

1. ANIMAL RESEARCH IN INDIA

B. K. SONI*

Stretching from 8° northern latitude to 35° N latitude, its elevation ranging from the mean sea level to highest mountain system of the world, the socio-economic conditions of farmers ranging from prosperity belt of North-west India, to predominantly poverty belt of Eastern India, the agricultural operation in-put intensity ranging from mechanized agriculture in certain parts to hand-tool agriculture in other parts, the cultivators in India represent a range and balance of enterprise which can hardly be matched by any country in the world. The diversity of cultivated flora and the seasonality of agricultural production are the characteristic which greatly influence the livestock production in India.

Present Status of Livestock Industry in India:

From times immemorial livestock keeping in India has been an integral part of country's agricultural economy. India is predominantly an agricultural country with about 70 per cent of its population dependant on income from the land. Livestock keeping centres round the small cultivator, to the large majority of whom livestock raising is a subsidiary occupation to crop production. The cultivator has meagre resources, he lives on small holding of 5 acres or less and the average number of animals possessed by him is only 2 or 3. Agriculture and rearing of animals go hand in hand in this country and mixed farming concept is, therefore, practised for obtaining the best results.

Numerically India possesses the largest cattle and buffalo population in the world. There are more animals per head of human population and per acre of cultivated land than in most of the other countries of the world. There are 176.06 million head of cattle, 52.92 million buffaloes, 40 million sheep, 60 million goats and about 9 million other livestock. In addition there are 117 million (1966 Census).

There are about 25 breeds or types of cattle which are distributed in different parts of the country. The well-defined breeds are of three distinct types viz., the milch type, the purely draught type and the dual purpose type. Only about a quarter of the total cattle and buffalo population conforms to the characteristics of well-defined breeds/types. The remaining 75 per cent are 'non-descript' animals. All gradation of quality exist and the line of demarcation between the two classes is scarcely distinct.

The buffalo is important dairy animal in India. It generally provides the farmer with milk and ghee (butter-oil). One characteristic feature of the buffalo milk is its high fat content which is about seven per cent on the average as compared with four to five per cent in milk of Indian cows. The higher fat content makes the buffalo more economical than the cow as the producer of butter and ghee. Out of six well-defined breeds of buffaloes, MURRAH is in more extensive use.

While the animals of the well-defined breeds/types and the non-descript animals are reared in the villages mainly by the framers, organized herds of almost all the well-defined breeds are maintained at farms, a large majority of which are owned by the Central and State Governments. Some of the farms are owned privately. The work done at these farms has helped in the production of high class bulls which are being

* Deputy Director-General (Animal Sciences), Indian Council of Agricultural Research, India.

utilized for the improvement of village cattle. The number of such farms in India is over 200.

Sheep is another important livestock species in India's agricultural economy having multi-faceted utility (for meat, wool, skin, manure and to some extent for milk). Sheep is known to be the most appropriate livestock species for utilization of sparse vegetation especially in arid and semi-arid areas with marginal and sub-marginal lands unfit for agricultural production even using more sophisticated methodology of water and land utilization. Indian breeds of sheep are able to survive prolonged periods of draught and semi-starvation and to travel over long distances for obtaining sufficient forage and water to subsist. They are less prone to hazards of tropical heat. They are non-seasonal breeders and thus have higher reproductive rates compared to those which are seasonal breeders and may fail to breed during their usual breeding season due to lack of favourable grazing grounds.

The northern temperate (Himalayan region) has approximately 12 per cent of the total sheep comprising medium to fine wool breeds. The north-western region has 30 per cent sheep population comprising mostly carpet quality wool breeds. This region contributes more than 50 per cent of the total wool produced in the country. The peninsular regions with 50 per cent sheep population has half of its population producing no wool and the other half producing very coarse coloured fleeces. The eastern region with only seven per cent of the sheep population maintains mostly animals for meat.

The 60 million goats in India are used all over the country for supplementing deficiencies in milk supplies and for providing mutton. In high altitude areas, goats are maintained for production of Mohair and Pashmina, a fine under-coat fibre which is highly priced for making woollen items.

The indigenous breeds of pigs are comparatively low producers and have poor feed conversion efficiency. However that pigs are important source of animal proteins is now being increasingly realized. In the last decade, for promoting piggy development, pig breeding farms have been set up in all States. Exotic breeds of pigs, primarily Large White Yorkshire are maintained at these farms. Concentrated piggy development programme is in hand in compact areas using exotic breeds.

Poultry production has made considerable strides in last two decades. Indigenous poultry which has low production is now being replaced by improved breeds of higher productivity. In all the States several poultry farms have been set up to produce hatching eggs and breeding stock of improved breeds needed for poultry development work in rural areas. To stimulate interest of rural poultry farmers, a net work of Poultry Extension centres have been set up. In addition development of poultry is taken up on a large scale through the Intensive Poultry Development-cum-Marketing centres. Large number of commercial poultry units with modern facilities for hatching, brooding, rearing have come up where birds with high productivity are maintained. Several breeds are maintained, among which White Leghorn and Rhode Island Red are more popular. The commercial farms supply hybrid chicks. In spite of difficult grain position, large number of poultry feed manufacturing units have been set up. Though there is encouraging trend in poultry development still much head-way has to be made to reach anywhere near the requirements of eggs.

Though the country has an enormous livestock population, the availability of milk, meat, eggs etc., is relatively small. This is due to low productivity of livestock and poultry. The present level of production milk of cows and buffaloes is 157 kg per cow and 504 kg per buffalo per year. The average wool and meat yield of indigenous sheep is 0.7 kg and 10.00 kg respectively.

While the average milk production on basis of total bovine population is low, the performance of herds of some of the well-defined milch breeds is high. The Sahiwal,

Sindhi and Gir are few examples of milch breeds. The average lactation yield in some of the herds at farms, has been of the order of 2,500 kg for Sahiwal and Tharparkar, 2,000 kg for Red Sindhi and Gir breeds. In buffalo, yields from 2,000–2,500 kg per lactation are common. In certain outstanding herds yield upto 4,000 kg have been recorded.

There is a large gap between the requirement and availability of feed and fodder. Only about a quarter of feed and 2/3rd of fodder requirements are estimated to be available. Only four per cent of the total area under cultivation is utilized for fodder production. In recent years, the production of high yielding crops has, however, made available increasing quantities of feed and fodder for animals and other sources are being tapped to narrow down the gap.

Even in its present state, the annual contribution of livestock to the Indian economy is of the order of Rs.31,860 million calculated at the price level prevailing in 1970–71. The internal and international trade in livestock and livestock products are also of considerable magnitude. The annual value of country's exports amount to Rs.140 million. The export of wool carpets and woolen products are valued at Rs.42.7 million and that of leather etc., over Rs.90 million.

Status of Animal Sciences Research:

A comprehensive set up for animal sciences research exists in the country. There are Central and State Research Institutions that have been set up to undertake research various aspects of livestock production i.e. breeding, nutrition, management, health, forage production and processing technology. The Central Institutes devote themselves primarily to fundamental and applied research, the State Institutes largely undertake research on problems of regional and local nature. In addition, the Agricultural Universities, of which 19 have been set up in the country also conduct research on various aspects of animal production.

The overall coordination of research is the responsibility of the Indian Council of Agricultural Research (I.C.A.R.). The Council promotes, guides and coordinates research in agriculture including animal sciences in the country. The Central Research Institutes are directly administered by the Council. In addition, the Council provides financial support for research schemes/projects in the State Institutes, Agricultural and other Universities and organized private research Institutions. The research support from the Council has made strong impact on animal sciences research and has helped to develop a strong research base in various Institutions. The Council has developed coordinated research projects under which problem oriented research on various aspects of animal sciences is undertaken. The concept of coordinated research projects provides for simultaneous research on a particular programme under different agro-climatic conditions, bringing together senior Scientists in a particular field to tackle the problem in a co-ordinated way.

The Central Research Institutes undertaking animal sciences research are:—

1. Indian Veterinary Research Institute, Izatnagar—U.P. (I.V.R.I.)
2. National Dairy Research Institute, Karnal-Haryana, (N.D.R.I.)
3. Central Sheep & Wool Research Institute, Avikanagar—Rajasthan (C.S.W.R.I.)
4. Central Arid Zone Research Institute, Jodhpur—Rajasthan (C.A.Z.R.I.)
5. Indian Grassland & Fodder Research Institute, Jhansi—U.P. (I.G.F.R.I.)

The I.V.R.I. comprises 14 full-fledged Divisions including Division of Animal Genetics, Nutrition, Poultry Research, Physiology & Pharmacology, Livestock Products Technology etc.

The object of the Institute is to conduct fundamental and applied research in genetics and breeding, nutrition, climatology, physiology, poultry science and animal health.

The N.D.R.I. has the main object of developing dairy cattle and buffaloes and to

conduct research on various aspects of dairying and dairy technology. The Institute has eight independent research Divisions including Divisions of Dairy Chemistry, Dairy Microbiology, Dairy Technology, Dairy Cattle Genetics, Nutrition, Physiology and Extension.

The Central Sheep & Wool Research Institute is engaged in research on fundamental and applied aspects of sheep and wool production and wool utilization including research on various aspects of sheep husbandry, animal nutrition and physiology.

The Indian Grassland & Fodder Research Institute is primarily engaged on development of forages and production of fodder crops in relation to economic milk production in dairy animals as well as for raising the nutritional status of other species of livestock.

The Central Arid Zone Research Institute, in addition to agricultural research, is engaged on fundamental and applied research on breeding, rearing and production of animals under arid and semi-arid conditions.

Some of the private organizations have also their own research set-up for conducting research on certain specific problems. The number of such organizations is small.

Animal Breeding:

As mentioned earlier, the productivity of different species of livestock in this country is comparatively low. This is the result of uncontrolled breeding over long periods accompanied with great inadequacy of nutrition and high incidence of diseases. Research studies to raise productivity of livestock and poultry have been taken up at several research centres.

Selection has been carried out to bring out genetic improvement in different cattle breeds in Government and selected private cattle breeding farms. Some of the important herds in which genetic improvement has been achievedly selection are those of the N.D.R.I. Karnal (Sahiwal, Red Sindhi and Tharparkar), Indian Agricultural Research Institute, New Delhi (Sahiwal), Allahabad Agricultural Institute, Allahabad (Red Sindhi), Livestock Research Station, Hosur (Red Sindhi and Kangayam) and the Institute of Agriculture, Anand (Kankrej).

Genetic studies pertaining to various characters like heritability, age at first calving, calving interval etc., have been made on the several important herds of different breeds.

Progeny testing of bulls maintained at organized herds has also been carried out in respect of several breeds.

With a view to accelerate milk production, research on cross-breeding of indigenous cows with exotic breeds has been taken up at several centres. A field research project to find out effect of cross-breeding for raising productivity of village cattle was taken up at 12 centres in the hilly and the heavy rainfall areas of the country. The results of these studies over a long period indicated that half-bred had higher milk production, better growth rate and early maturity compared to the indigenous breeds. Subsequently, research on introduction of exotic germplasm has been taken up on a large scale under a Coordinated Research Project at different centres wherein three exotic breeds of cattle, i.e. Jersey, Brown-Swiss and Holstein-Friesian are being used. Different combinations are being studied for their growth rate, age of maturity, age of first calving, milk production, calving interval etc. Though the programme is of long term nature, encouraging results have been obtained at different centres.

As a result of the cross-breeding research work carried out at the N.D.R.I. Karnal during the last 10 years, a new strain of dairy cattle 'Karan-Swiss' has been developed in the year 1972. It possesses exotic inheritance from Brown Swiss and Zebu inheritance from Sahiwal and Red Sindhi breeds. The average milk production of this strain is about 3,000 kg per lactation in 305 days.

Research on various aspects of artificial insemination such as cytomorphology and

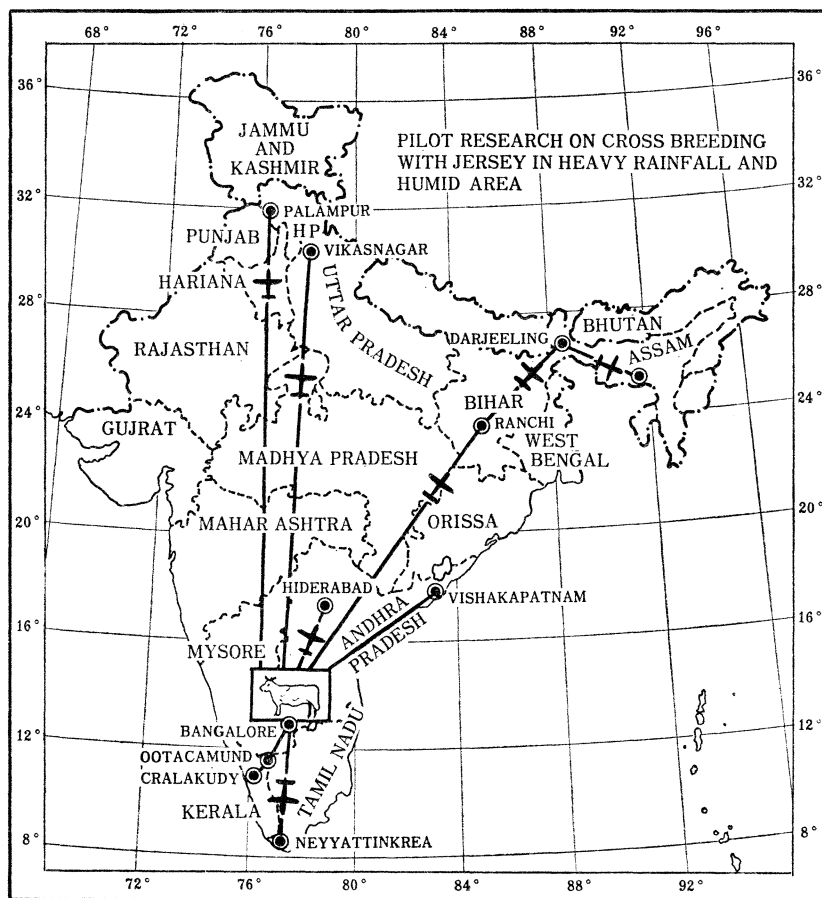


Fig. 1.

MULTI DISCIPLINARY APPROACH

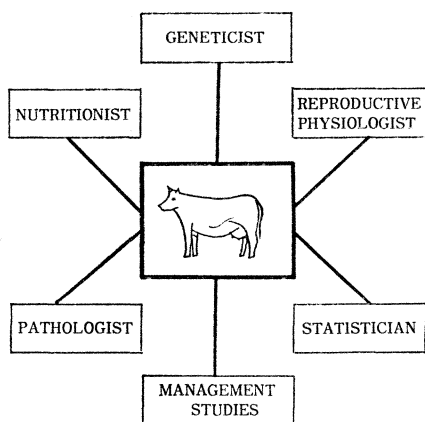


Fig. 2.

TARGET FOR THE BREEDING OF MILK COW

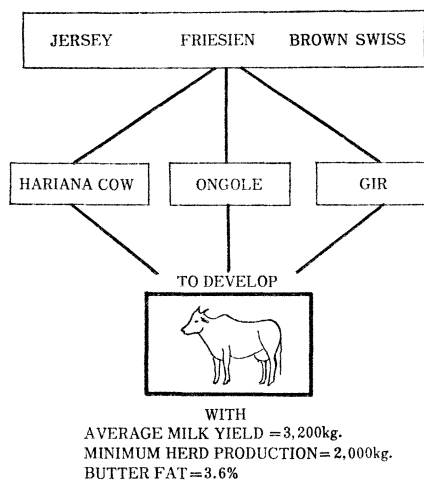


Fig. 3.

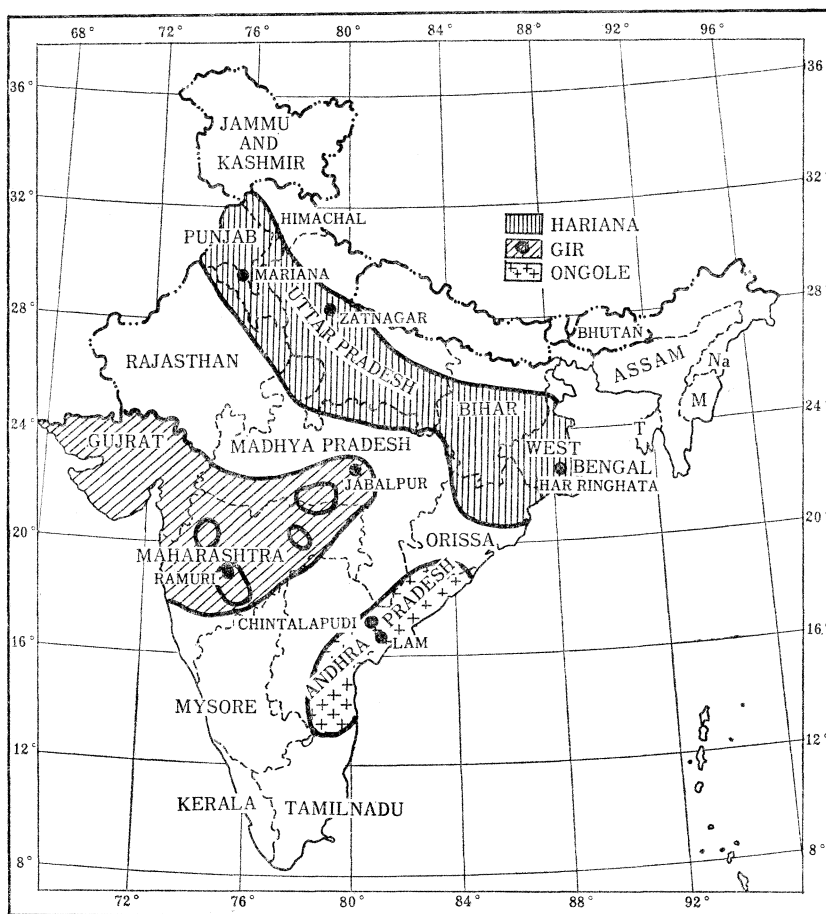


Fig. 4.

and physiology of spermatozoa, semen bio-chemistry, semen extenders, effect of nutrition and exercise on sperm production, seasonal effects of reproduction of Indian farm animals etc., has been carried out at the I.V.R.I. Izatnagar and N.D.R.I. Karnal and in some of the Agricultural Universities. In sheep, artificial insemination on a limited scale is being practised.

A number of sheep breeding farms have been established to study the potentialities of different breeds and to evolve new strains by selection and by cross-breeding of the local hardy sheep with rams of exotic breeds. Trials on acclimatization of exotic breeds particularly those from temperate region have also been taken up. Selection among experimental flocks is effected by taking into consideration the fertility, growth rate, wool and meat yield and wool quality. Fleece testing laboratories have been attached to the principal sheep breeding farms. The exotic breed used are mostly Australian merinos, rambouillet and polwarth.

Coordinated Research Projects for Sheep for Wool and Sheep for Mutton have been taken up. The object of the first project is to evolve a superior sheep producing fine quality wool. The mutton project aims at evolving new type of mutton sheep having a high genetic potential so that animals may attain a body-weight of 30 kg at six months'

age.

In addition extensive studies on heritability of wool, correlation between potassium types and production traits, correlation between haemoglobin types and economic characters have been made.

The Poultry Research Division of the I.V.R.I. has been engaged in poultry breeding research and a number of studies pertaining to heritability, production etc., have been made. Family selection methods, reciprocal recurrent selection and cross-breeding etc., have been studied for evolving superior birds.

Animal Climatology:

In India research is gradually being extended to understand the ways in which domestic animals react to climatic stress and of the characteristics which enable desirable productive qualities to be manifested under different conditions of stress. The studies have taken into consideration the fact that animal production forms an important part of the local economy and that their production is affected to an appreciable extent by high temperature and high humidity experienced for many months in the year. While indigenous animals have higher heat resistance most of them are poor producers. The wide variety of indigenous types of animals is suggestive of the fact that there is wide genetic range from which desirable characteristics might have been concentrated for selection and breeding. Keeping these factors in view, animal climatology investigations have been in progress at certain Institutions. At the I.V.R.I. a climatological laboratory with psychrometric chamber has been set up for conducting controlled experiments. The research work in animal climatology incorporates studies on the effects of climate on various physiological responses including reproduction of cattle, buffalo, sheep, goat, poultry and a few species of laboratory animals. At Cattle Breeding Farm, Haringhatta (West Bengal) studies were conducted to test the validity of the prevailing opinion that the better breeds of cattle which are found mostly in the north and north-western regions of the country with dry climate do not thrive well when transferred to certain parts in the east and south where the climate is hot and humid. The results of experiments with six breeds have shown that they possess sufficient adaptability and a change in climate alone should not prevent the animals from thriving in locations in the country far removed and different from their home tract.

In view of the fact that India is importing on reasonably large scale exotic animals—cattle, sheep, goats and poultry some of whom are placed on the farms/field having climatic conditions different from where these animals are obtained, it is becoming all the more necessary to conduct research on factors concerned with stress and strain. Preliminary research observations seem to indicate that given reasonable comfort, nutritious feed and proper management, the exotic animals can perform reasonably well even in hot and humid areas of India.

Indian buffaloes, particularly those in the dry northern region of the country, are found to be seasonal breeders as during the summer months (April to July) they do not show normal oestrus and as such most of them are not bred during that period. Studies of physiologists have indicated that such a condition is mainly due to photo-sensitization. If shelter is provided and water is sprinkled on buffaloes, a few times during the day, the animals show normal oestrus and can be bred throughout the year.

Animal Reproduction:

Extensive research studies on reproduction of livestock have been carried out in organized herds both in government and private farms. Attempts have also been made to make these studies on village animals but there have been limitations to make controlled studies. It has generally been found that compared to the Western cattle, the

age of maturity and inter-calving period among the Indian cattle are comparatively high. For instance, calving interval for farm cow has been found to be in Red Sindhi 18 months, Kangayam 16.7 months, Gir 16.7 months, Kankrej 16.2 months, Tharparkar 14.8 months, 15.7 months for Sahiwal, 16.7 months for Hariana and 16.6 months for Murrah breeds of buffaloes. In non-descript cattle it is 24 months or over.

Animal Nutrition:

In order to understand the basic nutritional requirements and to determine the chemical composition, digestibility and utilization of different feedstuffs, extensive research in animal nutrition has been conducted at different research centres of Animal Nutrition. The more important research studies among these include attempts at the improvement of feeding value of poor quality roughages including cereal straws by chemical treatment etc. At the I.V.R.I. incorporation of urea in concentrate mixtures for growing cattle and milking animals showed that urea could be used as an economic source of nitrogen to meet 50 per cent of the total digestible crude protein requirements without affecting either growth rate of calves or milk yield and butter fat production in milking animals. In urea supplemented rations, starch could be effectively replaced by factory made cane molasses without any adverse physiological or metabolic effects. Investigations carried out at the N.D.R.I. also showed similar results. It has also been found that rational feeding practices also permit considerable increase in the feeding value of poor quality feeds after they are included in a well-balanced ration. Rations containing 25 parts sunnhemp hay and 75 parts of paddy straw have been found to provide sufficient nutrients required for maintenance. A ration of hay and paddy straw in the ratio of 2:1 has been found to improve nitrogen and calcium utilization and provide wholly the nutrients required for maintenance and partly those required for production.

As there is acute shortage of concentrates in the country, several research investigations aimed at finding out the possibility of utilizing non-conventional feeds have been conducted. Under an I.C.A.R. scheme taken up at Trichur, it has been found that tapioca leaves contain about 30 per cent crude protein and can be used as ration for growing calves replacing conventional oilseed cakes. At Bangalore, tapioca meal, a by-product of tapioca starch industry, has been found to be a suitable source of carbohydrate for cattle. In a study carried out at Anand, it has been found that *Cassia tora* could be used as a replacement for concentrate feed mixture for improving the nutrition of milch animals.

An important aspect of research has been studied on rumen metabolism. This included study of digestive changes which take place in the rumen of dairy animals, as compared to cows, produce more acetic acid in the rumen by digestion of fodders containing cellulose, especially during the first 24 hours after ingestion. This attribute of buffaloes probably makes them better utilizers of roughages.

Studies on comparative economics of milk production of buffaloes and better breeds of Indian cattle have indicated that while buffaloes consume significantly less fodder per unit body-weight and the digestibility of crude fibre is significantly higher (79.96 *vs.* 76.74 per cent), the efficiency of conversion of feed into milk is, however, practically equal, being 23.3 and 24.0 per cent in buffaloes and cows respectively.

Several fodder cropping programmes have been tried to step up fodder yields and to increase the carrying capacity per hectare of land. Two crops of maize and cowpea, a third crop of maize, teosinte and cowpea in summer and the monsoon months, and a fourth crop of oat and mustard yielded 150 tonnes of green fodder a year per hectare. Another cropping programme found very effective consists of jowar, bajra, Sudan-grass, teosinte and cowpea sown in the rainy season and a mixture of berseem, mustard and oat in winter, through four cuts for each of these mixtures, yielded 200 tonnes of

green fodder a year per hectare.

Animal Products:

With a view to improve the economy of slaughter houses, study was undertaken under an all-India coordinated research project to develop techniques for the utilization of slaughter house by-products, including processing, packaging, storage and quality control.

In autumn season the wool obtained from some of the Indian sheep is coloured yellow (Canary coloured) which results in a considerable economical loss. With a view to study the causes of canary colouration and to develop methods for its elimination, a coordinated study has been undertaken. It has been possible to isolate the pigment from canary coloured wool, and it is observed that the pigment in the wool fibre, suint and the wool wax is identical. It is further observed that high alkalinity of the fleece is related to yellowing of wool and such alkali damaged wools have poor resistance to abrasion and cannot be used for apparel and carpet manufacture.

Environmental Pollution:

In recent years with industrialization and pressure on land, ill-effect of environmental pollution are being increasingly appreciated both for human beings and animals.

For higher agricultural production the use of pesticides, herbicides and insecticides has increased manifolds. The harmful effect of these on human, plant and animal life are being increasingly realized and monitoring systems developed.

Environmental pollution effects on domestic animals have been of much interest; not only for their health but also in the interest of human health. As the animals are mainly raised for economic reasons in rural areas, the risk from exposure to industrial pollution is comparatively less. A large number of dairy cattle and chickens, however, are kept close to industrial pollution and are thus likely to be affected. There has been little systematic study on the effects of environmental pollution in animals. A more intensive study on this problem has to be taken up in the light of other problems of animal production.

In conclusion, it may be stated that the importance of research for the development of economical animal production system has been recognized and it is hoped that in near future the animals will play their due role in improving the economic condition of the farmers and nutritional status of the public.

Discussion

F. S. Mensalvas, the Philippines: You mentioned about crossbreeding as a very fast method of improving livestock. To this, I agree. But how long will you keep on crossing in order to maintain the productivity of the animals?

To be able to cross continuously, there is also the need of maintaining at least two pure breeds which will use up a big portion of the total population of the species. With all these trouble, is it not better to practice continuous selection which will end up not only in increased production, but also in the development of a strain of high producing animals?

Answer: I fully agree with Dr. Mensalvas. The idea is not to continue to cross-breed. Selection will be and is being practiced among 1/2 bred and 3/4 bred. One of the National Institutes of Animal Research has already stabilized the exotic and local inheritance and has released a new breed "KARAN SWISS".

We hope to have two or three other strains or breeds to meet the different requirements of the various regions of the country and the standard of management.