PRESIDENTIAL ADDRESS

THE ORGANIZATION OF AGRONOMIC RESEARCH IN NEW ZEALAND

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DEVELOPMENTS IN CROP PRODUCTION

Although the term agronomy may be interpreted to cover all aspects of pasture and crop production, it is proposed to restrict this discussion to what is loosely called "crop agronomy". In so doing, I emphasize at the outset that I do not recognize a distinction between a horticultural and an agricultural crop.

The past decade has seen a new awareness of the need for increased crop areas and a more broadly-based system of crop production in New Zealand. Table 1 which is reprinted from the *Compendium of New Zealand Farm Production Statistics* (1972), published by the N.Z. Meat and Wool Boards' Economic Service illustrates recent trends.

In 1970-71 crop production (the first two categories) was valued at $m160 (poultry and bees being a small proportion of this), a figure which is comparable with the value placed on mutton and lamb of $m162. In addition to the crop production figures one needs to consider the 243,000 ha sown each year in fodder crops for livestock, which are not marketed or included in the crop production totals.

Recently there has been a marked increase in the production of many traditional crops as well as greater areas of crops relatively new to this country. For some crops such as maize the increase has been spectacular. The area sown to maize has risen from less than 3,000 ha in the years before 1966-7 to 9,000 ha in 1970-71, a three-fold increase in four years. In the same period the area in wheat increased from round 80,000 ha to well over 100,000 ha, and peas from 12,000 to more than 24,000 ha. Owing to substantial increases in yields per unit area, the total crop production has increased at an even faster rate, especially for cereals (Smith, 1971).

This renewed emphasis on crop production is the result of several factors:

(1) A search for other sources of farm income when prices for livestock products were depressed in the late 60s. Although there has been a dramatic improvement in the returns from animal production in the past year or two, it is by no means certain that markets will sustain present price levels. Fluctuations in crop areas may be expected to follow the relative profitability of livestock farming and crop production.

TABLE 1: Value and volume of farm production (at farm gate)

Farming Group	Gross farm income (value $ million) 1938-39	1960-70	1970-71	Volume index 1938-39	1969-70	1970-71
Grain and field crops	9.4	60.0	67.4	100	250	259
Horticulture, poultry, bees	12.6	87.2	93.9	100	319	322
Wool	18.5	139.4	132.9	100	224	228
Mutton and Lamb	24.4	188.3	161.6	100	264	256
Beef	13.1	176.7	186.6	100	306	318
Dairying	56.7	217.3	227.6	100	152	149
Pigs	4.8	24.9	27.5	100	92	106
All farm produce	139.5	893.8	897.5	100	213	213

(2) Increasing use of crop products, especially grains, for livestock feeding. Among other things, the growth of the poultry industry and the use of meals in pig feeding have created a big demand for cereals within New Zealand. This is in addition to an increased use of grains in feeding sheep and cattle.

There are many situations where farming systems that incorporate the growing of crops for livestock feeding are more productive than all-grass systems. To raise production further, an increase in cropping may be necessary in these areas.

(3) The trend towards vegetable proteins and oils as preferred foods for humans. Everitt (1973) summarized the situation with regard to proteins. He recognized that meat production is a grossly inefficient method of producing proteins for humans, and suggested that a far greater effort must be sought in integrating livestock resources with crop resources.

At present, there are warnings of the dangers to health that may follow the over-use of saturated animal fats such as butterfat, and evidence of a considerable demand for margarine once it became freely available. Factors such as these could result in greatly increased areas of oil seed crops such as sunflower and soya bean.

(4) Problems with soil-inhabiting pasture pests and the withdrawal of persistent insecticides such as DDT have led to the development of farm management techniques, such as crop rotations, for pest control. Not only do insect-damaged pastures result in a bigger demand for grains and fodder crops for livestock feeding, but practical means of pest control may well include the growing of crops in a rotation with pasture where this is possible.

(5) Improved techniques of crop production, including better means of weed, pest and disease control and the development of higher-yielding varieties, stimulate greater areas in crops by reducing costs of production. The development of "no-tillage cropping" could easily result in a marked increase in the areas on which crops can be grown as these are not subject to the limitations imposed by cultivation.

(6) The development of further overseas markets for crop products. The possibilities here merit much more market research and development. Asian countries, especially Japan, have shown interest in a range of crop products such as adzuki beans, soya beans and lucerne meal, but the real potential of overseas markets is largely unknown.

PRESENT ORGANIZATION OF AGRONOMIC RESEARCH ON CROPS

The increased importance of crop production in New Zealand is creating an expanded demand for research in agronomy. However, the number of crop agronomists engaged in research seems small in relation to the size of the industry. The Ministry of Agriculture and Fisheries (MAF), for example, employs only 10 crop agronomists (horticultural and agricultural) out of a scientific staff of more than 200 in the Research Division. Although some 17 district Field Research Officers conduct, as part of their duties, a varying amount of agronomic research on crops, their total effort in crop agronomy would be the equivalent of, perhaps, five or six scientists additional to the 10 indicated above. The Crop Research Division, Department of Scientific and Industrial Research (DSIR), employs 31 scientists of whom 29 are crop agronomists (if one includes plant breeders, geneticists and so forth), out of a total scientific staff of about 670 in the Department. Crop agronomists, including horticultural scientists, plant breeders and other workers in the field of crop agronomy, make up about 5% of the scientific strength in government research. In its report for the year ending March 31, 1972 (p. 15) the National Research Advisory Council estimated the gross government expenditure on crop production to be 5.5% of all "science" activities and horticultural production a further 4.2%. The "agriculture" sector totalled 42% of all activities attracting government expenditure on science.

Apart from the relatively small amount of research by the agronomy departments of the agricultural universities (Massey and Lincoln), and by private firms, practically all agronomic research in New Zealand is conducted by government organizations. Research associations, such as the Wheat Research Institute, do not now concern themselves with agromony.

When DSIR was established in 1926 the activities of an existing, integrated agronomic research body, the Plant Research Bureau, were split between that Department and the Department of Agriculture. Agronomists have had to "live with" a divided research structure since then. The fact that a working arrangement was built-up between the two Departments merely indicates that it is the workers not the system that makes things go.

The division of functions between the Crop Research Division and the Research Division, MAF, is fairly clear. Crop Research "conducts research in genetics, plant breeding and seed production; and basic studies in agronomy for the improvement of all field and horticultural crops" (D.S.I.R. Report, 1972). MAF is concerned with the evaluation of crop species and varieties under various environments and soils, and with all agronomic problems associated with crop production in the districts where such problems occur – growing practices, crop rotation, fertilizer use, weed, insect and disease control and problems of the harvesting and utilization of crops.

The shared research field between DSIR and MAF is mainly varietal evaluation. MAF is responsible for the final stages of evaluation of newly-bred material before and after release and for the certification of crop seeds. Various crop committees have been set up to ensure effective liaison between the two Departments. The establishment of the Agronomy Society of New Zealand in 1971 was a further step in the improvement in research communication among research and extension workers in agronomy.

SOME DEFICIENCIES IN THE PRESENT ORGANIZATION OF AGRONOMIC RESEARCH

The present organization is by no means ideal. Some of its weaknesses are:-

(1) The division of research on crop agronomy between DSIR and MAF may be too firmly established to be changed easily, but it seems absurd that a small country like New Zealand, with limited research resources, should continue to sustain such an

inefficient system. It has led to duplication of research effort and less-than-ideal utilization of resources of staff, finance and facilities. Agronomic research is not the only sector of agricultural research so divided and perhaps the time is ripe for a further effort to place all agricultural research activities within the one Department.

(2) Agronomic research suffers another artificial division in that horticultural research is organized separately from agricultural research, especially in MAF. The idea of a horticultural crop as something distinct from an agricultural crop is long out-dated as indicated by the development of large-scale "process cropping" and the growing of so-called horticultural crops on mixed agricultural farms. There are welcome signs (such as recent changes in the Advisory Services Division of MAF) that this is at last being recognized.

In the field of crop agronomy there is room for people specializing in certain crops such as fruit trees or cereals (or in glasshouse crop production), but a concept of "horticulture" as distinct from that of "agriculture" is undesirable. Insect pests, weeds and plant diseases make no distinction between a so-called horticultural crop and an agricultural crop. Soils and soil fertility problems are common to both. We cannot afford the duplication of research effort and the difficulties of communication between workers in "horticulture" and "agriculture" found in the present system.

I would like to see (a) "horticultural research stations" designated "crop research stations" and "horticultural scientists", "crop agronomists"; (b) a proper integration of work in soil fertility, weed and pest control and in crop production as a whole; (c) Field Research Officers develop the necessary expertise to be able to investigate so-called "horticultural" as well as agricultural problems; (d) the agricultural colleges teach crop production as a whole and not divided into two parts; (e) some of the traditional methods used in horticulture subjected to sound scientific examination and I would welcome the expertise of a horticulturist in assessing quality aspects of many agricultural crops and in giving a lead in developing more intensive systems of crop production.

(3) There is no adequate district organization to consider research on so-called "horticultural crops" applicable to local regions.

Most research of district Field Research Officers of MAF is specially directed towards solving local farming problems but there is no comparable district research organization in the horticultural field. In my view this could be developed as an activity of the Field Research Section.

(4) There is need for an organization to study problems in the commercial development of crops (and, in some cases, varieties) relatively new to the country.

Agronomic research, at the moment, largely confines itself to determining what crops and varieties will produce economic yields in what areas, but with new crops there is a lack of farmer expertise in their production and utilization and often a lack of market outlets because no-one is prepared to seek such outlets.

The difficulties in the commercial development of a new crop can be formidable. Small areas grown in the initial stages may be subject to bird, pest and disease attack; yields may suffer because of lack of information as to the best varieties, soils and growing practices for the district, and quality may suffer through lack of knowledge as to how to harvest, store and process the crop. Economic evaluation is usually pessimistic and often quite misleading. Crop failures through inadequate knowledge are common and small organizations attempting to break into established markets may find the competition too fierce.

From the national point of view, substantial research and financial assistance at this point may be well worth while. If wheat had never been grown in Canterbury, it would suffer from the same problems should its introduction be attempted – bird damage on small areas, unsuitable varieties and so forth.

Perhaps agronomic research in New Zealand needs to be bolder and prepared to risk greater investment of staff, finance and facilities in studies of crops of potential value. We need a research organization that covers more adequately the gap between the small trial plot and the profitable crop to the farmer.

(5) Agronomic research needs much better market information if it is to be conducted on efficient lines. It is very easy to spend much time and money finding ways and means to grow a new crop that nobody wants, or produce a new variety that nobody likes.

One has to be careful not to rely over-much on the practical and commercial man who has his own axe to grind. A wheat miller, for instance, may have his machinery set to mill a commonly-grown variety and he may not have the knowledge to adjust it to mill a new variety. I can recall several occasions when varieties have been rejected one year as being useless commercially; yet the same varieties are preferred by the same people a few years later. The brewing industry is one of the worst examples in this respect; or maybe tastes in beer change with time.

The desirable characteristics demanded by the trade may be hard to define and may change as markets change. This creates problems for the plant breeder and the agronomist but a research section that studies the markets and their requirements must surely be an essential part of any agronomic research organization. I do not know of any such market research group for crops in this country.

SOME THOUGHTS ON THE FUTURE ORGANIZATION OF AGRICULTURAL RESEARCH

Organizers of research structures in applied agricultural science are usually faced with two opposing needs. The scientist and the administrator see advantages in a discipline-based organization, whereas the farmer and the adviser see advantages in regional research stations. Regional research groups which can call upon scientists in many disciplines are well-adapted to tackle local farming problems, but may develop parochial attitudes that increase difficulties of getting work done on a national scale. They create problems of communication. In my view, therefore, the preferred basic research structure is one based on disciplines but with regional groupings of staff in each discipline as required by the problems of each region.

To develop an improved national organization of government research in agriculture we need:

(1) All agricultural scientists in the one Department.

(2) A discipline-based structure.

(3) A central research station for each major scientific discipline, for more basic research studies and for those classes of research that do not require to be located in particular districts. In crop agronomy there may be a need for more than one station (say, one in the "temperate" region and one in the "warm zone") as plant breeding activities would be concentrated on such central stations. Perhaps there are advantages in setting up a central station or stations which have crop and pasture agronomy (and plant breeding) under the one roof. These stations would be concerned with both agricultural and horticultural crops.

(4) Regional research stations that deal with all forms of applied agricultural research appropriate to the region in question. Crop agronomy would be only one of many disciplines operating on such regional research stations. These regional stations would also provide "out-station" facilities for the central research station or stations.

(5) A research group to conduct "off-station" research especially in those areas not serviced by the regional stations. This group would also be responsible for liaison with advisory staff and through them, with farmers, and for the organization and conduct of national series of experiments.

(6) Close association, especially at the regional level, among scientists in the various disciplines. Crop agronomists must work in teams with pasture agronomists, weed scientists, entomologists, plant pathologists, plant ecologists, soil scientists and workers in animal production.

(7) A market research and development group and an economics research section established by the Department concerned.

(8) A group to provide all necessary biometric services to all scientists.

A separate horticultural research facility is not required; this work should be integrated with general research in crop agronomy and with various discipline groups such as those concerned with weed, insect pest and plant disease control and with soil science.

If the present resources of DSIR and MAF were pooled, a research structure of this type could be built without setting up new research stations. Additional research staff would not be needed (except, perhaps, in some areas such as market research) and some of the present staff might even be freed from seemingly endless attendance at inter-departmental committees of one sort or another needed to make the present system work. Crop agronomy would readily fit into such a structure.

SOME CONCLUDING THOUGHTS

I hope these thoughts will be taken at their face value. They do not represent anything more than my own ideas on a complex subject, based on a lifetime of experience working in the field of research administration. The important point is to get the work done and those concerned with research organization and administration must always keep this in mind. A system should not be established as an end in itself but as a means to an end.

Most of us can learn to live with any system but we should be able to work better with a better system. The best organization will fail if those involved in it are not prepared to co-operate. Conversely, the poorest system will work if those concerned are keen on their job and willing to work with others. The present system of agricultural research organization is one that has grown up "like Topsy" rather than one that has been carefully planned from the outset and it may well be true that a much better system can be devised which will assist rather than frustrate the scientists and administrators involved in it.

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