Presidential Address

AGRICULTURAL DEVELOPMENT AND RESEARCH IN NEW ZEALAND

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IN THIS ADDRESS I propose to speak almost exclusively about future expansion of *animal production* in New Zealand, since essentially this is synonomous with agricultural development and the research which will be necessary to service this.

For this purpose it is intended to draw extensively on the work of the Agricultural Development Conference and to consider in detail the blueprint for agricultural expansion prepared by its Targets Committee. This is considered essential in relation to the discussion of agricultural research which will follow, since the National Research Advisory Council, whose recommendations on science can directly affect 80% of operating expenditure on research in New Zealand, has accepted in principle that priorities will be determined by the annual value of production from, and national importance of an industry, as well as by the number of problems requiring solution and the probability these may be resolved by research. All factors being equal, this implies that those sectors of agriculture from which greatest future productive increases are anticipated will require the greatest amount of additional research effort.

Thus, the main recommendations of the Agricultural Development Conference's Targets Committee will be considered first, briefly and, I hope, objectively. Some amendments will be suggested which are calculated to improve the definition of the blueprint it has prepared, and, finally, research needed to ensure the success of such a programme for expanding agricultural production in New Zealand will be described.

In deciding upon this course and expressing personal opinions on several contentious and important issues, I have deliberately accepted the challenge contained in the following section of the address given to this Society last

year by the immediate past President relating to the Agricultural Production Conference:

" It was rather noticeable that there were no research representatives on any of the Conference committees. This signifies that those organizing the Conference felt that research personnel had little to contribute to New Zealands' first attempt at indicative planning on a national scale. I hope this will be rectified by scientists themselves in the future."

PROPOSALS OF THE AGRICULTURAL DEVELOPMENT CONFERENCE TARGETS COMMITTEE

The major purpose of the Targets Committee's plan is to obtain by 1972–3, through expanded agriculture, £140 million more overseas exchange than was earned ten years earlier. To achieve this, the Committee has estimated that growth in the value of pastoral exports must increase at a compound rate of 4.1% per annum. A target total animal population has been set at 111 million ewe equivalents for 1972–3, and the compound annual rate of increase to reach this is 3.5%. These exceeded by about 50% projected livestock increases made by the Department of Agriculture Farm Advisory Division based on farming trends and farming policy at that time.

Neither the size of nor the necessity for these increases is questioned, but rather the means of achieving these targets. We cannot accept unquestioningly the statement contained in the Report of the Agricultural Development Conference (Anon., 1966a) that "The imponderables of future demand for products, and possible marketing problems, make it impossible to be definite about the actual classes of livestock needed in 1972". An essential of sound indicative planning is to anticipate and plan development in areas which are potentially most profitable. Recognition of this is especially important for livestock industries, since the composition of animal populations is changed relatively slowly, and for New Zealand the presence or absence in 1972–3 of sufficient numbers of the most profitable species and classes of livestock will be determined by decisions made now. Thus the choice of which livestock industry, if any, and aspects to concentrate on is as important as assessing a final target.

One assumes the Targets Committee has accepted, albeit tentatively, that New Zealand's present agricultural programme is best suited to increasing overseas earnings to the required level, and to supplying world demand for animal products. It seeks during the decade to 1972–3 a 50% increase in breeding ewes, a 46% increase in beef cows and heifers, and a 12% increase in dairy cows in milk.

It is my contention, however, that neither current trends in world animal production and trade, nor previous experience of financial returns from alternative systems of farming, nor prospective new developments and considerations such as the optimal use of national resources, support current policies as providing the best available course of action.

PRODUCTION AND TRADE IN ANIMAL PRODUCTS

Wool

During the 1960s, world wool production has remained stationary (Anon., 1965c), and total production of synthetics, which is now 25% higher than for wool, increased by 14% between 1963 and 1964 (Anon., 1965b). Between 1961 and 1964, world wool imports and exports fell by 10% and 5% respectively (Anon., 1965d), but, despite reduced purchases by all major importing countries, New Zealand's exports of wool increased during this period. The problems associated with receding global markets subject to sudden economic pressures are reflected, however, in current wool prices.

Meat

In contrast, world production and trade in meat has been buoyant, production of carcass meats increasing between 1961 and 1964 by 3.7 million metric tons (6%), imports by 37% and exports by 36%. Production and trade increases were greatest for beef; more than five times greater than for sheep and goat meats (Anon., 1965c, d) and, whereas demand for beef and veal rose markedly in all major meat importing countries, with the exception of Asia, it either plateaued or fell for sheep and goat carcass meat. An additional measure of this differential is the relative increase in value of world

exports over the same period, being 85% for cattle meats, and 23% for those of sheep and goats. Comparable figures for New Zealand are 30% for cattle and 19% for lamb and mutton.

Dairy Products

Between 1961 and 1964, world outputs of butter fell by 10%, and productions of cheese and dried milk powders increased respectively by 5% and 18%. Despite a lowered demand for foreign butter by the U.S.S.R., world imports of dairy products rose in all major geographical regions of the world, and in total by 630,000 metric tons (29%). Receipts from exports increased by 26%, of which New Zealand's share (40.5 million U.S. dollars equivalent) represented a 23% increase over 1961 earnings. Rise in demand was greatest for milk powders, but quantities of butter and cheese imported advanced by 20%. Hence, despite the present relatively low butter prices, largely the result of a particularly good dairying season in Europe, prospects for a continuing upward world demand for dairy products are good. Additional support for this is provided in world dairy cattle population numbers, now virtually stationary in total, but steadily declining in certain important exporting countries such as the U.S.A., and in the virtual disappearance by February, 1966, of U.S. surplus dairy products which previously had influenced profoundly some export markets for dairy produce. The net effect has been to increase considerably the scope for supplying cheese and milk powders to the Japanese and European markets, in particular.

In essence, this brief survey indicates that long-term world market prospects in animal products are brightest for beef, that there is an expanding demand for dairy products, a slowly yet progressively shrinking demand for wool, and that the potential for expanding sales of sheep meats appears limited and may be restricted to Asian markets.

In considering the specific case of New Zealand, however, it is not suggested from this analysis that profitable increases in the sales of sheep meats and wool will not be made in the future, for recent trends would show this to be incorrect. Rather, the analysis has attempted to establish which products have profitable markets and by

consistent expansion will provide an assured long-term demand.

It is conceded, no allowance is made that success in lamb export diversification could profoundly influence both sales and prices for sheep meats. Because of present uncertainties associated with this scheme, and the urgency of raising total overseas earnings to £467 million by 1972–3, however, a livestock target requiring a 50% increase in breeding ewes, and proportionately much smaller increases in beef and dairy cattle, is considered most unsatisfactory.

ALTERNATIVE METHODS FOR EXPANDING TOTAL PRODUCTION

Increasing Emphasis on Beef

Greatest potential for expansion is in beef production, but between 1961 and 1964 New Zealand exports of chilled and frozen beef rose by only 25% (24,500 metric tons) compared with Australia's 110% (150,000 metric tons), and South America's 72% (236,000 metric tons). The price per pound for New Zealand beef was also lower.

To expand beef exports suddenly, a massive increase is required in breeding stock. This can be provided most efficiently and readily by the national dairy herd. This possibility was recognized by the Agricultural Production Council when it established a dairy beef and veal working committee in 1965. This committee reported in March, 1966, that, given favourable economic conditions, about 640,000 calves suitable for beef or veal production could be produced annually from dairy cows without affecting current dairy herd improvement programmes or breed composition. These should yield a net increase in overseas funds of £28 million annually.

Despite considerable publicity and dissemination of results of research and industry experiences, both local and overseas, national exploitation of dairy beef, as reflected in the decline in total slaughterings of bobby calves during the last three years, has been disappointing, especially when allowance is made for increased replacements required by the rising national herd, and Tb testing. There are probably several reasons for this—managerial, economic and personal preferences—but the major factor is the absence of formal planning and organization of

this potentially large dairy beef industry. Guarantees of internal market stability are required, at least initially, to ensure rapid and successful establishment. The type of organization required can best be decided by the Agricultural Production Council, since amongst its members are representatives of the two main producer organizations involved, the Meat and Dairy Boards, and it can recommend directly to the Minister of Agriculture measures considered necessary to obtain the production targets.

This is an urgent priority, since full employment of dairy beef by dispensing with breeding stock overheads will markedly increase national output of beef per acre, and hence productive efficiency. For beef to flourish competitively this is a national necessity, since in 1963, when overseas earnings from the three major animal industries totalled £313 million (Reserve Bank statistics), an estimated £110 million was provided by dairy produce, bobby veal and other dairy meats, £195 million by the sheep industry, and £8 million by beef cattle. These returns, expressed in relation to the appropriate livestock populations by converting each to ewe equivalents (Agricultural Production Council's conversion factors), are £5.9, £4.1 and £0.5 per ewe equivalent for dairy cattle, sheep and beef cattle, respectively.

There are several reasons for the extremely low figure for beef—the large fraction of beef produced which is consumed locally, breeding stock overheads, and absence of past specialization. Given appropriate incentives, the effects of each can be reduced markedly.

Increasing Emphasis on Dairying

As previously demonstrated, dairy cattle are the best earners of overseas exchange per ewe equivalent. This results partly from the relatively high prices for dairy products, but mainly to the much greater efficiency of conversion of feed into milk than into meat or wool. Average gross efficiency indexes are 15% for dairy cows, 3% for breeding ewes and 5% for fattening steers (Hutton, 1963).

Thus, any increase in dairying will produce, in addition to extra milk products for export, a further increase in the supply of potential beef producers and a substantial rise in average farming efficiency. The cumulative

annual increase of 1.25% projected by the Agricultural Production Council is considered therefore as much too low, and a figure closer to the 4.5% chosen for breeding ewes more appropriate. This would require adding about 100,000 extra cows annually to the national herd and rearing 24% more calves than at present. These would be drawn from the 360,000 surplus female calves estimated as available annually.

In this way total milking cows could be increased to 2,840,000, or by 36%, between now and 1972–3. At current carrying capacities, one-third more land would be required than is now in dairying, but should the average rise to 1 cow per acre in the interim, as suggested by Stichbury (1966), no extra land would be needed.

Assuming a continuation of present trends in milk collection and manufacture, production of milk products could be expected to rise by 790,000 tons by 1972–3. These additional anticipated amounts of butter, cheese and milk powders would raise 1964 world exports for each by 15%, 7% and 13%, respectively, and increase New Zealand's overseas earnings by £46 million (in 1963 terms).

Industry requirements for expansion would be large, but this would apply to any farming sector making proportionately the greatest contribution to a 111 million ewe equivalent target. In recent years, however, the dairy industry more than any other has shown a remarkable capacity for expansion. Continuation of this trend, which currently involves an annual increase in collection and processing of about 90 million gallons of milk, would permit by 1972–3 the collection of virtually all milk for manufacturing as whole milk from 2,840,000 dairy cows.

The Partnership of Beef with Dairying

Reference has been made previously to the present opportunity for breeding and rearing 640,000 calves of dairy and part dairy origin which would be suitable for veal or beef production. With the increased dairy cow population envisaged, this could be increased to nearly one million, and net returns in overseas exchange from dairy beef to £42 million.

Rearing problems aggravated by seasonal calvings are not underestimated and initially the total cost of preweaning feedstuffs and mortality rates could be high. To

ensure a large and rapid turnover of stock, prerequisites of an efficient and profitable export industry, most of these cattle would require intensive farming. This could be achieved initially with a minimum substitution between different classes of stock on highly productive land. Gibbs (1963) has estimated from areas of all soil classes that there are respectively 8.75 and 2.33 million acres in the North and South Islands capable of carrying 6 ewe equivalents to the acre. Since 1.5 fattening cattle per acre would be comparable, addition of 1 million cattle annually to the total beef population would require a further 1.33 million acres. If, to this, the 3 million acres in dairying is added, there remains a balance of 6.75 million acres of similar actual or potential productivity, sufficient for more than 40 million ewe equivalents.

Even with an appropriate organization and incentives, creation by 1972–3 of an industry capable of breeding and rearing 1 million calves annually, and fattening, processing and marketing a similar number of cattle could prove impracticable. However, achievement of the target initially prescribed by the Agricultural Production Council's working party would provide overseas funds which, when added to those earned directly by the dairy industry, would account for 44% of total overseas earnings required of exports from pastoral farming by 1972–3; £238 million would remain to be earned by the sheep and beef industries as currently recognized. While this is £35 million more than their combined contribution in 1963, it is appreciably less than prescribed by the Agricultural Production Council.

The manner in which the proposals I have made would affect the final distribution of the animal population is, summarized in Table 1.

For the ten-year period, sheep would be required to increase by 21% instead of 46%, beef cattle, including dairy beef, by 64% instead of 44%, and dairy cattle by 43% instead of 14%. This redistribution of emphasis, because of its concentration on products yielding highest returns of overseas exchange per ewe equivalent, namely, dairy products and dairy beef, would also permit attaining the 1972–3 export earnings target with fewer total ewe equivalents. Thus, the revised cumulative annual increase in stock is calculated as 3.0% instead of 3.5%, and the

TABLE 1: ESTIMATED TOTAL EWE EQUIVALENTS—1962–72 (000's)

	1962	1972	Cum. % Increase	% Increase for 10 years
Total sheep	45,862	55,610	1.93	21.25
Breeding ewes	33,894	40,714	1.83	20.12
Other sheep	11,968	14,895	2.19	24.46
Total beef cattle	15,204	24,960	4.96	64.17
Breeding cows	6,872	8,333	1.93	21.26
Other cattle	8,329	16,627	6.91	99.62
Total dairy cattle	18,445	26,441	3.61	43.35
Cows in milk	13,776	19,810	3.63	43.80
Other cattle	4,669	6,631	3.51	42.02

total end population is reduced by 4 million ewe equivalents, accordingly.

FUTURE RESEARCH CONTRIBUTIONS TO AN EXPANDING AGRICULTURE

In 1963, the N.Z. Institute of Agricultural Science devoted its annual conference to analysing this country's potential for agricultural expansion, and a ceiling of 150 million ewe equivalents was assessed. If the projected increases required by the Agricultural Production Council are maintained, therefore, requirements will be equal to potential in 1981–2. This emphasizes the importance of economies such as those described above, since, although estimates of potential increase as research provides new information, the time interval between the present and when such is required to ensure further industry progress appears to be steadily shrinking.

To provide ways of increasing the rate at which important new information comes available, it becomes equally as important in research as in industry application to establish priorities and to assess these in terms of industry's most vital needs.

New Zealand's research commitment has been described in the National Research Advisory Council's report as £8,709,000 for 1966, excluding expenditure on buildings. This equals 0.47% of the gross national product. Agricultural production and processing research received 39% of total research expenditure, and of the 882 Government-

employed scientists in 1966, about one-half were engaged primarily on agricultural problems (see McBride and de Jeux, 1966). This is a low rate of investment in an industry required to earn 95% of New Zealand's overseas funds, and in relation to the many important problems facing it.

The N.R.A.C. recognized this in part by recommending to Government in 1965 a cumulative increase in research on agriculture over the following 5 years of £320,000 annually. Surprisingly, however, they gave no direction about projects they considered this could best be applied to. Where level of research investment is low, establishment of priorities is essential to avoid ineffectual dilution of funds. A constant problem associated with democracies is that in science, as in every other section of society, each may claim his work to be of high priority. This is exemplified in the summary of the report and recommendations presented to the N.R.A.C. in 1965 by but one of the four agricultural working parties, in which it is stated that no fewer than 90 research projects are considered to be of high priority.

Having chosen already, first, to question certain projections and recommendations made by the Agricultural Production Council and to offer certain alternatives; and, second, to support the opinion that research piorities in agriculture should be determined by industry needs; but having discovered in practice a general tendency to overlook this important precept, I propose chancing the full length of my arm by including as a postscript the research projects considered to demand highest priority in a support programme for expanding agriculture.

These have been classified under three broad, definitive headings:

1. Market Protection.
2. Product Volume.
3. Market Expansion.

Market Protection

Research on problems which can determine the acceptance or exclusion of our produce from vital markets, for little will be gained from vast increases in production if

qualititative and legislative barriers deprive us of economic market outlets. Included in this category are the following.

(1) *Salmonella*

By contaminating produce, thereby endangering public health, salmonella can cause the rejection of complete shipments of meat in particular, and imperil markets. Through outbreaks of salmonellosis it can also depress product volume.

(2) *Insecticides*

Residues of DDT are the most important. Much requires to be known about the rate of catabolism of DDT following its application to pasture, its metabolism and retention by the grazing animal, and the effect of each on product contamination. Residue tolerance levels have become particularly important in relation to market access.

(3) *Product Quality Maintenance*

Research on problems apparently peculiar to New Zealand products, such as factors affecting tenderness and degree of fatness in export meats, and variations in flavour, colour and texture of cheese and butter. To maximize the use of our essentially limited manpower and facilities, it is essential that basic research in these and other fields is concerned directly with aspects of these specific industry problems.

PRODUCT VOLUME

Research on factors affecting total yield, or the efficiency of animal production.

(1) *Feed Production*

(a) *Soil Fertility:* A continuing research task of major importance is to establish the fertilizer requirements of our most important soil types, for plants respond so markedly to changes in soil fertility and between soil types, and because both land resources and fertilizer sources are finite.

(b) *Pasture Pests:* Losses in livestock production associated with depredations of grass-grub have been esti-

mated as varying from £2–10 millions annually. DDT appears to be ineffective on some soils and grass-grubs resistant to it are present throughout New Zealand. DDT has introduced residue problems, and the discovery of alternative means of controlling grass-grub and porina caterpillar is of greatest importance.

(2) *Animal Production*

(a) *Analyses of Livestock Requirements:* To rationalize feeding, husbandry and management trials, and to apply results effectively from these, a comprehensive understanding of stock feed requirements is needed. This provides the soundest basis for developing new approaches to improving the production, quality and utilization of feed, and hence output per acre of beef cattle, dairy cattle and sheep.

(b) *Assessing Potentials in Livestock Production:* This involves integrating feed production and animal requirement data, and experimentally examining ways of utilizing each to achieve maximum output. Applied within and between each of the principal livestock industries, this approach will suggest ways of improving their individual efficiencies, and provide objective assessments to assist in determining the efficacy and economics of alternative systems of livestock farming.

It has particular application to beef production for which few accurate assessments exist of the potential of grassland feedstuffs to induce fast rates of liveweight gain for the extended periods demanded by efficient fattening. In this regard, the effect of stocking rate, and the use of supplements to stabilize feed supplies and to increase their percentage utilization require investigation both in relation to output per acre and per animal.

The practicality and economic implications of fattening cattle to acceptable carcass weights of about 450 lb by 15 months of age on grass with minimal use of supplements as required deserves close study. Results could have important effects both on total industry output and efficiency of land use.

There are comparable, but less pressing, needs for similar research in dairying and sheep.

(c) *Reproduction and Genetics:* At the present stage of New Zealand's agricultural development, research in genetic improvement and in reproduction are considered capable of making greatest contributions to increased output and efficiency in the sheep industry. The important role which cross-breeding can play in increasing fat lamb production in New Zealand has been discussed by Clarke (1966). The success of such a programme will depend on the clarity with which requirements are defined, and the availability of adequate objective measurements of the contribution each foundation breed and animal is expected to make. Improvement through breeding is slow, and we are lagging behind Australia, our closest and largest competitor.

Again, basic research studies in reproduction and genetics must be closely related to New Zealand's peculiar problems, since much effort can be wasted on problems being investigated overseas by larger and better equipped laboratories.

(d) *Breed Choice—Dairy and Dairy Beef:* Because of the importance attached to rapid development of dairy beef production, the proven dual-purpose capabilities of the Friesian, and the absence of any direct comparisons of Friesians and Jerseys as per acre producers of livestock products, research to provide this information is essential.

Each breed and main dairying locality is characteristically different, and thus the only satisfactory approach to this important problem is through a series of comparative trials covering these principal areas. In my opinion, the question may be resolved by discovering the suitability of the Jersey as a meat producer, since, compared with previous estimates, a complete breed change to Friesians would undoubtedly double the number of surplus calves suitable for beef production, and potential net earnings from these. Thus, should the straight Jersey prove unacceptable as a meat producer, the additional increment from Friesian beef would more than compensate for lowered carrying capacities, and higher transport, testing and processing costs.

(e) *Feeding Young Stock:* The value of pre-weaning feedstuffs for dairy replacements is currently estimated at £2 million annually. Additional replacements and dairy beef

could double this by 1972–3. Since the feedstuffs used can earn overseas funds directly, in association with an increasing knowledge of feed requirements of young stock, investigations must be made of early weaning and the substitution of local feeds, both plant (cereals) and animal (meat by-products), for milk in the diet. Critical examination of the nutritional and economic implications of multiple suckling both to beef and dairy production is required.

(f) *Regional Research:* In the past, it has proved relatively satisfactory to examine ideas and test new hypotheses on a few relatively small experimental units. Application of principles established to farming in general has been the prerogative of advisory officers and progressive farmers. Difficulties and dangers associated with this method of testing ideas and applying the results at a local level are magnified as regional characteristics increasingly influence the nature and level of productive response. This they will tend to do as productivity and the fraction of the feed directly harvested by the grazing animal rise to high levels, with a consequent narrowing of the margin between success or failure which may accompany the application of new techniques.

Regional research farms, not demonstration farms, can assist to overcome these difficulties. They should be sufficiently large to permit comparative animal trials to be run at a range of at least three carrying capacities, and, in addition to examining the effect of treatments on output of animal product, staff employed on these would be concerned with providing sufficient intermediate measurements to permit a sound interpretation of results. These units would meet an increasingly pressing need for more extensive replication of field experiments with animals, and as such their work should be closely linked to that of the main research centres. At the local level, they would provide a point of reference and meeting for research and advisory personnel.

While it is appreciated a start has been made to provide research areas for work of the Field Research Section of the Department of Agriculture, the foregoing envisages larger units with more extensive functions.

Market Expansion Research

Aspects of marketing and market development best accommodated by hiring expert salesmen in target coun-

tries are not included. These services are available at a price. To support these salesmen, market research should ensure:

(1) That where countries have large and established preferences for particular products, best use is made of our raw materials to satisy these. To achieve necessary standards and volume of product, both short- and long-term demand projections are required for the complete spectrum of goods we produce.

(2) Where a market has potential for marked expansion but has not developed preferences, our objective should be to obtain the information which will ensure such populations acquire a taste for the product we can produce most efficiently.

(3) Market research is required where statutory requirements are invoked in addition to strictures on quality, price and amount of product. This is to assess the likely profitability of such markets, having regard to present and possible future size, the cost of achieving the necessary standards, the scope for alternative outlets, and the risk of a more general application of similar legislature to other markets.

(4) The fourth, and last, subgrouping used here is what I would term "trade in ideas". This concerns not only market expansion but also product volume. We live by trade and rely on new ideas to foster this, but, unlike most other nations, including our strongest competitors, we do not exploit sufficiently discoveries made in other countries. We are not prepared to spend enough on discovering in the early stages approaches overseas workers are making to problems similar to ours. Geographically we are isolated, and consequently we should rely more, not less than other countries, on sending experienced workers overseas on specific and general observation excursions, as well as younger folk for post-graduate training.

Research of these four types must be the concern of Government, the producer boards and other marketing organizations in this country.

This completes my lists of priority topics. They number fourteen, and in total involve no more than twenty-five

to thirty projects covering the complete animal industry. It must be admitted that many important problems have been omitted from this list, such as the metabolic disorders bloat and grass staggers, and diseases like mastitis, facial eczema and Tb. It is not disputed that these are important or that research should proceed on such topics. In every case, however, control measures are available and can be resorted to if required, and eradication programmes are being successfully used. Factors restricting application of these are often lack of incentive or cost, but both can be influenced by changes to the internal farming economy. Incentives which encourage co-operation in disease control and eradication should be considered at least as favourably by Government as those which have fostered the growth of secondary industries to conserve overseas exchange, since internal investment of this type will result in increased direct earnings of overseas exchange. Their provision could assist materially concentration upon the problems on which it is considered greatest expansion of research effort should proceed during the next five years if the farming industries of this country are to receive maximum support to achieve the target set them by the Agricultural Production Council.

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