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Economics and Management of Vegetable Production

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PROCEEDINGS OF A SHORT COURSE ON ECONOMICS AND MANAGEMENT OF VEGETABLE GROWING

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Edited by Professor T.M. Morrison

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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 payouts, 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
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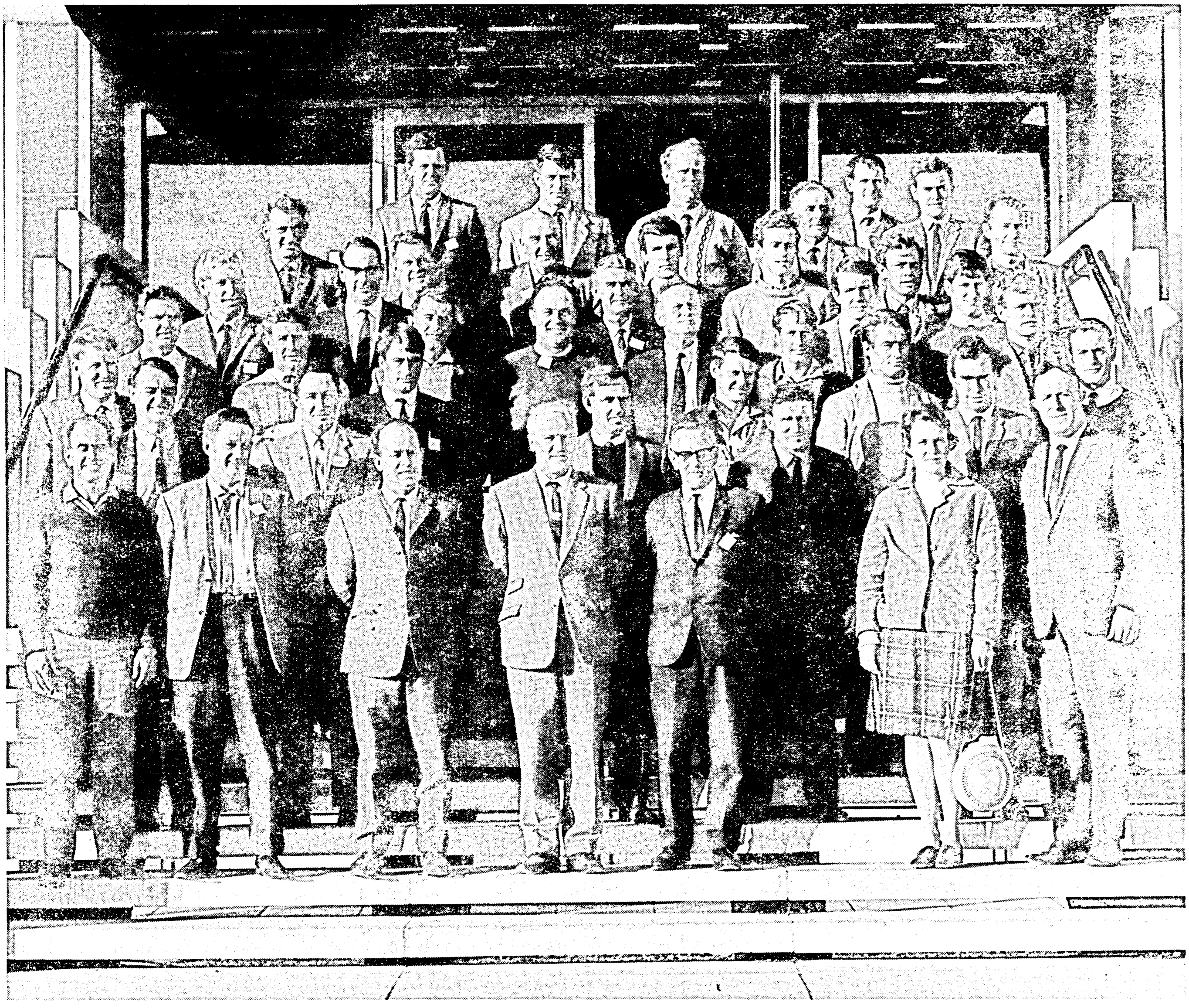

EXTENSIVE, INTENSIVE VEGETABLE PRODUCTION

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I regret that I am unable to be present at the short course but hope that this recorded talk will give you some idea of the vegetable work being carried out in the Horticulture Department at Lincoln. When you hear this I shall be scouring the Californian countryside and picking the brains of the people associated with that mecca for vegetable growers - Davis University - in the hope of bringing back additional information of use in our industry.

The last three years have seen a considerable change in attitude to vegetable growing. The shock of falling wool prices and unwanted primary produce in general stimulated the interest of farmers towards thoughts of diversification and many of the vegetables appeared to offer interesting opportunities. Most of these opportunities are however associated with the export of fresh or processed vegetables because our population is too small to absorb much increase in vegetable production either fresh or processed.

To compete on world markets from our isolated position obviously requires an industry geared to highest efficiency. If we view the vegetable industry in New Zealand then we would be deceiving ourselves if we considered it anything but chaotic.

At Lincoln we have been isolated from the main centres of vegetable production. Auckland grows something like 50 per cent of the fresh vegetables of New Zealand and Hawkes Bay and Gisborne 70 per cent or so of all processing crops. If Lincoln then was to contribute to the welfare of the New Zealand vegetable industry then it had to show that vegetables could be grown on the vast areas of the Canterbury plains and grown not for local fresh or processed consumption but for export, as only export in large quantities would utilise the many hundreds of thousands of acres available and suitable for vegetable production.

As we have already mentioned, to succeed for export, production must be highly efficient and for this to occur all <u>modern technology must be developed</u> for use to cut costs of production, increase yields so that growers will not demand, as they have and will do, increased prices per pound or ton of the crop.

At the Vegetable Research Station, Wellsbourne, England, Bleasdale first showed that vegetable crops could be planted much closer together and that in fact, we were not utilising our soils to the best advantage. Since then his work has been extended into the field successfully not only in Britain but also in the United States. Such work appeared to be relevant to conditions in Canterbury and investigations began into the development of extensive, intensive use of our soils. This <u>phraseology</u> has been used to imply the use of our Canterbury soils for vegetables on an extensive scale. Extensive often implies low yields with efficiency. Therefore, we add the word <u>intensive</u> to imply high yields also with efficiency.

What vegetables can we look at when thinking of diversification on a large scale? Peas and beans are already large and expanding so these were left out in the first instance. Onions appeared suitable for large scale production and offered possibilities for fresh export as well as processing and became one of the first crops for investigation. Brassicas ideally suited for the Canterbury climate with irrigation and a definite potential as process crops (Cauliflower, Brussel Sprouts, Sprouting Broccoli). Carrots and parsnips have a definite future. Celery and tomatoes are two very interesting crops for field production in Canterbury. In order to carry out precise work it was necessary to use precision equipment.

Use of Stanhay Precision Drill

The nature of the unit and its mechanism of operation is demonstrated. Essentially we are utilising a belt in which holes are punched to accommodate one seed. The seed sits in the hole until passing under a repeller wheel which removes loose seed, one seed in hole falls into soil. Low height above soil and low speed of movement ensure seed has minimum bounce and precision placement of seed is achieved.

To obtain success seed must be uniform in shape and size. If the seed is not it must be either graded or pelleted. With irregular seed i.e. lettuce, carrot, onion, pelleting is is essential for precision sowing. If the seed is very small then pelleting is again essential e.g. celery. Generally the smaller the seed, the less accurate the sowing as it becomes very difficult to grade to the fine limits necessary and doubles or blanks due to large seed become increasingly common.

When using pelleted seed it has been found advantageous to use a belt with a rib and a base plate with a groove. This allows the pellet to sink down below the level of the repeller wheel and prevents it being crushed. Before ever contemplating direct precision sowing of any crop therefore the seed must be looked at very carefully.

Table 1 gives a good idea of the degree of variation in various commercial samples of seed.

Table 1

	Variety 1		Variety 2	
Cabbage	>.0787"	4.9%	>.0625"	8.4%
	.0625"-.0787"	88.8%	.0472"-.0625"	86.5%
	<.0625"	6.3%	<.0472"	5.1%
Carrot	>.0472"	22.2%		
	.0394"-.0472"	50.3%		
	<.0394"	27.5%		
Onion	>.0787"	13.6%		
	.0625"-.0787"	84.1%		
	<.0625"	2.3%		

You can see that even varieties of cabbage differ in the seed size composition, and in fact two different belt sizes were required to drill each variety. If large seed was also required then three belt sizes would have been required. As it was, multiple sowings resulted from the small seed. The effect of seed size on germination is also critical when each seed must germinate to give a good plant stand. Preliminary studies on cabbage seed and onions indicated a considerable lessening of the vitality of these smaller seeds. Although they appear to germinate reasonably well in the laboratory test, in the field they succumb more easily to adverse conditions. Thus their presence in pellets may be even more important.

Pellets generally do give much greater precision of sowing and being larger over-ride variation in seed size eliminating doubles and misses to a very great extent. From work on pelleting on many vegetables it does appear as if pelleting materials can be detrimental to germination in general but usually not to a serious degree. Seeds pelleted do not appear to rapidly loose the ability to germinate even after 12 months, germination of tomato, cabbage, carrot and onion ranged over 60 per cent. However, pelleted seeds appear not to have the latitude for error that bare seed has. Depth of sowing appears to influence germination being tied up with a depth/water relationship.

The incorporation of fungicides was found to be satisfactory while a full Smut-White Rot treatment with Thiram and mercurous chloride incorporated proved to be successful with little suppression of germination even 12 months later.

Lettuce has proved to be the most difficult vegetable to pellet successfully while tomatoes and onions in my experience, seem particularly reliable. It should be borne in mind that different varieties of a particular crop may react differently to pelleting and considerably more work is needed on many factors before this process can be highly recommended for large-scale work.

Work in the field has suffered from lack of knowledge associated with fundamentals of seed response to pelleting and precision sowing. None-the-less interesting work has been carried out. The first crop to give definite advantages from direct seeding was cabbages. Cabbage seed direct sown to permanent positions matured 4-6 weeks earlier than when transplanted. In Canterbury the transplanting check can be very great under N.W. conditions, and direct sown cabbage is not in the paddock much longer than a transplanted one.

Techniques apply similarly to cauliflower, brussel sprouts and sprouting broccoli. Using the new hybrid varieties it should be possible to mechanise the harvesting of this crop. Similar developments can be expected in lettuce and celery.

<u>Onions</u>

Whether or not onion pelleting is necessary is still open to debate. Our work at Lincoln certainly has indicated that with precision sowing, there is a definite improvement in the control of the size of the onion. Pelleted seed has proved advantageous although more care with depth control was found necessary. Onions trickle sown at 1 inch depth were compared with onions pelleted and precision-sown at $\frac{1}{2}$ an inch. The latter were far too close together and if alternate bulbs had been removed and placed in between the rows to fill in all that bare soil then more could have been accommodated easily. All these plots had been untouched by hand weeding, having been kept clean by pre-emergence sprays of Propachlor. If narrow rows are required then a good weed control must be obtained first as there is no hope of steerage hoeing if rows are 4-6" apart.

Herbicide trials are therefore an integral part of work at Lincoln and it is because of the very great success with Propachlor that we felt confident about trying rows 4-6" apart during 1968-69. How to get 4" row centres was another problem. The nature of the unit made the closest row spacing 8". It was therefore necessary to develop a second tool bar and obtain a second series of units. Both units suspended quite happily on the hydraulic, creating a very pleasing bed system which would be fully utilised.

And there I regret to say, the story must end on onions this year as in company with others, the exceptional winds and cold in October did so much damage to onions and soil that the trial was discontinued.

Tomatoes

Finally tomatoes, perhaps not a crop ideally suited to Canterbury but even so one ideally suited to these new techniques of growing and therefore worth investigating.

Preliminary trials last season were very impressive and led to a much more complex trial being laid down during 1968-69. All seeds were pelleted and direct sown but a transplant comparison was included and was placed in the field as traditional on 15 November.

Three sowings were made this year - 20 October, 4 November and 18 November - and there were 9 density-treatments all based on 5 foot bed systems.

3 treatments had only 1 row/5' bed but spacings 2, 4 and 6" in the row
3 treatments had 2 rows/5' bed spacings 2, 4 and 6" in the row
3 treatments had 3 rows/5' bed spacings 2, 4 and 6" in the row

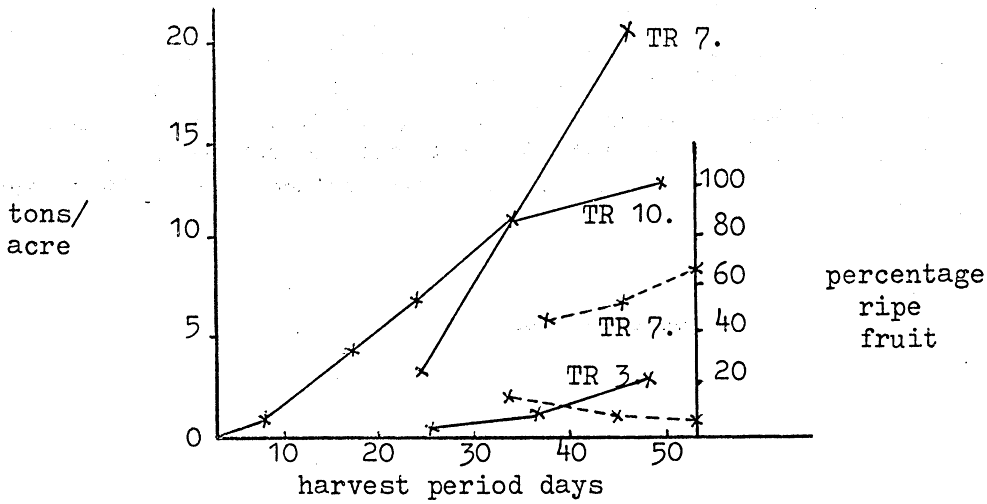
Densities thus ranged from 8,000 to 80,000 plants per acre.

The whole was based on variety Fireball. The first sowing was aimed at being sown before the last frost but due to cold soil temperatures emergence would not occur until after the last frost. Thus the first sowing would be as early as transplants which would suffer transplanting check after planting on 15 November. The two other plantings were aimed at determining how long the season could be in Canterbury.

Things went very well indeed, the first sowing emerged before the transplants were planted but transplants had a good rain at planting which reduced the growth check. Then disaster struck in the form of a violent hailstorm. Hail up to 2" long battered the crops and the tomato area looked a sorry sight. However by late February recovery had been dramatic and the fruit was setting. By March the picking had begun and the preliminary results for the first sowing can be divulged. In modern tomato growing we are after not only total yield and fruit quality but also total marketable yield at any one point in time to facilitate the destructive harvest necessary for mechanical harvesting. Only in this way can costs be kept to a minimum.

Figure 1 is a dramatic summary of the results extrapolated to an acre basis from 38 foot long plots. The trial is statistically sound and therefore extrapolation should be acceptable.

Figure 1 Total Marketable Fruit to 10 April (continuous lines)
Percentage Total Fruit (dotted lines)



Only two treatments have been placed on the graph - TR 7. which represents 80,000 plants per acre and TR 3. which represents 8,000 plants per acre. TR 10. is a transplant observation treatment for comparison 1 row to the 5' bed, 12" between plants approximately 4,000 plants per acre. The total accumulated yield over 6 harvests by the transplants was approximately 13 tons/acre by 10/4. TR 7. came into fruit later but by the second harvest was equal to the transplant and on 10 April represented a ripe marketable yield of over 20 tons per acre.

What is more, destructive harvests taken from replicated 10 foot portions of the guard beds indicated an increase of ripe fruit as a percentage of the whole crop from over 40 per cent on the first harvest to something close to 70 per cent by the final harvest.

Why the terrific difference between the effects of high and low densities? The plant at low density is seen to produce a much larger plant. It appears to devote a lot of valuable time to growing leaves and shoots at the expense of flowers and although potentially will produce a large yield per plant, this is at the expense of earliness and length of fruiting season. The high density plant, on the other hand, soon runs into competition factors. In the early stages this is advantageous because it gives mutual shelter from the cold winds and hastens growth even more. The plant also soon makes flower trusses and because of competition only makes a very few which quickly ripen and all at the same time.

Much work remains to be done before a new process crop can be said to have been found for Canterbury. New varieties even more suitable will arise from Mr Giesen's work at the Department of Scientific and Industrial Research, studies on nutrition and water requirements will give rise to even higher yields. Investigations into disease control at higher densities will undoubtedly be needed. Herbicides must be developed to remove the need for expensive hand labour. If these developments come to pass with the elimination of transplants, use of herbicides and finally, mechanical harvesting, then it is easy to see that the grower will be able to accept less not more from the process firm.

This then is the type of work we are developing at Lincoln College. The exciting possibilities seen in the tomato work can be replicated in nearly all fields of vegetable growing, including peas and beans. Vegetables have too long been the poor relative of crops, good to eat but not nice to grow. I hope this brief look at what can be achieved through research will help you to visualise a vegetable industry in New Zealand based on science and not tradition.

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