b]	0.54±0.11[a]
C6:0, Hexanoic acid (Caproic acid)	0.03±0.01[a]	0.97±0.08[b]
C8:0, Octanoic acid (Caprylic acid)	0.37±0.02[a]	2.45±0.06[b]
C10:0, Decanoic acid (Capric acid)	0.34±0.02[a]	7.14±0.10[b]
C12:0, Dodecanoic acid (Lauric acid)	2.68±0.03[a]	8.42±0.10[b]
C14:0, Tetradecanoic acid (Myristic acid)	1.92±0.05[a]	9.21±0.16[b]
C15:0, Pentadecanoic acid (Pentadecylic acid)	0.00±0.00[a]	0.75±0.01[b]
C16:0, Hexadecanoic acid (Palmitic acid)	43.46±0.61[b]	25.59±0.28[a]
C16:1, Methyl-cis-9-hexadecenoate (Palmitoleic acid)	0.00±0.00[a]	0.57±0.01[b]
C17:0, Heptadecanoic acid (Margaric acid)	0.00±0.00[a]	0.59±0.01[b]
C18:0, Octadecanoic acid (Stearic acid)	15.18±0.32[b]	10.40±0.20[a]
C18:1 (*cis* 9) (Oleic acid)	25.11±0.70[b]	22.91±0.17[a]
C18:2 (cis 9,12), (Linoleic acid, n-6)	9.28±0.22[b]	8.88±0.09[a]
C18:3 (cis 9,12,15) (α-Linolenic acid, n-3)	0.24±0.02[a]	0.65±0.03[b]
C21:0, Methyl heneicosanoate (Heneicosylic acid)	0.00±0.00[a]	0.95±0.04[b]

n=3, *mean with different superscript letters with in each row and column indicate statistically significant differences in the respective parameters ($p<0.05$). C-control without millet, T_1- finger millets, T_2- sorghum, T_3 pearl millets flour

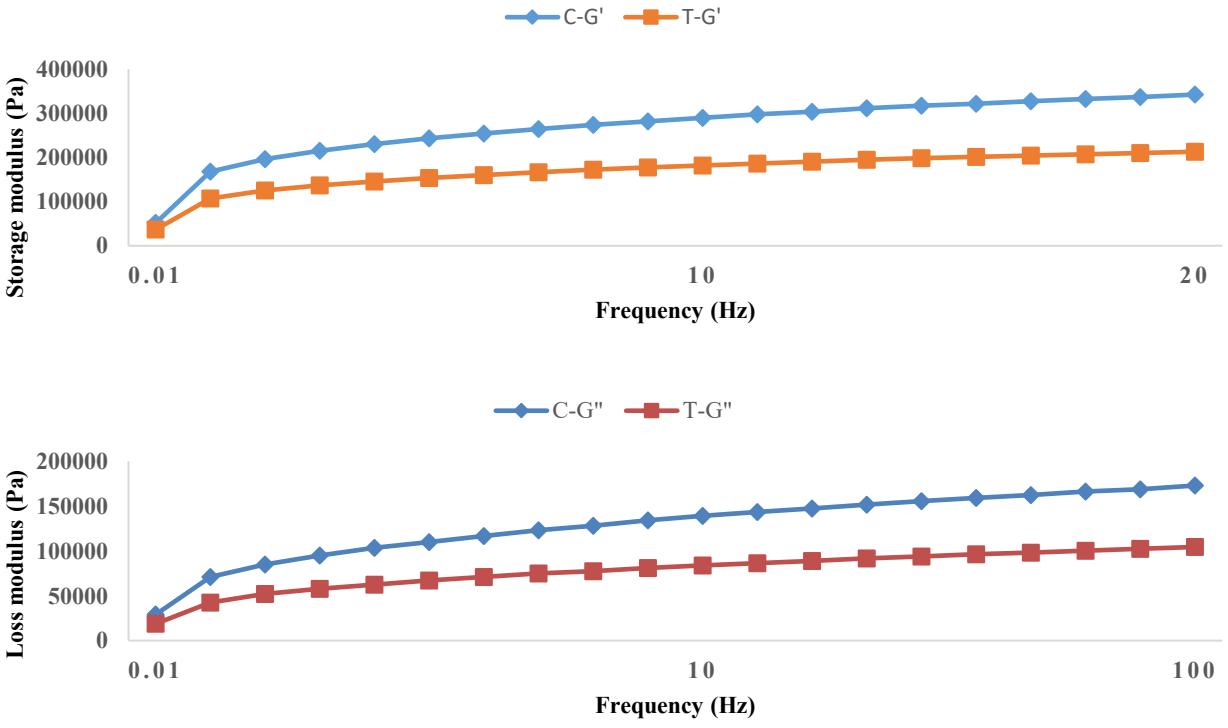


Fig. 1. Storage (G`) and loss modulus (G``) of goat milk-millet dough as a function of frequency

6.5 Disease Surveillance, Molecular Aetio-Pathology, Diagnostics and Medicine Development

6.5.1 Pathological and Epidemiological Investigation of Goat Diseases

Principal Investigator: Dr. Ashok Kumar

Co-Investigators: Dr. Anu Rahal, Dr. K. Gururaj, Dr. Nitika Sharma, Dr. A.K. Mishra, Dr. V. Chaturvedi

In Animal Health Division, facilities and infrastructure are available for the important infectious diseases affecting small ruminants especially goats and serve as diagnostic service provider for the institute as well as field samples of small ruminants across the country. The exhaustive list of diseases and various diagnostic tests available are as below:

- Johne's disease (Zn microscopy, JD iELISA, IS900 TaqMan probe PCR, IS1311 PCR-REA, mRNA multiplex TaqMan Probe RT PCR, Silver nano-immuno assay)
- Brucellosis (SAT, IgG-iELISA, IgM-iELISA, OMP31TaqMan probe RT PCR (BruTECT-SR™), Visual LAMP, triplex PCR for quick identification of *B. melitensis, B. abortus and C. burnetii*)
- Enterotoxaemia (EnteroLISA-ET™ –iELISA, ToxiScreen Pro™ –sandwich ELISA)
- *Coxiella burnetii* (IS1111 cPCR, Triplex PCR)
- Chlamydiosis (conventional 16srDNA PCR , SYBR green Real time PCR, mZN staining)
- *E. coli* pathotypes (Multiplex pathotyping PCR for EPEC, STEC/ETEC, EHEC, AEEC)
- Enteric viruses including Group A Rota virus (GARV), Group B Rotavirus (GBRV), Bovine corona virus (BCoV) (Multiplex reverse transcription PCR, Single tube multiplex Taqman probe real time PCR for quick detection of GARV, GBRV and BCoV)
- Enteric protozoans including *Eimeria* spp (ITS-1 and 18ssu cPCR, microscopy based OPG), Cryptosporidiosis (18ssu conventional PCR and REA, Triplex mRNA real time PCR, mZN staining)
- Cestode bladderworms like *Coenurosis gaigeri/cerebralis* (ND1 and Co1 cPCR, TM16p-iELISA), and differentiation with *Cysticercus tenuicollis* (*Taenia ovis*) etc.
- Antimicrobial screening laboratory (established under INFAAR project for selective screening of MRSA, VRSA for Staphylococcus spp; ESBL, ACBL and Carbapenam resistance for gram negative *Enterobacteriaceae*)

Achievements

- Total 2369 bio-samples were tested or different diseases and collected from different sources.
- Of 184 serum samples collected from livestock units for routine screening for brucellosis in goat and sheep (Both Male and female) revealed the zero positivity by SAT in goats and only sample was positive in sheep (0.66 percent positivity) .
- The biosample analysis collected from aborted females subjected for diagnosis of brucellosis based on SAT, revealed zero positivity (0/10 samples).
- **Zero Brucellosis in goat at ICAR-CIRG:** Continuous monitoring of brucellosis has been undertaken since 2015 through testing using SAT, IgG ELISA, IgM ELISA, and OMP31 Taqman probe PCR on all breeding stock and newly acquired animals. As a result, Zero percent (0%) brucellosis-associated abortion cases across all livestock units and Zero percent (0%) prevalence of brucellosis in all goat-based livestock units. Animals identified as positive at early stages are promptly quarantined and disposed of according to World Organisation for Animal Health (WOAH) guidelines.
- A total of 2145 faecal samples were subjected for parasitological examination, of which 7.64% (167/2185) were clinical positive for bursate, 5.08 % (111/2185) for coccidian output having OPG above 2000.

Study on causes and pattern of mortality in goats during 2024: A total of 204 animal carcasses were necropsied during the period 2024-25, The causes of deaths diagnosed were pneumonia (32.35 %), enteritis (20.1 %), Bloat (7.3%) , haemonchosis (2.9 %), weakness/debility (8.8 %), acidosis (1.4 %), hepatitis (2.4 % each), septicaemia (11.27 %), and others (13.48 %) including autolysis, urolithiasis, peritonitis, inanition, starvation, Pregnancy toxaemia, Toxaemia , JD , Toxaemic septic metritis, gid etc. Age-wise, highest mortality was recorded in 3-6 months (33.33%; 68/204) followed by adults (30.88 %; 63/204), 0-3 month age group (56/204,

27.45 %), and 6-12 months (8.33%; 17/204) age group.

Health activities performed for the Institute animals during 2024: Among health activities, 3462 deworming, 3150 dipping, 196 coccidiostat, 12294 vaccination, and 5229 treatments were performed in the institute farm animals. Various diseases inflicted the animals during the year 2024 and the details of morbidity are shown in Table. amongmorbid animals, the highest animals were affected with diarrhoea (63.3%) followed by fever/anorexia (11.1%), wound/abscess (10.8 %), lameness (5.4%), weakness (2.3%), bloat/tympany (1.18%), pneumonia (0.78 %), and others (5.14%) including ecthyma, urine retention, udder odema, mange, fracture, abortion, corneal opacity.

Table 1: Preventive health measures taken at ICAR-CIRG during 2024

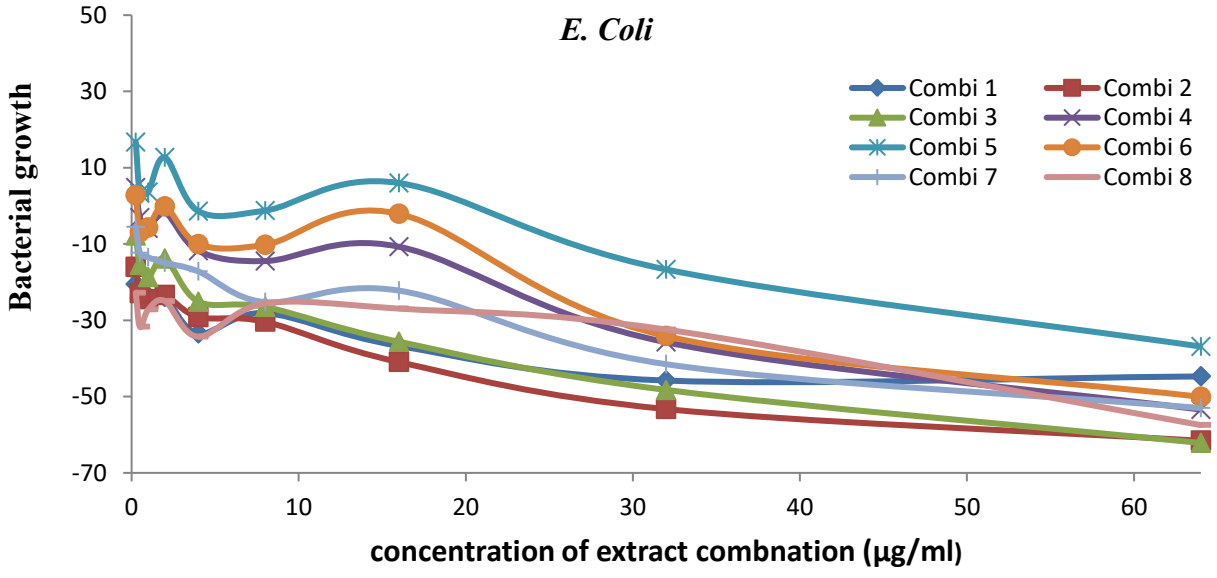
Sl. No.	Name of operation	Jamuna-pari unit	Barbari unit	Jakhrana unit	Sheep unit	APR	ANMPT	Animal Health	Total
1.	Deworming	587	1391	328	427	507	93	129	3462
2.	Dipping	811	942	260	474	520	107	36	3150
3.	Coccidiostat	93	98	0	0	0	0	5	196
4.	Vaccination:								
	Bio-vac (FMD+HS)	359	546	88	560	78	56	83	1770
	ET (with Booster)	1493	1644	653	1609	742	361	184	6686
	PPR	181	294	86	361	60	100	35	1117
	Goat pox	589	606	252	0	299	364	56	2166
	Sheep Pox	0	0	0	555	0	0	0	555
5.	Treatment	1456	1706	514	823	469	254	7	5229
	Total								

6.5.2 Herbal Adjunct for Increasing the Efficacy of Commonly used Antibiotics in Animal Practice

Principal Investigator: Dr. Anu Rahal

Co-Investigator: Dr. K. Gururaj

Using in silico molecular docking studies, eight herbal combinations were selected for dose evaluation. These combinations were used in the 2-fold dilution in the range of 64-0.25 µg/ml against a fixed dose of chloramphenicol against routine laboratory cultures of *S. aureus* and *E. coli* as well as fresh clinical isolates from the Human hospital.



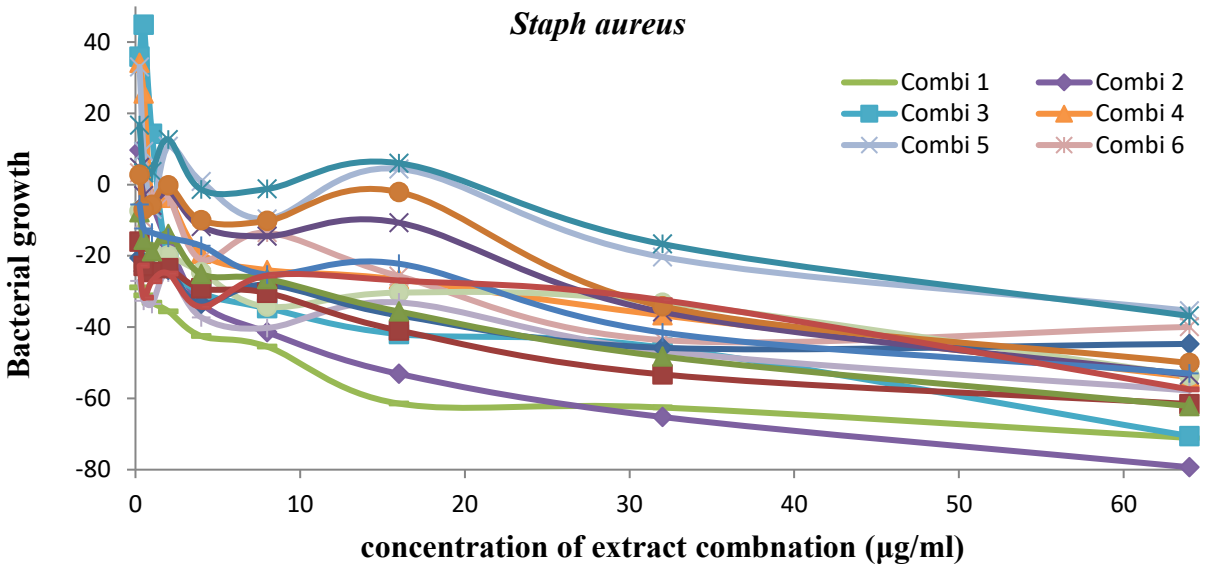


Fig. 1. Comparative effect of herbal extracts and their combination (µg/ml) on the growth of MRSA culture in presence of antibiotics

Use of ATR-FTIR be used to screen E coli for resistance: Four resistant ESBL E coli strains (known ABST) & ATCC25922 (non ESBL) were cultured in LB broth and 0, 1, 2, 3, 4, 5, 6, 7, 10, and12 h post incubation at 37C, 5 ml of broth withdrawn and centrifuged. 4 µl of the pellet was placed on Diamond crystal and infra-red spectra were obtained using an attenuated total reflectance accessory (ATR) at Fourier Transform Infrared Spectrophotometer (Thermo Scientific Nicolet iS10 FTIR Spectrometer). The spectra were collected from 4000 to 400 cm−1, with 4 cm−1 resolution and 32 scans. Temporal differences were observed in the spectra which correlated well with ABST pattern & growth curve of the strains.

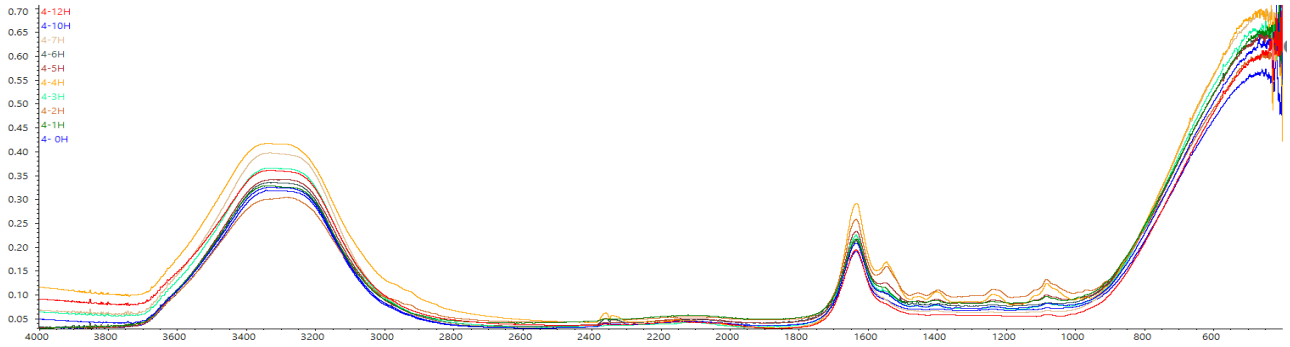
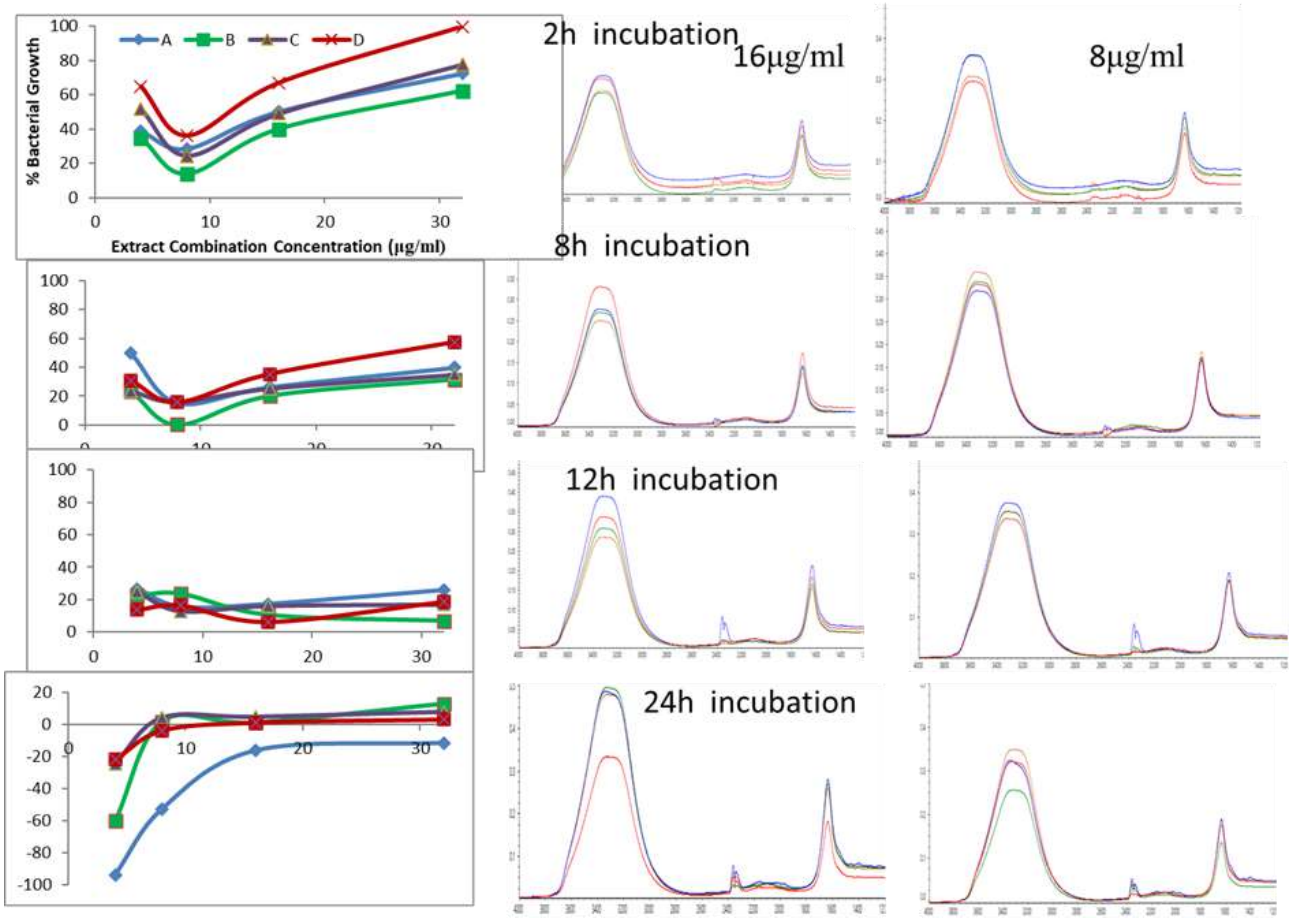


Fig. 2. Representative infra-red absorption spectra of strain 4 at different incubation period

The best four combinations were tested for time and concentration dependent antibiotic activity enhancement potential in the concentration range of 4-32µg/ml against a fixed dose (8 µg/ml) of chloramphenicol against *E. coli*. Attempts were made to study the change in bacterial metabolic activity in the presence of these extract combinations.



In vitro studies of herbal product for Orf: The protein structures derived from the resistant isolates were docked with sixty-eight phytochemicals. These sixty-eight molecules were further subjected to drug likeliness studies. Various physicochemical properties were calculated on the basis of their structure. Based on the drug likeliness results, sixteen plants bearing the best possible combination of these phytochemicals were selected and extracted (alcoholic) for in vitro studies. The extracts were sterilized by UV radiation. Working solutions in the concentration of 20, 30, 40, 50, 100, 200, 500 µg/ml were prepared for all extracts in Leibovitz's L-15 media. MTT assay was performed to assess the percent viability of MDBK cells at each concentration. In vitro efficacy of the different extracts was also assessed against LSD Virus Infection in MDBK cells.

6.5.3 All India Network Programme 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-Investigators: Dr. Ashok Kumar, Dr. Ravindra Kumar, Dr. Anu Rahal, Dr. K. Gururaj, Dr. Anil Kumar Mishra

Patho-epidemiological studies on the gastrointestinal parasitic infections-Coccidiosis in goats: A total of 2185 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 2185 faecal samples subjected for parasitological examination, 23.52% (514/2185) were positive for coccidia. A

total of 5 kids received for necropsy were diagnosed as coccidiosis based on gross pathology of intestines. Tissue samples from different segments of intestines were collected from all the cases in 10% buffered formalin, processed for histopathology and 4-5 µm paraffin sections were stained with haematoxylin and eosin.

Table 1: Pathology of Caprine Coccidiosis

Animal Number	History Age	Sex	Post Mortem Findings	Part of intestine showed whitish nodules on the mucosa	Histopathological lesions and severity of distribution of lesions
1	6 M	F	Enlargement and congestion of liver with distended gall bladder, thickening of intestinal mucosa with mild congestion	Jejunum and Ileum	Multifocal involvement, Intestinal mucosa revealed presence of different endogenous stages of Eimeria spp with diffuse cellular reaction comprised of MNCs
2	2-3 M	M	Presence of pale yellowish to red foci on the mucosa which were visible from serosa in ileum only	Ileum	Focal involvement, Endogenous stages present at some places but not severe
3	2-3 M	F	Diffuse congestion of all the segments of small intestine, thickening and oedema of mucosa with the presence of many small reddish nodules.	Duodenum, Jejunum and Ileum	Multifocal and scattered involvement, Endogenous stages of Eimeria spp. with diffuse villous and cryptic hyperplasia and diffuse cellular reaction and congestion.
4	5 M	F	No characteristic lesions and absent of white nodules on the mucosa	---	Focal, presence of few oocysts and other stages, no cellular reaction
5	8 M	M	Thickening and oedema of intestinal mucosa, congestion of liver	Caecum and colon	Focal, presence of endogenous stages with no cellular reaction but epithelial hyperplasia was evident.

Fig. 1. Numerous nodules of 2-3 millimetres in diameter on the thickened and oedematous intestinal mucosa in kids infected with Eimeria spp.

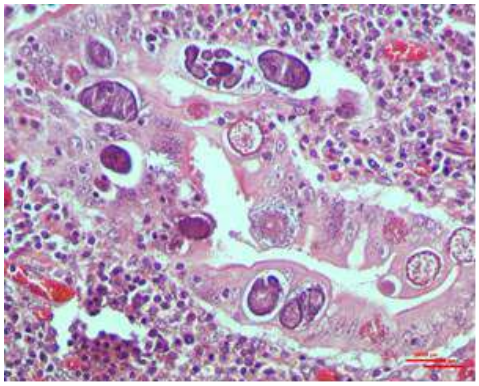


Fig. 2. Various stages of Eimeria spp. replicating in intestinal villous and cryptic epithelia of small intestine in kids affected with coccidiosis. X400, H&E.

Screening of plants for their anti-coccidial potential: The anti-coccidial potential of 12 plants chosen on the basis of ethno-veterinary literature was assessed in extract form. In clinical instances of coccidiosis, the ethanolic and hydro-alcoholic extracts had the strongest anticoccidial efficacy. The anticoccidial activity of the herbal extracts was evaluated in weaned goat kids (3-6 months of age), clinically infected with coccidiosis with FOC > 3000-4000. The clinically affected goat offspring were given a semi-liquid herbal extract (15 mg/kg body weight + inert material + water) orally for five days. The anticoccidial activity of the herbal extracts was evaluated 2–5 days after therapy. Hydro-alcoholic extracts of leaves of ICAR-CIRG_Plant XI & XII and seeds of ICAR-CIRG_Plant IX & X (names of plants coded) showed good anti-coccidial potential. In weaned goat kids, feeding these two herbal extracts increased the production metrics and decreased the FOC. These two extracts were therefore chosen to proceed with the formulation of the herbal anti-coccidial mixture. Examining the weaned kids after therapy using haematological, biochemical, pathological, and clinical methods showed that herbal extracts had no negative effects on their health.

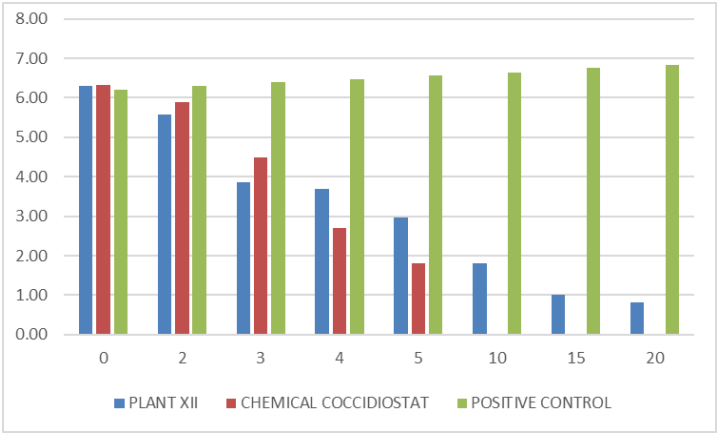


Fig. 3. Effect of hydro-alcoholic extract of leaves of ICAR_CIRG Plant XII on the Log transformed Coccidian OPG value in weaned goat kids (3-6 M)

Fig. 4. Anti-coccidial herbal prototype formulation

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.

Creating awareness about the ethno-veterinary practices among the goat keepers and small ruminant stake holders through national training programmes, DAPSC/DAPSTC sponsored training programmes: Exposure visits for farmers, goat keepers, and small ruminant stakeholders to the ICAR-CIRG Medicinal Garden were organized during National Training, as well as under DAPSC- and DAPSTC-sponsored training programmes on "Scientific Goat Farming." These visits aimed to raise awareness about the application of ethno-veterinary practices in goat farming. Additionally, efforts to promote these traditional practices among goat keepers and small ruminant stakeholders were done on DD Kisan's "Agri Ki Udaan" programme.

6.5.4 Metabolic Diseases and Control Strategies in Goats in Organized and Free-Range Farming

Principal Investigator: Dr. Nitika Sharma

Co-Investigators: Dr. Ashok Kumar, Dr. Ravindra Kumar, Dr. Anil Kumar Mishra, Dr. M. K. Singh, Dr. A. K. Dixit

Metabolic diseases in goats pose significant challenges to productivity and overall herd health. These disorders often result from nutritional imbalances, stress, and physiological demands related to reproduction and lactation. Given the variation in management practices, particularly between organised and free-range farming systems, there is a need to assess the metabolic health of goats and develop appropriate control strategies. The aim of this project is to address this gap through a comprehensive study of metabolic profiles and disease management protocols. A questionnaire was developed in English and Hindi to collect information regarding metabolic diseases from goat keepers, veterinarians, paravets and other small ruminant stakeholders. Across various farming systems, pregnancy toxaemia and ketosis were identified as the most common metabolic disorders in female goats, while urolithiasis was the most prevalent in male goats.

Table 1: Comparative prevalence of pregnancy toxaemia in different management systems

Management System	Prevalence (%)	Key Risk Factors
Intensive	8–15%	Overfeeding, multiple foetuses, obesity
Semi-Intensive	3–8%	Nutritional imbalance
Extensive/ Free range Farming	2–6%	Undernutrition, poor forage availability

Prevalence of sub-clinical ketosis: A total of 36 blood samples were collected from female goats of Jamunapari (18) and Barbari (18) breeds in different physiological states *viz.* pregnant and lactation for haematology and metabolic profiling. Results of metabolic profiling are shown in Table below. The status of the negative energy balance (NEB) in the goats of the aforesaid breeds was determined by estimation of glucose, BHBA and NEFA in the serum. In the present study, the animals found hypoglycaemic (<2mmol/l glucose), hyperketotic (BHBA > 3 mmol/l), NEFA > 0.4 mmol/l were considered to be in NEB (ketotic). Overall prevalence rate of subclinical ketosis among the goats was determined as 25 % (18/72). The goats of Barbari breed demonstrated highest prevalence rate of subclinical ketosis 27.77% (10/36) followed by Jamunapari goats 22.22 % (8/36). Variations of energy biochemical metabolites during peri-parturient phase were studied. BHBA and NEFA concentrations significantly increased while glucose level significantly decreased during pregnancy and peri-parturient phase in comparison with the non-pregnant non-lactating state.

Table 2: Details of Sample collected and does found positive for 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
36	10	36	8	72	18
Percent Positive- 27.7%		**Percent Positive- 22.22%**		**Percent Positive- 25%**	

Table 3: Metabolic Profile of goats in different physiological states

Parameters	Non-pregnant & non-lactating	Range	Pregnancy	Lactation	*P* value
Hb (g/dl)	11.07 ± 0.5	8-12	6.84 ± 0.38	7.30± 0.19	<.0001
BHBA (mmol/l)	0.72±0.31	0.2-3.6	0.169±0.33	0.281±0.03	<.0001
NEFA (mmol/l)	0.166±0.33	0.14-0.72	0.389±0.26	0.280±0.27	0.0254
Glucose (mmol/l)	3.85±0.84	2.64-4.18	2.493 ±0.26*	2.94 ±0.07	0.0004
Urea (mg/dl)	25.02±0.68	13-26	27.75±1.68	25.24±2.68	.0621
Total Protein (g/dl)	6.9±0.086	6-7.5	4.8±0.44	6.84±0.186	<.0001
AST (U/l)	17.19±0.63	66-230	90.58 ±0.41	96±0.91	<.0001
Calcium (mg/dl)	10.42±0.26	9-12	7.22 ±0.61	6.03±0.86	0.008
Phosphorus (mg/dl)	5.49±0.29	1.2-4.1	4.41±0.29	4.95±0.19	0.0394

Prevalence of Urolithiasis in Bucks under Organized Farming System

Age Susceptibility: Highest Prevalence: The 3–6 months age group exhibits the highest number of cases (9), indicating a critical period for monitoring. The majority of urolithiasis cases (16 out of 22) occurred in goats aged between 1 to 6 months, highlighting early life as a critical period for the development of this condition.

Age Trend: A marked decline in cases was observed in goats older than six months (3/33), indicating greater susceptibility among younger animals (19/33).

Breed Susceptibility: Barbari: Most cases occur in the 1–3 months age group (6/8). Jamunapari: Notable cases in the 3–6 months age group (5/7). Jakhrana: Cases were more prevalent in older age groups, including adults. Bundelkhandi: Fewer cases overall, with occurrences in the 9–12 months and adult categories.

Biochemical analysis: Increased BUN (40-54 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).

A folder on Metabolic diseases in goats for creating awareness about metabolic, nutritional and deficiency diseases has been prepared for distribution among small ruminant stakeholders.

Table 4: Urolithiasis-associated mortality in bucks maintained under an organized farming system at ICAR-CIRG Livestock Units (2023–2025)

Age Group	Barbari	Jamunapari	Jakhrana	Bundelkhandi	Total
1-3M	6	1	---	---	7 (7/22)
3-6M	2	5	2	---	9 (9/2)
6-9M	---	1	1	---	2 (2/22)
9-12M	---	---	---	1	1(1/22)
Adult	---	---	2	1	3 (3/22)
Total	8	7	5	2	22

6.5.5 All India Network Project on Antimicrobial Resistance (AINP-AMR) (ICAR-FAO Network Programme on Indian Network for Fishery and Animals' Antimicrobial Resistance)

Principal Investigator: **Dr. K. Gururaj**

Co-Investigators: **Dr. Anil Kumar Mishra, Dr. Ashok Kumar, Dr. Nitika Sharma**

During the reporting period (2024), 201 samples were collected and processed as per the standard operating procedure (SOP). Three out of the four districts committed in the sampling plan viz., Agra (n= 31), Mathura (n=84), and Etawah (n=86), were targeted. A total of eleven villages belonging to Six blocks of three districts of Uttar Pradesh were sampled. Bacteriological procedures were done as per the SOPs for two committed microbial organisms in animal science (SMD) which includes *Staphylococcus aureus* and *Escherichia coli* for anti-microbial resistance studies. Obtained a total of 201 isolates including 149 *E.coli* and 52 for *S. aureus* isolates were obtained and subjected to further AMR studies as per the SOP (Fig.1).

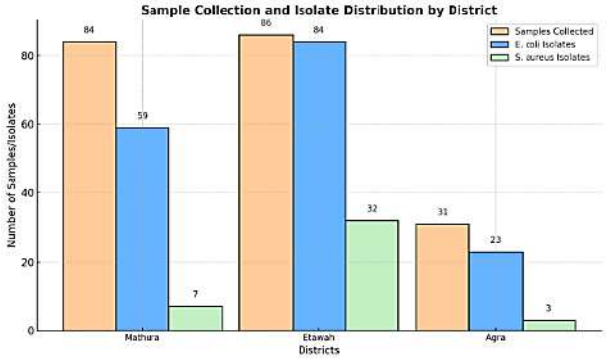


Fig.1. District-wise samples and Isolates taken for AMR study

***Staphylococcus* aureus and other *Staphylococcus* species isolated from biosamples and its AMR results:** All *Staphylococcus* species isolates underwent detailed characterization, including cultural and biochemical analyses such as coagulase, catalase, and mannitol fermentation tests. Molecular typing was conducted to confirm species identity. Furthermore, the isolates were evaluated for phenotypic antimicrobial resistance (AMR) through beta-lactamase production assessment, methicillin-resistant *Staphylococcus aureus* (MRSA) detection, and antimicrobial susceptibility testing. All testing procedures adhered to the recommended guidelines of INFAAR and the Clinical and Laboratory Standards Institute (CLSI), USA (formerly known as the National Committee on Clinical Laboratory Standards, NCCLS). Genotypic analysis included the detection of the *mecA* gene for MRSA resistance and *VanA/VanB* genes for vancomycin resistance. A trend of phenotypic and genotypic AMR isolates obtained for *Staphylococcus* species is provided in Fig.2 and Fig.3.

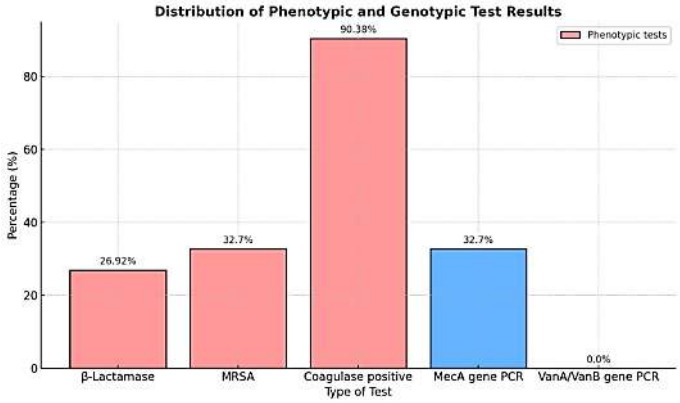


Fig.2. Proportion of phenotypic and genotypic resistance of *Staphylococcus* spp. during the reporting period (2024)

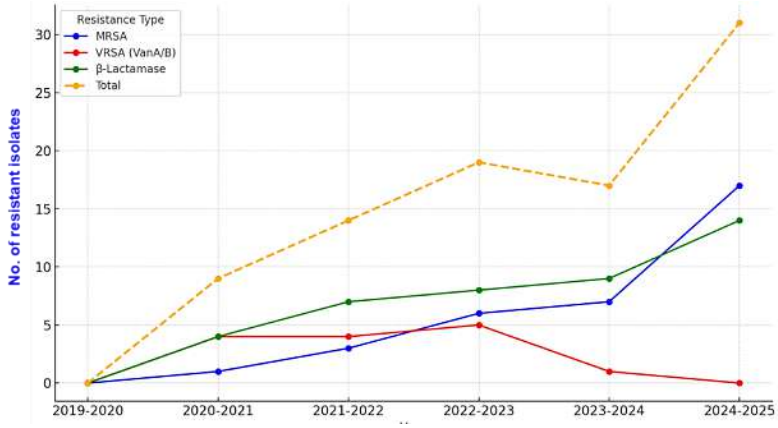


Fig.3. Year-wise resistance in *Staphylococcus* spp. obtained since last 6 years

***Escherichia coli* Isolation from Biosamples and Antimicrobial Resistance (AMR) Analysis:** Among Gram-negative bacteria, Escherichia coli has been extensively studied for its antimicrobial resistance (AMR) characteristics. This study involved a detailed evaluation of AMR profiles using both phenotypic and genotypic resistance assays to assess its antimicrobial susceptibility and resistance mechanisms.

Phenotypic and Genotypic Characterization of Antimicrobial Resistance in *Escherichia coli*: The phenotypic detection of extended-spectrum beta-lactamase (ESBL) production in *Escherichia coli* was performed using a combined approach involving the disk diffusion method and the double disk synergy test. The antibiotics ceftazidime, cefoxitin, and their combinations with clavulanic acid (ceftazidime-clavulanic acid) and cloxacillin (cefoxitin-cloxacillin) were employed for this assessment. In addition to ESBL detection, AmpC-β-lactamase (ACBL) typing and Imipenem minimum inhibitory concentration (MIC) testing were systematically conducted to evaluate resistance profiles and the same is presented in Figure 4 for the reporting period viz., 2024.

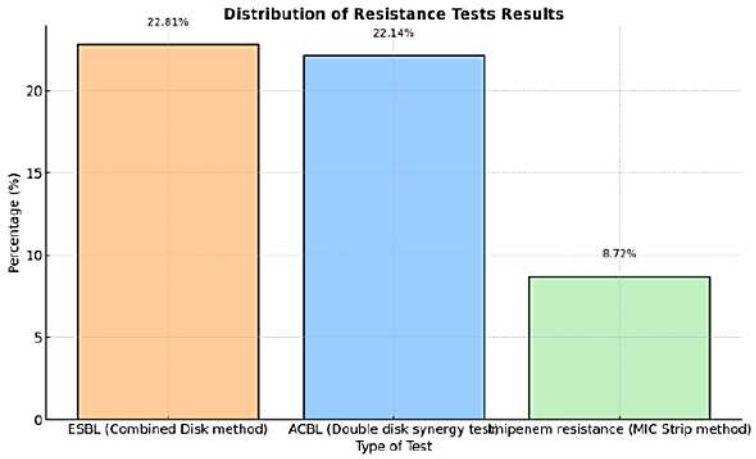


Fig.4. Proportion of phenotypic resistance of *Escherichia coli* during the reporting period (2024)

For molecular characterization, *E. coli* isolates underwent multiplex PCR-based assays for species confirmation (*E. coli* confirmation multiplex PCR) and pathotyping multiplex PCR to identify virulence genes. Additionally, PCR-based genotypic tests were conducted for *AmpC* gene detection, ESBL detection (multiplex-I, multiplex-II, and multiplex-III assays), and carbapenemase resistance determination with results for the period 2024 illustrated in Figure 5.

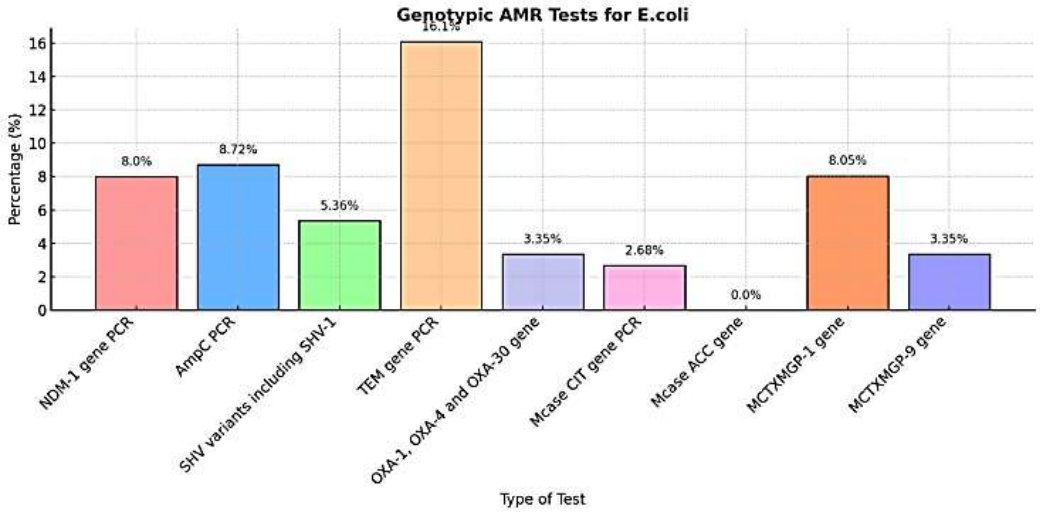


Fig.5. Proportion of genotypic resistance of Escherichia coli during the reporting period (2024)

The occurrence of antimicrobial resistance (AMR) was assessed across all tested samples. Samples exhibiting high-frequency AMR patterns, as determined through both phenotypic and genotypic assays, are systematically summarized in comprehensive six-year trend analysis resistance parameters in Figure 6, illustrating resistance trends over the study period.

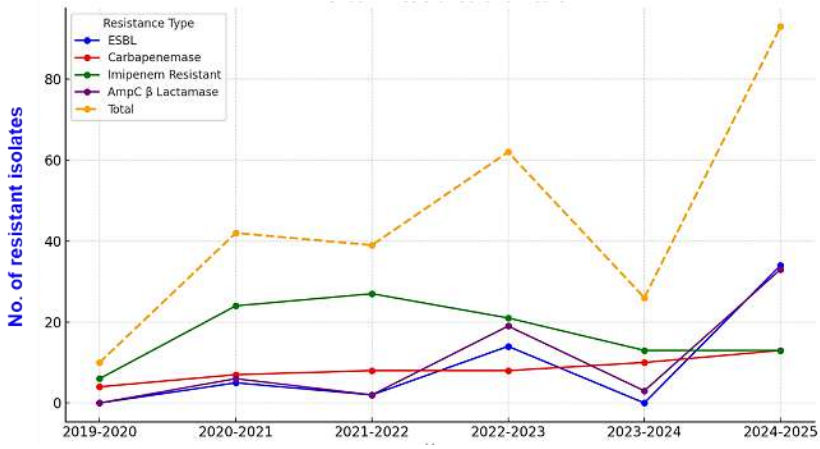


Fig.6. Year-wise resistance in *Escherichia coli* obtained since last 6 years

6.5.6 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

Principal Investigator: Dr. K. Gururaj

Co-Investigator: Dr. A.K. Mishra

A strategic approach was employed by selecting and combining highly immunogenic regions using a combination of bioinformatics tools, including ABCpred, Discotope, and VAXIJEN. The process began with the extraction of nucleotide and protein sequences of toxins (ETX and CPB2) from the NCBI database. A BLAST analysis is then performed to detect any homology with different taxa of goat species available in the NCBI database to avoid autoimmunity. Antigenicity analysis is conducted using the VaxiJen 2.0 web tool, followed by the extraction and refinement of the 3D structure using Phyre 2.2 and GalaxyRefine tools. The refined structures undergo Ramachandran analysis for structural validation. B-cell epitopes are selected using SVMTriP and IEDB, while MHC-I and MHC-II epitopes are identified with suitable alleles using IEDB. The selected epitopes are screened for antigenicity, allergenicity, and toxicity using VaxiJen 2.0, AllergenFP v1.1, and Toxinpred, respectively. Suitable linkers and adjuvants are chosen, and the MEV is constructed by linking the selected epitopes in an appropriate conformation. Physicochemical properties, including molecular weight, extinction coefficient, isoelectric point, net charge, solubility, and hydropathy, are analysed. The MEV is further screened for antigenicity, allergenicity, and toxicity, and its secondary and tertiary structure is analysed. Reverse translation and codon optimization are carried out for efficient expression. To confirm the native folding of key toxins, proteomic analyses such as circular dichroism (CD) will be performed on the purified fusion protein. This highly immunogenic multiepitope vaccine (MeV) candidate demonstrated the ability of antisera to detect and neutralize the toxicity of crude extracellular toxins from *Clostridium perfringens* suggesting its potential as an effective multiepitope subunit vaccine. Finally, in silico cloning is performed in an appropriate vector, and primer designing is completed for experimental validation.

Table.1: Final selected epitopes for beta-2 toxin

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	82	90	NQQLKSFEI	9	1.1202	NA*	NT**
MHC-I	77	85	FKYDPNQQL	9	1.1543	NA*	NT**
MHC-I	188	196	RQYATSGSR	9	1.2120	NA*	NT**
MHC-I	141	149	GKYILTPSF	9	0.7738	NA*	NT**
MHC-II	75	89	EDFKYDPNQQLKSFE	15	0.5921	NA*	NT**
MHC-II	54	68	ISPMKASAKEIDAYR	15	0.6970	NA*	NT**
MHC-II	138	152	ENEGKYILTPSFRTQ	15	0.6819	NA*	NT**
B Cell	197	207	DLKVEYSVVDH	11	1.6069	NA*	NT**
B Cell	76	86	DFKYDPNQQLK	11	1.2678	NA*	NT**
B Cell	122	127	SKDGKL	6	1.9426	NA*	NT**
B Cell	5	24	ISKFTVIFMFSCFLIVGAIS	20	0.5920	NA*	NT**
B Cell	59	104	SEDERVNNVEQYREMLEDFKYDPN QQLKSFEILNSQKSDNKEIFNV	46	0.5655	NA*	NT**
B Cell	93	100	SQKSDNKE	8	2.3177	NA*	NT**

Table 2: Final selected epitopes for ETX

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	129	137	EQKLKSQSF	9	1.0308	NA*	NT**
MHC-II	154	168	GTSIQATAKFTVPFN	15	0.9296	NA*	NT**
MHC-II	311	325	DSNIVKYRSLSIKAP	15	0.9516	NA*	NT**
MHC-II	117	131	VGKALLTNDTQQEQK	15	0.5386	NA*	NT**
B Cell	303	325	VDKKEKSNDSNIVKYRSLSIKAP	23	1.0679	NA*	NT**
B Cell	304	310	DKKEKSN	7	1.9942	NA*	NT**
B Cell	102	121	PKVELDGEPSMNYLEDVYVG	20	0.6254	NA*	NT**
B Cell	124	133	NDTQQEQKLK	10	1.8738	NA*	NT**
B Cell	257	265	RNLNTNNVQ-Chain A	9	1.5219	NA*	NT**

Construction1 (rEBV1) - epsilon and beta-2 epitopes joined by linkers: The rEBV1 protein from the designed chimeric construct has 429 amino acids and a molecular weight of 44.86 kDa. It is identified as a probable antigen with an antigenicity score of 1.3854 (Fig.1). Additionally, it is predicted to be a probable non-allergen and non-toxic, making it suitable for vaccine development.

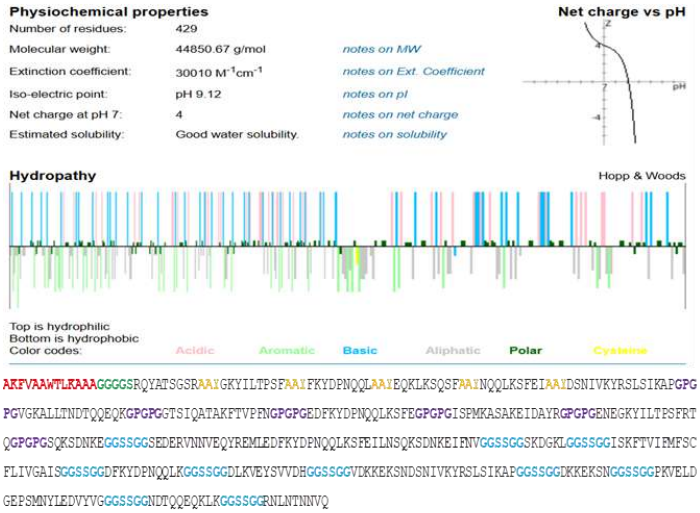


Fig.1. rEBV1 chimeric protein - its physicochemical properties

Confirmation of clones with rpET28a with DNA insert for tetravalent fusion protein: During the reporting period, a 420 bp ultramer encoding a tetravalent fusion protein interspaced by (GGGGS)4 linkers was constructed within a pET28(+) vector backbone for expression in the *E. coli* BL-21 DE3 system. Recombinant clones were selected, and the plasmid containing the DNA insert for the tetravalent fusion protein was extracted and confirmed. Expression of the 12.93 kDa tetravalent fusion protein was monitored using SDS-PAGE at 30-minute intervals post-induction, demonstrating successful protein production (Fig.2).

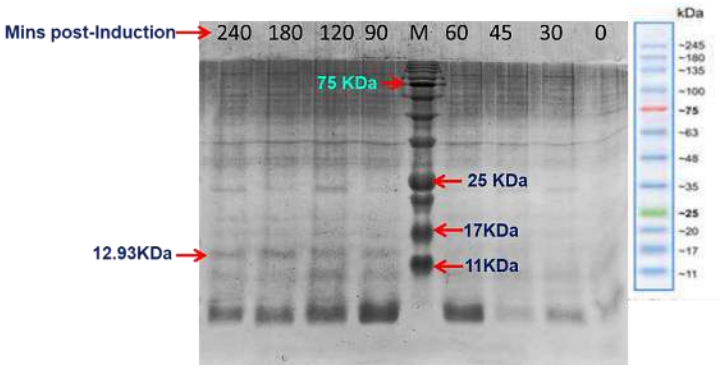


Fig.2. SDS-PAGE post induction at 30 min intervals for expression of 12.93KDa tetravalent fusion protein

Development of goat transcriptome web resource for enterotoxaemia (GoaTWR-E): During the reporting period, significant progress was made on the Goat Transcriptome Web Resource for Enterotoxaemia (GoaTWR-E). The database can be accessed through http://backlin.cabgrid.res.in/goatwr/index.php, and copyright has been applied (Fig.3). The database provides insights into the patho-epidemiological and molecular basis of enterotoxaemia in goats, caused by *Clostridium perfringens* toxins, particularly epsilon toxin (ETX). Transcriptomic data were generated from three groups: whole culture, trypsin-activated culture supernatant, and controls. Data were subjected to quality checks using FastQC, trimmed with Trimmomatic, and aligned using Bowtie and Tophat. Differentially expressed genes (DEGs) were identified and annotated using Cufflinks, BLAST2GO, and AgriGO to determine their cellular, molecular, and biological functions. A comprehensive database was developed, incorporating a MariaDB backend with PHP/MySQL, accessible through an interactive web interface built with AJAX/JQuery for easy retrieval and visualization of data. This resource aims to advance understanding of enterotoxaemia pathogenesis and guide vaccine development strategies, showcasing a pivotal achievement in goat health research.

Fig.3. Snapshot of the home page of GoaTWR-E database

6.5.7 Development of Phage based Therapeutic against Mastitis in Goats with Special Reference to *Staphylococcus Aureus* and *E. coli* Mastitis

Principal Investigator: Dr. Anil Kumar Mishra

Co-Investigators: Dr. Ashok Kumar, Dr. K Gururaj, Dr. Nitika Sharma

Data on clinical mastitis in Jamunapari, Barbari, and Jakhrana goats from April 1, 2010, to March 31, 2024, were compiled and analysed. The year-wise prevalence of clinical mastitis ranged from 1.12% (6/538; year 2010-2011) to 5.61% (25/446; year 2020-2021). The overall prevalence of clinical mastitis was found to be 3.17% (224/7059), with the highest prevalence in Barbari goats at 4.25% (141/3316), followed by Jakhrana (3.96 %; 37/934) and Jamunapari goats at 1.64% (46/2809). The highest cases of clinical mastitis were observed during the winter season (58.48%; 131/224), followed by the summer season (25.00%; 56/224) and the rainy season (16.52%; 37/224). The maximum cases of clinical mastitis were found in goats with parity 1 (39.29%; 88/224), followed by parity 2 (24.55%; 55/224) and parity 3 (16.96%; 38/224).

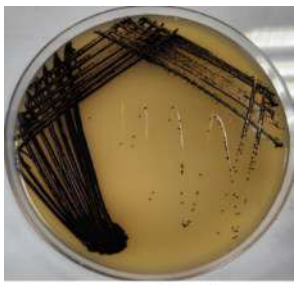
A total of 420 milking goats were screened for subclinical mastitis (SCM) using the California Mastitis Test (CMT) and Somatic Cell Count (SCC). Of these, 23 goats (5.47%) tested positive for SCM. Out of the cases of sub-clinical mastitis, *S. aureus* was detected in 14 cases, while *E. coli* was not detected in any samples. For clinical mastitis, 10 samples tested positive, with *S. aureus* identified in 6 cases, and *E. coli* again absent.

Out of 20 *S. aureus* isolates, vancomycin-resistant *S. aureus* (VRSA) was detected in 10 isolates through PCR, while 3 isolates were confirmed using the selective media. Methicillin-resistant *S. aureus* (MRSA) was identified in 4 isolates by PCR and in 13 isolates using the phenotypic test. Biofilm formation was observed in 3 isolates through PCR and in 2 isolates using the selective media. β-lactamase production could not be detected in any isolate through the phenotypic test. Regarding the coagulase reaction, 7 isolates tested positive, while 13 tested negative.

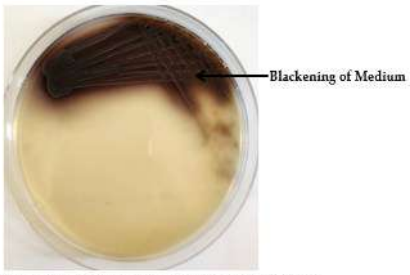
The antibiotics tested for sensitivity against *S. aureus* isolates included enrofloxacin, tetracycline, gentamycin, chloramphenicol, trimethoprim-sulfamethoxazole, penicillin and erythromycin. These antibiotics were evaluated for their effectiveness in terms of sensitivity, intermediate sensitivity, and resistance. Penicillin exhibited the lowest sensitivity, with only 1 isolate sensitive, none intermediate, and 18 isolates resistant. Enrofloxacin exhibited the highest sensitivity, with 16 isolates testing sensitive, 3 showing intermediate sensitivity, and none being resistant.

The MRSA and extended-spectrum beta-lactamase (ESBL)-producing *E. coli* were used as host bacteria for the isolation of *S. aureus* and *E. coli* phages. A total of 20 samples, including sewage, soil, and faeces, were collected for phage isolation. Out of 5 samples, only one *E. coli* phage isolate was successfully obtained, which was further purified and propagated.

E. coli Phage Showing Lysis in Spot Test



S. aureus on BP Medium



Vancomycin Resistant *S. aureus* on VRE Agar

6.5.8 Institute Project: Epidemiology of Pneumonia and Development of Package-of-Practices for its Control in Goats

Principal Investigator: Dr. Anil Kumar Mishra

Co-Investigators: Dr. Ashok Kumar, Dr. K. Gururaj, Dr. Nitika Sharma, Dr. M.K. Singh, Dr. Vinay Chaturvedi

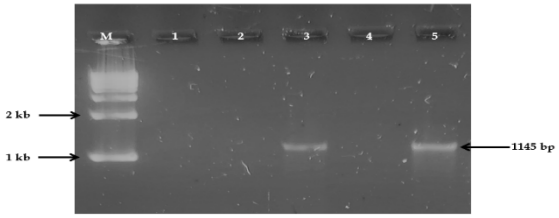
Data on pneumonia in post-mortem cases were compiled and analysed for the period spanning April 1, 2005, to March 31, 2024. Out of 2,654 post-mortem cases, 27.84% of deaths were attributed to pneumonia. The highest number of deaths due to pneumonia was observed in Barbari goats (29.96%; 326 out of 1,088), followed by Jakhrana goats (27.75%; 126 out of 454) and Jamunapari goats (25.81%; 287 out of 1,112). Number of deaths due to pneumonia was higher in male goats (32.86%; 346/1053) than in female goats (24.55%; 393/1601). The highest number of deaths was observed during the winter season (52.91%; 391/739), followed by the summer (29.23%; 216/739) and rainy seasons (17.86%; 132/739). Out of the total 739 deaths due to pneumonia, 80.38% (509/739) of deaths occurred in kids, while 19.62% (145/739) were reported in adults. Of the 80.38% of deaths in kids (0-12 months), 68.88% (509 out of 739) occurred in younger kids (0–6 months), while 11.5% (85 out of 739) were reported in older kids (6–12 months).

The overall mortality rate due to pneumonia in goats during the study period was assessed at 2.00% (739 deaths out of 36,937 goats). The highest mortality rate was observed in Jakhrana goats (2.97%; 126/4,235), followed by Jamunapari goats (2.51%; 287/11,442) and Barbari goats (1.53%; 326/21,260). Mortality rate was higher in male goats (2.61 % (346/13255) as compared to female goats (1.66 %; 393/23682). The mortality rate was higher in kids (2.66%; 594/22,290) compared to adults (0.98%; 145/14,647).

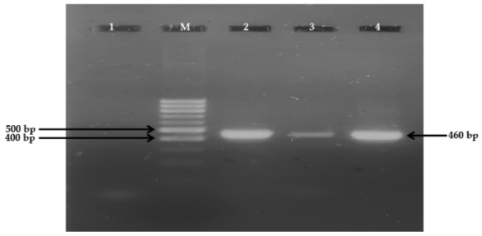
The overall morbidity rate due to pneumonia in goats during the study period was found to be 4.16% (1,106 cases out of 26,608 goats). The highest morbidity rate due to pneumonia was observed in Jamunapari goats (5.75%; 484/8,421), followed by Jakhrana goats (5.64%; 179/3,173) and Barbari goats (2.95%; 443/15,014). The morbidity rate was higher in male goats (5.83%; 550/9,442) compared to female goats (3.24%; 556/17,166). The morbidity rate was higher in kids (6.12%; 963/15,736) compared to adults (1.32%; 143/10,872). Among the total pneumonia cases, the highest occurrence was recorded in the winter season (56.78%; 628/1,106), followed by summer (33.91%; 375/1,106) and the rainy season (9.31%; 103/1,106).

To develop a clinical scoring system for caprine pneumonia, a format has been designed for recording clinical parameters related to the pneumonia. Data collection is currently ongoing at ICAR-CIRG farm clinics.

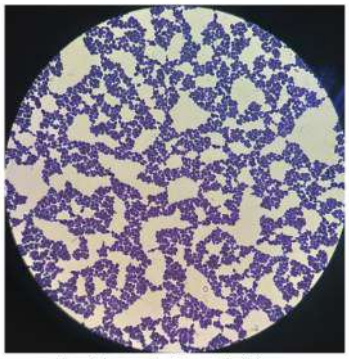
A total of 70 suspected biological samples (deep nasal secretions, pneumonic lungs etc.) were collected and processed for bacteriological isolation. *Staphylococcus aureus* was the most frequently isolated, with eight isolates, followed by *Mannheimia hemolytica* (seven isolates) and *Streptococcus* (six isolates). *Pasteurella multocida* was isolated from four samples, while *Pseudomonas aeruginosa* and *Escherichia coli* were isolated from three and two samples, respectively. In addition to the bacterial isolates, *Candida* spp. was isolated from one lung sample. Mixed bacterial infections were also observed in the caprine pneumonia-suspected biological samples. A combination of *Mannheimia haemolytica, Staphylococcus aureus,* and *Streptococcus* spp. was isolated from two samples. Additionally, co-infections of *M. haemolytica* and *S. aureus* were identified in one sample, while another sample exhibited the presence of *S. aureus* and *Streptococcus* spp.



Identification of *M. haemolytica* by PCR
Lane M: Molecular Weight Marker (1kb, Takara)
Lane 1: No Template Control
Lane 2: Negative Sample
Lane 3: Positive Sample
Lane 4 : Negative Control
Lane 5: Positive Control



Identification of *P. multocida* by PCR
Lane M: Molecular Weight Marker (100 bp)
Lane 1: No Template Control
Lane 2,3: Positive Samples
Lane 4: Positive Control



Candida **spp. in Gram Staining**

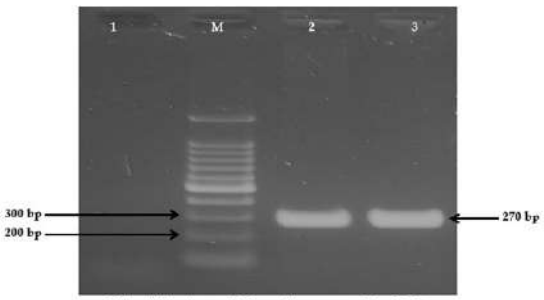
P. multocida **in Gram Staining**

6.5.9 All India Network Programme on Challenging and Emerging Diseases of Animals (AINP-CEDA): Goat and Sheep Mycoplasmosis

Principal Investigator: **Dr. Anil Kumar Mishra**

Co-Investigators: **Dr. Ashok Kumar, Dr. K. Gururaj, Dr. Nitika Sharma**

The manpower (Young Professional-I) approved under the project has been recruited, and the approved equipment (-20°C deep freezer) has also been purchased. A status paper titled "Status of Goat and Sheep Mycoplasmosis in India" was prepared and submitted to ICAR. Out of 10 pneumonic lungs screened, *Mycoplasma* spp. was detected in 5 lungs using genus-specific PCR.



Identification of *Mycoplasma* spp. by PCR
Lane M: Molecular Weight Marker (100 bp)
Lane 1: No Template Control
Lane 2: Positive Sample
Lane 3: Positive Control

6.6 Extension Interventions and Technology Dissemination for Sustainable Goat Production

6.6.1 NLM Project: Development of Goat Value Chain in Bundelkhand Region of Uttar Pradesh

Principal Investigator: Dr. A.K. Dixit

Co-Investigators: Dr. M.K. Singh, Dr. Ravindra Kumar, Dr. K Gururaj, Dr. B. Rai

Goat farming plays an important role in livelihood and nutritional security of goat rearing households in Bundelkhand region of Uttar Pradesh. 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. Besides assured income, employment and nutrition, goat- rearing supports crop production by proving cash for the purchase of critical inputs in financial distress and risk aversion in case of crop failure. Keeping the importance of small holders' goat value chain 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 under Project

Organised the Thirty *Kisan Gosthis*/field days in different adopted villages of Banda and Mahoba Districts.

The project beneficiaries were encouraged to adopt good management practices in their goat farming for better returns. Emphasis has been given to implementation of different activities/interventions on breeding, health, nutrition, housing, capacity building and market linkages. ICAR-CIRG also organized International Yoga Day, Vigilance awareness week, *Swacch Bharat Abhiyan, Kisan Diwas* and National Women Day programme in adopted villages of Banda and Mahoba District in adopted villages of Banda district.

Organised the door-to-door vaccination campaign against PPR and ET disease in adopted villages. Deworming was also performed in goats in these villages. About 2700 goats covered under these camps.

To improve farmers access to market and other government schemes/programme, 15 goats based Self Help Groups (SHGs) were developed with the help of local NGO Garmonnati Sansthan in Mahoba district. Meetings/ Kisan Gosthis was organized in these villages and farmers were aware on scientific goat farming.

To promote adoption of good feeding, breeding and nutrition practices among goat farmers, goat pallet feed -300 bags (50 kg each), mineral mixture -300 Kg., tub-190 nos., buckets-110 nos., plastic based low cost hanging feeder with waterer developed by CIRG (03 nos.). Dismantlable goat kids shelters were provided to two farmers. Technical literature developed at CIRG is distributed to 300 project beneficiaries.

To conduct the impact assessment study of technical interventions in goat production and mapping goat supply chain, a set of questionnaire schedules were developed and finalized.

Designed and Installed of Dismantlable Shelter for Goat Kids

The dismantlable kid shelter was designed by using 1.25 or one-inch iron angle as supporting frame with 1x2 inch iron mesh as filling material. The size of the kid house is eight feet by six feet; front elevation is six- feet -high and height at back is 5.5 feet for proper rainwater drainage. Out of 48 square feet floor area, 24 sq. foot (4 x 6 ft.) area is covered with plastic slat at one-foot-high so that the kids will have option to use the elevated floor or ground floor. The roof was made using improvised thatch with s bamboo framework for keeping the structure cooler even in hot summer. The structure can house around 20 to 25 kids of three-months age or 12 to 15 kids in the age group of 6 months old. Demonstration of dismountable Goat kid's cage in adopted villages of project area under NLM project ICAR-CIRG technologies demonstrated and provided to farmer *Plastic based Dismountable goat kid's cage* goat and discussed their benefits for goat farmers.

Media Coverage on Project Activities

बकरी पालन पर किसान गोष्ठी का हुआ आयोजन

अमर भारती ब्यूरो।

बांदा। राष्ट्रीय पशुधन मिशन द्वारा वित्त पोषित परियोजना बुंदेलखंड क्षेत्र में बकरी मूल्य श्रृंखला का विकास के अंतर्गत केंद्रीय बकरी अनुसंधान संस्थान मखदूम, मथुरा द्वारा बांदा कृषि एवं प्रौद्योगिकी विश्वविद्यालय बांदा के सहयोग से किसान गोष्ठी का आयोजन विश्वविद्यालय परिसर में जनिवार को किया गया।

जिसमें अलिहा, अमलोर, अटघार आदि गांव के करीब 30 बकरी पालकों ने बढ़ चढ़कर भाग लिया। इस अवसर पर बकरी पालकों को बकरियों के पोषण, बरसात में स्वास्थ्य प्रबंधन, कृत्रिम गर्भाधान का महत्व, नस्ल और प्रजनन प्रबंधन , सामान्य प्रबंधन एवं सफल विपणन आदि पर जानकारी प्रदान की गई। इस मौके पर विश्वविद्यालय के पशु चिकित्सा एवं पशु विज्ञान विभाग के सहायक प्राध्यापक डा.मयंक दुबे ने बरसात के दिनों में बकरियों का चारा प्रबंधन,आवास प्रबंधन एवं सामान्य प्रबंधन के बारे में बताया और बकरी पालन में बरसात में होने वाले प्रमुख संक्रमण रोग एवं उनसे बचाव के बारे में अवगत कराया। इस अवसर पर संस्थान के परियोजना कर्मी संदीप कुमार ने कृषकों को परियोजना के उद्देश्यों एवं इस वर्ष होने वाली गतिविधियों एवं बकरी पालन में बरसात में आने वाली प्रमुख समस्याओं को सुना और उनसे बचाव एवं रखरखाव की जानकारी दी। साथ ही बकरियों में टीकाकरण के महत्व को समझाया। साथ ही गांव - गांव जाकर पी. टी. का टीकाकरण अभियान परियोजना के तहत चलाया जा रहा है।कार्यक्रम के अंत में परियोजना के लाभार्थियों को बकरी दाना, पानी के लिए टब, सिंचरल मिक्सचर एवं तकनीकी साहित्य वितरित किया गया। इस कार्यक्रम का क्रियान्वहन परियोजना के अन्वेषक डा.अनुपम कृष्ण दीक्षित एवं सह अन्वेषकों के दिशा निर्देशानुसार परियोजना कर्मी संदीप कुमार एवं रामौतार द्वारा संपन्न किया गया।

सीआईआरजी ने किया वैज्ञानिक बकरी पालन पर किसान गोष्ठी का आयोजन

नैतिक आवाज

अस्थौन व रिवई में बकरी पालन समूह का हुआ गठन

महोबा। बीते 5 मई को ग्रामोन्नति संस्थान व केंद्रीय बकरी अनुसंधान संस्थान मखदूम फरह मथुरा उत्तर प्रदेश के संयुक्त तत्वाधान में महोबा जिले के चरखारी विकासखंड के ग्राम - अस्थौन एवं रिवई ग्रामों में बकरी पालन समूह का गठन किया गया द्य जिसका मुख्य उद्देश्य पशुपालन को बढ़ावा देना एवं किसानों को रोजगार प्रदान कर उनकी आजीविका को बढ़ाना। इन बैठकों में आधा सैकड़ा से अधिक किसानों ने सहभागिता की। जिसमें ग्रामोन्नति संस्थान की ओर से वरिष्ठ सलाहकार रुद्र प्रताप मिश्रा, महेश कुमार राजपूत , महेश चंद्र चौरसिया सहित सुंदरम सक्सेना आदि उपस्थित रहे।

वैज्ञानिक पद्धति से बकरी पालन की पालकों दी जानकारी

बांदा : सीआईआरजी मथुरा द्वारा कृषि एवं प्रौद्योगिकी विधि के सहयोग से बुन्देलखण्ड में बकरी मूल्य श्रंखला विकास कार्यक्रम के अन्तर्गत वैज्ञानिक ढंग से बकरी पालन करने पर किसान गोष्ठी का आयोजन विश्वविद्यालय परिसर में किया गया। जिसमें करीब 30 बकरी पालकों ने भागीदारी की। कृषि विधि परिसर में आयोजित बकरी पालन किसान गोष्ठी में अतिरा, अमलौर, अटघर आदि गांव के करीब 30 बकरी पालकों ने बढ़ चढ़कर भाग लिया। इस अवसर पर बकरी पालकों को बकरियों के पोषण, बरसात में स्वास्थ्य प्रबंधन, कृत्रिम गर्भाधान का महत्व, नस्ल और प्रजनन प्रबंधन, सामान्य प्रबंधन एवं सफल विपणन आदि पर जानकारी प्रदान की गई। इस मौके पर विश्वविद्यालय के पशु चिकित्सा एवं पशु विज्ञान विद्यालय के सहायक प्राध्यापक डा.मयंक दुबे ने बरसात के दिनों में बकरियों का चारा प्रबंधन, आवास प्रबंधन एवं सामान्य प्रबंधन के बारे में बताया और बकरी पालन में बरसात में होने वाले प्रमुख संक्रमण रोग एवं उनसे बचाव के बारे में अवगत कराया। इस अवसर पर संस्थान के परियोजना कर्मी श्री संदीप कुमार ने कृषकों को परियोजना के उद्देश्यों एवं इस वर्ष होने वाली गतिविधियों एवं बकरी पालन में बरसात में आने वाली प्रमुख समस्याओं को सुना और उनसे बचाव एवं समाधान की जानकारी दी। साथ ही गांव - गांव जाकर ई. टी. का टीकाकरण अभियान परियोजना के तहत चलाया जा रहा है। कार्यक्रम के अंत में परियोजना के लाभार्थियों को बकरी दाना, पानी के लिए टब, मिनरल मिक्सचर एवं तकनीकी साहित्य वितरित किया गया। इस कार्यक्रम का धन्यवाद परियोजना के अन्वेषक डॉ.अनुराग कुमार दीक्षित एवं सह अन्वेषकों के दिशा निर्देशानुसार परियोजना कर्मी संदीप कुमार एवं रामौतार द्वारा सम्पन्न किया गया।

सीआईआरजी ने किया वैज्ञानिक बकरी पालन पर किसान गोष्ठी का आयोजन

राष्ट्रीय प्रस्तावना न्यूज नेटवर्क

बांदा। राष्ट्रीय पशुधन मिशन द्वारा वित्त पोषित परियोजना बुंदेलखंड क्षेत्र में बकरी मूल्य श्रृंखला का विकास के अंतर्गत केंद्रीय बकरी अनुसंधान संस्थान मखदूम, मथुरा द्वारा बांदा कृषि एवं प्रौद्योगिकी विश्वविद्यालय बांदा के सहयोग से किसान गोष्ठी का आयोजन विश्वविद्यालय परिसर में शनिवार को किया गया। जिसमें अतिरा, अमलौर, अटघार आदि गांव के करीब 30 बकरी पालकों ने बढ़ चढ़कर भाग लिया। इस अवसर पर बकरी पालकों को बकरियों के पोषण, बरसात में स्वास्थ्य प्रबंधन, कृत्रिम गर्भाधान का महत्व, नस्ल और प्रजनन प्रबंधन , सामान्य प्रबंधन एवं सफल विपणन आदि पर जानकारी प्रदान की गई। इस मौके पर विश्वविद्यालय के पशु चिकित्सा एवं पशु विज्ञान विद्यालय के सहायक प्राध्यापक डा.मयंक दुबे ने बरसात के दिनों में बकरियों का चारा प्रबंधन,आवास प्रबंधन एवं सामान्य प्रबंधन के बारे में बताया और बकरी पालन में बरसात में होने वाले प्रमुख संक्रमण रोग एवं उनसे बचाव के बारे में अवगत कराया। इस अवसर पर संस्थान के परियोजना कर्मी श्री संदीप कुमार ने कृषकों को परियोजना के उद्देश्यों एवं इस वर्ष होने वाली गतिविधियों एवं बकरी पालन में बरसात में आने वाली प्रमुख समस्याओं को सुना और उनसे बचाव एवं समाधान की जानकारी दी। साथ ही गांव - गांव जाकर ई. टी. का टीकाकरण अभियान परियोजना के तहत चलाया जा रहा है।

6.6.2 ICAR Network Project: Impact Assessment of CIRG Developed Mineral Mixture '*Brijmin*'

CCPIs: **Dr. A. K. Dixit and Dr. Ravindra Kumar**

Minerals are essential components of a balanced diet. Their deficiency reduces the productivity of animals and susceptibility to disease.

Minerals play an important role in the body metabolism of animals thereby improving the fertility and productivity of livestock.

ICAR-CIRG developed BRIJMIN and distributed to different goat owners under DAPSC, DAPST and NABARD scheme to schedule caste and Schedule tribe beneficiaries.

Present study was conducted to assess the economic impact of mineral supplementation in goat farming and evaluate the resulting productivity gains and associated economic benefits.

A sample of 200 households were surveyed (100 beneficiary households and 100 non-beneficiary households, drawn from non-beneficiary villages, but similar in socio-economic characteristics as the beneficiary villages). An economic surplus model

was used to measure the benefits of mineral supplementation. Estimated change in total economic surplus and economic feasibility indicators revealed that B: C ratio in three different scenarios were 1.47, 1.56 and 1.86. Moreover, mineral supplements have the potential to improve live body weight productivity and also generate substantial economic welfare. Study suggests that government policies should facilitate the transfer of mineral supplement technologies to the private sector and strengthen distribution networks to improve its accessibility to farmers.

6.7 Development Action Plan for Scheduled Castes and Tribes

6.7.1 Income Improvement of Resource Poor Scheduled Caste Beneficiaries through Skill Development and Scientific Agricultural and Goat Production

Principal Investigator: Dr. Gopal Dass

Co-Investigators: Dr. Arvind Kumar, Dr. Nitika Sharma, Dr. A. K. Dixit, Dr. Mukesh Bhakat, Dr. Vijay Kishore, Dr. Ravi Ranjan

The socio-economic development and protection of scheduled castes from discrimination and exploitation have 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.

Input Distribution and Farmers Benefitted

S. No.	Input	Quantity	Beneficiaries		
			Male	Female	Total
1.	Goat feed	728 Quintal	907	380	1287
2.	Goat Feeder	119 Nos.	66	53	119
3.	Medicine kits	300 Nos.	173	127	300
4.	Mineral Mixture	4484 Kg.	765	470	1235
5.	Weighing balance	120 Nos.	91	29	120
6.	Hoof Cutter	373 Nos.	231	142	373
7.	Goats	69 Nos.	40	29	69
8.	Wheat seed	200 Quintal	442	58	500
9.	Mustard seed	20 Quintal	743	107	850
10.	Solar torch	88 Nos.	63	25	88
11.	Seed storage bins	63 Nos.	34	29	63
12.	Water bottles	86 Nos.	69	17	86
13.	Carry bags	488 Nos.	232	256	488
14.	Umbrella	388 Nos.	255	133	388
15.	Spade	400 Nos.	279	121	400
16.	Milk Can	300 Nos.	230	70	300
17.	Power Sprayer	110 Nos.	430	80	510
18.	Sewing Machine	100 Nos.	-	100	100
19.	Unnat Bakri Palan Books	45 Nos.	33	12	45
20.	Other literature	2400 Nos.	450	350	800

Fig. 1. Distribution of inputs to the project beneficiaries

Organization Of Trainings / Demonstrations / Health Camps / Exposure Visits

Trainings

Organised total of 12 trainings during the year 2024. Out of total, two were of five days, one was four days, four were of three days and five were of one day duration. In these training programmes, a total of 906 scheduled caste beneficiaries participated which constituted 598 male and 308 female participants. The training programme was on Assisted Reproductive Techniques and Scientific Goat farming in which participants were given the lectures on goat breeding, feeding, health management and also on marketing by the faculty of ICAR-CIRG, Makhdoom.

Demonstration

A total of 09 demonstrations were organized during year 2024. Out of total, 06 demonstrations were organized at livestock units, ICAR-CIRG, Makhdoom for 370 beneficiaries (213 males and 157 females) of 28 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 149 DAPSC beneficiaries (76 males and 73 females) of 14 villages of Agra & Mathura district of Uttar Pradesh and Bharatpur district of Rajasthan. 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 592 project beneficiaries (255 males and 337 females) of 25 villages of Agra & Mathura district of Uttar Pradesh and Bharatpur district of Rajasthan. During these camps, participants were 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.

Exposure Visits

During this year, a total of 10 Exposure Visits were organized for 1117 project beneficiaries (525 males and 592 females) of 16 villages of Agra & Mathura district of Uttar Pradesh and Bhaatpur district of Rajasthan. During visits, participants showed interest and asked many quarries 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 International Goat Day

The Vishwa Bakri Diwas was celebrated in the institute on 21.08.2024. For this programme, a total of 120 DAPSC project beneficiary's farmer (50 males and 70 females) were brought to the institute from adopted villages. All the participants were given the knowledge of scientific goat farming and contribution of the goats in rural livelihoods.

Organisation of Bakri Mahakumbh

During reporting year a Bakri Mahakumbh was organized in the Institute on 18.11.2024. This programme was attended by 600 DAPSC beneficiaries (200 males and 400 females) farmers. During the events farmer participants were also provided inputs to the goat production and exposure visit to the livestock units of the institute.

Preparation and Distribution of Varshik Bakri Palan Vivranika

Prepared Varshik Bakri Palan Vivranika 2025 which contained month wise activities of scientific goat farming. This Vivaranika was had advisories for goat farmers of goat farming for increasing productivity and reducing mortality. Prof. S.P. Singh Baghel, Honorable Cabinet Minister of Fisheries, Animal Husbandry, Dairying and Panchayati Raj, Govt. of India released this Vivranika on 27.01.2025 at ICAR-CIRG, Makhdoom. After release, it was distributed to DAPSC Project beneficiaries.

Impact Analysis of High Yielding Mustard & Wheat Seed

During reporting year, a total of 20.0 and 200.0 quintals of Mustard and wheat high yielding variety seeds were distributed to respectively 850 and 500 project beneficiaries for Rabi crop. Out of total, 50 beneficiaries of mustard seed and 100 of wheat seed beneficiaries were contacted, interviewed and recorded data of mustard & wheat production in their land. Based on data, the improvement in mustard yield ranged from 10.0 to 15% and in wheat production from 20.0 to 25.0%, respectively over the local seed varieties sown in the same villages.

6.7.2 Institute Project: Goat based Livelihood Improvement through Scientific Interventions in Tribal Districts under DAPST Scheme

Principal Investigator: Dr. A.K. Dixit

Co-Investigators: Dr. M.K. Singh, Dr. Gopal Dass, Dr. Ravindra Kumar, Dr. Ravi Ranjan, Dr. Khushyal Singh, Dr. Nitika Sharma

Goat farming is one of the important activities identified for poverty eradication and social equity among schedule cast and schedule tribe social class.

Central Institute for Research on Goats, is making efforts for income enhancement through scientific goat production and poverty reduction among the target population by capacity building / skill development.

Under the Development Action Plan for Schedule Tribe (DAPST), identified goat technologies and input distribution were made in four major states namely Uttar Pradesh, Madhya Pradesh, Rajasthan and Uttarakhand. Under this project one day training programme on Scientific goat farming, *Kisan Gosthi*, Farmers- Scientist Interaction, distribution of inputs were organised. The following activities have been carried out during the period of 2024-25. Project activities were organized in four states namely Rajasthan (Bharatpur, Karoli, Dhaulpur, Boondi districts), Madhya Pradesh (Tikamgarh, Shivpuri and Datia districts), and Uttar Pradesh (Lalitpur & Chitrakoot districts) and Uttarakhand (Rudrapur district).

Training programmes on scientific goat farming and input distribution programs (12) were organized in these states. The other activities include kisan gosthis (2), farm field school (1), exposure visits of kisan mela and CIRG (6), health camps (2) and workshops (2).

About 1300 goat farmers (majority of women goat farmers) received inputs and get benefited.

Input distribution include Traing kit- bag (604), pen (840), pad (848), Solar light (446), Hoof Cutter (200), Goat Pellet Feed (742), Flask bottle-334, Umbrella-838, Milkcane- 702, Mineral mixture-2166 kg., Plant saplings-2600, Technical literature-850, Vit. & Minerals-40 litrs, Lunch box-56 and Bakri Maha Kumbh Mela exposure visit -406 farmers.

6.7.3 NEH Component Programme

Nodal Officer: Dr. Arvind Kumar

Member: Dr. Ravi Ranjan, Dr. T.P. Singh

Organisation of Training Programme

Training on scientific goat farming and input distribution programme was organized for the goat farmers of Dirang (Arunachal Pradesh) on 27.11.2024 at ICAR-NRC on Yak. On this occasion the Director of ICAR- CIRG and the Director of ICAR- NRC on Yak were present. The training was attended by 100 goat farmers of nearby Dirang area. In this training the farmers were sensitized about local feed and fodder resources for proper nutrition, health management and vaccination schedule, and protection of goat kids from extreme cold weather of the reason.

Input Distribution to Goat Farmers

The inputs required for improving goat rearing were distributed to the goat farmers of Arunachal Pradesh. These inputs included adult pellet feed 18,000 kg, kid pellet feed 2000 kg, mash feed 2000 kg, mineral mixture 600 kg and medicine (Fentas plus 100 strips, Lorexane tube 100 Nos., Diarok Powder 200 packets), vaccines (Raksha goatpox 100 dose, Raksha ET 50 dose, Bloatosil Liq -100 ml).

Fig. 1. Input distribution to the goat farmers of Dirang

Establishment of Goat Based FLD Unit

An FLD unit on goats has been established at NRC on Yak for demonstration to the goat farmers and providing the goat progeny to the farmers of Arunachal Pradesh for promoting goat rearing and livelihood improvement in the NEH region.

Fig. 2. Goat based FLD unit established at NRC on Yak, Dirang

Organization of Exposure Visit of Nagaland Farmers

Exposure visit of 10 Nos. of progressive farmers of Nagaland was organized to ICAR-NEH, Nagaland Centre for demonstration and exposure to latest technology of hill farming at exhibition hall and interaction with scientists during National Conference held at ICAR-Nagaland Centre, Jharanapani on 29-30 November, 2024.

CHAPTER 7

RESEARCH PROJECTS

7. RESEARCH PROJECTS

A. Institute Funded Project

S. N.	Project No.	Title of the Project	Scientist Team
1.	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
2.	ANSC CIRG SIL 2021 008 00310	Herbal adjunct for increasing the efficacy of commonly used antibiotics in animal practice. additional objective: "Herbal Omnibus skin gel"	PI - Dr. Anu Rahal Co-PI(s) - Dr. K. Gururaj
3.	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(s) - Drs. Ashok Kumar, K. Gururaj, Nitika Sharma, M. K. Singh
4.	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)	PI - Dr. Gopal Dass Co-PI(s) - Drs. Nitika Sharma, A.K. Dixit, Arvind Kumar, Mohd. Arif (up to Jan, 2024), Ravi Ranjan, Vijay Kishore
5.	ANSC CIRG SIL 2023 004 00322	Development of Natural Farming based fodder production practices for Goats.	PI - Dr. Arvind Kumar (Since 30.01.2024) /Dr. Mohd. Arif Co-PI(s) - Drs. Ravindra Kumar, Arvind Kumar, K. Gururaj
6.	ANSC CIRG SIL 2023 003 00321	Evaluation of sheep wool for improving forage crop productivity.	PI - Dr. Arvind Kumar (Since 30.01.2024) /Dr. Mohd. Arif Co-PI(s) - Drs. Arvind Kumar, Ravindra Kumar, Gopal Dass
7.	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. Rajkumar, K. Gururaj, Tarun Pal Singh
8.	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. Rajkumar, Ashok Kumar, A. K. Dixit
9.	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. Rajkumar, Ashok Kumar, S. P. Singh
10.	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. M. K. Singh, Gopal Dass, Ravindra Kumar, Ravi Ranjan, Nitika Sharma, Khushyal Singh
11.	ANSC CIRG SIL 2024 004 00326	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
12.	ANSC CIRG SIL 2025 001 00331	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
13.	ANSC CIRG SIL 2025 002 00332	Status of reproductive ailments in goats reared under field conditions	PI- Dr. Yogesh Kumar Soni Co-PI(s) - Drs. S. P. Singh, Ravi Ranjan, Mukesh Bhakat, A. K. Dixit, Gopal Dass, A.K. Mishra

B. ICAR Funded Project

S. N.	Project No.	Title of the Project	Scientist Team
1.	ANSC CIRG COP 2015 001 00243	Component IV- Development of renewal energy-based fodder dryer cum winter protection shelter for goats.	PI - Dr. B. Rai Co-PI(s) - Drs. Arvind Kumar, Mohd. Arif (upto Jan, 2024), Y.K. Soni,
		Component V- Development of plastic based portable AI crates and improved hanging type feeders for drudgery reduction in goat farm.	PI - Dr. B. Rai Co-PI(s) - Drs. Ravi Ranjan, Arvind Kumar, S. D. Kharche (up 31.01.2024)
2.	ANSC CIRG COP 2022 007 00318	Outreach Program on Ethno vet Medicine	PI - Dr. Nitika Sharma Co-PI - Drs. Ashok Kumar, K. Gururaj, A. K. Mishra,
3.	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. Gopal Dass, R. Pourouchottamane (upto June, 2023), K. Gururaj, Ravi Ranjan, A. K. Verma, Vinay Chaturvedi (Since 18.06.2021), M. S. Dige
4.	ANSC CIRG COP 2021 009 00311	**ICAR- NBAGR:** Coordinated Research Project (CRP) Agrobiodiversity.	PI - Dr. S.P. Singh (Since 01.02.2024) / Dr. S.D. Kharche (till 31.01.2024) Co-PI - Dr. Y. K. Soni,
5.	ANSC CIRG CIL 2019 002 00284	**ICAR- FAO:** Joint project network "Indian network for fishery and animal antimicrobial resistance" (INFAAR) - ICAR- CIRG Collaborating centre.	PI - Dr. K. Gururaj Co-PI(s) - Drs. Ashok Kumar, A.K. Mishra, Nitika Sharma
6.	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. A.K. Dixit, S. P. Singh, Ravi Ranjan, Ravindra Kumar, V. Rajkumar, R. Pourouchottamane (upto June, 2023), M. S. Dige
7.	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
8.	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 (Since June 2022)
9.	ANSC CIRG COP 2012 030 00242	**ICAR:** Veterinary Type Culture-Microbes (NAINP Bangalore, CIRG Makhdoom Collaboration)	PI - Dr. Ravindra Kumar, Co-PI - Dr. A.K Mishra,
10.	ANSC CIRG COP 2022 006 00317	**ICAR:** Agri Drone Project	CCPI - Dr. Arvind Kumar Co-PI - Dr. Mohd. Arif (upto Jan, 2024)
11.	ANSC CIRG SOL 2024 006 00330	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
12.	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

C. Externally Funded Project

S. N.	Project No.	Title of the Project	Scientist Team
1.	ANSC CIRG SOL 2023 002 00320	**NLM:** Development of strategies for competent embryo production and efficient cryopreservation for faster propagation of superior goat germplasm	PI – S. P. Singh Co-PI(s) - Drs. S. D. Kharche (up 31.01.2024), 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 (since 15.02.2024) / Dr. Chetna Gangwar (till 14.02.2024) Co -PI(s) - Drs. S. D. Kharche (up 31.01.2024), Ashok Kumar, R. Pourouchottamane (June, 2023), K. Gururaj
3.	ANSC CIRG SOL 2022 003 00314	**NLM:** Development and evaluation of efficient regimen for oestrus synchronization in major Indian goat breeds.	PI – Dr. Y. K. Soni Co-PI(s) - Drs. S. D. Kharche (up 31.01.2024), S. P. Singh, Ravi Ranjan, Chetna Gangwar (Upto feb 2024), M K Singh.
4.	ANSC CIRG SOL 2022 001 00312	**NLM:** Development of Goat Value Chain in Bundelkhand Region of Uttar Pradesh.	PI - Dr. A. K. Dixit Co- PI(s) - Drs. M. K. Singh, R. Pourouchottamane (June, 2023), K. Gururaj, Ravindra Srivastava.
5.	ANSC CIRG SOL 2024 005 00329	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
6.	ANSC CIRG SOL 2024 004 00328	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
7.	ANSC CIRG COP 2024 007 00331	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. Ashok Kumar, K. Gururaj, Nitika Sharma

CHAPTER 8

PATENTS, TECHNOLOGIES DEVELOPED, COMMERCIALIZATION AND CONSULTANCIES (ITM UNIT)

8. PATENTS, TECHNOLOGIES DEVELOPED, COMMERCIALIZATION AND CONSULTANCIES (ITM UNIT)

8.1 Management of IP Portfolio

IPRs	Application/ Registration No.	Name of Innovation/ Technology/ Product/ Plant Variety	Date of application Filed/ submitted	Date of Application Granted/Registered**
Patent	202311067997	Herbal drug to control brucellosis and prevent shedding of *Brucella mellitensis* in sheep and goats. (Dr. Anu Rahal) 	10.10.2023	Complete filed on 07.10.2024
Trademarks	6315077	CIRG Logo	22.02.2024	Examination report submitted on 05.06.2024 (still under consideration of the Trade Mark Office)
Copyrights	131005	CIRG Signature Logo	22.02.2024	Examination report submitted on 05.06.2024 (still under consideration of the Trade Mark Office)

8.2 Commercialization of Technologies (Letter of consent signed - 01)

S No.	Name of Technology / Know-How	IP Protection (Yes/ No) *	Name of Contracting Party	Mode of partnership**	Date of Licensing	Revenue Earned (Rs.)
1.	Economic complete pellet feed formulation with Azolla for ruminant feeding	NO	Modern Goat Farm (M/s. Syed Nawaz Husain Naqvi, 120-B, Alkapuri, Bhopal)	Letter of consent for transfer of technology	12.07.2024	0.3 Lakh + applicable tax @18% GST

8.3 Technology License Agreement

S. No.	Name of Technology / Know-How	IP Protection (Yes/No) *	Name of Contracting Party	Mode of partnership**	Date of Licensing (TLA signed)
1.	Emulsion based Goat meat products	No	M/s Meat Country Incredible foods Pvt. Ltd. Mathura	Non-exclusive	12.07.2024
2.	Emulsion based Goat meat products	NO	M/s VDMR Agrotech Pvt. Ltd. Agra. (UP)	NO	12.07.2024
3.	Plastic based two tier housing /Vertical housing model for Goats.	No	Murthy Agro Traders, Villupuram, Tamilnadu	Non-exclusive	18.11.2024
4.	Plastic based hanging type feeders suited for all breeds of Goats.	No	Murthy Agro Traders, Villupuram, Tamilnadu	Non-exclusive	18.11.2024

8.4 ITMU Meetings: Two ITMU Meeting were Organised to present Institute Commercializable Technologies.

Programme Organized for Technology Commercialize/Transfer	Number of Participants	Major decision taken
06.11.2024 (ITMU Meeting)	Scientist & ITMU Members	• The patent application of Dr. Ravindra Kumar titled "Composition, production protocol, storage and utilization of Potato-paddy straw silage for ruminants feeding" he was advised to resubmit after incorporating all the required modalities for further review to ITMU. • The house suggested submitting the technology document and one validation report for all commercializable technologies • The chair suggested that number of Patents and other IPs like Trademarks, Trade names, Copyrights needs to be increased from the institute in the near future to achieve the targets by IPTM.
02.01.2025 (ITMU Meeting)	Scientist & ITMU Members	• The revised patent application "Composition, production protocol, storage and utilization of Potato-paddy straw silage for ruminants feeding" was reviewed and it was decided to be submitted to attorney for review and submission. • Dr. M.K. Singh presented the copyright on ***'Goat breeding Calendar'*** for registration. The House agreed for further submission to Copyright Office through attorney.
Any other initiative taken for commercialization		
One techno-business meetings were conducted through Agriinnovate with herbal drug firms for commercialization and are under negotiation	M/s. Indian Herbs	Agrinnovate India 27th August 2024

8.5 Capacity Building in IP Management

8.5.1 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.	Participated in "SRIJAN orientation program" at NASC Complex, New Delhi.	IP&TM, ICAR, New Delhi	17-19 Jan, 2024	Dr. K. Gururaj
2.	Showcasing CIRG-ITMU technologies (Stall) in Goat fair & Kisan Gosthi 2024.	ICAR-CIRG, Makhdoom	06.03.2024	2000 Approx. • Goat farmers were participated • 40 academics /scientific/ another stakeholder
3.	Showcasing of CIRG-ITMU technology in NASC complex at ICAR foundation day at New Delhi	ICAR, New Delhi	15-16 July, 2024	1000 Approx. Farmers/Entrepreneurs/ Students
4.	Attend FICCI Bharat R&D summit 2024 on "Industry- Academia collaboration"	FICCI, New Delhi	3-4 Oct,2024	Dr. Anu Rahal, I/c ITMU
5.	Showcasing CIRG technologies (Stall) in National Goat Conclave-2024	ICAR-CIRG, Makhdoom	18.11.2024	3000 Approx. Farmers/Entrepreneurs/ Students

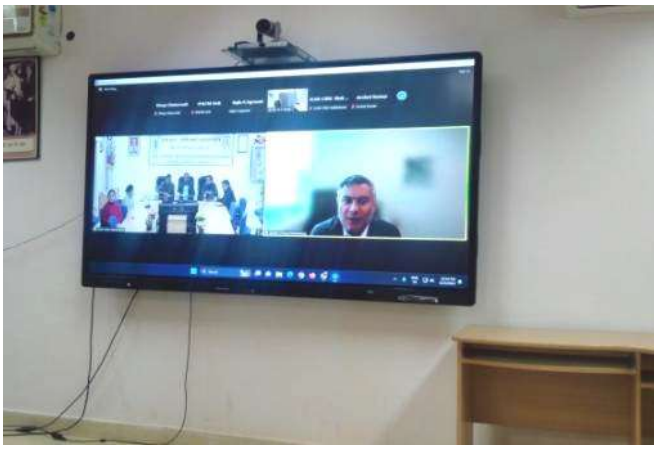
8.5.2 Training/Workshop/Seminar etc., Organized with respect to IP& Tech. Management.

S. No.	Name of Programme (Training/workshop/Seminar etc.) Organized	Date of Programme	Participants (No)	Participation category
1.	Two days webinar on "Intellectual Property Rights" (IPR)	23-24 Jan,2024	60 (50M +10F)	Scientists, Scholars &professional
2.	Industry-Scientists-Farmers Interface 2024	05.03.2024	100 (95M + 5F)	Professionals, including delegates from the industry, progressive farmers, policymakers, and expert panelists from across the country.
3.	Webinar on "IPR including Patents & Designs and non-patent IPs- Trademarks & Copyrights"	29.04.2024	30 (27M + 3 F)	Scientists, Scholars & professional
4.	Delivered 8 lectures on ***"Institute goat production technologies"*** in National Training Program with respect to IP&Tech. Management.	Feb-Dec. 2024	725	Farmers/entrepreneurs from 12-14 States

- 40 academics / scientific / another stakeholder
- 2000 goat farmers were participated

Term of Trade (ToT) Signed to M/s VDMR Agrotech Pvt. Ltd. Agra. (U.P) on the occasion of Industry-Scientists-Farmers Interface on 05.03.2024.

Showcasing CIRG ITMU Technology in NAS Complex at ICAR Foundation Day on 15-16 July 2024.



ICAR-CIRG celebrated World Intellectual property (IP) day on 29th April 2024 with the theme "IP and the SDGs: Building our common future with innovation and creativity" Dr. Pinki Chakraborty, Patent Associate and Mr. Indraneil Choudhary Associate from M/s United and United, New Delhi who has delivered a lead presentation on 'Overview of patent system in India'. (Total participants 30 (27M + 3F)

8.6 Commercializable Technologies

8.6.1 Technologies Certified by ICAR- (9 technologies)

1. PARACHEK
2. Aja-Sanjeev CARD - An eye mucosa colour based targeted selective treatment chart for goats. ani-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 faeces.
4. Duplex real-time PCR for quick detection of cryptosporidiosis in goats.
5. Peptide based ETX iELISA for assessing protective antibody titre against enterotoxaemia in goods.
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

8.6.2 Technologies under Commercialization

1. Goat feeders for better feed utilization.
2. Pelleted Complete Feed Technologies for Sustainable Goat Production under intensive feeding system.
3. Economic complete pellet feed formulation with Azolla for ruminant feeding.
4. Herbal anticoccidial complete pellet feed formulation for goats
5. Low methane producing herbal complete pellet feed for goats.
6. Intra vaginal sponge for Induction and Synchronization of oestrus
7. BRUCHEK: A Dot-ELISA Kit for detection of brucellosis in goats and Sheep
8. Diagnosis of para tuberculosis ELISA KIT (Serum and Milk)
9. Stressol-G: An Herbal Antistress Formulation
10. AJAS GREEN- Goat milk based natural herbal beauty soap
11. AJAS-Goat milk based natural beauty soap.
12. AJAS- Goat milk based antiseptic soap.
13. PARACHEK CARD-An eye mucosa colour based targeted selective treatment chart for goats.

14. Aja-Sanjeevani-Herbal Immunomodulatory Formulation for Amelioration of Weaning Stress in Goat kids.
15. EASY KIDDER - A herbal formula to minimize parturition problems.
16. *Moringa olifera* based complete feed formulation for lactating goats
17. BRUCLEAR
18. Power weeder for improving economic fodder production for goats.
19. Plastic based two tier housing/vertical housing model for goats.
20. Sandwiched portable plastic panel for protecting goat kids form cold stress.
21. Plastic based hanging type feeders suited for all breeds of goats.
22. Emulsion based goat meat products.
23. Retort processed shelf stable goat meat products.
24. Snacks type goat meat products.
25. Healthier goat meat products.
26. Goat milk mozzarella cheese.

CHAPTER 9

EDUCATION AND ACADEMIC COLLABORATIONS

9. EDUCATION AND ACADEMIC COLLABORATIONS

9.1 Education

During the academic year 2024–25, 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. & A.H. students of various affiliated institutions for internship and training.

9.2 List of Students Completed the Research Project/Dissertation/Internship

S. No.	Name of Student	Name of the Veterinary College or University	Total number of students who undertook internship at ICAR-CIRG gender wise	Days of Internship
1	Ms. Dolly	Sanskriti University	1 Female	60 Days
2	Ms. Priya Singh	Amity University, UP	1 female	180 Days
3	Ms. Komal	MVN University, Haryana,	1 female	45 Days
4	Ms. Manisha Sharma	Amity University, Madhya Pradesh	1 Female	60 Days
5	Ms. Saswati Barman	Sanskriti University, Mathura	1 Female	60 Days

S. No.	Name of the Veterinary College or University	Total number of students who undertook internship at ICAR-CIRG gender wise	Days of Internship	Duration/No Batch
1	IVRI, Izatnagar	21 student (17 boys & 04girls)	15 days	22 July,2024 to 04 August,2024 (1Batch)
2	DUVASU Mathura	64 student (44 boys & 20girls)	15 days	12August,2024 to 09 November ,2024 (6 Batch)
3	BHU, Varanasi	46 student (41 boys & 20girls)	15 days	13 Sep ,2024 to 28 Feb,2025 (4 Batch)

9.3 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

9.4 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

These partnerships support technology dissemination, capacity building, and entrepreneurship initiatives among farmers, youth, and women self-help groups.

CHAPTER 10

TRAINING AND SKILL DEVELOPMENT PROGRAMME

10. TRAINING AND SKILL DEVELOPMENT PROGRAMME

10.1 National Training Programme

Eight (8) national training programmes were organized on Scientific Goat farming, which were attended by farmers, unemployed youth, retired professionals and entrepreneurs.

S. No.	NTP	Date	Male	Female	Total Participants	State
1.	107	02-08 February 2024	103	07	110	11
2.	108	29 April – 05 May 2024	100	08	108	15
3.	109	12-18 July 2024	78	02	80	12
4.	110	30 July 05 August 2024	58	03	61	10
5.	111	03-09 September 2024	56	04	60	12
6.	112	05-11 November 2024	101	04	105	12
7.	113	26 Nov. – 02 Dec. 2024	89	04	93	13
8.	114	10 – 16 December 2024	102	06	108	12
		Total Participants	687	38	725	

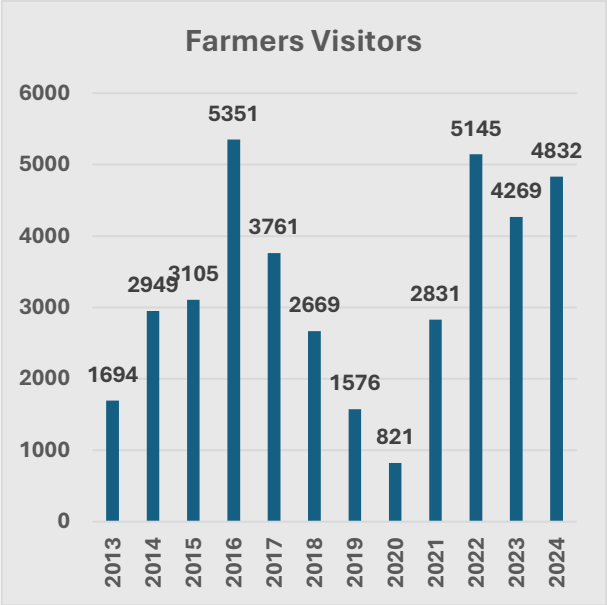
10.2 Sponsored Training Programme

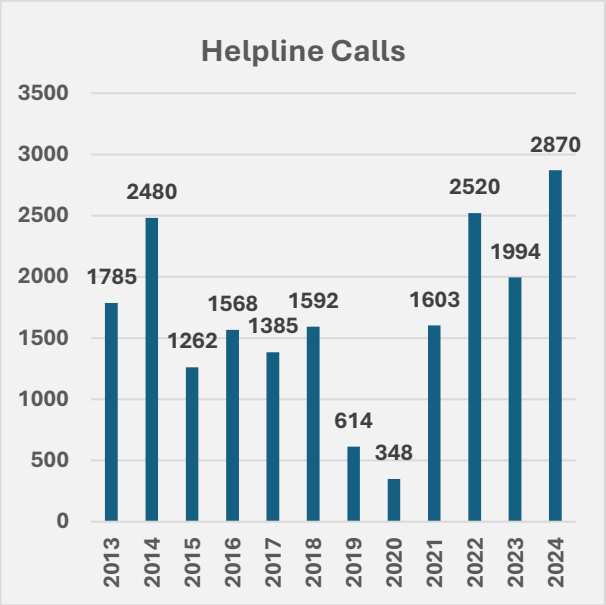
Ten (10) sponsored training programmes were organized in which goat farmers from various states were participated and learned good goat management practices

Sr. No.	Name of Sponsoring Agency	Date	Duration	Male	Female	Total Participants
1.	PRAN Begusarai Bihar	30 Jan. – 3 Feb. 2024	05 Days	5	15	20
2.	NABARD Pali (Raj.)	12-14 February 2024	03 Days	20	-	20
3.	PRAN Gaya Bihar	12-16 February 2024	05 Days	10	18	28
4.	ATMA Sitamarhi Bihar	09-13 March 2024	05 Days	22	-	22
5.	ATMA Purniya Bihar	11-14 March 2024	05 days	22	-	22
6.	ATMA, Darbhanga Bihar	20-24 August 2024	05 Days	20	-	20
7.	RC DSS, Ajmer Rajasthan	21-23 August 2024	03 Days	07	18	25
8.	ATMA, Gaya Bihar	23-27 September 2024	05 Days	25	-	25
9.	Brooke India	21-23 November 2024	03 Days	17	8	25
10.	ATMA, Sitamarhi Bihar	19-23 December 2024	05 Days	25	-	25
	Total Participants			173	59	232

10.3 Activities at Farmers' Single Window

- In total 4832 visitors registered at ICAR-CIRG Farmers' Single Window during the reporting period. It was 13% higher than the previous year number (4269).
- 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.





10.4 Specialized Training Programme

- Dr. Ravi Ranjan conducted training programme on "Artificial Insemination in Goats" for 20 Veterinary Officer from 15-17 Jan, 2024 at Male Reproduction Laboratory, ICAR-CIRG, Makhdoom sponsored by VOTI, Odisha-AHD.
- Dr. Ravi Ranjan conducted training programme on "Technological innovation in Assisted Reproductive Technologies for the improvement of Caprine germplasm" for 14 Scientist and Assistant Professor from 05-14 Feb 2024 at Male Reproduction Laboratory, ICAR-CIRG, Makhdoom sponsored by ICAR.
- Dr. Y. K. Soni organized Internship program of 11 Students of B.V.Sc. and A.H. of DUVASU Mathura from Aug. 12-26, 2024 at ICAR-CIRG, Makhdoom.
- Dr. S. P. Singh conducted training program on Animal Cell Culture Techniques for candidates belonging to the SC community from Oct. 28-30, 2024 at ICAR-CIRG, Makhdoom.

- Dr. S. P. Singh conducted national training for SC candidates on 'Animal cell culture and molecular techniques' from 18th to 21st February, 2025.

- Dr. Ravindra Kumar acted as a coordinated self-financed, 5 days Training on Feed fodder production, processing and ration formulations for Goats, 19-23 August 2024.

- Dr. Ravindra Kumar acted as a coordinated self-financed 5 days training programme on "Feed and fodder production, processing and ration formulations in goats, 17-21 February, 2025.

- Dr. A.K. Verma coordinated "Hands-on training on value-added goat milk product processing" from March 4-8, 2024
- Dr. T.P. Singh organized 02 days webinar on "Intellectual property rights" through online mode from Jan 23-24, 2024 at ICAR- CIRG, Makhdoom, Farah, Mathura, U.P.
- Dr. T.P. Singh organized a webinar on World Intellectual Property-2024 on April 29, 2024 at ICAR-CIRG, Makhdoom.

10.5 Other Training / Internship Programmes

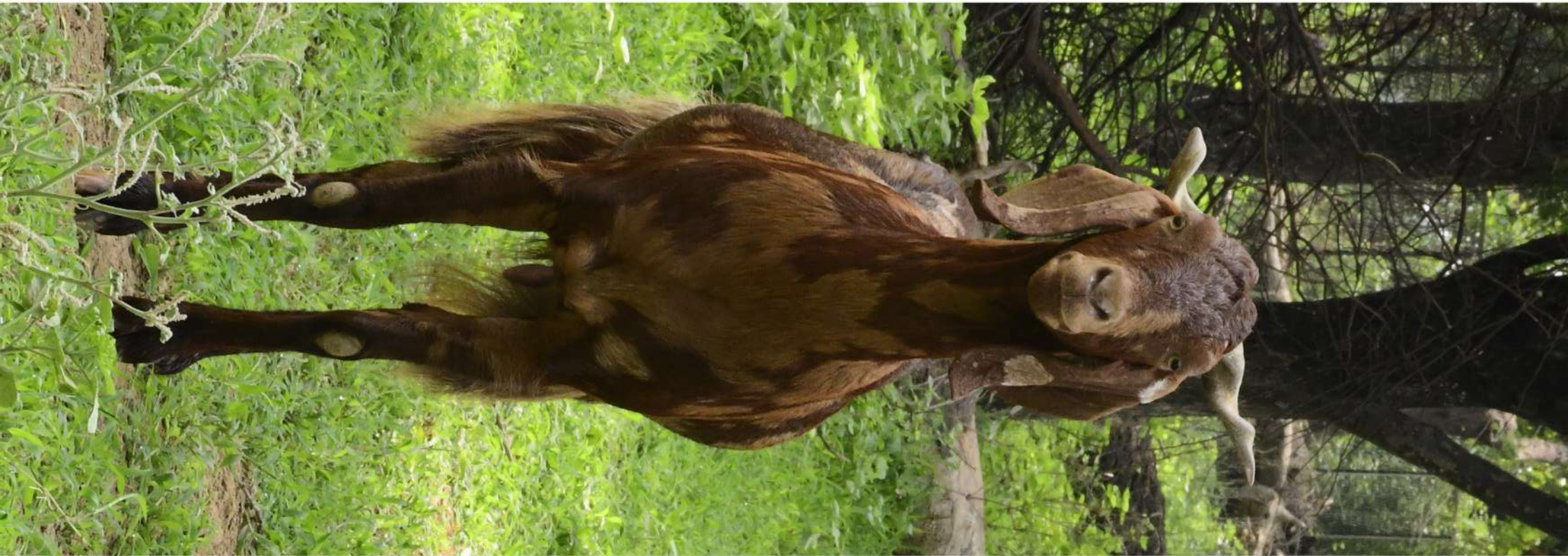
- Dr. Ravindra Kumar acted as a Co-course Director, MANAGE sponsored, 3 days Training on "Innovative and progressive Goat Production technologies", 12-14 August, 2024.
- Dr. Ravindra Kumar acted as a Co-Organizing Secretary, National Goat Conclave -2024, November 18, 2024.
- Dr. A.K. Verma coordinated, 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 9-23, 2024.
- Dr. A.K. Verma coordinated, Internship programme "Goat breeding, nutritional, reproductive and health management of goats, and value addition of the products" of BVSc & AH students from BHU, Varanasi, June 19 to July 03, 2024.
- Dr. A.K. Verma coordinated, a 15-day internship programme for B.V.Sc. &A.H. (ten students) of DUVASU, Mathura, Uttar Pradesh, October 11-25, 2024.
- Dr. T.P. Singh coordinated for conduction of Internship programme (March 9-23, 2024) in the Institute for final year B.V. Sc & A.H. students of BHU, Varanasi.
- Dr. T.P. Singh coordinated for conduction of Internship programme (July 22-August 04, 2024) in the Institute for final year B.V. Sc & A.H. students of ICAR-IVRI, Bareilly.
- Dr. T.P. Singh coordinated for conduction of Internship programme (Sept 26-Oct 10, 2024) in the Institute for final year B.V.Sc. & A.H. students of DUVASU, Mathura.
- Dr. T.P. Singh organized Hindi Pakhwara 2024 from Sept 13-30, 2024 at ICAR-CIRG, Makhdoom.
- Dr. Anil Kumar Mishra coordinated the Internship Programme of Batch-F of BVSc & AH students of Veterinary College, DUVASU, Mathura, Uttar Pradesh (India) on Aug 27–Sept 10, 2024 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura, Uttar Pradesh (India).
- Dr. K. Gururaj organized the Industry-Scientist-Farmer's Interface as a capacity of organizing secretary on 5th March, 2024 which was featured by technical sessions and panel discussions participated by over 100 experts from the industry stakeholders, progressive farmers, policy makers and scientists held at ICAR-CIRG
- Dr. Nitika Sharma coordinated the Internship Programme of Batch-A of BVSc & AH students of Veterinary College RGSC, Banaras Hindu University (BHU), Barkachha, Mirzapur, Uttar Pradesh from 13-27 September, 2024 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP).
- Dr. Nitika Sharma coordinated the Internship Programme of Batch-A of BVSc & AH students of Veterinary College RGSC, Banaras Hindu University (BHU), Barkachha, Mirzapur, Uttar Pradesh from 13-27 September, 2024 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP).
- Dr. Nitika Sharma coordinated the Internship Programme of Batch-A of BVSc & AH students of DUVASU Mathura from 11-25 September, 2024 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP).
- Dr. Nitika Sharma coordinated the Internship Programme of Batch-F of BVSc & AH students of Veterinary College RGSC, Banaras Hindu University (BHU), Barkachha, Mirzapur, Uttar Pradesh from 16-30 May, 2024 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (UP).
- Dr. Nitika Sharma coordinated the Internship Programme of Batch-II of BVSc & AH students of Veterinary College RGSC, Banaras Hindu University (BHU), Barkachha, Mirzapur, Uttar Pradesh from 12-26 May, 2024 at ICAR-CIRG, Makhdoom, Farah-281122, Mathura (U.P.).

10.6 Demonstrations

S. No.	Technology demonstrated	Date	Participants
1.	Plastic based two tier housing model for goats	16.02.2024	Demonstrated to the trainee participants of training on scientific goat farming sponsored by ATMA, Distt. Gaya, Bihar
2.	Two tier housing model for goats and plastic appliances of goat farming	21.02.2024	Demonstrated to the trainee participants of Mahoba distt., UP during sponsored training of NLM
3.	Plastic based two tier housing model for goats	29th April to 5th May, 2024	Demonstrated to the participants of 108th National Training on "Scientific Goat Farming"
4.	Plastic based two-tier goat housing model	05.02.2024	Demonstrated to the trainee participants of scientific goat farming
5.	Plastic based two-tier goat housing model and plastic appliances	14.07.2024	Demonstrated to the trainee participants of 109th National Training Program on scientific goat farming
6.	Plastic based two-tier goat housing model	02.08.2024	Demonstrated to the trainee participants of 110th National Training Program on scientific goat farming

CHAPTER 11

HUMAN RESOURCE DEVELOPMENT



11. HUMAN RESOURCE DEVELOPMENT

11.1 Capacity Building of Officers through Knowledge Exchange Programme

Name of Employee	Designation	Discipline / Section	Name of Training Programme Attended
Dr. Y. K. Soni-	Senior Scientist	Animal Physiology & Reproduction	Cutting-edge technologies for improving reproductive efficiency in livestock" from Oct 16-25, 2024 at NIANP, Bengaluru
Dr. Niitka Sharma	Senior Scientist	Animal Health	Entrepreneurship Orientation Program in Medicinal and Aromatic plants (EOPMAP) in the domain of "Medicinal and Aromatic plants" from Aug 1-12, 2024 at DMAPR, Anand, Gujarat
Dr. B. Rai	Principal Scientist	ANMPT	FRP Fabrication and Testing from Dec. 10-12, 2024 at ICAR-CIFA, Bhubaneswar
Dr. Arvind Kumar	Principal Scientist	ANMPT	FRP Fabrication and Testing from Dec. 10-12, 2024 at ICAR-CIFA, Bhubaneswar

CHAPTER 12

PUBLICATION

12. PUBLICATION

12.1 Research Publication

Ahlawat, S., Vasu, M., Choudhary, V., Arora, R., Sharma, R., Mir, M. A., & Singh, M. K. (2024). Comprehensive evaluation and validation of optimal reference genes for normalization of qPCR data in different caprine tissues. *Molecular Biology Reports, 51*, 268.

Ahlawat, S., Vasu, M., Mir, M. A., Singh, M. K., Arora, R., Sharma, R., Chhabra, P., & Sharma, U. (2024). Molecular insights into Pashmina fiber production: Comparative skin transcriptomic analysis of Changthangi goats and sheep. *Mammalian Genome, 35*, 160–169.

Arif, M., Kumar, A., Pourouchottamane, R., Gupta, D. L., & Rai, B. (2024). Enhancing productivity, profitability and land use efficiency of fodder oats (*Avena sativa* L.) and berseem (*Trifolium alexandrinum* L.) by intercropping. *Range Management and Agroforestry,* 45(1), 111–117.

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, S117-S122

Arif, M., Pourouchottamane, R, Kumar, A., Kumar, R., Rai, B., Gangwar, C., Kumar, R., Singh, M.K., Dixit, A.K. and 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,

Arora, R., Kaur, M., Kumar, A., Chhabra, P., Mir, M. A., Ahlawat, S., Singh, M. K., Sharma, R., & Gera, R. (2024). Skeletal muscle transcriptomics of sheep acclimated to cold desert and tropical regions identifies genes and pathways accentuating their diversity. *International Journal of Biometeorology*, 1–11.

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Dige, M. S., Gurao, A., Mehrotra, A., Singh, M. K., Kumar, A., Kaushik, R., Kataria, R. S., & Rout, P. K. (2024). Deciphering the molecular mechanisms of heat stress tolerance in goats: Insights from transcriptome and gene co-expression analysis. *Journal of Thermal Biology*, 104007.

Dige, M. S., Gurao, A., Singh, L. P., Chitkara, M., Singh, M. K., Dass, G., Verma, A. K., Pundir, R. K., & Kataria, R. S. (2024). Transcriptomic analysis reveals molecular insights into lactation dynamics in Jakhrana goat mammary gland. *BMC Genomics, 25*(1), 874.

Gangwar, C., Dixit, A. K., Singh, M. K., Pourouchottamane, R., Saroj, V., Kharche, S. D., & Rai, B. (2024). Phenotypic characterization of Sonpari goats in Sonbhadra district of Uttar Pradesh. *Indian Journal of Small Ruminants, 30*(1), 182–185.

Gangwar, C., Kumar, A., Gururaj, K., Kumar, A., Qureshi, S., Kumar, M., Mishra, A. K., & Ranjan, R. (2024). Bolstering buck fertility: The impact of Asparagus racemosus aqueous extract on semen cryopreservation and antioxidant defense system. *Biopreservation and Biobanking.* https://doi.org/10.1089/bio. 2023.0117

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Kumar, R., Verma, A.K., Tripathi, P. and Gupta, D.L. (2024). Effect of dietary incorporation of cotton seed cake (*Gossypium* sp.) on milk production, constituents, fatty acid profile, somatic cell counts and reproductive hormones in late lactating Barbari goats. *Animal Nutrition and Feed Technology,* 24, 277-287.

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Singh, M. K., Pourouchottamane, R., Kumar, A., Singh, S. P., Ranjan, R., Dixit, A. K., Sharma, N., & Kumar, R. (2024). Multiplier flock scheme in Barbari goats: An entrepreneurship model for in-situ breed conservation and improvement. *Indian Journal of Animal Sciences, 94*(1), 72–76. https://doi.org/10.56093/ijans.v94.il.115346

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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. Bundelkhand Region of Uttar Pradesh. *Indian Journal of Small Ruminants*, 31 (1): 80-83.

12.2 Popular Articles

Gangwar, C., A. K. Dixit, Manish Kumar, B. Rai, Manish Kumar Chatli (2024). Sonpari Bakripalan, Kheti, Published by DKMA, ICAR, July, 2024.

Kumar, A., B. Rai, R. Pourouchottamane and Ranjeet Singh. (2023). Bakariyon ke liye plastic adharit hanging feeder. Ajamukh, 45; July-Dec, ICAR- CIRG, Makhdoom, Mathura.

Kumar, A., Arif Mohammad and Kumar Ravindra. (2024). Bakari poshan me 'Hay' evam "Silage" ka mahatva. In: Kumar Ravindra and Kumar Arvind (edt.) Balanced Goat Nutrition and Feed Management. ICAR- CIRG, Makhdoom, Farah, Mathura, pp. 73-79.

Kumar A. and Arif Mohammad. (2024). Pashu Ahar keliye Azolla utpadan. In: Kumar Ravindra and Kumar Arvind (edt.) Balanced Goat Nutrition and Feed Management. ICAR- CIRG, Makhdoom, Farah, Mathura, pp. 80-83.

Kumar, R., Arif, M. and Kumar A. (2024). Silage based feeding system for goats. Indian Farming 74(01), 28-30.

Singh, T.P., Verma, A.K. Rajkumar, V., Kumar, R. and Chatli, M.K. (2024). Nutritional and economical assessment of goat meat. ICAR-CIRG NEWSLETTER, Volume XXV, Jan-June, 2024; Published by Director, ICAR- Central Institute for Research on Goats, Makhdoom, Farah-281122, Mathura, Uttar Pradesh. Pp. 2-3.

Kumar, A., Mishra, A. K., Gururaj, K., Sharma, N., Diwakar, R. P. and Singh, A. (2024). Staphylococcal mastitis in goats. Just Agriculture 5(3), 352-360.

Mishra, A. K., Gururaj, K., Sharma, N., Singh, A., and Chaturvedi, V., (2024). Pneumonic pasteurellosis in goats: An overview. Pashudhan Praharee (June 6, 2024). https://www.pashudhanpraharee.com/pneumonic-pasteurellosis-in-goats-an overview/#google_vignette

Dixit, A. K. Ravindra Kumar, Manish Kumar Chatli and B. Rai (2024). Environment and Goat Production under Mixed Farming System. Newsletter, Vol. XXV, January-June 2024. Published by ICAR-Central Institute for Research on Goats (CIRG), Mathura, Uttar Pradesh.

Dixit, A.K., Ravindra Kumar, K Gururaj, B Rai, Sandeep Kumar and Shradha Singh (2024). Bundelkhand me Bakri Palan: Ek Adhyan: Ajamukh, No. 45. Pp. 5-6. Published by ICAR-Central Institute for Research on Goats (CIRG), Mathura, Uttar Pradesh.

12.3 Abstracts

Dass, G., Sharma, N., Chaturvedi, V., Soni, Y. K., & Kaushik, R. (2024). Growth performance of Muzaffarnagari sheep maintained under semi-intensive feeding management. In Compendium of National Symposium on Animal Production Systems and its Role in Sustainable Use of AnGR (p. 79). NTR College of Veterinary Science, Gannavaram, Andhra Pradesh.

Dass, G., Sharma, N., Chaturvedi, V., Kaushik, R., & Singh, M. K. (2024). Production performance of Muzaffarnagari sheep maintained under semi-intensive feeding management. In Abstract Compendium of International Seminar on Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario (p. 21). Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry.

Kaushik, R., Goel, A., Dass, G., Chatli, M. K., & Rout, P. K. (2024). Differential gene expression pattern and genotyping of HSF-1 gene in caprine during heat stress period. In Abstract Compendium of International Seminar on Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario (p. 4). Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry.

Mahajan, S., Kaushik, R., Shukla, R., & Dass, G. (2024). Genotyping of Leptin and IGF-1 gene in Muzaffarnagari sheep using high-resolution melting analysis. In Abstract Compendium of International Seminar on Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario (p. 124). Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry.

Ranjan, R., Soni, Y. K., Singh, S. P., & Chatli, M. K. (2024). Artificial insemination in goats: Present status and future prospects in India. In SAPICON-2024, ICAR-CIRC, Meerut, November 27–29, 2024.

Soni, Y. K., Singh, S. P., Ranjan, R., Pathak, J., Pathak, M., Singh, M. K., Singh, M., & Kumar, S. (2024). Efficacy of estrus synchronization regimens on fertility in Barbari and Jamunapari goats. In IAHF Conference, ICAR-RC, NEH Region, Nagaland, November 29–30, 2024.

Kumar, R., & Gupta, S. (2024). Isolation, characterization of Lachnospira pectinoschiza from goat rumen and its effect of addition on in vitro fermentation parameters. Presented at the 8th Annual Convention of Society of Veterinary Biochemists and Biotechnologist of India (SVBBI) and National Symposium on "Unlocking the Potential of Veterinary Biochemistry and Biotechnology for Food and Nutrition Security," DUVASU, Mathura, December 20–21, 2024.

Kumar, R., Prabha, R., Gururaj, K., & Gupta, S. (2024). Metagenomic analysis of rumen microbial communities on supplementation of essential oils in Barbari goats. In ISSGPUCON 2024, RIVER Puducherry, April 24–26, 2024.

Kumar, A., Rai, B., Pourouchottamane, R., Ramachandran, N., Ranjan, R., & Kumar, R. (2024). Development and evaluation of plastic slatted floor based two tier goat housing system. In Book of Abstracts, National Conference on Hill Agro-Ecosystem: Challenges and Opportunities for Achieving Sustainable Development Goals (HAES-COSDG, 2024), ICAR-NEH, Nagaland Centre, Jharanapani, Nagaland, November 29–30, 2024.

Singh, T. P., Agrawal, R. K., Mendiratta, S. K., Chauhan, G., Verma, A. K., Rajkumar, V., Kumar, R., & Chatli, M. K. (2024). Antimicrobial, antioxidant, FT-IR and GC–MS/MS analysis of spices extracts - a promising preservative for meat products. In Compendium of XII Conference of the Indian Meat Science Association and National Symposium on Green and Sustainable Meat Sector: Global Game Changer (p. 286). DUVASU, Mathura. ISBN 978-93-67550-63-2.

Verma, A. K., Rajkumar, V., Kumar, R., Gururaj, K., Singh, T. P., & Kushwah, T. (2024). Impact of mineral and vitamin supplementation on growth, carcass traits and meat quality in vacuum-refrigerated storage. In Compendium, XII Conference of the Indian Meat Science Association and National Symposium on Green and Sustainable Meat Sector: Global Game Changer (p. 226). DUVASU, Mathura. ISBN 978-93-67550-63-2.

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Dixit, A. K., Kumar, R., Gururaj, K., Singh, S., & Kumar, S. (2024). Goat farming in Bundelkhand region of Uttar Pradesh: A socio-economic analysis. Presented at the International Conference of Indian Society for Sheep and Goat Production and Utilization, April 24–26, 2024, RIVER, Kurumbapet, Puducherry.

Sharma, N., Dixit, A. K., Singh, M. K., Srivastava, R., Dass, G., & Kumar, S. (2024). Empowerment of schedule tribe women through scientific goat farming practices. In Souvenir and Conference Book of the 18th Conference of Indian Association of Women Veterinarians on Multi-Dimensional Approach Towards Enhanced Nutritional Security and Food Safety (Abstract S4-010, pp. 257). DUVASU, Mathura, November 13–14, 2024.

Gangwar, C., Dixit, A. K., Singh, S., Rai, B., Pourouchottamane, R., Singh, S., & Kharche, S. D. (2024). Production performance of Sonpari goats in Vindhyachal region. Presented at the XVIII Conference of Indian Association of Women Veterinarians on Role of Women Veterinarian for Viksit Bharat, DUVASU, Mathura, November 13–14, 2024.

12.4 Lead / Invited Papers in Seminars / Symposia / Workshops

Singh, M K,, Dass G., and Chatli, M. K. (2024). Innovative Strategies for Sustainable Genetic Improvement and Profitable Goat Farming. Presented Lead Paper in International Conference on "Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario" 24 - 26 April, 2024. Organized by Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry, (Page No. 149-162).

Singh, M K, and Chatli, M. K. (2024). Strategies for Enhancing Goat Improvement in India. Presented Lead Paper in XVIII Annual Convention of ISAGB and International Conference ISAGBCON 2024 on "New Vistas in Harnessing Genetic Resources for Sustainable Animal Production" from 21 - 22 November, 2024 organized by Bihar Animal Sciences University, Patna & Indian Society of Animal Genetics and Breeding (ISAG&B), Patna, Bihar. (Page No. 90-100).

Pourouchottamane, R., Ramachandran. N., and Singh, M. K. (2024). Shelter Designs and Plans for Commercial Goat Establishment. Lead Paper in National Seminar on "Policy and Strategies for Indian Goat Sector in Amrit Kaal" from 19th November, 2024 organized by ICAR- Central Institute for Research on Goats, Makhdoom & Department of Animal Husbandry and Dairying (DAHD), Govt. of India. (Page No. 41-44).

Ranjan R, Soni Y. K., Singh S. P. and Chatli M. K. (2024). Artificial insemination in goats: present status and future prospects in India. SAPICON-2024, at ICAR-CIRC, Meerut 27-29th November 2024.

Verma, A.K., and Rajkumar, V. (2024). Overview of goat cheeses: Indian scenario" in the International Conference on Small holders' goat production in tropical countries – opportunities and constraints held on August 8-9, 2024 at PGRIAS, Kattupakam, Tamil Nadu, India.

Singh, T.P., and Chatli, M.K. (2024). "Unlocking the potential of goat meat and milk production and value addition in tropics". In: Compendium, 02 days International Conference on "Small holders' goat production in tropical countries – opportunities and constraints", Aug 08-09, 2024 at TANUVAS, Chennai, Pp-XXVII-XXXVI, ISBN 978-81-977035-4-6.

Chatli, M.K., Singh, T.P., and Verma, A.K. (2024). "The global landscape of goat meat industry", In: Compendium, XII Conference of the Indian Meat Science Association and National Symposium on "Green and sustainable meat sector: Global game changer", September 26-28, 2024 at DUVASU, Mathura, Uttar Pradesh, Pp-13-18. ISBN 978-93-67550-63-2.

Gururaj, K. and Mishra, A. K. (2024). Brucellosis in small ruminants: unraveling disease dynamics, exploring pathogenesis, and strategizing effective control measures. In: Compendium of National Conference of Association of Mastitis on "Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario" held at Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Kurumbapet–605009, Puducherry (India) on April 24-26, 2024. Lead Paper (Chapter 14), Pp: 93-98.

Dixit, A.K. and Chatli, M. K. (2024). Value Chain Assessment and Marketing Strategies for Goat Production. International Conference of Indian Society for Sheep and Goat Production and Utilization on "Recent trends and future perspectives to improve the performance, health and welfare of small ruminants under changing climate scenario on April 24-26, 2024 at Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Kurumbapet, Puducherry – 605 009 India

Dixit, A.K. Kumar, R. Arif, M., and Rai, B. (2024). Economic Significance of Fodder Trees in Goat Production: With special reference to Arid and Semi-Arid Regions of India. National Conference on "Agro-ecological Basis of Agroforestry: Interaction, Innovation and Incubation" 18-19 June 2024 organised by Indian Society of Agroforestry, ICAR- Central Agro – Forestry Research Institute, Krishivaniki Vihar, Gwalior Road, Jhansi 284003, Uttar Pradesh.

Dixit, A.K. (2024). Goat production for sustainable livelihood and Entrepreneurship development in India. XXXII Annual Conference & International Symposium on Advances in Physiological Research in Omics Era for Sustainable Animal Production and Livelihood Security under the Changing Climatic Scenario, organized by ICAR-Central Institute for Research on Cattle,

Meerut in collaboration with Society of Animal Physiologists of India (SAPI), 27-29 November 2024.

Dixit, A.K., Rai B., and Chatli M. K. (2024). Ecology and Goat Production: With Special Reference to Mixed Farming System in India. International Conference on Small Holders' Goat Production in Tropical Countries – Opportunities and Constraints on August 8-9, 2024 at Post Graduate Research Institute of Animal Sciences Kattupakkam, TANUVAS Chennai- 603203 India.

Chatli, M. K., Dixit, A.K., and Verma, A.K. (2024). Indian Goat Sector in Amrit Kaal. National Seminar on Goat Sector Blueprint: Insights and Spectrum on 19th November 2024 organised by ICAR-Central Institute for Research on Goats, Makhdoom, Farah, Mathura at Hotel Holiday Inn, Agra (Uttar Pradesh).

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12.6 Training Manual / Compendium / Books

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Ranjan, R., Gangwar, C., Bhakat, M., & Chatli, M. K. (2024). Recent advances in artificial insemination technology in goat (p. 172).

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12.7 Book Chapter

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Chatli, M. K., Dixit, A. K., & Gururaj, K. (2024). Goat sector in India: CIRG perspectives. In Recent advances in artificial insemination technology in goat (pp. 1–13). ICAR-CIRG. ISBN 978-93-6128-819-7.

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12.8 Miscellaneous Publications

Chatli, M. K., Singh, M. K., Dige, M. S., Verma, A. K., Gururaj, K., Dixit, A. K. and Kumar, R. (2024). Policy paper on Goat Breeding Strategies Enhanced Productivity; published under AICRP on Goats by CIRG, Makhdoom pp 1-48.

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12.9 Gene Bank Accession

Mahajan, S., Dass, G., Kaushik, R.*, Chatli, M.K., Shukla, R., and Singh, M.K. (2025). Genotyping of growth hormone gene of Indian sheep breed. NCBI Gene Accession No: PQ788174 (Marwari Sheep).

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Mishra, A.K., Gururaj, K., Kumar, N. and Sharma, N. (2024). Brucella melitensis isolate CIRG 1 outer membrane protein 31 gene, partial cds, PQ160892.1.

CHAPTER 13

PARTICIPATION IN WORKSHOPS / TRAINING / SEMINARS / SYMPOSIA / CONFERENCE / WEBINARS

13. PARTICIPATION IN WORKSHOPS / TRAINING / SEMINARS / SYMPOSIA / CONFERENCE / WEBINARS

- Dr. M.K. Singh participated in Goat Conclave on Sustainable Goat Farming in Rajasthan: Present Status and Future Pathways on 12th March, 2025 where I delivered a lecture on "Goat Husbandry in National Scenario- Challenges and Opportunities" and also leaded panel discussion for "Strategies for enhancing Goat Productivity, profitability and Sustainability
- Dr. M K Singh participated and presented lead paper in International Conference on "Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario" 24 - 26 April, 2024. Organized by Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Puducherry.
- Dr. M. K. Singh participated and presented a lead paper in XVIII Annual Convention of ISAGB and International Conference ISAGBCON 2024 on "New Vistas in Harnessing Genetic Resources for Sustainable Animal Production" from 21 - 22 November, 2024 organized by Bihar Animal Sciences University, Patna & Indian Society of Animal Genetics and Breeding (ISAG&B), Patna, Bihar.
- Dr. S. P. Singh and Dr. Y.K. Soni attended National seminar on hill agro-ecosystem: Challenges and Opportunities for Achieving Sustainable Development Goals organized by ICAR Research Complex for NEH Region, Nagaland Centre and Indian Association of Hill Farming from Nov. 29-30, 2024.
- Dr. Ravi Ranjan, Dr. S. P. Singh and Dr. Y.K. Soni Attended National Seminar on Policy and Strategies for Indian Goat Sector in 'Amrit Kaal' on Nov. 19, 2024 organized by ICAR-CIRG, Makhdoom.
- Dr. S. P. Singh attended SAPICON-2024, at ICAR-CIRC, Meerut 27-29th November 2024.
- Dr. Ravindra Kumar attended National symposium on "Challenges and prospects for Mitigating Enteric methane emissions from Indian livestock. Organized by ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru on 3rd October 2024.
- Dr. Ravindra Kumar attended National Seminar on "Policy and strategies for Indian Goat sector in "Amrit Kaal" held on 19th November, 2024.
- Dr. Ravindra Kumar attended 8th Annual convention of Society of Veterinary Biochemists and Biotechnologist of India (SVBBI) and national Symposium on "Unlocking the potential of Veterinary Biochemistry and Biotechnology for food and nutrition Security" organized by DUVASU Mathura from 20-21 December, 2024.
- Dr. Ravindra Kumar attended World Animal Nutrition conference on "Newer vistas to Animal Nutrition research towards climate resilient animal production for livelihood, food and nutritional security. Nagpur Veterinary College, MAFSU, Nagpur from 20-22 Jan, 2025.
- Dr. Ravindra Kumar attended international conference of ISSGPU (ISSGPUCON 2024) held at RIVER Puducherry from April 24-26, 2024.
- Dr. Ravindra Kumar attended National conference of ISSGPU (ISSGPUCON 2025) on "Transforming small ruminant production: empowering precision farming and genomic innovations for enhanced productivity and sustainable development" held at ICAR-CIRG from 5-7 March, 2025.
- Dr. A. K. Verma, participated, delivered an oral presentation and acted as a rapporteur ISSGPUCON 24 and International Conference on Recent trends and future prospectives to improve performance, health and welfare of small ruminants under changing climate scenario, April 24-26, 2024 at RIVER, Puducherry.
- Dr. A. K. Verma, participated and acted as a Co-chairman in one technical session in XII conference of the Indian Meat Science Association and National Symposium on "Green and sustainable meat sector: Global game changer", September 26-28, 2024, DUVASU, Mathura (UP).
- Dr. Tarun Pal Singh attended 02 days webinar on "Intellectual property rights" through online mode from Jan 23-24, 2024 at ICAR- CIRG, Makhdoom, Farah, Mathura, U.P. Attended "Industry scientist farmer's interface" on March 05, 2024 at ICAR-CIRG, Makhdoom, Farah, Mathura, U.P.
- Dr. Tarun Pal Singh attended the XII Conference of the Indian Meat Science Association and National Symposium on "Green and sustainable meat sector: Global game changer", September

26-28, 2024 at DUVASU, Mathura, Uttar Pradesh.

- Dr. Anil Kumar Mishra participated in the National Dialogue on "Innovation in Reshaping the Dairying" held at DUVASU, Mathura, Uttar Pradesh (India) on 09-04-2024.
- Dr. Anil Kumar Mishra participated and presented the paper (oral) on "Occurrence of abortions in different breeds of goats reared under semi-intensive farming system at organized farms in semi-arid region of India" in the International Conference on "Recent Trends and Future Perspectives to Improve the Performance, Health and Welfare of Small Ruminants under Changing Climate Scenario" organized by Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Kurumbapet-605 009, Puducherry (India) on April 24-26, 2024.
- Dr. Anil Kumar Mishra participated and presented the paper (oral) on "Assessment of mortality due to caprine pneumonia in Jamunapari, Barbari, and Jakhrana breeds under semi-intensive farming system" in the International Conference on "Advancement of Science and Technology for Environment, Society and People-2024" organized by Society for Technology, Environment, Science & People, Kozhikode, Kerala and held online on May 17-18, 2024.
- Dr. Anil Kumar Mishra participated and presented the paper (oral) on "Prevalence of Mastitis in Barbari, Jamunapari, and Jakhrana Goat Breeds" in the International Conference on "Recent Advances in Agriculture, Engineering, Applied & Life Sciences for Environmental Sustainability" organized School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand (India) & Agro Environmental Development Society Rampur, Uttar Pradesh (India) on October 23-25, 2024.
- Dr. Anu Rahal attended the techno-business commercial assessment meeting organized by Agrinnovate India Limited (AgIn) for the technology transfer and commercialization of the "Bruclear" (the herbal therapeutic preparation for brucellosis).
- Dr. K. Gururaj participated in a 45-day online international workshop on the Assessment Tool for Laboratories and AMR Surveillance Systems (FAO-ATLASS), organized by FAO-RAP in collaboration with FAO-VLC, held from 19 July to 2 September 2024.
- Dr. Nitika Sharma participated and presented the paper (oral) on "Empowerment of schedule tribe women through scientific goat farming practices" in 18th conference of Indian Association of Women Veterinarians on "Multidismensional Approach towards enhanced Nutritional Security and food Safety" held at DUVASU, Mathura during November 13-14, 2024.
- Dr. Nitika Sharma participated and presented the paper (oral) on "Acute hepatic and pulmonary cysticercosis in goat kids" in 5th Annual Convention of Veterinary Internal and Preventive Medicine Society and International Symposium on "Headway in Veterinary medicine: Improving Animal Health and productivity with respect to antimicrobial resistance" organized by VIPM Society at College of Veterinary & Animal Sciences, SVPUAT, Meerut, India on 22-23 November, 2024.
- Dr. Nitika Sharma participated in 10-days on-line training programme on "Entrepreneurship Orientation Programme in Medicinal and Aromatic Plants-IX" held on-line during 1-12 August, 2024 organized by ICAR-Directorate of Medicinal and Aromatic Plant Research, Boriavi, Anand, Gujrat.
- Dr. A.K. Dixit attended and delivered a lead paper on "Value Chain Assessment and Marketing Strategies for Goat Production" in International Conference of Indian Society for Sheep and Goat Production and Utilization on "Recent trends and future perspectives to improve the performance, health and welfare of small ruminants under changing climate scenario on April 24-26, 2024 at Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Kurumbapet, Puducherry – 605 009 India
- Dr. A.K. Dixit attended and delivered a lead paper on "Economic Significance of Fodder Trees in Goat Production: With special reference to Arid and Semi-Arid Regions of India in National Conference on "Agro-ecological Basis of Agroforestry: Interaction, Innovation and Incubation" 18-19 June 2024 organised by Indian Society of Agroforestry, ICAR- Central Agro – Forestry Research Institute, Krishivaniki Vihar, Gwalior Road, Jhansi 284003, Uttar Pradesh.
- Dr. A. K. Dixit attended and delivered a lead paper on "Goat production for sustainable livelihood and Entrepreneurship development in India" in XXXII Annual Conference & International Symposium on Advances in

Physiological Research in Omics Era for Sustainable Animal Production and Livelihood Security under the Changing Climatic Scenario, organized by ICAR-Central Institute for Research on Cattle, Meerut in collaboration with Society of Animal Physiologists of India (SAPI), 27-29 November 2024.

- Dr. A.K. Dixit attended and delivered a lead paper on "Ecology and Goat Production: With Special Reference to Mixed Farming System in India" in International Conference on Small Holders' Goat Production in Tropical Countries – Opportunities and Constraints on August 8-9, 2024 at Post Graduate Research Institute of Animal Sciences Kattupakkam, TANUVAS Chennai- 603203 India.

CHAPTER 14

RECOGNITIONS / AWARDS / PRIZES / HONOURS

14. RECOGNITIONS / AWARDS / PRIZES / HONOURS

- Gopal Dass received "Fellow Award" of SOCDAB during a National Symposium on "Animal Production Systems and its role in sustainable use of AnGR" organized by NTR College of Veterinary Science, Gannavaram (AP) and Society for Conservation of Domestic Animal Biodiversity from February 15-16, 2024 at NTR College of Veterinary Science, Gannavaram (AP).
- Gopal Dass received "Third Prize - Best Book in Agriculture Extension" from "MANAGE, Hyderabad" for the book entitled "Unnat Bakari Palan" as Co-Editor on 11.06.2024.
- Gopal Dass, M K Singh, Rakesh Kaushik and Manish K Chatli received Second Best Poster Presentation Award in Faculty/Scientist Category in International conference of Indian Society for Sheep and Goat Production & Utilization "Overview of All India Coordinated Research Project on Goat Improvement" Organizer: ICAR-Central Institute for Research on Goats, Makhdoom, Farah, Mathura, March 05-07, 2025.
- Rakesh Kaushik, Anjana Goel, Gopal Dass, Manish K. Chatli and P. K. Rout received Second Best Oral Presentation Award in Faculty/Scientist Category in International conference of Indian Society for Sheep and Goat Production & Utilization "Differential gene expression pattern and genotyping of HSF-1 gene in caprine during heat stress period" Organizer: Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry, Chennai, April 24-26, 2024.
- 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.
- 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; pp. 161.
- 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.
- Dr. Ravi Ranjan received Technical Secretary for Organized National Seminar on Policy and Strategies for Indian Goat Sector in 'Amrit Kaal' on 19th Nov. 2024 as technical secretary.
- Dr. Y. K. Soni received Dr. G. B. Singh Memorial Award 2024 of the Indian Society for Study of Animal Reproduction (ISSAR) in recognition of the meritorious contribution to the research in Animal Reproduction.
- Dr. Y. K. Soni invited as expert to deliver lecture on oestrus synchronization and artificial insemination in goats: Practical insights in EDP Training cum Workshop on "Commercial goat production: Potential for entrepreneurship" conducted by Agribusiness Incubation Centre, ICAR-IGFRI Jhansi (U.P.) on Sept. 23, 2024.
- Dr. Y. K. Soni invited as expert to deliver lecture on Reproduction management in goats in EDP Training cum Workshop on "Commercial goat production: Potential for entrepreneurship" conducted by Agribusiness Incubation Centre, ICAR-IGFRI Jhansi (U.P.) on Sept. 23, 2024.
- Dr. Y. K. Soni invited as panelist in Brain storming session on Semen quality standards for indigenous equine breeds organized online by NRCE, on April 18, 2024.
- Dr. Ravi Ranjan guided Ms. Kaustubh, Ph.D. student from GLA University in 2024
- Dr. Ravi Ranjan established a separate buck station and semen collection centre at AICRP Jamunapari unit for cryopreservation and conservation of elite germplasm of Jamunapari, Barbari and Jakhrana bucks semen.
- Dr. Ravindra Kumar, Head Animal Nutrition Management and PT Division and Principal scientist (Animal Nutrition) was awarded with Mid-career scientist Award from Indian Society for Sheep and Goat Production and Utilization (ISSGPU) during ISSGPUCON 2024 held at RIVER Puducherry from April 24-26, 2024.
- Dr. Ravindra Kumar was awarded with Appreciation certificate 2024 in Institute Foundation Day (12th July 2024) of ICAR-CIRG.3

- Dr. Ravindra Kumar was awarded with Best presentation award in 8th Annual convention of Society of Veterinary Biochemists and Biotechnologist of India (SVBBI) and national Symposium on "Unlocking the potential of Veterinary Biochemistry and Biotechnology for food and nutrition Security" organized by DUVASU Mathura from 20-21 December, 2024.
- Dr. Ravindra Kumar received Best paper Award of Co-authored papers In: ISSGAPUCON 2025 held at ICAR-CIRG from 5-7 March, 2025.
- Dr. Arvind Kumar developed technology for Round the year fodder production model for small goat herds.
- Dr. Arvind Kumar awarded with IAHF Fellow award by the Honourable Governor of Nagaland Shri La Ganeshan during inauguration of National Conference on "Hill Agro-Ecosystem: Challenges and Opportunities for Achieving Sustainable Development Goals" organized by Indian Association of Hill Farming (IAHF) held at ICAR RC for NEH Region, Nagaland Centre, Jharnapani during 29-30th November, 2024.
- Dr. Arvind Kumar awarded with 2nd place in Hindi Research Paper Presentation competition during celebration of Hindi Pakhawara on 13-30 September, 2024.
- Dr. A. K. Verma received best oral presentation award in ISSGPUCON 24 and International Conference on Recent trends and future prospectives to improve performance, health and welfare of small ruminants under changing climate scenario, April 24-26, 2024 at RIVER, Puducherry.
- Dr. A.K. Verma conferred Fellow, Indian Meat Science Association in XII conference of Indian Meat Science Association and National Symposium on "Green and sustainable meat sector: Global game changer", September 26-28, 2024, DUVASU, Mathura (UP).
- Dr. Tarun Pal Singh acting as a "Member of Editorial Board, Journal of Meat Science" published by Indian Meat Science Association, Hyderabad.
- Dr. Tarun Pal Singh awarded by ICAR-NRC on Yak, Dirang on 35th Foundation Day (Jan 23, 2024) at Dirang, West Kameng for publishing High impact research article on cheddar style-yak milk cheese in Food Bioscience (NAAS-11.20).
- Dr. Tarun Pal Singh received the "Best Agricultural Extension Book Award" from MANAGE, Hyderabad, for authoring the book "उन्नत बकरी पालन."
- Dr. Tarun Pal Singh, honoured with a Special Award for his outstanding contribution during Hindi Pakhwada-2024 (13th-30th September, 2024).
- Dr. Tarun Pal Singh acted as an external examiner to conduct annual practical examination-2023 of B.V.Sc. & A.H. (3rd year) students for the course of Livestock Products Technology at RAJUVAS, Udaipur from 18-20 Jan, 2024.
- Dr. Tarun Pal Singh served as a panel member for the interview conducted for YP-I on May 8, 2024, at ICAR-CIRG, Makhdoom.
- Dr. Tarun Pal Singh served as an "Independent Observer" for the conduct of the Indian Council of Agricultural Research (ICAR) 2024 PG-PhD degree examination on June 29, 2024 at Sikandara, Agra.
- Dr. Tarun Pal Singh acted as a "Microobserver" in Lok Sabha election-2024 on April 26, 2024 at Mathura.
- Dr. Tarun Pal Singh evaluated a "Ph.D. thesis" for Bharathidasan University, Palkalaiperur, Tiruchirappalli, Tamil Nadu, India.
- Dr. Tarun Pal Singh acted as "rapporteur" in XII Conference of the Indian Meat Science Association and National Symposium on "Green and sustainable meat sector: Global game changer", September 26-28, 2024 at DUVASU, Mathura, Uttar Pradesh.
- Dr. Tarun Pal Singh exhibited the Institute Technologies in the "ICAR Technology Day" on July 16-17, 2024 at NAS complex, New Delhi.
- Dr. Anil Kumar Mishra & Dr Nitika Sharma delivered a radio talk on "बकरियों में संक्रामक रोग, बचाव एवं टीकाकरण" at All India Radio, Mathura, Uttar Pradesh (India) on 23-02-2024.
- Dr. Anil Kumar Mishra acted as External Examiner to conduct Annual Practical Examination-2024 of Veterinary Microbiology Paper I & II at Mahatma Gandhi Veterinary College, Bharatpur, Rajasthan (India) on 26-02-2024.
- Dr. Anil Kumar Mishra acted as an external examiner for the M.V.Sc. thesis viva-voce examination of Miss Nidhi (Enrolment Number: V-2389/21) at DUVASU, Mathura, Uttar Pradesh (India) on 25-07-2024.
- Dr. Anil Kumar Mishra as Expert in the Brain Storming Session on "Transboundary animal diseases: way forward for prevention and

control" held at DUVASU, Mathura, Uttar Pradesh (India) on 01-02-2024.

- Dr. Anil Kumar Mishra received 'Award of Associate Fellow of National Academy of Dairy Science' awarded by National Academy of Dairy Science (India) on 09-04-2024.
- Dr. Anil Kumar Mishra received 'Best Oral Presentation Award' on 'Assessment of mortality due to caprine pneumonia in Jamunapari, Barbari, and Jakhrana breeds under semi-intensive farming system' in the International Conference on "Advancement of Science and Technology for Environment, Society and People-2024" organized by Society for Technology, Environment, Science & People, Kozhikode, Kerala (India) on May 17-18, 2024.
- Dr. Anil Kumar Mishra received 'Second Best Oral Presentation Award' on 'Prevalence of Mastitis in Barbari, Jamunapari, and Jakhrana Goat Breeds' in the International Conference on "Recent Advances in Agriculture, Engineering, Applied & Life Sciences for Environmental Sustainability" organized School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand (India) & Agro Environmental Development Society Rampur, Uttar Pradesh (India) on October 23-25, 2024.
- Dr. Anu Rahal acted as a member of the selection committee of associate professor and assistant professor at DUVASU, Mathura in year 2024.
- Dr. Anu Rahal acted as an external expert for Screening of Biodata of Teaching Faculty of Department of Veterinary Pharmacology & Toxicology, College of Veterinary Sciences& Animal Husbandry DUVASU Mathura under CAS Scheme in year 2024.
- Dr. Anu Rahal acted as an external examiner for Toxicology at CCS University, Meerut in year 2024.
- Dr. Anu Rahal acted as an external examiner for Ph.D. Comprehensive Examination- Veterinary Pharmacology & Toxicology of GBPUAT, Pantnagar.
- Dr. K. Gururaj invited as expert panelist for Industry–Farmers meet organised at the International Conference of Indian Society for Sheep and Goat Production and Utilization (ISSGPUCON 2024) held at RIVER, Puducherry, from 24th to 26th April 2024.
- Dr. K. Gururaj invited to deliver a lead paper titled "Brucellosis in Small Ruminants: Unraveling Disease Dynamics, Exploring Pathogenesis, and Strategizing Effective Control Measures" during the technical session on "Contemporary Diagnostic Techniques in Small Ruminants" at the International Conference of Indian Society for Sheep and Goat Production and Utilization (ISSGPUCON 2024) held at RIVER, Puducherry, from 24th to 26th April 2024.

Dr. Nitika Sharma acted as an external examiner for the MVSc thesis viva-voce examination of Miss Anupama Verma (Enrolment Number: V-1693/16) at DUVASU, Mathura, Uttar Pradesh (India) on 18 January, 2024.

- Dr. Nitika Sharma acted as an external examiner for the M.V.Sc. thesis viva-voce examination of Miss Shubhangi Choudhary (Enrolment Number: V-2378/21) at DUVASU, Mathura, Uttar Pradesh (India) on 18 January, 2024.
- Dr. Nitika Sharma acted as Co-Chairperson in technical session III multidimensional Approach towards enhanced Nutritional Security and food Safety in 18th conference of IAWV held at DUVASU, Mathura during November 13-14, 2024.
- Dr. Nitika Sharma acted as Jury Member in the Verghese Kurien Memorial Best Field Veterinarian Award Session in the 5th Annual Convention of Veterinary Internal and Preventive Medicine Society and International Symposium on "Headway in Veterinary medicine: Improving Animal Health and productivity with respect to antimicrobial resistance" organized by VIPM Society at College of Veterinary & Animal Sciences, SVPUAT, Meerut, India on 22-23 November, 2024.
- Dr. Nitika Sharma and Dr. K. Gururaj delivered a Radio talk on "नवजात मेमनों में स्वास्थ्य प्रबंधन एवं बकरियों के घरेलू उपचार" (ethno-veterinary practices) in Radio Krishi Pathshala Programme in year 2024.
- Dr. Nitika Sharma contributed and participated in the Documentary on "PPR in Small Ruminants" prepared by DAHD, Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India in year 2024.

Dr. Nitika Sharma delivered a TV talk to promote Ethno-Veterinary Medicines practices and Preventive Health Calendar for Goats in AGRI KI UDAAN Programme telecasted on 22.12.2024 on DD Kisan at 6:00 PM repeat telecast at 9:30 PM.

- Dr. Nitika Sharma is the External Expert for Institutional Biosafety Committee of DUVASU, Mathura since 17.10.2024.

- Dr. Nitika Sharma participated and acted as Panelist in the Brain Storming Session "Reverse Pharmacology: A Windfall to Post Covid Therapeutics" conducted by the Department of Veterinary Pharmacology and Toxicology, DUVASU, Mathura on 13 February, 2024.
- Dr. Nitika Sharma received Best Oral presentation Award on 'Acute hepatic and pulmonary cysticercosis in goat kids' in the 5th Annual Convention of Veterinary Internal and Preventive Medicine Society and International Symposium on "Headway in Veterinary medicine: Improving Animal Health and productivity with respect to antimicrobial resistance" organized by VIPM Society at College of Veterinary & Animal Sciences, SVPUAT, Meerut, India on 22-23 November, 2024.
- Dr. Nitika Sharma received Certificate of Excellence from BP International on 18.01.2024.
- Dr Nitika Sharma received Certificate of Honour in the Brain Storming Session "Reverse Pharmacology: A Windfall to Post Covid Therapeutics" conducted by the Department of Veterinary Pharmacology and Toxicology, DUVASU, Mathura on 13 February, 2024.
- Dr. Nitika Sharma received the "Indian Association of Women Veterinarians BEST RESEARCHER AWARD -2024"in recognition of outstanding achievements and noble services to Veterinary Medicine Profession in India in 18th conference of IAWV held at DUVASU, Mathura during November 13-14, 2024.
- Dr. Nitika Sharma, acted as VIPM Honoris Judcis and received award of honour in the 5th Annual Convention of Veterinary Internal and Preventive Medicine Society and International Symposium on "Headway in Veterinary medicine: Improving Animal Health and productivity with respect to antimicrobial resistance" organized by VIPM Society at College of Veterinary & Animal Sciences, SVPUAT, Meerut, India on 22-23 November, 2024.
- Dr. Nitika Sharma, received "Savitribai Phule Excellence Award for Lady Veterinarian 2024" for outstanding individual accomplishment and distinguished Veterinary services to the nation on the occasion of Republic Day of India 26 January, 2024.
- Under the mentorship of Dr Nitika Sharma, Dr Pallavi Chauhan, ICAR-NAARM 113th FOCARS Trainee completed her three-month Professional Attachment Training on the topic "Exploring the Antibacterial Efficacy, Toxicological Profiles, and Phytochemical Constituents of few Plant Extracts: A Comprehensive Study for Therapeutic Potential" from 18.12.2023 to 18.03.2024.
- Dr. A.K. Dixit received Certificate of Appreciation for outstanding and dedicated services to goat farmers under DAPSTC for their livelihood and all wellbeing.
- Dr. A.K. Dixit received SKSS Green Scientist Award for the exceptional contribution in the field of Environmental research and development.


Buck
Station
Semen Collection Centre


ISSOPUCON
2024


SKSS GREEN SCIENTIST AWARD - 2024
SARVHIT
KALYAN SEVA SAMITI
organizing
INTERNATIONAL CONFERENCE
(गाय , गौरैया, गंगा , संरक्षण)
NATURE, SCIENCE AND MODERN LIFESTYLE: ISSUES AND PERSPECTIVES
(IICNSMLIP-2024) & Green Scientist Award (2024)
SKSS National Green Scientist Award (2024)
28-29 December, 2024, Time : 10:30 am | Shri Puran Singh Memorial Auditorium, Lucknow
Certificate of SKSS GREEN SCIENTIST AWARD - 2024
This is to Certify that
Dr. A. K. Dixit
Principal Scientist
ICAR-CIRG Mathura
is awarded as SKSS Green Scientist Award -2024 for his exceptional contribution in the field of Research & Development.
Rajive Kumar
IFS (Retd.) Chairman
EAC Industry-1, MoEF and CC
SKSS NATIONAL AWARD

CHAPTER 15

AGRICULTURAL FARM AND AGRO-FORESTRY

15. AGRICULTURAL FARM AND AGRO-FORESTRY

Table 1: Major achievements in terms of fodder and grain/seed production and revenue generation (January to December, 2024)

Cultivation and supply of green fodder (Metric Ton)		
Through fodder crops	438.49	**589.86**
Through tree lopping	151.37	
Production of seeds /grains (Metric Ton)		
Barley	22.45	**33.08**
Guar	1.51	
Mustard	9.12	
Production and supply of straw (Bhoosa) (Metric Ton)		
Guar bhoosa	40.00	**40.00**
Agro-Forestry		
Plantation and gap filling	2250 Nos. of plant saplings of Bamboo, *Sahjan, Pakhar, Neem, Peepal, Bel, Bargad, Gular, Jamun, Desi babool, Sahtoot, Subabool* etc. were planted/gap filled in the agriculture farm area and other places of the institute.	
Plant saplings produced	Produced 650 plant saplings of *Sahjan, Neem, Peepal, Pakhar, Bargad, Gular, Jamun, Desi babool, Sahtoot, Subabool* etc. in the farm nursery.	
OTHERS		
Renovation and reclamation of farm land	7 acres land (undulated) was renovated and developed for Agro-forestry model.	
Revenue generated	Rs. 6,50,200/- (Rs 32,500/- sale of Moonj-Phoos & Pamma, Rs. 40,000/- sale of mustard straw (toori) and Rs 5,77,700/- from sale of mustard)	

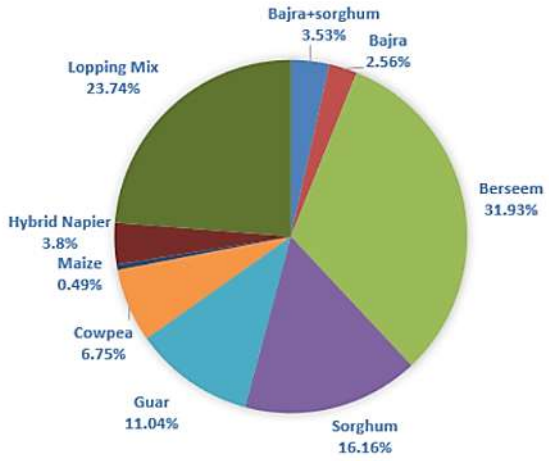

Fig. 1. Crop wise green fodder supply to different livestock units

Table 2: Status of forage crops sown during January to December, 2024

Sr. No.	Crops	Area in acres			
		Zaid	Kharif	Rabi	Total area
1.	Bajra	2.00	6.00	-	**8.00**
2.	Bajra+Sorghum	1.50	-	-	**1.50**
3.	Sorghum	3.20	2.00	-	**5.20**
4.	Hybrid Napier	0.25	-	-	**0.25**
5.	Guar	7.00	50.00	-	**57.00**
6.	Cowpea (Lobia)	4.00	7.50	-	**11.50**
7.	Moringa Gap filling (with seed)	-	1.00	-	**1.00**
8.	Maize	2.00	-	-	**2.00**
9.	Barley	-	-	55.00	**55.00**
10.	Oats	-	-	1.70	**1.70**

11.	Rijka			1.00	**1.00**
12.	Berseem	-	-	4.70	**4.70**
13.	Mustard	-	-	14.50	**14.50**
14.	Different grasses	-	10.00	-	**10.00**
Total Area		**19.45**	**76.50**	**76.90**	**173.35**

Table 3: Supply of feed grain and bhoosa to different livestock units

Livestock Unit	Supply of Grain, q		Supply of Guar *Bhoosa*, q
	Barley	Guar	
Sheep Unit	38.00	5.10	110.00
Jamunapari Unit	11.00	5.00	100.00
Jakharana Unit	5.00	3.25	60.00
Barbari Unit	24.50	10.00	70.00
ANMPT Shed	94.50	0.00	0.00
APR Shed	20.00	6.00	60.00
Total	**193.00**	**29.35**	**400.00**

Other Activities

- **Maintenance of Natural Farming Demonstration Unit**

  Agricultural farm section has established and maintaining a demonstration unit on Natural farming for fodder cultivation in about one-acre land. In this demonstration unit we are practicing natural ways of fodder cultivation such as preparation and spray of jeevamrit as natural fertilizer, beejamrit for seed treatment, mulching with plant residue and intercropping of leguminous and non-leguminous fodder crops. During the year 2024 several demonstrations were given on cultivation of forage crops through Natural Farming practices, preparation of jeevamrit, beejamrit and cultivation of forage crops through the techniques of Natural Farming etc. were organized for the farmers and students. Hands on training on preparation of jeevamrit & beejamrit for natural farming was also organized for the 25 participants of "Feed-Fodder Production, Processing and Ration Formulations for Goats" training programme.

Fig. 2. Demonstration of natural farming techniques of fodder cultivation

- **Installation of Drip Irrigation System**

  Drip irrigation system has been installed and laid out in about 7.0 Acres of agroforestry area. This is likely to reduce the water requirement for irrigation of agroforestry area and increase water use efficiency. The fodder trees of agroforestry area can be maintained with minimum resources and good quality tree fodder for the goats can be harvested during extreme winter and other fodder scarcity period.

Fig. 3. Installation of drip irrigation system in agroforestry field

- **Organization of Parthenium Awareness Week**

  Parthenium Awareness Week was organized form 16th - 22nd August, 2024 to create awareness about the harmful effects of parthenium among the CIRG staff and farmers of nearby villages. During this week-long activity the health hazards of parthenium grass and its eradication methods were demonstrated to the staff of agriculture farm, livestock units and farmers of nearby villages. Awareness programme was also organized for to the DAPSC project beneficiaries. During the awareness programmes the farmers were explained about the chemical and mechanical control of parthenium grass, its effect on reduction of productivity of our crops and health hazards on animals and human beings. A week long (16-22 August, 2024) Programme was observed by uprooting Parthenium plants present at agriculture farm, office premises, animal sheds and roadside of the campus. During this week-long celebration, two days programme was exclusively organized for the farmers (50 Nos. each day) of DAPSC adopted villages and they were made aware about the harms of the parthenium weed and their control measures. Some of the glimpses of the celebration are as follows. Demonstration was also given on how to control parthenium emerging in the agriculture land and dwelling areas. Director of the institute Dr. Manish Kumar Chatli also explained about the allergic effects of parthenium grass and urged the farmers and employees to eradicate this harmful weed.

Fig. 4. Activities of parthenium awareness week 2024

- **Plantation of Bamboo as Bio-Fence**

  Bio-fencing with bamboo plantation was done to prevent the entry of stray animals in our farm from Yamuna River side. About 2000 bamboo plants were planted along the Yamuna River bank of agriculture farm. The bamboo plants are coming up very well and in future this may act as effective bio-fence. The leaves of properly grown bamboo plants can also be fed to goats.

- **Demonstration of Fodder Production for Goats**

  Time to time the demonstrations on feed and fodder production and processing are conducted for the trainees of scientific goat farming, veterinary students, goat farmers of other sponsored trainings and school students. These demonstrations include round the year fodder production techniques for goats, nursery raising of fodder trees, hay making, mechanization of fodder cultivation and natural farming for fodder production etc.




- **Other Facilities/Infrastructure Developed**

  i) Land renovation in about 7 acres of area for pasture development and fodder tree plantation
  ii) Installation of toilet at Mayur Van
  iii) Layout of irrigation pipe line in 200 m length
  iv) Installation of one number of 12 hp submersible pump for irrigation purpose
  v) Repairing of farm boundary fencing for 2000 m length
  vi) Renovation of water storage pond and initiation of fish rearing
  vii) Procurement of Tractor and stainless-steel body water tanker one each
  viii) Net house for nursery raising


Fig. 5. Facilities/infrastructure developed at agriculture farm

- **Medicinal Garden**

(Coordinators: Dr. Nitika Sharma, Dr. Arvind Kumar and Sh. Sugad Singh)

A Medicinal Garden has been established at the Agriculture Section, ICAR-CIRG, Makhdoom, with the objective of collecting, documenting, and conserving local medicinal plant species of the semi-arid agro-climatic zone that possess ethno-veterinary significance.

Approximately 45 plant species, including trees, shrubs, herbs, and climbers, have been planted and are being systematically maintained in the garden. This initiative serves multiple purposes: conserving traditionally used medicinal plants, utilizing sandy and waste soil areas for the cultivation of medicinal flora, and raising awareness among the community about the importance and traditional uses of local medicinal plants in animal health care. Plants traditionally used for treating goat diseases have been identified and are being maintained in the Medicinal Garden.

Exposure visits of farmers, goat keepers, and small ruminant stakeholders to the ICAR-CIRG Medicinal Garden are organized during National Training Programs and those sponsored by DAPSC and DAPSTC on 'Scientific Goat Farming'. These visits aim to raise awareness about the application of ethno-veterinary practices in goat farming. Additionally, efforts are made to promote these traditional practices among goat keepers and stakeholders through the DD Kisan 'Agri Ki Udaan' programme."

Fig. 6. Creating awareness about the ethno-veterinary practices among the goat keepers and small ruminant stake holders through DD Kisan Agri Ki Udaan Programme

CHAPTER 16

METEOROLOGICAL OBSERVATION (2024)

16. METEOROLOGICAL OBSERVATION (2024)

Mean Monthly Meteorological Observations (January to December 2024)

Month	Max. Temp (°C)	Min Temp (°C)	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)	Vapour pressure (mm Hg)	R.H (%)	Temp (°C)	Vapour pressure (mm Hg)	R.H (%)			
January	15.84	5.69	8.34	7.58	91.65	15.89	9.58	71.61	2.00	67.40	01
February	25.72	9.19	13.17	9.10	79.30	25.00	9.52	39.17	4.60	212.70	01
March	32.39	13.66	20.02	12.29	66.52	31.44	11.32	32.48	12.16	260.00	02
April	40.68	20.77	29.08	14.03	45.60	38.93	12.90	23.80	0.00	232.00	00
May	43.65	25.69	33.94	18.19	44.42	42.24	17.77	27.94	0.00	281.10	00
June	44.00	28.47	35.13	21.87	52.83	42.18	19.00	32.67	78.54	185.60	03
July	36.85	27.85	31.55	27.32	78.42	34.76	27.23	65.61	22.50	155.90	02
August	34.44	25.84	29.02	26.45	88.03	32.19	26.61	74.48	151.91	122.30	16
September	34.18	24.55	28.22	24.73	86.90	32.87	25.20	73.97	187.74	133.30	07
October	37.61	20.92	26.42	19.45	73.87	36.39	17.71	38.26	0.00	260.90	00
November	31.93	13.52	17.15	12.80	87.63	30.68	13.03	38.37	0.00	182.90	00
December	23.58	7.11	10.85	8.35	85.58	22.52	9.10	46.13	5.50	156.90	01

Maximum temperature of 50.0°C recorded on 29th May 2024
Minimum temperature of 0.5°C recorded on 12th January 2024
Annual rainfall of 464.9 mm in 33 days (highest rainfall of 84.5 mm recorded on 12th September 2024)
(Generated and compiled by Dr. Y. K. Soni and Mr. Ranjeet Singh YP1)

CHAPTER 17

PARTICIPATION IN EXHIBITION / KISAN MELA

17. PARTICIPATION IN EXHIBITION / KISAN MELA

- ICAR-CIRG showcased goat technologies at Krishi Mela RLBCU Jhansi on 08-10 February 2024. Large number of farmers visited CIRG stall and seen goat technologies exhibited. Technical literature on scientific goat farming was distributed to the visitors and farmers.
- ICAR CIRG organised National Goat Fair and Agro- Industry Exhibition on 6th March 2024. More than 2000 goat farmers (majority of women goat farmers from SC and ST social class) participated in this fair. Goat competition, goat show was organised and about 40 stalls from different ICAR institute, other line departments and NGOs have showcased their technologies. About 40 progressive goat farmers from different states were awarded. Women goat farmers from SC and ST social class were also distributed goat inputs.
- ICAR-CIRG showcased goat technologies at International Agriculture & Horti Expo Workshop on 20-22 July 2024 at Pragati Maidan. New Delhi. CIRG was awarded 1st price for excellence research in goat.
- ICAR- CIRG showcased goat technologies in Pt. Deendayal Upadhyay Smrati Mela (29Sep -02Oct 2024) at Deendayal Dham Farah Mathura (U.P.). Farmers visited CIRG stall and seen goat technologies exhibited. Technical literature on scientific goat farming was distributed to the visitors 'farmers.
- ICAR- CIRG showcased goat technologies in Kisan Mela (19-20 October 2024) at Banda University of Agriculture and Technology, Banda. Shri Ayodhya Singh Patel Hon'ble chairman for Bundelkhand development board, V.C. and Director of extension BUAT Banda visited CIRG stall and appreciated efforts being made by the institute for the upliftment of goat farmers of Bundelkhand. Farmers visited CIRG stall and seen goat technologies exhibited. Technical literature on scientific goat farming was distributed to the visitors farmers.
- ICAR-CIRG showcased technologies at National Goat Conclave-2024 Bakri Maha Kumbh-2024 National Goat Fair and Agro-Industrial Exhibition at CIRG Campus on 18th November 2024. More than three thousand (3000) farmers participated and visited 45 stalls exhibited different technologies of their respective institutes.


58A
ICAR- CIRG. MATHURA


C.I.R.G.

CHAPTER 18

SWACHH BHARAT ABHIYAN ACTIVITIES

18. SWACHH BHARAT ABHIYAN ACTIVITIES

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के तहत अंतर्गत विभिन्न गतिविधियां आयोजित कर रहा है। आज दिनांक 16.12.2024 को संस्थान के निदेशक डा . मनीष कुमार चेटली ने कर्मचारियों, अधिकारीयों, यंग प्रोफेशनल को संबोधित करते हुए कहा कि स्वच्छ भारत अभियान महात्मा गांधी की एक परिवर्तनकारी मुहिम थी। ओर इस अवसर पर सभी कर्मचारियों, अधिकारीयों, यंग प्रोफेशनल ने भाग लिया ।स्वच्छता ही सेवा" की शपथ ली।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के अंतर्गत आज दिनांक 17.12.2024 को संस्थान के प्रांगण स्थित तालाब (Water Harvesting Pond) किनारे वृक्षारोपण एवं सफाई की व्यवस्था को देखा गया एवं सफाई की गयी। संस्थान के निदेशक डा . मनीष कुमार चेटली जी द्वारा वृक्षारोपण किया गया एवं संस्थान के कर्मचारियों, अधिकारीयों, यंग प्रोफेशनल को संबोधित करते हुए वृक्षारोपण के महत्तव के बारे मे समझाया एवं वर्षा के जल संचयन (जल ही जीवन) के बारे मे अवगत कराया । इस अवसर पर संस्थान के प्रधान वैज्ञानिक डॉ बी राय, डॉ अनुपम कृशन दीक्षित, डॉ अरविंद कुमार, एवं सतीश चंद्रा (ACTO), पुष्पेंद्र यादव (AAO), एवं संस्थान के कर्मचारियों, अधिकारीयों, यंग प्रोफेशनल ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के अंतर्गत आज दिनांक 18.12.2024 को संस्थान के सभागार में संस्थान के कर्मचारियों, अधिकारीयों, यंग प्रोफेशनल एवं विभिन्न क्षेत्रों बीजनौर, सौनभद्र, जालौन, फरखाबाद, बदायूं, इटावा) जिलों से आए 33 प्रशिक्षणार्थियों को स्वच्छता पर आधारित माननीय प्रधानमंत्री जी का चलचित्र (Short Video Film) दिखाया गया एवं स्वच्छता एंथम गीत के माध्यम से प्रशिक्षणार्थियों को स्वच्छता पखवाड़ा का महत्तव को समझाया एवं अपने घर ओर आस पास के क्षेत्रो को साफ सफाई करने और साफ रखने को प्रेरित किया । इस अवसर पर संस्थान के प्रधान वैज्ञानिक डॉ बी राय, डॉ रवि रंजन , डॉ अरविंद कुमार, एवं सतीश चंद्रा (ACTO), एवं संस्थान के कर्मचारियों, अधिकारीयों, यंग प्रोफेशनल एवं विभिन्न क्षेत्रोंजिलों से आए 33 प्रशिक्षणार्थियों ने भाग लेकर कार्यक्रम को सफल बनाया।

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केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के अंतर्गत आज दिनांक

21.12.2024 को संस्थान के में गेट से आगे दींनदयाल धाम कॉलोनी के सामने जो गंदे पानी का तालाब बना है उसके आह पास सफाई कार्य एवं श्रमदान किया गया। सस्थान के निदेशक एवं संस्थान में कार्यरत एवं कैम्पस में निवासरत सभी कर्मचारियों , तकनिशियन , यंग प्रोफेशनल ने कार्यक्रम में अपनी सहभागिता की एवं सफाई की एवं स्वच्छता पखवाड़ा का महत्तव को समझाया एवं अपने घर ओर आस पास के क्षेत्रो को साफ सफाई करने और साफ रखने को प्रेरित किया । इस अवसर पर संस्थान के निदेशक, डॉ विजय किशोर एवं सतीश चंद्रा (ACTO), एवं संस्थान के कर्मचारियों, कैम्पस में निवासरत सभी कर्मचारियों , तकनिशियन , यंग प्रोफेशनल ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के अंतर्गत आज दिनांक 22.12.2024 को संस्थान के खेल कूद प्रांगड़ (Sports Complex) उसके आस पास सफाई कार्य एवं श्रमदान किया गया । इस अवसर पर स्वच्छता एक महत्वपूर्ण समस्या है जो देश और सरकार दोनों के लिए महत्वपूर्ण है, स्वच्छता केवल सरकार से नहीं बल्कि समाज के सभी सदस्यों के सहयोग से संभव है, स्वच्छता की शुरुआत भी व्यक्तिगत स्तर से होती है, जिसके लिए लोगों की सच्ची इच्छा और संवेदनशीलता की आवश्यकता होती है, बड़े स्तर पर नगर पालिकाएँ, ग्राम पंचायतें और स्थानीय नेता भी सरकार की नीतियों और योजनाओं को लागू करने के लिए जिम्मेदार हैं, स्वच्छता एक समग्र प्रक्रिया है और इसे सरकार और समाज के सहयोग से ही सफलतापूर्वक पूरा किया जा सकता है। विषय पर ज़ोर दिया गया एवं अपने घर ओर आस पास के क्षेत्रो को साफ सफाई करने और साफ रखने को प्रेरित किया । इस अवसर पर संस्थान के एवं सतीश चंद्रा (ACTO), श्री वी.के.शर्मा एवं संस्थान के कर्मचारियों, कैम्पस में निवासरत सभी कर्मचारियों, तकनिशियन, यंग प्रोफेशनल ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के अंतर्गत आज दिनांक 23.12.2024 को संस्थान में किसान दिवस के उपलक्ष में बकरी पालन सगोष्ठी एवं सामग्री वितरण कार्यक्रम का आयोजन किया गया। आज किसान दिवस (पूर्व प्रधानमंत्री स्व श्री चौधरी चरण सिंह जी जन्मदिन) के अवसर पर संस्थान में स्थित भेड़ शेड पर विभिन्न गावों से आए 50 से 60 किसानों को संस्थान के प्रभारी निदेशक डॉ रवीद्र कुमार जी ने किसानों को संबोधित करते हुए स्वच्छता के बारे में अवगत कराया साथ ही यह भी अवगत कराया कि अपने पशुओं के आवास (बाड़े) में साफ सफाई का ध्यान रखना चाहिए जिससे कि हमारे पशु स्वस्थ रहें, साथ ही किसान दिवस के उपलक्ष में विभिन्न गावों से आए 50 से 60 किसानो को किसान दिवस की महत्वपूर्ण बातों पर प्रकाश डाला ओर DAPSC प्रोजेक्ट के तहत किसानों को टॉर्च (Torch) देकर सम्मानित किया गया। इस अवसर पर संस्थान के प्रभारी निदेशक डॉ रवीद्र कुमार, डॉ, अनुपम कृष्ण दीक्षित, डॉ बी राय, डॉ अरविंद कुमार एवं सतीश चंद्रा (ACTO), प्रकाश, रोहन एवं संस्थान के कर्मचारी, तकनिशियन, यंग प्रोफेशनल एवं विभिन्न गावों से आए किसानों ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के में आज दिनांक 24.12.2024 को संस्थान की तरफ से अछनेरा ब्लॉक के ग्राम पंचायत बस्तई में स्वच्छता पखवाड़ा अंतर्गत ग्राम वासियों को स्वच्छता की ओर प्रेरित किया एवं अपने आस पास सफाई करने तथा सफाई रखने को कहा गया। साथ ही ग्राम वासियों ओर ग्राम प्रधान श्रीमती राजकुमारी जी को यह भी अवगत कराया कि अगर गांव में सफाई रहेगी तो गांव में बीमारियां भी कम फैलेंगी और गांव की शान बढ़ेगी। गांव को स्वच्छ रखें गांव की सामूहिक व खुली जगहों को साफ - सुथरा रखें। गांव मे कूड़ा कचरा प्रबंधनं के लिए योजना बनाएं। कचरा प्रबंधन के लिए कचरा डालने के लिए दो अलग-अलग कूड़ादान बनवाएं। इस अवसर पर संस्थान के सतीश चंद्रा (ACTO), ग्राम प्रधान श्रीमती राजकुमारी जी प्रकाश, रोहन, रितेश कुमार, रणवीर सिंह एवं संस्थान के कर्मचारी, तकनिशियन, यंग प्रोफेशनल एवं ग्राम वासियों ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 में आज दिनांक 25.12.2024 को संस्थान में यमुना नदी के किनारे स्थित मयूर वन पर साफ सफाई की गयी तथा इस अवसर पर श्री सतीश चंद्रा (ACTO) जी ने वहाँ मौजूद कर्मचारियों से अपील की शांतिपूर्ण सुबह की सैर से लेकर यादगार पारिवारिक पिकनिक तक, स्थानीय पार्कों (मयूर वन) में बहुत कुछ है। वे हमारे लिए

महत्वपूर्ण हैं, और हमें उन्हें साफ रखने की ज़रूरत है। हमारे पार्कों को सुंदर और आकर्षक बनाए रखने में सफ़ाई एक महत्वपूर्ण भूमिका निभाती है। और इस अवसर पर संस्थान के एवं सतीश चंद्रा (ACTO), रोहन, राजेश एवं संस्थान के कर्मचारियों, तकनिशियन, यंग प्रोफेशनल ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के में आज दिनांक 26.12.2024 को संस्थान की तरफ से प्राथमिक विद्यालय थिरावाली फरह जनपद मथुरा में छात्रों (बालक एवं बालिकाओं) को श्री सतीश चंद्रा (ACTO) जी एवं प्रधान अध्यापक श्रीमती संतोष कुमारी जी ने संबोधित करते हुए बताया कि स्कूल की स्वच्छता और सफाई व्यवस्था छात्रों के लिए अनुकूल शिक्षण वातावरण को बढ़ावा देने में महत्वपूर्ण भूमिका निभाती है। स्कूलों में उचित स्वच्छता प्रथाओं का कार्यान्वयन न केवल स्वास्थ्य को बढ़ावा देता है बल्कि उपस्थिति, प्रेरणा और समग्र कल्याण को भी बढ़ाता है। तथा कला एव चित्रण प्रतियोगिता भी करायी गयी, एवं सभी छात्रों (बालक एवं बालिकाओं) को मिष्ठान वितरण किया गया। इस अवसर पर संस्थान के श्री सतीश चंद्रा (ACTO), रामेश्वर, राजेश एवं संस्थान के कर्मचारी, ,तकनिशियन , यंग प्रोफेशनल एवं प्रधान अध्यापक श्रीमती संतोष कुमारी, अध्यापक श्रीमती अखिलेश कुमारी श्रीमती खुसबू कुमारी ओर श्रीमती सुनीता कुमारी गुप्ता, ओर आँगन वाड़ी के बच्चों ने भाग लिया आँगनवाड़ी कार्यकरती श्रीमती सुशीला जी, ग्राम निवासी, श्री राजाराम जी जितू जी ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के में आज दिनांक 27.12.2024 को संस्थान में आज मुख्य अतिथि श्री डी.एस.शर्मा, कुल सचिव, ICAR, दिल्ली, श्री श्याम सुन्दर जी (AO), श्री चमन सिंह जी (FAO), श्री सतीश चंद्रा (ACTO) जी एवं अन्य सभी कर्मचारी द्वारा अतिथि ग्रह (Guest House) के पीछे सफाई की गयी। इस अवसर पर मुख्य अतिथि श्री डी.एस.शर्मा, कुल सचिव जी ने सफाई के महत्व को समझते 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 होता है। बल्कि स्वच्छता का मतलब हमारे घर से आस-पड़ोस में भी मौजूद गंदगी जैसे धूल, मिट्टी, खुला कचड़ा, जमा हुआ गंदा पानी, गढ्ढे, आदि इन सब से भी मुक्त होना जरूरी है। अगर हमारे चारों तरफ सफाई बनी रहेगी तो हमारा स्वास्थ्य भी बेहतर रहेगा। वैसे तो कहा जाता है कि अगर आपका मन साफ है तो आप तब भी स्वच्छ माने जाते हैं। इंसानों के लिए मन की सफाई आस-पास की सफाई जितना ही महत्वपूर्ण हो गया है। स्वच्छता को बरकरार रखने के लिए हमारे देश के प्रधानमंत्री भी स्वच्छता अभियान का पालन करने का आग्रह करते हैं। ऐसी ही कुछ स्वच्छता की आदतों का पालन बड़ों के साथ-साथ बच्चों को भी करना चाहिए ताकि वह कई तरह की बीमारियों से बच सकें। इस अवसर पर मुख्य अतिथि श्री डी.एस.शर्मा, कुल सचिव, ICAR, दिल्ली संस्थान के श्री श्याम सुन्दर जी (AO), श्री चमन सिंह जी (FAO), श्री सतीश चंद्रा (ACTO), रामेश्वर, राजेश एवं संस्थान के कर्मचारी, तकनिशियन, यंग प्रोफेशनल ने भाग लेकर कार्यक्रम को सफल बनाया।

केन्द्रीय बकरी अनुसंधान संस्थान के संयुक्त तत्वावधान में स्वच्छ भारत मिशन के अंतर्गत 16 से 31 दिसम्बर 2024 तक "स्वच्छता पखवाड़ा" अभियान 2024 के में आज दिनांक 31.12.2024 को संस्थान में आज पुराने अभिलेखों जो कि 20 वर्ष से अधिक पुराने है, जिनका कि कोई उपयोग नहीं हैं, आज उन अभिलेखों का संस्थान के निदेशक डॉ मनीष कुमार चेटली जी के समक्ष विधिवत रूप से क्रेशर के माध्यम से नष्ट कराया गया। इस अवसर पर संस्थान के निदेशक डॉ मनीष कुमार चेटली, श्री चमन सिंह जी (FAO), श्री श्याम सुंदर (AO), श्री पुष्पेंद्र यादव (AAO), श्री मुखेश चौहान (AAO) एवं श्री सतीश चंद्रा (ACTO), संस्थान के कर्मचारी, तकनिशियन, यंग प्रोफेशनल ने भाग लेकर कार्यक्रम को सफल बनाया।

CHAPTER 19

INSTITUTE EVENTS

19. INSTITUTE EVENTS

19.1 Bakri Maha Kumbh-2024, National Goat Fair and Agro-Industrial Exhibition

ICAR-CIRG organised National Goat Conclave-2024 with the collaboration of Department of Animal Husbandry and Dairying. Under this conclave, *Bakri Maha Kumbh-2024* National Goat Fair and Agro-Industrial Exhibition was organised at CIRG Campus on 18th November 2024. More than three thousand farmers participated and visited 45 stalls exhibiting different technologies on crop and animal production.

19.2 National Seminar on Policy and Strategies for Indian Goat Sector in 'Amrit Kaal'

Under National Goat Conclave-2024, a National Seminar on Policy and Strategies for Indian Goat Sector in 'Amrit Kaal' was organized at Hotel Holiday Inn, Sanjay Place, Agra. Secretary Animal Husbandry Ms Alka Upadhyay, Animal Husbandry commissioner Dr Abhijit Mitra, DDG (Animal Science) Dr Raghvendra Bhatta, ADG (AP&B) Dr G. K. Gaur and other dignitaries of ICAR and Animal Husbandry department graced the occasion. Stakeholders from different govt and private institutions participated and shared their views during the panel discussions.

19.3 Training and Input Distribution: DAPSC & DAPST Project

On 27.01.2025, Honourable Union Minister Prof. S.P. Singh Baghel, Animal Husbandry, Fisheries and Dairy and Panchayati Raj, Government of India, New Delhi released the Annual Goat Rearing Brochure-2025 developed under the Scheduled Caste and Scheduled Tribe Development Plan at the Central Institute for Research on Goats, Makhdoom. Along with this, the Union Minister in his address encouraged the farmers and goat rearers and appealed to them to rear goats in a scientific manner so that there can be a guaranteed increase in their income. In this program, Dr. Manish Kumar Chatli, Director, CIRG along with the project's Nodal Officer Dr. Gopal Das and Dr. Anupam Krishna Dixit and Dr. Arvind Kumar, all the scientists, administrative and technical officers and employees of the institute were present.

19.4 Training and Input Distribution Program with the Collaboration of Reliance Foundation

ICAR-CIRG organized one day training program for 50 ST women goat farmers from 11 villages of 4 blocks of Bundi district of Rajasthan with collaboration of Reliance Foundation. Experiences and views shared by the women goat farmers during the problem assessment exercise before training and best possible solutions of problems and good practices were provided to the participants. Input distribution to the participants under DAPSTC program was also conducted.

19.5 Organised visit of Director General (DG) ICAR

Hon'ble Secretary (DARE) & Director General (ICAR), Dr Himanshu Pathak sir visited at ICAR-Central Institute for Research on Goats, Makhdoom.


मुजफ्फरनगरी भेड़ प्रक्षेत्र
(भेड़ सुधार नेटवर्क परियोजना)

19.6 Celebration of Mahila Kisan Diwas

ICAR-CIRG organized one day training program for SC women goat farmers from Mathura district. One day training program on scientific goat farming was conducted.

19.7 Celebrated World Goat Day

Under Developmental Action Plan for Schedule Tribes (DAPST) organised the one-day training program on scientific goat farming, exposure visit and input distribution on the occasion of World Goat Day 21st August 2024. Ten (10) ST women goat farmers from Sarmathura block of Dholpur Rajasthan. These progressive farmers were received inputs by the Hon'ble Minister of State Fisheries, Animal Husbandry and Dairying, Panchayti Raj Minister of State Govt of India.

CHAPTER 20

IMPORTANT MEETINGS

20. IMPORTANT MEETINGS

20.1 Research Management and Coordination

In 2024, ICAR-CIRG effectively coordinated 33 research projects, including 13 institute-funded and 20 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), Quinquennial Review Team (QRT), and Institute Management Committee (IMC).

20.2 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.

20.3 Institute Technology Management Unit (ITMU)

Functioning under the NAIF scheme, ITMU managed intellectual property rights and promoted the commercialization of innovations. In 2024, it facilitated patent filings, technology transfers, and strengthened industry partnerships, contributing to the institute's innovation ecosystem.

20.4 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.

20.5 Research Advisory Committee (RAC)

The 31st RAC meeting was held on 16 August 2024 under the chairmanship of Prof. Dr. A. C. Varshney. The committee reviewed the institute's research achievements, suggested improvements, and emphasized biotechnological interventions and translational goat-based technologies.

20.6 Composition of Committees

20.6.1 Research Advisory Committee (RAC), 2024

Designation	Name	Affiliation / Email
Chairman	Prof. Dr. A. C. Varshney	Former VC, DUVASU, Mathura Email: varshneyac@gmail.com Mob: 9780046214
Members	Dr. A. S. Sirothia	Ex-Head, Animal Genetics & Breeding, MAFSU, Nagpur Email: arun.sirothia@gmail.com Mob: 9422110949
	Dr. M. Lakshman	Professor, Veterinary Pathology, PVNRTVU, Hyderabad Email: mekala_bry@yahoo.com Mob: 9963139099
	Dr. D. C. Shukla	Retired Head, Animal Physiology, ICAR-IVRI, Izatnagar Email: dcshukla1144@gmail.com Mob: 9359105032
	Dr. Harish Verma	Former Director (Extension), GADVASU Email: hkvpau@gmail.com Mob: 9815873929
	Dr. Manish K. Chatli	Director, ICAR-CIRG, Mathura
ICAR Nominee	Dr. Gyanendra K. Gaur	ADG (AP&B), ICAR HQ, New Delhi
Farmer Rep.	Shri Ramavtar Meena	Khirkhadi, Jhanoon, Dist. Sawai Madhopur, Rajasthan Email: ramwatermeena@gmail.com
Rural Rep.	Shri Gopeshwar Tripathi	Sri Ram Janaki Mandir, Gandhi Nagar, Basti Email: gopeshwar.tri2900.gt@gmail.com
Member Secretary	Dr. Ashok Kumar	Principal Scientist & I/c PME Cell, ICAR-CIRG Email: pmecirg@gmail.com, akumar63@gmail.com Mob: 9412826627

20.6.2 Quinquennial Review Team (QRT)

The final QRT (2019–2024) conducted its review in October 2024, assessing research relevance, innovation uptake, and institutional impact. The team provided critical recommendations for enhancing 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

20.7 Institute Research Committee (IRC)

The Annual IRC (2–4 April 2024) and Half-Yearly IRC (9–10 January 2025) meetings were chaired by the Director and coordinated by the PME Cell. These meetings assessed scientific progress and realigned projects with institutional priorities.

20.8 Institute Management Committee (IMC)

The IMC meeting, held on 5 November 2024 under the chairmanship of the Director, addressed financial planning, infrastructure development, and administrative matters. Key decisions supported both ongoing and new initiatives aligned with ICAR's governance framework.

20.9 Institutional Meetings Held (2024–25)

S. No.	Meeting	Chairman	Member Secretary	Date(s)	Purpose / Remarks
1	Annual IRC	Dr. Manish Kumar Chatli	Dr. Ashok Kumar	2–4 April 2024	Annual review of research projects
2	Half-Yearly IRC	Dr. Manish Kumar Chatli	Dr. K. Gururaj	9–10 January 2025	Mid-year progress evaluation
3	Research Advisory Committee (RAC)	Prof. Dr. A.C. Varshney (Former VC, DUVASU)	Dr. Ashok Kumar	16 August 2024	30st RAC Meeting; project evaluation & strategy
4	Institute Management Committee (IMC)	Dr. Manish Kumar Chatli	Not Specified	5 November 2024	Review of financial, administrative, and infrastructure aspects
5	Quinquennial Review Team (QRT)	Dr. H. Rahman	—	7–8 October 2024	Final review of institutional performance (2019–24)

CHAPTER 21

WOMEN CELL

21. WOMEN CELL

Women's Complaint Committee is meant to redress the gender related grievances of the women employees of ICAR-CIRG under Sexual Harassment of Woman at Workplace Act, 2013 and to provide them a congenial environment at their workplace. The Women's Complaint Committee of ICAR-CIRG has been reconstituted on 10th April, 2023 with following members:

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

No complaints were received during the Academic Year 2024-25. One meeting was conducted on December 30, 2024 to discuss the propositions for improving the work conditions of the female employees at ICAR-CIRG.

Secretary Animal Husbandry Ms. Alka Upadhyay, Animal Husbandry Commissioner, Dr. Abhijit Mitra, DDG (AS) ICAR, Dr. R. Bhatta during National Goat Conclave 2024

CHAPTER 22

हिंदी पखवाड़ा

22. हिंदी पखवाड़ा

संस्थान में हिंदी पखवाड़ा 2024 का आयोजन दिनांक 13 से 30 सितंबर तक बड़े ही हर्ष और उल्लास के साथ किया गया। यह आयोजन न केवल हिंदी भाषा को सम्मान देने और उसके प्रचार–प्रसार को बढ़ाने का अवसर प्रदान करता है, बल्कि यह हमें अपनी सांस्कृतिक जड़ों से जुड़ने और हिंदी को दैनिक जीवन में अपनाने की प्रेरणा भी देता है। हिंदी पखवाड़ा, जो हर वर्ष आयोजित किया जाता है, हमारे संस्थान के वार्षिक कैलेंडर में एक महत्वपूर्ण आयोजन बन चुका है। हिंदी पखवाड़ा का शुभारंभ 13 सितंबर, 2024 को संस्थान के कार्यकारी निदेशक के करकमलों से दीप प्रज्वलन के साथ हुआ। इस अवसर पर निदेशक महोदय ने अपने संबोधन में कहा, "किसी भी देश की एकता और विकास के लिए उसकी राष्ट्रभाषा का समृद्ध और सशक्त होना अत्यंत आवश्यक है। हिंदी हमारी पहचान है और इसे प्रोत्साहित करना हम सभी का कर्तव्य है।" उन्होंने संस्थान के सभी कर्मचारियों और प्रतिभागियों को हिंदी भाषा में कार्य करने और इसे अपनी दिनचर्या का अभिन्न हिस्सा बनाने का संदेश दिया। राजभाषा प्रभारी, डॉ. तरुण पाल सिंह, वैज्ञानिक, ने हिंदी पखवाड़ा की रूपरेखा प्रस्तुत की। उन्होंने आयोजन के महत्व को रेखांकित करते हुए सभी विभागाध्यक्षों, अनुभाग प्रमुखों, वैज्ञानिकों, तकनीकी एवं प्रशासनिक अधिकारियों और कर्मचारियों को इसमें सक्रिय भागीदारी के लिए प्रेरित किया। इस पखवाड़े के दौरान कई रचनात्मक और ज्ञानवर्धक गतिविधियों का आयोजन किया गया। इसमें शामिल थे: हिंदी टिप्पण और प्रारूप लेखन प्रतियोगिता, निबंध लेखन और प्रश्न मंच प्रतियोगिता, वाद–विवाद प्रतियोगिता, शोध–पत्र लेखन प्रतियोगिता, आशुभाषण और हिंदी हस्ताक्षर प्रतियोगिता. इन सभी गतिविधियों में कर्मचारियों ने बढ़–चढ़कर भाग लिया। उनकी रचनात्मकता और समर्पण ने यह सिद्ध कर दिया कि हिंदी भाषा के प्रति लगाव और आदर संस्थान के प्रत्येक व्यक्ति में गहराई तक निहित है। पखवाड़े के दौरान एक दिवसीय हिंदी कार्यशाला का आयोजन किया गया। इसमें जिसमें स्थानीय कवियों और साहित्य प्रेमियों ने भाग लिया। कवियों ने अपनी रचनाओं से न केवल हिंदी साहित्य की समृद्धि को उजागर किया, बल्कि उपस्थित दर्शकों को मंत्रमुग्ध कर दिया। कविताओं के माध्यम से जीवन, समाज और हिंदी भाषा के महत्व को रेखांकित किया गया। हिंदी पखवाड़ा के आयोजनों में संस्थान के सभी विभागों के प्रमुख, वैज्ञानिक, तकनीकी और प्रशासनिक अधिकारी, और कर्मचारियों ने भाग लिया। इस सामूहिक सहभागिता ने न केवल हिंदी के प्रति जागरूकता बढ़ाई, बल्कि संस्थान में आपसी सहयोग और सामंजस्य को भी प्रोत्साहित किया। कार्यक्रमों में भाग लेने वाले सभी प्रतिभागियों ने यह महसूस किया कि हिंदी हमारी सांस्कृतिक धरोहर है और इसे समृद्ध करना हम सभी की जिम्मेदारी है। 30 सितंबर, 2024 को हिंदी पखवाड़ा का समापन समारोह आयोजित किया गया। इस अवसर पर सभी प्रतियोगिताओं के विजेताओं को संस्थान के कार्यकारी निदेशक द्वारा प्रशस्ति पत्र और पुरस्कार प्रदान किए गए। निदेशक महोदय ने अपने समापन भाषण में सभी प्रतिभागियों और आयोजकों को बधाई दी और कहा कि हिंदी पखवाड़ा जैसे आयोजन न केवल हमारी भाषा को सशक्त करते हैं, बल्कि हमारे समाज को भी एक नई दिशा प्रदान करते हैं। समारोह के अंत में, राजभाषा प्रभारी ने धन्यवाद प्रस्ताव प्रस्तुत किया। उन्होंने इस आयोजन की सफलता के लिए सभी को धन्यवाद देते हुए कहा कि हिंदी हमारी संस्कृति की आत्मा है और इसे आगे बढ़ाना हम सबका कर्तव्य है। हिंदी पखवाड़ा 2024 का आयोजन संस्थान के लिए अत्यंत सफल और प्रेरणादायक रहा। इसने न केवल हिंदी भाषा के प्रति जागरूकता और प्रेम को बढ़ावा दिया, बल्कि कर्मचारियों में एक नई ऊर्जा और सृजनात्मकता का संचार भी किया। यह आयोजन एक यादगार अनुभव था, जिसने यह साबित किया कि यदि हम सब मिलकर प्रयास करें, तो हिंदी को न केवल राष्ट्रभाषा बल्कि एक वैश्विक भाषा के रूप में भी स्थापित किया जा सकता है।



CHAPTER 23

STAFF POSITION, FINANCIAL STATEMENT AND REVENUE GENERATION

23. 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	04	00
	Pr. Scientist	00	00	00
	Sr. Scientist	08	02	06
	Scientist	32	15	17
	Total	**45**	**22**	**23**
2.	**Administrative Posts**			
	Sr. Admn. Officer	01	00	01
	Admn. Officer	01	01	00
	Sr. Finance & Accounts Officer	01	01	00
	Assistant Director (OL)	01	00	01
	Security Officer	01	01	00
	Astt. Admn. Officer	03	02	01
	Private Secretary	01	00	01
	Personal Assistant	01	00	01
	Assistant	11	07	04
	UDC	05	02	03
	LDC	07	06	01
	Total	**33**	**20**	**13**
c.	**Technical Posts**			
	T-6	03	01	02
	T-5	00	00	00
	T-4	02	02	00
	T-3	01	01	00
	T-2	03	01	02
	T-1	46	18	28
	Total	**55**	**23**	**32**
2.	**Skilled Supporting Staff**	**101**	**74**	**27**
	Grand Total	**234**	**139**	**95**

23.2 Budget and Utilization for the Year 2024-25 (Rs. in Lakhs)

S.No.	Head	RE 2024-25	Utilization during the year 2024-25				
			Other than NEH, TSP and SCSP	TSP	NEH	SCSP	Total
1.	GIA-Capital	131.00	123.95	0.00	2.00	5.00	130.95
2.	GIA- Salary	1985.38	1977.35	0.00	0.00	0.00	1977.35
3.	GIA General	0.00	0.00				0.00
	i) Others	952.00	763.00	60.00	14.00	115.00	952.00
	ii) Pension	454.91	454.85				454.85
	Grand Total	**3523.29**	**3319.15**	**60.00**	**16.00**	**120.00**	**3515.15**

23.3 Budget and Utilization for the Year 2024-25 in respect of AICRP Goat Improvement Makhdoom (Rs. in Lakhs)

S.No.	Head	RE 2024-2025	Utilization during the year 2024-25				
			Other than NEH, TSP and SCSP	TSP	NEH	SCSP	Total
1.	GIA-Capital	107.00	100.99	0.00	1.00	5.00	106.99
2.	GIA- Salary	0.00	0.00	0.00	0.00	0.00	0.00
3.	GIA General	0.00	0.00	0.00	0.00	0.00	0.00
	i) Others	482.00	386.00	37.00	9.00	50.00	482.00
	ii) Pension	0.00	0.00				0.00
	Grand Total	**589.00**	**486.99**	**37.00**	**10.00**	**55.00**	**588.99**

23.4 Financial Statement for the Year 2024-25 (Rs. in Lakhs)

Institute Grant (Rs. in Lakhs)						
	RE 2024-25	Expenditure				
Recurring		Other than NEH, TSP and SCSP	TSP	NEH	SCSP	Total
Establishment charges	1935.38	1928.44	0	0	0	1928.44
Wages	50.00	48.91	0	0	0	48.91
Pension	454.91	454.85	0	0	0	454.85
OTA	0.00	0.00	0	0	0	0.00
TA	14.87	14.87	0	0	0	14.87
Other Charges	927.44	738.44	60	14	115	927.44
HRD	9.69	9.69	0	0	0	9.69
Total	**3392.29**	**3195.20**	**60.00**	**14.00**	**115.00**	**3384.20**
Non-Recurring						
Equipments	70.46	63.44	0.00	2.00	5.00	70.44
Information & Technology	20.93	20.90	0.00	0.00	0.00	20.90
Furniture	4.96	4.96	0.00	0.00	0.00	4.96
Vehicle & Vessels	30.15	30.15	0.00	0.00	0.00	30.15
Library Books& Journals	0.00	0.00	0.00	0.00	0.00	0.00
Livestock	4.50	4.50	0.00	0.00	0.00	4.50
Work	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total	131.00	123.95	0.00	2.00	5.00	130.95
Grand Total(A+B)	**3523.29**	**3319.15**	**60.00**	**16.00**	**120.00**	**3515.15**

23.5 Revenue Generation for the Year 2024-25

23.5.1 As per usual Format

S. No.	Particulars	Amount (Rs.)
1.	Sale of farm produce	8107143.00
2.	Sale of fish & poultry	826506.00
3.	Sale of publication and advertisement	279375.00
4.	Licence fee	1775091.00
5.	Interest earned on loans & advances	0.00
6.	Leave salary and pension contribution	0.00
7.	Application fee from candidates	104000.00
8.	Diploma Charges	366000.00
9.	Unspent balance of Grants of previous years	0.00
10.	Training	2833438.00
11.	Other Misc. Receipt	2939911.00
	Total	**17231464.00**

23.5.2 Revenue Generation for the Year 2024-25, as for new ICAR Guidelines

S. No.	Particulars	Amount (Rs.)
1.	Income from Sale & Services	12663311.00
2.	Income From fee/ Subscription	470000.00
3.	Income from royalty	279375.00
	Grand Total	**13412686.00**

23.6 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				
	Pr. Scientist		01		
	Sr. Scientist				
	Scientist	01			
2.	**Administrative Posts**				
	Sr. Admn. Officer				
	Admn. Officer	01			
	Sr. Finance & Accounts Officer	01		01	
	Finance & Accounts Officer				
	Assistant Director (OL)				
	Security Officer				
	Astt. Admn. Officer				02
	Private Secretary			01	
	Personal Assistant				
	Assistant				07
	UDC		01		
	LDC				
3.	**Technical Posts**				
	T-6, T-7-8, T-9		01		
	T-5		02		
	T-4	01			
	T-3	01			
	T-2				
	T-1			01	12
4.	**Skilled Supporting Staff**		**16**		
	Total	**04**	**21**	**03**	**21**

23.7 Employees Promoted / Technical & CAS Assessment

1. Dr. Y.K. Soni, Scientist to Sr Scale
2. Sh. Shyam Sunder, AO to SAO
3. Sh. Chaman Singh, SF&AO to CF&AO
4. Sh. Rajendra Singh, T-4 to T-5
5. Mrs. Anjali Singh, T-3 to T-4

23.8 Employees Transferred / Resigned

1. Sh. Chaman Singh, SF&AO transferred to ICAR-NBPGR, New Delhi as CF&AO

2. Sh. Arun Kumar Singhal, PS transferred to ICAR-HQ, New Delhi
3. Mrs. Jyoti Rani resigned Consequent upon her selection as Assistant in ICAR-IASRI.

23.9 List of Employees Joined in ICAR-CIRG, Makhdoom

S.No.	Name of Candidate	Designation	Date of Joining
1.	Santosh Kumar Gupta	T-1	20.05.2024
2.	Smriti Bharati	T-1	16.05.2024
3.	**Jyoti Rani**	T-1	17.05.2024
4.	Vaishali	T-1	15.05.2024
5.	Pushpendra Verma	T-1	13.05.2024
6.	Komal	T-1	21.05.2024
7.	Amit Singh	T-1	20.05.2024
8.	Rishi Raj	T-1	15.05.2024
9.	Shashi Kumar Keshri	T-1	21.05.2024
10.	Saurab Singh	T-1	17.05.2024
11.	Rohan Singh	T-1	16.05.2024
12.	Prakash Bhartiya	T-1	16.05.2024
13.	Pushpendra Yadav	AAO	12.08.2024
14.	Mahesh Kumar	Assistant	27.08.2024
15.	Mohini Kumari	Assistant	27.08.2024
16.	Vijayalaxmi Sharma	Assistant	09.09.2024
17.	Prakhar Saxena	Assistant	30.08.2024
18.	Dheeraj Kumar Sharma	Assistant	11.09.2024
19.	Shivam Gupta	Assistant	09.09.2024
20.	Ankit Kumar	Assistant	24.09.2024
21.	Arvind Chauhaan	AAO	04.12.2024

23.10 List of Employees Retired during 2024

S.No.	Name of Employee	Designation	Date of Superannuation
1.	Dr. S.D. Kharche	Pr. Scientist	31.01.2024
2.	Sh. Ranveer Singh	Tech. Officer	31.01.2024
3.	Sh. Brij Mohan	Tech. Officer	31.01.2024
4.	Sh. Ram Charan S/o Surajmal	SSS	31.01.2024
5.	Sh. Lal Singh	ACTO	31.03.2024
6.	Sh. Om Prakash S/o Babu Lal	SSS	31.03.2024
7.	Sh. Sindhi S/o Buddha	SSS	30.04.2024
8.	Smt. Rajni Saxena	T.O. cum Rec. (Sr. Clerk)	31.05.2024
9.	Sh. Srinath	SSS	30.06.2024
10.	Sh. Hari Singh S/o Lachcho	SSS	30.06.2024
11.	Sh. Om Prakash S/o Harish Chand	SSS	31.07.2024
12.	Sh. Bhudev Prasad	SSS	31.07.2024
13.	Sh. Bundhu Khan	SSS	31.08.2024
14.	Sh. Chandan Singh S/o Phool Singh	SSS	31.10.2024
15.	Sh. Prem Singh S/o Rohan Singh	SSS	31.10.2024
16.	Sh. Sukhram	SSS	30.11.2024
17.	Sh. Ganga Ram S/o Het Ram	SSS	31.12.2024
18.	Sh. Gopal S/o Bhagwan Singh	SSS	31.12.2024
19.	Sh. Gulab Singh S/o Bhajan Lal	SSS	31.12.2024
20.	Sh. Suresh S/o Pyare Lal	SSS	31.12.2024
21.	Sh. Prem Singh S/o Ratan Lal	SSS	31.12.2024

24. ICAR-CIRG Personel

Administration & Management	Animal Genetics & Breeding Division
Dr. M.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, I/c, F&AO	Sh. Shashi Kumar Kesari, T-1
Animal Health Division	**ANM&PT Division**
Dr. Ashok Kumar, Pr. Scientist & Head	Dr. Ravindra Kumar, Pr. Scientist & Head
Dr. K. Gururaj, Sr. Scientist	Dr. B. Rai, Pr. Scientist
Dr. A.K. Mishra, Sr. Scientist	Dr. Arvind Kumar, Pr. Scientist
Dr. Vinay Chaturvedi, CTO	Dr. V. Rajkumar, Pr. Scientist
Dr. Neha Gupta, STO	Dr. A.K. Verma, Sr. Scientist
Sh. T.K. Gautam, ACTO	Dr. T.P. Singh, Scientist
Mrs. Anjali Singh, T-4	Sh. Suraj Pal, ACTO
Ms. Smiriti Bharti, T-1	Sh. Rajendra SinghMs. Vaishali, T-1
Animal Physiology & Reproduction Division	**EE&SE Section**
Dr. Mukesh Bhakat, Pr. Scientist & Head	Dr. A.K. Dixit, Pr. Scientist & I/c,
Dr. Ravi Ranjan, Pr. Scientist	Dr. Khushyal Singh, Sr. Scientist
Dr. S.P. Singh, Sr. Scientist	Sh. Pravesh Sethi, T-4
Dr. Y.K. Soni, Sr. 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 & IInd I/c	Sh. Sugad Singh, T.O.
Dr. Y.K. Soni, Senior Scientist & IIIrd I/c	Sh. Prakash Bharatiya, T-1
Dr. Nitika Sharma, Senior Scientist, Member	
Sh. Dheeraj Kumar Sharma, Assistant	
Training & Skill Development Cell	**AKMU Unit**
Dr. Khushyal Singh, Sr. Scientist & Nodal Officer	Dr. V. Rajkumar, Pr. Scientist & I/c
Dr. A.K. Dixit, Pr. Scientist	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. Bachchu Singh, SSS
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, 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, Member	Sh. Shiv Singh, LDC
Dr. A.K. Mishra, Member	
Horticulture Section	
Sh. Satish Chandra, ACTO & I/c	
Sh. Rohan Singh, T-1	

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
Ms. 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
Mr. Sandeep Kumar	Young Professional-I	Sh. Chandan Singh	Skilled Worker
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Mr. Praveen Kumar	Young Professional-I	Mr. Dinesh Chand	Project Associate
Mr. Ranjeet Singh	Young Professional-I	Mr. Ramavtar	Field Worker
Mr. Deshraj	Young Professional-I	Mohd. Sohil	Lab Attendant
Ms. Tanuja Kushwah	Young Professional-I	Mr. Gopal	Lab Attendant
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