THE POSSIBLE USE OF TRANSPLANTS FOR ESTABLISHING SEEDCANE NURSERIES

By D. W. THOMAS

South African Sugar Association Experiment Station, Mount Edgecombe

Abstract

Both heat treated and untreated stalks were cut into single budded setts and planted into trays designed to lessen transplant shock. A tray consisted of 72 compartments, each shaped like an inverted pyramid measuring 50 × 50 mm at the top and 100 mm in depth. The germination rate of the setts varied from 63 to 91%. Approximately three months later the plants were ready for transplanting. At a spacing of 1,4 m between rows and 0,5 m within rows, 14 285 plants are required per hectare. With a germination rate of 80% the amount of seedcane needed to provide suitable buds to cut into single budded setts would be approximately two tons. The benefits of using transplants for nurseries, and certain commercial plantings, are discussed.

Introduction

The usual planting material for both commercial and seedcane crops is in the form of setts. In South Africa and in other countries, interest has been shown from time to time in using plants produced in small nurseries for estabishing fields (Boyce,[3] Judd,[6] Ramaiah *et al*[9]).

Various methods of propagating cane more efficiently have been tried, for example, bud chips have been used to reduce the amount of seedcane required (Ramaiah *et al*[9]). Where buds are used, the rate of propagation is increased because most of the buds on a stalk can be made to germinate and produce more individual plants. Rapid multiplication by tissue culture is another possibility (Hendre *et al*[5]). Any method by which the rate of propagation can be increased and the quality maintained, is a useful management aid particularly for new varieties and for bulking-up disease-free seed material. However, all these techniques are dependent on raising plants in a nursery and transplanting them into the field.

An efficient system of raising and transplanting vegetables (Todd[11]) has been developed in Florida. Plants are grown in inverted pyramid shaped compartments in trays which are easy to handle and which are usually suspended on wires about 0,5 m above the ground so that root growth can be controlled. The roots develop in the growing medium but when they reach the hole at the bottom of each compartment their growth is inhibited by light. When the plants ae pulled out of their compartments, they come out easily and their roots are not damaged, and so transplant shock is lessened.

The observations from three series of plantings in which plants were grown from single budded setts in these trays are described in this paper. The propagation potential and quality advantages for nurseries are also discussed.

Procedure

In all the trials, cane stalks were cut with a cane knife into single budded setts approximately 30 mm long. The setts were dipped in a fungicide and planted into trays made of polystyrene, each of which had 72 compartments, each shaped like an inverted pyramid measuring 50 × 50 mm at the top and 100 mm deep (Figure 1). The compartments were filled with ground pine bark or old filtercake mixed with compost. The trays were placed on wires about 0,5 m above the ground. After germination, the plants were given a balanced nutrient mixture twice a week. The day before transplanting, the leaves of the plants were trimmed. In the field, the plants were spaced 0,5 m apart and the rows were 1,4 m apart.

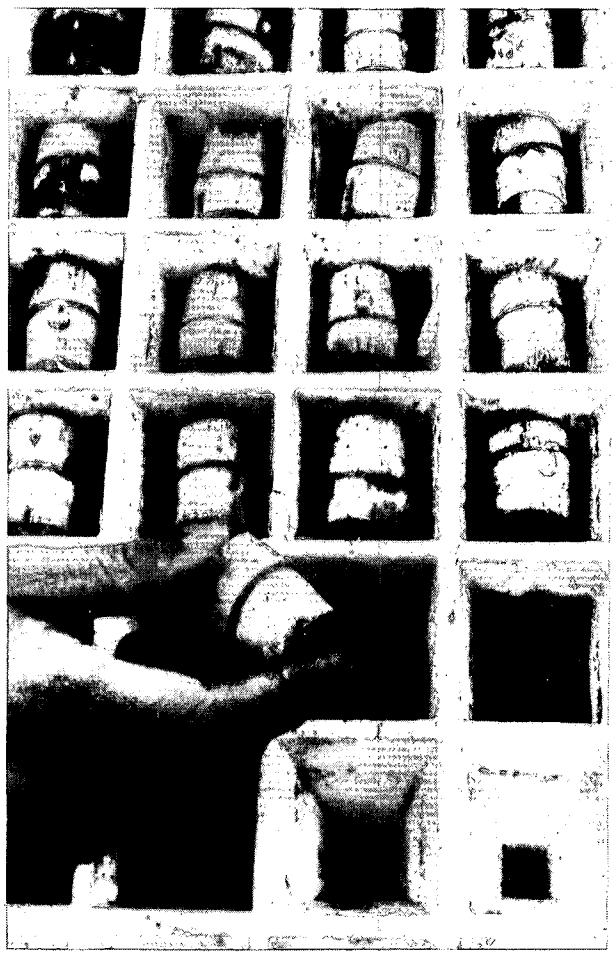

FIGURE 1 Planting single budded setts into a tray.

Trial 1

In August 1981, two commercial varieties, NCo 376 and N55/805, were each planted into three trays filled with the filtercake mixture. They were kept in a glasshouse at a minimum temperature of 22°C for a week before being taken outside. They were transplanted into the field in October 1981.

Trial 2

In May 1982, whole stalks of variety 71L760 were heat treated for two hours at 50°C. They were then cut into single budded setts and planted into 75 trays filled with pine bark. In October 1982 the plants were transplanted into the field.

Trial 3

In May 1983, single budded setts of an unreleased seedling from the breeding programme were planted into 54 trays filled with the filtercake mixture. The trays were kept in a glasshouse for four weeks at a minimum temperature of 22°C. They were transplanted into the field in early September 1983.

Observations and Discussion

Germination was lower in Trials 2 and 3 than in Trial 1 (Table 1), probably because less care could be taken in the chopping up of the stalks in the larger trials. The use of two circular saw blades set the appropriate distance apart should result in cane setts being cut more quickly, accurately and with less damage to the buds (Raaff,[8] van Rooyen[13]). The hot water treatment of the whole stalks before they were cut up may also have contributed to the poorer germination in Trial 2. Subjecting the single budded setts to hot, humid conditions for a few days before they are planted into the trays should improve germination. The amount of material to pre-germinate is small as a single budded sett weights approximately 30 g (Figure 1). Hot water treatment of these setts for nurseries is an attractive proposition if a reasonable level of germination can be obtained. In a field trial conducted by Bechet,[2] 57 percent of the heat treated single budded setts germinated but it is possible that this could be improved if the buds were kept in ideal conditions for germination.

TABLE 1

Germination rate of single budded setts in trays

Trial No.	Variety	No. of buds	Germination percentage
1	NCo 376	216	91
	N55/805	216	86
2	71L760	5 400	63
3	Seedling	3 888	73

Growth

Plant growth was satisfactory in the trays containing both the filtercake mixture and the pine bark. Any horticultural potting mixture, including a filtercake/sand mixture should be suitable for use. Soilless media offer many advantages, because physical and nutritional properties can easily be adjusted to meet the specific requirements of plants (Bunt[4]). Two types of roots develop from a planted sett, first the sett and later the shoot roots (van Dillewijn[12]) and it takes about three months from the time of planting for a shoot root system to develop well in the trays.

Estimating seedcane requirements

If transplants are spaced 0,5 m apart within rows spaced 1,4 m apart and 80 percent of the eight or nine better buds germinate per stalk, then just over 2 000 stalks weighing roughly two tons, will be required to produce sufficient planting material for one hectare. Plants can also be derived from various parts of a plant by tissue culture methods. For example, 200 000 plants can be obtained from a single shoot tip in six months (Hendre *et al*[5]).

Cost

The cost of approximately two tons of seedcane needed for one hectare, plus the cost of cutting out the buds, planting them in trays and looking after them for a few months, would be considerably more than the cost of eight tons of conventional seedcane required for one hectare. This would however be largely offset by factors such as the reduction in the cost of heat treatment; if the buds only are treated there would be about 90 percent less material to be treated. The transplant method also saves on growing approximately six tons of seedcane and the area so taken up could remain in commerical production. Tissue culture methods are too expensive and can, at present, only be considered for new varieties.

Yields

With the optimum plant population and adequately sized plants, there should be little difference in yield between fields established with transplants and those established in the conventional way, provided the transplants suffer no setback after being planted out in the field. In Hawaii (Judd[6]) similar yields were obtained from crops established by these two methods though stalk population was somewhat lower in the case of transplants. Good establishment initially appears to be essential and practices such as using transplants with well developed root systems, planting during the cooler months and applying some water are probably worth adopting. It appears also that the roots must be kept moist during the transplanting operation as significant yield differences occurred in a vegetable crop between plants which had wet roots and those which had relatively dry roots (Welch & Inman[14]). Trials to investigate the relationship between yields and the size of a transplant and the effect of spacing, are being carried out.

Advantages of nurseries

The quality of the seed material produced is likely to improve by using transplants for establishing nurseries. Off-type stalks can easily be identified when the stalks are being cut into single budded setts. For example, eight such stalks were found when the cane was being cut into setts for Trial 2. The nursery established with the transplants from this trial has proved to be true to type despite the fact that the source from which the seedcane came was of mixed varieties. Because the stools developing from transplants are easily distinguished from each other (Figure 2) or from the old crop, the removal of diseased, rogue or volunteer plants is greatly facilitated.

FIGURE 2 A nursery established with transplants.

A transplant scheme has the built-in advantages of producing quality plants and the ability to bulk-up nearly four times faster than the conventional method, therefore it is ideally suited to the two stage nursery programme which is recommended for large scale seedcane production (Anon[1]). Perhaps a second stage nursery established with transplants produced from transplants in a first stage nursery, without further hot water treatment, could be considered as a first stage nursery and treated accordingly. The chances are high that it would be as disease-free, and as true to type as a conventional first stage nursery

(after routine inspections and removing diseased stools). Although it would be one stage further away from hot water treatment; the second stage transplant nursery could be checked for RSD.

In some mill areas there is a tendency to centralize seedcane nurseries (Paxton[7]). In such schemes seed material must be transported over long distances and in such circumstances transplants should be advantageous because they are light. Transplants were found to weigh just under 100 g each (Figure 3), so slightly more than a ton of planting material would be needed to plant one hectare of land at a spacing of 1,4 m × 0,5 m. This type of central nursery scheme could be especially useful for the small growers of KwaZulu, where only a few kilograms of plants might be transported over long distances to their small nursery plots.

FIGURE 3 Plants ready to be transplanted.

Cutting and planting single budded setts in trays should perhaps be done during late summer when it is hot, which would be beneficial for germination and would also fit in with the period of low labour demand on the farm (Thompson & Moberly[10]). Planting could then take place from autumn to early spring when it is cooler.

Planting transplants into commercial fields could perhaps be considered in instances of severe disease outbreaks or critical seedcane shortages, where even the top few buds of millable cane could be used as seed material. Filling up gaps is another possible use and transplants also appear to be suited to highly mechanized planting. Further work will determine if there is any commercial potential in these directions.

Conclusion

The advantages of transplants should offer a useful option for nurseries.

Acknowledgements

This paper would not have been possible without the help of my colleagues at the Experiment Station, Agri-Lyon (Pty) Ltd, a number of sugarcane farmers and 'speedling' producers, all of whose assistance is gratefully acknowledged.

REFERENCES

1. Anon (1981). Seedcane production. *S Afr Sug Ass Exp Stn Bull* No 21: 9.
2. Bechet, G. R. (1979). Unpublished data.
3. Boyce, J. P. (1970). Plant population studies in irrigated sugarcane. MSc thesis, Univ of Natal.
4. Bunt, A. C. (1983). Recent developments in soilless media. *Span* 26,1: 12–14.
5. Hendre, R. R.; Iyer, R. S.; Kotwal, M.; Khupse, S. S. & Maxarenhas, A. F. (1983). Rapid multiplication of sugarcane by tissue culture. *Sugar Cane* No 1: 5–8.
6. Judd, D. S. (1970). Transplant experiments harvested. *Ann Rep Haw Sug Plant Assoc*: 125.
7. Paxton, R. H. (1983). Pest and disease control committees — the first year of operation. *Proc S Afr Sug Technol Ass* 57: 95–98.
8. Raaff, S. J. (1983). Personal communication.
9. Ramaiah, B. B.; Rao, G. N. & Rao, G. H. P. (1977). Elimination of internodes in sugarcane seedpiece. *Proc int Soc Sug Cane Technol*: 1509–1514.
10. Thompson, G. D. & Moberly, P. K. (1976). Programme planning - a step towards improved sugarcane production. *Proc S Afr Sug Technol Ass* 50: 40–49.
11. Todd, G. K. (1983). Personal communication with M. Kruger of Agri-Lyon (Pty) Ltd.
12. van Dillewijn, D. (1952). *Botany of Sugarcane.* Wattham, Mass., USA 53p.
13. van Rooyen, B. (1983). Personal communication.
14. Welch, N. C. & Inman, J. W. (1982). Celery yields and uniformity are affected by pre-transplant practices. *California Agric March–April:* 14–15.