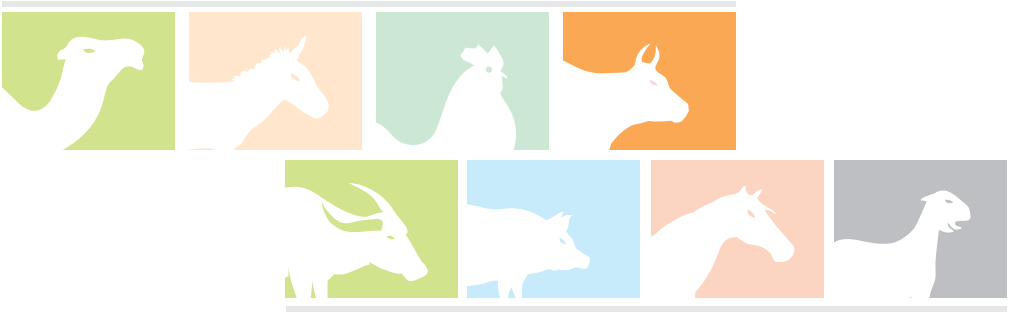
GUIDELINES FOR MANAGEMENT OF ANIMAL GENETIC RESOURCES OF INDIA









ICAR-National Bureau of Animal Genetic Resources

GUIDELINES FOR MANAGEMENT OF ANIMAL GENETIC RESOURCES OF INDIA

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Foreword

Biodiversity, both floral and faunal, remains vital for sustainable growth of agriculture and allied sectors, providing germplasm for improvement of crop and animal species. On account of a broad range of agro-climatic conditions in the country, we have diverse plant, animal, fish, insect and microbe resources. Because of these valuable genetic resources, India is recognised as one of the twelve mega centres of biodiversity in the world.

Management and preservation of biological diversity is recognised worldwide as the key to ensure sustainable development of agriculture not only in the present context but also in future. Therefore, search for new germplasm; its characterization and evaluation; preservation of wild and threatened varieties; and populations are essential. Being one of the earliest signatories to the Convention on Biological Diversity (CBD), India has taken important steps in developing new strategies for effective management of its agro-biodiversity and has established National Bureaux for management of plant, animal, microbe, insect and fish genetic resources, exclusively.

Domesticated animals constitute an important genetic resource in the country that lends strength to the food and livelihood security in agriculture based system. Despite contribution to the society, a large part of Animal Genetic Resources (AnGR) distributed all over the country is yet to be characterized, documented and evaluated scientifically. Assessment of threats and consequent preservation of valuable AnGR are also the priorities of the country. At the same time, exchange of animal germplasm for research and intellectual properties issues are extremely relevant to the changing world scenario. Following the recommendations of National Advisory Board for Management of Genetic Resources (NABMGR), these guidelines are the step forward to protect the interest of the country. I am sure these guidelines will help and guide all the stakeholders, both inside and outside National Agricultural Research System for scientific management of the AnGR of the country so that this useful resource can be preserved and utilized for posterity.

T. MOHAPATRA
Secretary, DARE &
Director General, Indian Council of Agricultural Research
Krishi Bhawan, New Delhi

Date : 13th October, 2016
New Delhi

Foreword

Animal Genetic resources (AnGR) are vital in providing livelihood security to billions of people, globally. In our country, AnGR not only provide food security but also are important contributors to national economy. Our country possesses a vast livestock diversity evolved within specific ecological niche during thousands of years. Due to adaptation to varied climatic conditions, the strength of indigenous livestock is well acknowledged worldwide due to unique attributes and traits which are more relevant in present context of climate change and nutritional requirement. There is perceptible need of the germplasm with traits like heat tolerance, disease resistance and better thriving ability in the changing global scenario. Fortunately, we have a rich resource of such diverse germplasm in the country; therefore, this valued AnGR needs careful attention for its effective management, use and conservation besides fulfilling the continuous increasing demand of the human population.

For management of AnGR, from time to time various strategies and approaches have been evolved by Government, Non-Government institutions and local communities. This document developed by ICAR-National Bureau of Animal Genetic Resources (ICAR-NBAGR) is an appreciable effort in this direction. These 'Guidelines for Management of Animal Genetic Resources of India' addresses important issues like identification, characterization, documentation, conservation, exchange, biosecurity and Intellectual property rights (IPR) with respect to India's large livestock and poultry diversity.

I am sure, the guidelines will not only help in management and sustainable use of our diverse AnGR but also protect this valuable animal genetic diversity against its indiscriminate use and exploitation and would help in facilitating development of National and International policies for the benefit of various stakeholders.

H. RAHMAN
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Indian Council of Agricultural Research
Krishi Bhawan, New Delhi

Date: 5th October, 2016
New Delhi

PREFACE

Animal Genetic Resources (AnGR) are essential component of agriculture production system which provides food and livelihood security to the people of India. Besides, their significant contribution to the national economy, they play important role in ensuring rural employment as well as women's empowerment in India. A large diversity of AnGR has evolved in past centuries to cater to various requirements related to food and agriculture of the people in different geographical and climatic regions. However, with the change in utility and socio-economic conditions of the people as well as increasing globalization, AnGR diversity is becoming highly vulnerable. Even some of the unique germplasm may become extinct if no proper corrective measures are taken. Adding to this, protection from IP infringement of native germplasm and their valuable traits and alleles is an important and urgent necessity. Although many initiatives have been taken in the recent past by various private and public sector agencies involved in animal sector; still, these efforts seem to be insufficient for the efficient management of hugh diversity of AnGR of the country.

ICAR-National Bureau of Animal Genetic Resources (ICAR-NBAGR) is the nodal agency for the management of national wealth of AnGR, specially working for identifying, characterizing and documenting new germplasm, countrywide. Besides, it also bears responsibility for putting the resources for their sustainable use and preservation of the germplasm for future. However, identifying and documenting new germplasm and their specific characterstics, their preservation as well as sovereign protection for posterity is a dynamic process; and to expedite it, there is a need of scientifically sound and uniformly applicable guidelines for management of AnGR across the country. This document of 'Guidelines for Management of Animal Genetic Resources of India' addresses all aspects of AnGR management including characterization, documentation, conservation, exchange and Intellectual property rights.

Dr R. S. Paroda, former Director General (ICAR) and chairman, National Advisory Board for Management of Genetic Resources (NABMGR) has been the driving force for developing these guidelines. We are thankful to Dr T. Mohapatra, Secretary, DARE and Director General, ICAR and Dr H. Rahman, Deputy Director General (Animal Sciences), ICAR for guiding us in preparation of this document. These Guidelines are the outcome of contribution made by a Core Group headed by Dr P. K. Vij, Principal Scientist of ICAR-NBAGR beside the inputs provided by all the internal and external experts. Final compilation and editing of these Guidelines done by Dr S. K. Niranjan, Senior Scientist, ICAR-NBAGR is highly appreciable. I am sure; these guidelines will not only help different stakeholders for scientific management of AnGR of the country but also guide them to protect sovereignty of our indigenous livestock and poultry at international level.

ARJAVA SHARMA
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Date: 22nd October, 2016
Karnal

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1. Dr R. S. Paroda, Chairman, Trust for Advancement of Agricultural Sciences, Avenue II, Pusa Campus, New Delhi.
2. Dr T. Mohapatra, Secretary, Department of Agricultural Research and Education and Director General, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.
3. Dr H. Rahman, Deputy Director General (Animal Sciences), Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.
4. Dr S. Ayyappan, Former Director General, Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.
5. Dr K. M. L. Pathak, Former Deputy Director General (Animal Sciences), Indian Council of Agricultural Research, Krishi Bhavan, New Delhi.

The NABMGR constituted a committee to finalize guideline documents for all genetic resources, who are gratefully acknowledged for their supervision, advice and support. Following are the members of the committee:

1. Dr Bhag Mal, Former Regional Coordinator, Bioversity International, New Delhi (Chairman)
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7. Dr K. N. Raja, Scientist, Animal Genetic Resources Division
8. Dr B. K. Joshi, Former Director, ICAR-NBAGR
9. Dr Arjava Sharma, Director, ICAR-NBAGR
10. Dr S. K. Niranjan, Senior Scientist, Animal Genetics Division

Glossary

Accession number	A unique identifier assigned to a livestock or poultry breed, when it is registered.
Agricultural biodiversity	Also referred as 'agrobiodiversity', encompasses the variety and variability of animals, plants and micro-organisms necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security.
Allelic frequency	A measure of commonness of an allele in a population.
Animal genetic resources (AnGR)	Animal genetic resources used for food and agriculture, excluding fish. The term includes breeds; special genetic stocks (breeding lines, mutants, etc.); wild relatives of domesticated species; and genetic variants of wild species.
At-risk breed	A breed with demographic characteristics (primarily population census size) suggesting that it will fail to exist in the future unless a conservation programme is implemented.
Baseline survey	A survey that obtains sufficient population data to determine a breed status. It provides a reference point for monitoring population trends.
Biological diversity	The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. It includes diversity within species, between species and of ecosystems.
Biological Diversity Act (2002)	Biological Diversity Act (2002) has been enacted with objective to provide for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.
Body length	The horizontal distance (in centimetres) from the point of shoulder to the pin bone.
Breed	A sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within same species. Breed is a group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity.

Breed standard	A description of the characteristics of the "ideal" animal to be obtained through the breeding programme of a standardized breed.
Breeders' associations or cooperatives	An association of breeders of a livestock breed for the sharing of knowledge and benefit with a cause of breed improvement.
Breeding programmes	Systematic and structured programmes for changing the genetic composition of a population towards a defined breeding goal or objective to realize genetic gain (response to selection), based on objective performance criteria.
Census	An exercise in the collection, processing and dissemination of data that involves the enumeration of all units (e.g. livestock-keeping households) in the area targeted.
Characterization	Recording of heritable qualitative and quantitative traits which are easily observed, measured and expressed in all environments; helpful for distinguishing breeds from each other. Standard descriptors are normally used for description of traits
Chest girth	Circumference of the body (in centimetres) immediately behind the shoulder blades in a vertical plane, perpendicular to the long axis of the body.
Conservation	Practice of protecting the abundance of biological diversity of genetic resources from loss and extinction, and ensuring the preservation of those genetic resources for the use of future generations.
Convention on Biological Diversity (1992)	The convention on the biological diversity was signed in 1992 at Earth summit in Rio de Janeiro. It does cover a complete range of biological diversity including agro-biodiversity and its different sectors. The convention states that while nations have sovereign right to exploit their own resources (article-3) they have also the duty to conserve them. The convention states the need for policy development and integration, in that government are required to develop national strategies on biodiversity and to integrate the conservation and sustainable use of biological diversity into relevant sectoral and cross sectoral plans, programmes and policies.

Cryoconservation	Conservation by cryopreservation of a breed's genetic material (usually semen, embryos or somatic cells etc.) in vitro, in a non-living state, so that live animals can, if necessary, be reconstituted in the future.
Degree of endangerment	A measure of the likelihood that, under current circumstances and expectations, the breed will become extinct in a specified period of time, and/or that will lose through time its genetic variation at a non sustainable rate
Descriptor (Breed Descriptor)	An easily identifiable and measurable trait or characteristic of a population or breed observed in an accession, which is used to facilitate data classification, storage, retrieval and use for classifying and differentiating the breed.
Diversity	Numeric quantification of the amount of genetic variability in a set of breeds, ideally covering both the diversity within and between breeds.
Documentation	Presentation of recorded data on a population or breed of livestock and poultry in a standard format that describes characteristics, production system, utility, socio-economic aspects etc.
Domesticated animals	Those species that are bred in captivity, and modified from their wild ancestors to make them more useful to humans, who control their reproduction (breeding), care (shelter, protection against predators) and food supply.
Domestication	The process by which plants, animals or microbes selected from the wild adapt to a special habitat created for them by humans, bringing a wild species under human management.
Ectoparasites	Parasites that live on the exterior parts of the host body.
Effective population size (Ne)	The size of a hypothetical idealized population that would generate the values of genetic diversity parameters observed for a given population. The Ne corresponds to the number of breeding animals per generation and is usually smaller than the actual population count.
Embryo transfer	The process whereby one or several embryos are placed into the uterus of the female with the intent to establish a pregnancy.

Endoparasites	Parasites that spend some part of their life cycle inside the body of the host.
Evaluation	Recording of quantitative traits whose expression is often influenced by environmental factors; it provides an assessment of the potential of germplasm for use in breeding/research.
***Ex situ* conservation**	The conservation of biological diversity outside its natural habitat including live animal conservation and cryopreservation of germplasm in gene banks.
Exotic breeds	Breeds that are not locally adapted.
Extinct	The taxa (population, breed, subspecies and species) not found after repeated searches of known and likely areas. In animals, if there is neither any breeding males (or stored semen) and breeding females (or oocytes) nor embryos remaining. No longer possible to recreate the population.
ΔF	Proportional change in the average inbreeding of a population in a generation. $\Delta F = 1/2Ne$.
Gene Bank	A facility where genetic resources (genetic material) are conserved under suitable conditions to prolong their lives.
Gene pool	A sum of all the genes and combinations of the genes that occur in a population of organisms of the same species.
Generation interval	Time between successive generations in a breeding population.
Genetic distance	A measure of the genetic differences between two populations (or species); calculated on the basis of allelic frequencies in both populations.
Genetic diversity	Heritable variation within and among populations that is created, enhanced or maintained by evolutionary or selective forces.
Genetic marker	A DNA polymorphism that can be easily detected by molecular or phenotypic analysis.
Genetic material	Any material of plant, animal, microbial or other origin containing functional units of heredity.
Genetic resources	Genetic material of actual or potential economic, scientific or societal value contained within and among species. In a domesticated species, it is the sum of all the genetic combinations produced in the process of evolution.

Genetic variation	Occurrence of differences among individuals of the same species, arising due to variation in alleles, genes or genotype.
Genome	All the genetic material (DNA sequences) in a single (haploid) set of chromosomes of an organism. The genetic material inherited from either parent.
Genotype	Genetic constitution of an individual organism as distinguished from its appearance or phenotype. The genotype interacts with the environment to produce the phenotype.
Genotyping	Process of identifying the genetic make-up of an organism at DNA level by using molecular methods.
Germplasm	Genetic material which forms the physical basis of heredity and which is transmitted from one generation to the next by means of germ cells. Often synonymous with genetic material. When applied to AnGR, it includes animal as a whole and their germ cells, tissue cultures, cell cultures, genes and DNA-based sequences.
Germplasm exchange	Mutual give and take of germplasm or genetic resources from all available sources.
Global plan of action on AnGR	The international community adopted the first ever global plan of action for AnGR in September 2007 comprising of 23 strategic priorities aimed at combating the erosion of animal genetic biodiversity at using AnGR sustainably.
Habitat	Part of an ecosystem with conditions in which an organism naturally occurs or can establish.
Height at withers	The vertical height (in centimetres) from the bottom of the front foot to the highest point of the shoulder between the withers.
Household survey	Collecting data from a random sample of households chosen from among all households meeting a specific set of criteria.
***In situ* conservation**	Conservation of a breed through continued use by livestock keepers in the production system in which the livestock evolved or are now normally found and bred.
***In vitro* conservation**	Maintenance of germplasm in a relatively stable form under more or less defined nutrient conditions in an artificial environment.

***In vivo* conservation**	Conservation of a breed through maintenance of live animal populations. It covers in situ- and ex situ in vivo conservation.
Inbreeding	Production of offspring through mating between individuals related by ancestry.
Inbreeding coefficient (F)	A measure of the level of inbreeding equal to the probability that the alleles at any given locus are identical as inherited from a common ancestor of the two parents.
Indigenous knowledge (IK)	Local knowledge - knowledge that is unique to a given culture or society.
Intellectual property rights (IPR)	Legal rights that are conferred to the owner of an intellectual creation. The IPR are granted by means of protection through appropriate legislation based on the type of creation. The IPR protection entitles the owner of the Intellectual Property or his assignee the exclusive right to fully utilize the invention/creation for commercial gain generally for a fixed period of time.
Line	A population created from members of an elite family known for superiority of a particular trait. The line has specific purpose.
Linkage disequilibrium	Distribution of multilocus genotype combinations in a population for a given pair of markers that is incompatible with independent inheritance, thus indicating genetic linkage of the loci.
Local breed	Breed that occur only in one country.
Locus	A distinct region of DNA (often a gene) in the genome.
Microsatellite	Tandem DNA repeat of a 2 to 5 bp unit, distributed in genome.
Molecular markers	DNA based markers used to describe an individual.
Monitoring of population	A systematic set of activities undertaken to document changes over time in the size, structure, characteristics and distribution of livestock populations, along with changes to their production environments (including their management). In these guidelines, monitoring is considered to be a sequence of surveys, which can be referred to as "monitoring surveys".

Multiplex PCR	Carrying out simultaneously in one reaction the amplification of several different loci by using different pairs of primers.
Natural environment	Describing the climate, soil, terrain and surface and disease and parasite challenge.
Non-descript	Livestock populations which have not been characterized and accredited, so far.
Nucleus herd	A subpopulation of a breed, under strict management, within which selection can be applied with greater intensity than in the rest of population.
Passport data	Basic information about the origin of a population or breed, such as details recorded for animal, pedigree or other relevant information that assists in the identification of an accession of germplasm.
Polymerase chain reaction (PCR)	Method for amplifying DNA segments that uses cycles of denaturation, annealing to primers, and polymerase-directed DNA synthesis.
Performance recording	Recording of data on traits of economic importance for individual animals, such as milk yield, growth, reproduction, health and longevity. The recorded data can be used for management and selection decisions.
Phenotype	External appearance of an organism, that results from the interaction of its genetic composition (genotype) with the environment.
Phenotypic characterization	Process of identifying distinct breed populations and describing their morphological and production characteristics within given production environments and their geographical distributions.
Phylogeny	Evolutionary history of a taxonomic group.
Polymorphism	Presence of multiple alleles at a given locus in the genome.
Production environment	It comprises the natural environment and the management environment in which a breed population is kept.
Population	A group of individual animals that share a geographic area or region and have common traits.

Principal component analysis (PCA)	Method for analysis of a set of variables, such as allele frequencies, by calculation of a new set of statistically independent coordinates that each correspond to a weighted combination of the original variables in such a way that each coordinate captures as much variation in the original variables as possible.
Quarantine	Official confinement of regulated articles (introduced germplasm) for observation and research or for further inspection, testing or treatment to ensure that it does not carry diseases injurious to the importing country.
Ranchi Declaration (2009)	Ranchi Declaration On Management And Conservation Of Farm Animal Genetic Resources (2009) came from a select group of experts representing various stakeholders representing national and international organizations participated in a brainstorming workshop on "Strategy for Conservation of Farm Animal Genetic Resources", organized jointly by the Trust for the Advancement of Agricultural Sciences (TAAS) and the Birsa Agriculture University (BAU), on April 10-12, 2009 at Ranchi.
Safety duplicates	A duplicate of a base collection of germplasm stored under similar conditions for long-term conservation, but at a different locations to insure against accidental loss of material from the base collection.
Sanitary certificate	An official paper document issued by an authorized officer at the country of origin of germplasm, which states health, disease/pathogen (free) and vaccination status of live animal or their genetic material being exchanged.
Selection	Any process, natural or artificial, which permits a change in the genetic structure of populations in succeeding generations.
Single nucleotide polymorphism (SNP)	Nucleotide polymorphism resulting from a point mutation and most often corresponding to a biallelic (having two different alleles) marker.
Strain	A population created through breeding within the breed (even some time through crossbreeding-synthetic strain) targeted to one or few specific trait(s) of economic importance.

Survey	A systematic exercise in data collection, processing and dissemination.
Trait	A recognizable quality or attribute resulting from interaction of a gene or a group of genes with the environment.
Transact survey	Survey approach involves drawing transects a priori across the area targeted by the survey and then travelling along them.
Transboundary breeds	Breeds that occur in more than one country.
Wild relatives	A population close to farm animal species, having common ancestors, but remained undomesticated.
World Trade Organization	It deals with the global rules of trade between nations to ensure that trade flows as smoothly, predictably and freely as possible. The WTO agreement on agriculture (AoA), adopted in 1994, governs world trade in agriculture products.

Abbriviations

AICRP	All India Coordinated Research Project
AnGR	Animal Genetic Resources
ANOVA	Analysis of variance
AQCS	Animal Quarantine Certification Station
ATMC	Agro-technology Management Centre
BDA	Biological Diversity Act
CAC	Codex Alimentarius Commission
CBD	Convention on Biological Diversity
CHRS	Central Herd Registration Scheme
DAHDF	Department of Animal Husbandry, Dairying and Fisheries
DARE	Department of Agricultural Research and Education
DBT	Department of Biotechnology
FAO	Food and Agriculture Organization of the United Nations
GATT	General Agreement on Tariffs and Trade
GEAC	Genetic Engineering Appraisal Committee
GMO	Genetically Modified Organisms
GoI	Government of India
IBSC	Institutional Biosafety Committee
ICAR	Indian Council of Agricultural Research
IETS	International Embryo Transfer Society
IP	Intellectual Property
IPR	Intellectual Property Right
ISAG	International Society of Animal Genetics
ITGRFA	International Treaty on Genetic Resources for Food and Agriculture
ITMU	Institute Technology Management Unit
mtDNA	Mitochondrial DNA
MFN	Most-Favoured Nation
MOEF	Ministry of Environment and Forests
MTA	Material Transfer Agreement
NABMGR	National Advisory Board for Management of Genetic Resources
NBA	National Biodiversity Authority
NBAGR	National Bureau of Animal Genetic Resources
NDDB	National Dairy Development Board
NGO	Non-governmental Organization
OIE	Office International des Epizooties
PC	Project Co-ordinator
PCA	Principal Coordinate Analysis
PD	Project Director
rDNA	Recombinant DNA
RCGM	Review Committee on Genetic Manipulation
SAHD	State Animal Husbandry Department
SBCC	State Biotechnology Coordination Committee
SMD	Subject Matter Specialist
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WTO	World Trade Organization
ZTMC	Zonal Agro-technology Management Centre

01

INTRODUCTION

Proper management of Animal Genetic Resource (AnGR) is vital for food security, sustainable development and in providing livelihood security to billions of people, globally. The diversity of AnGR in the form of domesticated livestock and poultry breeds has developed through evolution within specific ecological niche during last thousands of years. Several complex and interactive factors like human needs, adaptability of a species, agro-climatic conditions, animal husbandry practices along with combined results of both natural selection and directed selection by the breeders throughout the world ultimately culminated in the emergence of such animal diversity. Each animal population is specific combinations of alleles forming specific gene pool, which serves a particular purpose for mankind in their natural habitat.

The Global Plan of Action for Animal Genetic Resources is the first internationally accepted framework for management of Animal Genetic Resources endorsed by 191 countries and the European community at Interlaken, Switzerland, in 2007. Urgent need for such a holistic effort can be appraised by the following statement by Food and Agriculture Organization of the United Nations (FAO). *"Understanding the diversity, distribution, basic characteristics, comparative performance and the current status of each country's animal genetic resources is essential for their efficient and sustainable use, development and conservation. Complete national inventories, supported by periodic monitoring of trends and associated risks, are a basic requirement for the effective management of animal genetic resources. Without such information, some breed populations and unique characteristics they contain may decline significantly, or be lost, before their value is recognized and measures taken to conserve them"*.

India is globally acknowledged as one of the largest livestock diversity center. India possesses huge as well as diverse livestock population distributed over a large range of geographical, ecological and climatic regions. Among the 15 species (non-carnivore) domesticated in world till date, India possesses 11, which include all major species of farm

animals. In fact, Indian subcontinent remained as a major hotspot for the domestication of a number of farm animal species including humped cattle, buffalo, goat and red jungle fowl. Today, the country possesses 512 million population of 10 livestock species – cattle, buffalo, sheep, goat, pig, horse, donkey, camel, yak and mithun and 729 million poultry (Livestock Census, 2012). The country stands second in total livestock population in the world including first in buffalo, possessing about half of the buffalo of the world, second in cattle and goat, third in sheep and fifth in chicken populations. Although immense increase in livestock population has been seen for a number of farm animal species after Independence, the livestock dynamics always keep changing, and the overall livestock population decreased slightly (3.33 %) during 2007and 2012 Livestock Census.

Indian livestock contributes in the form of milk, meat, egg, wool, draft and manure, providing nutritional support as well as generating income for millions of people. The value of output from livestock sector at current prices during 2013-14 has been estimated as 6238.6 billion rupees, including 4074 billion rupees from milk, 1323.6 billion rupees from meat, 224.2 billion rupees from egg, 5.7 billion rupees from wool and 414.4 billion rupees from dung. The Gross Domestic Product (GDP)/Gross Value Added (GVA) from livestock sector for year 2013-14 was estimated to be 4060 billion rupees - 3.9 percent of total GDP/GVA and 24.8 percent of GDP/GVA from total agricultural sector, at current prices. The share of livestock in the agricultural GDP has increased consistently from 15 percent in year 1981-82 to about 25 percent in the year 2013-14. Milk is the largest agricultural commodity in country. The country has witnessed impressive growth from 17 million tons in 1950-51 to 146 million tons in 2014-15 with almost 4 percent increase annually for last two decades. The meat production in India has reached to 6.69 million tons during 2014-15 with annual growth of 5 to 7 percent in recent years. During 2007-08 to 2011-12, overall annual growth rate in meat production was observed to be 8.44 percent. The egg production in India has reached to 72.77 billion with per capita per annum availability of 61 eggs. Egg production from 1999-2000 onwards has achieved overall annual growth rate of 6 to 7 percent. The wool production of the country has been recorded as 48.14 million kg. Livestock also provide excellent draft power for agricultural works, transportation etc.

India is more privileged to possess large farm animal diversity, considering its vast geographic and ecological regions along with diverse necessity of the farmers of the region. A range of agro-ecological zones in India has also helped to develop this large number of breeds of various livestock species. At present, there are 160 registered indigenous breeds in the country, which include 40 for cattle, 13 for buffalo, 26 for goat, 42 for sheep, 6 for horses & ponies, 9 for camel, 6 for pig, 1 for donkey and 17 for chicken. Indigenous livestock breeds are well adapted to their local environment and their production also optimized for specific environment. Indigenous livestock of India are well acknowledged, worldwide, for possessing unique attributes or combinations of characteristics like disease resistance, tolerance to climatic extremes particularly heat

tolerance and better thriving ability. With changing global climate, these traits will become more and more important for sustainable animal production. Indian cattle and buffalo are very well acknowledged for tick resistance, parasitic resistance. Cattle breeds like Sahiwal, Gir, and Ongole were imported by many countries of the world for these traits. Similarly, most of the best buffalo breeds of the world are from India. Traits like prolificacy, meat quality and resistance to parasitic and other communicable diseases are also unique to Indian sheep and goat breeds. However, most of these breeds are facing genetic dilution due to many factors like increasing mechanization of agriculture, over emphasis on some high producing breeds, market forces and many unforeseen factors in different parts of the country. Further, for faster growth of livestock production, exotic breeds of cattle, sheep, pig and poultry were introduced, resulting in dilution of Indian local breeds. The adaptation of temperate exotic breeds needed more scientific management under tropical/sub-tropical climate of India. In view of the transition in the utility pattern of these genetic resources, local breeds are facing stiffer competition for their survival. Surely, this genetic erosion is a problem of national and international concern and a number of local breeds are at the risk of extinction. Maintenance and management of this valuable vast diversity has become a major challenge.

National sovereignty over animal genetic resources endorsed under Convention on Biological Diversity (CBD) requires describing and cataloguing valuable livestock and poultry breeds available in the country. In new global scenario under World Trade Organization (WTO) and Intellectual Property Rights, there is a need to protect the indigenous animal genetic diversity. This in turn demands an authentic national documentation system for valuable sovereign genetic resources with well-defined characteristics. Recognizing the importance of valuable animal genetic resources of our country, there is also urgent need to establish a sound basis for their management. During last few decades, continuous efforts have been made through various governmental agencies, which have immensely contributed to preserve indigenous farm animal diversity.

Indian Council of Agricultural Research (ICAR) initiated a mechanism to develop guidelines for management of agro-biodiversity including animal genetic resources so that it could protect the valuable animal genetic diversity and facilitate in developing various national and international policies. Following the recommendations of National Advisory Board for Management of Genetic Resources (NABMGR), primary guidelines for the management of animal genetic resources (AnGR) are prepared. These guidelines address wider aspects of AnGR management like characterization, documentation, conservation, utilization, exchange, quarantine and biosecurity, and intellectual property rights (IPR) issues. These guidelines are based upon various methodologies adopted at present and recommendations made for characterization, conservation and utilization of AnGR in the country. Guidelines and recommendations made on this aspect by FAO, United Nations were also considered and adopted at relevant places in this document. While, formulating these guidelines, various acts, laws and agreements

made by Indian government and international organizations were also taken into consideration.

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02

IDENTIFICATION AND CHARACTERIZATION

Breed is generally taken as reference point for the animal genetic diversity. For effective management of Animal Genetic Resources (AnGR), comprehensive knowledge about the breed is necessary. Therefore, breed identification and characterization is one of the primary activities for the management of AnGR and should be undertaken on priority, specifically by organizations involved in AnGR management, conservation and genetic improvement.

2.1. IDENTIFICATION OF A NEW POPULATION

Before characterization of a population, decision should be taken as the target population consists of animals that are assigned to recognized breeds or not. If the population is undefined or "non-descript", then the first target should be to group the animals in the targeted population into defined subpopulations, having breed characters.

Sufficient study of available literature and databases is recommended to acquire information on the availability of unique population, before conducting survey in unexplored areas. Information about the existing breeds and genetic diversity prevailing in the region should also be gathered. Collection of such information is always helpful in delineating the survey work for identification of new population.

Breed survey for identifying new breed or population should intended to answering the following questions-

- Does the unexplored area contain an unrecognized and undocumented population, which has unique traits?
- Are these unique traits present in most of the animals in the region?
- Is any recognized breed present in the survey area? If yes, then what are the differences between these two populations?
- What is the population size of that unrecognized breed in the survey area?

- What is the geographical distribution of that unrecognized population?
- Is unrecognized population particularly associated with a specific production environment or particular socio-economic or cultural groups within the survey area?
- What is the performance of that unrecognized population in its production environment?

The expeditions should focus on such an area of the country, wherein livestock populations have never been documented. Such areas are more likely to have unique and homogenous population with breed characters.

- At a first instance, a larger group of animals should be spotted and visually assessed for the homogeneity of the individuals in the population. Further, similar kind of homogeneity in other herds or flocks should also be found out.

  Uniqueness of the population can be extracted out from their breeders through putting certain questions like- Why they believe the animals are unique and can be recognized as a breed? What makes this population clearly different and distinctive from all other breeds?

- Animals should be observed individually to identify certain unique or specific features. Such unique features may be easily identifiable through visualization like physical traits viz. body size and conformation, coat colour, horn size and pattern, ear shape and size, hair or wool colour pattern etc. or through measuring performance traits like milk yield, fat yield. Uniqueness related to specific kind of adaptation, thermotolerance, disease tolerance, management or any specific kind of utility can also be considered at the same time. These traits or features which can be superficially defined as breed character by visual appraisal of individuals, should be used to differentiate from individuals of other defined breeds.

  Few unique traits or features (breed character) which are common in most of the individuals of the population should be marked further, and the distribution of these unique traits should be observed among individuals of a population. Decision should be taken, here, on the basis of initial observation and responses to questions by the local breeders to continue the enlarged survey for further characterization of the population.

  Based on the initial decision, transect method of survey should be conducted to delineate the distribution of the population as well as to estimate the numbers and types of animals present in large homogeneous areas. Information from the livestock breeders or State Animal Husbandry Department officials should be taken into consideration for defining geographical distribution of the population. However, it is always preffered to explore adjoining native tracts of other breeds for the availability of similar kind of animals.

It should be sufficiently clear that population has homogenous features and seems to be distinct and found in sufficiently larger geographical area. Grouping based on phenotypic morphological, physiological and behavioural resemblance; should be fundamental step to delineate a population in a larger area. Using statistical techniques viz. Principal coordinate analysis (PCA) may be helpful to identify relatively homogenous groups.

As a final process of identification of new breed, characterization of the population should be started. Characterization of a livestock breed or population should be done primarily on phenotypic basis (*phenotypic characterization*). However, molecular level (*genetic characterization*) may be carried out further to complement the phenotypic characterization of a population.

2.2. PHENOTYPIC CHARACTERIZATION OF POPULATION

Phenotypic characterization of a population is intended to document geographical distribution, population, morphological traits, production potential and reproductive status, management practices and utility of the breed/population in their typical production environment. It should include collection of data on production systems in which the breed/population is found, phenotypic attributes (physical features, performance levels and any unique features) and historical development of the breed/population through exchange, upgrading and selection, socio-economic status of the communities rearing the breed, relevant indigenous knowledge (including gender-specific knowledge) of management strategies used by communities to utilize the genetic diversity in their animals.

While most of these data elements can be collected directly during survey, the information about geography, soil, climatic condition, cropping system, animal husbandry, socio-economic conditions etc. may be gathered from secondary sources in the published and unpublished literature (including electronic data sets related to aspects of the production environment).

Physical traits can be collected while carrying out primary (initial) characterization studies during single visit to the field sites. Although data collected in a single visit can only provide indicative information on economically important quantitative traits. Repeated and more structured data collection is required for systematic characterization of such traits. Indicative data on average performance levels should be collected through one-time measurements, interviews with livestock keepers or from available records.

Further, during advanced characterization, variables that describe economic performance traits (e.g. growth, milk production, egg production, wool production), adaptation (levels of resistance and tolerance to stressors) and trends (e.g. in population size and structure, and phenotypic performance) should be studied.

2.2.1. SURVEY FOR CHARACTERIZATION

Survey should be carried out with meticulous planning as it entails high expenditure and labor. Survey for characterizing AnGR should intend to answering the following questions.

- Is a particular breed present in the survey area, for which survey is being done?
- What is the population of that particular breed in survey area?
- What is the geographical distribution of particular breed ?
- Is breed particularly associated with a specific production environment or particular socio-economic or cultural groups within the survey area?
- What is the performance of that particular breed in its production environment.
- Does breed have any important adaptation or unique traits?

Prior to survey: Animal Husbandry Department and local veterinary staff should be intimated before the field survey. It is better to conduct the survey accompanying the local veterinary staff. Prior permission should be obtained from the concerned authorities before survey, particularly in protected and restricted areas (border areas, Ladakh, some states in NEH region). Rapid appraisal should be conducted before surveying for the breed, which involves interaction with livestock keepers and other stakeholders a little bit in informal way. Then household surveys should be conducted formally for collecting data from random sample of households chosen from among all the households. Larger the samples, the more accurate the survey will be as estimator of the target population. Important items/equipment needed for survey must be kept during any visit (Annexure 1).

2.2.2. QUESTIONNAIRES FOR INTERVIEW

Questionnaires (Annexure 2-6) developed for such survey for recording the information about population can be used.

Interviews with individuals or selected groups of individuals should be conducted. Apart from the livestock keepers, individual interviews may be conducted with the government officials, service providers, livestock traders, community leaders or development/extension agents. Focus-group discussions can be held with livestock keepers, community representatives or other stakeholders.

- *Key informants*: For Survey, target community leaders, personnel involved in veterinary services, NGOs, breeders organizations, breed societies, researchers as key informants, are an important source of information.

2.2.3. SURVEY PLAN

On the assumption that the breeding tract of a breed is spread over adjoining/contiguous districts in one or more states, stratified two stage sampling design should be adopted.

Different zones may be identified within a district which should constitute the different strata. Villages within the stratum would constitute the first unit and houses within the village, the second unit.

Survey should be conducted in three districts. Within each district, select 4 strata randomly. From each stratum, 5 villages should be randomly selected. Each district should have one supervisor and four enumerators. One enumerator should carry out the survey work in 5 villages of a stratum and one supervisor covering 20 villages in all should monitor each district.

The enumerators should be well-versed with the nature and extent of diversity and management of the species to be surveyed. Collaborator(s), if required, should be identified and contacted. The enumerators and particularly supervisors should be with an animal husbandry or zoology background. Planning should be done well in advance to facilitate preparations for the proposed survey. The enumerators should be suitably equipped for each survey.

2.2.4. DURATION OF SURVEY

The duration of the survey may be 18 months for small ruminants (sheep and goats) and 24 months for large ruminants.

During the first 3 months the data on general information viz. population enumeration, management practices, and socio-economic status of the farmers should be completed. During this phase, the households and animals for detailed data recording should be identified. Subsequently, the enumerators should continue recording information on morphological characteristics, performance and utility traits as per the questionnaires.

2.2.5. DATA RECORDING

Complete enumeration of selected villages should be done for the purpose of deriving demographic distribution of the breed. This study should cover the following information: age-wise and sex-wise distribution, group-wise enumeration and geographical distribution of the breed.

When the complete information is obtained by stratified survey, the data regarding group-wise, sex-wise and breed-wise total population in the breeding tracts should be enumerated by superimposing the proportion obtained by survey on the livestock census data.

The field work phase of a phenotypic characterization study is an opportunity both to directly collect data on the production environments of the targeted AnGR population and to collect data on socio-economic profile of livestock keepers. This information should be related to datasets obtained from other sources like geographical distribution.

2.2.5.1. Data recording for cattle and buffalo

Information should be recorded on 3000 animals covering 3 districts of the breeding tract. In each district, 200 animals under each of the following group should be studied for aspects given against the group. Thus, there should be 1000 animals in a district, which should be randomly selected from 4 randomly selected zones.

Group classification and study coverage for characterization of cattle and buffalo breeds:

Group	*Study coverage*
Calves (up to 1 year)	Physical traits, feeding, management practices and growth traits
Stock (1 - 3 years)	Physical traits, feeding, management practices and growth traits
Milking females	Physical traits and feeding and management practices, production, reproduction and growth traits
Working males	Physical traits, and feeding and management practices, utility
Breeding bulls	Physical and reproductive traits, and feeding and management practices

Data recording for milking females and calves: Milk recording should be done once in a month, preferably on 15th day of calving, from the first month of lactation to the end. Milk fat and SNF should be estimated every month from morning milk only. Milk recording by weight may be preferred over by volume measurement Physical measurements for the mothers should be recorded during the first/second and 8-10 month of lactation and for calves; measurements should be taken for every month up to 6 months and thereafter every 3 months. While feeding practices for calves should be recorded every month, feeding of mothers should be done once in three months. Disease and other management aspects should be recorded by observations and by the information provided by the farmer. Reproductive aspects of these animals should be covered by observations and by the information provided by the farmer. Qualitative and quantitative descriptions of individual animals other than the above which are given in the breed descriptor should be covered once.

Data recording for rest of the groups: For stock (1–3 years) body measurements should be recorded once in every 6 months and for others only once. However, for feeding and management practices, one recording should be done once in every 3 months. During the visits in each season, reproductive and disease management aspects should be recorded by observations and by the

information provided by the farmer. Among the groups, breeding bulls might not be available in sufficient numbers and therefore studies should be limited to whatever numbers are available in the area of coverage. In addition to the above, other aspects as given in the breed descriptor should be covered once for all the animals.

2.2.5.2. Data recording for goat

Information should be recorded on 3000 animals covering 3 districts of the breeding tract. In each district, 200 animals under each of the following groups should be studied for aspects given against the group. Thus, there should be 1000 animals in a district, which should be randomly selected from 4 randomly selected zones.

Group classification and study coverage for characterization of goat breeds:

Group	*Study coverage*
Kids (1-3 months)	Physical traits, feeding, management practices and growth traits
Young stock (6-12 months)	Physical traits, feeding, management practices and growth traits
Yearlings	Physical and reproductive traits, and feeding management practices and growth traits
Milking does	Physical, productive and reproductive traits, feeding and management practices
Breeding bucks	Physical and reproductive traits and feeding and management practices

Data recording for milking does and kids: Milk recording should be done at fortnightly intervals, preferably starting on 10th day of kidding, for full lactation. Physical measurements for the mothers should be recorded during the first/second and 6th month after kidding and for kids; measurements should be taken for every fortnight. While feeding practices for kids should be recorded every fortnight, feeding of mothers would be done once in three months. Disease and other management aspects should be recorded by observations and by the information provided by the farmer. Reproductive aspects of these animals should be covered by observations and by the information provided by the farmer. Qualitative and quantitative descriptions of individual animals other than the above which are given in the breed descriptor should be covered once.

Data recording for rest of the groups: For young stock, body measurements should be recorded once in every 3 months and for others only once. However, for feeding and management practices, one recording should be done once in every 3 months. During the visits in each season, reproductive and disease management aspects should be recorded by observations and by the

information provided by the farmer. In addition to the above, other aspects as given in the breed descriptor should be covered once for all the animals.

2.2.5.3. Data recording for sheep

Information should be recorded on 3000 animals covering 3 districts of the breeding tract. In each district, 250 animals under each of the following groups should be studied for aspects given against the group. Thus, there should be 1000 animals in a district which should be randomly selected from 4 randomly selected zones.

Group classification and study coverage for characterization of sheep breeds:

Group	*Study coverage*
Lambs (1-3 months)	Physical traits, feeding, management practices and growth traits
Young stock (6-12 months)	Physical traits, feeding, management practices and growth traits
Milking ewes	Physical, productive and reproductive traits, feeding and management practices
Stud rams	Physical and reproductive traits, and feeding and management practices

Data recording for milking ewes and lambs: Milk recording should be done on 7th and 50th day of lactation. Physical measurements for the mothers should be recorded during the first/second and 6th month after lambing and for lambs; measurements should be taken every fortnight. While feeding practices for lambs should be recorded every fortnight, feeding of mothers should be done once in three months. Disease and other management aspects should be recorded by observations and by the information provided by the farmer. Reproductive aspects of these animals should be covered by observations and by the information provided by the farmer. Qualitative and quantitative descriptions of individual animals other than the above which are given in the breed descriptor should be covered once.

Data recording for rest of the groups: For young stock, body measurements should be recorded once in every 3 months and for others only once. However, for feeding and management practices, one recording should be done once in every 3 months. During the visits in each season, reproductive and disease management aspects should be recorded by observations and by the information provided by the farmer. In addition to the above, other aspects as given in the breed descriptor should be covered once for all the animals.

2.2.5.4. Data recording for horse and donkey

Information should be recorded on 1200 animals covering 3 districts of the breeding tract. In each district, 100 animals under each of the following group

should be studied for aspects given against the group. Thus, there should be 400 animals in a district, which should be randomly selected from 4 randomly selected zones.

Group classification and study coverage for characterization of horse and donkey breeds:

Group	*Study coverage*
Foals (up to 1 year)	Physical traits, feeding, management practices and growth traits
Young stock (1 - 3 years)	Physical traits, feeding, management practices and growth traits
Adult female (>3Year)	Physical traits and feeding and management practices, production, reproduction and growth traits
Adult male (>3Year)	Physical traits, reproductive traits and feeding and management practices and utility

Data recording for foals: Physical measurements for foals should be taken for every month up to 6 months and thereafter every 3 months. Feeding practices for foals should be recorded every month. Disease and other management aspects should be recorded by observations and by the information provided by the farmer. Reproductive aspects of these animals should be covered by observations and by the information provided by the farmer. Qualitative and quantitative descriptions of individual animals other than the above which are given in the breed descriptor should be covered once.

Data recording for rest of the groups: For stock (1–3 years) body measurements should be recorded once in every 6 months and for others only once. However, for feeding and management practices, the recording should be done once in every 3 months. During the visits in each season, reproductive and disease management aspects should be recorded by observations and by the information provided by the farmer. In addition to the above, other aspects as given in the breed descriptor should be covered once for all the animals.

2.2.5.5. Data recording for camel

Information should be recorded on 1200 animals covering 3 districts of the breeding tract. In each district, 100 animals under each of the following groups should be studied for aspects given against the group. Thus, there should be 400 animals in a district, which should be randomly selected from 4 randomly selected zones.

Group classification and study coverage for characterization of camel breeds:

Group	*Study coverage*
Camel calves (up to 1 year)	Physical traits, feeding, management practices and growth traits
Young stock (1 - 4 years)	Physical traits, feeding, management practices and growth traits
Milking females	Physical traits, feeding and management practices, production, reproduction and growth traits
Adult males	Physical traits, reproductive traits, and feeding and management practices and utility

Data recording for milking females and calves: Milk recording should be done once in a month preferably on 15th day of calving, from the 1st to 12th month of lactation. Physical measurements for the mothers should be recorded during the first/second and 11-12 months of lactation and for calves; measurements should be taken for every month up to 6 months and thereafter every 3 months. While feeding practices for calves should be recorded every month, feeding of mothers should be done once in three months. Disease and other management aspects should be recorded by observations and by the information provided by the farmer. Reproductive aspects of these animals should be covered by observations and by the information provided by the farmer. Qualitative and quantitative descriptions of individual animals other than the above which are given in the breed descriptor should be covered once.

Data recording for rest of the groups: For young stock (1–4 years) body measurements should be recorded every year and for others only once. However, for feeding and management practices, the recording should be done once in every 3 months. During the visits in each season, reproductive and disease management aspects should be recorded by observations and by the information provided by the farmer. In addition to the above, other aspects as given in the breed descriptor should be covered once for all the animals.

2.2.5.6. Data recording for pig

Information should be recorded on 3000 animals covering 3 districts of the breeding tract. In each district, 250 animals under each of the following groups should be studied for aspects given against the group. Thus, there should be 1000 animals in a district which should be randomly selected from 4 randomly selected zones.

- Group classification and study coverage for characterization of pig breeds:

Group	*Study coverage*
Piglets (0-2 months)	Physical traits, feeding, management practices and growth traits
Young stock (2-8 months)	Physical traits, feeding, management practices, and growth traits
Sows	Physical, productive and reproductive traits, feeding and management practices
Boars	Physical and reproductive traits and feeding and management practices

For the above groups and scheme of survey, the information should be collected on the basis of requirement as given in the descriptor and questionnaires. For young stock, body measurements should be recorded once in every 2 months and for others only once. However, for feeding and management practices, one recording should be done once in every 2 months. During the visits in each season, reproductive and disease management aspects should be recorded by observations and by the information provided by the farmer. In addition to the above, other aspects as given in the breed descriptor should be covered *once* for all the animals.

2.2.5.7. Data recording for chicken

Information should be recorded on 3000 birds covering 3 districts of the breeding tract. In each district, 250 birds under each of the following group should be studied for aspects given against the group. Thus, there should be 1000 birds in a district, which should be randomly selected from 4 randomly selected zones.

Group classification and study coverage for characterization of chicken breeds:

Group	*Study coverage*
Cockerels (up to 5 months)	Physical traits, feeding, management practices and growth traits
Pullets (up to 5 months)	Physical traits, feeding, management practices and growth traits
Cock (above 5 months)	Physical and reproductive traits, feeding and management practices and growth traits
Hen (above 5 months)	Physical traits and feeding and management practices, utility, egg production traits and growth traits.

In poultry, the egg laying normally starts at 5 months of age and before this information is to be recorded on the morphological characteristics, body weight and growth rate. Weekly body weights to be recorded on chicks from 0 day to 1 month of age and at fortnightly interval up to 5 months. Recording of body

weights at monthly interval from 5 months to 12 months. Recording of egg production from first day of laying (5 months) for a period of one year (up to 72 weeks of age). Recording of egg weight/mass, shell colour, shell strength, recording weight at slaughter, recording of dressing percentage and other carcass traits and feed utilisation on a minimum of 50 birds.

Disease and other management aspects should be recorded by observations and by the information provided by the farmer. Reproductive aspects of these birds should be covered by observations and by the information provided by the farmers. Qualitative and quantitative descriptions of individual birds other than the above which are given in the breed descriptor should be covered once. In addition to the above, other aspects as given in the breed descriptors should be covered once for all the birds.

2.2.6. PHOTOGRAPHY

Photographs of animals provide some information on the extent of variation among individuals, and illustrate with the production environment. If photographs are to be used in publications, they must be of high quality. photographs be submitted as TIFF or as EPS files (not compressed JPEG or GIF); preferably at the approximate size in which they are to be reproduced; with a resolution of 300 dpi; and always accompanied by the name of the photographer. Do not touch up the photographs.

2.2.7. DATA ANALYSIS

Collected data is then analyzed and compiled in the form of breed descriptors – formats for different species (Annexure 9-18).

Phenotypic characterization involves the collection of a large volume of data, which is needed to be processed and analyzed. This warrants carefully designed database for development of a flexible computer package for the management and analysis of the survey data.

Data should be analyzed in different ways such as on the basis of districts, animal classes, and user-defined strata. It provides breed descriptor after analysis of field survey data on a breed. ICAR-NBAGR has developed a Data Processing System for Animal Genetic Resources (DPSAnGR) for general and flexible applicability for management of field survey data of any domestic animal species. A range of other commercially available general statistical software for data analysis could also be used.

After phenotypic characterization, it should be clear that if the population is found distinct, then only it should to be registered as breed. Beside, being distinct group phenotypically, specific breeding management practices and cultural, historical and religious aspects of livestock keeping is also implied to determine a particular population to be deemed as separate breed (FAO 2011b).

2.2.8. STANDARDS FOR SECURITY AND PERSONNEL

Surveyer should follow the standards as and when required in field during survey. A four-wheel vehicle should be preferably used in undertaking exploratory missions along with safety equipment depending on the regions/areas. Appropriate clothing (woollen cloth/jacket/raincoat) should be carried when survey is planned to specific region or season.

2.3. GENETIC CHARACTERIZATION OF POPULATION

Genetic characterization assesses the genetic constitution of a breed/ population of a species. It assesses the genetic uniformity, admixture or subdivisions, inbreeding, or introgression in the population. It is also helpful in providing insights into breed formation, informing about closest wild ancestral species and localization of the site of domestication. Phylogenetic relationships of populations based on genetic analysis unravel the evolutionary history of the breeds/populations of a species. Through this, we can prioritize the breeds for conservation using molecular data and monitor its status in the defined geographical region.

Molecular characterization should ideally be done along with phenotypic characterization.

For genetic characterization of livestock biodiversity, FAO has given detailed guidelines in its document on Molecular Genetic Characterization of Animal Genetic Resources published in 2011 based on the Global Plan of Action for Animal Genetic Resources adopted in 2007 (www.fao.org/docrep/).

2.3.1. CHOICE OF GENETIC MARKER

DNA based microsatellite markers analysis methodologies are advantageous and most preferred for genetic characterization. With the automation in sequencing and genotyping technologies, it has now become much easier to genotype microsatellite loci in large number of samples, in a short span of time.

2.3.2. MICROSATELLITE MARKERS BASED GENOTYPING

Use recommended panel of 25 markers for cattle, buffalo, sheep, goat, camel, equines and 23 markers for pig (Annexure 19). This approach not only yields more accurate data than using a subset of the markers, but also offers more opportunity for comparison with results from previous studies.

International Society of Animal Genetics (ISAG)–FAO Advisory Group on Animal Genetic Diversity has recommended different panels of 30 microsatellite markers for nine major livestock species-cattle, buffalo, sheep, goat, horse, donkey, camel, pig and chicken (Molecular Genetic Characterization of Animal Genetic Resources). The list of these is also available at website-www.globaldiv.eu/docs/Microsatellite%20markers.pdf. However the primers lifted for buffaloes are selected from heterologous cattle species, which are being employed by ICAR-

NBAGR, since FAO list for buffalo was not available earlier.

2.3.2.1. Sampling design

For genetic characterization, it should be ensured that samples are drawn in such a way that it should cover most of the genetic variability in the population. For the sample collection, consider the structure of the production system, geographic locations and pedigree relationships.

Samples should be collected preferably from the areas (breeding tract) that are closest to the site of the development of the breed. Samples should also reflect different agro-climatic zones, where the breed is found.

Typically not more than 10 percent of any one herd or village population should be sampled and in any case not more than five animals should be sampled from any herd. Always avoid sampling from animals with common ancestors at least for three generations.

If it seems that there are genetic subdivisions within breed, then it is desirable to collect the samples that represent all the subtypes. Further, also keep the records of the animals and types, which are sampled.

For breeds that are of hybrid origin (via introgression, upgrading or the planned creation of a synthetic breed) it is essential to have data from parental breeds.

For breeds having a recent history of intense selection and/or inbreeding, sampling of animals from previous generations – which may be available in the form of cryopreserved semen samples– may be appropriate.

2.3.2.2. Sampling material

Blood is most preferable tissue for sampling. Generally 10-15 ml of blood should be collected as a sample from an individual. Other samples like semen, hide, bone, tissue (e.g. ear tissue), faeces, fossils, plucked hair with root cells and feathers can also be used.

For reliable estimation of allele frequencies, at least 25 and preferably 50 animals per breed should be typed for genetic characterization. More than 50 animals should be collected in view of possible losses, mistyping or missing. If there are population subdivisions, different subtypes or agro climatic zones, sampling a larger number of animals is recommended.

2.3.2.3. DNA extraction

Standard protocol (Phenol: chloroform method) should be followed for DNA extraction from blood or any other tissue. Kit based DNA extraction can be done as per protocol given by the manufacturer.

- Every sample of genomic DNA should contain a minimum of 100 µg at which it is used. The quality of the DNA should be as follows: A260/A280=1.7-2.0; A260/A230>1.5. One agarose gel electrophoresis photo with at least one size

marker should be submitted.

2.3.2.4. Genotyping

Automated microsatellite genotyping i.e. amplification using fluorescent dye labeled primers and genotyping by automated DNA sequencer should be preferred over manual genotyping through running Urea-PAGE polyacrylamide gels followed by silver staining technique.

While carrying out microsatellite based genotyping, at least one reference sample should be included in each experiment so as to cross-validate successive genotyping experiments. It is preferable that one laboratory performs all typing for a given marker in order to exclude laboratory-dependent scoring.

- Labeling of primers with different fluorescent dyes or product size based differentiation of primers labeled with same dye helps in multiplexing of markers, saving the resources as well as time. But that should be standardized before running test samples.

2.3.2.5. Data analysis

Microsatellite markers should address questions related to within breed or between breed diversity based on various parameters. Numbers of methods are available for analysis of data recorded as genotype designations for each individual across the microsatellite loci. Many software packages with different analytical methods freely available can be downloaded from internet.

The multi locus genotypes of individuals can be used to analyze the assignment accuracy of individuals to their respective population using software programme. The individuals can be assigned to the population in which the likelihood of their genotype is highest and to the (genetically) closest population.

Care should be taken to measure null alleles to avoid errors.

2.3.3. MITOCHONDRIAL DNA (mtDNA) ANALYSIS

mtDNA is consequently a powerful tool for establishing the levels of genetic diversity and phylogenetic structure within a species. mtDNA tells about the recent demographic processes affecting a population, for example whether a population has undergone a recent demographic expansion or has a more complex history. Each individual has a single haplotype therefore, phylogenetic analyses are relatively straightforward to interpret.

mtDNA sequencing is often used in cases where biological evidence may be degraded or small in quantity.

For genetic characterization based on mitochondrial DNA, sampling of animals with common maternal origin should not be taken.

2.3.3.1. Sampling material

Typical sources of DNA recovered may include blood, semen, hair, bones, teeth, and body fluids such as saliva.

Ancient samples should be cleaned as per standard procedure prior to the mtDNA sequencing process to remove contaminating materials surrounding or adhering to the sample. This step is important to ensure that the sequence of the DNA obtained from the sample originates from the sample and not from exogenous DNA.

2.3.3.2. DNA extraction

Standard procedure (phenol-chloroform method) or commercial kits should be followed for DNA extraction. Quality check should be done as per standard provided in earlier section.

2.3.3.3. Genotyping

Standard polymerase chain reaction (PCR) procedure should be followed to amplify small amount of DNA, which should be sequenced further, using set of primers designed to amplify displacement (D) - loop region.

2.3.3.4. Data analysis

The nucleotide sequences obtained from should be analyzed further for sequence alignment, identification of nucleotide variations, generation of haplotypes, estimation of population indices, such as, gene diversity, nucleotide diversity and pair-wise nucleotide differences, calculation of within breed and among breed differences through AMOVA, determination of demography, population expansion, estimation of phylogenetic relationship among different breeds of a species, identification of ancestral and descendent haplotypes and estimation of coalescence age using estimator ρ (rho) for time divergence by using various software programme.

Comparative analysis of data should be performed essentially to define the new breeds and assess the population structure at regular intervals in order to take necessary steps for the prioritization of conservation.

2.3.4. STANDARDS FOR SECURITY AND PERSONNEL

- Standards should be followed as and when required in field during blood or other sample collection and in lab during sample processing. Failure of power supply in laboratory can result in loss of unprocessed collected material. To ensure safety of collected material under processing, there should be a provision for back-up generator for running deep freezers and refrigerators. Hazardous chemicals used for processing/storage of samples should be handled with appropriate precautions using secure isolated area, mask, gloves, etc. Fire extinguishers and other fire fighting equipments should be provided in the premises with proper training imparted for use of the above.

DO'S AND DON'TS

In addition to above guidelines for exploration and germplasm collection, the collector(s) should follow a well-defined code of conduct as well as take necessary precautionary measures for its smooth execution as mentioned below:

Do's

Get acquainted with the local region for survey.

Always keep a route map of the target area and a GPS, with a list of important places and the distance covered during travel to facilitate record maintenance.

Before entering into a new area, take the help of local people, who know about the region and local language.

Explain the purpose and get consent from the farmers for collecting germplasm.

Important telephone numbers of concerned officers, including district authorities, hospitals, dispensaries and police station should be kept.

Keep your identity card and a certificate from Head of Organization for proposed mission.

Honour social customs of local inhabitants of the target area.

While talking and discussing with ladies, be polite and respectful to them.

Restrain the animal properly with sufficient manpower and take the measurement in front of owner.

Blood should be collected after proper restraining of the animal.

Sterilized vacutainer tube should be preferred for blood collection.

Don'ts

Do not provide lift to strangers in your vehicle under any pretext.

Do not indulge in unnecessary discussion related to politics, religion and local beliefs with the local people.

Do not make false promises to donors.

Do not plan the expedition during important festivals and peak election campaign in the target area.

Do not enter any house for collecting the information or blood samples in the absence of male members of the family.

Do not enter in forest areas/remote and difficult localities/tribal inhabiting areas, without local help from district officials/villagers.

Over-collecting of the genetic diversity with similar attributes should be avoided to save time and energy in collection and evaluation and to save space in the Gene Bank.

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03

REGISTRATION AND DOCUMENTATION

Our country has mechanism for recognising the valuable sovereign animal genetic resource with known characteristics in the form of authentic national documentation system. This mechanism is the sole recognised process for registration of "Animal Genetic Resources" material at national level. ICAR-National Bureau of Animal Genetic Resources (ICAR-NBAGR), Karnal is a nodal agency for the registration of animal germplasm of the country.

3.1. REGISTRATION OF LIVESTOCK AND POULTRY BREEDS

Any population of livestock and poultry found in India can be registered in the form of breed, provided it fulfils the criteria laid down for the registration.

Any livestock population to be registered, should come under widely accepted definition of breed-

(a) a sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within same species;

OR

(b) a group for which geographical and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity.

3.1.1. NATURE OF MATERIAL TO BE REGISTERED

Breeds/populations/strains of domesticated animals and their wild relatives, which are unique, stable and uniform, and has potential attributes of academic, scientific or commercial value.

The following categories of materials shall not qualify for registration-

(I) Material without accompanying documentary evidence for the claim made in the application.

(II) Material for which any form of protection has been sought elsewhere.

3.1.2. ELIGIBILITY CRITERIA FOR REGISTRATION

Any population having at least 1000 animals will be considered for registration as a breed. These animals may be maintained by the applicant/ breed society/ NGO/ Govt. Agency/ farmers in field conditions. All claims concerning the material submitted for registration should accompany scientific evidence for uniqueness, reproducibility and value in the form of-

(I) Publication in standard peer reviewed journal (a copy of reprint to be submitted).

AND/ OR

(II) Evaluation data for at least three years under research programmes like All India Coordinated Research Project (AICRP), Network Project, Adhoc Schemes, etc. supported with relevant extracts of the documents or verification by concerned Director/Project Director (PD)/Project Co-ordinator

AND/ OR

(III) Publication of information on potential value of germplasm in institute annual report or any other such reports

AND/ OR

(IV) Recommendation of the State Animal Husbandry Department/Livestock Development Board regarding the novelty and uniqueness of the breed claimed.

3.1.3. NODAL AGENCY

- ICAR-National Bureau of Animal Genetic Resources (ICAR-NBAGR), Karnal will be the nodal agency for registration of breeds. The application should be addressed to the Director, ICAR-NBAGR, along with the required information.

3.1.4. APPLICATION FORM

- Application shall be made on the prescribed Performa (Annexure 7-8).

3.1.5. WHO CAN APPLY

- Application can be submitted by any citizen of India / breed society registered as per constitution of India / NGO / Govt. agency.

3.1.6. VALIDITY OF REGISTRATION

- The period for validity of registration shall be 25 years.

3.1.7. DE-NOTIFICATION

- De-notification shall be done by the Registration Committee in case of false claim(s) or disputed IPR claim. Appeal for counter claim, if any, should reach the Registration Committee within a period of three months of the publication of Notification in Indian Journal of Animal Sciences - published by the I.C.A.R.

3.1.8. PROCEDURE FOR SUBMISSION OF APPLICATION FOR BREED REGISTRATION

Submission of Application and Material: All applications for registration of proposed breeds should be submitted to the following address: The Director, ICAR-National Bureau of Animal Genetic Resources, Karnal (Haryana).

The applicant should submit 3 copies of the application along with relevant documents, literature, no matter how small (even one page), for the proper evaluation of the breed.

The application must be signed by the applicant and countersigned by Director, Department of Animal Husbandry of the concerned state(s) or his representative with rubber seal.

The application must be accompanied by complete description of the breed using standard descriptors (Annexure 9-18).

A detailed history of the breed should be submitted.

Difference, distinction and details that are specific for that breed in comparison to other breeds in the vicinity or elsewhere should be listed.

Representative photographs of the breed (male, female, young ones and herd /flock) should be submitted.

A list of the registered animals of the breed that are conforming the breed standards laid out by the applicant or his organization should be submitted.

The breed should complete a minimum of 10 generations.

Letters from at least three different breeders/owners of the breed should be submitted, explaining:

- Why they believe it should become a recognized breed?
- How long they have been breeding the breed?
- Spell out the reasons for reorganization of the breed as a separate identity.
- What has been done to establish this breed- breeding strategies, parental stock etc.?
- What are the suggestions to further improve this breed in a long term perspective?
- What makes this breed clearly different and distinctive from all other breeds?

3.2. REGISTRATION OF VARIETY/STRAIN/LINE OF POULTRY

All applications for registration of proposed Varieties/Strains/Strains should be submitted to the following address: The Director, National Bureau of Animal Genetic Resources, Karnal (Haryana).

The applicant should submit 3 copies of the application along with relevant documents, literature, no matter how small (even one page), for the proper evaluation of the Variety/Strain/Line. E-mail softcopy of the application and descriptor at directornbagr@gmail.com

The application must be signed by the applicant(s) and countersigned by the Head of the Organization with rubber seal.

The application must be accompanied by complete description of the Variety/Strain/Line using prescribed descriptor (Annexure 18).

A detailed history of the development of the Variety/Strain/Line should be submitted.

Distinctiveness characteristics of the Variety/Strain/Line in comparison to other Varieties/Strains/Lines available in the country should be enlisted.

Representative photographs of the Variety/Strain/Line (male, female, young ones and herd/flock) should be submitted.

The Variety/Strain/Line should complete a minimum of 8 generations.

The applicant must certify that:

- The Variety/Strain/Line is distinct from other Lines/Strains whose existence is a matter of common knowledge at the time of filing of application.

It is sufficiently uniform and stable.

Any population having at least 1000 birds will be considered for registration as a Variety/Strain/Line.

All claims concerning the material submitted for registration should accompany scientific evidence for uniqueness, reproducibility and value in the form of :

(I) Publication in standard peer reviewed journal (a copy of reprint to be submitted).

AND/ OR

(II) Evaluation data for at least three years under research programmes like All India Coordinated Research Project (AICRP), Network Project, *Ad hoc* Schemes, etc. supported with relevant extracts of the documents or verification by concerned Director/Project Director (PD)/Project Co-ordinator (PC)

AND/ OR

(III) Publication of information on potential value of germplasm in institute annual report or any other such reports.

3.3. BREED ACCESSION NUMBERS

- ICAR-NBAGR will provide the unique accession number to each breed after registration. Accession numbers of extant breeds of livestock and poultry are given in Annexure 22.

3.4. ANIMAL GENETIC RESOURCES OF INDIA - INFORMATION SYSTEM

An Information System on Animal Genetic Resources of India (AGRI-IS) has been developed at ICAR-NBAGR, which covers all the indigenous breeds of domestic livestock and poultry species from India. This database contains descriptors of various breeds of livestock and poultry, information on farms, semen production,

vaccine production; and district-wise information on population, animal breeding, animal health infrastructure, animal products like milk, meat, egg, wool, etc. It also stores photographs of male and female animals of breeds. Information with regards to newly registered breed is also incorporated for documentation purpose.

SELECTED READINGS

Guidelines for registration of livestock and poultry breeds (2009) National Bureau of Animal Genetic Resources, Karnal (www.nbagr.res.in)

ICAR guidelines for intellectual property management and technology transfer/commercialization (2006), Indian Council of Agricultural Research, New Delhi.

04

MONITORING AND CONSERVATION

Monitoring and conservation are the most important activities in AnGR management and are necessary to develop early warning and response system for proper and effective conservation of AnGR. Conservation of animal genetic resources generally refers to all the human activities including strategies, plans, policies and actions undertaken to ensure that the diversity of animal genetic resources being maintained to contribute to food and agricultural production and productivity, or to maintain ecological, cultural values of these resources now and in the future. For conservation, the most critical steps are to monitor the population of breeds over a time interval, identify breed(s) at risk, prioritize the breeds for conservation, preferably for in situ and apply proper conservation strategies.

4.1. POPULATION MONITORING

Best way for monitoring the population is to conduct breed wise livestock census at the time interval of 5 years (which should match with generation interval). Breed wise livestock census is being conducted by DAHDF, GoI. in every 5 years interval, which can be best utilized to monitor the population status and trend of the livestock breeds. However, breed-wise census should be structured for providing number of breeding males and females in the population.

A recognized breed can also be monitored by conducting monitoring surveys in the breeding area. For that purpose, baseline survey can provide a starting reference point for the monitoring of the population in future. Further, monitoring survey for specific breed should be conducted at the interval of 5 years in cattle, buffaloes, equines, camels, yak and mithun; and 3 years in sheep, goat and pig, so that it will also record the population trend in minimum time duration.

Monitoring survey should be aimed to answering following questions

- What is present population of the breed?
- What is the geographical distribution of particular breed ?

- What is the structure and flock composition (number of breeding males and breeding females) of the population ?
- What are the geographical and temporal changes in breed?
- Is Breed increasing or decreasing in numbers?
- Is the population size of Breed increasing relative to other Breed in vicinity?
- What are the reasons in increasing or decreasing in numbers?
- What are recognized threats to Breed ?

Questionnaires for monitoring survey should be developed in such a way that it can identify and analyze threats to survival of the breed. Maintenance of a database containing all relevant information's on breeds of all species, population census, distribution status and ecological data is always helpful and essential to keep watch on the breed and further for designing and implementing conservation strategies.

- Following demographic parameters should be collected during monitoring survey, based on these parameters the risk status of a breed can be assessed.
  - Size of population of a breed
  - Population of breed in country, specifically in breeding tract of the breed.
  - Registered animals in breed inventories.
  - Number of breeding males and breeding females.
  - Distribution of population
- For identifying total number of animals of a particular breed by their age and sex Breed wise sample survey can also be conducted. About 15% of villages in every block of the each district of the breeding area of that breed should be randomly selected. Total Population can further be extrapolated from the sample survey. Period of such survey should be of one month duration.

4.2. DETERMINING RISK STATUS

The assessment of risk status of livestock breeds or populations is an important factor in planning of AnGR management, conservation and genetic improvement. This will tell the policy planner and stake holders whether, and how urgently, actions need to be taken for conservation.

After getting demographic information and population growth trend about the breed, the degree of risk should be assessed. Population size, more importantly the number of breeding animals (Number of breeding males and Number of breeding females) and rate of population decline are the most important factors in determining the risk status of a breed. Smaller is the population, greater is the risk.

Initially assign breed to a risk category as per criteria given under following breed Risk classification evolved by ICAR-NBAGR by taking different issues in

consideration. However, these definitions can be refined in future, if needed.

Breed is not at risk, if

Total population is more than 20,000; and total number of breeding females is more than 10,000 and total number of breeding males is more than 40 in cattle, buffalo, sheep, goat, horse and camel, yak and mithun.

Total population is more than 10,000; and total number of breeding females is more than 5,000 and total number of breeding males is more than 40 in pig and poultry.

Breed is vulnerable, if

Total population is 20,000 or less but more than 10,000; or total number of breeding females is 10,000 or less but more than 5,000; or total number of breeding males is 40 or less but more than 20 in cattle, buffalo, sheep, goat, horse and camel, yak and mithun.

Total number of animals is 10,000 or less but more than 5,000; or total number of breeding females is 5000 or less but more than 2500; or total number of breeding males is 40 or less but more than 20 in pig and poultry.

Breed is endangered, if

Total population is 10,000 or less, but more than 1,000; or total number of breeding females is 5,000 or less but more than 500; or total number of breeding males is 20 or less but more than 5 in cattle, buffalo, sheep, goat, horse and camel, yak and mithun.

Total number of animals is 5,000 or less but more than 500; or total number of breeding females is less than 2,500 but more than 250; or total number of breeding males is less than 20 but more than 5 in pig and poultry.

Breed is critical, if-

Total population is 1,000 or less; or total number of breeding females is 500 or less ; or total number of breeding males is 5 or less in cattle, buffalo, sheep, goat, horse and camel, yak and mithun.

Total population is 5,00 or less; or total number of breeding females is 250 or less; or total number of breeding males is 5 or less in pig and poultry.

Breed is extinct if

There is no breeding males (or stored semen) or no breeding females (or oocytes) or no embryos remaining.

4.2.1. UPDATATION OF RISK STATUS

Upgrade/upscale the risk category in view of following factors, by one class after classifying the risk status considering above population criteria (Gandini et. al. 2004, Alderson, 2010).

- Presence of population in less than 75 sq. Km area.

- 10% or more degree of introgression per generation.
- More than 3% rate of inbreeding per generation in the population.

It is important to communicate about risk status of the breed(s) to all the relevant stakeholders at national and state level including ICAR-NBAGR, NBA and DAHD&F. FAO should also be informed about risk status of a breed at international level. This will be important to make National Watch List and establishing early warning and information systems.

Regularly update the risk status of breeds, and for that regularly conduct monitoring survey for that particular breed, at least in 5 years interval, as described in earlier.

4.3. PRIORITIZING BREED FOR CONSERVATION

When more number of breeds are assigned to same or different risk classes, then breeds should be prioritize in view of financial expenditure and available infrastructure which restrict the number of breeds for conservation at a given time. It is always better to conserve as many breeds as possible.

Firstly, prioritize the breeds as per their risk status. Any breed under high risk status should be given higher weightage or priority for conservation.

Under the same risk category, priority should be given to the most genetically diversed breed, likewise genetically superior for economically important and unique traits.

If there are a number of breeds to be prioritized based on different criteria, the breeds should be ranked by providing *conservation value* to each breed as described by FAO (2012). Evaluate total score or index for each breed after taking all the factors in consideration for that breed and giving due weightage to each factor for prioritization. Based on conservation values from highest to lowest rank, breeds can be prioritized for the conservation.

Livestock breeds or populations categorized under any category of risk will require urgent action. It will be essential to develop strategic plan for conservation and implement these conservation/development programmes so that population may further expand and can be prevented from reaching any severe categories.

4.4. STRATEGIES FOR CONSERVATION

There is no single method of conservation/preservation which is optimal for all situations. During taking the decision for optimal conservation strategy, the available resources and capacities, risk of failure and costs of conservation methods should be considered.

Three major strategies are normally followed in conservation of farm animal genetic resources. The first two i.e. *in situ* conservation as well as *ex situ* in vivo involves conservation of living population. The third, ex situ in vitro encompasses

conservation of living ova, embryo, semen, somatic cell or other animal tissue, DNA etc. stored cryogenically in liquid nitrogen.

As a best preferred method of conservation, *In situ* conservation of livestock through involving livestock keepers in the production system should be adopted to maintain a breed in a dynamic state.

Ex situ in vitro (cryopreservation) should complement *in- situ* conservation.

4.5. IN SITU CONSERVATION

For *in situ* conservation, collect the information on different aspects like establishment of institutional structure and policies including specific measures to conserve breeds at risk, population status of the breed in its native tract and outside the native tract, communities responsible for maintaining the breed in its natural habitat along with the socio-economic status, breeding management of the breed and the programmes of government/ NGOs in breeding of the animals for the genetic improvement, and all kind of expenditures on the maintenance.

The most important factor of all conservation cum genetic improvement projects is that selection should be carried out for its traditionally valued characteristics and in the environment to which it is adapted. The herds must be managed within the natural environment for that breed and need to be exposed to conditions prevalent in the field.

Nucleus herd should be established in respective native tract of particular breed. Farmers maintaining the animals of that breed should be given certain incentives for encouraging more rearing.

Involving the farmers is one of the most effective and practical way of conserving the animals with minimum of inputs. This approach also will not involve large financial inputs and would be feasible under field conditions.

The farmers and stakeholders should be facilitated to establish a breed society. The farmers who own animals true to the type should be encouraged to register their animals with the society.

The owners of animals of the breed may be given suitable incentives preferably in form of husbandry inputs with the objective to compensate for the difference in levels of production between the breed under consideration and the replacement breed under the same animal management system and agro-ecosystem.

The existing farms of indigenous breeds should be declared as germplasm repositories and used for production of quality breeding males and semen. Efforts should be made to establish one such farm for each breed in the native breed tract. Only pure breeding of the indigenous breeds should be practiced at these farms. Facilities for frozen semen production should be developed in such

farms so as to disseminate the germplasm from pure breeding males typical to the breed in the native tract.

Gaushalas can be used for maintaining the purebred animals of different indigenous breeds. They should be provided sufficient resources and technical back up in conserving and improving these animals.

Livestock keepers/communities involved in in situ conservation of AnGR under risk should be identified and rewarded suitably by the Govt. agencies. Suitable incentives may also be provided to encourage the conservation.

There should be linkage between state owned breeding farms with local breeders association/groups so that breeding males could be make available to the communities.

Suitable laws and regulations should be formulated to protect livestock keepers rights as well as grazing lands to strengthen the conservation efforts further.

4.5.1. BREEDING POLICY FOR IN SITU CONSERVATION

The States should review their respective breeding policy in view of conservation of Indigenous breeds in their breeding tract. Each state should consider region specific and breed specific breeding strategies and programmes to implement the conservation.

Breeding tracts should be defined for each of the livestock breed. Selective breeding should be followed within the breeding tracts without any cross breeding. In case of cattle, the states should delineate and identify the geographical boundaries of the areas for non-descript cattle should be upgraded by crossing with bulls of indigenous breeds.

AH departments and Livestock Development Boards of concerned State should implement the breeding programmes for conservation. The existing State Breeding Farms as well as Central breeding Farms of indigenous breeds should be declared as germplasm repositories and used for production of breeding males. Only pure breeding should be practiced at these farms. Improvement of Indigenous breeds can be taken up in collaboration with Breeders' associations and Gaushalas.

Data base with regard to all the details of Indigenous breeds, including their breeding tracts, population, phenotype and performance characterization, genetic makeup, the institutional farm where they are being preserved and / conserved should be developed and updated routinely. The national level database for indigenous breeds developed by ICAR-NBAGR and NDDB should be updated routinely for this purpose. An information network related to germplasm should be set up by linking various agencies and institutions working for livestock improvement and conservation. Available information on different breeds should be published in regional languages in the form of any extension

material to create awareness among the farmers to conserve the important indigenous breeds.

4.5.2. IN SITU CONSERVATION INVOLVING FARMERS

Two villages belonging to each of 5 blocks distributed in core area of native tract of the breed tract should be identified. Initially around 150 females should be recorded for identified parameters. Based on production performance 100 elite unrelated females should be identified with the farmers and registered. These females should be inseminated/mated with the semen of superior males of the same breed. The owners should be provided incentive so that the animals are retained and kept in good health. 40-50 unrelated males should be selected at the farmers' premises and financial incentive should be provided. The farmers should maintain these males and provide breeding services with certain charge to the animals in that area through natural mating. The external support from the government should be gradually withdrawn while allowing the breed society to take over and continue the efforts in this direction. Breeding services like artificial insemination at farmers' doorstep, animal health services and feed supplements may be provided either free of cost or at subsidized rates.

A nucleus herd of about 200 breeding females with at least 20 breedable males (10:1 ratio) should be established in the native tract of the breed with government support. An open nucleus breeding system should be followed with bi-directional flow of germplasm from farm to field and *vice versa*. For a nucleus herd of 200 breeding females, the best 20 females may be selected from the villages each year as replacements for the animals to be culled from the nucleus herd. The same should be followed for breedable males also by replacing breeding males in the herd with young males from the field. An efficient field recording system should be in place to identify the elite animals as well as to monitor the genetic improvement.

4.5.3. IN SITU CONSERVATION INVOLVING INSTITUTES

Institute should be identified in native tract of the breed to maintain the animals. The young animals should be identified and procured from the farmers' households, at least 100 females and 20 males on the basis of true to type breed characteristics. Animal should be reared at the institutional farms. About 5 females should be mated with each bull of the same breed. Regular performance recording should be followed. Best 10 young males should be selected through multistage selection in each generation. Selected young males should be trained for semen production. At maturity a total of 5 males should be selected on the basis of growth, semen quality and freezability. Mating should be planned to avoid the relationship in form of circular mating after developing sire lines. After each five generations, 5 young males may be incorporated in institutional herd procuring from farmers of native tract. A

minimum of 2000 semen doses from each male should be collected, cryopreserved and used in for breed improvement and conservation. The surplus breeding males are distributed to the farmers for natural mating in the breeding tract.

- Associated herd progeny testing program may also be initiated if there are more such farms available for an indigenous breed so as to couple the conservation program with systematic genetic improvement.

4.6. *EX SITU IN-VIVO* CONSERVATION

The animals (often a very limited number) may be kept outside their natural habitat. During reconstruction of a population with frozen semen, we can use the few purebred *ex situ in vivo* conserved females as founders.

As an alternate, the young males from elite females should be selected and procured. The males should be reared to maturity under intensive management. The semen can be utilized in the breeding tract through SAHD/NGO network for up-gradation and improvement of the breed.

Cattle and buffalo

- 20 unrelated young male progeny of elite animals from the breeding tract should be procured and maintained at the organized farm for one year.
- These males should be trained to donate semen. A total of 2000 semen doses per male should be procured from 15 males making the total number of doses as 30,000. The semen from these males after evaluation should be frozen and stored.
- The males (progeny of elite cows) can be extensively used for breed improvement in the tract.
- Embryos from different breeds can also be stored for posterity by raising females at farm.

Sheep and goat

- 25 unrelated young male progeny of elite animals from the breeding tract should be procured and maintained at the organized farm for one year. Rearing cost should be provided, if reared by private agencies.

  These males should be trained to donate semen. A total of 1000 semen doses per male would be procured from 15 males making the total number of doses as 15,000.
- The semen doses should be cryopreserved. The males (progeny of elite cows) can be extensively used for breed improvement in the tract.
- The breeding males can either be supplied to breeders or breeding services are provided at central place. The target should be to produce the desired number

of progeny in the tract either by AI or through natural service depending upon the species, demand and facilities. The progeny thus produced should be followed for data recording. Such scheme should be sponsored for 10 years and transferred to any developmental agency in locality.

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05

CRYOPRESERVATION

Cryopreservation includes freezing of semen, ova, embryos, tissues etc. for future use in breeding or regenerating animals. Collection, testing, processing and banking of germplasm must meet high sanitary requirements and standards as prescribed. Animal must be disease free and Gene Banks must take utmost care while handling the germplasm.

5.1. GENE BANK

Germplasm should be collected under high sanitary conditions.

There should be at least one Gene Bank at National level (National Gene Bank), which should be supported by regional Gene Banks located at different regions/states for cryopreservation of germplasm of various livestock breeds.

- It should hold the capacity to cryopreserve sufficient number of semen doses and embryos apart from capacity to preserve other type of germplasm.
- ICAR-NBAGR has been designated as repository center for the domestic animal genetic resources of country in 2008 by ministry of Environment Forests, GOI under the National Biodiversity Act (2002). Accordingly First National Gene Bank of country has been established at ICAR-NBAGR.

Regional (State) gene bank should also be established in each state for cryo-conservation of germplasm of their respective state AnGR. 50% doses of semen and other kind of germplasm should be kept at Regional Bank and 50% should be transferred to the National Gene Bank. Regional Gene Bank should preserve only those breeds, which have native tracts in that state.

Gene Bank should be open for germplasm transfer. Semen doses kept at National Gene Bank as well as Regional Gene Bank may be transferred to the AI center for their use in field animals and equal quantity of semen doses should be replenished.

5.1.1. PHYSICAL STRUCTURE OF GENE BANK

Gene Bank should be sufficiently large to store different types of germplasm. It should contain separate places for each activity like germplasm acquisition/collection, processing and cryopreservation. All three activities will require their own facilities.

Laboratory under gene bank should contain area for wet lab, cold room or cooler cabinet, cryotank storage room and office for database management. There should be sufficient capacity to store liquid nitrogen.

Gene bank should have separate long term storage facility. Room for long term cryopreservation should be separate from laboratory facility.

There should be suitable facility to collect the germplasm from the animals in Gene Bank. Donors should be kept in different buildings and follow all in/all out policy. Group of animals can be brought into empty and sanitized building and then animals should be quarantined and germplasm should be collected. Proper ventilation and humidity is essential in such animal sections. Building for animals, collection pens should be completely separated from laboratory area. Working staff for both facilities should be different.

Collection of germplasm in field should be preferred when a large number of breeds are distributed in wide geographical area. Field collection requires specific protocols to be followed as well as specialized equipment.

Protocols related to collection from field should be followed as per FAO guidelines 'Cryoconservation of animal genetic resources (2012)'.

Germplasm collected from field should be transferred in liquid nitrogen as early as possible. Biosecurity protocols should be followed to prevent the transmission of diseases from one location to another. All the laboratory operations related to semen processing should be carried out in an enclosed area, reserved exclusively for the purpose of semen processing and not accessible to others.

The operations should be performed by the personal specifically allocated to the task and in no case tasks should be exchanged.

5.2. COLLECTION OF GERMPLASM

Generally Gene Bank concept is intended to preserve the germplasm for *ex situ/ in vitro* conservation strategy and to support breeding schemes. For breeding schemes, semen and sometime embryos are the most practical options, which can be updated regularly and can also be regularly taken back readily from the Gene Bank and used in the field.

For long term conservation programme, collection of various type of germplasm from as many species and breeds as possible is needed.

Semen is best choice for such strategy, when there are financial constraints and one has to make the collection over a short period of time. It needs simple

techniques and expertise.

However, wherever financial resources expertise and facilities are available, embryos are probably the better choice, somatic cells could also be considered as a possibility.

It is also important to duplicate the material and store the sets of samples at separate locations in order to reduce risks of loss. It is better to conserve small amounts of germplasm from many donor animals rather than large amounts from few donors.

It is preferable to choose donors that are as genetically and phenotypically diverse as possible; and store the breeds as pure lines rather than gene pools, so as to allow the use of the unique combinations of traits and flexibility in the combination of stocks.

Germplasm should not be collected from animals that are infected with a highly contagious disease. It is preferable to avoid sampling animals that are affected by any kind of diseases. All the donor animals should pass through quarantine before collection of germplasm.

5.2.1. COLLECTION OF SEMEN

Semen can be collected and frozen easily for most species. It is widely used germplasm for livestock improvement programmes as well as cryopreservation. Almost in all livestock species, this technique has been standardized. It can be stored easily and reused for reconstitution of a population through backcrossing.

Banking of sexed semen may potentially decrease the number of doses required for storage.

5.2.1.1. Standards for semen collection

Quality of frozen semen stored in Gene Bank is an important issue and must be taken care seriously and regularly. Standards for semen collection from donor bulls, semen processing and cryopreservation in case of cattle and buffalo, should be followed as per the "*Minimum standards for production of bovine frozen semen*" developed by National Dairy Development Board, Ministry of Agriculture, GoI (http://gldb.org.in).

Similarly, the breeding soundness and genetic merit of donor bulls to be used for semen collection, the diseases screening and other protocols for semen collection has to be followed as per these guidelines and as revised from time to time should be followed.

Semen collection starts from selecting suitable bulls with normal karyotype to rule out any cytogenetic abnormality. The bulls should be managed as per standard procedures and kept under hygienic condition. The bulls trained for semen donation, their semen evaluated for quality standards and collected observing all hygiene standards.

The bulls used for semen collection should be healthy and kept in quarantine/ artificial insemination centres over six months prior to semen collection and declared negative for genital and infectious diseases.

Donor bull should be free from various communicable diseases including Foot and mouth, Rinderpest, Contagious pleuropneumonia, Brucellosis, Tuberculosis, Paratuberculosis, Camphylobacteriosis genitalis bovis, Laptospirosis, Infectious bovine rhinotracheitis. Donor bull should also be free from all genetic disorders and chromosomal aberrations.

Most possible disease free conditions in case of other species should be followed as per the norms given for Sanitary health during import of germplasm of specific species.

The fertility of the breeding males should be good and semen should have acceptable levels of motility, livability, acrosomal integrity and membrane permeability etc.

The equipments needed for performing the various activities of Gene Bank are described in Annexure 20.

5.2.1.2. Collection procedure

In case of bull, ram, buck goat, buck rabbit and stallion semen is typically collected using an artificial vagina.

Once the collection is over separate the AV cone from the vagina and empty the water in between the liner and vagina. Put the AV along with a liner and separated AV cone into a chlorohexadine disinfectant solution for 15 min. Brush with a neutral soap and warm water (not exceeding 60^0 C), or use a washing machine. Rinse three times with clear water. Rinse with double distilled water. Rinse with small quantity of 70% alcohol. Lastly dry the AV and cone in a dust free area. After following all the above steps, AV should be assembled and placed in the incubator for the next collection.

The collection area should be easy to clean, dry and disinfect. A dusty floor should be avoided. Dummy or a teaser mount hindquarters must be kept clean. Dummy/teaser mount must be cleaned completely after each period of collection. It is advisable to repeat the cleansing upon each change of bull particularly in the case of soiling by defecation. Teaser mount should be of smaller height compared to the bull being collected. The hand of the person collecting the semen must not come in contact with the bull's penis.

The water temperature and pressure should be checked as per the requirement of the bull, as improper temperature and pressure affect the semen, quality and quantity. Before collection lubricate the upper inside of the collection liner with a non-spermicidal sterilized lubricating jelly. Washing/disinfections activities should

be done in a room adjacent to the collection area. It is recommended that A.V. should not be shaken after ejaculation; otherwise lubricant and debris may pass down the cone to join the contents of the collecting tube.

When successive ejaculates are being collected, a new A.V. should be used for each mounting. The vagina should also be changed when the bull has inserted its penis without ejaculating. The collection tube must be sterile with heating in an oven at 180^0 C for at least 30 min.

After collection tubes should be left attached to the cone within its sleeves until it has been removed from the collection room for transfer to the semen processing room.

In boar, semen is usually collected by using the hand-glove method. Electro-ejaculation may be considered for animals that have not been properly trained for AV technique. However, it should be avoided in the case of boars and stallions. Abdominal stroking technique can be used for semen collection in poultry.

Epididymal semen can be collected directly from the testes if a male has died before sufficient semen has been collected or if a male can be sacrificed because its genetic material is more valuable than the live animal.

5.2.1.3. Semen processing and freezing

After dilution and during refrigeration the semen should be kept in closed flask. During the course of filling the straws, the straws and the other consumables used for packaging should be used immediately after being unpacked. Materials for repeated use should be sterilized with alcohol, ethylene oxide, steam or other approved sterilization procedure. Glassware, straws etc. coming in contact with semen should be at the temperature as that of the semen. In case of automatic equipment, the stainless steel nozzles tubing etc. for filling and aspiration should be cleaned and sterilized. If sealing powder being used care should be taken to avoid contamination. The person in the semen-processing laboratory should disinfect his hands with 70% alcohol in-between the processes. Biological freezer with standard freezing protocol should be used in all the centres. The time from dilution to freezing should not be less than six hours. As different centres are using different semen extenders care should be taken to check the osmolarity to be optimum.

5.2.1.4. Semen evaluation

- Routine Evaluation should be done for volume, colour, consistency, mass activity, Initial motility, total sperm count and percent live sperm. Periodic evaluation of semen should be conducted to pH, post thaw incubation Test, acrosome integrity test, percent abnormal sperm, microbial load, HOST test and fertility evaluation.

5.2.1.5. Quality control for frozen semen

Semen quality should be assessed in form of parameters like motility, percent live spermatozoa, Sperm concentration, diluent used, final concentration of sperms etc.

Sperm concentration should be 20 million spermatozoa per dose (0.25 ml Mini straw)

The bacterial load (FSD) in semen dose should be with in the permissible limits. The bacterial load using standard plate count- acceptable colony forming units (CFU) in processed semen should be less than 5000 CFUs /ml.

The Hypo Osmotic Swelling Test (HOST) cut-off value should be 40%.

Acrosome Integrity (Fresh Semen) should be 70% or more.

Percent Intact Acrosome (PIA) should be 65 % or more.

Incubation / Thermo resistance test standard drop in motility by 10% after every 30 minutes

For a minimum concentration of 20 million per dose, minimum acceptable post thaw motility should be 50%.

A regular examination of the semen kept at Gene Banks may be carried out so as to as certain the fertility status of semen doses complying above parameters.

Semen freezing and storage record should have information about date of collection, animal number, total volume, extender used, dilution rate (20 million motile sperm per straw), number of doses frozen, post thaws motility (0 hour, 24 hours, 1 week), storage place and disposal.

5.2.2. COLLECTION OF EMBRYOS

Collection and preservation of embryos for a species is available, it is best option for conserving genetic diversity. However, it is more costly and requires advanced technologies for collection and preservation.

Preferably, embryos should be collected at blastocyst stage.

FAO recommended standard protocols for embryo collection and preservation from various livestock species should be followed. If gene banking involves trans boundary movement of embryos, particular attention should be paid to the OIE standards (http://www.oie.int) for the sanitary handling of *in vivo*-produced embryos.

5.2.3. COLLECTION OF OOCYTES

Cryopreservation of oocyte can support the semen storage for a breed. By using both, breed can be revived directly through in vitro fertilization and there will be no need for backcrossing for revival of a breed.

One dose of frozen semen per oocyte stored is required with equal number of oocytes collection.

FAO recommended standard protocols for oocyte collection and preservation from various livestock species should be followed.

5.2.4. COLLECTION OF GONADS

Cryopreservation of gonads could be another way to conserve the genotype of animals. Cryopreserved gonads may be used subsequently as a source of oocytes and spermsin an IVF procedure to produce embryos.

At least 50 gonads for each sex and each breed should be collected from unrelated individuals for cryopreservation.

FAO recommended standard protocols for gonads collection and preservation from various livestock species should be followed.

5.2.5. COLLECTION OF DNA

Genetic material can be preserved in the form of DNA under cryogenic conditions. This has the advantage over storage of live cells as it is economical, occupies less space and there is no spread of diseases. Although it is easiest method for preservation, however, at present, DNA can not be used for recreating the live animals. However, at same time, it may be useful in characterization and support conservation decision.

5.2.5.1. DNA Bank

Under Article 2 of the CBD, the term "genetic resources" means "any material of actual or potential value of plant, animal, microbial or other origin containing functional units of heredity". Genomic DNA as a whole or as a part of the genome or its functional units (RNA) is of actual or potential value, therefore, can be regarded as insurance for future. ICAR-NBAGR should be nodal agency for genomic repository and establish 'National Genomic Resources Repository (NGRR) or DNA Bank' for conservation of genomic resources. Accompanying data/ information for depositing genomic resource should also provided by the submitter. Standard methods should be followed for storage.

Every sample of genomic DNA meant for deposition should contain a minimum of 100 µg at which it is used only for repository and not for distribution. In case distribution is expected, replicates should be deposited. The quality of the DNA should be as follows: Spectrophotometer reading : A260/A280=1.7-2.0; A260/A230>1.5. One agarose gel electrophoresis photo with at least one size marker should be submitted.

5.2.6. COLLECTION OF SOMATIC CELL

Various types of somatic cells can be cryopreserved very easily following standard protocol. It is good option for cryopreservation, when a large number of breeds to be conserved with minimal expenditure.

5.2.7. COLLECTION OF BLOOD AND SERUM

collection and treatment must comply with veterinary rules and guidelines

formulated by various national and international agencies.

5.3. INVENTORY / PASSPORT DATA

All the germplasm should be maintained through proper recording system.

There should be a proper format in form of accession numbers for identification of each and every type of germplasm available in the Gene Bank. Accessions may be given in alpha-numerical according to type of germplasm, breed and species.

Pass port data of the donor animal and the breed should also be mentioned for each germplasm. Details about donor, its pedigree, index score, physical characters, production record (for female or sire's dam), physical traits, disease etc. Photograph of the animal should also be taken.

Passport data of sire describing details for its phenotypic characteristics, health status, pedigree record, sire index, semen quality parameters should be recorded and kept in semen bank for future reference (Annexure 21).

Similarly quality of germplasm should also be recorded and maintained in proper inventory, time to time. Inventories for each type of germplasm should be separate.

5.4. GERMPLASM REQUIREMENT FOR CONSERVATION

The quantity of germplasm needed for revival of a breed when extinct should be assessed.

In general, reconstitution of a breed will require maximum amount of germplasm. It is evident that maximum germplasm should be stored; however spatial, financial and technical aspects always limit the maximum collection goal.

It becomes also essential to restrict the collection up to certain level because it will provide space and way to preserve the germplasm from other breeds or species.

5.4.1. SEMEN REQUIREMENT

Semen doses needed for reconstitution of a breed depends on number of generations for backcrossing, length of reproductive cycles, conception rates, sex ratio etc. Therefore, total number of semen doses for at least 5 generations of backcrossing, which will allow getting 97% breed purity needs to be considered. Further, to get optimum variability in reconstituted breed, the number of donors should also be evaluated. To restrict inbreeding in to reconstituted breed up to 1%, effective population size (N_e) should be more than 50.

Cattle and buffalo: A total of 2000 doses each from 15 unrelated Bulls should be preserved. Thus, a total of 30,000 semen doses per breed should to be preserved.

Sheep and goats: A total of 1000 doses each from 25 unrelated breeding males should be preserved. Thus a total of 25,000 semen doses per breed should to be preserved.

5.4.2. EMBRYOS REQUIREMENT

To maximize N_e in a reconstituted breed, each female should obviously need to produce multiple embryos. At least 20 embryos each from twenty five donors from unrelated origin should be stored with maximum genetic diversity.

5.5 GENE BANK SECURITY

A Gene Bank should have a risk management strategy in place which includes inter alia measures against power cut, fire, flooding and earthquakes etc. A Gene Bank should follow the local occupational safety and health requirements and protocols where applicable.

5.5.1. BUILDING SAFETY AND SECURITY

The structure of Gene Bank should be strong enough to withstand any environmental challenges like earthquakes, fire, floods). Construction in vulnerable area or prone to any natural calamities should be avoided. Cryopreserved germplasm should be restricted from unauthorized access by controlling access to the room.

Storage facilities should be protected with standard security facilities such as fences, alarm systems, security doors and any other system that helps to shield the Gene Bank. Fire alarm switches should also be installed.

5.5.2. PRECAUTION IN GENE BANK

Protective clothing should be provided and used in the storage area. The in-store working period should be kept minimum.

Liquid nitrogen should be handled very safely. Liquid nitrogen causes hypoxia and respiratory distress and freeze burn or "burning" of skin and soft tissues upon contact. Specific precautions should also be taken in the design of storage facilities. When working with liquid nitrogen, one must avoid all skin contact. Protective gloves should be worn as well as standard lab coats. Specially designed "tongs" should be used for handling of straws and containers for storage of germplasm.

5.5.3. POWER BACKUPS AND FIRE FIGHTING SYSTEM

Electric supply must be available at all times. Both normal and emergency – mains and low voltage (battery) – circuits are recommended. A single low wattage safety light (battery powered) can be kept on permanently. Emergency lighting must also be provided in the machinery room to allow emergency repair work to be undertaken.

It includes extinguishers and fire blankets. For areas affected by thunderstorms, a lightning rod should be fitted to the Gene Bank. The selection and use of 'first stage' fire lighting equipment should be made in consultation with local fire brigades and staff instructed accordingly. Dry chemical powder extinguishers should be recommended. Fire- proof blankets and buckets of dry sand, automatic water sprinkler systems should also be kept.

5.5.4. GENE BANK PERSONNEL

A Gene Bank should employ the requisite staff to fulfil all the routine responsibilities to ensure that the Gene Bank can acquire, conserve and distribute germplasm according to the standards.

Active Gene Bank management requires well-trained staff, and it is crucial to allocate responsibilities to suitably competent employees. Staff should have adequate training acquired through certified training and/or on-the-job Training and training needs should be analyzed. Gene Bank personnel should be aware of and trained in safety procedures to minimize risks to the germplasm.

5.5.5. GENETIC RESOURCES CONSERVED IN GENE BANKS

Conservation of genetically identical sub-sample of germplasm accession should be safely duplicated by keeping it at other location. The objective is to reduce the chance of partial or complete loss of germplasm accessions, feared to occur due to natural disasters or any other calamities owing to any cause.

Primary consideration should be given to the geographic location and environmental conditions of the location while selecting the location for safety duplication. The location should not be in the epicenter region of earthquakes and should be elevated so that it is not flooded during heavy rainfalls or rising sea levels due to global warming. If the location is at higher altitude (permafrost condition), it helps in management of lower temperature at more economical costs.

Samples intended for safety duplication of germplasm should be processed and prepared in the same way as the original germplasm conserved in a Gene Bank.

All germplasm conserved in situ should be safety duplicated at least in one more site and/or backed up by an alternative conservation method such as in vitro conservation or cryopreservation.

All safety duplication of germplasm should be carried out under unambiguous legal agreements between the depositor and the recipient of the safety duplicate, setting out terms of reference for safe keep, monitoring and distribution of duplicated germplasm.

SELECTED READINGS

FAO. 2012. Cryoconservation of animal genetic resources. FAO animal production and health guidelines no. 12. Rome.

Minimum standards for production of bovine frozen semen. NDDB, http://gldb.org.in/msp_for_production_of_bovine_semen_2012.pdf

OIE terrestrial animal health code (2003) office international des épizooties, rue de prony, Paris, France.

Compendium of minimum standards of protocol & standard operating procedures for bovine breeding. 2014. Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture Government of India (dahd.nic.in)

06

GERMPLASM EXCHANGE AND QUARANTINE

Various Acts, rules and regulations formulated by the Government of India, time to time, to regulate Exchange of animal germplasm between India and other countries. Access to any biological material including Animal Genetic Resources of the country is regulated under Biological Diversity Act (BDA, 2002). Under Section 3 to 5 of the BDA 2002"No person shall without previous approval of the National Biodiversity Authority, obtain any biological resource occurring in India or knowledge associated thereto for research or for commercial utilization or for bio-servey and bio-utilization." Under Section 4 of BDA, 2002," No person shall without approval of National Bio-diversity Authority, transfer the results of any research relating to any biological resources occurring in, or obtained from, India for monetary consideration or otherwise to any person who is not a citizen of India or citizen of India who is non-resident or a body corporate or organization which is not registered or in corporate in India or which has any non-Indian participation in its share Capital or management. For this purpose transfer does not include publication of research papers or dissemination of knowledge in any seminar, if such publication is as per guidelines issued by the central Government." The provisions of sections 3&4 shall not apply to collaborative research projects conform to the policy guidelines issued by Central government in this behalf and approved by the Central Government.

6.1. EXCHANGE OF ANIMAL GERMPLASM FOR RESEARCH

Guidelines regarding the Exchange of Genetic Resources for Research are prepared by the ICAR, which also covers the Exchange of animal genetic resources.

The animal germplasm, which is used to improve the livestock to meet the food requirement of the people can be imported/ exported after completing all the necessary requirements or bilateral agreement or treaty between the two countries, as the case may be.

Export and import of animal germplasm needs to be decided on case-to-case

basis.

The animal germplasm may be in different forms viz. a) Live animal- Normal/ GMO, b) Cryopreserved germplasm-Semen, Embryos, Oocytes, Somatic cells, DNA

6.1.1. GUIDELINES FOR ISSUING EXPORT/IMPORT PERMIT

No germplasm shall be imported into India without a valid sanitary import permit issued.

All applications for a permit to import consignments by land, air or sea shall be made in relevant form and sent in triplicate to the Director of the concerned Bureau .

The import permit shall be issued for import of germplasm if, after a detailed import risk analysis, the concerned authorities are satisfied that the import of the consignment will not adversely affect the health of the crops, animal and human populations of this country.

The import risk analysis shall be conducted by the concerned officers of the Bureau on the basis of internationally recognized scientific principles of risk analysis and the analysis shall be conducted with reference to the specific product and the disease situation prevailing in the exporting country vis-à-vis the disease situation in India.

The issue of permits shall be refused if the results of the import risk analysis show that there is a risk of the specific germplasm bringing in one or more specific diseases, which are not prevalent in the country and which could adversely affect the health and safety of the human and animal populations of this country.

The import permit shall lay down the specific conditions that will have to be fulfilled in respect of the consignment, including pre-shipment certifications and quarantine checks.

The permit shall also specify the post-import requirements with regard to quarantine inspections, sampling and testing.

The import permit issued under this clause shall be valid for a period of six months, but can be extended by the competent authority for a further period of six months, on request from the importer and for reasons to be recorded in writing.

All types of germplasm shall be imported into India through the seaports or airports located at Delhi, Mumbai, Kolkata and Chennai or any other international airport/seaport, where the Quarantine and Certification Services Stations are located.

On arrival at the entry point, the germplasm shall be inspected by the Officer-in-charge of the Animal Quarantine & Certification Services Station or any other officer duly authorized by the Director of the ICAR-NBAGR, wherever required, in

accordance with the specific conditions laid down in the sanitary import permit and with general guidelines issued by the Bureau from time to time.

After inspection and testing, where-ever required, the concerned quarantine or certification authority shall accord quarantine clearance for the entry of the germplasm into India or, if required for research, order its destruction or its return to the country of origin.

Wherever disinfection or any other treatment is considered necessary in respect of any germplasm, the importer shall, on his own or at his cost through an agency approved by the Director of the Bureau, arrange for disinfection or other treatment of the consignment, under the supervision of a duly authorized quarantine officer.

It shall be the responsibility of the importer -

- To bring the livestock germplasm to the concerned Quarantine & Certification Services Station, or to the place of inspection, disinfection or treatment or testing as directed by the Quarantine officer duly authorized on this behalf;
- To open, repack and load into or unload from the Quarantine Station and seal the consignment;
- To remove them after inspection and treatment or testing, according to the directions of the Quarantine officer duly authorized by the Bureau.

The Director General, ICAR may, in public interest, relax any of the conditions specified under this Schedule relating to the permit in relation to the import of any germplasm.

6.1.2. GENERAL INFORMATION TO BE PROVIDED

6.1.2.1. Live animal

Identification number of the animals. Pedigree chart with performance level in past three generations of sire and dam must accompany the proposal for consideration.

History of the breed and origin of the breed. Contributions of existing or lost breeds who contributed to the development of particular breed/strain.

Phenotypic descriptors of the breed, characteristics of the breed or strain.

Complete karyological profile and heritable disorders need to be submitted, Genetic markers or genetic profile, if known.

Description of geographical distribution and natural habitat of the breed or strain. Heat and cold or environment tolerance index in the animals/breeds, wherever available for import/export to the relevant region where it shall be used to management or performance.

The list of parasites (endo/ecto), bacterial/ viral/ fungal diseases, which are

endemic to the area where breed exists.

Reproductive status of the animals and herd/flock average to which animals originally belong. Production performance level and herd mate averages.

6.1.2.2. Genetically modified animals

The gene or group of genes for which the animal/ germplasm has been targeted or selected or modified.

Present level of expression of the gene, tissue specificity, level of expression of gene.

Effect of gene modification or gene introduction or gene deletion on-growth, physical health, mental status of animals, physiology and behavior and any other ill effects.

Performance level of the animal, reproductive status.

The complete sequence of gene for which targeting or modification has been done must be given.

Effect of gene modification on environment/biosphere must be spelled out clearly at the time of import/export of germplasm.

6.1.2.3. Semen

Identity number, age, history of the sire, pedigree with performance level for at least 3-4 levels.

Number of semen doses/per collection/per bull, type and level of extender used for dilution and freezing, name and concentration of cryoprotectant used. When semen was collected must be given.

Age of storage of semen (duration of storage in cryogenic conditions) at transportation, cryogenic temperature, methods of cryofreezing, types of semen adjutants or antioxidants used.

Motility (%), live and dead sperm count at freezing and thawing.

Disease profiling of semen carried out.

Results of fertility trials of liquid and frozen semen.

6.1.2.4. Embryos

Identity number, age, history of the sire, pedigree with performance level for at least 3-4 levels.

Physiological status, health status of donor.

History of genetic disorders in donor or her family/pedigree.

Method of embryo collection, hormones used.

Number of embryos/per collection/donor at collection.

Method of freezing, cryoprotectant, adjuvant/antioxidant used for freezing.

Duration of freezing of embryos, temperature.

Fertility status and conception rates in recipients.

6.1.2.5. Somatic cell/stem cell

Identity Number, sex and age of the donor, pedigree.

Source of tissue and how it has been collected.

Composition or trade specification of the culture medium and other supplementation used for production of cells.

Passage number of cells, ploidy level at the time of freezing.

Composition of freezing medium, method and temperature freezing, cryo-protectant used.

Survival rate and re-growth period after thawing and re-seeding.

Success rate in nuclear transfer and other usages i.e., number of embryos per nuclear transfer trials.

6.1.3. GENERAL GUIDELINES FOR EXPORT OF GERMPLASM

Elite germplasm, with production average among top 10% population in the country should not be exported.

The genetic material of animals should not be exported to a country that has the history of exporting the germplasm to other country/ countries for commercial purpose.

The genetic material should not be exported to any country who is presently India's business rival in international trade arena.

The genetic material should not be exported to any country who can pass it to any other country with which our country does not have trade/cultural or exchange links/treaty and can pose a serious threat or any other potential hazard.

The live animals especially should not be exported to the country who may infringe animal welfare and ethical issues i.e. we should not export cows which may be passed on to other country; that can cause communal tensions or disturbance is social ethnic disturbances.

The animals/breeds known to cause bio-hazard or disease spread to the host country should not be exported for any purpose.

Animals/germplasm should not be exported to any country, which does not have adequate infrastructure of suitable environment to keep these animals in good condition of health and upkeep, to avoid ethical problems.

Animals' species/breeds of national importance should not be permitted to export.

Animals of strategic importance should not be permitted for export.

Animals having small population coming in endangered list should be banned for export.

Wild relatives of domestic animals should not be allowed at all for export.

6.1.4. MATERIAL TRANSFER AGREEMENT (MTA) FOR EXCHANGE

ICAR has adopted the protocol/procedure for germplasm exchange and MTA to be followed in ICAR system (circular no. 4-18/2010-IC.II dated 24.01.2011). Following procedure must be adopted for exchange of any type of germplasm under collaborative and other than collaborative categories.

Request should be made by indenter to ICAR-NBAGR for material transfer.

Pre-examination by ICAR-NBAGR: Determination of "Approved" status of the collaborative research project and other than collaborative research project-In case of any ambiguity or discrepancy, views of concerned SMD with respect to collaborative research projects involving the germplasm of terrestrial and aquatic animals should be obtained and recorded. Further, it should be determined that the concerned SMD has no objection to transfer of the particularly proposed material and /or specific clause(s) for MTA, if any- Specific views/recommendations of concerned SMD, if needed, in relation to any ambiguity or discrepancy; or no objection to the proposed transfer of germplasm should be obtained.

MTA will be approved by DARE, GOI/NBA to be used for export of all Indian germplasm. SMTA to be used for exchange (import] of Designated Germplasm from IARCs.

Recommendation of the Germplasm Export Facilitation Committee- Performa for Collaborative Research Project as per section 5 of BDA based on which recommendation is made, should be properly filled. Clarity in terms of name and designation of the person authorized by the Department for sending germplasm should be reflected. The Bureau would generally perform the single window transfer of germplasm, unless otherwise warranted /approved/authorized. For other categories also similar details in similar format should be provided.

Request should be forwarded to DARE for approval through concerned SMD.

Further examination of the proposal in DARE in respect of orderliness. Referring the case file and examination by the nodal officer ADG(ANP) or any other in respect of orderliness of the proposal and making final recommendation for the consideration of Competent Authority. Further, self-explanatory Note by DARE for Seeking Approval of Competent Authority will be needed. Approval will be communicated to the concerned. Lastly, compliance by ICAR-NBAGR will be done for execution of germplasm exchange under MTA, communication to NBA and DARE and maintenance of database of approved transactions.

- Collaborative projects are exempted from obtaining approval of NBA. However, NBA may also ask for a copy of the approval given by the competent authority along with relevant details. In case of any violation of the Act/Rules (BDA), NBA

will not take any responsibility, and the Indian collaborator will have to explain and defend the action.

Check-List of Elements for Material Transfer Agreement: Complete check list for MTA is given in Annexure 2 of ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization, 2006, which should be followed as MTA for animals, overall. However, ICAR /its institutions with the other contracting parties must enter into MTA on case-to-case basis through discussion, elaboration of individual clauses, negotiation, development and inclusion of broadly the following elements. One of the format for the MTA is provided in Annexure 23.

Further, relevant documents concerning to medical history, health status, details of infectious diseases including zoonotic to which the animal may have been exposed should be attached with the agreement. Recipient should agree to comply with Animal Welfare Act and its implementing regulations, as applicable.

6.2. EXCHANGE OF ANIMAL GERMPLASM FOR OTHER THAN RESEARCH

Guidelines for export and import of the any type of germplasm (live animals, semen, ova, embryo and gonads) of livestock species have been laid down by Department of Animal Husbandry, Dairying & Fisheries (DAHDF), Ministry of Agriculture, Govt. of India which may be followed for exchange of animal germplasm. Details of guideline in general as well as sanitary may be obtained at website of DAHDF (www.dahd.nic.in).

All the exchange of AnGR/germplasm will require prior permission from BDA as per the provisions made under Biological Diversity Act and Rules and Regulations framed by MOEF Govt. of India under this Act.

Exchange of animal germplasm is regulated as per provisions made under The Livestock Importation Act, 1898 and various amendments made from time to time. General and sanitary guidelines for exchange of germplasm including live animals have been developed and modified time to time by the DAHDF, Ministry of Agriculture, GOI. Important features of Guidelines laid by the DAHDF are described below, which are subjected to change made by the department, time to time. These changes may be available from Website of the department (www.dahd.nic.in).

DAHDF, Govt. of India is the nodal agency for making/modifying the regulations exchange of germplasm, through notification. DAHDF may restrict import of any other product through notification from time to time and may also remove or continue the restriction on various germplasm already under restricted list in Exim policy of Ministry of Commerce, GOI.

The guidelines formulated by OIE, Codex Alimentarius and IETS, as the case may be, should be strictly adhered to while importing the genetic material. The pre

and post import quarantine for live animals and the germplasm should be strictly adhered to according to GOI health protocols.

For import of bulls and embryos, the standards for import of germplasm as prescribed in the "Guidelines for export / import of bovine germplasm" issued by DAHDF, MoA, GoI and as revised from time to time shall be followed.

No live-stock germplasm shall be imported into India without a valid sanitary import permit. The sanitary import permit shall be issued after a detailed import risk analysis, the concerned authorities are satisfied that the import of the consignment will not adversely affect the health of the animal and human populations of the country.

The detailed procedure for the import of animal products as mentioned below can be accessed by going to the Department of Animal Husbandry, Dairying and Fisheries website http://dahd.nic.in/, or following links.

a. Procedure for import of Livestock products into India
(http://dahd.nic.in/order/livestockimport.doc)

b. Sanitary conditions/Health Protocols for various products
http://dahd.nic.in/heath_protocol.htm

c. Guideline for Import/Export of Bovine Germplasm
http://dahd.nic.in/trade/RGIIEX.pdf

d. Import Health certificate for import of Dog into India
http://dahd.nic.in/trade/importofdog.pdf

f. Veterinary certificate for import of milk and milk products in to India
http://dahd.nic.in/trade/veterinary.pdf

g. Animal health certificate for import of in vivo bovine embryo in to India
http://dahd.nic.in/trade/veterinary.pdf

h. Veterinary certificate for import of skin/hides into India
http://dahd.nic.in/trade/vci.pdf

i. Notification to regulate the import of equine species of animals into India
http://dahd.nic.in/9%20Jun.pdf

j. Notification for bovine semen
(dahd.nic.in/dahd/upload/Trade1/reviseddraftnotification.doc)

For export of animal genetic resources from India, Department of Animal Husbandry, Ministry of Agriculture, GOI will be regulatory authority. Sanitary Health Certificate related to the germplasm in a prescribed format issued by DAHDF should be required before exportation.

6.3. QUARANTINE OF ANIMAL GERMPLASM

As per provision by OIE *Terrestrial Animal Health Code* (Article 1.4.4.1 and Article 1.4.4.2)-Countries shall take the necessary action to ensure that the border posts

and quarantine stations in their territory shall be provided with an adequate organization and sufficient equipment for the application of the measures recommended in the Terrestrial Code.

In India, DAHDF is the nodal agency for quarantining the animal germplasm for import and export. It will supervise the import/export of livestock and livestock products (including embryo, semen), biological and micro-organisms from the carrier to the Quarantine Station and arrange for necessary tests, vaccinations at the Quarantine Station and to attend their release, dispatch or destruction and incineration, as the case may be. At present, four Animal Quarantine Certification Stations (AQCS) are functioning at Delhi, Mumbai, Chennai and Kolkata.

6.3.1. QUARANTINE PROCEDURE

After import of animal germplasm into India, it shall be the responsibility of the importer to bring the livestock or its product to the concerned Animal Quarantine & Certification Services Station, or to the place of inspection, disinfection or treatment or testing as directed by the quarantine or veterinary officer duly authorized on this behalf; to open, repack and load into or unload from the Animal Quarantine Station and seal the consignment; and to remove them after inspection and treatment or testing, according to the directions of the Quarantine or veterinary officer duly authorized by the DAHDF.

Details of quarantine procedure (before arrival, on arrival at the point of entry, during quarantine period) may be obtained from DAHDF, Ministry of Agriculture, GoI. Quarantines procedures followed by the DAHDF are well defined for live animal, semen, embryo germplasm imports.

SELECTED READINGS

Guidelines for export /import of bovine germplasm (revised 2011) deptt. of AHD, ministry of agriculture.

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Procedure for germplasm exchange to be followed in ICAR system. Letter no. 18/2010-IC.II dated 24 January, 2011 Department of agricultural research & education, Krishi Bhawan, Ministry of Agriculture, Govt. of India.

The Biological Diversity Act, 2002, the 5th February, 2003 Legislative department, Ministry of law and justice, Government of India. http://www.moef.nic.in/divisions/csurv/nba_act.htm

The gazette of India part ii-section 3-sub-section (i) dated 8 Oct., 2012, notification G.S.R. 752 (e) under the livestock importation act, 1898. Deptt. of Animal Husbandry and Dairying, ministry of agriculture, Govt. of India.

The Live- stock Importation (Amendment) Act, 2001, 29th August, 2001. Legislative department, Ministry of law and justice, Government of India.

07

BIOSECURITY

Animal biosecurity is the product of all actions undertaken by an entity to prevent introduction of disease agents into a specific area. Animal biosecurity is a comprehensive approach, encompassing different means of prevention and containment. Biosecurity for the AnGR is essential for its proper management, particularily covering health and disease aspects. A critical element in animal biosecurity, bio-containment, is the control of disease agents already present in a particular area, and works to prevent novel transmissions. There are certain Acts and regulations formulated by Government of India to protect the animals against the disease spread or any biological contamination leading to animal hazard.

7.1. PREVENTION AND CONTROL OF INFECTIOUS AND CONTAGIOUS DISEASES IN ANIMALS

Prevention, control and eradication of infectious and contagious diseases in animal genetic resources are governed under 'Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009'. The list of scheduled diseases are mentioned and covered under the Act is attached with Annexure 24. Various provisions made under the different sections of the Act should be followed for prevention, control and eradication of infectious and contagious diseases in animal genetic resources. Details of the provisions under the Act may be obtained from Gazette of India No.29 dated 20/03/2009 or as and when updated version is made available.

Provisions mentioned under the Act by and large include the some important measures like- appointment of veterinary officers, reporting of outbreak of the any of the scheduled diseases, segregation of infected animals, steps in prevention of the diseases, declaration of controlled area, prohibited movement of the animals in and out of controlled area, precautionary measures in controlled area, establishment of quarantine camps, inspection and detention of animals at camps, declaration of infected area, segregation,

examination and treatment of infected animals, resorting to euthanasia of infected animals, if required, disposal of infected carcass, conducting post-mortem, prevention of escape of causative organism.

7.2. BIOSECURITY MEASURES FOR TRANSBOUNDARY DISEASES

Any exotic disease as a matter of principle should not be handled in any of the existing open laboratories without containment facilities. Major trans-boundary disease problems are Avian Influenza (Bird Flu), Swine flu, Peste des petits Ruminant (PPR) and Foot and Mouth Disease.

ICAR-National Institute of High Security, Animal Diseases (NISAD) Bhopal has biosafety level-4 facility to handle high-risk pathogens/List "A" diseases of OIE and, right now is the only laboratory authorized by Government of India to handle exotic animal pathogens.

In order to provide referral diagnostic services one central and five Regional Disease Diagnostic Laboratories have been setup by the Central Government under the Animal Disease Management and Regulatory Medicine Scheme. The Centre for Animal Disease Research and Diagnosis (CADRAD) of IVRI, Izatnagar is working as the Central Laboratory and has been identified as the referral apex laboratory for disease diagnosis. The Regional Laboratories are located at Pune, Kolkata, Bangalore and Jalandhar.

In exercise of the powers conferred by sub-section (1) of section 3 and section 3A of the Live-stock Importation Act,1898 (9 of 1898), the Central Government can prohibit import of livestock and livestock products into India from any of the countries reporting the outbreak of highly pathogenic disease. The prohibition, as mentioned in the Act or notified time to time by the agency, may be in force for a period of six months from the date of notification or till such time it is modified or withdrawn, whichever is earlier.

7.3. BIOSAFETY OF GENETICALLY MODIFIED ORGANISM

Safe handling, transport and use of living modified organisms (LMOs), which may have adverse effects on biological diversity, taking also into account risks to human health is regulated under an International agreement '*Cartagena Protocol on Biosafety to the Convention on Biological Diversity*'.

In country, GMOs and products thereof are regulated as per the "Rules for the manufacture, use/import/export and storage of hazardous microorganisms/ genetically engineered organisms or cells, 1989" (commonly referred as Rules, 1989) notified by the Ministry of Environment and Forests (MoEF), Government of India under the Environment (Protection) Act (1986). These rules are implemented by MoEF, the Department of Biotechnology (DBT), Ministry of Science and Technology and the State Governments through the six competent authorities notified under the Rules which are- Recombinant DNA Advisory

Committee (RDAC), Institutional Biosafety Committee (IBSC), Review Committee on Genetic Manipulation (RCGM), Genetic Engineering Appraisal Committee (GEAC), State Biotechnology Coordination Committee (SBCC) and District Level Committee (DLC).

Biosafety guidelines are available at http://dbtbiosafety.nic.in/ to provide guidance to organizations that have Institutional Biosafety Committees (IBSCs) with the rules notified by the Ministry of Environment and Forests (MoEF), Government of India under the Environment (Protection) Act, 1986.

7.4. IMPORT AND EXPORT OF HAZARDOUS MICROORGANISMS AND GENETICALLY ENGINEERED ORGANISMS OR CELLS

- Import and export of hazardous microorganisms and genetically engineered organisms or cells is regulated under Sections 6, 8 and 25 of the Environment (Protection) Act, 1986 with a view to protecting the environment, nature and health from the biohazards.

7.5. REGULATION FOR HANDLING OF INFECTIOUS SUBSTANCES DURING TRANSPORT

- The transport of infectious substances, which are known or are reasonably expected to contain pathogens including bacteria, viruses, rickettsia, parasites, fungi, and other agents such as prions, which can cause disease in humans or animals should be regulated as per guidelines described under "Guidance on regulations for the Transport of Infectious Substances" (WHO 2009–2010).

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Guidelines and Handbook for Institutional biosafety committees (IBSCs) (Revised 2011) Deptt. of Biotechnology, Govt. of India.

08

INTELLACTUAL PROPERTY ISSUES

ICAR has developed guidelines for Intellectual Property Management and Technology Transfer / Commercialization related to agricultural and allied sciences. The Governing body of ICAR has approved the guidelines on 19 September 2006. These ICAR Guidelines are for internal use of the ICAR only and may be adapted as appropriate for others also, specially by the institutions working under NARS. Detailed descriptions about these guidelines may be obtained from www.icar.org.in.'ICAR Guidelines for Intellectual Property Management and Technology Transfer/ Commercialization'

Any Intellectual Property (IP) related issues; technology transfer with respect to animal genetic resources will be in accordance with these guidelines. The procedures described in these guidelines will be followed related to following issues- ownership of the IP and conflict of interest related to AnGR will be regulated as per provisions made under chapter 3 (Section 3.2-3.4). Various forms of IP generated in ICAR are described in Section 3.5. General procedure for IP management should be followed as per provisions made under chapter 4 (Section 4.1-4.9).

Management of patents including filing a patent, maintenance of patents, patent watch and monitoring will be followed as per provisions made under chapter 5 of the guideline document. Similarly, procedures for management of other forms of IP will be made as per chapter 7 of the guidelines.

Procedures for technology transfer/ commercialization, valuation of technology, licensing of IP and implementation of licenses can be followed as per provisions described in chapter 8 of the guideline document.

The guidelines also provide procedures for animal breed registration along with the management of other forms of IP like copyright protection (Software, database and CD ROM), trademarks, GI and designs.

8.1. REGISTRATION OF GERMPLASM

As per provision under Section 3.5.5 of ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization (2006), Animal/poultry breeds/strains cannot be protected in India as patents or variety protection.

Improved breeds/ strains developed in ICAR, however, constitute valuable assets and to check their misuse or exploitation, ICAR will have a system of their registration and documentation at the National Bureaus of Animal Genetic Resources for quickly placing them through disclosure in the public domain thereby forestalling any unforeseen patenting in other countries.

Registration of livestock and poultry genetic resources has been initiated to protect and check the bio piracy of indigenous AnGR. Accession numbers have been given to each of extant breeds of various species of livestock and poultry (Annexure 22).

Guidelines, descriptors and application form for registration of new breeds have been prepared by ICAR-NBAGR and can be accessed at www.nbagr.res.in /guidelines.html.

8.2. PATENTS

In India, patenting is governed as per law under The Patent Act, 1970 (as amended in 2005) and The Patents Rules, 2003 (as amended in 2006). Guidelines for Patenting of biotechnological inventions may be referred from the Manual of Patent Practice and Procedure 2005 of the Indian Patent Office (http://patentoffice.nic.in, www.ipindia.nic.in). The application formats for filing provisional/ complete patent applications are available at the website of Indian Patent Office, which may be downloaded for patent filing.

ICAR has also described various provisions under chapter 5 of the guidelines for Intellectual Property Management and Technology Transfer / Commercialization related to Agricultural and allied sciences (2006) for the management of patents including filing a patent, maintenance of patents, patent watch and monitoring.

Patentability of biotechnological inventions may be seen from the Manual of Patent Practice and Procedure 2005 of the Indian Patent Office (http://patentoffice.nic.in). Whereas all patent cases will be addressed only as per the patent law, the following provisions of the Indian Patents Act should be clearly understood.

8.3. COMMERCIALIZATION OF TECHNOLOGY

Any technology product or process can be commercialized so as to generate revenue from the technology. ICAR Guidelines for Intellectual Property Management and Technology Transfer/ Commercialization should be followed

for commercialization of technology including developing MoA.

8.4. GEOGRAPHICAL INDICATORS

In order to facilitate the registration a geographical indications registry is set up. The Controller General of Patents, Designs and Trade Marks appointed under the Trade Marks Act, 1999 is the Registrar of Geographical Indications.

Any association of persons or producers or any organization or authority established by or under any law for the time being in force representing the interests of the producer of the goods concerned can apply for registration of geographical indications. The application is to be made in the prescribed form. The forms are prescribed in the geographical indications of goods (registration and protection) rules 2002. The procedure for registration is described under the Geographical Indications (Registration and Protection) Rules, 2002.

Further readings

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ANNEXURE 1

LIST OF ITEMS/ EQUIPMENT FOR SURVEY

Survey / collecting items

Digital camera, video cameras with additional memory card, binocular, digital vernier calliper Measuring tapes, Measuring cylinder, Sliding rulers, Altimeters, portable balance and Spring balance Global Positioning System (GPS), Automatic temp. & humidity reader.

Blood collection items

vacutainer tubes with EDTA, Needle (18-24 Gauge), Syringe, adaptor, cotton, antiseptic, cooling packs, plastic rope polythene bags, sutli-cord (thick and thin), ice bucket.

Others: Stapler, candle, match box, water bottle, scissors, torch light, field note book, pencil, ballpoint pen and permanent marker, hunter shoes, hand gloves, waist pouch, rain suit (shirts, trousers), rucksacks, sun glasses, etc.

Reference material

lap-top and accessories, list of local names of breeds, road-map, climate map, list of rest-houses/ lodges, hotels, resting/ stay places and list of local contacts (phone, fax, e-mail).

First aid box

Anti-malaria pills, anti-allergen tablets, pain killers, anti- amoebic and anti-diarrhoeal tablets, mosquito repellent, antifungal/ antibacterial/ antiseptic creams or lotions, cotton-packs, band-aid, dettol, dressing gauze, water-purifying tablets, etc.

ANNEXURE 2

QUESTIONNAIRES FOR SURVEY OF CATTLE AND BUFFALOES GENETIC RESOURCES

QUESTIONNAIRE 1. General information about the householder and animals maintained by him (only once).

Date of visit :	District/ Stratum :	
Code :	Tehsil/ Taluka/ Zone :	Village :
Code :	Household Number :	
Name & Address:		
Name of Enumerator :		

GENERAL INFORMATION

Ag. Holding (acres):		
Irrigated (acres):		
Unirrigated (acres):		
Fodder Grown (1)/ Not (2):	Winter:	Summer:
Profession:		
Annual Income(Rs.):		
No.of family members:		
No. of literate members:		
No. of members engaged in dairying:	Male:	Female:

Sale/ purchase of animals:

1) Animal Fair:
2) Middle man:
3) Any other:

UTILITY

	Cattle	Buffalo
1. Milk production		
2. Agricultural operation:		
3. Breeding:		
4. Religion:		
5. Any other:		

MANAGEMENT PRACTICES

Housing

during day(1)/ night(2)both day & night(3)/ none(4) :

a) Open(1)/closed(2):
b) Kutcha(1)/ Pucca(2):
c) Separate)/ part of residence(2):
d) Flooring Kutcha(1)/ Pucca(2):
e) Full walled(1)/ half walled(2):
f) Well ventilated Y(1)/ N(2):
g) Sanitary condition of the stall: very clean Y(1)/ N(2):
h) Pucca drain for urine to drain out Y(1)/ N(2):

Wallowing

Morning:	Noon:	Evening:
Y(1)/ N(2)	Y(1)/ N(2)	Y(1)/ N(2)

Fodder Grown (Yes / No)

Green Fodder	Dry Fodder
Winter:	Winter:
Summer:	Summer:
Chaffed(1)/ Unchaffed(2):	Chaffed(1)/ Unchaffed(2):

Feed

Seeds/ Grains:	Cakes/ Concentrate:
Others:	Feeding: Soaked/ Cooked/Raw:
Feeding: Mixing with fodder/ alone:	At milking time/ other times:

Cleaning of milking utensiles Y(1)/ N(2):

Udders washed before milking Y(1)/ N(2):

Breeding method: Natural(1)/ Artifical Insemination(2):

Species /Breeds	Upto 1 year		1-3 years		3 Years and above					
					Male			Female		
	Male	Female	Male	Female	used for breeding	For breeding and work	For work only	In milk	Dry	Not calved even once
Cattle (Breeds)										
Buffalo (Breeds)										
Others (Species/ Breeds)										

Disease Treatment Herbal(1)/ Allopathic(2)/ Local(3)

Vaccination:

QUESTIONNAIRES 2: Feed and feeding practices (Individual animals)

District/Stratum :	Code :	Tehsil/ Taluka/ Zone :
Date of visit :		
Village :	Code :	Household Number :
Address :		
Name of Enumerator :		
Allotted No.:	Breed : (name/ code)	Classification : (name/ code)
Date of Birth :	Age :	
Dam No.:	Sire No.:	

FEEDING

a) Grazing Distance(km) Time(hrs)
   Morning(1)
   Evening(2)
b) Individual(1)/ Group feeding(2):
c) Feed:

Feed	Morning		Noon		Evening	
	Name	Qty (kg)	Name	Qty (kg)	Name	Qty (Kg)
Green fodder						
Dry fodder						
Concentrate						
Minerals						

d) Water: Adequate(a)/ inadequate): Quantity:
   Water source(Name):
e) Feeding (Green Fodder/ Dry Fodder)

   i) Green Fodder mixed in Dry fodder:
   ii) Drying method of fodder:
   iii) Silage making:

QUESTIONNAIRE 3: Physical and qualitative traits (Individual animals)

Date of visit :		
District/ Stratum :	Code :	Tehsil/ Taluka/ Zone :
Village :	Code :	Household Number :
Name & Address :		
Name of Enumerator :		
Allotted No :	Breed : (name/ code)	Classification : (name/ code)
Date of Birth :	Age :	
Dam No.:	Sire No.:	
Purpose of breeds: milk(1)/ meat(2)/ draugth(3)/ others (specify):		

Hair characters

a. Length Short(1)/ medium(2)/ Long(3):
b. Sheen Glossy(1)/ Dull(2):
c. Curl Curly(1)/ straight(2):

Colour Name

a. Coat (hair):
b. Skin:
c. Muzzle:
d. Eyelids:
e. Hoofs:
f. Tail switch:

Horns : Present(1)/ Absent(2)

a. Colour/ Black(1)/ Brown(2)/ White(3)/, others(specify):
b. Size(cms):
c. Shape: Straight (1)/ Curved(2):
d. Orientation:
   Lateral pointing tips(1)/ inward pointing tips(2)/ Upward pointing tips(3)/ downward pointing tips(4)/ Forward pointing tips(5)/ backward pointing tips(6):

Ears

a. Length (cms):
b. Orientation: horizontal (1)/ Dropping (2):

Head

a. Length (cms):
b. Poll prominent(1)/ Not prominent(2):

c. Any other peculiar character (specify):

Body

a. Hump: large(1)/ medium(2)/ small(3)
b. Dewlap: large(1)/ medium(2)/ small(3)
c. Naval flap: large(1)/ medium(2)/ small(3)
d. Penis sheath flap: large(1)/ Medium(2)/ small(3)/ absent(4)
e. Basic temperament: docile(1)/ moderate(2)/ tractable(3)/ wild(4)

Udder

a. Shape: bowl(1)/ round(2)/ trough(3)/ pendulous)
b. Fore udder size: large(1)/ medium(2)/ small(3)
c. Rear udder size: large(1)/ medium(2)/ small(3)
d. Teat shape: cylindrical (1)/ funnel(2)/ pear(3)
e. Teat tip: pointed(1)/ round(2)/ flat(3)
f. Milk vein: large(1)/ medium(2)/ small(3)

Body size: Massive/ large/ medium/ small

Weight(kg)	Measurements
a. Birth weight:	a. Chest girth(cm):
b. 6 month weight:	b. Body length(cm):
c. 12 month weight:	c. Height at withers:
d. 24 month weight:	d. Tail length
e. Weight at Ist mating:	(Above hock/at hock/ below hock touching the ground)
f. Weight at Ist calving:	

Reproduction(Females)

a. Age at 1 oestrous (months):
b. Oestrous cycle duration(days):
c. Oestrus duration (hrs):
d. Age at 1 mating (months):
e. Age at 1 calving (months):
f. Interval from calving to Ist conception (days):
g. No. of services/ conception:
h. Calving interval (days):
i. Gestation length (days)
j. No. of calvings :

Reproduction (Males)

a. Age at training of bull:
b. Age at first ejaculation/ mounting (days):
c. Age at first mating (N.S.):

d. Age at first collection of quality semen(AI) :

Abnormalities

a. Twinning :
b. Dystocia :
c. Placental retention :
d. Abortions :
e. Still births :
f. Postgestational mortality :
g. Others(Specify) :

Type of Work

a. Drought tolerance
   (Allocate grades 1 to 5, 1=high)
b. Heat tolerance
   (Allocate grades 1 to 5, 1=high)
c. Purpose: ploughing(1)/ threshing(2)/ power(3)/ etc
d. Capacity for work : hard(1)/ medium(2)/ light(3)
e. Average duration of work per day (hrs):

QUESTIONNAIRE 4: Milk Recording

Name :	s/ o :	Village :
Block :	District :	Milk recorder :
Animal No :	Breed :	Date of Birth/Age
Homebred/ purchased:		

1. Age at first service:
2. Order of lactation
3. Age of first conception:
4. Date of calving:
5. Age/date at first calving:
6. Sex of calf & No : weaned/unweaned
7. Date of conception:
8. No. of services: Natural/A.I
9. Date of drying:

S.No.	Date of Recording	Milk Yield		Total Fat%	SNF	Remarks/Sign.
		Morning	Evening			

ANNEXURE 3

QUESTIONNAIRES FOR SURVEY OF SHEEP GENETIC RESOURCES

QUESTIONNAIRE 1: General Information about the householder and animals maintained (only once).

Allotted No.:	Name of Farmer :	
Date of visit :	District/ Stratum :	Tehsil/ Taluka/ Zone :
Village :	Code :	Household Number :
Community :		
Ag. Holding (acres) :	Non-irrigated :	
Fodder (Grown(I)/ Not (2)) :		
Annual income (Rs.) :		
No. of family members :	Male	Female
No. of literate members :	Name of Enumerator :	

INFORMATION ABOUT ANIMALS

Species	Breed	Sex	Category (upto 6 M/ 6-12 M/ 1Y & above)	Number of Animals	Purpose

QUESTIONNAIRE 2: Data on management practices. (only once for each house flock basis)

Allotted No. & Name of Farmer : Date of visit :
Name of Enumerator :

1. Flock information:
   Rams: Entire Castrated Ewes Lambs
   Migratory/Stationery Migration to (Place) Distance km
   Migration period From month to month
   Flock size (Migratory): No. of persons with migratory flock:
   Feed Resources during migration:

2. Housing During day (I)/ night (2)/ both day & night (3)/ none (4):
   a. Open (I)/ closed(2): b. Flooring Kutcha (I)/ Pucca (2):
   c. Soil replacement Interval (months): d. During extreme seasons (rainy, winter):
   e. During lambing: f. Period of confinement after lambing:

3. Seasons:
   Breeding season:
   Lambing season:
   Percent lambing:
   Shearing season(s)/ Periods:
4. Diseases:
   Common disease: Treatment Type (Herbal/Allopathic/ Local)

Type	Month	Chemical/Biological agent
Drenching		
Dipping		
Vaccination against (name)		

5. Expenditure: Grazing Health cover Shearing Others
6. Income:

Income from sale of	No/ Quantity	Rate	Amount	Mode
Wool				
Sheep				
Manure				
Others (specify)				

7. Disposal of surplus animals Number Age Mode
   1.Sale: Slaughter
   2.Home consumption
   3. Other

QUESTIONNAIRE 3 :Feeding & other management practices (once in a quarter on flock basis)

Allotted No.:
Name of Farmer : Date of Visit :
Name of Enumerator :

1. Feeding: Abundant/ Scarcity
2. Grazing:
   i. Day (continuous/ interrupted) ii. Night (continuous/ interrupted)
   iii. Distance (km) iv. Time
3. Practice of feeding:
   Stall fed (I)/ Semi stall fed (2)/ Grazing (3)
   Part feeding/ Part feeding during Scarcity/No feeding
4. Supplementation: (Yes/ No)
   Type of supplementation: Green fodder/dry/fodder/conc./others (specify)
5. Feed:

Time of feeding	Type of feeding	Name of fodder	Quantity (kg)
Morning			
Noon			
Evening			

QUESTIONNAIRE 4: Physical traits, Wool production & quality (only once)

Allotted No.:
Name of Farmer : Date of visit :
Name of Enumerator :
Animal No : Breed : Classification :
Sex Male(I)/Female(2) :
Date of birth : Age :
Ewe No.: Ram No :
Purpose of breed: Wool- Apparel(I)/ Carpet(2)/ Course(3)
Meat(4)/ Skin(5)/ Milk(6)/ Others (specify)

1. Body Colour % Surface area

2. Horns Present(I)/ Absent(2)
   a. Colour: Black(I)/ Brown(2)/ White(3),Other (specify):
   b. Size (cms):
   c. Shape(straight(I)/ curved(2):
3. Ears
   a. Length(cms):
   b. Orientation: (horizontal(I)/ Pendulous(2)/ erect(3):
4. Head
   a. Forehead(Convex(I)/ Concave(2)/ Straight(3):
   b. Any other peculiar characters (specify):
   c. Wattles(Present(I)/ Absent(2)):
   d. Beard (Present(I)/Absent(2):
5. Tail
   a. Type: b. Shape c. Length Short(I)/ Medium(2)/ Long(3)
6. Coat
   (a) Type: (Hair(I) / Wool(2):....
7. Information at shearing time
   a. Age by dentition
   b. Body weight
   c. Body measurements Chest girth Body length Ht. at withers
   d. Wool production (Sampling site - Mid side)
      i) Wool cover -bare(I)/ covered (2) a. Head b. Face c. Belly d. Legs
      ii) Type (Apparel/ Carpet/ Coarse)
      iii) Duration of clip (months)
      iv) Greasy fleece wt. (kg
      v) Fibre diameter (micron)
      vi) Medullation percentage Hetero Hairy
      vii) Staple length (cms)
      viii) Lusture (lusturuous/ non-lustutrous)
      ix) Canary coloration (Yes/ No)

QUESTIONNAIRE 5: Production and Reproduction traits

Allotted No. :			
Name of Farmer :	Date of visit :		
Name of Enumerator :			
Animal No. :	Breed :	Classification :	
Sex Male (I)/ Female (2) :			
Date of birth :	Age :	Ewe No :	Ram No :

1. Body weights
   a. Birth weight :
   b. Weaning weight with age :
   c. 3 month weight :
   d. 6 month weight :
   e. 12 month weight :
   f. Weight at Ist Lambing :
   g. Weight at marketing :
   h. Age at marketing (mo) :

2. Body measurements

Measurement	Birth	Weaning	At marketing with age
Chest girth			
Body length			
height at withers			

3. Reproduction

(a) Male
   (a) Age at first mating (months):
   (b) Any abnormality of testes (Cryptorchidism)

(b) Female
   (a) Age at 1 oestrous (months):
   (b) Oestrous cycle duration (days):
   (c) Oestrus duration (hrs):
   (d) Age at Ist mating (months):
   (e) Age at Ist Lambing (months):
   (f) Interval from Lambing to Ist conception (days):
   (g) Lambing interval (days):
   (h) Gestation length (days):
   (i) Seasonality: Yes (I)/ No(2), If yes, indicate season: Summer(1)/ Rainy(2)/ Winter(3):
   (j) Lifetime No. of lambing :
   (k) Litter size :

4. Abnormalities:
   (a) Abortions:
   (b) Placental retention:
   (c) Still births:
   (d) Post-gestational mortality:
   (e) Others (specify):

5. Carcass characters
   (a) Age at slaughter (months):
   (b) Weight at slaughter (kg):
   © Carcass weight (kg) :

6. Skin Production	Lamb	Adult
(a) Skin wt (kg):	Dry	
	Wet	
(b) Skin length (kg) :		
(c) Skin width :		
(d) Defects :		

7. Milk production
   (a) 7th day of lactation :
   (b) 50th day of lactation :
   (c) Any abnormality of teats (Supranumary etc.)

ANNEXURE 4

QUESTIONNAIRES FOR SURVEY OF GOAT GENETIC RESOURCES

QUESTIONNAIRE 1.General information about the household, management practices and animals maintained (only once)

Allotted No	Name of farmer
Date of visit :	Qr.No.1/ 2/ 3/4/:
District/ Stratum :	Tehsil / Taluka / Zone:
Village :	Code:
Household Number :	Community:

GENERAL INFORMATION

Ag. Holding (acres): Unirrigated:

Fodder (Grown(1)/ Not(2):

Annual income(Rs.):

No. of family members : Male: Female:

No. of literate members : Name of Enumerator:

A. Flock information:

Bucks. Entire Castrated Doe Kids

Migratory/stationery :

Migration to : (Place) (Distance in Km)

Migration period From month to month

B. Management practices :

1. Housing:

during day(1)/ night(2)/ both day & night(3)/ none(4):

a) Open (1)/ closed(2): b) Kutcha (1)/ Pucca(2):

c) Separate (1)/ part of residence(2): d) Flooring Kutcha(1)/ Pucca(2):

e) Full walled (1)/ half walled(2): f) Well ventilated Y(1)/ N(2):

g) Pucca drain for urine to drain out Y (1)/ N (2):

2. Fodder:
   Chaffed (1)/ unchaffed (2):
   Green Fodder:
   Dry Fodder:

3. Cleaning of milking utensils Y(1)/ N(2):....
4. Udders washed before milking Y(1)/ N(2):

5. Disease Treatment Herb (1)/ Allop (2)/ Local(3)

6. Vaccination

7. Information about animals

Species	Breed	Sex	Category (up to 6 mo/6-12 mo/1 yr & above)	No. of Animals	Purpose

QUESTIONNAIRE 2: Feed and other management practices (once in a quarter on flock basis)

Allotted No. :
Name of farmer : Date of visit :
Name of Enumerator :

1. Grazing Distance(km) Time(hrs)
   Morning
   Evening

2. Individual(1)/ Group feeding (2):
3. Source of fodder: home grown(1)/ purchased(2)/ collected from field (3):
4. Feed:

	Morning		Noon		Evening	
	Name	Qty(kg)	Name	Qty(kg)	Name	Qty(kg)
Green fodder						
Dry fodder						
Concentrate						
Minerals						

5. Water: Adequate(a)/ inadequate (2):
   Quantity:
6. Practice of feeding:
   Stall fed(1)/ semi stall fed(2)/ grazing(3):
   Part feeding/ Part feeding during scarcity/ No feeding:

QUESTIONNAIRE 3: Physical and qualitative traits (Individual animals)

Allotted No.:
Name of farmer : Date of visit :
Name of Enumerator :

Animal No.: Classification :
Sex Male(1)/ female(2) : Date of birth : Age :
Doe No.: Buck No.:
Purpose of breed : milk(1)/ meat(2)/ fibre(3)/ others(specify):

1. Colour Name %surface area
   a. Coat (hair):
   b. Skin:
   c. Muzzle:
   d. Eyelids:
   e. Hoofs:

2. Horns
   Present(1)/Absent(2)
   a. Colour: Black(1)/ Brown(2)/ White(3)/ others(specify):
   b. Size (cm):
   c. Shape: Straight (1)/ Curved (2):
   d. Orientation:

3. Ears
   a. Length(cms):
   b. Orientation: Horizontal(1)/ Pendolous(2)/ Erect(3):

4. Head
   a. Forehead: convex(1)/ concave(2)/ straight(3)
   b. Any other peculiar character (specify):
   c. Wattles: present(1)/ absent(2):
   d. Beard: present(1)/ absent(2):

5. Tail
   a. Type:
   b. Shape:
   c. Length. Short(1)/ medium(2)/ long(3):

QUESTIONNAIRE. 4: Milk recording (fortnightly)

Allotted No :
Name of farmer : Date of visit :
Name of Enumerator:

Animal No. Doe No. :
Buck No.:
Date of birth: Date of last kidding: Lactation No.:

1. Milk yield

	Milk yield(kg)			Time(min.)			Milk fed to kid		
Fortnight & date	M	E	Total	M	E	Total	M	E	Total
1.									
2.									
3.									

2. Milk samples

Time M(1)/ E(2)	date of testing	Fat%	SNF%	Specific gravity
1				
2				
3				
4				
5				

QUESTIONNAIRE. 5: Growth, reproduction, mohair/pashmina and hair production traits (once a month)

Allotted No.:		
Name of farmer :		Date of visit :
Name of Enumerator :		
Animal No.:	Breed :	Classification :
Sex: Male(1)/ Female(2)	Date of birth:	
Age :	Doe No.:	Buck No.:

1. Body weights(kg)
   a. Birth weight:
   b. Weaning weight:
   c. 3 month weight:
   d. 6 month weight:
   e. 12 months weight:
   f. Slaughter weight:
   g. Weight at 1st kidding:

2. Body measurements (cm)

Measurement	Birth	Weaning	6 months	1 year
Chest girth				
Body length				
Height at withers				

3. Reproduction traits
   a. Age at 1st oestrous (months):
   b. Oestrous cycle duration (days):
   c. Oestrous duration (hrs):
   d. Age at Ist mating (months):
   e. Age at Ist kidding (months):
   f. Age at weaning (months):
   g. Interval from kidding to Ist conception (days):
   h. Kidding interval (days):
   i. Gestation length (days):
   j. Seasonality :
      Summer(1)/ Rainy(2)/ Winter(3)/ No(4):
   k. Lifetime No. of successful mating :
   l. Litter size :

Abnormalities: (Indicate no.)

a. Abortions:
b. Placental retention:
c. Still births:
d. Post-gestational mortality:
e. Others (specify):

QUESTIONNAIRE. 6: Carcass characters and skin production traits (once a month)

Allotted no. :		
Name of farmer/ Slaughter house:		Date of visit:
Name of Enumerator:		
Animal No.:	Breed :	Classification:
Sex Male (1)/ Female (2):	Doe no. :	Buck no. :

1. Carcass characters
    a. Age at slaughter (months):
    b. Weight (kg):
    c. Carcass weight (kg):

2. Skin production
    a. Skin weight (kg):
    b. Skin length (cm):
    c. Skin width (cm):

ANNEXURE 5

QUESTIONNAIRES FOR SURVEY OF PIG GENETIC RESOURCES

QUESTIONNAIRE 1.General information about the household, management practices and animals maintained (only once)

Allotted No.:	Name of farmer :	
Date of visit:	Qr.No.1/ 2/ 3/ 4 :	
District/ Stratum:	Tehsil / Taluka/ Zone:	
Village:	Household Number:	Community:
Agricultural Holding (acres):	Un-irrigated:	
Annual income (Rs.):		
No. of family members :	Male:	Female:
No. of literate members :		
Name of Enumerator :		

A. Herd information :

Boars: Entire Castrated Sow Piglets

B. Management practices:

1. Housing:

during day(1)/ night(2)/ both day & night(3)/ none(4):

a) Open(1)/ closed(2):
b) Kutcha (1)/ Pucca(2):
c) Separate (1)/ part of residence(2):
d) Flooring Kutcha (1)/ Pucca(2)/ Wooden(3):
e) Full walled (1)/ half walled(2):
f) Well ventilated Y(1)/ N(2):
g) Pucca drain for urine to drain out Y(1)/ N(2):

2. Fodder:

Kitchen Waste/ Vegetable waste:
Raw/ Cooked

3. Disease : Treatment Herb (1)/ Allopathic (2)/ Local(3)

4. Vaccination :

5. Information about animals :

Species	Breed	Sex	Number of Animals			Purpose
			Up to 2 M	2-8 M	Adult	

Others
(only total number)

QUESTIONNAIRE 2: Feed and other management practices (once in a quarter on herd basis):

Allotted No.:
Name of farmer : Date of visit:
Name of Enumerator :

1. Scavenging Distance (km) Time (hrs)
   Morning
   Evening

2. Individual (1)/ Group feeding(2):

3. Source of fodder: home grown (1)/ purchased(2)/ collected from field (3):

4. Water: Adequate(a)/ inadequate (2):
   Quantity:

5. Practice of feeding:
   Stall fed (1)/ Semi stall fed(2)/ Scavenging (3):
   Scavenging with supplementation of kitchen/ vegetable waste

QUESTIONNAIRE 3: Physical and qualitative traits (Individual animals)

Allotted No.:		
Name of farmer :		Date of visit :
Name of Enumerator :		
Animal No.:		
Sex Male (1)/ female(2):	Date of birth :	Age:

1. Colour	Name	%surface area
a. Coat(hair):		
b. Skin :		
c. Muzzle :		
d. Eyelids :		
e. Hoofs :		
f. Any other marking :		

2. Ears
   a. Length (cms):
   b. Orientation: Horizontal(1)/ Pendulous(2)/ Erect(3):

3. Head
   a. Snout: convex(1)/ concave(2)/ straight(3)
   b. Any other peculiar character (specify):

4. Tail
   a. Shape :
   b. Length. Short(1)/ medium(2)/ long(3):

QUESTIONNAIRE. 4: Growth, reproduction and hair production traits (once a month)

Allotted No.:		
Name of farmer :		Date of visit :
Name of Enumerator :		
Animal No.:	Breed :	
Sex: Male (1)/ Female (2).	Date of birth:	Age:

1. Body weights (kg)
   a. Birth weight :
   b. Weaning weight :
   c. 3 month weight :
   d. 6 month weight :
   e. 12 months weight :
   f. Slaughter weight :
   g. Weight at 1st furrowing :

2. Body measurements(cm)

Measurement	Birth	Weaning	6 months	1 year
Chest girth				
Body length				
Height at withers				
Neck girth				

3. Reproduction traits
   a. Age at 1st oestrous (months):
   b. Oestrous cycle duration (days):
   c. Oestrous duration (hrs):
   d. Age at Ist mating (months):
   e. Age at Ist furrowing (months):
   f. Age at weaning (months):
   g. Interval from furrowing to Ist conception (days):
   h. Furrowing interval (days):
   i. Gestation length (days):
   j. Seasonality: Summer(1)/ Rainy(2)/ Winter(3)/ No(4):
   k. Lifetime No. of furrowing:
   l. Litter size at birth : at weaning :
   m. Litter weight

4. Abnormalities: (Indicate no.)
   a. Abortions: b. Placental retention:
   c. Still births: d. Adult mortality: e. Others (specify):

QUESTIONNAIRE 5: Carcass characters and skin production traits

Allotted No.:	
Name of farmer/ Slaughter house :	Date of visit :
Name of Enumerator :	
Animal No.:	Breed :
Sex Male (1)/ Female (2) :	

1. Carcass characters
    a) Age at slaughter (months):
    b) Live Weight (kg):
    c) Carcass weight (kg):
    d) Carcass length
    e) Dressing % (Hot/ cold)
    f) Meat bone ratio
    g) Fat thickness
    h) Lean %
    i) Fat %
    j) Bone %
    k) Feed Conversion Efficiency

ANNEXURE 6

QUESTIONNAIRES FOR SURVEY OF POULTRY GENETIC RESOURCES

QUESTIONNAIRE 1: General information about the householder and birds maintained by him (only once)

Allotted No.:	Name of Farmer :
Date of visit :	Order No. 1/ 2/ 3/ 4 :
District/ Stratum:	Tehsil/ Taluka/ Zone :
Village :	Code :
Household No.:	Community :
Name of Enumerator :	

GENERAL INFORMATION

Ag. Holding (acres) : Irrigated (acres) :

Annual income (Rs.) :

No. of family members :

No. of literate members :

No. of members engaged in poultry :

FLOCK INFORMATION

Population of different categories of birds (Actual No.)

Breed/ Non-descript	Up to 5 months Cockrell	Pullet	Above 5 months Cocks	Hens	Utility (eggs/meat/both/ game/others)
Fowls					
Ducks					
Others					
Total					

QUESTIONNAIRE 2. Data on management practices (only once for each house)

Allotted No.:	
Name of Farmer :	Date of visit :
Qr. No.1/ 2/ 3/ 4 :	
District/ Stratum :	Tehsil/ Taluka/ Zone..
Village :	Code :
Household number :	Community :
Name of Enumerator :	

1. (a) Disease Treatment Herbal(1)/Allopathic (2)/ Local(3)
   (b) Vaccination

2. Flock information

Farm type	No. of flocks	Flock type (Breeding stock/ Commercial/Both	Size Small/ Medium/ Large 1-50),(50-500),(>500)
Govt.			
Private			
Others			

3. Type of Management
   a) Intensive production
   b) Backyard or farmyard production

4. Housing

During day(1)/ Night(2)/ Both(3)/ None(4):

   a) Confinement housing, litter floor/ slot or wire floor/ cage/ battery
   b) Type of housing:
   I Pucca/ kutcha/ others:
   ii) Single storied/ Multi storied:

5. Feeding
   a) Scavenging/ Scavenging with supplementation of kitchen waste/ Scavenging with supplementation of formulated feed/ both
   b) Free ranging/ free ranging with supplemental feeding
   c) Full feeding with local feeds/ manufactured concentrate/ both
   d) Others

Time of feeding (Morning/ Noon/ Evening)

6. Feed

	Name	Qty (Kg)
Green fodder		
Concentrates		
Minerals		
Others		

7. Water

Adequate(1)/ Inadequate(2)

Water Source (Name):

8. Mortality(%)

a) 0-1 weeks

b) 1-4 weeks

c) 4-8 weeks

9. Stress tolerance

a) Stress tolerance (Allocate grades, 1-5, 1=high)

b) Heat tolerance (Allocate grades 1-5, 1= high)

QUESTIONNAIRE 3. Physical traits (for each bird)

Allotted No.:		
Name of Farmer :	Date of visit :	Qr. No.1/ 2/ 3/ 4 :
District/ Stratum :	Tehsil/ Taluka/ Zone :	
Village :	Code :	
Household number :	Community :	
Name of Enumerator :		
Bird No. :	Breed :	Classification :

1. Plumage colour
   White/ Black/ Red/ Blue/ Brown/ Gold/ Others(Specify):

2. Pattern
   Solid/ Dull/ Stripped/ Patchy/ Spotted/ Barred/ Other (Specify):

3. Skin Colour
   White/ Yellow/ Blue/ Black/ Other:

4. Shank Colour
   White/ Yellow/ Black/ Blue/ Green/ Other:

5. Earlobe Color
   White/ Red/ Black/ White and Red/ Others (Specify):

6. Comb Color
   Black/ Red/ Others(Specify):

7. Eye Colour
   Grey/ Black/ Brown/ Others (Specify):

8. Comb type
   Single/ Pea/ Rose/ Walnut/ Cushion/ Strawberry/ Duplex/ V-shaped/ double:

9. Other Specific visible traits
   (e.g. dwarfism, feathered legs, naked neck, silky frizzle, multiple spurs, etc.)

QUESTIONNAIRE 4. Data on performance characteristics

Allotted No. :		
Name of Farmer :	Date of visit :	Qr. No.1/ 2/ 3/ 4 :
District/ Stratum :	Tehsil/ Taluka/ Zone :	
Village :	Code :	
Household No.:	Community :	
Name of Enumerator :		
Bird No :	Breed :	Classification :

1. Egg Production:
   a) Age at first egg (days)
   b) Age at 50% production (days)
   c) Age at culling (days
   d) Total eggs
   e) Egg quality traits

Date	Egg No.	Egg wt.	Shell colour W/B/ C/O	Shell strength strong/ brittle	Albumin qlty: thick/thin	Blood spots	Meat spots	Albumin index	Yolk index	Haugh unit	Shell wt.	Albumin wt.	Yolk. wt	Sp. gravity

2. Reproduction:
   a) Broodiness (usual/ sometimes/ rare/ others)
   b) Fertility and hatchability
      I Fertility %
      ii) Hatch of fertile eggs %
      iii) Hatch of total eggs %

3. Growth

a) Body weights at different age

Age	Weight(g)	Age	Weight (g)
0 day		16 weeks	
1 week		18 weeks	
2 weeks		20 week	
3 weeks		6 months	
4 weeks		7 months	
6 weeks		8 months	
8 weeks		9 months	
10 weeks		10 months	
12 weeks		11 months	
14 weeks		12 months	

b) Age at slaughter (days)

c) Weight at slaughter (g)

d) Feed utilization

Kg feed/ Kg gain (0-8 weeks)

Kg feed/ Kg gain (8-12 weeks)

Kg feed/ Kg gain (n-n weeks)

4. Egg production curve

ANNEXURE 7

APPLICATION FOR REGISTRATION OF LIVESTOCK AND POULTRY BREEDS

(To be submitted to The Director, NBAGR, Karnal- 132001, Haryana)

Please refer to guidelines for filling the application form appended and Codes

1. Application status (Code) | N | R |

2. Species name

3. Breed name

4. Origin

IN	EX	CR	SY	OT

5. Criteria for registration [Distinct feature(s)]

6. Documentary evidence

PR	IR	OR

For Use of NBAGR

(i) Application number

(ii) Date of application

(iii) Whether new or revised?

N	R

(iv) If revised, Date of 1st Application

(v) Action taken

a) Forwarded for registration
b) Sent for validation
c) Incomplete, sent for revision

(vi) Whether registered or rejected

(vii) Date of registration or rejection

(viii) Registration Number

(ix) Notified on:

(x) Remarks

7. Particulars of community/agency/scientist(s)/breeders/farmers who evolved and maintained the breed

8. Name and address of the corresponding person

Name (Dr./Ms/Mr.)

Designation

Address

Tel- Fax- E-mail

9. Passport information of the breed

Place of origin (Tehsil/ Distt/ Province)	Present area of distribution	Utility

Approximate population	No. of Breedable Males	No. of Breedable females

Remarks

Farmers/ community contributions, if any

Parent Stock / Pedigree involved in breed development

Method of development

SB	CB	UG	OT

Organised Herd/Breed Society, if any

10. Salient Characteristics (attach detailed description as per Breed Descriptor performa)

11. Additional Information/ Remarks (if any)

UNDERTAKING

I/We undertake to ensure long term conservation of the aforesaid breed in its natural habitat and to provide required germplasm/genetic stock to NBAGR; its sustainable use by maintaining appropriate numbers and providing access as appropriate on prior informed consent and on mutually agreed terms. I/We also agree to provide any further information or data pertaining to the description and unique characteristics to the ICAR/NBAGR in a transparent manner.

COUNTERSIGNED by Director
Department of Animal Husbandry
Of the concerned state or his representative

Signatures

Full Name

Designation & Address

Ph Fax

E-mail

SEAL

SIGNATURES of the Applicant (s)
Name
Designation & Address
Ph Fax

E-mail

Guidelines for filling Application and description of Codes

1. Use capital letters or write legibly. All items are self-explanatory. Give explanation for a particular item in "Remarks" wherever needed.
2. Use Codes for filling in *Item 1, 4, 6 and* 9. In case of the code "Other" fill in specific details.
3. For filling species and breed name (*Item 2 & 3*) give English or Hindi name, if known. In case a local name is given then also specify in parenthesis the language or dialect in which this name is used.
4. Be to the point for *Item 5*, give only the distinct features, traits or products/bye-products, considered suitable for consideration of registration.
5. Give particulars of organisation associated with development of the breed in *Item 7*. Attach separate sheet for additional names along with address and phone/fax/email, etc.
6. Give particulars of developers in *Item 7* and that corresponding person in Item 8 as the applicant and developer may not be always the same.
7. Item 9 has passport information of the breed. Give clearly place of origin, present area of distribution (state, district), utility ((milk, egg, wool, meat, draught power, etc.), Approximate population including number of breedable males and females, Parent stock/Pedigree involved in development of the breed, Also give breeding method used.
8. Give detailed description of traits & characteristics of the material in Item 10. Follow the format of descriptor for the respective species.
9. Undertaking to the effect ensuring conservation and maintenance of the breed for facilitating access and sustainable use has been given, which may be read and implied before putting signatures.
10. Furnish the application form complete in all respects along with requisite documents to *The Director, NBAGR, P O Box 129, Karnal* – 132 001 (*Haryana*)

Codes for filling information in Col. 1, 4, 6 and 9

Item 1 : Application Status		Item 6 : Documentary evidence	
N	New	PR	Published literature
R	Revised	IR	Institute annual report
		OR	Any other report
Item 4 : Origin			
IN	Indigenous	Item 9 : Method of development	
EX	Exotic	SB	Selective breeding
CR	Crossbred	CB	Crossbreeding
SY	Synthetic	UG	Upgrading
OT	Others (Specify)	OT	Others (Specify)

ANNEXURE 8

APPLICATION FOR REGISTRATION OF CHICKEN VARIETIES/STRAINS/LINES

(To be submitted to The Director, NBAGR, Karnal- 132001, Haryana)

Please refer to guidelines for filling the application form appended and Codes

1. Application status (Code) | N | R |

2. Species name

3. Variety/ Strain/ Line name

4. Origin

IN	EX	CR	SY	OT

5. Criteria for registration [Distinct feature(s)]

6. Documentary evidence

PR	IR	OR

For Use of NBAGR

(i) Application number

(ii) Date of application

(iii) Whether new or revised?

N	R

(iv) If revised, Date of 1st Application

(v) Action taken

a) Forwarded for registration
b) Sent for validation
c) Incomplete, sent for revision

(vi) Whether registered or rejected

(vii) Date of registration or rejection

(viii) Registration Number

(ix) Notified on:

(x) Remarks

7. Particulars of the organization that evolved and maintained the Variety/ Strain/ Line

8. Name and address of the corresponding person

Name (Dr./ Ms/ Mr.)

Designation

Address

Tel- Fax- E-mail

9. Passport information of the Variety/ Strain/ Line

Address of Organization where developed	Place of availability	Specific Utility Traits

Approximate population	No. of Breedable Males	No. of Breedable

Remarks

Schemes/ Contributions, if any

Parent Stock / Pedigree involved in breed development

Method of development

SB	CB	UG	OT

Organised farm/ flock (s), if any

10. Salient Characteristics (attach detailed description as per Descriptor performa)

11. Additional Information/ Remarks (if any)

UNDERTAKING

I/We undertake to ensure long term conservation of the aforesaid Variety/ Strain/ Line and to provide 50 blood samples to NBAGR; its sustainable use by maintaining appropriate numbers and providing access as appropriate on prior informed consent and on mutually agreed terms. I/We also agree to provide any further information or data pertaining to the description and unique characteristics to the ICAR/NBAGR in a transparent manner.

COUNTERSIGNED by Head
of organization
Designation & Address
Ph Fax
E-mail
SEAL

SIGNATURES of the Applicant (s)
Name
Designation & Address
Ph Fax
E-mail

In case of Non-Govt. Organisations
COUNTERSIGNED by Director, Department of Animal Husbandry of the concerned State or his representative

Signatures
Full Name
Designation & Address
Ph Fax
E-mail
SEAL

Guidelines for filling Application and description of Codes

1. Use capital letters or write legibly. All items are self-explanatory. Give explanation for a particular item in "Remarks" wherever needed.
2. Use Codes for filling in Item 1, 4, 6 and 9. In case of the code "Other" fill in specific details.
3. For filling species and variety/ strain/ line name (Item 2 & 3) give English or Hindi name, if known. In case a local name is given then also specify in parenthesis the language or dialect in which this name is used.
4. Be to the point for Item 5, give only the distinct features, traits or products/bye-products, considered suitable for consideration of registration.
5. Give particulars of organisation associated with development of the variety/strain/line in Item 7. Attach separate sheet for additional names along with address and phone/fax/email, etc.
6. Give particulars of corresponding person in Item 8.
7. Item 9 has passport information of the variety/ strain/ line. Give clearly place of origin, places of availability (state, district, etc.), specific utility trait(s), Approximate population including number of breedable males and females, Parent stock/Pedigree involved in development of the variety/strain/line, Also give method of development in codes described below
8. Give salient characteristics of the Variety/ Strain/ Line in Item 10. Attach detailed characteristics in the prescribed descriptor.
9. Undertaking to the effect ensuring conservation and maintenance of the Variety/ Strain/ Line for facilitating access and sustainable use has been given, which may be read and implied before putting signatures.
10. Furnish the application form complete in all respects along with requisite documents to The Director, NBAGR, P O Box 129, Karnal – 132 001 (Haryana)

Codes for filling information in Col. 1, 4, 6 and 9

Item 1 : Application Status		Item 6 : Documentary evidence	
N	New	PR	Published literature
R	Revised	IR	Institute annual report
		OR	Any other report
Item 4 : Origin			
IN	Indigenous	Item 9 : Method of development	
EX	Exotic	SB	Selective breeding
CR	Crossbred	CB	Crossbreeding
SY	Synthetic	UG	Upgrading
OT	Others (Specify)	OT	Others (Specify)

ANNEXURE 9

BREED DESCRIPTOR FORMAT FOR CATTLE AND BUFFALO BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name/ origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution
   c. Place(s) State District(s)

8. Estimated population
   a. Year of estimation
   b. Population
   c. Source / Reference
9. a. Communities responsible for developing the breed
   b. Description of community (Farmers/ nomads/ isolated/ tribals)
10. Herd Book/ Register established (Yes/ No)
11. Herd: Average size …
    Composition: Breeding females…. % Replacement females (1-3yrs) …. % Calves…. %
    Breeding bulls…. % Replacement males (1-3yrs) …. % Bullocks…. %
11. Utility of the breed
    (Milk/meat/draught/manure/other specify)
13. Basic temperament of the breed (docile/ moderate/ tractable/ wild)
14. Any other information

II. PHYSICAL CHARACTERS

1. Colour Male Female
   a. Coat Colour
   b. Skin
   c. Muzzle
   d. Eyelids
   e. Tail Switch

f. Hooves

2. Horns — Male — Female
   a. Colour
   b. Size
   c. Shape (Straight/ curved)
   d. Orientation
3. Ears
   a. Length
   b. Orientation (horizontal/ drooping)
4. Head
   a. Forehead (convex/ concave/ straight)
   b. General description
5. Body — Male — Female
   a. Hump (large/ medium/ small)
   b. Dewlap (large/ medium/ small)
   c. Naval flap (large/ medium/ small)
   d. Penis sheath flap (large/ medium/ small)
6. Udder
   a. Shape (bowl/ round/ trough/ pendulous)
   b. Udder size (large/ medium/ small)
   c. Teat shape (cylindrical/ funnel/ pear)
   d. Teat tip (pointed/ round/ flap)
   e. Milk vein (prominent/ not prominent)
7. Any other information

III. PERFORMANCE

1. Body Weight(kg)

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Birth Weight						
Pre-Weaning Weight						
12 month Weight						
24 month Weight						
Wt. at First mating						
Wt. at First calving						
Adult weight						

2. Body measurements (cm)

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Chest girth						
Body length						
Height at withers						

3. Dairy performance

Parameter	First Lactation			Overall		
	Average	Range	N	Average	Range	N
Daily milk yield (Kg)						
Peak milk yield (Kg)						
Lactation length (days)						
Lactation milk yield (Kg)						
Fat %						
SNF %						

4. Reproduction — Average — Range — N

a. Males
   - (i) Age at first ejaculation (months)
   - (ii) Age at first mating (months)

b. Females
   - (i) Age at first oestrus (month)
   - (ii) Oestrous cycle duration (days)
   - (iii) Oestrus duration (hrs)
   - (iv) Age at first mating (months)
   - (v) Age at first calving (months)
   - (vi) Service period (days)
   - (vii) Calving interval (days)

5. Draught performance
   - a. Purpose (ploughing, threshing, power etc.)
   - b. Physiological parameters — Before work — After work
     - Rectal temperature (°F)
     - Respiration rate /min
     - Pulse rate /min
   - c. Fatigue Score
     - Frothing

Leg in-coordination
Excitement
Inhibition of progressive movement
Tongue protrusion

d. Draught Power (HP)
e. Average duration of work per day (hrs)

6. Drought tolerance (Excellent/ Very Good/ Good/ Average/ Low)
7. Heat tolerance (Excellent/ Very Good/ Good/ Average/ Low)
8. Any other information specific to the breed

ANNEXURE 10

BREED DESCRIPTOR FORMAT FOR GOAT BREEDS

I. GENERAL INFORMATION

1 Name of the breed
2. Synonyms
3. Background for such a name/ origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds (in appearance)
7. Classification
   a. Size (Small/ Medium / Large)
   b. Utility (Mutton/ Milk/ Dual/ Fibre/ Hair or any other)
8. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District
9. Estimated population
   a. Population
   b. Year of estimation
   c. Source/reference
10. a. Community responsible for developing the breed
    b. Description of community (Farmers/ nomads/ isolated tribals)
11. Flock: Average size …
    Composition: Doe … % Bucks…. % Kids …… %
12. Any other information

II. PHYSICAL CHARACTERS

	Male	Female
1. Colour		
Distinctive colour markings, if any:		
2. Head profile (straight/ convex/ slightly convex)		
3. Ears (erect/ pendulous/ horizontal)		
4. Wattles (present/ absent)		
5. Horns		
a. Number		
b. Shape		
c. Orientation		
d. Size (Small < 15/ medium 15-25/ large > 25 cm)		
6. Coat type (hair/ cashmere/ pashmina/ mohair)		
7. Beard (present/ absent)		
8. Any other information		

III. PERFORMANCE

1. Body weight (kg)

Weight at	Male			Female		
	Average	Range	N	Average	Range	N
Birth						
Weaning/3 months						
6 month						
1 Year						
First Kidding						
6 teeth (Adult)						

2. Body measurements (cm)

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Chest girth						
Body length						
Height at withers						

3. Carcass characters

Trait	Average	Range	N
Age at slaughter (months)			
Weight at slaughter (kg)			
Dressing % (Hot)			
Dressing % (Cold)			

4. Dairy performance

Trait	Average	Range	N
Daily milk yield (g)			
Total lactation milk yield (kg)			
Lactation length (days)			
Fat (%)			
SNF (%)			

5. Reproduction — Average — Range — N

   a. Age at first mating in males (days)
   b. Age at first oestrus (days)
   c. Oestrous cycle duration (days)
   d. Age at first mating in females (days)
   e. Age at first kidding (days)
   f. Kidding interval (days)
   g. Service period (days)
   h. Litter size
   i. Lifetime number of kidding

6. Fibre characteristics

   a. Age at shearing/ combing/ collection/ clipping (months)
   b. Type of fibre (Mohair (True/ heterotype/ Kemps)/ Cashmere/ Pashmina/ Hair)
   c. Fleece Colour

Trait	Average	Range	N
Greasy fleece weight (g)			
Clean fleece weight (g)			
Staple length (cm)			
Fibre diameter ( )			

7. Any other information

ANNEXURE 11

BREED DESCRIPTOR FORMAT FOR SHEEP BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name/ origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District

8. Estimated population
   a. Year of estimation
   b. Population
   c. Source/ Reference
9. a. Communities responsible for developing the breed
   b. Description of community (Farmers/ nomads/ isolated/ tribals)
10 Flock: Average size ….
   Composition: Ewes … % Rams…. % Lambs …… %
11. Utility of the breed [Fibre (Apparel/ Carpet/ Coarse)/ Meat/ Milk/ Skin/ Fur (lamb skins)/ Pelt/ Transport/ Manure/ Others (specify)]
12. Any other information

II. PHYSICAL CHARACTERS

1. Colour
   Distinctive colour markings, if any
2. Head profile (straight/ slightly convex/ convex)
3. Ears (erect/ pendulous/ horizontal)
4. Wattles (present/ absent)

5. Horns
   a. Number
   b. Colour
   c. Shape
   d. Orientation
   e. Size (small < 15/ medium 15-25 /large > 25 cm.)
6. Coat
   a. Type (hair/ wool)
   b. Length (12-month fleece) (short <5/ medium 5-10/long >10 cm)
   c. Lustre (lustrous/ non-lustrous)
   d. Crimp / curl (straight/low crimp = < 4 / high crimp = > 4 cm.)
   e. Fineness (fibre diameter)(fine < 21/ medium 22-26 coarse >26 micrometers)
   f. Wool cover (covered/ bare)
      Head
      Face
      Belly
      Legs
7. Beard (present/ absent)

8. Tail
   a. Type
   b. Shape
   c. Length (short/ medium/ long)
9. Any other information

III. PERFORMANCE

1. Body weight (kg)

Weight at	Male			Female		
	Average	Range	N	Average	Range	N
Birth						
Weaning/ 3 months						
6 months						
1 year						
First lambing						
Adult weight						

2. Body measurements (cm)

Body measurement	Male			Female		
	Average	Range	N	Average	Range	N
Chest-girth						
Body length						
Height at withers						

3. Carcass characters

Body measurement	Male			Female		
	Average	Range	N	Average	Range	N
Age at slaughter (days)						
Weight at slaughter (kg)						
Carcass weight (kg)						
Dressing %						

4. Dairy performance

Trait	Average	Range	N
Daily milk yield (g)			
Total lactation milk yield (kg)			
Lactation length (days)			
Fat %			
SNF %			

5. Reproduction Average Range N

a. Age at first mating in males (days)
b. Age at first mating in females (days)
c. Age at first Oestrus (days)
d. Oestrus cycle duration(days)
e. Age at first lambing (days)
f. Lambing interval (days)
g. Service period (days)
h. Litter size
i. Lifetime lamb production

6. Wool production (true wool/ heterotypes/ hair/kemps)

a. Age at shearing (months)

b. Fleece colour

Trait	Average	Range	N
Greasy fleece weight (kg)			
Clean fleece weight (kg)			
Staple length			
Fibre diameter			
Medullation %			

7. Pelt production

Trait	Male			Female		
	Average	Range	N	Average	Range	N
Pelt weight (g)						
Pelt length (cm)						
Pelt width (cm)						

8. Any other information specific to the breed

ANNEXURE 12

BREED DESCRIPTOR FORMAT FOR CAMEL BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name / origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District
8. Estimated population
   a. Year of estimation
   b. Population
   c. Source/ Reference
9. a. Communities responsible for developing the breed
   b. Description of community (Farmers/ nomads/ isolated/ tribals)
10. Utility of the breed (Milk/ meat/ draught/ manure/ other specify)
11. Temperament (Active/ Dull)
12. Any other information

II. PHYSICAL CHARACTERS

	Male	Female
1. Coat color		
2. Body color		
3. Hair on ears and eye lid (Jheepra) (Absent/ Prominent/ Very Prominent)		
4. Hair length (Small/ Medium/ Large)		
5. Head		
a. Size (Small/ Medium/ Large)		
b. Stop (Well marked depression above the eyes) (Absent/ Prominent/ Very Prominent)		
c. Fore head (Normal / Prominent)		

d. Supra-orbital fossa
e. Muzzle
Type
Lips

6. Ears
   a. Length
   b. Orientation (horizontal/ drooping)
7. Body size(Small/ Medium/ Large)
8. Chest pad (Developed/ Not developed)
9. Hump size (Small/ Medium/ Large)
10. Udder (Round/ Pendulous)
11. Milk vein (Small/ Medium/ Large)
12. Any other information

III. PERFORMANCE

1. Body weight (kg) and measurement (cm)

Trait	Male			Female		
	Average	Range	N	Average	Range	N
Birth weight						
Adult weight						
Chest-girth						
Body length						
Height at withers						
Neck length						
Distance between eyes						
Length of fore leg						
Length of hind leg						
Foot pad length Fore						
Hind						
Length pad width Fore						
Hind						

2. Dairy performance

Parameter	First Lactation			Overall		
	Average	Range	N	Average	Range	N
Daily milk yield (kg)						
Peak milk yield (kg)						
Lactation length (days)						
Lactation milk yield (kg)						
Fat %						
SNF %						

3. Reproduction	Average	Range	N
a. Age at first mating in males (mo)			
b. Age at first mating in females (mo)			
c. Age at first Oestrus (mo)			
d. Oestrus cycle duration (mo)			
e. Age at first calving (mo)			
f. Calving interval (mo)			
g. Service period (mo)			

4.Hair production	Average	Range	N
a. Age at clipping (mo)			
b. Weight of clipping(kg)			
c. Hair length (cm)			
d. Hair diameter (μ)			

5. Draught capacity (Hard/ medium/ light)
6. Any other information specific to the breed

ANNEXURE 13

BREED DESCRIPTOR FORMAT FOR HORSE BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name/ origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District

8. Estimated population
   a. Year of estimation
   b. Population
   c. Source / Reference
9. a. Communities responsible for developing the breed
   b. Description of community (Farmers/ nomads/ isolated/ tribals)
10. Herd Book/ Register established (Yes / No)
11. Stud: Average size …
    Composition: Stallions…. % Mares …. % Foals…. %
12. Utility of the breed
    (Transportation/ riding/ sports/ others)
13. Any other information

II. PHYSICAL CHARACTERISTICS

1. Coat colour
2. Head Markings

3. Head
   a. Forehead (Convex/ Concave/ Flat)
   b. General description
4. Ears
5. Eyes
6. Back (Straight/ Concave/ Moderate)
7. Cannon
8. Fetlock, Pastern and Hoof
9. Tail Setting
10. Any other information

III. PERFORMANCE

1. Body weight (kg)

Weight at	Male			Female		
	Average	Range	N	Average	Range	N
Birth						
6 months						
1 year						
First foaling						
Adult weight (above 3 yrs)						

2. Body measurements (cm)

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Height at withers						
Height at croup						
Body length						
Girth						
Face length						
Face width						
Ear length						
Ear width						
Space between eyes						
Length fore arm						
Height at knee						
Height at hock						
Distance between fetlock and coronet						
Chest width						
Shank (Cir)						
Throat latch						
Poll to withers length						
Distance between withers to croup						
Distance between croup to head of tail						
Tail length						

3. Reproduction	Average	Range	N
a. Age at puberty in male (months)			
b. Age at first service in male (months)			
c. Age at first oestrus (months)			
d. Oestrus cycle duration (days)			
e. Oestrus duration (hours)			
f. Age at first covering (months)			
g. Age at first conception (months)			
h. Age at first Foaling (months)			
i. Service period (days)			
j. Foaling interval (months)			
k. Gestation period (days)			

4. Type of work
   a. Transportation
   b. Riding
   c. Games and sports
   d. Other activities (Horse safaris)

5. Any other information specific to breed

ANNEXURE 14

BREED DESCRIPTOR FORMAT FOR PIG BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name/ origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. Classification
   a. Short-eared
   b. Snout-length (long or short)
   c. Belly type (pot or flat)
8. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District

9. Estimated population
   a. Year of estimation
   b. Population
   c. Source/ reference
10. a. Communities responsible for developing the breed
    b. Description of community (Farmers/ nomads/ isolated/ tribals)
11. Flock: Average size …
    Composition: Sows … % Boars…. % Piglets …… %
12. Utility of the breed (Pork/ Hair/ Manure/ Others (specify)
13. Any other information

II. PHYSICAL CHARACTERS

1. Colour Male Female
   Distinctive colour markings
2. Snout profile (straight/ convex/ slightly convex/ concave)
3. Ears (erect/pendulous/ horizontal)
4. Coat
   a. Bristle (long/ medium/ short)
   b. Fineness (bristle diameter)
5. Hoof placement (partial/ full)
6. Top line (Straight/ concave)
7. a. Number of teats
   b. Teat position
8. Any other information

III. PERFORMANCE

1. Body weight (kg)

Weight at	Male			Female		
	Average	Range	N	Average	Range	N
Birth weaning						
3 months						
6 months						
1 year						
Slaughter						
First furrowing						
Adult weight						

2. Body measurements (cm)

Body Measurements	Male			Female		
	Average	Range	N	Average	Range	N
Chest girth						
Body length						
Height at withers						
Neck girth						

3. Carcass characters

Carcass characters	Male			Female		
	Average	Range	N	Average	Range	N
Age at slaughter (days)						
Carcass Weight (kg)						
Hot						
Cold						
Length (cm)						
Dressing %						
Hot						
Cold						
Meat: bone ratio						
Fat thickness						
Lean %						
Fat %						
Bone %						
Feed conversion efficiency						

4. Reproduction — Average Range — N

a. Males
   i. Age at first mating (days)

b. Females
   i. Age at first oestrus (days)
   ii. Oestrous cycle duration (days)
   iii. Oestrus duration (hrs)
   iv. Age at first mating (days)
   v. Age at first furrowing (days)
   vi. Furrowing interval (days)
   vii. Litter size at furrowing
   viii. Litter weight (kg)
   ix. Litter size at weaning
   x. Lifetime number of furrowing
   xi. Productive life span (months)

5. Bristle production

a. Number of cutting per year
b. Bristle colour

Trait	Age	Male			Female		
		Average	Range	N	Average	Range	N
Bristle weight (g)	1st cutting						
	later cutting						
Bristle length (cm)	1st cutting						
	later cutting						
Bristle diameter (μ)	1st cutting						
	later cutting						

6. Any other information specific to the breed

ANNEXURE 15

BREED DESCRIPTOR FORMAT FOR YAK BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name / origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. a. Native tract of distribution in terms of longitude and latitude & altitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District

8. Estimated population
   a. Year of estimation
   b. Population
   c. Source / reference
9. a. Communities responsible for developing the breed
   b. Description of community (Farmers/ nomads / tribals)
10. Herd Book / Register established (Yes / No)
11. Herd: Average size …
    Composition: Breeding females…. % Calves…. %
    Breeding male….%, Cattle-yak hybrids----------%
12. Utility of the breed
    (Milk/ meat/ hair & fibre/ draught/ transportation/ manure/ hide/ other specify)
13. Basic temperament of the breed (docile/ moderate/ tractable/ wild)
14. Any other information

II. PHYSICAL CHARACTERS

1. Colour Male Female
   a. Coat colour
   b. Coat pattern

c. Muzzle
d. Eyelids
e. Tail Switch
f. Hooves

2. Horns Male Female
   a. Colour
   b. Size
   c. Shape and orientation
3. Ears
   a. Size
   b. Orientation (horizontal/drooping)

4. Head
   Forehead (convex/concave/straight)
   General Description

5. Body Male Female
   a. Hump (large/medium/small)
   b. Dewlap (present/absent)
   c. Naval flap (large/medium/small)
   d. Penis sheath flap (large/medium/small)

6. Udder
   a. Shape (bowl/round/trough)
   b. Udder size (large/medium/small)
   c. Teat shape (cylindrical/funnel/pear)
7. Any other information

III. PERFORMANCE

1. Body Weights (Kg)

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Birth weight						
Weaning weight						
12 month weight						
24 months weight						
Weight at first mating						
Weight at first calving						
Adult weight						
Summer						
Winter						

2. Body measurements (cm)

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Chest girth						
Body length						
Height at withers						

3. Production performance

a) Milk

Parameter	First Lactation			Overall		
	Average	Range	N	Average	Range	N
Daily milk yield						
Peak milk yield						
Lactation length						
Lactation milk yield						
Fat %						
SNF %						

b) Meat

Parameter	Male			Female		
	Average	Range	N	Average	Range	N
Age at slaughter (days)						
Weight at Slaughter (kg)						
Carcass weight (kg)						
Dressing %						

c) Hair/fibre

Hair production	Average	Range	N
a. Age at clipping			
b. Weight of clipping (kg)			
c. Hair length			
d. Hair diameter			

Down fibre (undercoat) production	Average	Range	N
a. Age at clipping			
b. Weight of clipping (kg)			
c. Hair length			
d. Hair diameter			

4. Reproduction Average Range N
   a. Males
      (i) Age at first ejaculation (months)
      (ii) Age at first mating (months)
   b. Females
      (i) Age at first oestrus (month)
      (ii) Oestrous cycle duration (days)
      (iii) Oestrus duration (hrs)
      (iv) Age at first mating (months)
      (v) Age at first calving (months)
      (vi) Service period (days)
      (vii) Calving interval (days)
      (viii) Gestation period (days)
5. Draught performance
   a. Purpose (ploughing, threshing, transportation, power etc.)
   b. Average duration of work per day (hrs)
6. Drought tolerance (Excellent/ Very Good/ Good/ Average/ Low)
7. a) Heat tolerance (Excellent/ Very Good/ Good/ Average/ Low)
   b) Cold tolerance (Excellent/ Very Good/ Good/ Average/ Low)
8. Any other information specific to the breed

ANNEXURE 16

BREED DESCRIPTOR FORMAT FOR MITHUN BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms
3. Background for such a name / origin
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds
   (in appearance)
7. a. Native tract of distribution in terms of longitude, and latitude
   b. altitude
   c. Approximate area of distribution (sq km)
   d. Place(s) State District

8. Estimated population
   a. Year of estimation
   b. Population
   c. Source / Reference
9. a. Communities responsible for developing the breed
   b. Description of community (Farmers/ nomads / tribals)
10. Herd Book/ Register established (Yes / No)
11. Herd: Average size …
    Composition: Breeding females…. % Calves…. %
    Breeding male….%, Cattle-Mithun hybrids----------%
12. Utility of the breed
    (Meat/ Milk/ draught/ manure /other specify)
13. Basic temperament of the breed (docile/ moderate / wild)
14. Any other information

II. PHYSICAL CHARACTERS

1. Colour Male Female
   a. Coat colour

b. Coat pattern
c. Stocking pattern
d. Muzzle
e. Eyelids
f. Tail Switch
g. Hooves

2. Horns — Male — Female
   a. Colour
   b. Size
   c. Shape
3. Ears
   a. Length
   b. Orientation (horizontal/ drooping)
4. Head

Forehead (Convex/ concave/ straight)

Poll (Prominent/ flat/ depressed)

General Description

5. Body — Male — Female
   a. Dorsal ridge/Hump (large/ medium/ small)
   b. Dewlap (Present/ absent)
   c. Naval flap (large/ medium/ small)
   d. Penis sheath flap (large/ medium/ small) — -
6. Udder
   a. Shape (bowl/ round/ trough)
   b. Udder size (large/ medium/ small)
   c. Teat shape (cylindrical/ funnel/ pear)
7. Any other information

III. PERFORMANCE

1. Body weights (Kg)

Parameter	Age	Male			Female		
		Average	Range	N	Average	Range	N
Birth weight							
Weaning weight							
12 month weight							
24 months weight							
Weight at first mating							
Weight at first calving							
Adult weight							

Parameter	Age	Male			Female		
		Average	Range	N	Average	Range	N
Chest girth							
Body length							
Height at withers							

3. Production performance

a. Meat

Parameter	Age	Male			Female		
		Average	Range	N	Average	Range	N
Age at slaughter (days)							
Weight at Slaughter (kg)							
Carcass weight (kg)							
Dressing %							

b) Milk

Parameter	Age	Male			Female		
		Average	Range	N	Average	Range	N
Daily milk yield							
Peak milk yield							
Lactation length							
Lactation milk yield							
Fat %							
SNF %							

4. Reproduction — Average — Range — N
   - a. Males
     - (i) Age at first ejaculation (months)
     - (ii) Age at first mating (months)
   - b. Females
     - (i) Age at first oestrus (month)
     - (ii) Oestrous cycle duration (days)
     - (iii) Oestrus duration (hrs)
     - (iv) Age at first mating (months)
     - (v) Age at first calving (months)
     - (vi) Service period (days)
     - (vii) Calving interval (days)
     - (viii) Gestation period (days)
5. Draught performance
   - a. Purpose (ploughing, transportation etc.)
   - b. Average duration of work per day (hrs)
6. Drought tolerance (Excellent/ Very Good/ Good/ Average/ Low)
7. Heat tolerance (Excellent/ Very Good/ Good/ Average/ Low)
8. Any other information specific to the breed

ANNEXURE 17

BREED DESCRIPTOR FORMAT FOR CHICKEN BREEDS

I. GENERAL DESCRIPTION

1. Name of the breed
2. Synonyms / local names, if any
3. Background for such a name
4. Since when the breed is known
5. Strains (or within breed types)
6. Most closely related breeds (in appearance)
7. Origin of breed (Indigenous/ exotic)
8. Origin, if imported (Name of country)
9. a. Native tract of distribution in terms of longitude and latitude
   b. Approximate area of distribution (sq km)
   c. Place(s) State District

10. Estimated population
    a. Year of estimation
    b. Population
    c. Source/ Reference
11. a. Communities responsible for developing the breed
    b. Description of community (Farmers/ nomads/ isolated/ tribals)
12. Flock: Average size …

Composition: Cocks … % Hens…. % Chicks …… %

13. Utility of the breed (Eggs/ meat/ game/ others)
14. Any other information

II. PHYSICAL CHARACTERS

1. Colour
   a) Plumage colour
   b) Plumage Pattern
   c) Skin colour
   d) Shank colour

e) Earlobe colour
f) Comb colour
g) Eye colour

2. Comb
a) Type
b) Size

3. Other specific visible traits

III. PERFORMANCE

1. Egg production characteristics	Average	Range	N
a) Age at first egg (months)			
b) Annual egg production			
c) Clutch size (days)			
d) Clutch interval (days)			
e) Laying cycle (months)			

2. Egg quality traits	Average	Range	N
a) Egg weight (g)			
b) Shell weight (g)			
c) Albumen weight (g)			
d) Yolk weight (g)			
e) Shell thickness (µ)			
f) Specific gravity			
g) Albumen index			
h) Yolk index			
i) Haugh units			
j) Shell colour (white/ brown/ cream or tinted/ other)			
k) Albumen quality (thick/ thin)			
l) Egg inclusion bodies (blood spots/ meat spots)			

3. Reproduction characteristics

a) Broodiness (usual/ sometimes/ rare/ other)			
b) Fertility and hatchability (%)	Average	Range	N
i) Fertility			
ii) Hatchability on fertile egg basis			
iii) Hatchability on total egg basis			

4. Growth characteristics

Body Weight at	Male			Female		
	Average	Range	N	Average	Range	N
Hatching (g)						
8 weeks (g)						
12 weeks (g)						
Adult weight (kg)						

5. Mortality (%)	Average	Range	N
a) 0-1 weeks			
b) 1-8 weeks			
c) 8-20 weeks			
d) n- weeks			

6. Carcass characters

Carcass Characters		Male			Female		
		Average	Range	N	Average	Range	N
Age at slaughter (days)							
Weight	Hot						
	Cold						
Dressing %	Hot						
	Cold						
Meat : bone ratio							
Feed conversation efficiency							

7. Any other information specific to the breed

ANNEXURE 18

DESCRIPTOR FOR VARIETIES/ STRAINS/LINES OF CHICKEN

I. GENERAL DESCRIPTION

1. Name of the Variety/ Strain/ Line
2. Since when it is developed
3. Specific trait/purpose for which developed
4. Unique characteristic that distinguishes it from other Varieties/ Strains/ Lines
5. Most closely related Varieties/ Strains/ Lines (in appearance)
6. Origin: Breeds/ Varieties / Strains/ Lines used in its development
7. Organization responsible for its development
8. Type of stock
   - commercial
   - others (specify)

9.Flock size

   a. Total no. of birds at the farm
   b. No. of breeding males
   c. No. of breeding females

10. Are the birds of this line available with the farmers/ entrepreneurs?
    If yes,
    a. Place(s) of distribution
    b. Estimated population in the field
    c. Type of management
       intensive production
       backyard or farmyard production
       scavenger
11. Utility of the stock (Eggs/meat/meat and eggs/others)
12. Any other information

II. PHYSICAL CHARACTERS

	Male	Female
1. Feather characteristics		
a) Feather morphology		
normal		
frizzle		
silky		

others (specify)

b) Feather distribution
   - normal
   - naked neck
   - feathered shanks and feet
   - beard
   - crest
   - others (specify)

c) Feather growth rate
   - fast
   - slow

2. Colour

a) Plumage colour
   - White
   - Black
   - Blue
   - Red
   - Brown
   - Gold
   - Others (specify)

Male Female

b) Plumage pattern
   - Solid
   - Dull
   - Stripped
   - Patchy
   - Spotted
   - Barred
   - Others (specify)

c) Pattern within feather
   - self-white
   - self-black
   - self-blue
   - self-red
   - self-wheaten
   - barred
   - mottled
   - others (specify)

d) Skin colour
   - White
   - Yellow

Blue
Black
Others (specify)

e) Shank colour
White
Yellow
Black
Blue
Green
Others (specify)

	Male	Female

f) Earlobe colour
White
Red
Black
White & Red
Others (specify)

g) Comb colour and its intensity (dark, medium, light)
Black
Red
Others (Specify)

h) Eye colour
Grey
Black
Brown
Others (specify)

3. Comb type and size (large, medium, small)
Single
Pea
Rose
Walnut/ cushion/ strawberry
Duplex/ v-shaped/ double

4. Wattles (present/ absent)

5. Other specific visible traits

III. Performance	Average	SE	Range	N

1. Egg production characteristics

a) Egg production and age
Age at first egg (days)
Age at 50% production (days)
Age at peak production (days)

Age at culling (days)

b) Egg production Average SE Range N

Broilers

Hen-day production up to 52 weeks

Hen-housed production up to 52 weeks

Clutch size (days)

Clutch interval (days)

Layers

Hen-day production up to 72 weeks

Hen-housed production up to 72 weeks

Clutch size (days)

Clutch interval (days)

c) Egg quality traits at 40 weeks (*based on minimum of 50 eggs*)

Traits	40 Weeks			
	Average	SE	Range	N
Egg weight (g)				
Shell weight (g)				
Albumin weight (g)				
Yolk weight (g)				
Shell thickness				
Specific gravity				
Shape index				
Albumin index				
Yolk index				
Haugh units				
Shell colour				
Blood spots				
Meat spots				

2. Reproduction characteristics

a) Broodiness (usual/ sometimes/ rare/ other)

b) Fertility and hatchability (*based on minimum of 500 eggs each of 3 hatches*)

Average SE Range N

I Fertility (%)

ii) Hatchability on fertile egg basis (%)

iii) Hatchability on total egg basis (%)

3. Growth characteristics (*based on minimum of 500 records each for male and female up to 20 weeks of age, and thereafter 500 pooled records)*

a) Body weight (g)

Broiler/meat type bird

Body Weight (g) at	Male Avg/SE	Range	N	Female Avg/SE	Range	N	Pooled Avg/SE	Range	N
Day old									
5 weeks									
6 weeks									
20 weeks									
40 weeks									
52 weeks									

Layer/egg type bird

Body Weight (g) at	Male Avg/SE	Range	N	Female Avg/SE	Range	N	Pooled Avg/SE	Range	N
Day old									
5 weeks									
6 weeks									
20 weeks									
40 weeks									
52 weeks									

b) Body measurements (cm) (based on minimum of 100 records-only for meat type birds/broilers)

At	Keel length Avg/SE	Range	N	Shank length Avg/SE	Range	N	Breast angle Avg/SE	Range	N
5 weeks									
6 weeks									
12 weeks									
20 weeks									

c) Feed utilization (based on minimum of 50 males and 50 females in broilers or meat type birds, and 100 females in egg type chicken/layers)

Broilers	Weeks of age	kg feed/kg gain Male Avg/SE	Range	N	Female Avg/ SE	Range	N	Pooled Avg/SE	Range	N
	0- 5									
	0-6									

Layers	Weeks of age	kg feed/kg gain Avg/SE	Range	N
	0-8			
	9-16			
	kg feed/dozen eggs			
	17-40			
	41-72			

4. Carcass characters (based on minimum of 25 male and 25 female birds - only for meat type /broilers)

Carcass characters	Male			Female		
	Avg/SE	Range	N	Avg/SE	Range	N
Age at slaughter (days)						
Live weight (kg) at slaughter						
Carcass weight (kg)						
Dressing %						
Meat: bone ratio						
Carcass quality traits						
flesh colour						
tenderness						
flavour						

5. Mortality(%)

Type of bird	Period		Male	Female	Pooled
Broilers/meat type	Brooding	0-5 weeks			
		0-6 weeks			
	Growing	6 - 20 weeks			
		7 - 20 weeks			
	Laying	21-52 weeks			
Layers/ egg type	Brooding period (0-6 weeks)				
	Growing period (7 - 20 weeks)				
	Laying period (21-72weeks)				

6. Physiology and stress tolerance

a) Tolerance of temperature and humidity extremes
b) Tolerance of industrial floor pen housing
c) Tolerance of industrial cage housing

7. Resistance to specific disease(s), if any

8. Any other unique characteristic

ANNEXURE 19

MICROSATELLITE PRIMERS FOR GENETIC CHARACTERIZATION OF LIVESTOCK BREEDS

Cattle

Sr. No.	Locus	Primer Sequence (5'-3')	Size Range (bp)
1.	BM1824 -F	gagcaaggtgtttttccaatc	178-198
	BM1824 -R	cattctccaactgcttccttg	
2.	CSRM60 -F	aagatgtgatccaagagagaggca	80-116
	CSRM60 -R	aggaccagatcgtgaaaggcatag	
3.	CSSM008 -F	cttggtgttactagccctggg	180-202
	CSSM008 -R	gatatatttgccagagattctgca	
4.	CSSM033 -F	cactgtgaatgcatgtgtgtgagc	147-189
	CSSM033 -R	cccatgataagagtgcagatgact	
5.	CSSM66 -F	acacaaatcctttctgccagctga	177-207
	CSSM66 -R	aatttaatgcactgaggagcttgg	
6.	ETH10-F	gttcaggactggccctgctaaca	187-223
	ETH10-R	cctccagcccactttctcttctc	
7.	ETH225-F	gatcaccttgccactatttcct	132-158
	ETH225-R	acatgacagccagctgctact	
8.	ETH3-F	gaacctgcctc tcctgcattgg	96-122
	ETH3-R	actctgcctgtggccaagtagg	
9.	HAUT27-F	ttttatgttcatttttgactgg	132-162
	HAUT27-R	aactgctgaaatctccatctta	
10.	HEL1-F	caacagctatttaacaagga	102-120
	HEL1-R	aggctacagtccatgggatt	
11.	HEL5-F	gcaggatcacttgttaggga	140-170
	HEL5-R	agacgttagtgtacattaac	
12.	HEL9-F	cccattcagtcttcagaggt	137-169
	HEL9-R	cacatccatgttctcaccac	
13.	ILSTS005-F	ggaagcaatgaaatctatagcc	156-208
	ILSTS005-R	tgttctgtgagtttgtaagc	
14.	ILSTS006-F	tgtctgtatttctgctgtgg	276-310
	ILSTS006-R	acacggaagcgatctaaacg	
15.	ILSTS011-F	gcttgctacatggaaagtgc	249-277
	ILSTS011-R	ctaaaatgcagagccctacc	
16.	ILSTS033-F	tattagagtggctcagtgcc	131-163
	ILSTS033-R	atgcagacagttttagaggg	
17.	ILSTS034-F	aagggtctaagtccactggc	137-199
	ILSTS034-R	gacctggtttagcagagagc	
18.	INRA005-F	caatctgcatgaagtataaatat	120-148
	INRA005-R	cttcaggcataccctacacc	
19.	INRA035-F	atcctttgcagcctccacattg	91-135
	INRA035-R	ttgtgctttatgacactatccg	
20.	INRA063-F	atttgcacaagctaaatctaacc	157-189
	INRA063-R	aaaccacagaaatgcttggaag	
21.	MM12-F	caagacaggtgtttcaatct	101-129
	MM12-R	atcgactctggggatgatgt	
22.	MM8-F	cccaaggacagaaaagact	116-140
	MM8-R	ctcaagataa gaccacacc	
23.	TGLA122-F	ctaatttagaatgagagaggcttct	134-166
	TGLA122-R	ttggtctctattctctgaatattcc	
24.	TGLA227-F	cgaattccaaatctgttaatttgct	65-115
	TGLA227-R	acagacagaaactcaatgaaagca	
25.	TGLA53-F	gctttcagaaatagtttgcattca	146-186
	TGLA53-R	atcttcacatgatattacagcaga	

Buffalo

Sr. No.	Locus	Primer Sequence (5'-3')	Size Range (bp)
1.	ILSTS019-F ILSTS019-R	aagggacctcatgtagaagc actttggaccctgtagtgc	169-185
2.	ILSTS056-F ILSTS056-R	gctactgagtgatggtaggg aatatagccctggaggatgg	132-178
3.	BM1818-F BM1818-R	agctgggaatataaccaaagg agtgctttcaaggtccatgc	229-279
4.	ILSTS025-F ILSTS025-R	gttacctttatataagactccc aatttctggctgacttggacc	110-144
5.	ILSTS036-F ILSTS036-R	gagtattatgcttgggaggc agacaggatgggaagtcacc	122-172
6.	ILSTS095-F ILSTS095-R	gaaagatgttgctagtgggg attctcctgtgaacctctcc	187-219
7.	CSSM033-F CSSM033-R	cactgtgaatgcatgtgtgtgagc cccatgataagagtgcagatgact	149-175
8.	ILSTS089-F ILSTS089-R	aattccgtggactgaggagc aaggaactttcaacctgagg	106-144
9.	ILSTS058-F ILSTS058-R	gccttactaccatttccagc catcctgactttggctgtgg	118-182
10.	HEL013-F HEL013-R	taaggacttgagataaggag ccatctacctccatcttaac	158-198
11.	ILSTS028-F ILSTS028-R	tccagattttgtaccagacc gtcatgtcataccttgagc	143-173
12.	ILSTS061-F ILSTS061-R	aaattataggggccatacgg tggcctaccctaccatttcc	109-165
13.	CSSM019-F CSSM019-R	ttgtcagcaacttcttgtatcttt tgttttaagccacccaattatttg	125-159
14.	CSRM060-F CSRM060-R	aagatgtgatccaagagagaggca aggaccagatcgtgaaaggcatag	160-188
15.	ILSTS052-F ILSTS052-R	ctgtcctttaagaacaaacc tgcaacttaggctattgacg	135-179
16.	CSSM057-F CSSM057-R	gtcgctggataaacaatttaaagt tgtggtgtttaaccctgtaatct	95-129
17.	CSSM047-F CSSM047-R	tctctgtctctatcactatatggc ctgggcacctgaaactat catcat	119-197
18.	ILSTS060-F ILSTS060-R	taggcaaaagtcggcagc ttaaggggacaccagccc	150-204
19.	ILSTS030-F ILSTS030-R	ctgcagttctgcatatgtgg cttagacaacaggggtttgg	136-170
20.	ILSTS033-F ILSTS033-R	tattagagtggctcagtgcc atgcagacagttttagaggg	112-154
21.	ILSTS026-F ILSTS026-R	ctgaattggctccaaaggcc aaacagaagtccagggctgc	131-153
22.	CSSM066-F CSSM066-R	acacaaatcctttctgccagctga aatttaatgcactgaggagcttgg	142-210
23.	ILSTS029-F ILSTS029-R	tgttttgatggaacacagcc tggatttagaccagggttgg	140-180
24.	CSSM045-F CSSM045-R	tagaggcacaagcaaacctaacac ttggaaagatgcagtagaactcat	86-166
25.	ETH003-F ETH003-R	gaacctgcctctcctgcattgg actctgcctgtggccaagtagg	96-192

Goat

Sr. No.	Locus	Primer Sequence (5'-3')	Size Range (bp)
1.	ILSTS008 -F ILSTS008 -R	gaatcatggattttctgggg tagcagtgatgaggttggc	167-195
2.	ILSTS059 -F ILSTS059 -R	gctgaacaatgtgata tgttcagg gggacaatactgtcttagatgctgc	105-135
3.	ETH225 -F ETH225 -R	gatcaccttgccactatttcct acatgacagccagctgcttact	146-160
4.	ILSTS044 -F ILSTS044 -R	agtcacccaaaagtaactgg acatgttgtattccaagtgc	145-177
5.	ILSTS002 -F ILSTS002 -R	tctatacacatgtgctgtgc cttaggggtgaagtgacacg	113-135
6.	Oar FCB304 -F Oar FCB304 -R	ccctaggagctttcaataaagaatcgg cgctgctgtcaactgggtcaggg	119-169
7.	Oar FCB48 -F Oar FCB48 -R	gagttagtacaaggatgacagaggcac gactctagaggatcgc	149-181
8.	Oar HH64 -F Oar HH64 -R	cgttccctcactaggaaagttatatatgc cactctattgtaagaatttgaatgaa tgagagc	120-138
9.	Oar JMP29 -F Oar JMP29 -R	gtatacacgtggacaccgctttgtac gaagtggcaagattcagaggggaag	120-140
10.	ILSTS005 -F ILSTS005 -R	ggaagcaatgaaatctatagcc tgttctgtgagtttgtaagc	174-190
11.	ILSTS019 -F ILSTS019 -R	aagggacctcatgtagaagc acttttggaccctgtagtgc	142-162
12.	OMHC1 -F OMHC1 -R	atctggtgggctacagtccatg gcaatgctttctaaattctgaggaa	179-209
13.	ILSTS087 -F ILSTS087 -R	agcagacatgatgactcagc ctgcctcttttcttgagagc	142-164
14.	ILSTS30 -F ILSTS30 -R	ctgcagttctgcatatgtgg cttagacaacaggggtttgg	159-179
15.	ILSTS34 -F ILSTS34 -R	aagggtctaagtccac ggc acctggtttagcagagagc	153-185
16.	ILSTS033 -F ILSTS033 -R	tattagagtggctcagtgcc atgcagacagttttagagg	151-187
17.	ILSTS049 -F ILSTS049 -R	cattttcttgtctctcccc gctgaatcttgtcaaacagg	160-184
18.	ILSTS065 -F ILSTS065 -R	gctgcaaagagttgaacacc aactattacaggaggctccc	105-135
19.	ILSTS058 -F ILSTS058 -R	gccttactaccatttccagc catcctgactttggctgtgg	136-188
20.	ILSTS029 -F ILSTS029 -R	tgttttgatggaacacagcc tggatttagaccagggttgg	149-191
21.	RM088 -F RM088 -R	gatcctcttctgggaaaaagagac cctgttgaagtgaaccttcagaa	109-147
22.	ILSTS022 -F ILSTS022 -R	agtctgaaggcct gagaacc cttacagtccttggggttgc	186-202
23.	OarAE129 -F OarAE129 -R	aatcccagtgtgtgaaagactaatccag gtagatcaagatatatttttcaacac	130-175
24.	ILSTS082 -F ILSTS082 -R	ttcgttcctcatagtgctgg agaggattacaccaatcacc	100-136
25.	RM4-F RM4-R	cagcaaaatatcagcaaacct ccacctgggaaggccttta	105-127

Sheep

Sr. No.	Locus	Primer Sequence (5'-3')	Size Range (bp)
1.	BM757 -F BM757 -R	tggaaacaatgtaaacctggg ttgagccaccaaggaacc	178-198
2.	BM827 -F BM827 -R	gggctggtcgtatgctgag gttggacttgctgaagtgacc	214-224
3.	BM1314 -F BM1314 -R	ttcctcctcttctctccaaac atctcaaacgc cagtgtgg	141-161
4.	BM6506 -F BM6506 -R	gcacgtggtaaagagatggc agcaacttgagcatggcac	189-199
5.	BM6526 -F BM6526 -R	catgccaaacaatatccagc tgaaggtagagagcaagcagc	140-170
6.	BM8125 -F BM8125 -R	ctctatctgtggaaaaggtgg gggggttagacttcaacatacg	105-121
7.	CSRD247 -F CSRD247 -R	ggacttgccagaactctgcaat cactgtggtttgtattagtcagg	203-237
8.	CSSM31 -F CSSM31 -R	ccaagtttagtacttgtaagtaga gactctctagcactttatctgtgt	162-182
9.	CSSM47 -F CSSM47 -R	tctctgtctctatcactatatggc ctgggcacctgaaactatcatcat	120-160
10.	HSC-F HSC-R	ctgccaatgcagagacacaaga gtctgtctcct gtcttgtcatc	267-285
11.	INRA63 -F INRA63 -R	gaccacaaagggatttgcacaagc aaaccacagaaatgcttggaag	165-203
12.	MAF214 -F MAF214 -R	aatgcaggagatctgaggcagggacg gggtgatcttagggaggttttggagg	187-231
13.	OarAE129 -F OarAE129 -R	aatccagtgtgtgaaagactaatccag gtagatcaagatatagaatatttttc aacacc	141-169
14.	OarCP20 -F OarCP20 -R	gatcccctggaggaggaaacgg ggcatttcatggctttagcagg	67-79
15.	OarCP34 -F OarCP34 -R	gctgaacaatgtgatatgttcagg gggacaatactgtcttagatgctgc	108-122
16.	OarCP49 -F OarCP49 -R	cagacacggcttagcaactaaacgc gtggggatgaatattccttcataagg	80-110
17.	OarFCB48 -F OarFCB48 -R	gagttagtacaaggatgacaagaggcac agaggatcgcaaagaaccag	142-164
18.	OarFCB128 -F OarFCB128 -R	cagctgagcaactaagacatacatgcg attaaagcatcttctctttatttcctcgc	97-123
19.	OarHH35 -F OarHH35 -R	aattgcattcagtatctttaacatctggc atgaaaatataaagagaatgaaccacacgg	111-139
20.	OarHH41 -F OarHH41 -R	tccacaggcttaaatctatatagcaacc ccagctaaagataaaagatgatgtgggag	118-140
21.	OarHH47 -F OarHH47 -R	tttattgacaaactctcttcctaactccacc gtagttatttaaaaaaatatcatacctcttaagg	124-146
22.	OarHH64 -F OarHH64 -R	cgttccctcactatggaaagttatatatgc cactctattgtaa gaatttgaatgagagc	120-134
23.	OarJMP8 -F OarJMP8 -R	cgggatgatcttctgtccaaatatgc catttgctttggcttcagaaccagag	115-129
24.	OarJMP29 -F OarJMP29 -R	gtatacacgtggacaccgctttgtac gaagtggcaagattcagaggggaag	86-144
25.	OarVH72 -F OarVH72 -R	ctctagaggatctggaatgcaaagctc ggcctctcaaggg gcaagagcagg	121-133

Equine

Sr. No.	Locus	Primer Sequence (5'-3')	Size Range (bp)
1.	HTG4 -F	ctatctcagtcttgattgcaggac	131 -143
	HTG4 -R	ctccctccctccctctgttctc	
2.	HTG6 -F	cctgcttggaggctgtgataagat	78 -102
	HTG6 -R	gttcactgaatgtcaaattctgct	
3.	HTG7 -F	cctgaagcagaacatccctccttg	116 -128
	HTG7 -R	ataaagtgtctgggcagagctgct	
4.	HTG8 -F	caggccgtagatgactaccaatga	176 -192
	HTG8 -R	ttttcagagttaattggtatcaca	
5.	HTG10 -F	caattcccgccccaccccggca	88 -114
	HTG10 -R	tttttattctgatctgtcacattt	
6.	HTG14 -F	ccagtctaagtttgttggctagaa	127 -139
	HTG14 -R	caaaggtgagtgatggatggaagc	
7.	HTG15 -F	tcttgatggcagagccaggatttg	128 -146
	HTG15 -R	aatgtcaccatgcggcacatgact	
8.	AHT4 -F	aaccgcctgagcaaggaagt	142 -164
	AHT4 -R	cccagagagtttaccct	
9.	AHT5 -F	acggacacatccctgcctgc	126 -140
	AHT5 -R	gcaggctaaggggctcagc	
10.	HMS2 -F	acg gtggcaactgccaaggaag	216 -236
	HMS2 -R	cttgcagtcgaatgtgtattaaatg	
11.	HMS3 -F	ccaactcttgtgcacataacaaga	149 -169
	HMS3 -R	ccatcctcacttttcactttgtt	
12.	HMS6 -F	gaagctgccagtattcaaccattg	157 -169
	HMS6 -R	ctccatcttgtgaagtgtaactca	
13.	HMS7 -F	caggaaactcatgttgataccatc	168 -186
	HMS7 -R	tgttgttgaaaca taccttgactgt	
14.	VHL20 -F	caagtcctcttacttgaagactag	85 -109
	VHL20 -R	aactcagggagaatcttcctcag	
15.	LEX20 -F	ggaataggtgggggtctgtt	196 -208
	LEX20 -R	agggtactagccaagtgactgc	
16.	NVHEQ5 -F	cgcatgtgcttcccctcac	149 -161
	NVHEQ5 -R	cctctttccacgcaatcactcta	
17.	NVHEQ11 -F	ggccccacccactaaatatcactg	120 -130
	NVHEQ11 -R	cggggtcttggaaatttatgaagg	
18.	NVHEQ18 -F	ggaggagacagtggccccagtc	118 -134
	NVHEQ18 -R	gctgagctctcccatcccatcg	
19.	NVHEQ29 -F	gagattttgccccaaaggtta	91 -103
	NVHEQ29 -R	ctcttctttcttccccaggtct	
20.	NVHEQ40 -F	tggcatctgaatggagaatg	146 -156
	NVHEQ40 -R	gattatgatgctacaggggaaag	
21.	NVHEQ100 -F	ccaaagcagaacatgtgaagtt	185 -203
	NVHEQ100 -R	tggcatagatgttagctaagtga	
22.	NVHEQ21 -F	ccagaacctggactgaacagtgtc	151 -161
	NVHEQ21 -R	gaatgtgcttgatgcagaagaagg	
23.	NVHEQ54 -F	agatgtccaccttctcgctg	176 -186
	NVHEQ54 -R	cggggcttttaggaggtaacta	
24.	NVHEQ79 -F	attgcctgtgctgagatgg	132 -136
	NVHEQ79 -R	gcaaattgcctctgtatcacac	
25.	UCDEQ425 -F	agctgcctcgttaattca	238 -250
	UCDEQ425 -R	ctcatgtccgcttgtctc	

Pigs

Sr. No.	Locus	Primer Sequence (5'-3')	Size Range (bp)
1.	CGA-F CGA-R	atagacattatgtccgttgctgat gaactttcacatccctaaggtcgt	266-302
2.	IGFI-F IGFI-R	gcttggatggaccatgttg catatttttctgcataacttgaacct	278-294
3.	SOOO5-F SOOO5-R	tccttccctcctggtaacta gcacttcctgattctgggta	215-257
4.	SOO26-F SOO26-R	aaccttcccttcccaatcac cacagactgctttttactcc	92-110
5.	SOO68-F SOO68-R	agtggtctctctccctctcttgct ccttcaacctttgagcaagaal	218-242
6.	SOO90-F SOO90-R	ccaagactgccttgtaggtgaata gctatcaagtattgtaccattagg	243-251
7.	SO178-F SO178-R	tagcctgggaacctccacacgltg ggcaccaggaatctgcaatccagt	110-124
8.	SO215-F SO215-R	taggctcagaccctgctgcat tgggaggctgaaggattgggt	137-163
9.	SO218-F SO218-R	gtgtaggctggcggttgt ccctgaaacctaaagcaaag	164-184
10.	SO225-F SO225-R	gctaatgccagagaaatgcaga caggtggaaagaatggaatgaa	172-194
11.	SO226-F SO226-R	gcacttttaactttcatgatactcc ggttaaacttttncccccaataca	185-205
12.	SO227-F SO227-R	gatccatttataattttagacaaagt gcatggtgtgatgctatgtcaagc	231-253
13.	SO228-F SO228-R	ggcataggctggcagcaaca agcccacctcatcttatctacact	227-245
14.	SO355-F SO355-R	tctggctcctacactccttcttgatg ttgggtgggtgctgaaaaatagga	247-273
15.	SO386-F SO386-R	tcctgggtcttattttcta tttttatctccaacagtat	156-172
16.	SW24-F SW24-R	ctttgggtggagtgtgtgc atccaaatgctgcaagcg	92-112
17.	SW72-F SW72-R	atcagaacagtgcgccgt tttgaaaatggggtgtttcc	100-116
18.	SW122-F SW122-R	ttgtcttttattttgcttttgg caaaaaaggcaaaagattgaca	110-132
19.	SW632-F SW632-R	tgggttgaaagatttcccaa ggagtcagtactttggcttga	157-173
20.	SW857-F SW857-R	tgagaggtcagttacagaagacc gatcctcctccaaatcccat	145-157
21.	SW911-F SW911-R	ctcagttctttgggactgaacc catctgtggaaaaaaaaagcc	153-175
22.	SW936-F SW936-R	tctggagctagcataagtgcc gtgcaagtacacatgcaggg	86-112
23.	SW951-F SW951-R	tttcacaactctggcaccag gatcgtgcccaaatggac	125-133

Camel

Sr. No.	Locus	Primer sequence (5' -> 3')	Size Range (bp)
1.	CMS9	tgctttagacgacttttactttac atttcactttcttcatacttgtgat	233-256B 231-243D
2.	CMS13	tagcctgactctatccatttctc attatttggaattcaactgtaagg	248-265B 238-254D
3.	CMS15	aaatacttaaaggttcccaga ttgtaaactaaagccagaaag	140-159B 121-144D
4.	CMS17	tataaaggatcactgccttc aaaatgaacctccataaagttag	144-149B 149-167D
5.	CMS18	gaacgacccttgaagacgaa agcagctggttttaggtcca	157-186B 157-163D
6.	CMS25	gatcctcctgcgttcttatt ctagcctttgattggagcat	118-128B 93-102D
7.	CMS32	acggacaagaactgctcata acaaccaataaatccccatt	198-204B 198-209D
8.	CMS50	tttatagtcagagagagtgctg tgtagggttcattgtaaca	154-183B 170-190D
9.	CMS121	caagagaactggtgaggattttc agttgataaaaatacagctggaaag	151-159B 147-166D
10.	CVRL01	gaagaggttggggcactac caggcagatatccattgaa	188-253B 196-253D
11.	CVRL02	tgtcacaaatggcaagat agtgtacgtagcagcattattt	206-216B 205-216D
12.	CVRL05	ccttggacctccttgctctg gccactggtccctgtcatt	148-174B 155-176D
13.	CVRL06	ttttaaaaattctgaccaggagtctg cataatagccaaaacatggaaacaac	185-205B 196-203D
14.	CVRL07	aataccctagttgaagctctgtcct gagtgcctttataaatatgggtctg	255-263B 272-306D
15.	LCA66	gtgcagcgtccaaatagtca ccagcatcgtccagtattca	212-242B 240-244D
16.	VOLP03	agacggttgggaaggtggta cgacagcaaggcacagga	145-206B 145-176D
17.	VOLP08	ccattcaccccatctctc tcgccagtgaccttatttaga	142-180B 144-150D
18.	VOLP10	ctttctcctttcctccctact cgtccacttccttcatttc	232-260B 250-268D
19.	VOLP32	gtgatcggaatggcttgaaa cagcgagcacctgaaagaa	256-262B 256-262D
20.	VOLP67	ttagagggtctatccagtttc tggacctaaaagagtggag	142-172B 150-203D
21.	YWLL 08	atcaagtttgaggtctttcc ccatggcattgtgttgaagac	154-180B 133-172D
22.	YWLL 09	aagtctaggaaccggaatgc agtcaatctacactccttgc	158-177B 158-162D
23.	YWLL 38	ggcctaaatcctactagac cctctcactcttgttctcctc	180-192B 182-190D
24.	YWLL 44	ctcaacaatgctagaccttgg gagaacacaggctggtgaata	101-117B 90-114D

B = Bactrian camel (*Camelus bactrianus*), D = dromedary camel (*Camelus dromedarius*).

ANNEXURE 20

EQUIPMENTS FOR GERMPLASM CRYOPRESERVATION IN GENE BANK

Semen storage

Microscope, equipments for cooling samples (cooler cabinet), CO_2 incubator, laminar flow, Osmometer, spectrophotometer, makler counter chamber, haemocytometer, Straw filling , sealing and labeling equipments, Freezing equipment, dry liquid nitrogen shipping tank, long term liquid nitrogen tanks Equipments for analyzing the quality of germplasm like Computer-assisted sperm analysis (CASA) unit and flow cytometer should also be available in Gene Bank.

Embryo storage

Temperature controlled water bath, liquid nitrogen tank, stereo microscope with a heated stage, cassou gun and sheaths, Biosafety cabinet, gradient freezing machin

PASSPORT DATA SHEET

Details of bulls/donors to be submitted in National Gene Bank

S.N.	Item	Remarks
1.	Name of semen collection centre	
2.	Species	
3.	Breed of donor	
4.	No. of donor	
5.	Date of birth	
6.	Date of semen collection	
7.	Sire index (if tested)	
8.	Any abnormality in genital organs	
9.	Age at first collection	
10.	Any abnormality detected in karyotyping	
	Characteristics of the bull (Physical characteristics)	
10.	Colour	
	Coat colour :	
	Skin colour :	
	Muzzle :	
	Eyelids :	
	Tail :	
	Hoofs :	
12.	Horn	
	Colour :	
	Size :	
	Shape :	
	Orientation :	
13.	Ears	
	Length :	
	Orientation :	
14.	Head	
	Forehead :	
15.	Body (Large/ medium/ small)	
	Hump :	
	Dewlap :	
	Naval flap :	

Penis sheath flap :
Basic temperament :

16. Body weight (kg)
    Birth weight :
    Pre-weaning weight :
    12 month weight :
    24 month weight :
    Weight at first collection :
17. Body measurements
    Chest girth :
    Body length :
    Height at withers :
18. A statement regarding absence of infection
    - Foot and mouth
    - Rinderpest
    - Contagious pleuropneumonia
    - Brucellosis
    - Tuberculosis
    - Paratuberculosis
    -Camphylobacteriosis genitalis bovis
    - Laptospirosis
    -Infectious bovine rhinotracheitis
19. Any character specific to the animal
    Semen quality
    -Motility
    -Percent live spermatozoa
    -Sperm concentration
    -Diluent used
    -Final concentration of sperms
    -Recommended method of thawing
20. No. of doses frozen with date of freezing
21. Container no.
22. Total no. of doses of this donor
23. Total doses submitted in Gene Bank
24. Photograph of donor enclosed Yes/ No
25. The donor animals confirming to breed characteristics and selected on the bases of pedigree, performance and health status were quarantined for a period of one month and vaccinated for all communicable diseases before collection of germplasm.

DETAILS OF DNA TO BE SUBMITTED IN NATIONAL GENEBANK

Name of DNA collection centre

Species

Breed

Sr. No.	DNA Quantity and Quality		Information of donor animal			
	DNA isolation date	DNA Concentration	Absorbance 260/280 of DNA solution	location	Sex	Sample collection date

At least 50 samples of a breed should be supplied.

DNA Concentration should be around 100-250 ng/ µl.

Volume of DNA solution supplied should be at least 300 µl.

DNA should preferably be dissolved in Tris-EDTA buffer.

The ratio of absorbance at 260 nm and 280 nm of DNA should be ~1.8.

DETAILS OF EMBRYOS TO BE SUBMITTED IN NATIONAL GENE BANK

Sr.No.	Item	Remarks
1.	Name of embryo collection centre	
2.	Species	
3.	Breed of donor	
Characteristics of the donors		
4.	Dam's milk yield (Best and Average) Semen Donor	
5.	Breeding value of bull	
6.	Dam's milk yield	
7.	Bull No.	
8.	Photographs of donors	
9.	A certificate regarding absence of infections in donors as per OIE standards	
Information regarding embryos		
10.	Method of Embryo collection	
11.	Day of embryo collection after insemination	
12.	Embryo freezing protocol used along with diluent/ cryoprotectant detail	
13.	Embryo thawing protocol	
14.	No. of embryos frozen with date of freezing	
15.	Total embryos submitted in GeneBank	
16.	The donor animals confirming to breed characteristicsand selected on the bases of pedigree, performance and health status were suitably quarantined and vaccinated for all communicable diseases before collection of germplasm. Certified that embryo supplied are of transferrable quality.	

ANNEXURE 22

BREED ACCESSION NUMBERS

SN	Breed	Home Tract	Accession number
CATTLE			
1	Amritmahal	Karnataka	INDIA_CATTLE_0800_AMRITMAHAL_03001
2	Bachaur	Bihar	INDIA_CATTLE_0300_BACHAUR_03002
3	Bargur	Tamilnadu	INDIA_CATTLE_1800_BARGUR_03003
4	Dangi	Maharashtra and MP	INDIA_CATTLE_1104_DANGI_03004
5	Deoni	Maharashtra and Karnataka	INDIA_CATTLE_1108_DEONI_03005
6	Gaolao	Maharashtra and MP	INDIA_CATTLE_1110_GAOLAO_03006
7	Gir	Gujrat	INDIA_CATTLE_0400_GIR_03007
8	Hallikar	Karnataka	INDIA_CATTLE_0800_HALLIKAR_03008
9	Hariana	Haryana, UP and Rajasthan	INDIA_CATTLE_0520_HARIANA_03009
10	Kangayam	Tamilnadu	INDIA_CATTLE_1800_KANGAYAM_03010
11	Kankrej	Gujarat and Rajasthan	INDIA_CATTLE_0417_KANKREJ_03011
12	Kenkatha	UP and MP	INDIA_CATTLE_2010_KENKATHA_03012
13	Kherigarh	Uttar Pradesh	INDIA_CATTLE_2000_KHERIGARH_03013
14	Khillar	Maharashtra and Karnataka	INDIA_CATTLE_1108_KHILLAR_03014
15	Krishna Valley	Karnataka	INDIA_CATTLE_0800_KRISHNAVALLEY_03015
16	Malvi	Madhya Pradesh	INDIA_CATTLE_1000_MALVI_03016
17	Mewati	Rajasthan, Haryana and UP	INDIA_CATTLE_1705_MEWATI_03017
18	Nagori	Rajasthan	INDIA_CATTLE_1700_NAGORI_03018
19	Nimari	Madhya Pradesh	INDIA_CATTLE_1000_NIMARI_03019
20	Ongole	Andhra Pradesh	INDIA_CATTLE_0100_ONGOLE_03020
21	Ponwar	Uttar Pradesh	INDIA_CATTLE_2000_PONWAR_03021
22	Punganur	Andhra Pradesh	INDIA_CATTLE_0100_PUNGANUR_03022
23	Rathi	Rajasthan	INDIA_CATTLE_1700_RATHI_03023
24	Red Kandhari	Maharashtra	INDIA_CATTLE_1100_REDKANDHARI_03024
25	Red Sindhi	On organized farms only	INDIA_CATTLE_0000_REDSINDHI_03025
26	Sahiwal	Punjab and Rajasthan	INDIA_CATTLE_1617_SAHIWAL_03026
27	Siri	Sikkim and West Bengal	INDIA_CATTLE_2221_SIRI_03027
28	Tharparkar	Rajasthan	INDIA_CATTLE_1700_THARPARKAR_03028
29	Umblachery	Tamilnadu	INDIA_CATTLE_1800_UMBLACHERY_03029
30	Vechur	Kerala	INDIA_CATTLE_0900_VECHUR_03030
31	Motu	Orissa, Chhattisgarh & AP	INDIA_CATTLE_1526_MOTU _03031
32	Ghumusari	Orissa	INDIA_CATTLE_1500_GHUMUSARI _03032
33	Binjharpuri	Orissa	INDIA_CATTLE_1500_BINJHARPURI _03033
34	Khariar	Orissa	INDIA_CATTLE_1500_KHARIAR _03034
35	Pulikulam	Tamilnadu	INDIA_CATTLE_1800_PULIKULAM_03035
36	Kosali	Chhattisgarh	INDIA_CATTLE_2600_KOSALI _03036
37	Malnad Gidda	Karnataka	INDIA_CATTLE_0800_MALNADGIDDA_03037

38	Belahi	Haryana and Chandigarh	INDIA_CATTLE_0532_BELAHI _03038
39	Gangatiri	Uttar Pradesh and Bihar	INDIA_CATTLE_2003_GANGATIRI_03039
40	Badri	Uttarakhand	INDIA_CATTLE_2400_BADRI_03040
BUFFALO			
1	Bhadawari	UP and MP	INDIA_BUFFALO_2010_BHADAWARI_01003
2	Jaffarabadi	Gujrat	INDIA_BUFFALO_0400_JAFFARABADI_01006
3	Marathwadi	Maharashtra	INDIA_BUFFALO_1100_ MARATHWADI _01009
4	Mehsana	Gujarat	INDIA_BUFFALO_0400_MEHSANA_01004
5	Murrah	Haryana	INDIA_BUFFALO_0500_MURRAH_01001
6	Nagpuri	Maharashtra	INDIA_BUFFALO_1100_NAGPURI_01007
7	Nili Ravi	Punjab	INDIA_BUFFALO_1600_NILIRAVI_01002
8	Pandharpuri	Maharashtra	INDIA_BUFFALO_1100_PANDHARPURI_01008
9	Surti	Gujarat	INDIA_BUFFALO_0400_SURTI_01005
10	Toda	Tamilnadu	INDIA_BUFFALO_0018_ TODA _01010
11	Banni	Gujarat	INDIA_BUFFALO_0400_BANNI_01011
12	Chilika	Orissa	INDIA_BUFFALO_1500_CHILIKA_01012
13	Kalahandi	Odisha	INDIA_BUFFALO_1500_KALAHANDI_01013
SHEEP			
1	Balangir	Orissa	INDIA_SHEEP_1500_BALANGIR_14033
2	Bellary	Karnataka	INDIA_SHEEP_0800_BELLARY_14019
3	Bhakarwal	Jammu and Kashmir	INDIA_SHEEP_0700_BHAKARWAL_14001
4	Bonpala	Sikkim	INDIA_SHEEP_2200_BONPALA_14034
5	Changthangi	Jammu and Kashmir	INDIA_SHEEP__0700_CHANGTHANGI_14002
6	Chokla	Rajasthan	INDIA_SHEEP_1700_CHOKLA_14008
7	Chottnagpuri	Jharkhand	INDIA_SHEEP_2500_CHOTTANAGPURI_14035
8	Coimbatore	Tamilnadu	INDIA_SHEEP_1800_COIMBATORE_14020
9	Deccani	AP and Maharashtra	INDIA_SHEEP_0111_DECCANI_14021
10	Gaddi	Himachal Pradesh	INDIA_SHEEP__0600_GADDI_14003
11	Ganjam	Orissa	INDIA_SHEEP_1500_GANJAM_14036
12	Garole	West Bengal	INDIA_SHEEP_2100_GAROLE_14039
13	Gurez	Jammu and Kashmir	INDIA_SHEEP__0700_GUREZ_14004
14	Hassan	Karnataka	INDIA_SHEEP_0800_HASSAN_14022
15	Jaisalmeri	Rajasthan	INDIA_SHEEP_1700_JAISALMERI_14009
16	Jalauni	UP and MP	INDIA_SHEEP_2010_JALAUNI_14010
17	Karnah	Jammu and Kashmir	INDIA_SHEEP__0700_KARNAH_14005
18	Kenguri	Karnataka	INDIA_SHEEP_0800_KENGURI_14023
19	Kilakarsal	Tamilnadu	INDIA_SHEEP_1800_KILAKARSAL_14024
20	Madras Red	Tamilnadu	INDIA_SHEEP_1800_MADRASRED_14025
21	Magra	Rajasthan	INDIA_SHEEP_1700_MAGRA_14011
22	Malpura	Rajasthan	INDIA_SHEEP_1700_MALPURA_14012
23	Mandya	Karnataka	INDIA_SHEEP_0800_MANDYA_14026
24	Marwari	Rajasthan and Gujarat	INDIA_SHEEP_1704_MARWARI_14013
25	Mecheri	Tamilnadu	INDIA_SHEEP_1800_MECHERI_14027
26	Muzzafarnagri	Uttar Pradesh and Uttarakhand	INDIA_SHEEP_2024_MUZZAFARNAGRI_14014
27	Nali	Rajasthan	INDIA_SHEEP_1700_NALI_14015

28	Nellore	Andhra Pradesh	INDIA_SHEEP_0100_NELLORE_14028
29	Nilgiri	Tamilnadu	INDIA_SHEEP_1800_NILGIRI_14029
30	Patanwadi	Gujarat	INDIA_SHEEP_0400_PATANWADI_14016
31	Poonchi	Jammu and Kashmir	INDIA_SHEEP__0700_POONCHI_14006
32	Pugal	Rajasthan	INDIA_SHEEP_1700_PUGAL_14017
33	Ramnad White	Tamilnadu	INDIA_SHEEP_1800_RAMNADWHITE_14030
34	Rampur Bushair	Himachal Pradesh	INDIA_SHEEP_0600_RAMPURBUSHAIR_14007
35	Shahbadi	Bihar	INDIA_SHEEP_0300_SHAHBADI_14037
36	Sonadi	Rajasthan	INDIA_SHEEP_1700_SONADI_14018
37	Tibetan	Arunachal Pradesh	INDIA_SHEEP_2300_TIBETAN_14038
38	Tiruchi Black	Tamilnadu	INDIA_SHEEP_1800_TIRUCHIBLACK_14031
39	Vembur	Tamilnadu	INDIA_SHEEP_1800_VEMBUR_14032
40	Katchaikatty Black	Tamilnadu	INDIA_SHEEP_1800_KATCHAIKATTYBLACK_14040
41	Chevaadu	Tamilnadu	INDIA_SHEEP_1800_ CHEVAADU _ 14041
42	Kendrapada	Odisha	INDIA_SHEEP_1500_ KENDRAPADA _ 14042
GOAT			
1	Attapady	Kerala	INDIA_GOAT_0900_ATTAPADYBLACK_06001
2	Barbari	Uttar Pradesh and Rajasthan	INDIA_GOAT_2017_BARBARI_06002
3	Beetal	Punjab	INDIA_GOAT_1600_BEETAL_06003
4	Black Bengal	West Bengal	INDIA_GOAT_2100_BLACKBENGAL_06004
5	Changthangi	Jammu and Kashmir	INDIA_GOAT_0700_CHANGTHANGI_06005
6	Chegu	Himachal Pradesh	INDIA_GOAT_0600_CHEGU_06006
7	Gaddi	Himachal Pradesh	INDIA_GOAT_0600_GADDI_06007
8	Ganjam	Orissa	INDIA_GOAT_1500_GANJAM_06008
9	Gohilwadi	Gujarat	INDIA_GOAT_0400_GOHILWADI_06009
10	Jakhrana	Rajasthan	INDIA_GOAT_1700_JAKHRANA_06010
11	Jamunapari	Uttar Pradesh	INDIA_GOAT_2000_JAMUNAPARI_06011
12	KanniAdu	Tamilnadu	INDIA_GOAT_1800_KANNIADU_06012
13	Kutchi	Gujarat	INDIA_GOAT_0400_KUTCHI_06013
14	Malabari	Kerala	INDIA_GOAT_0900_MALABARI_06014
15	Marwari	Rajasthan	INDIA_GOAT_1700_MARWARI_06015
16	Mehsana	Gujarat	INDIA_GOAT_0400_MEHSANA_06016
17	Osmanabadi	Maharashtra	INDIA_GOAT_1100_ OSMANABADI _06017
18	Sangamneri	Maharashtra	INDIA_GOAT_1100_ SANGAMNERI _06018
19	Sirohi	Rajasthan and Gujarat	INDIA_GOAT_1704_SIROHI _06019
20	Surti	Gujarat	INDIA_GOAT_0400_SURTI_06020
21	Zalawadi	Gujarat	INDIA_GOAT_0400_ZALAWADI _06021
22	Konkan Kanyal	Maharashtra	INDIA_GOAT_1100_ KONKANKANYAL _06022
23	Berari	Maharashtra	INDIA_GOAT_1100_ BERARI _06023
24	Pantja	Uttarakhand and Uttar Pradesh	INDIA_GOAT_2420_ PANTJA _06024
25	Teressa	Andaman & Nicobar	INDIA_GOAT_3300_ TERESSA _06025
26	Kodi Adu	Tamil Nadu	INDIA_GOAT_1800_ KODIADU _06026
HORSE & PONIES			
1	Bhutia	Sikkim and Arunachal Pradesh	INDIA_ HORSE_2223_BHUTIA_07005

2	Kathiawari	Gujarat	INDIA_HORSE_0400_KATHIAWARI_07002
3	Manipuri	Manipur	INDIA_ HORSE_1200_MANIPURI_07003
4	Marwari	Rajasthan	INDIA_HORSE_1700_MARWARI_07001
5	Spiti	Himachal Pradesh	INDIA_ HORSE_0600_SPITI_07004
6	Zanskari	Jammu and Kashmir	INDIA_ HORSE_0700_ZANSKARI_07006
CAMEL			
1	Bikaneri	Rajasthan	INDIA_CAMEL_1700_BIKANERI_02001
2	Jaisalmeri	Rajasthan	INDIA_CAMEL_1700_JAISALMERI_02002
3	Jalori	Rajasthan	INDIA_CAMEL_1700_JALORI_02004
4	Kutchi	Gujrat	INDIA_CAMEL_0400_KUTCHI_02007
5	Malvi	Madhya Pradesh	INDIA_CAMEL_1000_MALVI_02008
6	Marwari	Rajasthan	INDIA_CAMEL_1700_MARWARI_02003
7	Mewari	Rajasthan	INDIA_CAMEL_1700_MEWARI_02005
8	Mewati	Rajasthan and Haryana	INDIA_CAMEL_1705_MEWATI_02006
9	Kharai	Gujarat	INDIA_CAMEL__0400_ KHARAI _02009
POULTRY			
1	Ankaleshwar	Gujarat	INDIA_CHICKEN_0400_ANKALESHWAR_12001
2	Aseel	Chhattisgarh, Orissa & AP	INDIA_CHICKEN_2615_ASEEL_12002
3	Busra	Gujarat and Maharashtra	INDIA_CHICKEN_0411_BUSRA_12003
4	Chittagong	Meghalaya and Tripura	INDIA_CHICKEN_1319_CHITTAGONG_12004
5	Danki	Andhra Pradesh	INDIA_CHICKEN_0100_DANKI_12005
6	Daothigir	Assam	INDIA_CHICKEN_0200_DAOTHIGIR_12006
7	Ghagus	Andhra Pradesh and Karnataka	INDIA_CHICKEN_0108_GHAGUS_12007
8	Harringhata Black	West Bengal	INDIA_CHICKEN_2100_HARRINGHATA BLACK_ 12008
9	Kadaknath	Madhya Pradesh	INDIA_CHICKEN_1000_KADAKNATH_12009
10	Kalasthi	Andhra Pradesh	INDIA_CHICKEN_0100_KALASTHI_12010
11	Kashmir Favorolla	Jammu and Kashmir	INDIA_CHICKEN_0700_KASHMIRFAVOROLLA _12011
12	Miri	Assam	INDIA_CHICKEN_0200_MIRI_12012
13	Nicobari	Andaman & Nicobar	INDIA_CHICKEN_3300_NICOBARI_12013
14	Punjab Brown	Punjab and Haryana	INDIA_CHICKEN_1605_PUNJABBROWN_12014
15	Tellichery	Kerala	INDIA_CHICKEN_0900_TELLICHERY_12015
16	Mewari	Rajasthan	INDIA_CHICKEN_1700_ MEWARI _12016
17	Kaunayen	Manipur	INDIA_CHICKEN_1200_ KAUNAYEN _12017
PIG			
1	Ghoongroo	West Bengal	INDIA_PIG_2100_GHOONGROO_09001
2	Niang Megha	Meghalaya	INDIA_PIG_1300_NIANGMEGHA_09002
3	Agonda Goan	Goa	INDIA_PIG_3500_ AGONDAGOAN _09003
4	Tenyi Vo	Nagaland	INDIA_PIG_1400_ TENYIVO _09004
5	Nicobari	Andaman & Nicobar	INDIA_PIG_3300_ NICOBARI _09005
6	Doom	Assam	INDIA_PIG_0200_ DOOM _09006
DONKEY			
1	Spiti	Himachal Pradesh	INDIA_DONKEY__0600_SPITI_05001

ANNEXURE 23

MATERIAL TRANSFER AGREEMENT
Indian Council of Agricultural Research
Krishi Bhawan, New Delhi–110001, INDIA

Agreed between
of the Indian Council of Agricultural Research, Krishi Bhawan, New Delhi–110001, the apex agricultural research organization of India, being the first Party (Provider of the Material)
And
Being the Second Party (Recipient of the Material)

For the Supply/ Exchange/ Transfer of Genetic Resources for Food & Agriculture/ Germplasm / Genetic Material/ Genetic Components for Research (Mark any one of the following)

- ☐ Within India, not covering persons as described in Section 3(2) of the Biological Diversity Act, 2002 (18 of 2003) (BDA).
- ☐ Within India, wholly or partly covering persons as described in Sec. 3(2) of BDA.
- ☐ Outside India, with Members of the International Treaty for Food and Agriculture (ITPGRFA), and wholly or partly covering persons as described in Sec. 3(2) of BDA.
- ☐ Outside India, with Non-Members of ITPGRFA, and wholly or partly covering persons as described in Sec. 3(2) of BDA.

As follows:

Recipient Name	
Recipient Institution/ Organization/ Agency/ Centre	
Recipient Full Address with PIN Code	
Phone number	
Fax	
Email	
Nature of activities	
Germplasm material	(Semen/DNA/Tissues or any other, specify)
Supply made through	
For Official Use of Supplier	1. Germplasm Identity (Species name, common name, etc.) 2. Accession Number 3. Short Description of the Material

I/We agree to abide by the following terms of the MTA and certify that:

i) The germplasm MATERIAL(S) transferred herein as above shall be used only for the purpose of research under my/ our direct/ close supervision and will not be used for commercial purposes or profit making whatsoever, without prior written approval of the NBA/ MoEF/ DARE/ ICAR, Government of India as the case may be. The importer/ recipient (Second party) agrees to provide a concept note of research project in which the MATERIAL(S) will be used, including the manner in which to be used. The importer/recipient (Second party) agrees to cease any use of the material in case of suspension of research project at the instance of either party or due to factors beyond the control of either party. Upon such suspension of further research work, both parties will mutually agree for adopting a suitable provision for their preservation. In case of failure of the parties to arrive at an agreement, the materials including derivatives will be destroyed upon 90 days notice from ICAR-NBAGR.

ii) All information and material supplied by ICAR-NBAGR shall be deemed to have been disclosed or provided to the recipient in confidence. The recipient agrees to preserve the confidential status of the material and information.

iii) The germplasm MATERIAL(S) or its (their) part(s), components or derivatives (including live or dead tissue/ DNA) that can be used to retrieve whole DNA/fragment or sequence or any other genetic information shall not be distributed or transferred to any third country/ party, except those directly engaged in research under direct supervision of the recipient (second party), without prior written approval of the NBA/ MoEF/ ICAR/ DARE, Government of India as the case may be.

iv) Any development of commercial product based on research on gene manipulation/selective breeding programme for genetic improvement shall not be undertaken without written consent of NBA/MoEF/ICAR/DARE, Government of India as the case may be. Modalities of undertaking any such work will be worked out before its conduct.

v) If any third country/ party is to be associated with any commercial development arising out of the germplasm accessed, permission from NBA shall be sought.

vi) The recipient agrees to acknowledge explicitly the name, original identity and source of the material, if used directly or indirectly, in all research publication(s) or other publications, such as, monographs, bulletins, books, etc. and shall send a copy of each of the publications to the ICAR-NBAGR.

vii) The recipient agrees to supply the feed back information on the performance/ utilisation/ research outcome of the material(s) to the ICAR-NBAGR.

viii) The recipient agrees not to claim any intellectual property right over the MATERIAL(S) received including its related information and knowledge without prior written approval of the NBA/

MoEF/ ICAR/ DARE, Government of India as the case may be.

ix) The intellectual property protection or benefit sharing in respect of derivatives of the material(s) received/accessed, where applicable, shall be as per the Indian IPR/ Biodiversity laws.

x) The recipient agrees to hold the entire responsibility for the quarantine/SPS clearance of the material accessed as specified herein above. The recipient shall abide by the biosafety guidelines of ----------
(Name of the importing country/ organisation) and shall not hold NBAGR/ ICAR/ DARE, Government of India responsible for any identity/ quality/ viability/ purity/ quarantine/ biosafety related or any other related matter/hazard that may be attributable to the release of genetic material/ resource accessed as specified in this Agreement. The recipient agrees to hold entire responsibility for the importer/ indenting country's biosafety and other related hazards due to release of genetic material. The recipient agrees waive all claims against NBAGR/ ICAR/ DARE, Government of India and to defend and indemnify them from all claims and damages/recoveries arising from the use, storage or handling of the material.

xi) The recipient also agrees that the material is for experimental use and is being supplied without any warranties, whatsoever.

xii) The MTA is non-assignable. The recipient agrees to abide by any other conditions that may be set in and conveyed to them from ICAR-NBAGR in respect of this germplasm access/exchange or any Law, Rules, Regulations, etc. enacted by Government of India from time to time.

xiii) In case of any dispute between the parties to this MTA, the dispute shall be referred to the Sole Arbitrator to be appointed by the Secretary, DARE, Government of India. The Decision of the Sole Arbitrator shall be final and binding on the Parties. The Arbitration proceedings shall be governed by the Arbitration and Conciliation Act, 1996. The Arbitration proceedings shall be in New Delhi.

ANNEXURE 24

SCHEDULE DISEASES

(under Prevention and Control of Infectious and Contagious Diseases in Animals Act, 2009)

Multiple species diseases

1. Anthrax.
2. Aujeszky's disease.
3. Bluetongue.
4. Brucellosis.
5. Crimean Congo haemorrhagic fever.
6. Echinococcosis/hydatidosis.
7. Foot and mouth disesase.
8. Heartwater.
9. Japanese encephalitis.
10. Leptospirosis.
11. New world screwworm (*Cochliomyia hominivorax*).
12. Old world screwworm (*Chrysomya bezziana*).
13. Paratuberculosis.
14. Q fever.
15. Rabies.
16. Rift Valley fever.
17. Rinderpest.
18. Trichinellosis.
19. Tularemia.
20. Vesicular stomatitis.
21. West Nile fever.B.

Cattle diseases

1. Bovine anaplasmosis.
2. Bovine babesiosis.
3. Bovine genital campylobacteriosis.
4. Bovine spongiform encephalopathy.
5. Bovine tuberculosis.
6. Bovine viral diarrhoea.
7. Contagious bovine pleuropneumonia.
8. Enzootic bovine leucosis.
9. Haemorrhagic septicaemia.
10. Infectious bovine rhinotracheitis / infectious pustular vulvovaginitis.
11. Lumpy skin disease.
12. Malignant catarrhal fever.
13. Theileriosis.
14. Trichomonosis
15. Trypanosoma

Sheep and goat diseases

1. Caprine arthritis/encephalitis.
2. Contagious agalactia.
3. Contagious caprine pleuropneumonia.
4. Enzootic abortion of ewes (ovine chlamydiosis).
5. Maedi-visna.
6. Nairobi sheep disease.
7. Ovine epididymitis (Brucella ovis).
8. Peste des petits ruminants.
9. Salmonellosis (S. abortusovis).
10. Scrapie.
11. Sheep pox and goat pox.

Equine diseases

1. African horse sickness.
2. Contagious equine metritis.
3. Dourine.
4. Equine encephalomyelitis (Eastern).
5. Equine encephalomyelitis (Western).
6. Equine infectious anaemia.
7. Equine Influenza.
8. Equine piroplasmosis.
9. Equine rhinopneumonitis.
10. Equine viral arteritis.
11. Glanders.
12. Surra (Trypanosoma evansi).
13. Venezuelan equine encephalomyelitis.

Swine diseases

1. African swine fever.

2. Classical swine fever.
3. Nipah virus encephalitis.
4. Porcine cysticercosis.
5. Porcine reproductive and respiratory syndrome.
6. Swine vesicular disease.
7. Transmissible gastroenteritis.

Avian diseases

1. Avian chlamydiosis.
2. Avian infectious bronchitis.
3. Avian infectious laryngotracheitis.
4. Avian mycoplasmosis (*M. gallisepticum*).
5. Avian mycoplasmosis (*M. synoviae*).
6. Duck virus hepatitis.
7. Fowl cholera.
8. Fowl typhoid.
9. Highly pathogenic avian influenza and low pathogenic avian influenza in poultry.
10. Infectious bursal disease (Gumboro disease).
11. Marek's disease.
12. Newcastle disease.
13. Pullorum disease.
14. Turkey rhinotracheitis.

Other diseases

1. Camelpox.
2. Leishmaniosis

guidelines

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