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by

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When the Herd Improvement Plan was introduced in New Zealand at the commencement of the 1939/40 season, one of its basic principles was the application of field survey work to Dairy Cattle Production Studies - this paper is mainly concerned with the nature and purpose of such work. At the outset it would be well to emphasise the role such surveys have to play in research generally and to discuss briefly the limitations placed upon animal production studies by the absence of adequate field information.

It will readily be conceded that the objective of animal production studies may be either the understanding and explanation of why certain results are secured in the field, or it can be the working out of entirely new methods for practical application, or, as is perhaps most often the case, it may be a combination of both. In any case it is clear that the background of research into animal production must inevitably be the field conditions actually existing in the animal industry being studied. The limitations imposed on research workers in the amount of field data available are, however, very considerable, and in all too many cases it becomes necessary for them to rely on data restricted to field observations over a very limited area.

The existence of an organisation actively and continuously in touch with extensive and representative field conditions should, therefore, be of very considerable importance in overcoming this difficulty, and in speeding up the definition of the problems to be attacked and the application of any results accruing therefrom. The value and purpose of field surveys by such organisations can best be illustrated by a discussion of the surveys now being conducted under the Herd Improvement Plan.

TECHNIQUE: The reorganisation of Herd Recording in New Zealand under the Herd Improvement Plan resulted in an organisation particularly well adapted for the conduct of field surveys. Six major Herd Improvement Associations replaced the original twenty-eight Herd Testing Associations and steps were immediately taken to ensure maximum efficiency in all phases of recording work and to bring about uniformity of methods. Copies of monthly testing returns for some 280,000 cows are available to the investigational staff in Wellington, thus giving a coverage of approximately 16% of all cows in New Zealand.

The source of supply of all data is as follows:-

1. From all Recording Officers who in the ordinary course of their duties visit some 24 to 26 herds monthly and who, in addition to testing all cows for milk and butterfat production, arrange to identify heifer calves by ear tattoo (thus providing data for studies on breeding) and also collect detailed data on all cows culled or wasted from the herd.
2. From Selected Recording Officers where it is considered that the data is such as to require more than ordinary care and knowledge in its collection - this applies particularly to the data collected on mastitis.
3. From Consulting Officers one of whom is attached to each Herd Improvement Association and who has been specially selected because of an extensive general knowledge of field conditions. These officers are responsible for data collected on nutrition, fertility, and special problems of management etc.

FIELD SURVEYS IN OPERATION:

1. Production Studies: Through the routine work of recording officers complete data on monthly milk and butterfat production for some 250,000 to 300,000 cows is available annually in the central office in Wellington and this data has already been used to define normal conditions of milk and butterfat production, including such things as breed characteristics and production averages, age composition of the dairy cattle population, influence of month of calving, and change in production according to age. The latter deserves special mention because of its emphasis on the necessity for checking apparently valid conclusions against actual field conditions. In the early stages of sire survey work when it became necessary to define the nature of age correction factors under New Zealand conditions, the normal method of determining the average production of large numbers of animals of the same age for each breed was followed. Using the mean production for all two-year-old cows as a base, it was then possible to calculate the actual pounds of fat increase to more mature ages, and so to arrive at the percentage increase in production from two-year-old to maturity. This involved the assumption that the increase in production for each individual cow in the population examined, was in the same proportion as the increase in the mean for age to age in that whole population. Correction factors so calculated are actually used in several countries at the present time. Before this conclusion could be considered valid, however, it seemed necessary to apply it in practice, and for this purpose some 1,500 lifetime records of production for Jersey cows tested from two years till at least seven years were used. Although the mean values for each age for the whole 1,500 cows again corresponded to the general population data, it was found that the increase according to age for individual animals did not operate as a percentage increase. In fact the reverse was the case - cows which were low producing as two-year-old animals showed a much bigger percentage increase than cows which were high producing at two years of age. It should, of course, be emphasised that this increase in production does not include only the increase in production due to age alone but also includes all those environmental conditions likely to alter a cow's production from normal - therefore the correction factors evolved are not correcting for age alone, but are also automatically correcting for other environmental influences. Thus the application of age correction factors under practical field conditions does necessitate a double correction age and environment, and whether this is done as Lush suggests by two separate corrections, or as Campbell and Ward suggest by a single combined correction, is a matter for preference. The main point, however, is that age correction factors have been used by a number of workers without due reference to their accuracy under field conditions.

One other survey concerning Production also deserves mention in view of its importance at the present time. Due to acute labour problems and, in some cases, economy measures, the question of stripping or non-stripping of dairy cows has come into considerable prominence. Through the Herd Improvement Associations and later by detailed reports from consulting officers it has been possible to isolate between 30 and 40 herds in which non-stripping has been the practice for at least one and in many cases for three or four seasons. Most of these herds have testing records for the seasons prior to and succeeding the dropping of stripping and consequently a considerable number of what could be termed experimental herds are thus available for immediate study of the whole question of the importance of stripping. By the co-operation of other research workers in examining these herds it is fully expected that a substantial report on all phases of this important problem will be available in the near future.

2. Nutrition Studies: The main purpose of field surveys as they affect dairy cow nutrition must be to arrive at a correct estimate of the problems of dairy cattle nutrition under the conditions

peculiar to New Zealand dairying, with its dominant emphasis on grassland farming. Obviously, it would not be correct to duplicate overseas experiments intended for practical application, unless the conditions of those experiments were first checked against New Zealand field conditions. Consequently, the work of collecting data on dairy cow nutrition has been fundamentally one of determining the methods and practices of those dairyfarmers who have already achieved, and are maintaining, high levels of production. The next point to decide is whether those methods and practices are relatively uniform, or whether they include a wide variation in feeding practices and pasture types, as well as considerable differences due to adaptation to changed local conditions. For example, much speculation exists as to the nature of the typical lactation curve for New Zealand conditions and survey work has already demonstrated that the normal physiological curve established by overseas workers has no uniform parallel in New Zealand dairy herds. All overseas references point to the fact that the normal cow reaches the peak of her lactation within the first thirty days from calving - extensive analysis of lactation curves for high producing herds and cows in New Zealand fails to confirm this finding and a wide variation is apparent in the shape of the curve both for herds and cows. Furthermore, it is not apparent that those herds and cows which reach their production peak in the third and fourth month from calving, are lower in production than those herds and cows which reach a peak in their first or second month. This problem is still under investigation but it involves important considerations for workers engaged in dairy cattle nutrition. Is there a serious weakness in our whole system of dairy cow nutrition, or are the facts outlined simply indicative of an adjustment in the nature of the lactation curve to the economic production curve hereafter to be recognised as one peculiar to our particular methods of dairyfarming?

This emphasises the importance of field survey work in first determining the nature of the local problems facing the nutrition worker, and then perhaps transferring the emphasis from a description of the feed conditions expected to result in high production, to one of describing and explaining the reason for the success of the conditions prevailing in those herds which have already achieved a high productive level,

There is, furthermore, the added consideration that such a re-orientation of the problem would avoid the dangers of advocating a feeding policy which may not have completely explored the full implications of such factors as economy of production, and the health of the animals involved.

But probably the most important role of field surveys in nutrition may be to indicate the general correlation between good, medium and poor levels of production and the corresponding level of nutrition. By making available representative data along these lines it should then be possible for research workers to indicate the extent of under feeding prevailing, and the steps necessary to correct that position and so to bring about an immediate improvement in production.

Under the Herd Improvement Plan a general survey of feed conditions is being made in approximately 250 herds through the consulting officers attached to each Herd Improvement Association. Each officer visits at least 40 herds in the spring, summer and autumn, recording his own observations of pasture type and conditions, and obtaining full details of all matters relating to the feeding, management and health of the herd.

Further work is already in hand to compile production curves under differing soil and climatic conditions in order to explore the possibility of whether new pasture types can be better adapted to local conditions than those in existence at the present time.

3. Animal Breeding: It seems clear that the role of genetics in animal breeding will, for the next few years at least, depend largely on biometrical methods, and for this purpose large scale field surveys are all important. The main problems to be answered are,

- (1) The extent to which phenotype (i.e. meat, wool, milking qualities etc.) is influenced by environment.
- (2) The influence of heredity on phenotype and the selection value of such phenotypic expression.
- (3) The extent to which practical considerations limit the selection value based on
 - (a) Phenotype and
 - (b) Genotype.

These problems are such that they can only be fully answered after an extensive field survey, and necessitate studies of lifetime histories of production (i.e. phenotypic expression), generation records of parent and offspring in order to determine selection values, and a survey of the practicability of using parents after they have reached an age when they can be progeny tested. The latter point also involves consideration of the problem of inbreeding and the measures to be taken, say in one sire herds, where it is desired to avoid undue inbreeding.

Surveys in dairy cattle production in New Zealand indicate that the selection value based on female phenotype varies approximately between 14 and 20 per cent. of the females superiority above the herd average. In other words, (and in the absence of genotypic selection of the sire) selecting progeny from high producing cows will, over any reasonably sized population, result in a gain of approximately 14 to 20 per cent. of the superiority of those cows above the breed average. Consequently, the main emphasis today is on the selection of replacement dairy stock from sires which have already been proved on the basis of their progeny.

4. Animal Diseases: At first appraisal it does not appear at all obvious to what extent field surveys can assist in the solution of problems of animal health. Yet a closer examination reveals several reasons why such surveys may have much to offer at the present time in providing some clear definition of the general conditions of incidence of disease, the condition of management, feeding etc. which make for better control of such diseases, and in suggesting profitable lines for research. The technique of the collection of data on disease problems is, however, by no means an easy one and it is only with the use of large numbers that a reasonably approximate picture of the disease position is likely to be secured.

Work already carried out under the Herd Improvement Plan on the collection of data on disease losses has already been adequately summarised (in the New Zealand Dairy Board's 16th Annual Report) and warrants little further mention at this stage.

Two or three points arising from the survey on fertility in dairy cattle have a strong bearing on the value of field surveys and perhaps warrant further mention.

From some 250 herds detailed mating particulars for all cows in the herd have been made available and from these it has been possible to arrive at a reliable estimate of the normal fertility index in New Zealand dairy herds. Such a figure is essential to experiments concerned with evolving a field technique for artificial insemination, where it is necessary to determine how closely the artificial method competes with natural mating.

The compilation of full details on all matings within a large and representative number of herds has also proved of importance in studying problems which would be more difficult of solution experimentally. One of these is the question of whether the peculiar conditions of dairying in New Zealand, whereby approximately 75 per cent of dairy cows calve within a period of three months, are responsible for the creation of an exhaustion problem in bulls, and a consequent lowering of their fertility. Examination of weekly fertility indices for the whole of the mating season, and correlation of individual bull results on the basis of fertility index to number of matings, has so far failed to reveal any evidence of an exhaustion problem.

This fertility data is now being examined for evidence on problems of abnormal periods between oestrus, and the possible correlation between condition of nutrition and fertility abnormalities. Further investigation is also being made into the question of high production and its relation to fertility, and it is probably along such lines as these that field surveys are essential as a first line of attack on the general problem. To those interested in the question of genetic influence on fertility it can be pointed out that here again a field survey is likely to accomplish what would be extremely difficult of determination experimentally. The building up of complete fertility data on a generation basis for large numbers of animals should be capable of statistical treatment so as to obtain some indication as to whether inheritance of poor fertility is likely to be an important factor or otherwise. In the case of young bulls of poor fertility it is probable that this consideration cannot be altogether dismissed.

During the 1940/41 season a field survey of mastitis is being attempted, and it is hoped to secure the full-co-operation of at least 1,000 dairyfarmers. There are, however, considerable difficulties facing any attempt to secure an adequate field survey of the mastitis problem and the criterion of mastitis in this survey (in the absence of a suitable field test) is to be the farmers' observation of clinical cases. The data secured should, however, have an important bearing on a general definition of conditions associated with higher incidence of mastitis - it should also give some indication of the extent to which herds vary in the losses suffered from mastitis and what are those undefined management conditions so frequently quoted by various authorities as of importance in controlling mastitis. Furthermore, an adequate field survey should also make it possible to investigate the extent to which any recommendations in connection with mastitis control are actually proving beneficial to the Industry.

CONCLUSION: The foregoing remarks have briefly and perhaps inadequately sketched a background of field surveys in existence at the present time, and the value and purpose of such surveys in contributing to a study of dairy cattle problems. The application of systematic and continuous field surveys is still in its infancy but New Zealand is more fortunate than most other dairying countries, in the possession of a centrally organised Herd Recording movement. This is, of all institutions, probably the best adapted to the conduct of widespread field surveys because of the continuous contact between the recording officers and large numbers of representative dairyfarmers. It is certain that much room exists for improvements in the technique of these field surveys, but with the active co-operation of research workers and research institutions it should be possible to speed up the investigation of dairy cattle production problems. As the work proceeds, and with improvements in technique, it should also be possible to intensify and in some cases specialise the field survey in particular directions so as to parallel experimental work actually in progress at research institutions.

Finally, there are two conditions fundamental to the success of field surveys - the institution conducting these must at all times secure and retain the confidence of the farmers supplying the field data and the research authorities must give their full support in the planning of the survey, the discussion of the data collected, the scope of any intensification of the survey, and the working out of practical advice accruing from the survey. Under the Herd Improvement Plan a Technical Committee, consisting of representatives of research institutions and producers, co-operates with the Herd Recording technical staff in fulfilling the latter function.

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