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IMPROVING BEEF CATTLE

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THERE appears very little need to harangue an audience of this persuasion that exports of pastoral products constitute the main source of earning New Zealand overseas exchange. Briefly, some 84% of overseas exchange is earned by the farming sector compared with 6% by the manufacturing industries, with the humble sausage casing earning as much as the greatest individual earner in the manufacturing section, processed foods. Neither is it necessary to emphasize that the maintenance of New Zealanders' high standard of living depends on an expansion of these exports.

It is true that exports of primary products have increased over the past few years. For example, from 1965 to 1970 the value of dairy products rose by 31 million dollars — an increase of 16%. Most of this increase in value was due to an expansion in the sales of non-fat solids. Over this period the value of butterfat has remained relatively stable, but this stability, in conditions of world surpluses of butter, has been achieved only because of the quota system operating in the United Kingdom which limits imports of dumped butter on to that market.

At the moment these world surpluses seem to be disappearing and there are welcome signs of an upturn in price. The position, however, is clouded by the possibility of Britain joining the European Economic Community. What effect Britain's accession to the Treaty of Rome will have is anyone's guess at present, but the prospect certainly is not sending quivers of anticipatory excitement down the spines of dairy farmers.

The value of sheep products has risen also, but only because of greatly expanded production. The value of wool has declined markedly, following the lapse of patents on synthetic fibres, the fall first being felt for coarse, and later by fine wools. It appears unlikely, failing some new and novel use for it, that wool will ever recover its former value but that prices will remain fairly closely tied to its major competitor, synthetics.

Luckily for the sheep and wool farmer the value of lamb meat has been well maintained over this period, the market absorbing the greatly expanded sales of lamb without any depression in prices. Again, however, some doubt over future lamb sales exists with the possibility of levies on the product and Britain joining an enlarged European Economic Community.

The future, then, is clouded by doubts and uncertainty; our progress in increasing exports based on pastoral products appears as difficult as climbing an icy cliff in a fog, where the loss of one of our precarious handholds will send us plunging into an economic morass.

The cry is for diversification, to reduce our dependence on our two old economic stalwarts, the sheep and the dairy cow. In this respect, at least, one small gleam illuminates the pervading gloom. Receipts for beef from 1965 to 1970 rose from 55 million to 154 million dollars. While increased exports accounted for an increase in value of 78% there was also a very welcome increase in the price. The price of beef products rose by 59% and the overall contribution of increased price to export receipts was 105%. Moreover, United Nations predictions show an increasing gap between demand and production of beef.

Thus, of all products sold, only the value of beef has increased substantially. This increase in value has elevated the beef animal from its heretofore lowly position as a self-reproducing piece of agricultural machinery, useful for cleaning up pastures after sheep, crushing fern, and producing athletically fit beef at the age of three years, to an animal of some economic importance.

The increased status of the beef animal has stimulated interest in methods of increasing beef production.

As far as breeding is concerned these may be dealt with under three headings:

(1) A genetic improvement of existing breeds.

(2) Introduction and testing of new beef breeds.

(3) Integration of the dairy and beef industries.

The improvement of beef cattle by breeding involves no new techniques but depends on the well-established principles of testing to identify the superior animal, and selection of a limited number of superior animals to provide the breeding stock for the next generation. The effectiveness of this policy will depend on a number of factors, probably the most important of which are the efficiency of testing and selection pressure.

Because most females are required for breeding purposes the main avenue for rapid improvement lies in the selection of the sire. Luckily two of the traits we are most interested in, liveweight gain and 20-month weight, can be measured on the live animal and have reasonably high heritabilities. Overseas estimates give the heritability of liveweight gain as between 40 and 60% and the heritability of liveweight at 18 to 20 months a similar value. There are few New Zealand data on this subject. Dairy Board data derived from liveweight gains of 264 sons of 72 sires yielded a heritability estimate of 57%, and for 29 sons of six Friesian bulls, 49%.

So we have a reasonably high heritability which means that fairly effective selection of the best animals can be made on the animals' own performance. But the rate of progress depends not only on heritability and selection pressure but on genetic variation. For example in the dairy field, the heritability of butterfat production is low, but genetic variation is high, so that by using progeny tests with a fairly large number of animals rapid progress can be made. On the other hand, the heritability of solids-not-fat is high but genetic variation is low, so that although the number of progeny required to define the sires genetic potential is small, progress that can be made is very slow.

New Zealand data show genetic variation in growth rate of Fresians from 11 to 20 months as ± 47 lb. This is in fairly good agreement with overseas data. Under ideal conditions of testing, *i.e.*, when animals are compared with a large group of animals by different sires, the genetic superiority of the animals selected will be + 26 lb if the top 50% of bulls are selected, +58 lb if the top 10% are selected, and + 87 lb if the top 1% are selected. These estimates are of course subject to a considerable error, the standard deviation of each estimate being ± 33 lb. Accuracy of selection can be improved by progeny testing. The genetic superiority of sires selected on a progeny test involving 50 animals will be + 34 lb if 50% are selected, + 77 lb if 10% are selected, and + 116 lb if 1% are selected. The errors of the estimate are much reduced, the standard deviation of each estimate being ± 15 lb.

Thus progeny testing can increase the rate of gain at any selection pressure, but of course this is achieved at the rate of a greatly increased generation interval. In general, progeny testing of sires as far as liveweight gain is concerned is likely to be of value only in defining which sires should be used to breed future generations of bulls.

Whatever system is used it appears that worthwhile improvement can be made. Using a selection differential of between 5 and 1%, increases in growth rate of the order of 100 lb could be achieved in 10 years — "could be", but are unlikely to be, under the herd structure that obtains in New Zealand. The greatest rate of improvement would occur if every herd performance-tested bulls and used the best bulls in the herd. Clearly this is impracticable as most herds are geared to producing steers. So the beef industry relies on a small number of bull-producing herds, the majority of which consists of herds of 40 cows or fewer.

On-farm testing in these herds has certain limitations. First, groups of bulls being compared are going to be small so the efficiency of selection is reduced. Secondly, because of small size, most of the bulls being compared with each other will be sons of the same sire. Selection of bulls within one sire group under the best conditions will give only 80% of the rate of improvement that will occur when selection is made from sons of a large group of bulls. Also, owing to variations in sex ratios and bull losses, it is unlikely that the selection pressure could exceed 10%. Lastly, because of chance selection of bulls there will be quite large genetic differences between herds, making the comparison of bulls selected from different herds quite impossible. This situation is compounded by management differences between herds. Bitter experience from the testing of dairy bulls would suggest that, for these reasons, progeny tests on an individual farm are not a very reliable indication of how a bull would perform on other properties.

So even if all bull-producing herds were testing, and selecting only the best bulls, progress would fall far short of that theoretically possible. In fact only 24% of herds do performance-test, so that in the immediate future most bulls will continue to be sold on type, their merit being described rather than measured. The sale rings will continue to be graced for some time with those "great deep bodied bulls" with "outstanding constitution simply oozing with prime cuts" down to (and the kindest words are often found for the poorest animals) "a bit on the small side but quality in every inch", or "not much to look at but very nippy over the hills".

The testing situation can be improved by a system of large-scale breeding units. In its simplest form, this can exist by groups of farmers testing their bulls under uniform conditions. A few such groups do exist at the moment.

The system has the advantage that selection of bulls is much more effective. However, if the selected bulls are going to be used for natural mating then this will limit the selection differential.

In fact any natural mating system has the serious drawback that it precludes progeny testing for carcass characteristics, limits the use of progeny testing for liveweight gain, even in large-scale systems, and makes impossible the widespread use of progeny-tested sires. Further, because the industry at large gets the benefit of improvement in these herds second hand, progress in these herds will be much slower. The most rapid method of improvement of course would occur if large numbers of bulls were tested under uniform conditions at a central testing station, with widespread use of these tested bulls through A.I. in the industry at large, with progeny testing of these young sires being used to select the sires of future generations to go into the central testing station.

Thus effective improvement of beef livestock seems to depend on a radical change in both attitudes and breeding management. It is no surprise then that many have turned to the search for superior breeds. If it takes 10 years of hard work to improve liveweight gain by 100 lb, how much simpler to achieve this by finding a breed that has this superiority.

A large number of exotic breeds have been imported in recent years either in the flesh or by proxy in the form of semen.

The list reads like an extract from a Noah's Ark roll call:

> Brahmin, Sussex, Murray Grey,
> Devons, Red Lincoln, Charolais
> Dun and Belted Galloway.
> Also imported for the common good is
> The hump backed lop-earned Santa Gertrudis.

This semen will be used from the North Cape to the Bluff and in a short time tropical, tick-resistant, sacred Indian cattle will be seen basking in the winterless north, hiking over the hills in the King Country and shivering on the snow lines of the Southern Alps. And this list does not exhaust possible future candidates for the New Zealand beef herds of the future. The Simmental has entered Britain and will be imported into New Zealand as soon as possible, closely followed by the Blond Aquitaine and the Limousin.

Yet of all the breeds imported only the Charolais has been tested under New Zealand conditions and then only as a crossing sire on to dairy cows. Results from these crosses have shown the Charolais × Jersey to be inferior to the Friesian × Jersey when the calves are bucket reared, and roughly on a par when reared on nurse cows. Both breeds were superior to the traditional beef breeds. The value of the Charolais as a hill country animal has yet to be determined. Some of its known defects such as calving difficulties may militate against its widespread use.

One fact has emerged from the trials. The Friesian is a highly efficient beef animal under dairying conditions. It has also been tested on hill country. At Whatawhata and Invermay Research Stations the breed has performed very well both as a breeding cow and as a meat producer.

The use of the Friesian as a beef breed on the hills has much to recommend it. Not only has the breed demonstrated its ability to put on weight quickly, but the females, because of their dairy descent, have a vastly superior lactation performance compared with traditional beef breeds. Widespread use of the Friesian as a beef breeding animal carries with it some dangers. Selection of the breed for beef only could lead to the development of two distinct strains of the breed. While this is of no significance if the strains are strictly confined to dairying or beef there is little doubt that surplus heifers from beef herds would be sold in the market that gives the highest return, and many of them would finish up in dairy herds.

But while improvement of existing breeds and possibly the use of new breeds can improve the efficiency of beef production, by far the greatest potential for increasing the production of beef lies in the integration of the beef and dairy cattle industries.

While somewhere over a million beef breeding cows are stomping round the hills producing calves that will be used either as replacements or for beef, over a million calves from the dairy industry are being slaughtered annually.

The over-capitalization involved in breeding stock is obvious enough, but integration of the industries depends on the ability of hill farmers to change from reproductive to productive beef, the acceptability of the surplus calves from dairy farms as beef animals, and stability of supply.

Of course the separation of the beef and sheep, and dairying into highly specialized industries has a sound historical basis. For very many years the only animal of economic significance in the sheep and cattle industry was the sheep, cattle being used as a "pasture conditioner". In the dairy industry sales of cull cattle for beef, either as bobby calves or cull cattle, contributed but little to the farmer's income. The only commodity of value was butterfat and until the advent of tanker collection, which started in 1951, the majority of farmers supplied cream to dairy factories, draining the skim milk through pigs.

In such a situation, that is, low beef prices and the troublesome disposal of skim milk, the Jersey was the logical breed for dairying. It is not surprising, then, that the predominant breed changed from Shorthorn to Jersey between the first and second world wars. The breed reached its zenith in the early 1950s when it accounted for 85% of all dairy cows in New Zealand.

But the change to tanker collection, obviating as it did the need to dispose of skim milk, coupled with a feeling among farmers that non-fat-solids would assume greater importance in future, had started the swing to Friesian before its value as a beef animal was realized. Thus the percentage of Friesian inseminations in the A.B. scheme, which was less than 4% in 1955, increased to over 14% in 1960 and to 20% in 1965. The increase in the price of beef and the dairy beef diversion scheme has since accelerated the demand for Friesian semen so that from 1965 the demand has risen from just over 20% to 52% of all inseminations in 1970. This was not entirely due to a desire to indulge in dairy beef; it also reflects the increase in income that can be derived from the sale of heavier bobby calves and cull cows.

The increasing use of the Friesian should greatly facilitate the integration of the two industries. The number of animals of dairy origin kept for beef, mainly Friesian crosses, has steadily increased over the past few years. In 1965 approximately 25,000 animals of dairy origin were kept for this purpose; this increased to 50,000 in 1966, 75,000 in 1967, 150,000 in 1968 and 250,000 in 1969. Animals retained for beef in 1969 represented some 60% of the available suitable animals, *i.e.*, Friesian and beef breed crosses. In both 1968 and 1969, 100,000 of these animals found their way on to sheep farms, the remainder being retained on dairy farms. The sharp increase in numbers retained on dairy farms, from 30,000 in 1968 to 150,000 in 1969, is probably due, at least in part, to the dairy-beef diversion scheme. Providing the swing to Friesian continues the number of suitable calves for beef derived from the dairy industry will increase dramatically in the next few years.

The pathways for improving both the efficiency and total production of beef are therefore fairly obvious — the improvement of existing breeds, the introduction of new and superior breeds, the use of Friesian animals from the dairy herd to provide the source of animals raised for beef on sheep farms.

The pathways then are obvious, but many questions have to be answered before they are effectively implemented. There is no doubt that an effective A.I. scheme is by far the most effective way of improving livestock. What then are the problems associated with A.I. in beef cattle? What minimum advantage is required to recoup the extra costs involved in A.I.? One suspects that many of the expected difficulties would disappear if the returns were high enough.

Which exotic breeds should be tested in New Zealand? Obviously there are a tremendous number of potential contenders and their overseas performance, one would think, would need to be carefully screened before they are admitted to New Zealand. Is it worth while, for example, introducing new breeds which, at best, have only a marginal superiority over the Friesian?

If it is desirable to use the dairy industry as a source of male animals for beef, and there are good reasons for doing this, how much emphasis should be placed on beef and dairy characteristics in the selection of bulls? With the numbers of animals now retained, even modest increases in performance would result in substantially increased returns. Thus an increase of 10 lb in dressed carcass weight would increase returns by $550,000. Should we then adopt the Swedish system of buying double the number of bulls required for dairy proving and then cull half before the bulls go into the dairy-proving scheme? Or is it worth while operating a mixed system in which the best growth-rate-tested, but as yet unproven dairy bulls, are available for use by beef farmers and by dairy farmers on their inferior cows.

It is difficult to imagine that many of these questions will be answered, and effective action implemented without the guiding hand of a body responsible for livestock improvement in general, that is, one responsible for both dairy and beef improvement. The setting up of such a body has already been mooted.

A pattern exists for such an organization. The Dairy Board Farm Production Division is responsible for dairy cattle herd improvement. The progress that this organization has made in the field of cattle improvement, which is considerable, has been due as much to the type of organization as the personnel involved.

Its strength lies in the fact that testing organizations are closely integrated with the Dairy Board. The Board processes all testing data, and has been able to evolve from such data sire-proving systems, and to implement such systems through its artificial breeding service. Further, through testing organizations and its advisory service it can keep in close contact with farmers.

One envisages the new organization operating on similar lines, with its testing, data processing and analysis, and A.I. services closely integrated.

Only such a body, with a responsibility to both the dairy and beef industries, could determine the weight to be given to beef and dairy characteristics in Friesians, for example, and implement its findings.

Many of the facilities required for such an organization are already in operation. Testing organizations and systems exist for both the testing of dairy and beef cattle. We have the data processing facilities needed to collate the testing information and a number of highly-qualified geneticists to evolve the breeding plans required. We have an A.I. service capable of servicing all the animals likely to be submitted. We have the advisers.

We have in short all the ingredients to cook up a livestock organization second to none in the world. All we lack is the chef and the kitchen.