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Report on the Development of the Cattle and Dairy Industries of India.

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(Summary of Principal Conclusions and Recommendations.)

CHAPTER I

The total output of milk in India is exceptionally large, being between 700 and 800 million maunds or 5,600 and 6,400 million gallons per year. Compared with other countries India stands second in volume of milk production. She produces over four times the output of Great Britain, over five times that of Denmark, over six times that of Australia and over seven times that of New Zealand.

Owing to the density of India's human population the per capita consumption of milk is, however, extremely low. Estimates indicate that the average consumption per head per day does not exceed 7 to 8 oz.

According to existing dietary standards the quantity of milk required for the maintenance of satisfactory growth and health lies between 15 and 30 oz. per head daily. The output of milk in India would, therefore, need to be at least doubled in order to meet even the minimum requirement.

The consumption of milk is shown to vary according to income level. If consumption is to be increased it is essential that the price of milk should be within the purchasing power of the majority of the population. It is therefore not only necessary to increase the existing output of milk, but to effect all possible economies in the costs of production and distribution of milk and the manufacture of milk products.

CHAPTER II

In planning the development of the dairy industry it is essential to ensure that it caters for the existing taste and dietary habits of the population. Marketing surveys show that of the total output of milk, roughly one third is consumed as liquid milk. Of the remainder over 76 per cent. is converted into *ghee* and over 22 per cent. into *khoa*, *dahi* and other indigenous products. Western products such as creamery

butter and cheese are scarcely used except by Europeans and a small number of Indians who have acquired a taste for them.

The relative unimportance of Western products is also apparent from an examination of the quantity of milk products imported into India. These represent less than half of 1 per cent. of the total value of the milk products produced in India. An increase in the value of ghee by only 1 per cent. would add more to the wealth of the dairy industry than the replacement of the whole of the imported milk products by Indian produced articles.

There is little doubt that the evolution of the indigenous milk products which are peculiar to India (i. e., *ghee*, *khao*, *dahi*, and related products) has been largely due to the fundamental difficulties involved in handling milk under tropical conditions and to the special problems associated with the lack of adequate communications and transport facilities.

The fact that 90 per cent. of the population live in rural areas introduces a further obstacle to the introduction of Western methods into Indian dairying practice. In particular it appears that the widespread adoption of a large-scale factory system of dairying in India would involve almost insuperable difficulties.

These facts indicate that what is needed in Indian dairying is a new out-look and a new technique; an out-look which recognises the special nature of India's problems and a technique which is designed to solve these problems.

Among the more important considerations which should be taken into account in the formulation of such a technique the following may be mentioned: first, the attention should be concentrated on the production of indigenous milk products and not on products of Western origin; second, steps should be taken to ensure that an adequate supply of milk and/or milk products is available for consumption by the rural population; third, any attempt to introduce improved methods should be effected by evolutionary rather than revolutionary changes of technique; fourth, the combination of producers on a village industry basis (as distinct from a factory basis) should prove the most effective form of dairy organisation in India; and fifth, any improvements in production should be supplemented by the provision of improved marketing facilities.

CHAPTER III.

Consideration of the methods of producing and distributing milk for liquid consumption should not be limited to the supply of milk to large urban centres, which include only some three per cent. of the population. Nevertheless, in view of the abnormally low milk consumption in large cities and of certain special difficulties involved in the provision of adequate supplies of milk in such densely populated

areas, a separate section of the present Report has been devoted to problems connected with city milk supplies.

As regards the general problems of milk production and distribution, these are partly associated with the lack of knowledge of hygienic methods of handling milk, and partly with the difficulties inherent in the tropical nature of the climate, the poverty of the Indian cultivator, and the lack of adequate communications and transport facilities.

On account of these special difficulties the methods of producing and handling milk in India may have to be greatly modified from those employed in temperate zones. Extensive investigations will require to be carried out on this subject. Such investigations should not be limited to laboratory studies, but should be tried out in practice under village conditions.

Some form of heat treatment will probably prove the best and most economical method of prolonging the keeping quality of milk under tropical conditions. Such treatment should be applied as soon as possible after production. Refrigeration also offers great scope for development in relation to the transport of milk to large cities, but the costs involved are considerable and will need to be greatly reduced if the method is to be capable of widespread adoption.

The distribution of milk not only introduces the risk of re-contamination but offers unlimited opportunity of adulteration. As regards recontamination, it is extremely doubtful whether the introduction of modern Western methods, such as pasteurisation and bottling, could ever be employed on any considerable scale in India. For the mass of the population some form of 'loose' milk distribution is inevitable. It is suggested that cheap methods of 'loose' milk delivery, such as those largely employed in rural areas in Great Britain should be investigated under Indian conditions, and if necessary, modified to suit local needs.

As regards adulteration, figures collected from provinces show that from 20 to 65 per cent. of samples are watered or otherwise adulterated. Assuming that milk is, on the average, adulterated to the extent of 10 per cent. of added water, the financial loss to the dairy industry amounts to over 10 crores of rupees. Legislation exists for checking adulteration, but this is not applied effectively.

A second essential in checking adulteration is the formulation of reliable methods of analysis and satisfactory standards of purity. As regards methods of analysis, it is recommended that standardised apparatus should be employed and that revised conversion tables should be worked out. As regards standards of purity, extensive investigation is still required to enable the fairness of existing standards to be assessed. It is also suggested that the feasibility of allowing the 'standardisation' or 'toning' of milk should be considered.

CHAPTER IV.

There is no doubt that the production of *ghee* must be looked upon as the most important single factor in any scheme of development of the dairy industry. This product is of special value in Indian dairying economy, since it not only provides the cultivator with a cash sale, but leaves with him the greater and more valuable part of the milk, *i. e.*, the non-fatty solids contained in the *lassi* or butter-milk. This also applies to the production of 'country' butter.

The first direction in which improvement might be effected in the production of *ghee* is in the total outturn. But it is equally essential that quality should not be sacrificed in efforts to obtain higher yields of *ghee*. The whole subject of the relationship of out-turn to quality of *ghee* requires thorough investigation.

Figures collected from provinces show that up to 65 per cent. of the samples of *ghee* which were examined were adulterated. A calculation of the total quantities of adulterants available in India indicates that these amount to at least 6 per cent. of the total output of *ghee*. It is found, however, that there is a difference of opinion among authorities regarding the analytical standards for the detection of adulteration. These require re-investigation. In addition it is most desirable that a cheaper and quicker method for detecting adulteration should be devised.

It is suggested that the difficulties involved in the sale of *banaspatine* under the term (vegetable) *ghee* could be met by the adoption of legislation similar to that which governs the sale of margarine in Great Britain.

It is urgently necessary that facilities should be provided for the improved marketing of *ghee*. Additional markets should be established in those *ghee* producing areas which are not at present adequately provided for. In addition, an attempt should be made to establish grading centres, preferably under the Agricultural Produce (Grading and Marketing) Act, 1937. The value of advertisement as a means of popularising improved grades of *ghee* should be explored.

'Creamery' butter constitutes only about 0.15 per cent. of the total output of milk products in India. There are, however, indications that the demand for such butter is increasing and the needs of this branch of the dairy industry should not therefore be neglected. The most important direction in which improvement should be sought is in the quality (flavour and texture) of the product.

CHAPTER V.

Apart from liquid milk and *ghee* the most important dairy products produced in India are *khoa*, *dahi* and certain other indigenous milk products. The quantity of milk utilised in their manufacture approximates 95 million maunds (760 million gallons), which is more

than twice that utilised for the whole of the production of manufactured milk products in Great Britain. It is also significant to find that the indigenous Indian milk products realise more per maund of milk than liquid milk itself. This is contrary to the experience of practically all Western countries, but re-emphasises the importance of these products to the Indian dairy industry.

Certain of these products are manufactured by a process of partial desiccation, while others are produced by the souring of the milk. The processes of manufacture are however primitive and crude, and urgently call for improvement. Attention should be given to better methods of packing and marketing and to the provision of standards of quality. It is also suggested that the manufacture of indigenous milk products might provide a useful outlet for separated milk, where this is available.

It is desirable that the nutritive value of the various indigenous milk products should be carefully investigated in view of their widespread consumption.

The production of cheese in India is negligible, and imports of cheese are equivalent to only 0.002 per cent. of India's total milk production. Nevertheless the manufacture of European varieties of cheese (to replace imports) might be encouraged at hill stations.

CHAPTER VI

The amount of separated milk produced in India is small and little if any of it is wasted. A considerable quantity is, however, made into casein, and this is lost as a source of nutriment. The question arises to whether it would be justifiable to attempt to establish milk condensing and drying factories.

The present market for condensed milk in India is relatively small. There is a considerable market in South and East Africa, in Malaya, and in other Far Eastern countries but the possibility of building up an export trade from India is open to considerable doubt. Very little milk powder is consumed in India, but there is some indication that the market for this product might be expanded. Consideration of a number of relevant factors indicates that the feasibility of establishing condensing and drying factories in India would depend largely on whether the requisite quantities of milk could be collected at convenient centres, and whether such milk would be of sufficiently good quality to be capable of conversion into condensed milk and milk powder.

CHAPTER VII

India possesses the largest number of cattle of any country in the world. Out of the world's cattle population of about 690 million animals, 215 million (or just under one third) are located in India. Owing to adverse climatic and economic conditions the productive

value of the cattle industry is not commensurate with its size. Nevertheless the actual and potential value of cattle products is very great.

Milk and milk products may be valued at about 300 crores of rupees. This is roughly equivalent to the value of India's total output of rice, and is three to four times the value of the output of wheat. India is also the largest exporter of hides and skins in the British Empire, her yearly output of this group of products being valued at roughly 40 crores of rupees, or more than the value of the total Indian production of sugar. Cattle labour also represents an important contribution of live-stock to Indian agriculture, the monetary value calculated on the basis of cultivation costs being estimated at between 300 and 500 crores of rupees.

The value of cattle as a means of raising the fertility of the soil cannot be readily computed. One estimate places the cash value of cattle manure at 270 crores of rupees. There is no doubt that the widespread adoption of 'composting' would greatly enhance the value of this manure. But the potential value of cattle as a means of introducing a 'mixed-farming' system in India, and thus of improving crop yields, is incalculable. In any such system of 'mixed-farming' the introduction of leguminous fodder crops would still further increase soil fertility, while the improvement in crop yields should off-set any apparent increase in the cost of milk production.

CHAPTER VIII

Comparatively slow progress is being made in the distribution of pedigree and approved bulls; the number of bulls at present at stud represents only one per cent. of India's requirement. There is little doubt that material progress will only be achieved by increasing the number of approved and registered stock raised in villages and by private breeders. The purchase of such bulls for distribution provides a most valuable stimulus to improved cattle breeding in selected areas and gives encouragement to progressive breeders. At the same time it is essential that 'type' should be preserved within each breed and this will necessitate the continued maintenance of Government breeding farms where the methods of breeding can be more accurately controlled.

It is difficult to assess the value of the present castration policy in eliminating the scrub bull. Progress in the number of castrations performed varies from province to province. There is still considerable difficulty in getting young stock castrated at a sufficiently early age. One direction in which future action should be concentrated is the intensification of castration measures in selected breeding areas, combined, if possible, with the inoculation of all local stock against rinderpest.

CHAPTER IX

There is probably no single measure which would do more towards increasing and cheapening milk production in India than an improvement in the milk yields of Indian cattle. At present the yields of village cattle average only about 600 lb. per year. An increase in yield would lower the cost of milk production by spreading maintenance costs and costs of depreciation and labour over a larger output of milk.

In formulating breeding policies two essentials must be kept in mind: first, the necessity for adopting a policy which will meet local requirements; and second, the need for continuity in the programme of breeding and the urgency of ensuring that the programme is not prematurely interrupted.

Certain breeders have tended to rely on cross-breeding with sires of high-yielding European breeds to raise the productivity of their stock. The immediate beneficial results of such cross-breeding on milk yield are striking, but they have invariably been obtained in herds where exceptional facilities for the control of breeding, as well as of feeding and general management, have been available. In the hands of *gowalas* and similar uneducated owners of milking stock the results have frequently been disastrous. There is no doubt that the general adoption of a policy of cross-breeding to improve the milk yields of country stock would be fatal to the development of sound dairying in India.

Breeding experiments carried out at various centres show that by careful selection indigenous strains of Indian cattle can be built up which are capable of giving milk yields comparable with those found among average European stock. It is essential that the breeding of high yielding strains should be greatly extended. In order to encourage such breeding the establishment of herd-books and of a system of milk record should be proceeded with as soon as possible.

There is no doubt that she-buffaloes must be looked upon as the premier milk-producing stock in India. Their growing popularity is reflected in the census statistics, while marketing surveys indicate that they already provide nearly half of India's total milk supply.

With intensive milk production there is inevitably a constant rivalry between constitution and economic performance. Management is therefore an extremely important factor, particularly under the exacting conditions of climate experienced in the Indian plains. The relation of management to the maintenance of a sound constitution should be looked upon as one of the major subjects for investigation in connection with the breeding of improved stock.

CHAPTER X

The majority of Indian milch cattle are seriously underfed. This is apparent not only from a superficial inspection of stock, but from

the slow rate of growth, the late maturity and the long dry periods of cattle kept under village conditions.

Estimates of the total quantities of nutrients available for the feeding of cattle in India show a marked deficiency especially in the amount of protein. If milk production is to be increased the provision of a very much larger food supply is essential.

Coarse fodders are relatively valueless for milk production. Cultivated grasses are reasonably satisfactory, but the fodders of outstanding value are the leguminous crops such as berseem (Egyptian clover) and lucerne (alfalfa). It has already been noted that these are of special importance to Indian agriculture by virtue of their ability to enhance the fertility of the soil. Wide variations in the yields and costs of production of these fodder crops have, however, been recorded. Careful and extensive investigations into the factors responsible for these variations are urgently needed. Such investigations should include a study of the effect of the leguminous crops on the subsequent growth of cash and food crops. They should also include a study of the value of different fodders in the feeding of milking stock and on the costs of milk production. The conservation of such fodder crops also requires investigation.

Efforts should be made to increase the available supply of protein-rich concentrates such as linseed, cotton-seed and earth-nut cakes. This might be achieved by encouraging the export of vegetable oils and by improving the efficiency of the mills.

It appears to be a fairly universal experience that Western rationing systems are not suitable for application to Indian cattle and buffaloes. It is therefore desirable that a suitable system of rationing should be devised for the guidance of milch cattle owners. In addition it will be necessary to obtain representative analytical figures of typical feeding stuffs for as many agricultural areas as possible.

During the past few years instances of mineral and vitamin deficiency diseases have been recorded in India. There is little doubt that such deficiencies are far more common than has been generally supposed, and that they are a source of serious economic loss. It is desirable that extensive surveys of the incidence of such deficiency diseases should be undertaken, and that the information so obtained should be supplemented by accurate studies of mineral requirements and by mineral analyses of fodders drawn from typical cattle breed- and milk producing areas.

CHAPTER XI

In order to provide an adequately staffed and equipped centre for research into the many problems which face the dairy industry, it is recommended that the existing Imperial Dairy Institute should be transferred to a more suitable site and should be reconstituted as an

Imperial Dairy Research Institute. Under the Director the work of the Institute would be divided into four sections, namely, dairy bacteriology, dairy chemistry, dairy technology and dairy husbandry. Details are given regarding the buildings, equipment and staff required for such an institute.

If such an institute is established, the need for a separate experimental creamery (such as that proposed at Anand) will not arise. The Anand Creamery would, however, provide an ideal substation for the study of problems involved in the supply of milk to large cities, should such a substation ultimately be required. It is suggested that the whole of the Anand Creamery proposals should be held over meantime until the new Research Institute has been established and preliminary experiments have been carried out on the various problems involved in dealing with liquid milk.

Side by side with the development of the new Research Institute, efforts should be made to encourage the investigation of dairying problems at provincial agricultural colleges. The Imperial Council of Agricultural Research might give valuable assistance in this direction.

The course for the Indian Dairy Diploma provides a valuable basis of instruction for students who desire general training in dairying. The proposal to extend the period of instruction from two to three years is shown to be unnecessary though certain alterations in the syllabus are desirable. In particular, more stress should be laid on the methods of production of indigenous milk products, on the need for devising cheap types of equipment, and on improvement in the methods of producing milk and milk products by co-operative enterprise and by the development of village industries. The course should also include practical training in methods of imparting instruction.

Training for the I. D. D. should be given at provincial agricultural colleges and not at the central institute. It is doubtful, however, whether such training could at present be satisfactorily arranged in all provinces. It is therefore suggested that the number of centres should meantime be limited. The transfer of instruction would necessitate the provision of certain safeguards, including the adoption of a uniform syllabus and of a reasonable degree of uniformity in the methods of instruction at all centres and the establishment of a central examining board. The appointment of a special committee under the Imperial Council of Agricultural Research is recommended.

As regards post graduate training, the course for the National Diploma in Dairying of Great Britain is entirely unsuitable for Indian students. For graduates who require training in technical dairying, the I. D. D. course provides adequate instruction. For graduates who require training in research methods facilities should be provided at the Imperial Dairy Research Institute. Opportunity should also be taken to encourage such graduates to gain further experience by

studying at recognised research laboratories abroad. For this purpose scholarships might be provided by the Imperial Council of Agricultural Research.

If improved methods for the production and handling of milk and the manufacture of milk products are to be made use of in the villages, it will be essential to have available a large number of workers trained in certain elementary dairying practices. Courses of training for such workers should be provided at provincial agricultural colleges. It is recommended that serious consideration be given to the provision of dairy training for women.

It is desirable that dairying instruction at veterinary colleges should be extended to include a knowledge of elementary dairying and of the principles involved in the production and handling of milk including the management of a dairy herd.

It is strongly recommended that provincial governments should take the necessary steps to establish an advisory service for the dairy industry. As a first step it is suggested that a Dairy Development Officer should be appointed in each province. The major duty of such an officer would be to initiate dairying developments and to take the lead in encouraging the adoption of improved methods. The Dairy Development Officer should work under a special committee representative of the various branches of government activity concerned.

In order to secure co-ordination between the central and provincial governments, it is recommended that the Director of the Imperial Dairy Research Institute should act as part-time Dairy Expert to the Imperial Council of Agricultural Research, and that in this capacity he should be responsible for maintaining contact with provincial dairy developments. He should be provided with a special officer who could relieve him of much of the detailed work involved and who could act as personal liaison officer between the centre and the provinces.

CHAPTER XII

The solution of problems connected with the breeding of cattle requires the appointment of an animal geneticist. Work in this field would include the investigation of problems of inheritance, of problems involving a study of the physiology of reproduction (including endocrinology), and of problems connected with management and constitution. In the investigation of problems of inheritance full use should be made of records available at the various Government breeding farms.

Greater use should be made of existing experimental and demonstration farms (of which there are some 200 in India) in studying problems of fodder production. Such farms should be equipped with small herds of pedigree milch cattle. They could thus fulfil a dual function by acting as centres for the study of mixed-farming methods

and by providing valuable nuclei for the breeding and distribution of pedigree milking stock.

In devising a rationing system suitable for Indian cattle and buffaloes, full use should be made of existing provincial research centres (i. e., Lyallpur, Dacca and Coimbatore) as well as of the newly established Animal Nutrition section of the Imperial Veterinary Research Institute at Izatnagar. A provisional allocation of work is suggested in the Report. The Imperial Agricultural Research Institute at New Delhi should undertake such comprehensive fodder and feeding stuffs analyses as are required.

As regards mineral and vitamin deficiency diseases, the Disease Investigation Officers who have been appointed in each province through the Imperial Council of Agricultural Research should be responsible for field surveys, while facilities should be provided at the Nutrition Section at Izatnagar for the mineral analyses of suspected pastures.

Adequate facilities for instruction in breeding and live stock management are available at most provincial Agricultural colleges. At veterinary colleges, however, facilities for practical instruction are lacking. It is recommended that, as a minimum, each veterinary college should possess a small herd of milking cows, with accompanying bulls and young stock, and sufficient land to demonstrate agricultural operations and to produce fodder for the herd.

There is urgent need for securing suitable men who can be specially trained in cattle breeding and management. The potentialities of a student for live stock work will usually become apparent during his college course, and every effort should be made to pick out such a man for further training. This training should include experience on an approved cattle breeding farm and an advanced course in animal husbandry at a central institution.

In connection with the ultimate establishment of a Genetics Section at Izatnagar a small number of trained geneticists will be required. It is suggested that the Imperial Council of Agricultural Research should consider awarding one or two special scholarships to enable promising post-graduates to obtain the necessary research training overseas.

The effective dissemination of knowledge acquired at research centres, as well as the control of breeding and live stock improvement, will ultimately depend on the employment of a large staff of trained men who can work among cultivators in the villages. For such 'stockmen' it is desirable that special elementary courses of instruction should be instituted.

It is strongly recommended that, in the interests of both efficiency and economy, live stock improvement and veterinary work should be

unified under a single department of animal husbandry. It is recognised that for local and personal reasons immediate unification may not be desirable or possible in all provinces. But it is suggested that unification should be looked upon as the ultimate goal.

If unification is adopted, it will be essential for the Director of the unified department to have on his staff a Live Stock Expert with special knowledge and experience of cattle breeding. It will also be essential to ensure close co-operation with the Department of Agriculture. This would be facilitated by the appointment of a Fodder Specialist, who would normally work in close touch with the Live Stock Expert.

Further cattle improvement cannot be effected without increased expenditure, whether the control of such improvement is under the agricultural department or is unified with the veterinary department. Existing figures show clearly that the extent of live stock improvement in the different provinces runs roughly parallel with expenditure. The unification of animal husbandry and veterinary work should not therefore be looked upon as a means of reducing expenditure on cattle improvement: rather, is it a means of making the best use of any funds available for live stock improvement and of ensuring that such improvement is effected under the most favourable conditions.

The present measures which are designed to improve the general standard of Indian cattle are largely concerned with draught breeds. Every effort should be made to augment the number of agencies which can be used for developing the milking potentialities of indigenous Indian breeds of cattle. Such agencies should include the Military Dairy Farms, district and demonstration farms, and *gowshalas* and *pinjrapoles*. It is suggested that a special officer should be appointed under the Imperial Council of Agricultural Research whose duties would include the stimulation of interest in milch cattle breeding at various centres and the giving of expert advice to *gowshalas* and *pinjrapoles* which desire to improve their methods of management and to adopt a constructive breeding policy.

In order to maintain close cooperation between all departments concerned with rural development, it is suggested that a Board of Rural Development should be constituted in each province. This Board would include the Directors of the Departments of Agriculture, Forestry, Veterinary services and Public Health, a representative of the Irrigation and Revenue Departments and the Registrar of Co-operative Societies. Specialist officers would attend the meetings of the Board. The Chairman would be a non-technical officer of the rank of Commissioner and with a special knowledge of and interest in rural conditions. The Board would act solely as a co-ordinating and advisory body, but would be in a position to make direct representations to the responsible minister in regard to any controversial matters.