LINCOLN COLLEGE
NEW ZEALAND

DEPARTMENT OF HORTICULTURE

BULLETIN 8

Economics and Management of Vegetable Production

Editor : T. M. Morrison

PROCEEDINGS OF A SHORT COURSE ON

ECONOMICS AND MANAGEMENT OF VEGETABLE GROWING

MAY 1969

Edited by Professor T.M. Morrison

Department of Horticulture
Lincoln College
Canterbury
New Zealand

Department of Horticulture
Bulletin No. 8 1969

PREFACE

The Vegetable and Produce Growers Federation for a number of years has been encouraging collection of costs of production of process crops. While this is valuable in maintaining a watching brief on processor pay-outs, it is only one factor in assessing the relative profitability of competing crops. The full science or art, of management must be brought to bear on the problems before any solution can be suggested.

With farmers diversifying into vegetable production and others likely to follow as processing expands into export it is opportune that a course such as this was held at this time. Some of the discussions show the pertinence of papers to problems facing the industry right now. Others show the way to the future.

The course offered a new look in education to vegetable growers. We have maintained that our greatest contribution to the established grower is to bring recent information to his notice - preferably after he has been in the industry for some time. With a recession in fresh vegetable prices, "economic" management is probably the most serious omission from growers' education. Fortunately in this department and others in the College we can present an expertise in this modern subject.

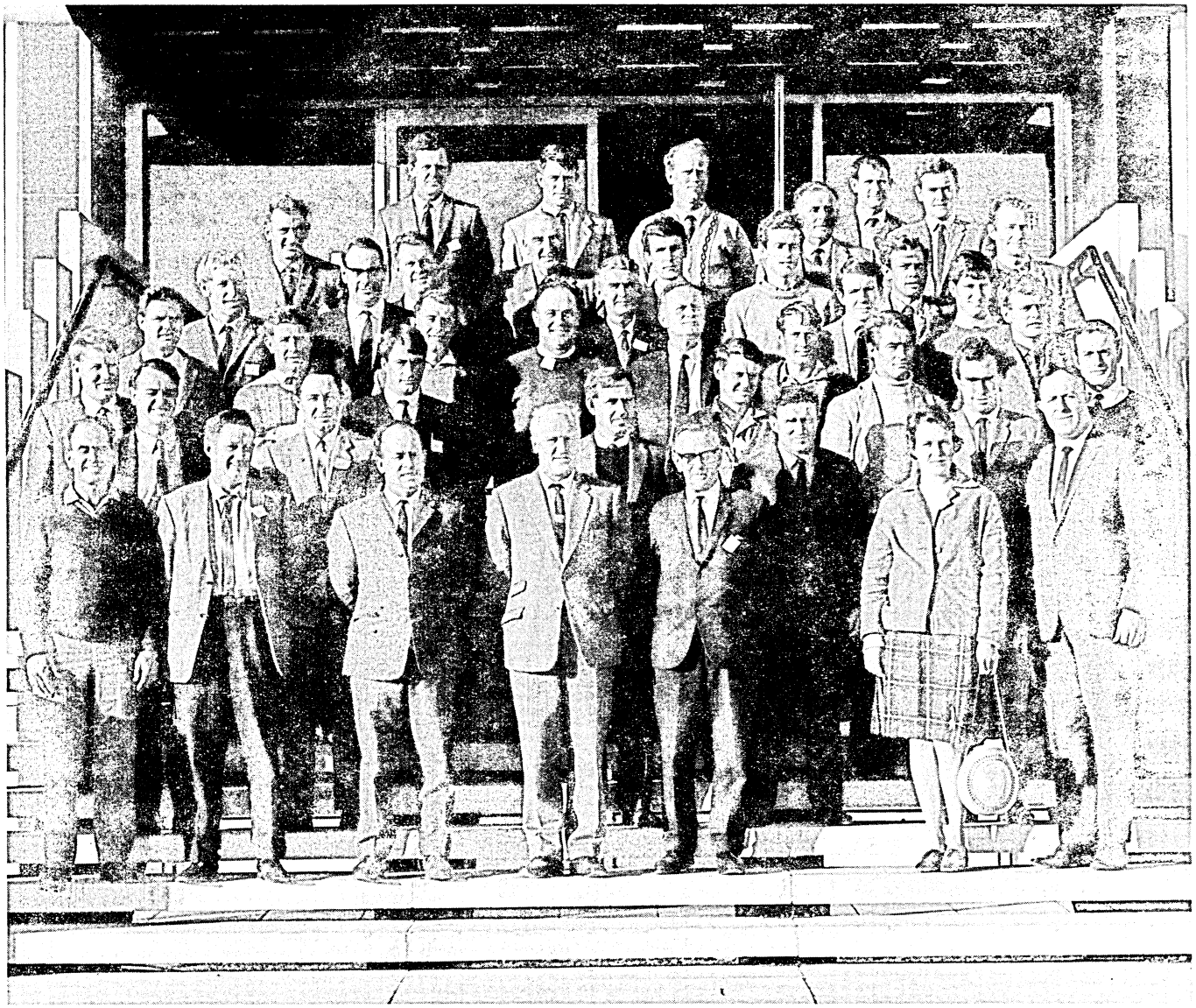
The papers do not attempt to answer all specific questions but are designed to give a base on which the individual grower can build for himself from his own experience. They also may serve to demonstrate to the grower that in horticulture we have a long way to go to fill the gaps in our "management" knowledge. It behoves all growers to help us and consequently themselves to acquire this knowledge.

Finally I must thank all lecturers at this course for they provided a stimulating four days and all growers who attended, for without a receptive audience no course can succeed.

T.M. Morrison
Professor of Horticulture
Lincoln College

CONTENTS

---oooOooo---



PROCESS CROP SEMINAR

No. 3 Lecture Theatre
Hilgendorf Wing
Lincoln College

This seminar was organised by the Crop Research Division of the Department of Scientific and Industrial Research in conjunction with Professor Morrison's Horticultural Department at Lincoln College. The objectives were to examine the present state of the process crop industry and to work out tentative guide lines for future research projects.

Summary

The more important conclusions drawn from this meeting included:

a) The necessity for broadening the basis of advisory bodies on process crops to include processing and possibly marketing representatives and for such advisory committees to encourage full co-operation between all parties concerned in the industry.

b) The possibility of setting up a research laboratory on the lines of the Wool Research and the Dairy Research Stations. This should be initiated primarily by the producer section of the industry and should include in its terms of reference new product assessment and marketing.

c) The meteorological department should be advised that there is a need for expanding their agricultural meteorology section and that this section should be primarily based on an agricultural centre such as Lincoln.

d) The N.Z.A.E.I. should be encouraged to look into harvesting and other sophisticated machinery for process crop production, and that import restrictions on such machinery should be eased to encourage an expansion of extensive cropping methods.

e) It might be possible to overcome shipping difficulties to a marked extent by the use of refrigerated containers. These could if necessary be carried as deck cargo and would not conflict with other cargoes for the allotment of restricted refrigerated hold space.

f) The most pressing research problem in the Canterbury district is probably irrigation. This work will need the backing of a meteorological service and should be associated with nitrogen fertiliser trials.

Those attending were:

F. Bailey	Horticultural Superintendent
R. Ballinger	Grower
I.L. Baumgart	Assistant Director-General, D.S.I.R.
L. Bennett	Department of Agriculture
R. Boyce	Levin
W. Brandenburg	Department of Agriculture
Dr W.T. Bussel	Levin
Professor J.R. Burton	N.Z.A.E.I.
J. Casey	Seedsman
J. Douglas	Agricultural Research

M. Driver	D.S.I.R.
W.N. Dunlop	Federated Farmers
J. Dunn	N.Z.A.E.I.
J.J. Fawkner	Winchmore
B.R. Freeman	Horticultural Seedsman
D.L. Fyfe	Press
H.J. Giesen	D.S.I.R.
D. Haigh	Processor
P.L. Harland	Industries and Commerce
R.O. Hooker	T.J. Edmonds
J. Hemstalk	Neil Cropper
E. Hewitt	Winchmore
I.J. Inkster	Agricultural Research
J. Lowe	Unilever Limited
H.A.L. Morris	Massey
R. Milne	Department of Agriculture
R. Moir	Grower
Professor T.M. Morrison	Lincoln College
A. Mulholland	Federated Farmers
R.T. O'Toole	Horticultural Seedsman
J.A. Palmer	D.S.I.R.
J. Rankin	Seedsman
M.P.H. Rousham	Potato Board
B.J.P. Ryde	Lincoln College
Dr H.C. Smith	D.S.I.R.
G. Tate	Lincoln College
R. Taylor	I.C.I.
M. Wraight	Unilever
C. White	Neil Cropper/Watties
N. Wright	Federated Farmers
Mr Wilson	Department of Agriculture
Ian Emmett	Star
G. Strachan	D.S.I.R.

MINUTES

Session 1 - Research

This session was opened by the Chairman Mr I.L. Baumgart, Assistant Research Director, D.S.I.R. who introduced the two principal speakers, Dr H.C. Smith, Director, Crop Research Division D.S.I.R. and Mr J.S. Dunn Senior Research Officer, N.Z. Agricultural Engineering Institute.

Dr H.C. Smith - Trends in Research Projects on Process Crops

A. Plant Introduction

The Crop Research Division at Lincoln and Otara is expanding its facilities for testing new introductions of crop and vegetable plants. These include glasshouses, laboratories, offices, and also quarantine services to ensure freedom from disease, this expansion is proceeding too slowly at present.

B. Plant Breeding

The breeding programme with peas, beans, asparagus, onions, potatoes and tomatoes is being expanded at Crop Research Division, Lincoln at the expense of research on basic crops e.g. cereals and brassica forage crops.

C. Plant Production

An expansion of research on fertiliser application, weed control, direct seeding, mechanical harvesting, irrigation and shelter is required at Crop Research Division, Horticultural Research Centre, Field Research Division and at Lincoln College.

D. Crop Quality and Product Development

Further research on: Quality measurement techniques for selecting new varieties and developing better methods of production. Developing new food products is being conducted at Crop Research Division and Plant Diseases Division, D.S.I.R. and Massey University.

Trends in Research Organisation

The D.S.I.R. (C.R.D. and P.D.D.) is moving towards an expansion of basic research on introduction, breeding and agronomy (nutrition and water requirements, precision seeding, and mechanical harvesting development).

The Department of Agriculture is expanding work on applied research by screening overseas and new New Zealand crop varieties; by developing new techniques of weed control, fertilising cultivation and mechanical harvesting methods. A greater trend towards the amalgamation of field research and horticultural research is required as soon as possible.

More co-operation in research planning is being aimed at via meetings e.g.

1. V.R.E.A.C. (Growers Extension Research)
2. Interdepartmental Vegetable Research Committees
3. The Seeds Committee
4. University and growers conferences

Mr J.S. Dunn - Mechanisation for Process Cropping

Fully mechanised techniques of producing our process crops will soon be essential. We have not the labour to realise our cropping potential without them and even if we had, use of such labour would price the final product off the market.

As a first approach to crop mechanisation we are apt to think of the traditional steps in growing a crop and try to replace each hand operation by a machine capable of doing the same jobs. This way we will make little progress. Mechanisation involves rethinking the whole process of growing, harvesting and handling our crops to give the machine the best possible conditions for working effectively. To put it simply, we may have to grow our crops to suit the machine. While this will probably mean accepting some loss in yield, it may be the only way in which we can grow some crops at all.

In the U.S.A. tomatoes, sweet corn and peas were at the point of obsolescence until machinery and techniques were developed which would enable them to be harvested mechanically and so eliminate unacceptable labour and drudgery. We may not be so far from a similar position with asparagus, the brassica crops (sprouts, broccoli and cauliflower) and the berry fruits (strawberries, raspberries, black currants and gooseberries).

Where do we start?

Harvesting is usually the most complex operation in producing a crop. If we first consider the factors involved in simplifying this stage, we can then perhaps modify the more straight-forward pre-harvest operations accordingly without too much difficulty.

It is not impossible to duplicate in a machine the human senses required to discriminate between mature and immature plants at harvest but the complexity and cost of such equipment would, in most cases, make it quite impracticable. The alternative is to try and minimise variation within the crop so that the machine has no need to make any selection and all individuals within the crop are treated alike. The crop is then harvested as a once-over operation only. It is inevitable that there will be some wastage but the greater the degree of uniformity the lower is this likely to be.

How can we increase the degree of uniformity in producing our crops? In the following comments I am thinking only of our annual crops grown from seed.

Factors affecting uniformity

Environment

For all individuals in any crop to approach uniformity at harvest growth must start simultaneously and continue at an equal rate. Seed bed preparation must be treated much more seriously than at present, and both physical and chemical factors must be considered fully.

The superficial seed bed technique as developed and used in row crops in the U.K. and Europe has proved itself under a wide range of conditions. Not only can crop establishment be improved but real savings in labour and machinery use can also be achieved. It could find a wide application here.

Soil analysis to indicate fertiliser and lime requirement assumes a greater importance with more intensive cropping. Knowing the limitations of many existing methods of applying both types of material, it is obvious that improved equipment and user techniques will be required.

With conditions in Canterbury during the 1968-69 season not yet memories, no one should need reminding of the part irrigation has to play in process cropping. It is an essential not only as an aid to uniformity but to enable growth to continue at all. An effective and acceptable method of water application is a vital part of mechanising our process cropping but its use must be understood or it can contribute to further crop variation.

At the other extreme drainage must not be neglected. Wet areas lie cold and delay growth. They may also interfere with timely field operations in growing the crop and at harvest.

Sowing the crop

Conventional drills are not suitable for sowing many process crops where complete mechanisation techniques are to be employed. They usually sow at satisfactory overall rates but most of them deliver seeds in a random manner with little or no regard to the relative spacing between individual seeds. With the cereals, wheat, oats and barley, and the grasses, this is of no great concern as each plant has the ability to tiller and so fill any vacant ground adjacent to where it is growing. If space is restricted tillering will be reduced.

Most of our process crops, however, have not this accommodating facility. They must have sufficient room between themselves and their neighbours before development of the economic portion of the plant can occur. There must also be a sufficiently high population of them to ensure that no ground remains uncropped.

Even with crops which can tolerate a degree of over-crowding, a regular spacing is essential if all plants are to grow under comparable conditions and be given the chance to produce to the full and mature at the same time.

Precision or spacing drills in which the seeds are metered individually and placed rather than dropped into the soil have been in use overseas for a number of years and have now reached a high degree of development. They will sow almost any type of seed at almost any desired spacing between seeds and between rows. In addition their depth of sowing is more consistent than that of conventional drills. Such drills are not common in New Zealand, but their numbers can be expected to increase once their advantages and the techniques of using them become known.

The advent of precision drills has emphasised the importance of the optimum spacing between plants if maximum yields are to be obtained. Where water and fertiliser requirements are adequately met it has been found possible to increase yields appreciably by reducing traditionally accepted row widths and increasing the plant population. Closer row spacing and increased mechanisation are not always compatible but it may be possible to resort to some form of compromise as has been done in the use of bed planting techniques.

The seed

The use of accurate seed placement demands seed of a high germination potential. The seed must also be graded for size and the size known so that the correct cell size may be fitted in the drill. Limits of grading are small with small seeds but may be increased for the larger ones without upsetting unduly the singleness of delivery.

Low density and irregularly shaped seeds such as those of carrots, lettuce and parsnips, in their natural state, cannot be selected and sown individually by the drill's metering mechanism. By the process of pelleting this difficulty is being overcome with some success. Seed is now being pelleted in New Zealand.

Seed of the beet family are peculiar in having a clustered seed which is really a group of one to five seeds contained within an irregular corky husk. It is obvious that even if such compound seeds were sown individually clusters of seedlings would result. The singleness of such seed clusters can be improved,

however, by subjecting them to a controlled rubbing process. After close grading, the treated seeds can be sown individually and will produce an increased proportion of single plants. Members of the beet family with genetically monogerm seed are now being produced by seed breeders.

However high a seed's germination potential and however accurately the seed is placed at its correct spacing, prospects can be poor if the seed suffers from an attack by unfriendly seed borne or free living soil fungi. The use of powder, slurry or steep seed dressings can give a large measure of protection and ensure that the number of emerging plants more nearly equals the number of seeds sown.

The genetic make-up of individual seeds within a variety can have a profound effect on variability within a crop. Some lack of uniformity is inevitable within any naturally occurring population but by ensuring that only good strains of seed are obtained from reputable suppliers, this can be kept to a minimum. Varieties derived by hybridisation should show a high degree of uniformity and are likely to feature much more in our cropping in the future than they do now.

Weed and pest control

Weed and pest control must be both timely and effective if competition from these influences is not to disturb even growth and interfere with the harvesting processes. The action required in both cases is more likely to be preventive rather than remedial.

Weeds - the cheapest and most effective form of control, where access between rows is possible, is probably by mechanical means. Multi-row tractor mounted hoes in the early stages of growth can clean 80-90 per cent of the cropped area and reduce appreciably the amount of selective herbicide needed to control weeds within the row. The herbicide application is then confined to a narrow band over each row.

Where a crop can be grown in narrow rows, an early overall spraying may eliminate the need for any inter-row cultivation or even further spraying. The full leaf canopy of an actively growing crop at close spacing can provide an effective blanket to smother further weed growth.

With some crops it is possible to obtain effective long-term weed control from incorporating a herbicide into the seed bed before sowing.

Insect and fungi - conventional spraying applications, either overall or by bank, are the usual methods of control although the need for systemic granule materials at an early stage of growth may require the use of directed row crop applicators.

Mechanised harvesting

The harvesting of peas, beans and many of the root crops is already possible although further development is needed. In crops such as asparagus, the brassicas and strawberries, mechanical harvesting is in its early stages.

Development is likely to follow two distinct paths depending on the crop. If the end product deteriorates rapidly after reaching its maturity peak, as is

the case with peas, large machines operated by the processing factory and working to a very close schedule are likely to result. Individual areas under such crops will become large to increase the ratio of working to travelling time.

Smaller farmer owned machines are likely to be adequate where the stage of maturity can be held without deterioration of quality.

Mechanising specific crops

Root crops

Conventional potato harvesters with modified shares and smaller pitch chains will handle a wide range of root crops. Good cleaning properties are needed but root damage and losses must be minimal. Red beet are handled very gently by the Scott-Viner twin belt harvester and this system has been incorporated into several alternative versions of the universal vegetable harvester developed by the National Institute of Agricultural Engineering in England and now in limited production.

Peas

Observations in Hawke's Bay indicate that irregular spacing of peas sown with conventional grain drills is limiting yield. The New Zealand Agricultural Engineering Institute will be looking at other methods of sowing in the 1969-70 season.

Present harvesting methods using mobile viners remove the peas from their pods. Deterioration starts immediately and processing must be completed within hours if quality is to be maintained. This severely limits the area from which crops can be drawn. Deterioration in unopened pods is negligible by comparison. The development of a pod stripping harvester would be of obvious benefit.

Beans

Most existing bean harvesters can only deal with one or two rows of plants at a time so the rate of progress is slow; and because of the width of the longitudinal picking mechanism narrow row widths are unacceptable. Recent work in England and the U.S.A. has shown that bean yield can be increased two and three fold by planting much closer and using a square 5" x 5" or a 6" x 6" format. The introduction of recently developed full width harvesters will permit these closer plant spacings to be used and at the same time allow higher working rates.

Tomatoes

The tomato harvesters is use in parts of the U.S.A. are large and costly and their present design does not lend itself to scaling down for small unit operation.

Plant breeders are working to produce varieties in which a high proportion of the fruit matures simultaneously so that wastage of immature or over-ripe fruit with the same aim has been demonstrated by Mr R.A. Crowder of the Horticulture Department at Lincoln College during the past two seasons. By

direct drilling tomato seed at high densities maturity has been hastened and uniformity improved considerably using existing commercial varieties. This season it was possible to harvest in one pick 20 tons per acre of ripe fruit or 68 per cent of the total fruit produced.

Brassicas

As with tomatoes, direct sown brassica crops have come to maturity sooner and produced much more uniform plants than when sown in seed beds and subsequently transplanted. Dr P.J. Salter of the National Vegetable Research Station in England has grown cabbage and cauliflower, adequately supplied with water and fertiliser, in this manner and been able to harvest up to 80 per cent of the heads at one time depending on variety. The comparable figure for transplants was between 30 and 40 per cent.

Although sprouts behave similarly to produce uniform plants agronomists and breeders are now working together to produce plants on which all the sprouts on each stem also mature simultaneously. Hybrid seed with a high degree of such uniformity is being offered for sale in England at $110 a pound this season. Demand for processed (frozen) sprouts is rising steadily in U.K. and the overall sprout acreage there has increased by 10,000 acres in the last two years.

In Conclusion

Process cropping is offering us an opportunity to intensify our farming; to combine our high sunshine rates and plentiful mountain rains in producing high return crops for which there would seem to be a steadily increasing market. Mechanisation is an essential part of this operation but it must not be considered in isolation. In realigning our crops for treatment by machine it will be necessary to enlist the services of the plant breeders, the crop husbandry specialists and workers in many other disciplines. It will be developments in these fields just as much in engineering which will determine our progress. The overall rate of progress will depend on the degree of co-operation between all concerned.

Discussion (precis)

After some debate it was decided that "Process Crops" was too loose a term for exact definition but in the present context it referred to vegetable crops preserved by freezing, canning or drying for later human consumption.

Mr N. Wright introduced the subject of contact between New Zealand research workers and scientists overseas. Dr Smith replied that overseas contacts were made by both scientists and responsible members of the New Zealand public travelling abroad who were continuously reporting back on new lines of research observed in their travels. This was augmented by correspondence between New Zealand scientists and scientists working overseas on similar lines of research and the receipt of journals and annual reports from overseas. Personal contacts with overseas workers was very valuable and encouraged as much as possible within the budget available.

Within New Zealand there were two bodies. The Vegetable Research and Extension Advisory Committee which consisted of representatives from the relevant University Departments, the Department of Agriculture, D.S.I.R. and the Vegetable and Produce Growers Federation. This committee reports directly to the Minister of Science and Agriculture. There is also the Interdepartmental Vegetable Committee between the Department of Agriculture and D.S.I.R.

Dr Smith went on to say that the boundary between agricultural and horticultural crops was dissolving and there is scope for the reorganisation of these committees on broader lines. Mr Morris of Massey University stressed that the committee should include the aspects of processing and marketing and that these sides of the industry be represented.

It was suggested that the above committees should be invested with some powers to control production in the industry but this met little general support.

The difficulties encountered when trying to import new equipment and machinery from abroad was brought up and discussed at length. It was felt that blanket restrictions, applied to machinery not manufactured in New Zealand, was unduly handicapping the development of the industry. It was decided to bring this matter to the attention of the Minister of Science and Agriculture when he attended the evening session. It was further suggested that funds should be made available to the N.Z.A.E.I. so that they could investigate new lines of mechanical harvesters and like equipment from overseas which might be of value to the industry.

Professor Morrison said that there is at present no organisation interested in Agricultural Climatology. Much more information was needed on the timing of irrigation and the role of heat units in crop maturity. A small meteorological service to farmers was required on the lines of the British Meteorological offices advice to farmers on when to irrigate. One small meteorology unit was colaborating with the Plant Physiology Division at Palmerston North at the moment but this would need to be greatly expanded.

Session 2 - Extension

Chairman: Mr F. Bailey, Horticultural Superintendent, Christchurch
Speaker : Mr G. Wilson, Horticultural Division, Vegetable Specialist

Problems of agricultural extension

Most activities in extension and advisory work on process crops were based on the Hawke's Bay, Poverty Bay areas because these two between them accounted for some 72 per cent of the process cropping acreage in New Zealand.

Mr Wilson outlined the relative importance of various districts for fresh vegetable and glasshouse production. Franklin county in particular has shown a great increase in the acreage of vegetable crops grown in recent years and is now by far the most important district.

The following crops were quoted as being the most significant from the process crop research stand-point:

	1967-68 Acreage	Gross return/acre	Total gross return
Peas	16,000	$90-100	$1,600,000
Tomatoes	1,600	500	800,000
Asparagus	2,000	250	500,000
Beans (green)	1,700	200	340,000
Sweetcorn	2,000	100	200,000
Broad Beans	400	200	80,000

He than went on to outline what he felt were the most basic problems for research to tackle in the immediate future. By crops the list includes:

Peas
1. New varieties to provide improved yield and disease resistance. (Important diseases include, mosaic and top yellows virus, Fusarium oxysporum, F. solani and the collar rot fungi.)
2. Plant population and spacing efficiency.
3. Nutrition.
4. Rotation, influence on disease incidence.
5. Bacterial blight.

Tomatoes
1. Sclerotinia control
2. New varieties and investigation of machinery likely to be suitable for New Zealand mechanical harvesting.
3. Direct drilling and plant density.
4. Fusarium and Verticillium wilt control.
5. Nutrition.

Asparagus
1. Fusarium crown rot. Evaluation of resistant varieties, influence of soil type and cultural treatments, study of incidence in new areas.
2. Spacing and direct seeding (long term effect of close spacing).
3. Nutrition (fertilisers and organic matter).

Beans
1. Halo blight.
2. Root diseases, fusarium and Thielaviopsis basicola.
3. Sclerotinia.
4. Mosaic virus.

Sweet Corn
1. Corn earworm control.

Broad Beans
1. Variety selection and improvement.
2. Seed discoloration and virus diseases.

General
1. Weed control, particularly tomatoes, beans, asparagus and corn.
2. Cost of production detail.
3. Brussels sprouts varieties nutrition, spacing, harvest mechanisation.
4. Productivity evaluation tomato, broad beans etc. in Canterbury.

Mr G.F. Tate - Costs and the Farmer

We have all felt and heard of the cost price squeeze but the farmer, with costs rising and product prices falling is perhaps the most affected sector of the community. For example the upward movement in sheep farmers' costs in recent years has been in excess of 3 per cent per annum with a cumulative change of over 17 per cent in the past seven years.(1)

This cost price squeeze also has affected the process crop grower. In the report published by the Agricultural Economics Research Unit at Lincoln College(2) a survey was made of the returns of growers of processed peas for the 1967-68 season. In this report the authors concluded that total costs to the farmer in the production of processed peas had increased by some 30 per cent over the seven year period since a similar survey had been taken.

Gross revenue per acre was basically similar so that the nett effect from the information contained in the survey was a drop in relative profitability of about $10 per acre for the farmer.

As I understand the 1967-68 year in Canterbury at least, was about the average of the last three harvests, this indicates that the grower of processed peas is now financially worse off than he was at the start of the decade.

When we look at the gross margin (i.e. Gross Revenue less direct costs with overhead costs excluded) for processed peas we find that at average yields the crop is not markedly more profitable than say wheat or barley which can be readily grown on similar land.

Despite this there are more farmers wanting processed pea contracts in Canterbury than there are contracts available. It seems that aspects of soil fertility affect the guaranteed price and ease of harvesting are also major considerations to the farmer.

Because in general processed crops are grown on land that is handy to town and of good quality the capital involvement of farmers is at a high level. For satisfactory returns to capital high profits per acre must be obtained.

Profitability is very much a function of yield and price - an increase in either usually resulting in added profitability at no extra production costs.

For most farming enterprises it has been the ability to increase yield per acre and production per labour unit that has enabled the farmer to offset rising costs.

For the growers of processed peas in Hawke's Bay a 1959-62 survey gave an average per acre yield of green peas of 1.36 tons per acre. The 1967-68 survey gave an average yield in the same district of 1.48 tons per acre. While it would be dangerous to draw too much from the difference in these yield figures, the increase of approximately 9 per cent in yield per acre at least suggests that to some extent improved yield may have operated to mitigate the overall drop in income caused by increased costs.

Any technological improvement that can be devised to improve the yield of crops is likely to have a marked effect on increased profitability. Perhaps of even greater importance is the fact that an increased yield could result in cheaper production and thus the opening up of a much greater market for our processed products. Dr Jim White (3) has estimated that there are, in Canterbury, over 800,000 acres of soils suitable for growing processed peas. In 1967 we used 3,000 acres of 0.4 of one per cent of the total. White pointed out that if the average yield of peas achieved in the Christchurch area during the 1967-68 season could have been raised from the 1.6 tons to 2 tons per acre, then the same return to the farmer could have been achieved at a payout of some $10 below the $56 average actually received.

As by far the biggest single cost in growing peas is the cost of the seed (over half of the direct costs and nearly one third of the total costs as assessed in the Agricultural Economics Research Unit survey) there seems little likelihood of achieving increased profitability through cost cutting for the farmer. Some attention to the effects of precision drilling the seed spacing may however be justified.

However the inability to cut costs does not apply to all processed crops. When one looks at tomatoes the survey done by Sanderson (4) on costs and returns for tomatoes for processing shows some interesting comparisons.

Of the total direct costs involved in tomato growing and harvesting for processing, Sanderson's survey concluded that the biggest single item of cost was labour representing in, for example, the Nelson district 44 per cent of the direct costs of production. When combined with the cost of contract harvesting approximately 60 per cent of the direct costs of production were taken up by labour.

Work study research to reduce labour inputs on repetitive operations and to save time, especially at peak periods when labour demand may be critical, could be expected to produce substantial cost cavings. In the case of this crop then extension and research work can, with benefit, be directed at avenues that are not available in the processing pea industry. Publication of preliminary results from investigation into large-scale intensive production of tomatoes by R.A. Crowder (5) makes exciting reading for the Canterbury farmer. Crowder suggests the feasibility of direct precision seeding of suitable varieties of tomatoes in the ground in mid-November when frost danger is virtually past. Through high density planting with uniform ripening varieties, the possibilities of once over mechanical harvesting achieving yields per acre in excess of 30 tons are mooted. It is suggested this could reduce the cost to the farmer to the extent of $40 to $50 per acre of plants and planting.

I understand mechanical harvesting of tomatoes was pioneered at Davis University, California, over ten years ago and commercial mechanical harvesters have been in operation in the U.S.A. since 1962. Provided varieties with consistent concentrated fruit setting and maturity and resistance to mechanical damage are available the removal of physical hand labour opens the way to production on a scale not hitherto envisaged in Canterbury.

However, as was the case with peas, Sanderson points out the fluctuations in yield had a significantly more marked effect on nett revenues than did fluctuations in growing costs. An increase in yield from 18 tons to 20 tons per acre in the Nelson area at a price of $32 per ton was expected to boost nett return per acre from approximately $140 to $186. In other words an 11 per cent increase in yield was giving a 33 per cent increase in revenue. This then again illustrates that while other lines of attack may benefit the greatest added gain from research and extension work is likely to come from increasing per acre yield.

In selecting what crops to grow the individual farmer finds the best management lies in increasing to the maximum acreage his most profitable alternative consistent with such things as:

1. good husbandry with respect to soil fertility and structure, disease etc.
2. labour availability for pinch periods
3. machinery capacity
4. risk of crop or market failure through concentration rather than diversification

With processed crops, specialisation by the farmer must also assist the processing company in reducing overheads at harvest, in reducing client servicing costs, and in ensuring that a crop will be successfully grown due to the added knowledge and skill the specialist producer will find it worth his while to obtain.

Whereas diversification is often desirable to spread risk, under a contact system such as applied with processed crops the vulnerability of the individual producer is much reduced through as assured price as compared to selling on the open market.

Professor Philpott[6] has drawn attention to the trend in the U.K. away from the traditional multi-product market garden areas towards the large scale specialist production units of the Eastern countries. In New Zealand this opportunity for large scale specialisation in horticultural crops must have great significance for the Canterbury farmer. The advantages in economics of scale production should not be overlooked by either farmer or processor.

Where it is possible for the farmer to arrange his rotation to grow two crops in one year or three crops in two years profitability can be increased. Unfortunately the process crop industry, in Canterbury anyway, is so dominated by peas that no viable rotation applying only to processed crops is available. I understand in Hawke's Bay some farmers are able to follow peas with beans on the same area in the one year with consequently highly improved profitability.

A rotation used by one Canterbury farmer of peas - sprouting broccoli or brussels sprouts - cereal offers scope for highly profitable land use.

Crowder has suggested that direct precision seeding of brassicas such as cabbage and cauliflower results in harvesting 4-6 weeks earlier than with transplants of the same species. Extension of this technique then seems likely to give further avenues for more intensive crop rotations with consequent benefit to the efficient farmers.

Work by plant breeders to produce plants with the ability to mature in a shorter time may increase the opportunities for intensive rotations. Under such a system some reduction in overall yield would be acceptable to gain more crops in the rotation. However uniformity of maturity date to facilitate mechanical, or at least 'blanket' once over harvesting, seems important for farm scale production of any crop.

I believe the good cropping farmer in this district at present growing a variety of cereals, pulse and small seed crops is ideally placed to rapidly adapt himself to the large scale production of processed crops. This farmer already has an appreciation of the skills of cultivation, soil fertility maintenance, weed control and machinery operation. Given the market stability the processing industry could offer, these farmers would utilise what at present is still relatively low cost land to produce in quantity crops such as onions, potatoes, peas, beans, carrots, parsnips and brassicas.

The evolution of pre-emergence weed control, systemic insecticides, precision seeding and mechanical harvesting throw open the door to the big operator to move in with lower overheads resulting in reduced per unit costs of production with advantages to all concerned.

References

1. N.Z. Meat and Wool Boards' Economic Service Publication S1451 1969 'Movement in Sheep Farmers' Costs 1968-1969'

2. Hamilton, B.N. & Johnson, R.W. 1968. A.E.R.U. Research Report No. 53 'Processing peas: a survey of growers' returns 1967-68'

3. White, J.G. 1968. Proceedings of the 18th Lincoln College Farmers' Conference, 'Possibilities in frozen peas and beans'.

4. Sanderson, K.T. 1965. 'A field survey and report of costs and returns for tomatoes for processing'

5. Crowder, R.A. 1968. 'Preliminary investigations into large scale intensive production of tomato'

6. Philpott, B.P. 1968. Proceedings of the 18th Lincoln College Farmers' Conference, 'Overseas trends affecting New Zealand Agriculture'

Discussion

On the subject of Mr Wilson's list of research priorities it was quickly pointed out that from the point of view of Canterbury irrigation was perhaps the most urgent priority before any work on particular crops. Potatoes should

be added to the list and tomatoes relegated to a low position due to their poor export potential.

Mr Morris gave as the principal reason why New Zealand could not hope to export tomato paste at a profit the fact that tomato paste was a commodity the price of which depended largely on the scale of manufacture. In this we could not hope to compete with the very large scale producers overseas but we might well find a market for a more sophisticated tomato product.

Professor Morrison said that in Mr Wilson's list of projects he could find little mention of anything relating to the economics of cropping. Management and economics advice could well be a much more important aspect of the advisory services in the future.

In reply Mr Wilson said that his list was drawn up from problems which existed in the field over the past year. Economics and management was a problem to the actual advisory officers concerned but at the present time did not loom large.

Mr Mulholland was worried about the possible problems which might be incurred by a 2 crop a year system as advocated in Hawke's Bay, but Mr Wilson said that problems did arise if it was economic to do this he felt that it was worthwhile.

The possibility that commercial firms might be in a better position to give advice to growers on pest and weed control and cultural practices was raised by Professor Morrison. He visualised the state advisory officer functioning mainly as a purveyor of up to date information from research projects.

Mr Taylor pointed out that from the commercial organisations angle priorities were apt to be different and he compared the acreage of process vegetables with the much larger acreage of cereals. Obviously if a commercial organisation was going to act in an advisory capacity the scale of operations was important. Mr Bailey also felt that they were apt to be biased in their advice, and Mr Wills said that he though that in advisory work there was room for anyone who could assist but there must be some form of checking. However, when the Agriculture Department had had occasion to check commercial firms' figures they had normally found them to be very correct, according to Mr Inkster.

Mr Brandenburg said it was easy to get at cross purposes with processors and there was a tendency to leave advice on certain crops to the latter. But he did not feel that at some stage they could avoid being forced into a situation whereby they become an arbitrator between grower and processor interests.

Mr Driver introduced the concept of product value. He said that as an example a 10 ton crop of potatoes exported as 'french fries' could be worth a thousand dollars to the country, though not of course to the farmer.

Session 3 - Crop Production

Chairman: Dr H.C. Smith

Mr A. Mulholland - A case for process crops on a Nation-wide basis
A farmer's view point

As a representative of Federated Farmers I am really here to ask questions. We live in a world of some $3\frac{1}{2}$ billion people where perhaps one third of this number eat well whilst the rest do not so well. The figure of 1,800 calories a day has been quoted as the daily ration of one of the Chinese living today in Mainland China, a drop of some 20 per cent on their pre-war level. This gives some idea that in this world of plenty there is a large area of need. The world population increases at something like 1 million mouths a week. Rather a lot to feed. In process growing we are looking at another diversification from the traditional avenues of farming of the greater part of New Zealand. Though process growing has of course been practised in small areas for a number of years, we are traditionally a meat and wool producing country but are reaching a stage where we are finding a problem in placing our production. We have turned in quite large areas of wheat production and this in turn is creating new problems. So we come to the farmers in traditional agricultural areas showing interest in new crops.

Now I would like to put a number of questions to this conference not as a farmer well versed in process cropping but as a representative of a group of farmers who may become involved in this type of agriculture. I think one of the basic questions is will it pay? We as farmers are the basis of the New Zealand economy. If it doesn't pay then all sections of the community will suffer. Before we enter into this new cropping programme we will want to know the return to expect. This is my first question.

1. Will the return on his investment in process crops be sufficient to maintain his standard of living in the face of rising costs? The farmer is unique in his position in as much as he cannot pass on his rising costs. Therefore he can only improve his efficiency. This he has done in the past.

2. Will the return from this type of farming cover the high capital cost involved in plant and machinery? Process crops mean bigger and more efficient equipment and more labour.

3. How well can these crops be integrated into the normal farming rotation? This is probably the most important question from the point of view of the practical farmer. Under process cropping I can see long-term pasture going by the board.

4. What stage have our plant breeders reached in producing varieties suitable for the wide variety of environments encountered throughout the country, and will the Government provide adequate finance to this project?

5. Will the Government give urgent consideration to the equalisation of freight rates from South Island ports? To a degree this has been answered

by the waiving of the 10 per cent surcharge. But there is a great deal of work to be done on containerisation.

6. Should we not accelerate our research into nitrogen in a more economic form, as well as its effects when coupled with irrigation. This problem has been emphasised by the recent drought.

Further we must look beyond the use of superphosphate and lime as the basic fertilisers on farms.

I would plead for the whole of the industry to pull together as one team. Federated Farmers up to now has had no connection with the process industry. However, in the future members of this organisation may well form a large section of the producers of process crops and I would like to see Federated Farmers represented on all research and organisational committees which may be formed for the advancement of the industry.

Mr W.C. Wills - Research requirements in an expanding vegetable processing industry

To adequately measure the necessary research requirements for the grower sector of the vegetable processing industry, it would be an advantage to first review the industry's projected growth rate in New Zealand.

A reasonable guide for these assessments can be found in the targets for production and exports of canned and processed fruit and vegetables, presented to the National Development Conference by the Horticulture Working Party.

It is anticipated that exports will increase by 17½ per cent per annum until 1972-73 and 15 per cent per annum to 1978-79. The targets, expressed in 1967-68 values would be:

1967-68	actual value	$2,275,000
1972-73	projected	5,600,000
1978-79	projected	12,940,000

The projections of total production envisage the following targets in rounded figures. From a total production figure of $28 million in 1967-68 to a target of $35 million in 1972-73. The second five year period is expected to reach the target value of $49 million in 1978-79. The assumptions in which these targets are based include:

a) Most export expansion potential exists for processed fruit and vegetables of types already exported.

b) New processes will be developed and will assist this expansion.

c) Development of some new products can be anticipated - onions and strawberries.

It is anticipated that Australia will offer much potential especially if the phasing out of duties is carried out according to the programme laid down in the Free Trade Agreement.

The first obstacle to this expansion has already been encountered when Australia raised strong opposition to imports of frozen peas and beans from New Zealand. Processor and grower representatives in Australia and New Zealand were brought together last year and Australian governments agree to the establishment of a combined pea and bean industry panel comprising an equal number of processor and grower personnel from each side of the Tasman and appropriate government officers.

It is significant that agreement has been reached and exports of peas will accelerate up to and including 1970 with the position to be reviewed thereafter. Other markets have shown considerable promise of expansion.

This brief examination of the industry prospects and projections reveals the extent of increased research activity that will be required in relation to the vegetable industry.

It may be of interest to researchers and growers that the Horticulture Working Party's recommendation "that the annual increase for financial grants for horticultural research be raised from the $7\frac{1}{2}$ per cent recommended by the National Research Advisory Council, to $12\frac{1}{2}$ per cent" was adopted at the National Development Conference recently.

It is not my intention to attempt to nominate priorities in research, but rather would I endeavour to draw attention to some aspects of research which are considered of increasing importance in view of accepted production targets for the next ten years.

Just as manufacturers or any other business find it essential to obtain and continually up-date costs of production data, so our processed vegetable growing industry must be equally as knowledgeable on such matters. The Vegetable and Produce Growers Federation would be failing in its responsibilities to the whole processing industry and to growers, both present and future, if this essential research were to be neglected.

There are some who cast doubt on the need for this work and possibly encourage suspicions on the absolute validity of farm production costing procedure. It has however, survived as an acceptable costs indicator in practically all agriculture, including horticultural producing sectors.

Crop production economics are important when assessing export potential, but the greatest value is to the grower. These statistics provide essential information that enables the grower to assess profitability, a factor that ultimately influences him to grow or not to grow.

Although there may be some short-term advantages in including an uneconomic crop within a farming production pattern, ultimately the true criteria for sound and profitable farming will be to ensure that each crop will carry its share of costs and contribute to profits.

An established crop survey and costing procedure, annually up-dated, will reveal cost factor increases per acre which may occur. Improved management will assist toward increased production per acre, but research is expected to make the major contribution.

Breeding work on peas, beans and tomatoes should be directed toward improved varieties for yield, quality, close maturity and disease resistance. Extension research of varieties to obtain environmental acceptance is necessary.

It is realised that a great deal of work has been carried out in inducing increased production per acre by density planting and direct seeding. Trials have proved that the potential for increased production per acre can be considerable with greater density of plant population. However, the chances of increased disease incidence under these growing conditions is obvious, particularly in certain areas.

Problems arise too, of weed control in crops. New methods of cultivation must be devised or chemical weed control relied on, to ensure crops are not rendered unprofitable.

There has been some outstanding success with chemicals for weed control, but unfortunately unaccountable failures in their effectiveness in many field crops calls for considerably more research in this field.

With these problems in mind and the continual risk of crop loss through disease, I suggest that some claims made for greatly enhanced production results, even if they may only be potential ones measured on plot trials, can be dangerously misleading, particularly to potential newcomers.

Plant diseases root, stem or foliage continue to be the major inhibiting factors in striving for volume production. Possibly Sclerotinia can be blamed for most losses in vegetable crops, as it certainly features prominently in the percentage deductions for wastage in dwarf machine-harvested bean crops.

Expansion of our processed vegetable industry will require additional land, new areas, and increased individual acreage commitments. New techniques must be developed in the production operations from planting to harvesting, involving extensive mechanisation. Much has been done with the limited resources available, but with the expected rapid expansion of the industry as projected in targets, research and researchers will face a challenge, that if it is to be successfully met will require considerably expanded resources.

Discussion

Mr Wright brought up the question of who would provide the capital for the purchase of sophisticated equipment necessary for process crop production. In reply Mr Mulholland said that for the small-scale operation the agricultural contractor would have a part to play. A farmer would have to be on a fairly large scale to consider the purchase of precision drills, steerage hoes and harvesting equipment.

Mr Wright's second question was on the state of research into nitrogen fertilisers. Professor Morrison said that he had a post-graduate degree student working on anhydrous ammonia and as Australia had 3 plants manufac-

turing this now, this was likely to be New Zealand's most economic source of nitrogen for some time. Mr Inkster said that extensive work on nitrogen manuring had been carried out on field crops but up to now this had been uneconomic. Mr Boyce said that crop nutrition had been a large part of the work at Levin but major response was still to phosphate and secondly to potash.

Mr Wright said that this was not necessarily the case in Canterbury as Levin soils were totally different. The same criticism could be levied at the Winchmore programme on irrigation.

Mr Bennet said that the Department of Agriculture was in the process of starting a demonstration farm in the Kirwee-Darfield area which was a more representative site for process crop production. There they intend to irrigate crops and to bring in the nitrogen factor. He felt that role of nitrogen was going to be completely different from in the past by using short rotation systems.

Mr Driver said that both nitrogen manuring and irrigation trials carried out in the past had indicated that nitrogen manuring was uneconomic. But the situation was changing. Under high fertility conditions where a good crop could be anticipated it often paid to use nitrogen. There are also the effects on quality and maturity which will have to be worked out.

Professor Morrison said he was interested in the possible role of berry fruits into cropping rotations. Could farmers cope with a 3 year fruit crop?

Mr Mulholland said that if it would be proved to be profitable he had no doubt that the Canterbury farmer would take them up.

Mr Wills however, felt that berry fruits were a specialist crop and could not be fitted into any existing rotation.

Professor Morrison brought up the subject of who was to become the new extensive process crop grower. It could either be the present market gardener who possibly had much of the necessary equipment but who would have to invest more capital in land or the present extensive farmer who had the land but who would have to put more capital into equipment.

In replying Mr Mulholland suggested that process crops might well replace wheat on high yielding soils and thus force the growing of the latter out on to more marginal soils which would relieve the present position of over-supply.

Mr Wraight said that generally in New Zealand at present the processor produced the major portion of the specialised harvesting machinery except in the case of beans and sweet corn. The processor would like to alter this position and to revert the capital tied up in harvesting machinery into more profitable channels. Ownership of machinery by growers or contractors might well lead to their more efficient use. Mr Haigh agreed with the viewpoint and added that the processor might well be prepared to assist in the capital cost of machinery provided that the grower would take over the trouble and expenses of operating it.

Session 4 - Processing

Chairman: Mr D. Haigh of D.J. Haigh & Company

Mr P.L. Harland - Marketing of processed crops

In its report to the Second Plenary Session of the National Development Conference in May 1969, the Manufacturing Committee defined "marketing" as "the continuous process of determining consumer needs and desires; stimulating product development to meet these needs; achieving effective product presentation; ensuring maximum availability; creating, by advertising and supporting promotional activity, product awareness and stimulating product trial; maintaining consumer satisfaction through acceptable pricing and consistency of product quality; and measuring results and reactions: all leading to the long-term maximisation of the firm's profit". In my view, when we speak of processing and when we see the titles of organisations such as the New Zealand Quick Frozen Foods Processing Bureau, we are not doing justice to the industry. The preserving and marketing of food is just as complicated and required just as much or more machinery and know-how as many other manufactured products in New Zealand using other raw materials such as wood, steel or plastics, and the preserving of food should therefore be recognised as a manufacturing operation with all the attendant problems of marketing as applied to manufactured goods in general. Returning to the definition of marketing with its message of major importance that marketing is "the continuous process of determining consumer needs and desires". Having I hope instilled that point into your thoughts, let us look at the marketing of preserved foods.

But first let me say that I am aware the Seminar organisers made considerable effort to find an expert on this subject, therefore I should mention that my experience in this field is limited. However, I am pleased to see that in their choice of Chairman some comfort is afforded me in being able to lean on a proven expert in the field of marketing frozen processed foods. But even one as successful as Mr Haigh will, I am sure, support my emphasis on the need for continuous marketing and study to maintain that other important part of the definition of marketing which I mentioned previously, that is, the long-term maximisation of the firm's profit, and I hope he will not object to my mentioning that to keep up with world marketing activities in processed foods, and in particular with developments in the United States, he intends travelling overseas soon to see what new developments can be applied to the operation of his company, nor am I sure will he object to my mentioning that there is a prospect of his visit to New York coinciding with the National Fancy Food and Confectionery Show which will be held at the Coliseum in New York City from 3-6 August.

Regarding the New York Food Show, I remind you that the New Zealand Government, through the Department of Industries and Commerce and its Trade Commissioner service, will be represented in the form of a New Zealand stand for the second year in succession. Here again is an example of continuous marketing, and this year 29 New Zealand food processors are to take part, which compares with last year's showing by 26 companies. Although I am not sure how many companies are repeating their participation at this year's New York Fancy

Food Show which is recognised as a major food importers' showcase for the United States speciality food trade, I understand that the majority of last year's participants have entered the show again.

The return to the Show by these companies is again part of the continuous process in marketing, and during the intervening period a great deal occurred and is occurring as a consequence of various companies' participation at the New York Food Show last year. Participating companies received reports on the reaction of the trade to their individual products and also lists of enquiries which could not be dealt with orally at the Show by representatives at the time. A number of the enquiries have led to subsequent business, and a number of companies, which a United States company expressed an interest in representing, had the satisfaction of seeing their United States representative a few weeks ago here in New Zealand, thus placing their agency arrangements on a business-like footing. This result, directly attributable to last year's participation at the Show, therefore, paves the way for practical sales promotion at this year's Show, and creates that continuity of activity so necessary between producer and seller of goods.

New Zealand food producers placed on display at the New York Food Show a great variety of products such as instant freeze-dry beaf tea, fruit cakes (using New Zealand flour and butter), beer (using New Zealand hops, etc.), frozen and canned eel and venison, bottled and canned fruits such as chinese gooseberries ("Kiwi Fruit", their common marketing name in the United States), tree tomatoes ("Tamarillos"), and canned feijoas, canned strawberries and other berryfruits. The interest expressed by the United States trading community in many New Zealand products represented at the Show indicates the tremendous potential for New Zealand food products where for the 50 or 60 food items on display from New Zealand no quota system exists or import licence is required for the United States market. There are difficulties to overcome for the new product entering such a market - for example, labelling and requirements of the health authorities concerned with the contents, but these are no more stringent than we would wish to apply to ourselves in the production and consumption of such items. It is really a matter of conforming with the customers' requirements, a most important factor in overseas trade, or for that matter any trade, and not the least of these requirements is ensuring that your prices are competitive with other world suppliers. And this is an important point to remember; imported foods, unless supplied in bulk institutional packs, are not directly competing with domestic producers, but are competing with other foreign suppliers. This I venture to say puts New Zealand in a good position for many of our processed food products in many markets.

I could continue at length on the subject of food marketing in the United States and on the National Fancy Food and Confectionery Show, because as some of you may know, I returned to New Zealand earlier this year after being for the past 4 years in our New York Trade Office where, among other things, I was endeavouring to promote New Zealand foodstuffs and assisted with the organisation of New Zealand's participation at the National Fancy Food and Confectionery Show held in New York last August. Instead, I would refer you to the report on the Show contained in the Department of Industries and Commerce magazine "Export News", March 1969 issue.

However, I should not over-emphasize the importance of the United States market - there are many opportunities in many other markets - and the Trade Commissioners have organised participation at the Food Shows in other countries last year, including Austria (Vienna), Japan (Osaka, Nagoya, Tokyo) as well as in New York, and this year Italy (Milan) and New York again.

Marketing of Frozen Vegetables

Now I should like to consider more closely the marketing of frozen vegetables which is a major theme of this Seminar. Today's trend in Western consumer orientated markets is towards top-quality frozen and freeze-dried vegetables in convenient packs, a trend brought about by the rise is living conditions, movement of labour from agriculture to industry, increased number of tourists and improved standards of restaurants. Changes from traditional multi-product market garden areas to larger scale specialised production units, associated with developments in marketing have assisted this trend.

Production of quick frozen peas in New Zealand reflects this trend, and as shown in the abstract of statistics figures, jumped from 6,904 tons to 16,572 tons in ten years ended 30 June 1968, almost a three fold increase, sliced beans increasing from 966 tons to 2,501 tons - about 250 per cent increase - while "other" frozen vegetables have shown a more spectacular increase from 1,111 tons to 5,554 tons, or about a fivefold increase during the same period. The "other" vegetables include corn, broad beans, mixed vegetables, etc. I believe a significant part of the "other vegetables" is frozen potato products, mostly frozen chips or "French fries" as they are more commonly known overseas, and I have heard recently of a company which produced 3,000 tons of frozen "French fries" last year. If the trend for frozen French fries follows the United States trend (where incidentally in my experience local Supermarket retail prices for frozen French fries varied from about (US) 59 to 75 cents a pound compared with the average price of fresh potatoes of about (US) 7 cents per pound), we can soon expect to see an increase in frozen potato production proportionately similar to the United States where in 1967 with a frozen potato production of 1,400,805,000 lb this represented over three times the volume of production of frozen green peas for the same year. Indeed I have one estimate that there would be production of about 10,000 tons of frozen potato chips in New Zealand for the year ending 30 June 1969, and I understand that the Statistics Department will take into account this change in production and provide separate frozen potato figures.

However, regarding New Zealand production of frozen fruit, I am surprised that there have not been greater advances in production for New Zealand and overseas markets. New Zealand statistics for the past three years show a rising trend to 206 tons for the year ended 30 June 1968, but this compared with other substantial figures in 1958- 148 tons; 1961- 101 tons, and an apparent "bonanza" in 1959 of 216 tons of frozen fruits. I assume some of this tonnage would be berryfruits, and I am aware of keen interest in berry-fruits in the fresh, frozen or canned form in various markets, but particularly in the U.S.A., also in frozen berryfruits for Australia. Therefore, it appears that in the production and marketing of berryfruits there is a need for study to establish whether new ways - perhaps with greater mechanisation - can be evolved to produce berryfruits in quantity at a competitive price for an increase

in our share of world markets. And price, I emphasise, is of prime importance for berryfruits in U.S.A. and Europe markets because of competition from other suppliers through geographic and other advantages.

Although a discussion on marketing can hardly be complete without statistics, I do not intend to continue quoting figures attached to the papers I have presented to this Seminar which can be readily interpreted. For example, the statistics clearly indicate the importance of exports of frozen peas from New Zealand to the United Kingdom, which in 1967-68 amounted to 53,942 cwt.

An essential part of the Continuous Marketing Process is keeping abreast of world marketing trends, and I hope we have an opportunity of hearing from Mr Haigh after his return from overseas and his "look at United States marketing trends". Therefore, in finding and developing markets for frozen freeze dry and preserved vegetables, fruits, etc, the following criteria should be noted:

1. Minimum export standard must be met, e.g. asparagus spears are required to have certain dimensions. It is essential to supply to exact specificiations of the buyer.

2. Existence of consumer demand - It is interesting that canned sweet corn became so popular in Malaysia where it is used in Chinese recipes that it is sold by hawkers and roadside food-stalls. It is even used by an ice-cream manufacturer.

   However if a vegetable is unknown in a certain market, an education campaign for the housewife can be organised, admittedly at varying expense, involving store demonstrations and receipe distribution.

3. Regulations should be strictly adhered to - Frequently a health certificate from a government authority is required before vegetables can be landed. The existence of import licensing, quotas or high tariffs should also be checked.

   It is of interest to record that under the N.A.F.T.A. understandings, provision is made for the gradual elimination in each country of tarriffs on frozen and dehydrated peas and beans imported from the other. Thus, for the Australian market, peas and beans should be duty-free on Schedule A by January 1974.

4. Labelling and packaging must be correct for other countries - Consumer packs usually must state country of origin and other essential details such as manufacturer or distributor, net weight and contents. Sometimes it is more economical to ship in bulk and have products broken down and packaged overseas, but we should be conscious of adding the greatest value possible to the product, including the packaging, before it leaves our shores.

5. Price must be right for the market - At certain times of the year, high prices may be paid for top-quality fresh foods. In November/January, for example, when there are few locally-grown strawberries in the United

States, and Mexican supplies are at their lowest, prices for top-quality fresh New Zealand strawberries can soar. However, it must be remembered that either flooding the market or poor quality of even one consignment will drastically affect prices. This calls to mind the wisdom of a fresh asparagus exporter who air-freighted his asparagus spears around the world to check the quality before exporting, with subsequent export success. The Department of Industries and Commerce magazine "Export News", February 1969, tells an interesting story of airfreighting fruit and vegetables by a Hawke's Bay grower. Although this produce can hardly be classed as processed food, the exacting requirements in shipping such products by air - for example, the requirement of maintaining a supply of water to fresh asparagus tips travelling in bunches - places them close to a manufactured product from an export marketing point of view. Some of these seasonal price changes in fresh produce in the Northern Hemisphere at times can have a helpful influence on the price of their frozen equivalents.

6. Good freight service - If shipping services are not frequent enough, the possibility of airfreighting should be considered. Frequently because of long sea-freight delivery times, countries will seek closer sources of supply: for example, Japan can obtain goods from the Republic of China in three days and will do so, rather than wait 45 days for shipments from New Zealand by sea with the risk of market fluctuations in the intervening period. There is little doubt that development and promotion of a market must be supported by adequate shipping and/or freight service. With processed crops so often dependent on refrigerated space, there seems to be scope for the development of self contained (perhaps diesel) refrigerated containers which can be placed on ships with inadequate freezer space.

7. Efficient distribution techniques - For bulk supply, although brand is less important than quality and price, at the retail level it is difficult to introduce a new brand on any competitive market without considerable advertising. One New Zealand company, however, has launched its brand name successfully on the Australian market, installing its own freezer cabinets in several large food retailing stores, selling a range which includes asparagus, butter beans and broad beans previously not available in frozen form in Australia.

There are many facets of overseas marketing in a number of parts of the world including right here in New Zealand that I could have referred to, but this is a Seminar where discussion is encouraged and I shall therefore shortly return the meeting to the Chairman, but before doing so I wish to bring to your notice the supporting paper prepared by the Department of Industries and Commerce, Wellington, which has been distributed and provides a capsule commentary on some of the marketing information available in my Department in Wellington on the marketing of frozen foods overseas. The majority of this information is obtained from Trade Commissioners' reports being sent in from our overseas offices, and is another example of my original theme of the Continuous Marketing Process. It demonstrates that the Department of Industries and Commerce has developed a strong link in the chain of the "continuous marketing process", and perhaps it could be appropriate for this Seminar to

consider whether this link is being effectively chained with other such links concerned with processed crops, the grower, processor, researcher, seller, shipper, buyer and consumer.

Mr H.A.L. Morris - New forms of processed vegetables

A great deal of know-how exists in the field of raw material production and this includes methods of mechanical harvesting and other facets which will greatly aid the future development of the industry. But there is a lack of know-how in the field of product utilisation and in the marketing of processed products. I am appalled that the industry as a whole tends to sit back and say that process product development and marketing are in the hands of the commercial sector only.

This I would suggest to you is both unreasonable and improper. The whole industry's fortunes both from the point of view of production, right through the whole organisation does rely on the successful marketing of skilfully produced products. This is something which cannot be left to the commercial sector of the industry, who moreover are likely to be more concerned with individual small products, individual small fractions of an overseas market and are certainly not concerned with New Zealand as a whole and its horticultural process product activity. Quite clearly if we are to expand our horticultural industry, everybody recognises that this will be through the development of export products and we have therefore a prospect of doing one of two things. We may firstly aspire to getting all this increased export marketing from established products. That is we look forward only to exporting processed peas, beans and so on. Alternatively we may aspire to producing entirely new forms perhaps forms which have not up to now been marketed anywhere in the world. Now I personally believe that the second alternative offers the greatest opportunities, simply because if we aspire to only producing the established forms these are process products which are very much dependent on scale. There are very many large producers and very many large processors throughout the world who in many cases will be able to successfully compete with us in terms of cost and indeed in quality. So it is the second alternative, the production of skilfully produced products which have not yet been marketed anywhere but which we then inject into various areas of the world in a variety of forms in a variety of prices tailored for individual markets and individual consumer requirements.

If we are to do this sort of thing we must have some sort of know-how and expertise developed in the field of utilisation. The approach envisaged here is somewhat along the lines of the U.S.D.A. product utilisation divisions which are located at various points in the United States. This job is not only to link in with the raw material producer and in many cases understand them at certain facets of this programme, but also link in with the marketing aspects of an individual product development. At the present time in New Zealand we have only two individuals at two locations in the D.S.I.R. operating on a limited scale on this problem. This is a very very small contribution to what may be the whole key to the problem we have been discussing today. Now I simply wanted to make this plea and then pass on quickly to a variety of samples illustrating the sort of approach that will need to be considered in

the future if we wish to expand export marketing, bearing in mind the small-scale of our indsutry at present and probably for a few years hence. The first illustration is of onions. We understand that there is a very ready market for onion products in Japan and at the moment we are trying to infiltrate this by exporting a fresh and perishable commodity. But clearly if onions are eaten in Japan the Japanese may be prepared to accept onions processed in different forms. We do not know what the right form is but we need market information and utilisation work to find out this. Is it in fact a dried flaked onion made by drum drying? Is it a frozen onion product? Is it an ordinary air dried or freeze dried onion or indeed an onion concentrate or an onion essence? These are the sort of exercises one must go through in getting the most profitable product from our raw material. A particular example I have here applied to the berry fruit industry, one might dry the product by drum drying it, or for another export market produce a consumer product - blackcurrant and honey, an entirely new product to be injected into an overseas market.

When looking at the established products we wonder whether these could be improved. A large proportion of the costs of exporting is involved in transport and storage of frozen articles. For many years dehydro freezing has been established in the United States but as far as I know has never been considered locally. Dehydro freezing involves taking a pea and drying it down to about half its moisture content without any loss of quality but at the same time reducing the volume by half. The product is then subsequently frozen and shipped. The advantage of this is that you save half the packaging costs, half the storage costs and half the transport and marketing costs for this product. This produces a product which is most suitable for catering institutions bearing in mind the appearance which is not quite as good as the established frozen product. If we are looking at dried goods we must study the market and tailor the product to suit. Do we want to market sliced dried carrots or would sliced shredded carrots be preferred? If we dry a vegetable is there any advantage in compressing it? We take a dried vegetable which is already half the original volume and compress it down to half the volume again and get a solid tablet. The example here happens to be beetroot which in fact, rehydrates to a normal condition. As far as new products are concerned new dried vegetables would include the herbs, pimentos, sweet potatoes, pumpkin and leeks. Who is to know which of these may be a most profitable venture in the future and dovetail a good deal of our research towards successfully launching a particular product? A dried product can be tableted into an immediately edible form, either by straight compressing by puffing to give a traditional Asian type product to make a vegetable wafer.

Finally we can consider whether a traditional product like potatoes for certain markets could be blended with another material. If we were wanting to export a french fry sort of product we could consider the blending of the potato with fish, meat etc. and extruding it in a variety of forms.

Discussion

The Chairman Mr D. Haigh opened the discussion by asking Mr Morris how much effort at Massey University was being put into product development.

Mr Morris: Very little indeed, the primary object of the University is teaching. What work is being done is with student help and a bit of hobby work by individuals. There is no definite programme and no time allotted for this work. I would stress that any utilisation work must be undertaken by rubbing shoulders very closely with the raw material producing expert and with the marketing man. This integrated approach is one which could be used in selecting a product. From the producing side the production side and the marketing side might produce a blue print - 'operation onion' to develop a market in Japan.

Mr Baumgart: Mr Morris has described the small contribution in two places by D.S.I.R. and his own restricted effort though it is possible to see from the examples handed round the latter is producing results. This is something that as the industry is developing it should take very seriously as to whether the research programme does have to be designed to push along and provide the information which is going to be needed for the efficient processing of the raw material available in New Zealand. Many may be aware that 2 or 3 years ago consideration was given to the establishment of a research association in this field where the industry in co-operation with Government, considered the setting up of a laboratory much like the Wool Research Organisation at Lincoln or the Dairy Research Institute at Palmerston North. At that stage it was decided it was not time but with the tremendous developments which have taken place over the last few years and the plans for expansion in the future I feel that this sort of thing will have to be considered to reach world markets, to take advantage of the raw materials which are going to become available. I do not think of the type of industry we have been talking about can hope to make it without fairly substantial research backing. The initiative in this will probably have to come from the industry and if so I presume that Government will be quite receptive to this type of thinking.

Mr Morris: I am not too sure that the research association idea is quite appropriate to the circumstances of this industry. In a research association I take it that it is usually financed by existing processed industry. We were hoping to develop a whole new national industry and in this case there must be a great deal of producer finance injected into the research scheme. I think this is only fair to the processing industry as after all the existing industry may not be the ones to capitalise on any new developments. I would like to see a great deal more pressure from the producing sector towards getting utilisation work undertaken.

Professor Morrison: Mr Harland's talk indicated that the Industries and Commerce Department are doing a very good job in selling our products overseas but, could not a Growers' organisation, at least from the product point of view, do a better job? Is it not time for the formation of a Growers' Export Organisation of some sort from which would follow a research association. You would then have an association which could do something that at present, processors obviously cannot. How existing processors can fit into this organisation, I do not contemplate.

Mr Boyce: Some of the samples passed round today are probably unique. Is there an intermediate stage of product development to produce a quantity of a material

to show to a prospective buyer? Has anything been done to alleviate the present surplus of onions by processing them?

Mr Morris: There are in fact two lines of research. Development of new products and improving the efficiency of an established one. With new products one has to produce the product on a sufficient scale for market investigation. For instance in the case of berryfruits the Vegetable and Produce Growers did arrange with a private company to produce sufficient berryfruit flake to send off as market samples.

In onions this has not been done but a small-scale trial on onion flake is envisaged sometime in the future. At present there are not the people or the finance available to do this product utilisation work.

Mr Wright: What are Mr Harland's views on the importance of improved transport services in marketing new products.

Mr Harland: Freight services are, of course, extremely important. The development of self contained refrigerated containers might considerably facilitate the utilisation of present services. Much of the present problems originate from the allocation of available space on ships. Refrigerated containers are coming in anyhow and though there will be very many difficulties someone should look into this.

Mr Morris: Controlled atmosphere storage has been widely investigated overseas and might well be considered here.

The problem of a National Shipping line was raised but Mr Harland pointed out that we had no way of knowing which direction our trade would go in the future and we could not have a national shipping line going everywhere.

Later Mr Morris said that the approach does involve taking a product - onions for instance. Look at the Japanese market get the market statistics make a survey of consumer habits. How do they eat onions? Would they eat a dried onion? What forms could you market? When you have this information you are then faced with examining the feasibility of growing, processing, preserving and stabilising onions in New Zealand, and bearing in mind the agronomic cost and other factors, you may then be able to say that there is a prospect of a market for onions overseas in this or that form at some price. Then manufacturers may show interest. But at the present time there is no such linkage, there is no such body as a utilisation division which could put in the required effort to get even one product off the ground.

In reply to a question as to whether information on exact requirements of processors were freely available to plant breeders, Dr H.C. Smith replied that at present information came through in a rather indirect fashion. New pea varieties, for instance, were given out to processors both in New Zealand and the U.K. for product quality assessment and there were tasting panels to evaluate flavour. With regards to potatoes, up till now there had been no demand for a variety especially adapted for processing. Present varieties

used for processing must also be acceptable to the fresh market. A further difficulty in product evaluation was the fact that both the variety and the processing method would be altered and the latter was likely to have quite as much effect on the end product as the former.

Evening Session - The session was opened by an address from the Minister of Science and Agriculture - Hon. B.E. Talboys.

"How glad I am to have the opportunity to take part in this Seminar, brief though my part will be. The holding of a seminar such as this attracts my interest for a number of reasons. First I think your meeting today is the outcome of two factors. One the work C.R.D. is doing in emphasising process qualities in its vegetable research programme because it has an eye to extensive production rather than the traditional horticultural production. Two, the granting of a research contract to Professor Morrison's Horticulture Department at Lincoln College has certainly had its influence on this. I feel sure there is so much to be gained from this link between D.S.I.R. and the universities. It is an association which stimulates workers in both institutions. In fact, grants for specific approved projects at universities are now established policy and I have no doubt that in the course of time we will reap a goodly harvest from them.

The contract between D.S.I.R. and Lincoln College provides briefly for Professor Morrison to study the extensive production of vegetable crops and evaluate techniques to reduce labour and increase the scale of operations. There has been some suggestion that this conference has, so to speak, beaten the gun, before there is a great deal in the way of reports to comment on, and it has even been suggested that research interests could be rocking the boat a bit. I know that Mr Wills has discussed the implications of establishing processed crop production in Canterbury and I think you will have appreciated some interactions which are far beyond the simple plant research considerations. But I do not feel it is too early, nor do I feel that a bit of modest boat rocking will do any harm. Because I think New Zealanders are beginning to appreciate that there is a real potential in our horticulture and much of it is in processed crops. It seems to me to be a first class idea to hold this discussion so early in the currency of the research contract so that the research group will have the opinions of others represented here today who will be affected by anything arising from this project and who have a great deal to contribute to it. This leads me to my second reason for my particular interest in today's proceedings. In the past there has been a tendency for research and extension people to go ahead with a project without enough concern for how their findings may affect others who will be vitally concerned in the implementation of results.

There has been in the past a tendency for scientists to talk to scientists. There has been a tendency for a scientist to publish the results of his work and then leave it for someone else to make the discovery. I reluctantly accept the idea that if he does not publish he will perish, but to my mind there is no more affective way of publishing than to tell the

fellow who might recognise in the work that is being done a development opportunity and to discuss with him the implications to hear from him some of his views which could cast some light on the work that is being done. The growth that we must attain depends on work at Crop Research, at the universities, on the farm, but finally it depends on persuading some business enterprise that the sum of that work is the basis for investment. Someone is going to have to invest some money in the plant, market surveys, in the actual processing, otherwise we have not got very far. Now what is so often lacking is a system of communication so that what we have here today is a good thing. At the risk of labouring a point that I have often made in relation to the success of the National Development Conference, I should emphasise that, I think the pattern for the ultimate success of that exercise arose very largely from a series of meetings held by the Department of Agriculture before the Conference came into being on the whole farm approach to advisory work.

These meetings organised by the economists of the agricultural department took the step of inviting representatives of all those interested and associated with the servicing and the financing of farming. Many of these people operating on the perimeter of the farm subsequently admitted quite frankly that they had hitherto been working in something of a vacuum with relatively little appreciation of the ramifications of the impact of changes in farming on what they were doing themselves. There were two way advantages in the consequent awakening. Those who before had merely gone through the motions of being a part of farming found new opportunities of playing a constructive role. Those in the advisory services were able to use far more effectively a wide range of skills in planning assistance to and development of, the farming industry. You have done something similar today in looking into new concepts in horticultural crop production and in inviting representatives of all the interests that might be expected to become involved in that examination. If this were nothing more than those in extension, production, distribution and processing seeing research intentions and having an opportunity to relate the project to practical conditions, this would be excellent in itself. But I think, there are wider issues than this implicit in the data which have been prepared for this Seminar, some of which will undoubtedly have been covered in your discussions. I understand that a C.R.D. estimate of the potential acreage of soils suitable for large-scale production of vegetable crops within a workable distance of a processing centre to the west of Christchurch is about 170,000 acres. Now in terms of our comparative dearth of soils of this sort, so eminently suited to this type of production this is a national asset of very great value not only for the new concept of utilisation envisaged in this Seminar, but also by the development of a broader based export economy indicated in the targets of the National Development Conference. The term indicative planning has been applied to the Agricultural Development Conference and of course has become better understood by the public in relation to the current National Development Conference. These same principals must be applied to the project which you have been discussing today. Even modest success with research applied to 170,000 acres will have repercussions for beyond the small-scale of the research effort itself. It seems highly desirable that there should be a periodic reconvening of the interests present today to ensure that the full implications of the development are examined periodically and that full

advantage is taken of the potentialities as they appear, also perhaps to prevent any section of this chain of research production and extension from developing any unexpected weaknesses. In preparatory work for this Seminar there has been a great deal of close liaison of this sort and it is fair to observe that the Lincoln environment is traditionally conducive to a continuation of this. I am content to commend what has already been done. I am confident that you will find a way to ensure from the research investment a dividend that will be widely distributed among the interests which have set this project rolling.

I come back finally to the simple proposition that what is needed more than anything else is clear lines for communication, a willingness on the part of each section to talk with and listen to the others. As we can develop this not only in this sphere, but in other spheres of our economy I am certain that there is real progress to be made."

Discussion

Mr Ballinger then invited each of the previous session chairmen to give a summary of what they felt were the most pertinent points raised during their respective sessions.

Mr I.L. Baumgart, Chairman of Research Session said that it was obvious that plant breeding, mechanisation, marketing and processing must in future all move forward in phase. There should be some sort of forum set up where representatives of all the above factions could come together to ensure future co-ordination and co-operation.

Mr Brandenburg made a plea for a co-operative body on which processors were represented as well as agricultural advisors and growers at a local level as a first stage.

Mr Haigh said that as a processor he noted that in the past all New Zealand companies involved in this field had been looking for export markets in opposition to each other and that this had entailed the expenditure of considerable amounts of money. He felt that colaboration would be much less costly.

Mr Wills pointed out that there was a major obstacle in inviting representation of processors on any advisory committees as there was no single organisation representing this body and one could not expect a member of one company to represent the whole industry.

Two other points were raised under this section. Firstly the lack of meteorological information with an agricultural bias. Mr Palmer pointed out that something like the British Meteorological Office's information service on irrigation requirements on district basis was required before worthwhile agronomic experimentation could be carried out in this field. Professor Morrison pointed out that there was a small agricultural meteorology research section in Wellington. This would need considerable expansion and would be better situated at a central point for agricultural research such as Lincoln.

The second point again referred to a matter strongly debated in the morning session that agricultural machinery for precision sowing, harvesting and other sophisticated operations not made in New Zealand but available from overseas is at present only able to be imported under licence. There appears to be little support for applications to import this machinery which seems to be a key starting point in extensive production of processed crops.

Mr Dunn pointed out that precision drills are essential for optimum ground coverage, besides which they saved valuable seed and reduced the need for much subsequent labour for thinning the crop. Professor Morrison added that often more than 50 per cent of the production costs of horticultural crops were bound up in harvesting and stressed the urgency for research on mechanising this process.

Mr Bailey, Chairman of the Extension Session summed up his period by stressing the need for further co-operation and co-ordination between all parties concerned with process crops. He mentioned the need for work on irrigation especially in Canterbury where the need for work on irrigation especially in Canterbury where moisture stress has a paramount influence on crop production. The other point brought up was the need to take into account the potential of crops when attempting to decide on the priorities to plant breeding and other research work.

Mr Wilson said that he felt that the present system whereby extension officers relayed potential problems for investigation for central co-orindation probably gave a fairer impression of what was needed than individual approaches to research officers. But he would welcome suggestions from a greater field than at present contributing when drawing up future priority lists. Mr Boyce endorsed this view and said that he himself was quite satisfied with the present system of drawing up a list of priorities.

Mr Driver pointed out the difficulties of a research worker obtaining valid facts from the industry. Professor Morrison, however, felt that more should be done by the research worker himself by going out to producers and obtaining the desired answers at first hand.

Dr Smith, Chairman of the Crop Production Session - work on nitrogen fertilisers should be co-ordinated with irrigation work. This is especially important for the Canterbury region. Mr Mulholland backed this by pointing out that increased cropping for processing would mean a major reduction in the traditional pasture acreage. By curtailing the period land spent under pasture we will be reducing the naturally produced nitrogen and this will have to be replaced by artificial nitrogen.

Professor Morrison said there was a great deal to be done in the field of agricultural education to bring the present day farmer more in touch with the sophisticated cropping which was becoming increasingly important today. Mr Wraight said that in Hawke's Bay the process of transition from traditional farming practice to the greater finesse required in producing vegetables for processing was gradual. A farmer would start with a few acres of one crop and build up his acreage together with expertise over a period of years. He thought a similar situation was likely to pertain in Canterbury.

Mr Ballinger brought up the point that with the trend for the enlargement of horticultural production units there could now be no finite division between what was farming and what was horticulture. On this same point Mr Driver said that in order to produce crops cheaply enough for processing large production units and skilled cropping methods giving maximum yields, are essential. Mr Wright said that specialisation would also come in and Mr Tate had mentioned during the morning session large scale units specialising in perhaps 2 crops. This he felt was especially relevant for better utilisation of machinery and capital in the Canterbury situation.

Dr Smith then raised the further point of profitability to the farmer and the high cost of specialised equipment. Should this be paid for by the processor, a contractor or the farmer. The latter would obviously require some assurance as to prices and markets for his crop before making an large investment. As things were at present, there is considerable room for improvement in the efficiency of utilisation of existing machinery for pea vining. The processors would undoubtedly welcome a grouping of large acreages of one crop within a limited area.

Mr Haigh, Chairman of the Processing Session - It is important that we take heed of all information obtained by the Industries and Commerce Department and others on market requirements and the potential overseas. It is important that we produce quality goods at a price to suit our customers and moreover produce goods in a form which is both acceptable and desirable to them. We must look at the potential for crops and products five or more years ahead.

Mr Morris said that he though that utilisation research should not be left to the processor, but should be fostered on a national scale and should have its place alongside crop production and research on marketing.

Professor Morrison summing up said, "The industry has been dissected today and I am here to put in the final suture. The day's programme has been highlighted by the vocality of the production researcher. There appears to be an optimism about our entry into process cropping. The researcher appears to be ready for this and indeed is anticipating it. I looked for a note of optimism and found it in Mr Wills who sees a potential for New Zealand products even in the Australian pea market. I think it is notable too that there is a lack of economics, a lack of marketing, a lack of management data on knowledge and we cannot advise the industry at this point. It is very clear that we are missing the stimulation we could gain from a growers' marketing organisation. Between the researchers I think there is sufficient co-operation but there is a lack of direction about these co-operative commitments. This is also true of the Engineering Institute. We have not put to the Engineering Institute what we feel it should be doing or whether it can in fact do these things. If it cannot, why not? As far as farmers are concerned, before they can accept this process crop concept we must find how to reduce the labour requirement of these horticultural crops and he must get rid of his ideas of long rotation pastures. Unfortunately we have not got the service to advise the farmer in this new programme. Neither the farm not the horticultural advisory services are geared to this. The advisory service is desperately awaiting the graduates who can fill this need

and it is up to the colleges in particular to provide these. There is also a need for a great deal more research on machinery and I think that it was pertinent that Mr Dunn said that the costs of sophisticated planting and sowing machinery are reasonable. The field of irrigation and nitrogen, particularly the former, is a major restriction in the build up of this industry and should have a high priority on research effort. The details such as seeds, meteorological service and perhaps even liquid nitrogen, we are aware of and will certainly be looking into. Farmer and processor profitability are both important. If both of these needs are satisfied I am certain that nationally we are also entering a profitable business. Which land and which grower will be involved seems open to argument. Many of us feel that it is the high capital land which will be utilised first followed by the poorer land when irrigation becomes established. Another feature brought out by Mr Tate is that it is not always cost reduction that we are looking for, frequently it is production increases and peas are a good example of this.

The role of processing was highlighted by Mr Driver's comment that "French fries" represent a return to the country of about $1,000 per acre, the whole potato perhaps some $200 to the farmer. This is the role of processing within this country. Process research requires the co-operation of the producers as well as the processor and requires a producers' marketing organisation of some form.

DEPARTMENT OF HORTICULTURE BULLETINS

1. Proceedings of fruitgrowers' short course, May 1967, edited by G.F. Thiele. 1967. (out of print)

2. Advice to prospective horticultural students commencing practical work. G.F. Thiele. 1967.

3. Extensive vegetable production. R.A. Crowder. 1968 (out of print)

4. Development of machine methods for extensive crop production. R.A. Crowder. 1968. (out of print)

5. Preliminary investigations into large-scale intensive production of tomatoes. R.A. Crowder. 1968. (out of print)

6. Horticultural management inventory. In preparation.

7. Economics and management of fruitgrowing: Proceedings of a short course, edited by T.M. Morrison. 1968.

8. Economics and management of vegetable growing: Proceedings of a short course, edited by T.M. Morrison. 1969.

9. Process tomato growing in Canterbury - II. R.A. Crowder. 1969.

Printed by the Lincoln College Press.