

A Digitized Inventory of Domestic Animal Resources of India

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ABSTRACT

A comprehensive digitized inventory of India's domestic animal resources provides data on livestock species: cattle, buffalo, sheep, goat, equine, camel and poultry. It offers information in seven modules on geographical distribution; morphological description and diagnostic features; performance; livestock farms; products and byproducts; market information, trade data and patents. It also provides colored photographs of male and female animals of each breed of above-mentioned animal species. It uses secondary data on different aspects of each breed of different species. The data was standardized using database normalization techniques and the same was then converted into database format using a relational database management system (RDBMS). The system is menu driven designed using MS-Access at the back end and Visual Basic 6.0 at the front end. A user-friendly graphical user interface has been developed for storage and retrieval of information from the database. The database system provides information on different aspects of domestic animal resources at a single/uniform platform, which can be of use to a wide range of users from students, teachers, planners, administrators, policy makers, farmers, dairy industry, patent offices and the scientific community at large.

Key Words: Animal Resources; Breed; Database; Inventorization; Relational Database Management System.

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INTRODUCTION

The term "animal genetic resources" is the commonly accepted, abbreviated for "those animal species that are used, or may be used, for the production of food and agriculture, and the populations within each of them" (FAO, 1999). The term farm animal genetic resources is used to include all animal species, breeds and strains (and their wild relatives) that are of economic, scientific and cultural interest to humankind in terms of food and agricultural production for the present or the future (Rege and Gibson, 2003). These come from 40 species of animals that have been domesticated during the past 10,000 to 12,000 years, which contribute directly or indirectly to agricultural production (FAO, 2000). Domestic animal diversity is a term that has been used to mean the genetic differences among and within breeds of species used for food and agriculture. According to FAO (1999) estimates, domestic animal genetic resources supply around 30% of total human requirements for food and agricultural production. Livestock also produce such non- food items as hides, skins, wool, traction power and fuel in some communities (Steinfeld et al, 1997; Rege, 1998). In addition livestock are a major source of revenue and export earnings for many countries (Winrock International, 1992). Livestock can also contribute towards environmental sustainability in well-balanced mixed farming systems (De Haan et al., 1997). This may be through provision of draft power, and manure and urine as fertilizer (Steinfeld et al., 1997).

Traditionally, India has been a mega biodiversity centre of the world. The rearing and management of domesticated animals are age-old traditions, and farmers are well versed in the upkeep of animals. There are well-defined breeds of domestic animals distributed in certain areas known as native breeding tracts. All

these breeds have been evolved through selective breeding by the farmers/breeders using the traditional and scientific knowledge, and today we have 34 recognised breeds of cattle, 10 of buffalo, 20 of goat, 41 of sheep, 6 of camel, 6 of equine and 18 of poultry. Besides this, there are lot of other strains/genotypes that need to be evaluated for defining as distinct breeds. Planners, researchers, development agencies and farmers need data on livestock resources for future studies and evolving realistic strategies for improvement and rearing of livestock. The data is also required for monitoring prices and movement of livestock products, animal feed, and establishment of services such as veterinary hospitals, artificial insemination centers, meat and dairy industries etc. Further, there is a need to study animal resources in relation to other aspects of agriculture such as soil, vegetation, climate; socio-economic conditions, land use and water resources for overall development of agricultural sector in general and livestock sector in particular. In view of above, a national database on livestock resources can be of immense help for sustainable development of these resources in the country. Such a database combined with databases on other natural resources can help planners, research and developmental (R & D) agencies in evolving more realistic strategies and development plans for management and conservation of this natural wealth of the country. Besides this, there persist many gaps in the data on livestock resources due to reasons like data not being compiled in its entirety and most of the data are not computerized as yet.

Keeping in view the above constraints and data gaps, a comprehensive digitized inventory of domestic animal resources (Cattle, Buffalo, Sheep, Goat, Equines, Camel and Poultry) of India with specific focus on breeds of various species with their

geographical distribution, morphological description, diagnostic features, livestock farms, products and byproducts of various species and their commercial value, market information and trade data, and patents registered was developed. The main goal was to integrate the scattered data on different aspects of domestic animals. The database is an important part of Indian Bio Resource Information Network/Jeev Sampada, the first ever digitized inventory of India's vast bio-resources, sponsored by National Bioresources Development Board, Department of Biotechnology, Government of India. This database gives detailed information on domestic animals along with coloured photographs that will help in better understanding of the breed characteristics and differences among them. The digitized inventory has several modules viz. data entry/modify, on line query, photographs, reports, graphs, data source etc. The information system generates direct reports in predefined formats through selection of desired parameters and shall eventually become a decision support system for policy planners. The inventory will be of interest to students, professionals and policy planners, and will help in understanding characteristics of different breeds and planning strategies for their improvement and conservation.

MATERIALS AND METHODS

The working unit of a database for farm animal genetic resources is the breed. This term is taken in its widest possible sense. A generally accepted working definition of the term, in the context of databases and research on animal genetic resources, is that of a population within the species, possessing a number of particular traits that permit the grouping of these animals under a common label (the breed name) and is always associated to a geographical area and one or more human groups. Data, the heart of any database, were collected from secondary sources from various government and research organizations with the involvement of eight institutes namely-National Bureau of Animal Genetic Resources, Karnal; National Dairy Research Institute, Karnal; National Research Centre on Camel, Bikaner, Rajasthan; National Research Centre on Equines, Production Campus, Bikaner, Rajasthan; Central Sheep and Wool Research Institute, Avikanagar, Rajasthan; Central Institute of Research on Goats, Makhdoom, Uttar Pradesh; Central Leather Research Institute, Chennai, Tamil Nadu and Central Avian Research Institute, Izatnagar, Uttar Pradesh. A uniform approach was followed to standardize the collected data using database normalization techniques (Date, 2001) and the same was then converted into database format using back-end tool viz., MS-Access relational Database Management System (RDBMS). The data was then digitized as per standardized database format. A user friendly Graphical User Interface (GUI) was developed for storage and retrieval of information from the database by using front-end

programming tools viz. MS-Visual Basic 6.0 (Jennings, 2000) and Seagate Crystal Reports Professional Versions 7.0. Various electronic forms for data entry, editing, updating of data equipped with automatic validation checks to safeguard the database against duplicate and/or unnecessary data entry were incorporated in the software to facilitate easy data storage. The online query and report generation modules were added to the system for information retrieval. Attention was also paid to incorporate automatic graphic presentation of the retrieved data. The whole database system has been recorded on the CD-ROM medium in auto-setup form.

RESULTS AND DISCUSSION

The digitized inventory of India's domestic animal resources provides data on seven species: cattle, buffalo, sheep, goat, equine, camel and poultry. It has several modules (fig.1) viz. data entry/modify, on line query, reports, graphs, photographs etc and offers information on geographical distribution; morphological description and diagnostic features; performance; livestock farms; products and byproducts; market information and trade data; and patents.

Report generation is an important aspect of a database. Due attention has been given while designing reports. The information system generates direct reports in predefined formats through selection of desired parameters. It also generates reports in the form of line, pie and bar diagrams. Morphological description of any breed of livestock can be generated. Likewise, available photographs of all breeds have been incorporated into the database. The user can retrieve the photographs by interacting with the module.

Data entry and updating of database is continuous process, as with the passage of time, need arises for entry of new data as well as updating the existing one. Hence, the database has been provided with these facilities. Efforts have been made to put proper validations in place as per requirements of the inventory. The detailed description of data modules of the system are briefly described below:

1. Geographical distribution: This module holds information of geographical distribution of various breeds of livestock and poultry in India (fig.2). The user can navigate the following information:

- | | |
|--|------------------------------|
| ? Name of Species | Name of corresponding breeds |
| ? Breeding tract of the corresponding breed along with information on its longitude and latitude | |

Morphological description and diagnostic features: This module of the database provides following information on morphological description and diagnostic features of each breed.

- | | |
|--------------------------------|-------------------------------------|
| ? Name of species | ? Average female length |
| ? Name of corresponding breeds | ? Average male heart girth |
| ? Synonym/local name | ? Average female heart girth |
| ? Colour | ? Average male birth weight |
| ? Visible character | ? Average birth female weight |
| ? Average male height | ? Average adult male weight |
| ? Average female height | ? Average adult female weight |
| ? Average male length | ? Specific characteristics/ remarks |



Fig.1. Different modules of the database

2. *Performance*: Performance of livestock breeds is one of the important areas where data recording is almost nil at farmers' level. Available data from organized farms recorded from secondary sources was entered in the database. This module contains information of morphological description and diagnostic features of each breed. It holds following information on cattle, buffalo, camel and equine breeds.

- ? Name of species
- ? Name of corresponding breeds
- ? Total lactation milk yield
- ? Milk fat percentage
- ? First lactation milk yield
- ? Lactation length
- ? Dry period
- ? Age at first calving
- ? Calving interval

On sheep breeds, it provides the following information.

- ? Name of species
- ? Name of corresponding breeds
- ? Lambing percentage
- ? Age at first lambing
- ? Wool yield
- ? Staple length
- ? Fibre density
- ? Medullation
- ? Fibre diameter

Similarly, on goat breeds the following aspects were considered.

- ? Name of species
- ? Name of corresponding breeds
- ? Average milk yield/lactation
- ? Milk fat percentage
- ? Lactation length
- ? Age at first kidding
- ? Kidding interval
- ? Twinning percentage
- ? Triplets percentage
- ? Mortality rate (kids)
- ? Mortality rate (adults)

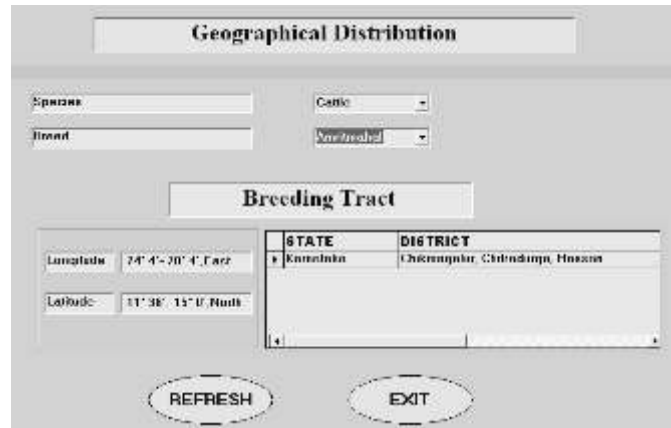


Fig.2. Geographical distribution of breeds of different species

3. *Livestock Farms*: The module on livestock farms holds information on livestock farms and contact agencies in relation to breeds of different species in the following format.

- ? Name of species
- ? Name of corresponding breeds
- ? Livestock farms
- ? Contact agencies

In case of poultry, it contains information on hatcheries in India as well as on poultry farms and farmers.

- ? State
- ? District
- ? Poultry farms/farmers
- ? Hatcheries

4. *Products and by-products of various species and their commercial value*: Central Leather Research Institute, Chennai, has collected the secondary data on by-products while NDRI, Karnal has provided data on livestock products. The data source from CLRI is a handbook –“Utilization of slaughterhouse waste material for animal feed, TIFAC, Technologies for value realization of carcass byproducts in developing countries” (www.indiaagrstat.com). The module on by-products provides the following information for the year 1992 on buffalo, crossbred cattle, indigenous cattle, sheep and goat in the sub-modules given below.

(i) Availability of by-products from animals:

- ? Species (cattle, buffalo, sheep and goat)
- ? By-products (blood, bones, hair and teeth, hides and skins, horns and hooves, meat, ruminal contents, tissues)
- ? Year

(ii) Availability of by-products from slaughtered animals:

- Species (cattle, buffalo, sheep and goat)
- Year
- By-products (blood, hides and skins, horns and hooves, ruminal contents, inedible tissues)

(iii) Availability and non-recovered by-products from fallen animals:

- | | |
|--------------------------------------|---------------------------------------|
| ? Species | ? Availability of blood |
| ? Year | ? Approximate yield of blood |
| ? Population | ? Non-recovered blood |
| ? Mortality rate | ? Availability of meat |
| ? Number of carcass | ? Approximate yield of meat |
| ? Average weight of animal | ? Non-recovered meat |
| ? Total weight of carcass | ? Availability of rumen digesta |
| ? Total non-recovery | ? Approximate yield of rumen digesta |
| ? Availability of hides and skins | ? Non-recovered rumen digesta |
| ? Availability of horns and hooves | ? Availability of hair and teeth |
| ? Approximate yield of horns /hooves | ? Approximate yield of hair and teeth |
| ? Non-recovered horns and hooves | ? Non-recovered hair and teeth |
| ? Availability of bones | ? Availability of tissues |
| ? Approximate yield of bones | ? Approximate yield of tissues |
| ? Non-recovered bones | ? Non-recovered tissues |

(iv) Yield of by-products from slaughtered animals:

- | | |
|----------------------------|------------------------------------|
| ? Species | ? Approximate yield from an animal |
| ? Year | ? Yield/day |
| ? Slaughtered animals/ day | ? Yield/month |
| ? By-products | |

(v) Availability of tissues from fallen animals:

- | | |
|--|----------------|
| ? Species | ? Yield |
| ? Year | ? Availability |
| ? Tissues (small intestine, large intestine, stomach, liver, spleen, heart, lung, trachea, free fat, brain, bile, tongue, kidneys) | |

The module on animal products holds information about total milk production across different states and the country as a whole. The module on milk products holds data on cheese, condensed milk, malted milk food and milk powder. It also contains the production statistics of beef and veal, buffalo meat, egg, egg food, goat meat, hatching egg, meat, poultry meat, wool (all India and state-wise), milk (buffalo, cow and goat; state-wise); wool, mutton and lamb (all India and state-wise). Different fields under this module are:

- | | |
|-----------|------------|
| ? Species | ? Year |
| ? Product | ? Quantity |
| ? State | ? |

The report along with the bar diagram depicting the cow milk production for the state of Punjab for the period 1990-91 to 1998-99 has been shown in fig.3.

The module on value of output from livestock sector deals with the value of different items under livestock at current and constant prices for different states and all India for the period 1991-92 to 1999-2000. The products (items) covered are: livestock, milk, dung, egg, meat and wool.

- | | |
|--|---------|
| ? State | ? Year |
| ? Product (livestock, milk, dung, egg, meat, wool) | |
| ? Pricing level (constant/current) | ? Value |

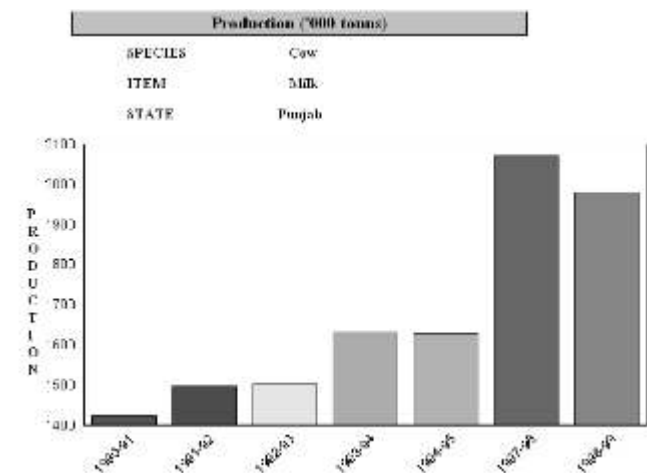


Fig.3. Total cow milk production in Punjab during different years

5. *Market information and trade data:* This module provides information about the import and export in both quantity and value. It gives information on quantity in kg and value in rupees. The following products have been covered: blue veined cheese, butter, butter fresh, butter milk, butter oil, condensed milk, curdled milk and cream, dairy and poultry products and honey, dairy spreads, eggs, fresh cheese, grated or powdered cheese of all kinds, leather, livestock meat and edible meat offal, melted butter (ghee), milk for babies, milk and cream containing fat not exceeding 1%, milk and cream containing more than 1% butter and less than 6% by weight, milk food for babies, poultry meat products, processed cheese not grated/powdered, raw wool and animal hair and skimmed milk.

- | | |
|--------------------------|------------------|
| ? Product | ? Quantity |
| ? Status (import/export) | ? Amount (value) |
| ? Year | |

6. *Patents (processes, products, etc.), if any:* This module contains the information on the patents of dairy processes registered in India. The secondary data has been collected from the Indian Patent Office, New Delhi.

This component of the database contains the following information:

- | | |
|------------------|-----------------|
| ? Patent number | ? Patent title |
| ? Date of filing | ? Patent holder |
| ? Approval date | |

User can also search the patent information by entering key words.

SUMMARY

The inventory of domestic animal resources contains information on geographical distribution, morphological description and diagnostic features and performance of each breed. It holds information on the livestock farms, State wise hatcheries and district-wise poultry farms. The database also contains species wise availability of byproducts viz. availability of byproducts from fallen animals, availability of byproducts from slaughtered animals. It also contains species wise production of various products in different states and state wise data of value of output from livestock sector at current and constant prices. The database contains available information on Import and Export of various items. Information on patents registered in India has also been incorporated into the database.

The database system provides information on different aspects of animal resources on a single user-friendly platform, which can be shared by the potential users including planners, administrators, policy makers, farmers, dairy industry, and the scientific community at large. The inventory hopefully would fill the persisting gaps in the data on resources in general and on animal genetic resources in particular fulfilling the need of a centralized database on animal resources in the country.

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