The economics of poor seed quality in a transplant nursery

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Abstract

The use of cell transplants grown by nurserymen in compartmentalised trays has become popular in New Zealand during the last five years. Costs of establishment using cell transplants can be higher than bare root transplants but benefits of accurate scheduling, mechanised handling, earlier production, shorter time in the field and uniformity, have meant that the system has continued to flourish. The system has high production and fixed costs which has meant the germinability of the seed has an important bearing on the commercial viability of a transplant nursery. This paper illustrates the economic costs of poor germinability using a cost of production model developed on a Lotus spreadsheet. The model demonstrates, for example, that the increase in costs per 1000 plants produced, exceeds the cost of the seed for these plants when germination drops to 85%. The availability of higher quality seed lines with good germination and high varietal purity would be of significant benefit to nurserymen and their clients.

Additional key words: *cell transplants, germinability, cost modelling, varietal purity.*

Introduction

In 1987 our vegetable growing business shifted from using bare-root transplants to cell transplants for stand establishment of brassica, celery, lettuce, silver beet, tomatoes, peppers and other crops which we transplant. The reasons for changing to cell transplants were:

a) conservation of expensive seed by providing better germination conditions and better scheduling of requirements,
b) the improved quality of transplants because of greater control of growth and the fact that the cells provide a reservoir of nutrients and water when transplanted,
c) plants can be held if conditions are unsuitable for planting,
d) the need for post-establishment irrigation is lessened,
e) cheaper weed control and,
f) earlier production.

The change has been successful and has resulted in less seed use, especially with improved germination conditions through the use of a germination room and more accurate seed sowing. We have now moved to contract growing of cell transplants for other commercial growers.

Seed quality

Seed quality is of major concern to cell transplant nurserymen. Despite the importance of seed for vegetable production in New Zealand, there has been little literature published on vegetable seed quality improvement and vegetable seed usage in this country. Global seed companies have large resources to put into plant breeding research and development, seed growing and marketing, and this has meant that, in general, it is easier to procure seeds from overseas rather than develop a national seed production industry. New Zealand does, however, have some locally bred cultivars, e.g., onions, curcurbits and silver beet, although one variety of silver beet seed is produced in the United States because of lower costs and marketing opportunities in the U.S.

There are several distinct characteristics which influence the seeds' utility to the grower. These are:

a) varietal purity,
b) physical purity,
c) germination,
d) vigour,
e) health.

This paper is mostly concerned with the economic effect of germination, but it is worth noting that varietal purity is a major problem in that hybrid seeds, especially those of the popular brassica varieties, do contain some off-types which cannot be dealt with effectively when using cell transplants for stand establishment. In this type of situation, the gaps in the paddock which cell transplants solved have been replaced by off-types. Since cell transplants cost about twice as much as bare-root

transplants to produce (F. Bristol, unpublished work), this is a significant problem to the vegetable grower using cells for hybrid lines, especially brassica crops (Chudleigh, 1989). The seed health issue too, should not be overlooked: our own problems can include black rot in brassicas and *Septoria* leaf spot in celery.

Modelling the Cost of Production

In 1987, before a complete change was made to cell transplants, a trial greenhouse was set up for one year. The 120 m^2 trial greenhouse produced 2,128 trays, each containing 198 cells, 53% of its full production of 4,000 trays per annum. From the records kept during the course of the trial, a cost production model on a spreadsheet (Lotus 1 2 3) was developed. This model includes those costs related directly to production of the cells and those costs associated with capital investment in the project. The model was developed in terms of costs per 1000 cells produced. Variables which can be built into this model include the germinability of the seed.

The cost of poor seed quality can easily be illustrated with this model. Simply changing the germination percentage causes the model to produce a new figure in dollar costs per 1000 plants (Tables 1 and 2).

Discussion and Conclusions

Seed of poor quality (particularly low germinability and low uniformity of germination) has a significant economic cost in producing cell transplants. With the example of broccoli (Table 1), the increase in costs when the germination percentage drops to 85% exceeds the cost of seeds per thousand plants. It is common practice in our nursery to double sow and thin when germination drops to 70% as at this stage the additional seed costs become viable when set against the additional labour costs incurred by thinning.

Seed with high germination percentages certainly has economic value to the grower. This paper illustrates the cost to the grower/nurseryman of poor quality seed and perhaps the seed industry should examine closely the reasons for poor seed quality. The marketing of separate lines for those who wish to purchase high quality seed is the answer. Lack of germinability under the favourable conditions offered by cell transplant systems largely result from factors which affect seed viability. These include:

a) improper seed development or premature harvest,
b) injury during harvest processing and drying,
c) seed ageing due to inadequate storage. A storage temperature of close to 0°C and a seed moisture content of 7% appear to be appropriate for most vegetable species,
d) dormancy.

We do experience some problems from seed that is dormant or becomes dormant. In summer, lettuce thermodormancy problems have been alleviated by seed priming (Heydecker and Coolbear, 1977). Celery seed germination has also been enhanced with hydration-type treatments (e.g., Coolbear *et al.*, 1991).

Plant breeding is one way of making seed quality improvements (Gray, 1983), however seed technology improvements also have a clear quantifiable economic benefit to the grower and nurseryman (Nagely, 1989). Among those which are currently being researched and developed, the separation of viable and non-viable seeds at the pre-sowing stage is of particular importance. The challenge for the seed industry is firstly to supply the cell transplant producers with seed of 95% plus germination

Table 1. The cost of production for broccoli transplants using seeds of different germinability (1987 costs).

Germination (%)	Production costs[1]	Fixed costs	Total costs	Increase in costs
100	22.44	7.14	29.58	
95	23.51	7.51	31.02	1.44
90	24.70	7.93	32.63	3.05
85	26.03	8.40	34.34	4.85
80	27.53	8.92	36.45	6.87
75	29.22	9.52	38.74	9.16

[1] Seed cost per 1000 plants is $3.66.

Table 2. The 'cost of production model' applied to lettuce cell transplants using seeds of different germinability (1987 costs).

Germination (%)	Production costs	Fixed costs	Total costs	Increase in costs
100	18.92	7.14	26.05	
95	19.80	7.51	27.32	1.27
90	20.79	7.93	28.72	2.67
85	21.89	8.40	30.28	4.23
80	23.12	8.92	32.05	6.00
75	24.53	9.52	34.04	7.99

and then, secondly, to ensure that seed lines are as free from off-types as possible.

Normal contract production practice in our nursery has the growers providing the seed and we charge them on a per tray basis. Thus, increased costs per 1000 plants are borne by the client. If we were to take control of seed procurement and be more discerning in the quality of seed we purchase, it would mean that we would be able to pass on considerable benefits to client growers.

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