

VISION-2025



CIRG Perspective Plan

CENTRAL INSTITUTE FOR RESEARCH ON GOATS
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INDIAN COUNCIL OF AGRICULTURAL RESEARCH



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FOREWORD

Indian agriculture must continuously evolve to remain ever responsive to manage the change and to meet the growing and diversified needs of different stakeholders in the entire production to consumption chain. In order to capitalize on the opportunities and to convert weaknesses into opportunities, we at the ICAR attempted to visualize an alternate agricultural scenario from present to twenty years hence. In this endeavor, an in-depth analysis of the Strengths, Weaknesses, Opportunities and Threats (SWOT) was undertaken to place our research and technology development efforts in perspective so that we succeed in our pursuit of doing better than the best. Accordingly, the researchable issues are identified strategies drawn and programmes indicated to have commensurate projects and relevant activities coinciding with the launch of the 11th Five Year Plan.

The significance of goats is that they are small livestock in high demand and can thrive on low inputs and local resources. They have distinct social, economical and biological advantages with significant contribution to the agrarian economy and livelihood security. Goats in India number about 124.4 million that is nearly 15.5% population, 22% milk, 10.5% meat and 13% skins of the world. Value of different goat products in India works out to over Rs. 9350 crores per annum. The goat sector also generates about 5% rural employment and 20 million families in India are engaged in goat keeping. Recognizing the overall importance of goats in our agriculture, the Council established a Central Institute for Research on Goats at Makhdoom, Mathura.

The estimated annual demand for meat is 7.7 m MT against the availability of 5.6 m MT. Goats contribute about 3.0% to the total milk and 8.5% of the total meat production of the country. A great export potential also exists for live goats, goat meat, goat skins and their products. The rapidly changing patterns of demand for livestock and livestock products point to goat production being an increasing component of the agricultural economies of India. The extent to which the rural poor will benefit from these changes depends on how goats can be integrated into developing markets and whether cheaper livestock products benefit the rural poor as consumers as well as producers.

It is expected that realizing the Vision embodied in the document would further ensure that the CIRG, Makhdoom continues to fulfill its mandate to make Indian agriculture locally, regionally and globally competitive. The efforts and valuable inputs provided by my colleagues at the ICAR Headquarters and by the Director and his team at the Institute level for over an year to develop Vision 2025 deserve appreciation.



(MANGALA RAI)

Secretary, Department of Agricultural Research & Education
and

Director General, Indian Council of Agricultural Research
Dr. Rajendra Prasad Road, Krishi Bhawan, New Delhi 110001, India

February, 2007

PREFACE

Goats play a very vital role in the livelihood security and employment generation of a large population of small and marginal farmers and landless labourers. There is great scope for goats to play an important role for smallholder farmers as they are small livestock in high demand and can thrive on low inputs and local resources. The rapidly changing patterns of demand for livestock and livestock products also point to goat production being an increasing component of the agricultural economy of India. The extent to which the rural poor will benefit from these changes depends on how goats can be integrated into developing markets and whether cheaper goat products will benefit the rural poor as consumers as well as producers.

The Goat was the earliest ruminant to be domesticated. It has the widest ecological range except dog. Keeping in view the importance of goats in the national economy and rural development more so for the below poverty line population, a National Goat Research Centre was established at Makhdoom near Mathura in Uttar Pradesh in 1976. This NRC got the status of a full fledged Institute in 1979 and named as the Central Institute for Research on Goats with the mandate to conduct both applied and fundamental research to improve the productivity of goats and thereby socio-economic status of the goat keepers in the country.

The process for drafting of the **Perspective Plan as VISION-2025** was initiated about a year back. Several long drawn discussion meetings were held with the Institute Scientists to synthesize their views and draft the Perspective Plan as per the ICAR guidelines. The draft document was also presented before the RAC of the Institute for inviting inputs for its improvement. The document was then presented before the DDG (Animal science) and the Director of all the Animal Science Institutes for its critical review and modification keeping the mandate of the Institute in view. Finally the Perspective Plan was presented before the Director General ICAR along with the DDG (Animal Science) and Directors of all the Animal science Institutes for perusal and approval. The visionary guidance and suggestions made by them have been incorporated and the final document prepared.

I am extremely grateful to Dr. Mangla Rai Secretary DARE and Director General ICAR for adopting the noble concept of perspective planning in the ICAR system and providing guidelines and guidance to develop a sound Perspective Plan of the Institute for undertaking research, training and extension programmes during the next 20 years to achieve the mandate of developing the Poor Men's Cow- the Goat as a source of livelihood security, poverty alleviation and employment generation for the smallholders. I am highly grateful to Dr. K.M. Bujarbaruah Deputy Director General (AS), Dr. V.K. Taneja the then Deputy Director General (AS), and Dr. S. Ayyappan Deputy Director General (Fisheries) for their critical appraisal and inspiring guidance in finalizing and shaping the document. Most grateful thanks are due to Dr. Lal Krishna ADG (AH), Dr. C.S. Prasad ADG (AN&P), Dr. T.J. Rasool ADG (AP&B) and Dr. O.P. Dhanda the then ADG (AN&P) for their valuable suggestions while finalizing the document. I most sincerely thank the Chairmen and Members of the Institute RAC and QRT for their critical suggestions and recommendations.

I thankfully acknowledge the sincere efforts and valuable contributions made by the Heads of Divisions and the Scientists of the Institute in preparing the Perspective Plan. Most sincere thanks are due to Dr. N.K. Sinha, Dr. H.S. Sisodiya and other staff of the ERC Section of the Institute for providing untiring help in timely compiling and preparing this document.

May, 2007



(N.P. Singh)
Director

CIRG, Makhdoom, Mathura

EXECUTIVE SUMMARY

1. The Central Institute for Research on Goats (CIRG) was established by the Indian Council of Agricultural Research (ICAR), Ministry of Agriculture, Government of India at Makhdoom village near Farah town in Mathura district of Uttar Pradesh on July 12, 1979 for undertaking research on all aspects of goat production and utilization. The Coordinating Unit of the All India Coordinated Research Project on Goat Improvement was also transferred to CIRG from the Central Sheep and Wool Research Institute, Avikanagar. The Institute has acquired and developed modern laboratory facilities over the years to conduct research on Goat Genetics and Breeding, Feed Resource Development & Utilization, Nutrition, Physiology, Reproduction, Management, Diagnosis & Prevention of Diseases, Transfer of Improved Technologies and Milk and Meat Products Technology. The ARIS Cell and Library are the common facilities available to all the Research Divisions and Sections. The Institute has three Goat Breeding Farms on Jamunapari, Barbari and Jhakrana breeds and one Sheep Breeding Farm on Mujaffarnagari breed for conducting research on Genetics and Breeding besides three Experimental Flocks for conducting research on Nutrition, Health, Physiology, Reproduction and management aspects. The Coordinating Unit of AICRP on Goat Improvement is also located at the Institute. In all 10 goat breeds located in different regions of the country are being studied under the AICRP. In addition, two breeds of Gujarat State are also being studied under Institute Projects. The Total Plan and Non-Plan Budget allocation of the Institute has increased from Rs. 217.60 lakhs during VI Plan to Rs. 5989.90 lakhs during X Plan. The Scientific Cadre Strength of the Institute has been fixed at 51.
2. The impact of research, extension, training and consultancy programmes under taken by the Institute on goat production and utilization has been very significant in the areas of breed improvement, reproductive efficiency, disease diagnosis, control and over all survivability, feed resource development, feeding systems, commercialization of goat rearing and human resource development. But there exists considerably wide gap between the availability of improved goat production technologies developed by the Research Institutions and their acceptability and adoption by the traditional goat farmers. However, a large number of commercial goat farms have come forward to adopt the improved and modern goat production technologies to a great extent and in turn deriving reasonably higher economic returns. Several technical, social, economical and administrative constraints in adopting the modern technologies have been identified.
3. Our Vision is to develop the poor men's cow- the goat as a source of livelihood security, poverty alleviation and employment generation for the smallholders. The Mission is to enhance and then sustain goat productivity in respect of meat, milk and fibre through Research, Extension and HRD support. The Mandate of the Institute is to undertake basic and applied research in all disciplines of goat production and product utilization, to impart trainings, to transfer technologies and provide consultancy services for improving quantity and quality of meat, milk and fibre production from goats and to develop processing technologies of goat products.
4. Goat is thought to have been the earliest domesticated ruminant and of all the species of domesticated animals except dog, has the widest ecological range. Originating in Asia, goats have spread over all the continents and inhabit almost all-climatic zones from arctic- circle to the equator. Goats have served the mankind earlier and longer than cattle and sheep. They are often termed as the poor men's cow. They

have distinct social, economical, managerial and biological advantages over other livestock species. They significantly contribute to the agrarian economy and play a very vital role in the livelihood security of the small and marginal farmers and landless labourers especially in arid, semi-arid and mountainous regions of the country. Goats have several advantages over other animals. They are hardy, disease resistant and widely adapted. They thrive well and reproduce in tropical, cold, humid as well as dry regions. Their small size compared to cattle and buffaloes permit them to be maintained on a limited area. The breeding animals are inexpensive. Goats consume a wide variety of grasses, weeds, forbs, bushes, shrubs, tree leaves and crop residues that would otherwise go waste and cause pollution. Goat is an efficient converter of the sparse vegetation available in wastelands, community grazing lands of arid, semi-arid and mountainous regions into milk, meat, skin, fibre and manure while utilizing traditional and under employed manpower. They are gentle and easy to control. Their small size makes them suitable for home slaughter and the meat can be consumed by the family before it spoils in warm climate where no refrigeration facilities are available. The goats can be milked any time of the day and are therefore named as the moving refrigerators. Goat milk is prescribed for children, old and sick as it is easily digestible and has medicinal value. Goat meat (chevon) is preferred over other meats because it is leaner and there are no religious taboos against its consumption. The vast population and large genetic resource are the strengths of the programme.

5. World's current population of goats is around 807.60 million as per the FAO estimates. The developing countries of the world have about 94.50% of the goats and the developed ones only the rest 5.50%. India possesses about 124 million goats making 14.87% of the world population and stands second to China. Although the population of all livestock species has shown increasing trend since 1951 the goat population has increased at a much faster rate than others in India. The growth rate of goats in India has varied from 0.94 to 5.10% with an average of 3.05% during 1951-2005 in spite of about 41% slaughter and about 15% natural mortality annually. The goats around the world contributed 12438.40 TMT of milk, 4562.10 TMT of meat and 985.90 TMT of fresh skins per annum. India produced 2700 TMT of milk, 475 TMT of meat, 130 TMT of skins, 8.50 MT of Pashmina and 400 TMT of manure which make 21.71% of the milk, 10.47% of the meat and 13.15% of the fresh skins of the world goat production. In India about 4.80 to 5.00 million goats are slaughtered for meat every year. The estimated value of different types of goat produces works out to about Rs. 9350 per annum. The goat sector also generates about 5% rural employment and about 20 million families belonging to small and marginal farmers and landless labourers are engaged in goat keeping. In addition a large number of commercial goat farms have been established in different parts of the country. Goats, which have been offering health and economy to small holders in India through ages, have come to be more intensively involved in animal agriculture. The economic gains that accrue from them have been documented. They are known to provide a Cost: Benefit ratio of 1:11.7 with an investment return rate (I.R.R.) of over 30%. This calls for immediate efforts for their overall development.

6. There has been a lot of controversy over the role of goats in ecological degradation, soil erosion and desertification. Two conflicting views prevail on the goat's role in land use (i) The goat is the major cause of deforestation, rangeland destruction and soil erosion, and as such, its propagation should be checked, and (2) Goat acts as regenerator of vegetation through dispersal of seeds in its droppings and vegetative propagation through their browsing habit. A task force to evaluate the impact of sheep and

goat rearing in ecologically fragile zones was constituted by the Govt. of India in 1987 under the Chairmanship of Professor K. Hanumantha Rao then a Member of Planning Commission with a large number of foresters and environmentalists as members. The task force observed that there was no definite evidence to prove that goats pose a threat to the ecology as is generally believed. In any case their negative effect, if any, on ecology has been vastly exaggerated. It further observed that within the desired grazing pressure, sheep and goats are more economical and less harmful than other ruminants.

7. Lack of awareness to adopt improved technologies due to poverty, illiteracy and little or no say in decision making process is the weakness of the goat owners. Non-availability of elite breeding males, effective vaccines, grazing lands and feed resources are the other weaknesses. The goat farmers are exploited by the middle men in marketing of surplus animals for meat markets. Sufficient modern abattoirs for hygienic slaughter are not available and a large number of goats are slaughtered in unauthorized places. There is great scope for rearing goats for meat production under semi-intensive and intensive systems of management. The reproduction rate, multiple births, growth, slaughter - weight, dressing percentage, bone: meat ratio and survivability can be significantly improved which in turn will provide higher returns to the goat owners. Scope for value addition in milk, meat, skin fibre and manure is tremendous. Opportunities for employment generation and foreign exchange earnings are very high. Increase in population, shrinkage in grazing lands, slaughter of elite breeding males, emerging diseases and shortage of trained manpower are posing threat to development of goat industry in the country.

8. Goat rearing for meat production needs greater attention. Strategy should aim at increasing slaughter weight produced per doe per year through improved breeding, reproduction, nutrition and health cover interventions. Attempts are also required to be made to increase the milk production in different goat breeds. The medicinal values of goat milk need to be evaluated, high lighted and exploited. Some of the identified issues are characterization of goat genetic resources, enhancing quantity and quality of meat and milk production, improving feed resources, controlling diseases, improving fertility and flock productivity, transfer of improved technologies, human resource development through organization of training programmes and extensive use of biotechnological tools.

9. The following thrust areas have been identified for future research, extension and human resource development-

- Production of superior germ plasm of different goat breeds through ONBS adopting AI and MOET techniques both under farm and field conditions.
- Conservation and improvement of threatened goat breeds by producing and distributing superior breeding males using ONBS.
- Augmentation in meat, milk and fibre production using physiological approaches and reproduction technology.
- Feed resource development through establishment of perennial pastures, silvi-pastures, horti-pastures and agro-forestry systems.
- Development of supplementary and complete feeds using locally available feeds, fodders, tree leaves, crop residues and agro-industrial by-products.
- Development of Model Goat Production Systems (semi-intensive and intensive) for integrated rural development based on goat farming.

- Surveillance and monitoring of goat diseases and development of prophylactic and curative health cover systems including indigenous and herbal medicines.
- Post harvest evaluation, improvement, utilization and marketing of goat milk, meat, fibre, skin and manure.
- Evaluation of socio-economic, ecological and environmental aspects of goat rearing.
- Goat improvement through dissemination of innovative technologies.
- Human resource development, organization of training programmes and provision of consultancy services.

With a view to emerge as a vibrant institution and to achieve national and international goals, CIRG has felt the need for reorienting and recasting of the Vision 2020 and develop this Perspective Plan as VISION-2025.

1. PREAMBLE

World's human population is around 5901 million. India possesses about 17.40% of the World human population. Two-third of the world's poor live in Asia below nationally defined poverty lines and 65% of them are poor livestock keepers who derive a large part of their household from domesticated animals. The rapidly changing patterns of demand for livestock and livestock products point to livestock production being an increasing component of the agricultural economies of Asia in general and India in particular. The extent to which the rural poor will benefit from these changes depends on how livestock can be integrated into developing markets World's current population of cattle, buffaloes, sheep and goats is around 1355, 174, 1081 and 808 million respectively. Asian region possesses about 33.61, 96.88, 42.29 and 64.33% and India 13.65, 56.31, 5.79 and 14.87% of the total world population of the four respective livestock species (FAO, 2005). There is scope for goats to play an important role for smallholder farmers in accessing these new markets. Their significance, which is now being exploited in several countries, is that they are small livestock in high demand and can thrive on low inputs and local resources.

The Goat belongs to order Artiodactyla, family Bovidae and genus Caprine. The genus Capra is described under five species. Goats are thought to have been the earliest domesticated ruminants and associated with human beings along with the process of civilization since 7000 B.C. Goats have the widest ecological range of all the species of domesticated animals except dog and have served the mankind earlier and longer than cattle and sheep. Originating in Asia, goats have spread over all the continents and inhabit almost all-climatic zones from arctic- circle to the equator.

Goats have distinct social, economical, managerial and biological advantages over other livestock species. They significantly contribute to the agrarian economy and play a very vital role in the livelihood security of the small and marginal farmers and landless labourers especially in arid, semi-arid and mountainous regions of the country. Goats have several advantages over other animals. They are widely adapted. They thrive well and reproduce in tropical, cold, humid as well as dry regions. Their small size permits them to be maintained on a limited area. The breeding animals are inexpensive. Goats consume a wide variety of grasses, weeds, forbs, bushes, shrubs, tree leaves and crop residues that would otherwise go waste and cause pollution. They are gentle and easy to control. Their small size makes them suitable for home slaughter and the meat can be consumed by the family before it spoils in warm climate. The goats can be milked any time of the day. Goat milk is a source of family nutrition and prescribed for children, old and sick as it is easily digestible and has medicinal value. Goat meat (chevon) is preferred over other meats because it is leaner and there are no religious taboos against its consumption.

World's current goat population is around 807 million. Asian region has the highest and over 64.33% of the world population of goats. India possesses 124.36 million making 25.1% of Asia and 14.87% of the world goat population. The developing countries of the world have about 94.5% of the goats and the developed ones only the rest 5.5%. The growth rate in India varied from 0.94 to 5.13% with an average of 3.55% during 1951-2002.

The goats around the world produced 12438 TMT of milk, 4562 TMT of meat and 986 TMT of fresh skins annually. The Asian region contributed 54.08% of the milk, 75.34% of the meat and 79.91% of the fresh skins of the world production of goats. India produced 21.70% of the milk, 10.41% of the meat and 13.14% of the fresh skins of the world and 40.14% of the milk, 13.82% of the meat and

16.45% of the fresh skins of the Asian goat production. Around 89% of the goats in the world are reared primarily for meat. In India about 47.5 million goats making about 40% of the total population are slaughtered for meat every year. In addition goats provide substantial quantity of Pashmina and Mohair textile fibres. They also produce around 400 TMT of valuable manure. The estimated value of different types of goat produces works out to over Rs.9350 crores per annum. The goat sector also generates about 4% rural employment and about 20 million families belonging to small and marginal farmers and landless labourers are engaged in goat keeping. A large number of commercial goat farms have been established and several are in the process of establishment in different parts of the country.

There has been a lot of controversy over the role of goats in ecological degradation, soil erosion and desertification. No domesticated animal has suffered from so much abuse as the goat due to this wrong conception. Two conflicting views prevail on the goat's role in land use (i) The goat is the major cause of deforestation, rangeland destruction and soil erosion, and as such, its propagation should be checked, and (2) Goat acts as regenerator of vegetation through dispersal of seeds in its droppings and vegetative propagation through browsing. The high pressure on and shrinking of grazing lands, especially in view of their low carrying capacity results in their over use and depletion of natural vegetation. The livestock population is increasing due to low farm incomes from marginalization of land holdings and increased dependence on livestock, leading to over exploitation of the shrinking grazing lands. In addition, Sheep because of their bifid upper lip and cattle with their large size hooves and heavier body weights cause more loosening of the soil rendering it susceptible to water and wind erosion. Agriculture operations in general and on the arid and semi arid lands in particular cause more soil erosion than by the livestock grazing. Goats also help in dispersal of grass, bush and tree seeds. They consume grass and bush seeds and fodder tree pods while grazing and defecate hard coat undigested seeds especially of pod-bearing after providing acid treatment while passing through digestive system and fortifying with nutrients in the form of the faecal pellets and spread more uniformly all over the grazing land. The goat saliva left on the bitten foliage adds nitrogen directly to the plant cells inducing quick re-growth. The biting of tender leaves and twigs by goats also induce tillering and faster luxuriant re-growth of both branches and foliage. A task force to evaluate the impact of sheep and goat rearing in ecologically fragile zones was constituted by the Govt. of India in 1987 under the Chairmanship of Professor K. Hanumantha Rao one of the leading economists and then a Member of Planning Commission with a large number of foresters and environmentalists as members. The task force observed that there was no definite evidence to prove that goats pose a threat to the ecology as is generally believed. In any case their negative effect, if any, on ecology has been vastly exaggerated. It further observed that within the desired grazing pressure, sheep and goats are more economical and less harmful than large ruminants. It is revealed that goats should not be categorized as animals responsible for the destruction of ecology. It is unwise to put the blame on goats for land degradation and desertification caused by activities of human and other livestock. What is needed, therefore, is to maintain a balance between the number of goats and other livestock species and the quantity and type of feed resources, which are available for the combined population.

CIRG, MAKHDOOM, MATHURA

Keeping in view the importance of goats in the national economy and rural development more so for the below poverty line population, a National Goat Research Centre was established on 302 ha land at Makhdoom village near Farah town of Mathura district in Uttar Pradesh about 22 km from

Mathura and 32 km from Agra on National Highway No.2 in July 1976. It got the status of a full fledged Institute on July 12, 1979 and named as the Central Institute for Research on Goats incorporating the All India Coordinated Research Project on Goats with the mandate to conduct both applied and fundamental research on all aspects of goat production and product utilization. One of the four Blocks of Laboratory cum Administrative building was constructed in the VIII Plan. All Research Laboratories except Goat Products Technology were accommodated in this 'A' block. The Library, ARIS Cell and Administrative Offices were also accommodated in this building. A Guest House was also constructed during the IX Plan. The research laboratories were gradually equipped and modernized with instruments, equipments, furniture and other infra-structure facilities. Computerization of the laboratories and offices was completed during the X Plan. The Institute is connected with all modern communication facilities viz. Telephone-0565-27663380, Fax-0565-2763246, E-Mail- cirg@cirg.res.in and Website- www.cirg.res.in

2. MANDATE

2.1 VISION:

“Develop Poor Men’s Cow- the Goat as a Source of Livelihood Security, Poverty Alleviation and Employment Generation for the Smallholders”

2.2 MISSION:

The Mission is to enhance and then sustain goat productivity in respect of meat, milk and fibre through Research, Extension and HRD support.

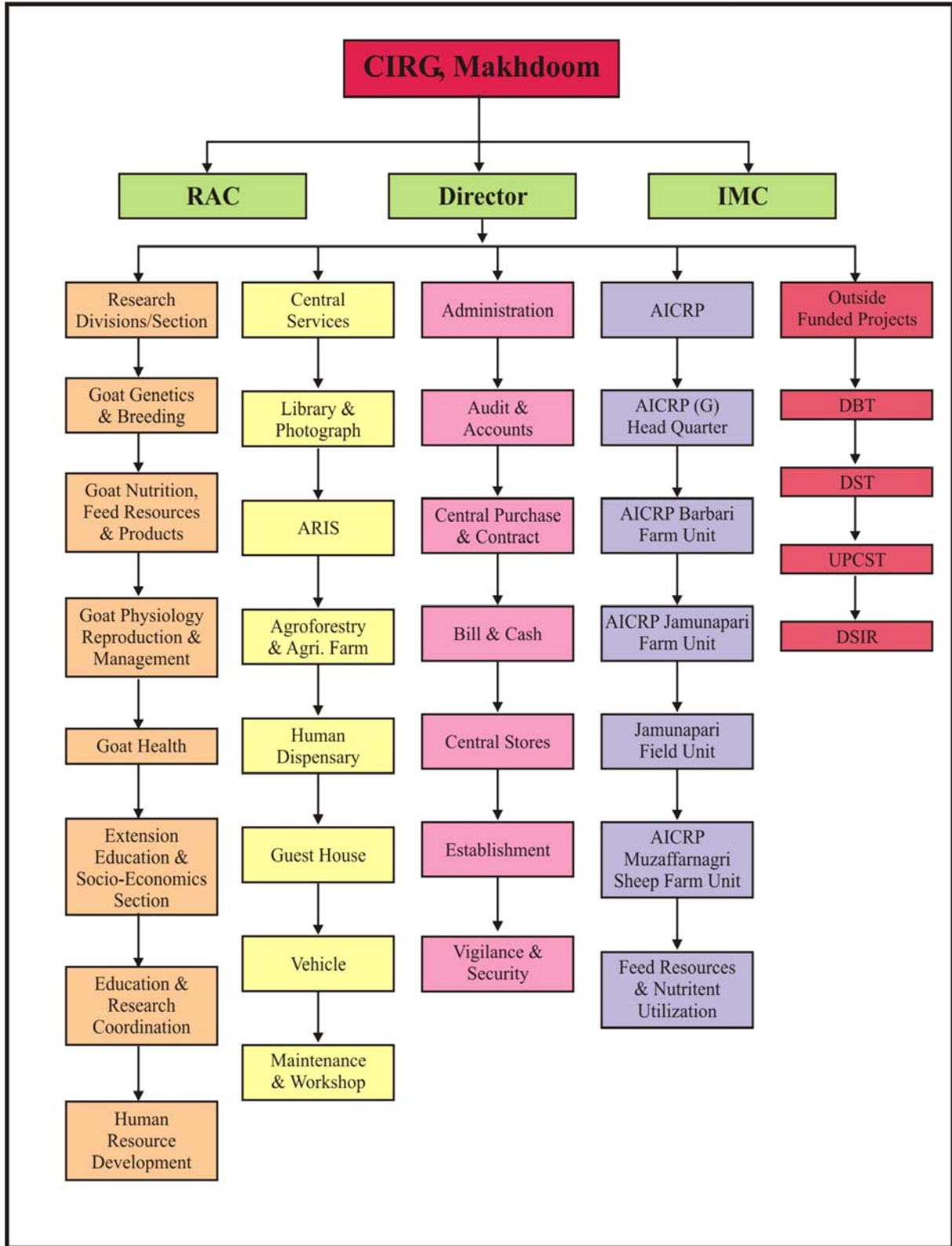
2.3 MANDATE:

The Mandate of the Institute is to undertake research, training and extension education programmes for improving milk, meat and fibre production of goats and to develop processing technology of goat products.

2.4 OBJECTIVES:

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

2.5 ORGANIZATION SET UP:



3. GROWTH

3.1 INFRASTRUCTURE:

The CIRG is located at 27.10 N, 78.02 E and 169 m above MSL. It was established at Makhdoom village of Mathura district in U.P. on 302 ha of undulating, sandy, and kans and moonj infested ravine land. Initially there were no office building, residential quarters, experimental farms, research laboratories, animal sheds and roads etc. available at the location. The Institute, during the last over 25 years, has acquired and developed minimum facilities to undertake research, training and extension education and human resource development programmes in different fields of goat production and utilization.

3.1.1. LABORATORIES:

Presently the Institute has four Research Divisions and one Research Section. All the Divisions have specialized research laboratories to carry out research under different Programmes.

Genetics and Breeding Division: This Division has three laboratories viz. Cytogenetics, Biometrics, Statistics & Computation and Molecular Genetics.

Physiology, Reproduction and Management Division: This Division has Environmental Physiology, Male Reproduction, Female Reproduction and Embryo Transfer Technology, Cryo-preservation and Animal Management laboratories.

Nutrition, Feed Resource and Product Technology Division: This Division has Mineral, Feed Resource Evaluation, Conservation and Post-harvest Technology, Rumen Microbiology, Products Processing, Product Evaluation and Quality Control laboratories.

Goat Health Division: There are Pathology, Medicine, Parasitological, Microbiology, Epidemiology and Public Health Laboratories in this Division.

Extension-Education and Socio-Economics Section: This Section has Audio-visual and Exhibition laboratories and also a Museum.

Central Services:

Library: The Institute Library possesses about 2500 books, 2000 bound volumes of Research Journals, 128 current Journals and Annual Reports etc. on different aspects of goat production and utilization. Facilities of Inter-library book loaning, National and International scientific information Exchange, Documentation, Indexing, Abstracting and Review Journals are also available in the Library.

ARIS cell: The Agriculture Research Information System (ARIS) was established in the Institute as early as in 1996. The Institute has its own website both in Hindi and English. The web based E-mail service has been provided. The E-mail conferencing system has also been developed.

Agriculture Farm: The Agriculture farm area at the Institute is about 302 ha. The soil of the farm is sandy, alluvial and saline. It is poor in organic carbon, N and P. The ground water is saline and can hardly be utilized for life saving irrigation for agro-forestry and pastures. The Yamuna River water is used mainly to irrigate cultivated fodder crops. Farm provides browsing/grazing to the animals. Some cultivated forest cover and developed silvi-pastures are available as a rich source of feed and fodder. In addition, cultivated fodders are also grown and supplied to the Livestock Units. Surplus green fodders are conserved as hay and silage for feeding goats during lean periods.

Animal Farms: The Institute is maintaining about 2500 goats and sheep in different Projects at the following Animal Farms-

- a. **Barbari Goat Farm:** There are 10 sheds of 60' X20' size, three Stores, a Clinic and an Office available at the Unit.
- b. **Jamunapari Goat Farm:** There are 10 sheds of 60' X20' size, two Stores, a Clinic and an Office available at the Unit.
- c. **Jakhrana Goat Farm:** There are three sheds and two Stores available at this Unit.
- d. **Muzaffarnagri Sheep Farm:** This Farm is having a Store, an Office and 8 sheds of different dimensions.
- e. **PRSM Experimental Farm:** Newly constructed six animal sheds, a Weather Station, two Stores, a Clinic and an Office are available at this Farm.
- f. **NFR Experimental Farm:** Four animal sheds with one metabolic shed is available for conducting nutritional experiments. A Feed Processing Unit is also available at this Unit.
- g. **Goat Health and Segregation Unit:** Separate sheds for animals sick of different diseases are available at this Unit. A Veterinary Dispensary needs to be established.
- h. **Post Mortem Room:** A Post Mortem Unit of adequate size and with an Incinerator is available for investigations and proper disposal of the carcasses.

3.1.2. BUILDINGS:

- | | |
|-----------------------------|---------------------------------------|
| i. Main Laboratory Building | ii. Goat Products Technology Building |
| iii. Human Dispensary | iv. Workshop and Maintenance Section |
| v. Central Hall | vi. Guest House |
| vii. Central Stores | viii. Residential Buildings |

3.2. BUDGET:

(Rs. in Lakhs)

Plan Period	Plan	Non-Plan	Total
IX Plan (1997-2002)	1352.86	1569.48	2922.34
X Plan (2002-2007)	1917.17	3308.99	5226.16
XI Plan (2007-2012)	6160	5865.52	12,025.52

3.3. MAN-POWER:

Plan Period	Scientific	Technical	Admn.	Auxiliary	Supporting
IX Plan (1997-2002)	51	74	35	-	106
X Plan (2002- 2007)	51	72	36	-	104

3.3.1. SCIENTISTIFIC CADRE STRENGTH:

Discipline	Scientist	Sr. Scientist	Pr. Scientist	Total
Animal Genetics & Breeding	5	2	2	9
Animal Physiology	3	2	1	6
Animal Nutrition	3	2	1	6
Animal Reproduction	2	1	-	3
L.P.M.	1	1	-	2
Vety. Pathology.	1	-	1	2
Vety. Microbiology	3	1	-	4
Vety. Parasitology	1	1	-	2
Vety. Public Health	1	-	-	1
Vety. Medicine	1	1	1	3
L.P.T.	3	1	-	4
Vety./Ag. Extension	1	1	-	2
Vety./Ag. Statistics	1	-	-	1
Ag. Economics	1	1	-	2
Agronomy	1	-	-	1
Farm Machinery & Power	1	1	-	2
Total	29	15	6	50

4. SALIENT RESEARCH ACHIEVEMENTS:

4.1 GENETICS AND BREEDING:

(i) Identification of Gene Pools in Goats –

- DNA fingerprinting and Micro-satellite characterization has been carried out in Indian goat breeds.
- Micro-satellite characterization has been carried out in eight Indian goat breeds using 22 markers and best markers for breed differentiation have been reported.
- Sequencing of mitochondrial HVRI region was carried out in 10 goat breeds of different agro-climatic regions.
- Gene diversity in Indian goats and markers usefulness for breed differentiation has been established.
- The neighbour-joining tree of Indian goat breeds along with wild goats was constructed for the first time in India.

- The Indian goats appear to cluster in three different groups viz. Group I- Jamunapari, Sirohi, Marwari, Changthangi, Chegu, Group II- Jakhrana, Black Bengal, Osmanabadi, Barbari and Kutchi and Group III- Local (non-descript) goats.
- Indicator traits for resistance to gastro-intestinal nematodes have been established in Barbari and Jamunapari breeds of goats.
- Milk protein polymorphism has been studied in different Indian goat breeds.

(ii) Improvement in Jamunapari Goats-

- The 12 month body weights have increased from 20.32 kg in 1985 to 29.60 kg in 2003 indicating an improvement of 45.67% over the years.
- The milk yield at 140 days has increased from 105.85 kg in 2001 to 140.98 kg during 2005 indicating an improvement of 33.02%.



- In all 814 elite goats of Jamunapari breed were supplied to different State Govt. / NGOs and farmers for breed improvement during Xth Plan period.
- The overall flock survivability increased from 81.35 in 1985 to 94.60% in 2005.

(iii) Improvement in Barbari Goats-

- The 12 month body weights have increased from 18.52 kg in 1985 to 24.44 kg in 2003 indicating increase of 31.96% over the years.



- The milk yield at 90 days has increased from 42.52 litres in 1985 to 78.82 litres in 2003 indicating about 85.37% increase over the years.
- Kidding rate of 1.6 indicated higher population growth potential in Barbari breed goats.
- The overall flock survivability increased from 75.2 in 1985 to 92.7% in 2005.
- In all 1256 elite animals of Barbari goats were supplied to different agencies viz. State Govts., NGOs and goat farmers for breed improvement during Xth Plan period.



(iv) Improvement and Conservation of Jamunapari Goats in their Breeding Tract-

- The improvement of Jamunapari goats in their natural habitat was started at Chakarnagar in Etawah district of U.P. with active support of farmers to restore the pride of Jamunapari goat.
- The increasing trend in body weight from base population is observed indicating use of superior breeding bucks by villagers over the years. There is no decline in performance of the village flocks over the years. The fertility and viability is increasing year after year.

(v) Improvement in Muzaffarnagari Sheep-

- An improvement of 7.3% in adult body weights was recorded during Xth Plan period.
- The 6 and 12 month body weights increased from 18.7 and 23.9 kg in 1977 to 25.1 and 32.7 kg in 2004 showing an improvement of 34.2 and 37.2% respectively.
- Under intensive feeding the body weights at 6 months age increased from 25.5 kg in 1977 to 33.7 kg in 2004 indicating an improvement of 32.1%.
- First and Second six monthly wool yield was improved by 76.8 and 57.1% respectively.
- The over all flock survivability has improved from 78.0 in 1977 to 97.4% in 2004.

4.2 NUTRITION, FEED RESOURCE AND PRODUCT TECHNOLOGY:

(i) Development of Economic Feeding Systems for Goats-

- Several fodder tree leaves and cultivated leguminous fodders based complete feeds for different categories of goats as mess, pellets and blocks have been developed for economic goat meat and milk production.
- Supplementary feeding requirements of different categories of goats during different physiological stages have been worked out.
- Entolobium tree leaves as defaunation agent improved feed intake, nutrient utilization and growth rate in goats.
- Subabool (*Leucaena leucocephala*) leaf meal could be incorporated up to 30% in the complete feeds for goats without any deleterious effect.

- Supplementation of 15 g common salt and 15 g mineral mixture daily in the feed of the adult goats improved protein and energy availability by about 16%.
- Milk replacers were developed and tested successfully in pre-weaning Barbari kids.
- Two and three-tier silvi-pasture models using several perennial grasses, legumes, fodder shrubs and trees were developed and evaluated for goats.

(ii) Feed Technology:

- A low cost Feed Pellet Making machine was developed for preparation of complete goat
- feeds in the form of pellets.
- A Complete Feed Block making machine was developed, tested and used for making CFBs for different categories of goats.



(iii) Green House Technology:

- Technology for drying of rainy season herbage in the form of hay under Poly houses was perfected. Hay racks for drying the herbage have also been developed.

(iv) Goat Products Technology:

(a) Carcass and Meat Quality Evaluation:

- Live animal traits, carcass and non-carcass component yield, cutability, carcass composition, fat partitioning and meat composition of goat carcasses of different breeds and age groups have been studied.
- Effects of age, system of feeding and management on quantity and quality of meat production have been studied.

(b) Goat Meat Products:

- Processing techniques for manufacture of value added products from spent goat meat have been developed and Recipes viz. pickles, sausages, cubes, shami kebabs, samosas, patties, roll slices, cutlets, croquettes, meat balls, warm and serve meat curries and chevonettes have been standardized.
- The quality attributes of value added meat products and their shelf-life have been evaluated.



(c) Goat Milk:

- Effects of breed, season, time of milking, parity and stage of lactation on major milk constituents and Paneer yield have been investigated.
- Keeping quality of Barbari and Jamunapari goat milk during summer, winter and rainy seasons at room temperature have been studied.

(iv) Goat Milk Products:

- Processing techniques for preparation of Paneer, a value added product using different coagulants have been developed and standardized.
- Quality and shelf-life of Khoa, Shrikhand, Channa, Mozzarella cheese, Whey drink and Dahi (curd) have been studied.



4.3 PHYSIOLOGY, REPRODUCTION AND MANAGEMENT:

(i) Conservation of Energy and Climatic Adaptation:

- Benefits of predominantly black/dark coat color commonly found in desert goats through energy economy have been worked out.
- The breed variation in sustaining water deprivation and effect on field application has been worked out.
- Physiologically Sirohi goats are best suited to combat the thermal stress in semi-arid climate.
- The package of best management practices under both intensive and semi-intensive system has been developed.

(ii) Augmentation in Reproduction:

- A modified freezing protocol has been developed for ex-situ conservation of buck semen.
- The post-thaw motility has increased from 55 to more than 60%.
- Optimum number of live spermatozoa required per inseminating dose has been perfected.
- Post-thaw motility was found better in straws having lower sperm concentration of 50-100 m spermatozoa as compared to higher concentration of 150-200 m spermatozoa.
- Fertility rate with frozen semen using deep cervical technique ranged from 25-48%.
- Technologies have been developed to preserve buck semen as liquid and as frozen and fertility trials have been conducted.

(iii) Embryo Biotechnology:

- Good quality embryos were successfully collected through non-surgical technique.
- Technologies have been perfected for collection and transfer of embryos for quick multiplication of superior goat germplasm.
- The conception rate in recipient does through surgical transfer varied from 20 to 40%.
- Thirty seven kids were born out of intra-cervical embryo transfer technique.
- Laparoscopic technique could be applied for oocyte recovery and application of collagenase enzyme proved to be beneficial in oocyte recovery.
- Caprine embryos could be successfully frozen at 4-12°C by vitrification technique.
- An eight cell in-vitro fertilized (IVF) embryo was transferred to a local goat and a healthy kid was born of a surrogate mother for the first time in the Country.

(iv) Housing Requirements-

- Housing requirements for different categories of goats have been determined and shelter management techniques standardized.

(v) Feeding and Watering Devices-

- Sets of 11 Feeding and Watering devices suitable for Goat and Sheep Farms have been developed and/or modified. This technology has been adopted by several Commercial Goat Farmers in different parts of the country.



4.4 GOAT HEALTH:

(i) Microbiology:

- PCR based diagnosis directly from clinical material, serum and milk-ELISA diagnostic methodology has been developed.
- Several isolates of Mycobacterium Avium Paratuberculosis (MAP) have been characterized in organized and farmer flocks.
- A comb based dot-ELISA kit and PCR based test has been developed for diagnosis of *Brucella melitensis* infection in goats and sheep. The dimension of caprine Brucellosis disease has been studied in organized and unorganized farms.
- Development of DNA based vaccine against *Brucella melitensis* is underway.
- A latex agglutination test for quick and spot diagnosis of *M. Capri* infection has been developed.
- Pathogenic *E. coli* strains were isolated from the fecal samples and heart blood samples at autopsy of kids died of diarrhea. About 200 doses of experimental polyvalent vaccine, incorporating six strains of various sero types of entero-pathogenic *E.coli*, were used successfully in pregnant does to control the kid mortality.
- Outbreaks of PPR were investigated throughout the country. The disease appears to be endemic in goats and sheep



BRUCHECK: A Dot-ELISA kit for detection of brucellosis in goats

in India and the outbreaks seem to spread steadily now in young animals all over with high mortality of 38.75 to 48.90% and morbidity of 19.34 to 46.66%.

(ii) Medicine:

- Epidemiology of important goat diseases like PPR, Goat Pox, Contagious Ecthyma, FMD, Haemonchosis, Colibacillosis was studied in changing climatic conditions in organized farms.
- Several medicinal plants were evaluated for the control of Haemonchosis in goats.
- Behaviour of blood biochemistry and Complete Blood Count (CBC) was studied in goat diseases for clinical diagnosis.
- A herbal drug against Ectoparasites with the trade name “Alquit” has been developed, validated and found to be very effective.



(iii) Veterinary Public Health:

- Baseline information on epidemics of goat diseases at National level has been analyzed. Major diseases recorded were PPR, FMD, E.coli infection, Contagious ecthyma, Goat Pox, gangrenous mastitis, Enterotoxaemia, Pasteurellosis etc.

(iv) Parasitology:

- Monensin @ 40 mg per kid/day in premixed concentrate mixture was found to be effective in coccidiosis.
- The basic epidemiological information under field conditions on the common parasitic infestation and incidence of mortality has been studied.

4.5 EXTENSION EDUCATION AND SOCIO-ECONOMICS:

- Goat rearing has been found to be profitable under semi-intensive and extensive system of management under field conditions giving net profit of 0.76 rupee per rupee of total input cost with a net income of Rs. 1300 to Rs. 1800 per goat/annum.
- Several Extension Education Models in adopted villages and off and on-Campus training programmes have been studied. A Distant Extension Method for Commercial goat farming has also been studied.
- Mortality and morbidity losses in goats under field conditions have been estimated to be Rs. 11,720 million/annum at the National level and Prophylaxis measures may result in a net saving of Rs. 5,144 million/annum.
- Basic information on goat production systems, marketing and ITK has been collected.
- The constraint analysis of BPL farmers revealed that non-availability of medicines, vaccines,



treatment, grazing, credit, proper market and feeds for goats were the major handicaps in successful goat rearing.

- The constraints in organization of Goat Cooperative Societies have also been studied.
- About 750 commercial goat farmers of 11 States were surveyed. About 25% farmers were undertaking goat rearing as their primary source of income and were fully dependent on it.
- The role of middlemen in goat marketing and exploitation of goat farmers by them was studied.
- About 52 ethno-veterinary herbal combinations were used by the goat farmers for treatment of 15 common diseases/ ailments of goats mostly due to resource crunch.



4.6 ARIS

- The Agriculture Research Information System (ARIS) Cell was created during 1996. CIRG has established the first functional LAN of National Agriculture Research System of India. Subsequently, web site of the Institute was launched from the server located at CIRG. Thus, CIRG web site <http://www.cirg.res.in> was the first web site launched from the own server and on OSS/FS software. The Institute has also launched Hindi version of the web site.
- The web-based email was created making the email of CIRG accessible from all over the world on Internet. The email conferencing systems generally known as Mailing Lists of List servers were created on 7 aspects of agriculture.
- The ARIS Cell organized 4 National and one International training programme on Sustainable and affordable information system development using OSS/FS and Development of Internet and intranet using Linux Operating system. The Unit is advising Institutions and Universities in setting up their Internet

4.7 TRAINING PROGRAMMES:

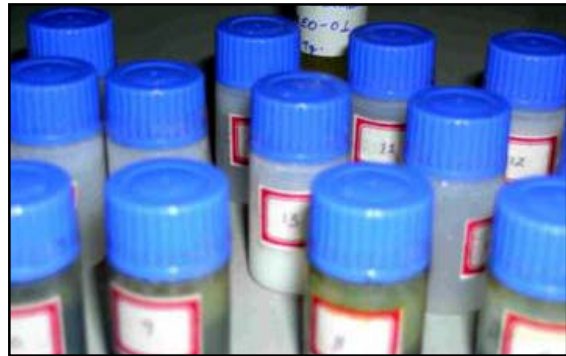
- Data processing and computer application for Animal Science Research.
- Molecular tools for Animal Genome Research.
- National and International training programme on development of Internet and Intranet using Linux operating System.
- Ten-day National training programme on Commercial Goat Farming for farmers/NGOs/Industrialists/Govt. Officers etc. 2 to 4 times a year.
- Training of State Veterinary Officers on intensive and semi-intensive sheep and goat rearing practices.
- International training on feeding management of goats under ICAR-NARC work plan.

- Specialized training programme of 10 days duration on Buck semen freezing and artificial insemination in goats for State Animal Husbandry Deptt / SAU's.
- One week training programme on Commercial Goat Farming.
- Training programme of 10 days duration on Current Reproductive Techniques for enhancing goat production for scientists/teachers.
- International training programme for 03 days for 13 Member Delegation from National Livestock Development Project, Ethiopia.
- Thirty two one day on campus training programmes on Scientific Goat Rearing for 1805 goat keepers/farm women under Ravine Stabilization Project of Uttar Pradesh.
- Training programme on Scientific Goat Rearing for the Veterinary/Animal Husbandry Officers of the country sponsored by Directorate of Extension, Ministry of Agriculture, Govt. of India.

4.8 OTHER TECHNOLOGIES DEVELOPED



Jamunapari Goat Breed



Development of Herbal therapies for goat



Kid feeder with watering device



Development of complete feed blocks



Circular kid watering device



Meat pickle

5. IMPACT ASSESSMENT

The impact of research, extension, training and consultancy programmes under taken by the Institute on goat production and utilization has been very significant in the areas of breed improvement, reproductive efficiency, disease diagnosis, control and over all survivability, feed resource development, feeding systems, commercialization of goat rearing and human resource development. But there exists considerably wide gap between the availability of improved goat production technologies developed by the Research Institutions and their acceptability and adoption by the traditional goat farmers. However, a large number of commercial goat farms established during about two years have come forward for adopting the improved and modern goat production technologies to a great extent and in turn deriving reasonably higher economic returns. The leading States in adoption of improved technologies for commercializing goat production are Maharashtra, Rajasthan and Uttar Pradesh. Several technical, social, economical and administrative constraints in adopting the modern technologies have been identified. The impact of goat research and development efforts may be seen in the sharp increase in population and production of meat, milk and skins over the years.

5.1. GROWTH:

5.1.1 Goat Population:

- Goat population in the country has significantly increased from 47.14 million in 1951 through 75.62 million in 1977 to 124.36 million in 2003 as per Livestock Censuses. There has been an over all growth rate of 3.55% in spite of about 40% slaughter and about 15% annual mortality.
- Annual rural employment generation through goat rearing has increased from about 3.2% in 1972 to about 4.2% in 2003.

5.1.2 Goat Production:

- The meat production from goats has increased from 235 Thousand MT in 1961 to 475 Thousand MT in 2005.
- The milk production from goats has increased from 535 Thousand MT in 1961 to 2700 Thousand MT in 2005.
- The skin production from goats has increased from 75.6 Thousand MT in 1980 to 130.0 Thousand MT in 2005.

5.1.3 Contribution of Goats to Indian Economy:

- The goats as per the estimates made on the basic of different commodities annually produced and their prevailing market rates contribute Rs. 9349.49 crores annually to the Indian economy.

5.1.4 Impact of Research:

S. No.	Particular	Improvement	
		From	To
1.	Body Weight at 12 M age	20 kg in 1985	29 kg in 2003 (32 to 45%)
2.	Milk Yield 140 days	62.4 kg in 1985	88.4 kg in 2005 (42 to 49%)
3.	Dressing	42%	49%
4.	Reproduction Rates	68%	113%
5.	Kidding Rates	1.25 in 1985	1.80 in 2003
6.	Survivability	70% in 1985	95% in 2005
7.	Kid Feeder	Wastage 30%	5%
8.	Kid Waterers	Wastage 30%	5%
9.	Bruchek-Dot-ELISA Kit	Abortion 14%	3%
10.	Herbal Therapies	Ectoparasites 100%	0%
11.	Utilization of low-grade roughages in Complete Feeds	Nil	40-60%

6. SCENARIO

World possesses 807 m goats and India with 124.4 m stands second after China. Goat population in the country is poised to reach 170 million by 2025. Goats in India contribute 15.5% population, 22% milk, 10.5% meat and 13% skins of the world and 23% population, 40% milk, 14% meat and 16.5% skins of the Asian region. Around 89% of the goats around the world are reared primarily for meat. About 47.5 m goats (40%) are annually slaughtered for meat in the country. Value of different goat produces in India works out to over Rs.9350 crores per annum. The goat sector generates about 4% rural employment and 20 million families in India are engaged in goat keeping. Per capita meat consumption in India is less than 5 kg per year as against 13.7 kg in Pakistan, 38.6 kg in China and 58.6 kg in Brazil. Estimated annual demand for meat is 7.7 m MT against the availability of 5.6 m MT. Goats contribute 8.5% of the total meat and about 3.0% of milk production of the country. India exported 3 lakhs live goats, 280 Metric Ton goat meat and 25 Metric Ton goat skins and earned over 4 m US Dollars during 2003. A great export potential exists for live goats, goat meat, goat skins and their products. Around 250 commercial goat farms have been established in different parts of the country. Thus the rapidly changing patterns of demand for livestock and livestock products point to goat production being an important component of the agricultural economies of India.

6.1 STRENGTHS:

- Goat populations have increased with an annual growth rate of 3.55% despite of over 41% slaughter rate and about 15% annual mortality. This shows that this species has great potential as meat animal.

- Availability of goat germplasm adaptable to wide range of agro-ecological conditions for sustainable production.
- Goats provide quality social, nutritional, financial and employment security to the most disadvantaged places and people in the country.
- Goats have high prolificacy and fecundity.
- Women and children are the major force to rear goats.
- Goat rearing is more economical than other livestock species.
- Goats are essential component of livelihood of landless, small and marginal farmers.
- Goats efficiently survive on scrub vegetation under diverse and harsh environments.
- Goats act as a source of investment and insurance against disasters.
- Goat milk contributes about 4.0% to the total milk production.
- Poor farmers keep goats for milk for family consumption as it serves as a source of nutrition to children and older people.
- Goat skins are most sought after commodity in the international leather markets.
- Goats gain support from below poverty line population.

6.2 WEAKNESSES:

- Misconception about goats that they destroy vegetation and cause ecological degradation.
- Feed scarcity due to shrinkage of grazing lands and increasing stocking rates.
- Low inputs due to poverty inhibit expression of genetic potential.
- Lack of marketing infrastructure and exploitation by middlemen.
- Non-availability of prophylactic and curative health cover.
- Lack of interest for commercial goat production.
- Genetic potential of over 75% non- descript goats has not been studied.
- Indiscriminate slaughter of males at an early age has resulted in shortage of breeding bucks.
- Goat keepers in the country are mostly illiterate and resource poor.
- Poor Govt./NGO support for transfer of improved goat technologies.
- Lack of provisions for easy loans by Banking Sector.
- Lack of input support for goat farmers in rural development programme.

6.3 OPPORTUNITIES:

- Live goats their meat, fibre and products have export potential.
- There are no religious taboos against goat meat.
- Lean meat of goats is the most preferred meat by consumers.
- Goat milk greatly contributes to family nutrition.
- Goat milk has medicinal value.
- Goat milk is recognized as an important health food for the future.
- Butter, Paneer, Cheese and Powder made from goat milk have export potential.

- Goats have a role to play in cottage industry.
- Goats gain support from below poverty line people.
- Goats are most suitable animals under drought conditions.
- Goats sustain themselves on scrub vegetation and top feeds.
- Goats are valued as best bio-organic manure producer.

6.4 THREATS:

- Extinction of some very important goat breeds.
- Non-availability of superior breeding bucks.
- Indiscriminate slaughter of kids at an early age.
- Loss of goat germ plasm due to change in agricultural production system.
- Poverty of goat farmers.
- High mortality in goats due to endemic and emerging diseases.
- Shrinkage of grazing lands and increase in livestock population.
- Natural disasters compel the goat farmers to dispose of high quality animals.

6.5 SHORT COMINGS:

(i) Breed Improvement:

- There is no National or State level goat breeding policy in the country.
- Findings of on farm research are seldom replicable under field conditions mainly due to non-availability of required inputs.
- Genetic potential of Indian goat breeds has not been fully evaluated in their home tracts.
- Molecular analysis has not yet been carried out to establish markers with production traits for sustainable goat production.
- The recognized and compatible breeds have not been used for improvement of local non-descript goats.
- Non-availability of elite breeding males due to acute shortage has forced the goat farmers to use inferior bucks of unknown merit indiscriminately.
- Artificial Insemination with quality semen in goats has not been practiced in the field by the State Livestock Development Departments and adopted by the goat farmers.
- There is no organization to take up breed improvement programme following Open Nucleus Breeding System (ONBS) and using modern reproduction technologies for.

(ii) Nutrition and Feed Resource Development:

- The livestock population in general and goat population in particular is increasing and the grazing lands are shrinking.
- The switching over from extensive system of goat rearing to semi-intensive and intensive systems is very slow and has not picked up to the desired extent.
- No or little efforts have been made to improve the available grazing lands through reseedling

with nutritious perennial grasses, legumes, fodder bushes and trees to improve quantity and quality of the biomass.

- Information on trace minerals status in grazing area is meagre. Mineral supplementation, particularly trace minerals in extensive system of goat production is not practiced.
- No or little efforts are made to conserve surplus fodders and monsoon herbage for feeding during scarcity/ lean periods using improved conservation technologies.
- Commercial production of complete/ supplementary feed mixtures using agro-industrial by-products, low-grade roughage and fodder tree leaves more so for goats has not been taken up by the feed industry.
- Strategic supplementary feeding of goats with concentrates and mineral mixtures and cultivated fodders for meat kids and pregnant and lactating goats is not being followed as per the recommendations.

(iii) Health Care:

- Disease diagnostic facilities are not available and disease information system is not functional almost through out the country.
- Surveillance, monitoring and forecasting of important goat diseases has not received due priority by the State development departments.
- Regular vaccination and de-worming measures against infectious diseases of goats are not practiced in the States. Vaccines like PPR are not readily available with the State Governments to control the disease.
- Prevention of nutritional deficiencies and reproductive disorders is important for efficient goat production. But these areas have received little attention under R&D activities.
- CAE and PPR in goats have not yet received due R&D priority though the diseases have taken heavy toll worldwide.
- Preventive measures suggested against internal and external parasites in goats are not being practiced by the farmers.

(iv) Housing and Management:

- Provision of adequate and appropriate housing and management requirements get lowest priority due to financial limitation of the goat farming community resulting in heavy economic losses due to mortality, morbidity and low production more so during inclement weather.

(v) Extension Education and Technology Transfer-

- Poor extension education and transfer of technology system in the States.
- Lack of multi faceted delivery system of modern technologies to the farmers at their doorsteps.
- Inadequate linkage of R&D with the State Departments and Extension machinery.
- Limited application of audio-visual aids on goat husbandry practices.
- Lack of confidence building of farmers to use facilities of Co-operative and Marketing Societies.
- Limited macro and micro level impact assessment studies on available production technologies.

6.6 ORGANIZATIONAL NEEDS:

- There should be a National body like NDDB for goat production and marketing.
- Goat breeding policy should be finalized on regional basis and monitored.
- Use of improved buck semen in every veterinary hospital should be made essential.
- Silvi-pasture development on degraded lands should be institutionalized.
- Feed manufacturers may be encouraged for compounding supplementary and complete goat feed as mess, pallets and blocks.
- Vaccination against infectious diseases should be done regularly by State Governments.
- Slaughtering of goats below 10 months should be banned.
- Required number of elite breeding males of different goat breeds should be made available to the farmers.
- Quality control of goat milk and meat should be given serious consideration.
- Centralized Goat Information Centre may be established.
- Referral laboratories on goat disease investigations should be established on regional basis.

7. PERSPECTIVE

World's human population is around 5901 million. Two-third of the world's poor live in Asia and 65% of them are poor livestock keepers who derive a large part of their household from domesticated animals. India possesses about 17.40% of the world human population. Underprivileged families account for about one-fourth of the population and contribute 70-80 of the total livestock produce. The rapidly changing patterns of demand for livestock and livestock products point to livestock production being an increasing component of the agricultural economies of Asia in general and India in particular. The extent to which the rural poor will benefit from these changes depends on how livestock can be integrated into developing markets and whether cheaper livestock products benefit the rural poor as consumers as well as producers. World's current population of cattle, buffaloes, sheep and goats is around 1355, 174, 1081 and 808 million respectively. Asian region possesses about 33.61, 96.88, 42.29 and 64.33% and India 13.65, 56.31, 5.79 and 14.87% of the total world population of the four respective livestock species (FAO, 2005). There is scope for goats to play an important role for smallholder farmers in accessing these new markets. Their significance, which is now being exploited in several countries, is that they are small livestock in high demand and can thrive on low inputs and local resources.

Goats have distinct social, economical, managerial and biological advantages over other livestock species. They significantly contribute to the agrarian economy and play a very vital role in the livelihood security of the small and marginal farmers and landless labourers especially in arid, semi-arid and mountainous regions of the country. Goats have several advantages over other animals. They are widely adapted. They thrive well and reproduce in tropical, cold, humid as well as dry regions. Their small size permits them to be maintained on a limited area. The breeding animals are inexpensive. Goats consume a wide variety of grasses, weeds, forbs, bushes, shrubs, tree leaves and crop residues that would otherwise go waste and cause pollution. They are gentle and easy to control. Their small size makes them suitable for home slaughter. The goats can be milked any time of the day. Goat milk is a source of family nutrition and prescribed for children, old and sick as it is easily digestible and has medicinal value.

Goat meat (chevon) is preferred over other meats because it is leaner and there are no religious taboos against its consumption.

World's current goat population is around 808 million. Asian region has the highest and over 64.33% of the world population of goats. India possesses 124.36 million making 25.1% of Asian and 14.87% of the world goat population. The developing countries of the world have about 94.5% of the goats and the developed ones only the rest 5.5%. The growth rate in goat population in India has varied from 0.94 to 5.13% with an average of 3.55% during 1951-2005. Presently, there are 5.4, 15.1 and 41.5 goats per 1000 hectares of land area and 11.6, 12.7 and 12.2 goats per 1000 human heads in the world, Asia and India, respectively. The goats around the world produced 12438 TMT of milk, 4562 TMT of meat and 986 TMT of fresh skins annually. The Asian region contributed 54.08% of the milk, 75.34% of the meat and 79.91% of the fresh skins of the world production of goats. India produced 21.70% of the milk, 10.41% of the meat and 13.14% of the fresh skins of the world and 40.14% of the milk, 13.82% of the meat and 16.45% of the fresh skins of the Asian goat production. The goats in India provide 475 TMT of meat, 2760 TMT of milk, 129.5 TMT of skins and 450 TMT of manure annually. About 47.5 million goats making about 40% of the total population are slaughtered for meat every year. In addition goats annually provide about 8.5 MT Pashmina and Mohair textile fibres. The estimated value of different types of goat produces works out to over Rs.9349.5 crores per annum. The goat sector also generates about 5% rural employment and about 20 million families belonging to small and marginal farmers and landless labourers are engaged in goat keeping. Realizing the economic importance of goats a large number of commercial goat farms have already been established and several are in the process of establishment in different parts of the country. Thus goats have been important to food and economic securities of small holders in India for countless years and their contributions have been rising.

The goat population in India is poised to reach around 170 million and the annual meat, milk and skins production to 700, 6000 and 225 thousand MT respectively by 2025. The human population is likely to touch 1.5 billion and the annual meat requirement to 9855 thousand MT. Thus there will be a large gap between the requirement and the availability. Although buffaloes, sheep, goats, pigs, poultry and fishes contribute substantial quantities of meat, the goat meat (chevon) is the most preferred meat in India. Further, there is very high demand of live goats, goat meat and goat meat products both in developing and developed countries more so because there are no religious taboos against it and it is leaner and mostly organic. The goat milk is cheap, wholesome, easily digestible and nutritious. It is recommended for use in dyspepsia, peptic ulcer, pyloric stenosis, liver dysfunction, jaundice, biliary disorders, acidosis, insomnia and food allergies. These virtues of goat milk need to be highlighted and commercially exploited in the national and international markets. The goat skins are also a very potential source of income and a few goat breeds produce very high quality skins which are used in leather garments, shoes and fancy toys and show pieces. The goat manure and folding are very valuable source of nutrients for organic crop farming, ornamental and horticultural plantation. Studies have shown that goats are not responsible for vegetative destruction, soil erosion and desertification as blamed more than large ruminants and man made reasons.

The productivity of goats in respect of milk, meat and fibre is low in general. The major reasons for low productivity are inadequate grazing resources, poor nutrition, tropical heat, disease problems and serious lack of organized efforts for bringing genetic improvement. The studies have shown that the

goat productivity can be significantly improved if the above aspects are thoroughly researched upon, required inputs are judiciously provided and the listed constraints are adequately solved. Research with goats has markedly grown in the last decade. Nonetheless, there still remain many challenges facing the goat industry, which require considerable research to adequately address there. The CIRG has an important role to play in identifying these critical research needs, seeing that it conducted, and ensuring that findings are disseminated to those who can derive benefit from them. There are a large number of aspects that will necessitate research attention in the coming years in order to maintain as well as assume greater role of goats in the mixed farming systems of our country.

Goat Genetics Research: Genetic improvement of goats holds great promise for enhancing their productivity. Considerable genetic diversity exists in Indian goats but there has been very little effort to tap this resource. Some fragmentary efforts have been made during last 25 years to describe, evaluate, conserve and manage some of the goat breeds. These have, however, been based on small populations and generally in institutional flocks. Research programmes, therefore, need to be taken up on identification, characterization and evaluation of indigenous goat genetic resources. There is need for research on gene-based technologies to identify indigenous genetic resources possessing traits influencing adaptability to harsh environments, productivity under sub-optimal conditions and disease and parasitic resistance. Studies on improvement of goats for meat, milk and fibre through selection/grading with superior breeds have been limited to a few breeds and involving small number. Priority efforts are required on faster multiplication and production of superior germplasm of different Indian goat breeds through Open Nucleus Breeding Scheme adopting Artificial Insemination and Multiple Ovulation Embryo Transfer Techniques both under farm and field conditions. A mechanism to safeguard, conserve and increase population through reproductive biotechnology of some of the rare breeds of goats before their extinction should be a priority. Sequencing and mapping of the goat genome will allow identification of individual genes controlling specific production and economically important traits viz. growth rate, milk yield, carcass quality, feed conversion efficiency and nutrient metabolism. The potential impact of globalization on the goat gene pool should also be considered. Use of reproduction biotechnology for conservation of threatened goat breeds has to be intensified. Semen freezing technology and use of frozen semen on large scale need perfection.

Feeds and Feeding System Research: Feedstuffs represent the major cost of production of goats. Thus, nutrition and feeding practices are of great importance and more research is needed to develop and evaluate feeding programmes that enhance level, efficiency, and profitability of production of goat meat, milk and fibre. There is need for basic and applied research to address influences on nutrient requirements of factors such as genotype, diet, and environment along with physiological processes responsible for their potential impacts in order to maximize the long-term rate of progress. Goats in India are generally reared under extensive system and play only a secondary role to crop as well as other livestock production. The greatest limitation in our natural pastures is on the availability of adequate energy throughout the year and adequate protein for more than half the year. The adult body weights, reproduction rates and milk production are lower and morbidity and mortality rates are higher. The birth, weaning and slaughter weights and dressing percentage are poor and bone: meat ratio is narrow in kids maintained solely on grazing on the degraded lands. There is great prospect of improving these natural rangelands. Research is needed on development of feed and fodder resources through development of multi-tier pastures by reseeded the grazing land with nutritious perennial grasses, legumes,

fodder shrubs and trees. Research is needed on harvesting and conserving the abundantly available monsoon herbage as hay, silage, feed blocks etc. for use during lean periods. Research is also needed on identification, evaluation, improvement and utilization of low-grade roughage and agro-industrial by-products. With the shrinking of community grazing lands it may not be possible to continue rearing goats under extensive system and the goat farmers will have no option but to switch over to semi-intensive and intensive systems not only to maintain but also to improve the productivity. Studies on development of strategic supplementation of goats during different physiological stages, seasons and regions for different breeds will have to be conducted to suggest suitable feeding systems for adoption by the goat keepers. Further, studies are, on priority, required on development of intensive system of goat meat production to improve the quantity and quality of meat. For this, work on development of complete feeds as mess, pallets and feed blocks using cheap and locally available ingredients needs to be undertaken. Production performance and economics of different goat breeds under different feeding management systems based on mixed farming also needs to be studied. Development of Model Goat Production Systems based on mixed farming for different regions for integrated rural development needs due emphasis. Nutrition research in regards to understanding how genes and nutrients interact and physiological mechanisms responsible for effects of nutritional manipulations will of paramount importance.

Goat Health Research: Society is questioning the safety and acceptability of food from animals. Implications of this for the goat industry in developing countries where production is primarily extensive are unclear. Today, the public or consumer is not only interested in the wholesomeness of the product but also how, where and under what conditions the item was produced. While traditional concerns such as fat, cholesterol and drug residue levels remain at the top of the list, there is recent interest in whether animals were raised on grass or under organic system of production. Research on surveillance, monitoring and forecasting of goat diseases and systems for prophylaxis and treatment have to be continued. Development of vaccines against the emerging goat diseases has to be prioritized. Critical investigation of goat diseases and developing location specific preventive and control measures needs to be continued. Extensive use of synthetic anthelmintics is resulting in widespread resistance of internal parasites. It is uncertain if new commercial compounds will be developed before resistance to the ones currently available reaches intolerable levels. Free movement of animals from one area to another has aided the spread of resistant nematodes in the country. Therefore, there is need for internal parasite research in a number of topics, such as management strategies to avoid high nematode burdens, treatment with inherent anthelmintic activity, and use or development of goats with resistance to internal parasites and acceptable levels of performance. Studies on recurrent diarrhoea in adult goats and kids, its effective prevention and control measures also require attention.

Goat Products Research: The living standards of a large population are rising, concomitant with an increased demand for meat and milk. Distribution of goat products is going through both horizontal and vertical integrations as well as increased globalization. Studies on evaluation of quality of meat, milk and fibre produced by various goat breeds under different management systems and development of processing technologies for new value added meat and milk products need to be undertaken. Goat researchers have not kept up with research and industry enhancements in carcass packaging, storage, grading systems, or new products, or in the development of dairy products that are beneficial for gastrointestinal and cardiovascular health. These are critical areas that deserve attention in order to add

value to goat products for substantial economic returns. The advantages of consuming Indian goat meat mostly produced organically and the medicinal value of the goat milk need to be highlighted in the national and international markets to exploit the rising demands of such food products.

Studies on the socio-economic aspects of goat farming in small and commercial goat holdings have to be conducted. Studies on the marketing of live goat and goat products both in internal market and for export are very important. Participatory research projects with the farmers especially in the area of breed and feed resource development and commercialization of goat farming need priority.

There is need for greater cooperation and collaboration among research institutions and organizations in order to achieve most efficient use of limited resources. Such research should have well defined goals and realistic objectives, leading to identifiable outcomes with positive impacts. Duplication should be avoided and previous experiences built upon. Furthermore, stakeholders must be involved in research prioritization. If the above measures were adopted from planning to implementation stage, goat milk, meat and skin production would be significantly improved during the next two decades. The most important determinants of research conducted are the availability of funding and suitable scientific manpower.

8. ISSUES, GAPS AND STRATEGIES:

8.1 ISSUES:

- Description and evaluation of goat genetic resources and their conservation.
- Enhancing production and quality of meat, milk and fibre.
- Improving nutrition and feed resources for goats.
- Prevention and control of goat diseases and health management.
- Improving fertility and flock productivity.
- Transfer of technology.
- Human resource development.
- Consultancy services.

8.2 GAPS:

- Wide gap between the availability and adoption of improved goat production technologies.
- Wide gap between the requirement and availability of feed and feed resources for goats.
- Wide gap between the requirement and availability of elite breeding males.
- Wide gap between the requirement and availability of goat health services.
- Scope for rearing goats under semi-intensive and intensive systems.
- Conservation of goat germplasm, production of elite males, improving feed resources, improving fertility, controlling diseases, transfer of technology and development of human resource are the major issues for enhancing quantity and quality of goat meat, milk and fibre production.

8.3 STRATEGIES:

- Survey and evaluation of important indigenous goat genetic resources in their home tract and steps for their conservation through ONBS.
- Improvement of indigenous goats through selection for body weight, milk yield, prolificacy and improved management and nutrition for increasing meat and milk production.
- Meat kid production systems using economic complete feeds.
- Feed resource development through development of two and three-tier perennial pasture on community grazing lands using silvi-pasture, agro-forestry and horti-pasture systems.
- Development of feeding strategies using agro industrial by-products in complete feeds as pallets and blocks.
- Strategic supplementary feeding management.
- Development of prophylactic, diagnostic and curative techniques including production of vaccines against important goat diseases.
- Development, improvement and perfection of A.I. technique using frozen semen and embryo transfer technology.
- Testing, refining and dissemination of technologies developed for improvement of goat through improved breeding, reproduction, feed resource, feeding, health cover, management, value addition and marketing.
- Training of scientists in frontier areas like biotechnology related to breeding, reproduction, health, nutrition etc. and in social sciences for testing and refinement of technologies, market assessment and surveys.
- Training of trainers, goat farmers and entrepreneurs in commercial goat farming.
- Provision of consultancy services.

9. PROGRAMMES AND PROJECTS:

9.1 PROGRAMMES:

- Development of technologies for improving goat milk production.
- Development of technologies for improving goat meat & skin production.
- Development of technologies for improving goat fibre production.
- Development of technologies for improving feed and fodder resources for goats.
- Disease diagnosis and development of prophylactic and control measures.
- Development of value added goat milk, meat, skin and fibre products.
- Transfer of technology for improving goat meat, milk, skins and fibre production.
- Development of human resource for improving goat meat, milk, skin and fibre production.
- AICRP on Goat Improvement.

9.2 XIPLAN PROJECTS:

a. Genetics and Breeding:

1. Evaluation and improvement of growth, milk, meat and skin traits in Indian goat breeds (Jamunapari, Barbari, Jakhrana, Beetal and Bengal goats) through Multi Disciplinary Approach.
2. Quantitative Trait Loci (QTL) mapping for production, reproduction and other traits in Indian goats.

b. Nutrition, Feed Resource & Products Technology:

1. Development of Fodder production, conservation and processing technologies for small holders and commercial goat farmers.
2. Development of economic feeding systems for improving goat production.
3. Studies on evaluation of Carcass traits, meat quality attributes and milk composition.

c. Physiology, Reproduction and Management:

1. Improved productivity of goats through reproductive iotechnologies including refinement of frozen semen, strengthening of semen bank and augmentation of prolificacy.
2. Development of Model Goat Production System including adaptability and environmental aspects for integrated rural development based on goat farming.

d. Goat Health:

1. Monitoring and Surveillance of Important Goat Diseases in India.
2. Diagnosis and development of prophylaxis and treatment for control of brucellosis, JD and CCPP in goats.

e. Extension Education and Socio-Economics:

1. Transfer of Technology and its impact on improving goat production.
2. Organization of National & International Training Programmes and provision of consultancy services for improving goat production.

9.3 PROGRAMMES ON TIME SCALE:

S.No.	Programme	Time Scale		
		2007-12	2012-17	2017-25
1.	Development of technologies for improving goat for milk production	+	+	-
2.	Development of technologies for improving goat for meat & skin production			
	a. Meat	+	+	-
	b. Skin	-	+	+
3.	Development of technologies for improving goat for fibre production	-	+	+
4.	Development of technologies for improving feed and fodder resources for goats	+	+	+
5.	Disease diagnosis and development of prophylactic and control measures	+	+	+
	a. Development of diagnostic for goat diseases	+	-	-
	b. Development of new generation diagnostics and vaccines	+	+	+
6.	Development of value added goat milk, meat, skin and fibre products			
	a. Value addition of milk and meat	+	+	-
	b. Value addition of skin	-	+	+
	c. Value addition of fibre	-	+	+
7.	Transfer of technology for improving goat meat, milk, skins and fibre production	+	+	+
8.	Development of human resource for improving goat meat, milk, skin and fibre production			
	a. Meat and milk	+	+	
	b. Fibre	-	+	+
9.	AICRP on Goat Improvement	+	+	+

9.4 FUND REQUIREMENTS:

S.No.	Programme	Funds Required (Rs. in lakhs)		
		2007-12	2012-17	2017-25
1.	Development of technologies for improving goat for milk production	1200	2750	2550
2.	Development of technologies for improving goat for meat & skin production	1600	3500	6000
3.	Development of technologies for improving goat for fibre production	1000	2000	4000
4.	Development of technologies for improving feed and fodder resources for goats	2000	3000	5000
5.	Disease diagnosis and development of prophylactic and control measures	2000	3500	5500
6.	Development of value added goat milk, meat, skin and fibre products	1000	2000	4000
7.	Transfer of technology for improving goat meat, milk, skins and fibre production	1000	2000	4000
8.	Development of human resource for improving goat meat, milk, skin and fibre production	1900	4000	6000
9.	AICRP on Goat Improvement	1500	3000	6000
Total		12300	25750	43050

10. LINKAGES, COORDINATION AND EXECUTIVE ARRANGEMENTS:

There will be a dire necessity to establish National and International linkages for effective implementation of the proposed programmes. Some are listed below-

- Linkage between the Institute and State Development Departments.
- Greater interface with the Department of AH and Dairying, GOI.
- Linkage with State Agricultural Universities.
- International linkages with ILRI, Israel, France, UK, USA and Australia for training and exchange of visits for enhancing knowledge and capability of the Scientists to achieve the objectives.
- Inter-institutional linkages with IVRI, NDRI, IGFRI, CSWRI, NRC on Mustard, NRC on Agro-forestry and CSWCR&TI.
- Inter-divisional linkages within the Institute.
- Inter-sectional linkages with the technical, administrative and supporting staff at the Institute level.

11. CRITICAL INPUTS:

11.1 Funds:

Programme No.	Equipments	Works	Feed	Vehicle	Chemical/ glasswares	Others
1	XX	X	XX	X	XX	-
2	XX	X	XX	X	XX	-
3	XX	X	XX	-	XX	-
4	XX	X	-	-	XX	-
5	X	X	-	-	X	-
6	XX	X	X	X	XX	-
7	XX	XX	-	-	XX	-
8	X	XX	X	XX	-	-
9	X	X	-	X	-	-

- Less important, X General importance, XX Highly important

11.2 Additional Manpower and Financial Requirements (XI Plan):

S.No.	Items required	Man power	Financial	Rs. (in lakhs)
1.	Regional Stations:			
	i. Eastern	S—	5 x 4 = 20	Rs. 25 x 5 = 125.00
	ii. Hot desert	T—	3 x 4 = 12	Rs. 9 x 5 = 45.00
	iii. Cold desert	A—	2 x 4 = 08	Rs. 5 x 5 = 25.00
	iv. Southern peninsular	SP—	10 x 4 = 40	Rs. 16 x 5 = 80.00
2.	Transfer of Technology	SMS	1 x 4 = 4	Rs. 4 x 5 = 20.00
		Technical	1 x 4 = 4	Rs. 4 x 5 = 20.00
3.	Training Programmes	Technical	1 x 5 = 5	Rs. 2.2 x 5 = 11.00
4.	Workshop Strengthening	Technical	4 x 1 = 4	Rs. 4.5 x 4 = 18.0
5.	PME Cell Strengthening	Technical	3 x 1 = 3	Rs. 4.0 x 3 = 12.00
	Grand Total		Rs. 356.00	

S= Scientific T= Technical A= Administrative SP= Supporting

11.3 Infrastructure:

- Creation of a new Division of Goat Production and Management.
- Upgrading of Extension Education Section to be a Division of Transfer of Technology.
- Creation of a new Section of Goat Products Technology.
- Creation and strengthening of IPR, PME and HRD Cells.
- Strengthening of goat disease surveillance, monitoring, forecasting and their prevention system.
- Development of perennial silvi-pastures and agro-forestry systems on the available Agriculture Farm lands.

- Installation of machineries for production of supplementary and complete feeds for goats using low grade roughages and agro-industrial by-products.
- Setting up of a Goat Germplasm Centre to meet the growing field demand of elite breeding bucks of different breeds for faster breed improvement.
- Construction of approach, boundary and farm roads.
- Construction of Farmers and Student Hostels.
- Construction of remaining parts of the Lab-cum- Administrative building.
- Procurement of need based Laboratory instruments /equipments.
- Strengthening of Extension Education and Transfer of Technology with Exhibition hall, Museum, equipments and instruments.
- Construction of Residential Quarters of Type III, IV and V categories.
- Construction of Goat Products Technology Laboratories.
- Construction of a Farmer Training and Communication Centre.

12. RISK ANALYSIS:

The goat rearing is less risky as compared to crop cultivation and large animal rearing. While crop cultivation in the rain-fed areas is a gamble and rearing of large ruminants requires heavy investment and input support goats may be maintained with no or little inputs and provide milk and meat for human consumption even during natural disasters. However occurrence of natural calamities viz. floods, droughts, famines, epidemics etc. may cause severe reduction in productivity due to heavy morbidity and mortality losses. Sharp increase in goat population in spite of a very heavy slaughter rate may pose acute shortage of feeds and fodders and also vegetative destruction and ecological degradation. Hence we will have to contain goat population and improve their productivity per goat per unit time and feed. Uncontrolled sale and slaughter of elite, threatened and extingting germplasm due to sudden rise in demand and prices may cause genetic erosion of the available goat germ plasm. Unhealthy competition between men and animals for the same area of land in general and between different livestock species for the available feed resources in particular due to shrinkage of grazing lands will force the goat farmers to switch over from extensive system of goat rearing to semi-intensive and intensive systems. Imposition of certain trade barriers in the international market may also adversely affect the goat production. Unless the benefits of the improved technologies already developed and to be developed are not transferred and adopted by the goat farmers we can not expect improvement in the productivity of our goat population. We will, therefore, have to provide required in put support to achieve the goals and mitigate the risks. The success of the listed programmes shall largely depend upon the availability of financial and manpower resources required at time to time.

13. REVIEW, REPORTING AND EVALUATION:

(A) MEETINGS:

- Director and Scientists Meeting : Half Yearly
- RAC Meeting : Annually
- IRC Meeting : Annually
- QRT Meeting : Five Yearly

(B) REPORTING:

- Institute Annual Report Institute News letter
- ICAR News Letter ICAR Reporter
- ICAR Publications Research Publications
- Presentation in Symposium/Seminar etc. Popular Articles
- Technical Bulletins Quarterly Reports
- Half Yearly Reports

(C) EVALUATION:

- Institute Management Committee (IMC)
- Research Advisory Committee (RAC)
- Institute Research Committee (IRC)
- Quinquennial Review Team (QRT)

14. RESOURCE GENERATION:*(Rs. in lakhs)*

IXth Plan actual	Xth Plan actual	XIth Plan projected
67.81	162.44	264.00

Details of anticipated earning during XIth Plan

S. No.	Details of Resource Generation	Anticipated earning during XI th Plan (Rs. in lakhs)
1.	Consultancy including drafting of Project proposals	5.00
2.	Externally Funded Projects/ Research contracts	
	a. Network (AICRP) Projects of ICAR	50.00
	b. DST/ CST Projects	50.00
	c. NIAP	50.00
3.	Royalties - Sale of Book, Video Films, Bulletins etc.	2.00
4.	Testing Fees	2.00
5.	Training and Education Fees	10.00
6.	Other Items:	
	a. Sale of livestock and livestock products	50.00
	b. Sale of Agricultural Produce viz. dry wood, grass, weeds etc.	25.00
	c. License Fee of Residential Houses & Guest House etc.	10.00
	d. Interest on Short Term Loans	10.00
	Total	264.00

15. OUTPUTS:

Evaluation and improvement of growth, milk, meat and skin traits in Indian goat breeds through multi disciplinary approach will help develop elite germ plasm of different goat breeds suitable for different regions of the country. The breeding, feeding, management and prophylactic and curative health cover technologies thus developed will help improve the goat productivity when disseminated in

the field for adoption by the small holder goat keepers and the commercial goat farmers. The technologies for establishment, management and utilization of perennial grass and legume pastures and production, conservation and processing of feeds and fodders for goats will help improve the nutritional status of goats for intensive goat production in the country. Similarly technologies will be developed for economic feeding systems for improving goat production. The technologies for improving reproduction rates through development and refinement of A.I. and frozen semen technology, establishment and strengthening of goat semen bank and augmentation of prolificacy will be developed to produce more number of kids per doe per year for enhancing meat production. The Model Goat Production Systems including adaptability and environmental aspects for integrated rural development based on goat farming will also be developed. Monitoring and surveillance systems for important goat diseases in the country will be developed. Diagnostic, prophylaxis and treatment methods for control of brucellosis, JD and CCPP will be developed to reduce morbidity and mortality in goats. The studies on socio-economic aspects of goat farmers in different regions of the country will help in planning of rural development programmes. Technologies will be made available for evaluation of goat milk, meat, skin, fiber and manure and development of their value added products. Organization of training programmes and provision of consultancy on various aspects of goat production and utilization will develop the scientific, technical and village human resource for undertaking goat farming on scientific and commercial lines. A large number of research, technical and popular articles, reports, books, bulletins, leaflets, hand bills etc. on different subjects of goat science and technology will be published in national and international publications. The elite germ plasm, complete feeds as pellets and blocks, the machinery for production of these feeds, frozen semen and embryo transfer technology, value added milk, meat skin and fibre products, disease diagnostic kits, prophylactic vaccines and herbal medicines may be got patented.

16. OUTCOME:

World's current population of goats is around 807.6 million as per the FAO estimates. The developing countries of the world have about 94.5% of the goats and the developed ones only the rest 5.5%. India possesses about 124 million goats making 14.87% of the world population and stands second to China. Although the population of all livestock species has shown increasing trend since 1951 the goat population has increased at a much faster rate than others in India. The growth rate of goats in India has varied from 0.94 to 5.10% with an average of 3.05% during 1951-2005 in spite of about 41% slaughter and about 15% natural mortality annually. The goats around the world contributed 12438.4 TMT of milk, 4562.1 TMT of meat and 985.9 TMT of fresh skins per annum. India produced 2700 TMT of milk, 475 TMT of meat, 130 TMT of skins, 8.5 MT of Pashmina and 400 TMT of manure which make 21.71% of the milk, 10.47% of the meat and 13.15% of the fresh skins of the world goat production. In India about 4.8 to 5.0 million goats are slaughtered for meat every year. The estimated value of different types of goat produces works out to about Rs. 9350 per annum. The goat sector also generates about 4% rural employment and about 20 million families belonging to small and marginal farmers and landless labourers are engaged in goat keeping. In addition a large number of commercial goat farms have been established in different parts of the country.

Goats are reared mostly by small and marginal farmers and landless labourers in arid, semi-arid and mountainous regions and grazed/browsed on waste lands, community grazing lands, crop stubbles supplemented with tree lopping and provided little or no supplementary feeding with concentrates and cultivated fodders. The women, children or the old men of the family maintain the goat flocks as zero input

occupation under extensive production system. Therefore, although the productivity is lower, the outputs under the present system of goat rearing are reasonably higher in comparison to the inputs. Provision of critical inputs like superior breeding bucks, supplementary feeding with concentrates and cultivated fodders, prophylactic and curative health cover against different diseases, improved housing and better marketing facilities are seldom considered by the goat farmers in general. The studies conducted have revealed that even small inputs in respect of the above may bring appreciable improvement in the overall productivity.

The scientific, technical and other manpower, financial and material inputs have led to development of several improved technologies in different disciplines relating to goat production. The major emphasis has been on development of superior germplasm of the indigenous goat breeds. There has been a very significant improvement in quality and quantity of meat, milk and skin production through increased kidding rates, body weights, slaughter weights, dressing percentage, survivability and lactation yield and length in the superior germplasm compared to the indigenous non-descript population in different regions of the country when required nutrition, management and health inputs were provided. Reasonably higher outputs have been witnessed in the productivity of the farmers' flocks of different regions and breeds in respect of milk, meat and financial returns. The outputs in terms of technology generation have already been detailed in previous pages.

Implementation of the proposed programmes will help in generating technologies and strategies for improving milk and meat production from goats which in turn will improve the socio-economic status of our small and marginal farmers and landless labourers most of whom rear goats for their livelihood security. In addition, the increase in productivity will provide additional nutritional securities to the teeming millions through availability of animal products viz. meat and milk. Improvement in quantity and quality of the goat milk and meat will also open avenues for large scale export earnings. If the goat population continues to grow at the present rate the total population may reach around 166.62 million by 2025. Since we are proposing to improve the reproduction rate and survivability the growth rate may further increase. Thus the improvement in productivity will be the result of number increase as well as increase in per animal production per unit time. The annual meat and milk production from goats is likely to reach 640 and 5720 TMT by 2025. We will, therefore, have to arrange for large-scale off-take of the surplus animals through export of live animals as well as raw and processed meat and meat products. The medicinal value of the goat milk needs to be popularized and exploited in the national and international markets. Similarly increasing demands of organic food and food products will have to be exploited through supply of goat milk and meat mostly produced organically in our country. It is estimated that about 25% of the goats slaughtered are slaughtered below 6 month age resulting in low production and poor quality of meat. The most appropriate age recommended for slaughter from quantity, quality and economic point of view, is 10-12 months depending on the breed of goats. There will be proportionate increase in the production of goat skins, fibres and manure. Indian goat skins have a rising demand in the world market due to their superior quality. We will have to exploit the market demand through development of value added goat skin products. Increased production of goat manure will greatly supplement the demand for organic farming. Improvement in goat production will improve social, economical, nutritional and employment status of the rural community in general and tribal populations in particular. Recently, commercial goat farming is coming up in different parts of the country in a big way. Many entrepreneurs will venture to come in goat industry in the near future. This will further improve export potential of live animals, goat meat and milk products particularly in the SAARC and West Asian Gulf countries to the tune of Rs. 7.0-12.0 billion in 10-15 years.