Presidential Address

THE PROGRESS AND PROSPECTS OF ARTIFICIAL BREEDING IN NEW ZEALAND

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MANY OF THOSE ASSOCIATED with the early work on artificial breeding in New Zealand probably thought that the main obstacle to putting a worthwhile national herd improvement plan into operation was a technical one. The objective was to apply artificial breeding on such a scale that it would contribute something measurable to the productive ability of our dairy stock. The process seemed so simple and sound; merely select the best bulls, and then multiply their influence many times by the then new artificial breeding techniques.

Now, after sixteen years, some of the problems have been solved but not without many disappointments and setbacks, and technical performance has advanced beyond the most optimistic dreams of that era; but the same objective of national herd improvement held in the first years' efforts still seems to recede from our grasp.

My particular interest in this project has been on the technical side, and for that reason this paper will deal mainly with the practical application of artificial breeding in New Zealand conditions. However, as the application of any system of artificial breeding must be dependent on its practicability in the country in which it is applied, some of the observations may be of value when assessing the possible future role of artificial breeding in herd improvement in New Zealand. The paper will discuss the development of artificial breeding in New Zealand and then outline briefly the present position, before attempting to describe some of the ways in which it may eventually establish itself as a useful measure in dairy herd improvement. Throughout this work the practical problems of applying artificial breeding on an extensive scale seems to have occupied us fully, but we did have the comfort of knowing that the other, and equally important, aspect of the work—that is, the selection of suitable bulls—was in the capable hands of the Herd Improvement Department of the Dairy Board, who are still responsible for this side of the work.

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From the start, it was obvious that the application of artificial breeding in New Zealand was going to differ in some important respects from its use overseas. The very restricted length of the breeding season for dairy cows in New Zealand has been our main problem, but it should not be forgotten that there are also advantages. The fact that the national herd consists mainly of one breed is a distinct advantage in artificial breeding, and the absence from this country of some of the major cattle scourges of the world is another asset. The reduction in recent years in the losses from two important diseases affecting production in dairy herds—contagious abortion and mastitis—have also helped to some extent, and particularly during the early years the interest shown and loyal support given to this work by the farmers in the experimental groups, sometimes I am afraid to their disadvantage, have all been features which have assisted.

Slowly, very slowly it seemed at times, the various technical problems were overcome, and although material improvements can still be made, a stage does at last seem to have been reached where a satisfactory rate of success can be expected even with a rapidly increasing demand. Some difficulties that appeared serious in the early days have been solved and, although other problems seem to take their places—the point has been reached where the numbers involved are big enough to expect some effect on the national herd.

The Progress of Artificial Breeding

To appreciate the present situation in artificial breeding, some knowledge of the early approach to the problem is essential, and so it will be necessary to outline very briefly the progress of artificial breeding during the past fifteen years. For convenience, the development may be considered in three periods. The first covers the time spent in attempting to devise instruments and field organization for dairy farmers to carry out inseminations on their own cows. The second deals with an attempt to distribute the advantages of sire selection by artificial breeding in pedigree herds, and the third describes the expansion of artificial breeding in commercial grade herds.

During the first period, an attempt was made to devise an instrument to simplify the inseminating operation so that intelligent farmers could use the techniques on their own herds, using material processed at the bull centre, and at the same time making use of the regular dairy farm services such as cream or milk collections to distribute prepared doses of semen. It was realized that, for artificial breeding to form any impression on the national herd-breeding programme, it would have to be applied on a very wide scale.

The system was a failure because of technical imperfections in the instrument, and because the dose used by the cervical method of insemination was too small. The Russians were using the same sort of technique quite successfully at the same time, but with much larger doses of semen. Another fact which emerged at this time was the acute shortage of the class of bull which was considered suitable for artificial breeding work.

The failure of the cervical inseminating technique with small doses, and the shortage of bulls, forced us to consider the intra-uterine method of insemination which was found to be much more successful with very small doses of semen, but this method needed a much greater degree of manipulative skill than could be expected from the dairy farmer. It was clear that, from this point onwards, the work would have to be done by trained technicians. The failure to apply farmer inseminations marked the end of the first period.

During the second period a very acute shortage of suitable bulls had to be faced. As a rule not more than one or two could be obtained each year, with, at that stage, remote chances of the numbers increasing. The problem was how to use the bull power to the best advantage. It was apparent that, as over 70 per cent. of dairy farmers use pedigree bulls, the best use of the meagre resources in bull power available could be made by encouraging the use of artificial breeding in pedigree herds, so that the sons of the A.B. stud bulls would eventually find their way into commercial herds by the usual stock sales. In this way every successful insemination would be contributing something to improving the stock in the country, and half would not be lost as is the case with bull calves born to grade cows. At the same time the heifers born in the pedigree herds would tend to raise the productive ability of the herds for the next generation of bull calves. By this time the merit class in surveyed bulls was sufficiently well known to assure breeders of a ready sale for any bull calves from A.B. bulls.

The A.B. Section at Ruakura offered a free service to pedigree farmers within a thirty-mile radius of Hamilton. Although the bull team was small, it represented some of the best known studs in the country, and the individual bulls had outstanding production records. One in particular was from a very fashionable stud and at that time also had an imposing production record, and had been successful in the show ring.

This offer of free service resulted in 208 cows being inseminated in 1946, 321 in 1947, 341 in 1948 and 359 in 1949. After this date the service was commercialized following the starting of commercial grade groups in the area. The pedigree groups were continued as a separate entity for one more year,

but were afterwards absorbed into the commercial grade groups in the areas. The conception rates for this service were good, but in spite of this the demand grew during the first two years then remained static at about 350, which, in an area which would contain 20,000 pedigree cows, represents a coverage of 2 per cent. for a free service. Out of a total of 1,229 cows in calf for the period that this scheme operated, not more than one or two of the resultant progeny found their way into the A.B. bull stud, but a substantial number were sold to other farmers in the usual sales. The service did not appeal to the well-established pedigree breeder, and on lack of support would have to be classed as another failure. It is important to note that this approach was tried early in the development of A.B. in New Zealand, and it is a pity that it was not more successful because, on theoretical grounds, the system appeared to have great potential for herd improvement through breeding.

Commercial Breeding Groups

The second period ended with the establishment of commercial artificial breeding groups, though it is fair to say that, during the initial stages, a serious attempt was made to obtain the support of the pedigree breeder; in fact, the first commercial groups were organized on the understanding that pedigree cows had preference over grade cows for merit bull semen, and in addition it was considered necessary that each commercial group should contain at least 25 to 30 per cent. of pedigree cows. As the demand for A.B. service grew rapidly from grade herds, it was found impossible to maintain the proportion of pedigree cows at that level. In fact, the position today is that, less than 3 per cent. of cows inseminated are registered pedigrees.

Many will be familiar with the extremely rapid growth of commercial A.B. in New Zealand since 1949, when the first group was organized on this basis near Hamilton. For those not conversant with this work the figures are given in Table 1.

The figures for 1956 are approximations because the final returns are not yet available. The total includes cows from all the main dairying districts in New Zealand, with in general approximately the same proportion of the total cows in each district. Up to the present it has been possible to service this number from the Dairy Board's centre at Newstead, and it seems likely that it will be able to do so for some time yet, but if the need arises there is no reason why the same sort of centre could not be set up in other parts of the country.

The policy at present is to give a 66 per cent. service from merit sires, to attempt to settle 1,000 cows to each yearling bull in the bull stud, and to settle the balance with bulls of two, three or four years of age. In actual practice it

TABLE 1: NUMBER OF COWS INSEMINATED IN COMMERCIAL BREEDING GROUP, 1949-56.

Year	Total Cows Inseminated
1949	1,596
1950	3,603
1951	5,891
1952	16,748
1953	56,461
1954	85,753
1955	145,916
1956	175,000

has so far been possible to give a better than 66 per cent. service from merit bulls. The figure has been nearer 80 per cent. for the past two years. It has not been possible to average 1,000 inseminations to the yearling bulls, the present average being 638, but every effort is being made to avoid wastage in the field of the material that is collected and to this end it is specially marked so that field technicians can recognize it immediately and use it all up before completing the day's run. Some inducement is already being offered farmers to rear the heifers from the yearling bulls by repayment of insemination fees for all such heifers brought into the shed and tested.

This attempt to get 1,000 inseminations to each yearling bull has been made necessary because now less than 50 per cent. of the users of artificial breeding are herd testing, and the indications are that this figure will fall still further. By recent changes in constitution, herd improvement associations have included the users of artificial breeding in their membership on an equal footing with those using the herd-testing service, a very necessary movement to strengthen the overall herd improvement work.

Without doubt, the most important point in the technical side of artificial breeding is the conception rate. This figure is obtained by expressing the total cows in calf as a percentage of the total inseminations given. This will include inseminations on sterile cows, but as the same system has been used for many years the results from year to year are comparable. In New Zealand the figures have fluctuated from 46 per cent. in 1953 to 58 per cent. in the 1956 season. The lower percentages have been associated with the periods of most rapid growth. In 1955 the rate was 49.4 per cent. In the face of this result

for 1955, it is rather difficult to understand the increase of 20 per cent. in the demand for service between 1955 and 1956. With a conception rate of close to 60 per cent. for 1956, one wonders what the increased demand will be for 1957.

The objective in artificial breeding work has been to get 75 per cent. of cows in calf in each herd participating in the scheme. This was achieved in 1954 with a conception rate of 54.4 per cent. in the seven weeks' operation period. There is a slight danger that, if more than 75 per cent. of a herd settled to A.B. bulls, some of the heifer calves would find their way to the meat works as bobby calves, the daughters of the sons of merit sires naturally being the first to go. The position is safeguarded to some extent by the fact that, as farmers are paying for cows in calf, in years with good conception rates they tend to hold back some cows for natural mating towards the latter part of the insemination period, as they consider that they will already have enough in calf to give them their own replacements and there is no sense in paying for any more. If this policy becomes too widespread, it would be better to give a shorter service period and try to give more farmers a chance to use the A.B. bulls. From a dairy farmer's point of view, any conception rate over 55 per cent. could be regarded as satisfactory, and it appears that this figure is going to be exceeded quite substantially this year.

Production figures for the progeny of A.B. bulls are given in the latest Dairy Board report. For all proven bulls the figure was 18 lb. of butterfat above expectancy, and for the sons of proven bulls 8 lb. above expectancy. When the figure for the proven bulls is compared with the surveys on the naturally bred daughters, that is to the original surveys, and the figures adjusted for the difference in numbers, the result is fairly close—18 lb. for the artificially bred daughters compared with 22 lb. for the original surveys. This result also includes several bulls which would not be selected for the A.B. bull team on present standards. Only four of the sixteen young bulls so far recorded were below expectancy, and the overall figure of 8 lb. above expectancy is regarded as satisfactory.

The Artificial Breeding Stud

One of the most encouraging features of the bull survey work has been the greater number of bulls becoming available for artificial breeding work. Out of 38 bulls qualifying for A.B. work in 1951, only one was available for purchase. In 1956, 25 merit Jersey bulls were bought, 20 being included in the bull team, the remaining five not passing the health tests. The reason for this increase is rather obscure because, in 1951, 1,625 Jersey bulls were officially surveyed, 335 of them reaching

merit standard. The figures for 1955 were 2,015 and 494 respectively. The increased availability of bulls in 1956 were out of proportion to the increase in numbers surveyed. The bull survey totals for Jersey bulls seems to be close to 2,000 annually, of which approximately 500 reach merit standard.

Table 2 shows the artificial breeding stud for the 1956 breeding season.

TABLE 2: THE ARTIFICIAL BREEDING STUD FOR 1956.

Breed	Merit	Yearlings	2, 3, 4 Year-olds
Jersey	43	19	38
Friesian	7	—	5
Ayrshire	4	2	3

From the point of view of immediate expansion, the team of proven Jersey bulls is the limiting factor. The size of the stud in relation to the total cows serviced appeared satisfactory in 1956, and at present it seems necessary to maintain this ratio in any future expansion, that is, 5,000 inseminations or 2,500 cows in calf for each merit bull.

During the past season deep-frozen semen has been used for two purposes. First, for groups which have no transport service on Sundays, the areas affected being Northland and parts of the South Island; secondly, for a nominated service for pedigree breeders. It is too early yet to say how successful these ventures have been. Preliminary reports suggest that conception rates will be lower, possibly by 10 per cent. compared with the usual commercial packing.

In some areas the pedigree nominated service seems to have worked quite satisfactorily, in others the results have been disappointing. This is largely due to the difficulties of maintaining such very low temperatures in small semen banks. From this more extensive experience with deep-frozen semen, it is certain that a great deal more mechanization will have to be included in the processing and distribution phases of the work before it can assist very much with seasonal demand for service which is typical of New Zealand dairying.

As an illustration, during the busy period, which extends from the latter part of September to the first two weeks of November, over 7,000 doses of semen are issued daily from Newstead, with peaks of over 9,000 doses. This is packed in the distribution centre into lots of 40 to 60 ml. in four or five test tubes in vacuum flasks. Eighty such packs must be sent off on the various methods of distribution by 8 a.m. The fact

that deep-frozen semen must be packed in individual glass ampoules slows up the dispatch time enormously. Admittedly, the packing for deep-frozen material could be done the previous day, but in that case the costs in dry ice would be prohibitive.

Before leaving the description of the progress of artificial breeding to consider the prospects, one other practical feature should be mentioned. One of the most encouraging features of the work has been the ability of field technicians to handle the heavy seasonal demand. Some technicians are working groups of over 1,300 cows, which means average daily inseminations of 50 or more, and odd peak days of 75 to 80 cows. What is also very heartening is the fact that newly trained technicians are doing as good a job as the more experienced ones. This aspect of the practical work gave us a lot of apparently unnecessary worry during the early planning of the field organization.

Prospects for Artificial Breeding

What are the prospects of artificial breeding? On technicial grounds there does not appear to be any reason why a much larger proportion of the dairy cows in New Zealand could not be inseminated each year, with a good expectation of success. The present average of insemination to each merit bull (5,000) appears to be about the maximum that can safely be expected with present techniques. The much improved conception rate obtained this year, which promises to be close to 58 per cent. places artificial breeding in a much stronger position than it has held before in this country. The experience of several years of very intensive work during the rush period at the bull centre has at last met with some success. This will be welcomed by the bull centre staff who have given their best efforts through some discouraging years. This improvement in results will give more confidence in the main features of the collection, processing, storage and transport techniques, and it is confidently expected that any increase can be met by expanding or multiplying the present arrangements.

This does not mean that the present results are regarded with satisfaction, or that they cannot be improved. Now more thought can be given to details of this work to attempt to bring the conception rates to a level with natural mating or better.

Within the A.B. organization, there is provision for up to 4 per cent. of experimental matings. Previously, full advantage has not been taken of this, because the low conception rates in the general run of the work made farmers resentful of the additional burden of experimental work. From now on, much more use will have to be made of this facility. One of the most urgent problems is the development of a more efficient semen extender. If one could be found which would improve

keeping quality for up to 48 hours, most of the immediate problems in transport would be solved, but it is unlikely that there will be any spectacular advances from now on. However, raising the conception rate by even one half per cent. is worth while on the present scale of operations.

The ultimate part that deep-frozen semen will play in the future of artificial breeding is not easy to assess even after several years' experience with it. My own hopes are not as high as they were a year or so ago. It seems evident that, taking it over all, the conception rates are well below (8 to 10 per cent.) the usual commercial methods of processing and transport. Until this difference can be narrowed down considerably it is going to be very difficult to get it used extensively in the field, especially now when conception rates by ordinary techniques are so much better. The position is similar overseas, but as New Zealand stands to benefit much more than most countries by the successful application of deep-freeze techniques we cannot afford to let the matter drop.

There are other serious difficulties associated with the extensive use of deep-freeze semen which will have to be overcome even when conception rates between the two methods of processing are much closer. The first and very important is the matter of cost. The artificial breeding work is at present sound financially, but the users are likely to be very sensitive about increasing the cost of the service, and at present it is a very expensive matter to maintain temperatures as low as — 79° C. for lengthy periods. Again, before deep-frozen semen can be of any material help in the rush periods of the year, a great deal more progress will have to be made in the packing rates and transport of large quantities. Finally, the deep-frozen semen would be most useful in overcoming peak demands during the rush period for each group, that is, during the first four weeks. At this time the technicians are so busy that the extra work involved in thawing out and opening individual ampoules of semen would be most unpopular. Doubtless most of these difficulties can eventually be solved, but is is questionable whether substantial progress will be possible until dry ice is much more readily available in the main dairying districts, or until some small, efficient, and reasonably cheap low temperature storage unit is devised. The first problem for the future, however, is to improve the conception rates from deep-freeze material.

On the production side, the results also appear to be up to expectations. Improvements in the methods of selecting bulls for this work are constantly being examined, and there is little doubt that the system used to select bulls for this work is the best that can be devised for the dairy industry in New Zealand.

If it is accepted that the prospects for the successful application of artificial breeding are now much better, are we in a position to maintain the production standards with, perhaps, a still greatly increasing expansion? Although commercial A.B. has developed very rapidly over the past seven years, we are still servicing only 8 per cent. of the milking cows in the Dominion—which is a small percentage compared with the present position in many other dairy countries. The question is difficult to answer without some estimate of the possible expansion, particularly in view of the better results now being obtained. It could be argued that, if expansion continues at the rate of 20 per cent. when conception rates are 49 per cent., what is it likely to be when conception rates are nearer 60 per cent.? On this basis it seems reasonable to expect a very material increase in the demand for a few years at any rate. On the other hand, opinions have been expressed within the dairy industry that the main period of rapid expansion is passed, and that, from now on, growth will be at a much steadier rate.

For some reasons it would be wiser to control the rate of expansion from now on, to what can be handled successfully each year. It is suggested that increases of from one-fifth to one-quarter would be the maximum. One of the main difficulties in planning ahead in this work is to know the demand in time to cater for it. Any extraordinary demands for expansion, such as the building of more bull centres, would have to be known many months ahead to plan for dealing with them.

Bull Power Resources

It might be profitable to examine the resources of bull power available to see what can be done with the material on hand. The controlling factor at present is the number of merit or proved Jersey bulls available to the A.B. bull stud, as the peak demand in the spring is for this class of semen.

From the sire survey reports, it appears that there are close on 2,000 Jersey bulls being surveyed each year, this figure having been maintained over the past three years. It was possible last year to obtain 20 bulls for use at the bull centre and if the numbers of bulls serveyed are maintained it is reasonable to expect a similar number each year. Assuming a life of three years at the bull centre, and working on the present coverage per bull of 2,500 cows, in three years' time 60 bulls could be located at the stud, and thereafter the yearly intake would be balanced by the losses. On present figures, this team would be capable of settling 150,000 cows, which would represent 75 per cent. of the 200,000, cow population to be inseminated. If, at the same time, 20 yearling bulls are

tested annually, this should bring six bulls (on a conservative estimate) into the team annually, which would eventually build up the team by 18 when the bulls become proven sires, still allowing only three years' useful life for the younger bulls. On the same basis as the figures above were calculated, this group could service another 60,000 cows. The total of 260,000 cows would be the cows bred to proven bulls, which can by right represent only two-thirds of the inseminations, so the total, including the inseminations to unproved bulls, would be 390,000 cows. If these calculations are sound, then the present bull reserves will be capable of handling expansion to about double the present figure, or when about 16 to 18 per cent. approximately of the dairy cow population is being artificially bred.

If the demand should grow to exceed that figure, does it mean that the production standards will have to be lowered? How can the difficulty be overcome?

In the first place, it has been known for some time that bulls which are surveyed in low producing herds have been unfairly appraised because the poor feeding and management are masking outstanding genetic merit, and by limiting selection to the higher producing herds many outstanding breeding bulls are being missed. The Herd Improvement Department of the New Zealand Dairy Board have been fully aware of the situation and the recent changes in the assessment of merit bulls have been brought about by this type of difficulty. In fact, matters have been taken a stage further by an arrangement to locate and use in the artificial breeding bull team some bulls which have daughters in low producing herds but with high expectancies. If, after a trial in the A.B. stud, it appears that this class of bull is showing up well in comparison with bulls selected by the usual standards, then another source of bull power will be available.

From the first attempts to put this decision into operation, it seemed likely that the bull with relatively low daughter average and high expectancy is a fairly scarce animal, but several should be available for inclusion in the bull team for 1957. It is most important that farmers accept these bulls and give them a fair trial in the A.B. work. Even on a pessimistic estimate, it should be possible eventually to build up a team of 18 bulls of this class, allowing selection of six such bulls each year, which would normally advance the total cow coverage by 60,000 cows.

So far only the potential bull reserves from the present data available to the dairy industry have been considered. Perhaps our greatest weakness in this respect is our failure to make use of our own team of outstanding bulls to breed future sires for the organization. As there are only 3 per cent.

of pedigree cows in the artificial breeding organization, and as they are fairly evenly distributed throughout the country, and as they belong to private owners who have fixed ideas about their own breeding programmes, the group does not appear on first glance to offer a very prolific source of future A.B. bulls. On the other hand it seems extremely wasteful that, in a breeding unit of 175,000 cows, half of the successful matings are carried off the farms in the bobby calf lorries in nine months' time. Many of these bull calves must be out of cows of high production merit but because they are grades are unacceptable for breeding. It seems that farmers who cannot get A.B. service from proved bulls would be doing the next best thing by using such bulls in their herds. This is already being done on a limited scale by private arrangement between neighbours, but as the extensive application of this approach would undoubtedly harm established pedigree breeders, it has not been officially accepted or encouraged by the artificial breeding organization.

The breeding of yearling bulls for use within the A.B. organization is not likely to help matters very much, because we can already get as many as we require from normal commercial channels. The use of too many yearlings during the busy part of the A.B. season is also out of the question owing to overall slowness at service and to the small quantities of semen produced. In the busy season, when large quantities of semen must be dispatched by public transport, minutes are very precious and there is a limit to the number of yearlings which can be handled in relation to the number of proven bulls in a team. On past experience, this maximum would be close to the number located at the bull stud last year, namely, 20 yearlings to 40 merit sires. Any scheme which would increase the number of proved bulls available to the A.B. stud would be much more readily applied than the yearling approach. Thus it seems vital that the proportion of tested herds in the industry be increased, and unless this can be achieved by the time the demand for artificial breeding has about doubled what it is today, it seems from the estimates of bull reserves made above that continued expansion will have to be at the cost of lowered bull standards.

If the slight downward trend which has been noticeable in the past year or two in the total cows under test is largely due to the expansion of artificial breeding, and if farmers are going to continue this policy, then the production standards of the A.B. teams of the future are bound to suffer. One of the main difficulties in getting satisfactory surveys from yearling bulls is the fact that less than half of their heifers are retained, reared and milked. The Dairy Board's estimate that, out of every 100 cows in calf to each yearling bull, only 11 daughters

will eventually be tested, discloses a very unsatisfactory situation. If the users of A.B. will realize the desperate need for surveying more of these young bulls, it seems certain that more complete use would be made of the semen collected from these yearlings and more of their heifers would be retained in the sheds for milking and testing.

Loss of Testing Material

Another serious source of loss of testing material from these young bulls may occur after seasons of good conception rates. In these circumstances, the total cows in calf in the average herd will be higher than the minimum required for rearing replacements. There will be a strong temptation for farmers to discard to the meat works as bobby calves, any surplus heifers from the young unproved bulls. This loss would be serious in the case of heifers from yearling bulls and it appears that more strenuous efforts are needed to encourage their retention in the herd. It has been mentioned that farmers who breed and test heifers from yearling bulls can claim a refund on the insemination fees spent in obtaining that heifer. So far this concession does not apply to heifers tested but not bred by the testing member. If the response to the present arrangement is insufficient, it may be necessary to extend the refund to cover all tested daughters from yearling bulls.

The problem of holding increasing numbers of young unproved bulls at the bull centre is becoming embarrassing. To keep a bull from the yearling stage until they can be proved is very costly. On the other hand, as will be shown later, the losses from health examinations for mature bulls entering the stud are heavy and would represent another leak in the number of bulls eventually entering the bull team as merit sires.

The prospects for maintaining the present satisfactory production levels if the artificial breeding organization grows beyond double its present size do not perhaps look very bright in the way presented here. Conservative estimates have been taken on purpose, and the actual position could well be much better. Some encouragement may be taken from the fact that seven years ago the number of bulls available for A.B. work was very much smaller in proportion to the bulls surveyed than it is today. Perhaps the fact that A.B. is becoming more generally available, thus releasing some of the bulls which farmers previously had to keep for themselves, and the fact that fair prices are being paid, may increase the supply above the estimates now being made. It is hoped that this will prove to work out in practice. Also, purposely, no allowance has been made for the successful development of deep-freeze work. It is hoped that, by the time the national demand for

artificial breeding service has reached the stage where bull quality is likely to be affected, some more tangible assistance will be forthcoming from the deep-freeze techniques. It appears that we may have a few years' grace to improve our deep-freeze techniques.

There are two other aspects of artificial breeding which have not yet been considered and which should be mentioned. The first is the reputed danger of genetic defects being widely distributed with the increasing coverage from A.B. bulls. An attempt is being made to collect information on abnormal calves born as a result of artificial service. A few reports have already been received but as they have been so few it has not been possible to form any opinion on the position beyond the fact that all reports have concerned different bulls, and on investigation some of the conditions described were clearly infective processes and not genetic defects. Information has also been sought about the incidence and nature of abnormal calves born in naturally bred herds, to try to estimate the importance of these in the industry as a whole and if possible to locate the source of the defects, with the object of avoiding those families when selecting bulls. Again the information has been too scanty to be of any practical use. It is believed that widespread distribution of genetic defects is not likely to be a real problem in artificial breeding.

The other aspect which should be mentioned briefly is the question of bovine venereal disease and artificial breeding. The two dangers are the transmission from herd to herd of contagious and often serious diseases through careless insemination techniques, mainly through the use of contaminated instruments. The risks here have been reduced to the minimum by the use of plastic pipettes. These have been available at such a cheap price that they can be discarded after use, and there is no excuse for pipettes to be used a second time. Field technicians have on the whole been very careful in their personal cleanliness and have taken a responsible attitude to the importance of keeping high standards in their work. It is certain that the risks to farmers from this source are as low as they are in any country.

The second risk is the transmission of infection through diluted semen. We are confident that all reasonable precautions are being taken to exclude infected animals from the bull stud. Tests are made for tuberculosis, contagious abortion, vibriosis, leptospirosis and trichomoniasis. Health tests carried out on prospective additions to the bull team at Newstead during the past year have resulted in one bull out of five being rejected for leptospirosis titres. In addition, four adult bulls have been rejected for positive contagious abortion tests in the past three years. It seems that an active campaign of vaccination should

reduce these risks for farmers using natural mating, particularly in the case of contagious abortion where vaccine has been proved of great value in protecting heifers from field infection. The only objection to this measure is the possible permanent blood titres which might affect the chances of animals being selected for export.

It is fortunate from the viewpoint of maintaining numbers at the bull stud that losses from the other diseases have been very slight in the past few years. With the improvements that are constantly being made to the diagnostic tests for these diseases, it may be assumed that the farmer's interests can be safeguarded very satisfactorily in these matters and it is certain that the users of A.B. are running very much less risk of acquiring venereal disease in their herds than those buying and using adult bulls.

Summary

The present position seems better than has been experienced previously. The conception rates appear to have been raised to a much more satisfactory level, and, what is equally important, production levels of artificially bred stock are up to expectations. The present problems seem to be to maintain this position and if possible improve it during the next few years when there may be continued expansion. To enable the present production standards to be maintained, there must be no falling off in herd testing, and farmers must co-operate by rearing and testing all heifers from yearling bulls. Past experience has shown that a good deal more work will have to be done on the deep-freeze technique of semen storage before it can be expected to assist the seasonal demand for service in New Zealand.

Although progress in artificial breeding has at times seemed painfully slow in New Zealand compared with its growth in other countries, steady progress is being made and the experience of past years, although beset with many disappointments, has prepared a solid foundation for future development, both in the artificial breeding and sire selection aspects of this work.