SOME OBSERVATIONS ON PROPAGATION AND SELECTION IN YOUNG POTTED SUGARCANE SEEDLINGS

By D. W. THOMAS
South African Sugar Association Experiment Station, Mount Edgecombe

Abstract

Sugarcane seedlings which had grown in pots for eight months were cut at soil level and weighed and the brix values of stalk juice determined. Both the remaining underground parts and the stalks (setts) were used to establish single stools in the field. Only 45 - 58% of plants survived when underground parts were used, while 82 - 98% survived with the use of setts. A correlation coefficient of 0,34 was obtained between above ground masses of potted seedlings and cane masses of single stools, and one of 0,32 between brix values in seedlings and those in single stools.

Introduction

In the Mount Edgecombe sugarcane breeding programme, seed is sown in January and seedlings are transferred to small pots in early February, and transplanted to the field in September or October. Seedlings therefore spend approximately 8 months in the pots before being transplanted to the field. Normally they are trimmed a number of times during this period to make them sturdier for transplanting, but if left untouched they produce stalks 0,1 - 0,5 m in length. Accordingly it might be possible to select the better seedlings at the time of transplanting, and so either decrease the number of plants that must be taken to the single stool stage in the field, or, by increasing the number of seedlings grown in the pots, improve the general quality of plants at the single stool stage. Similar attempts[1,2] with much younger plants have not led to the use of selection of potted seedlings. Stevenson, Galuinadi and Pederson[5] grew plants at a later selection stage in comparatively large pots for 9-10 months, and found a fairly close relationship, for biochemical characters as well as certain agronomic attributes, between measurements made on these plants and measurements on plants in the field programme.

The present study was carried out to determine whether selection based on measurements made on potted seedlings, would be effective in improving the quality of the clones transplanted to the single stool stage in the field. Initially plants were cut at ground level for weighing and the remaining underground parts (stem bases, roots and soil) were transplanted. However, only a few plants survived this treatment and attempts were then made to use the stems of the potted seedlings as propagating material to establish plants in the field. In this paper the method of growing single stool plants from small setts, i.e. the stems of the potted seedlings, is described and a preliminary report on selection at the potted seedling stage is presented.

Materials and Methods

Shortly after germination in January seedlings are transplanted to clay airbricks having six compartments, and placed next to each other on a cement terrace, resulting in a spacing of a 100 mm x 100 mm between plants. The volume of each compartment is 0,56 ℓ. The soil used is a mixture of sand, top soil and compost which is made from bagasse and filtercake. Superphosphate and muriate of potash are added and the mixture is then sterilized with methyl bromide. Spray irrigation is applied through perforated pipes about three times weekly depending on the prevailing weather. Plants are normally trimmed five or six times to a height of approximately 300 mm, to make them more suitable for transplanting to the field in September or October. After each trimming they are top-dressed with a multinutrient fertilizer mixture.

Samples of seedlings were measured on the day of transplanting to the field in three consecutive years, from 1975 to 1977, each sample comprising 120 seedlings representing between one and four crosses.

In the first year the seedlings which had been trimmed in the normal way were cut at soil level and the aerial part of each seedling weighed immediately. The remaining underground parts (bottom part of stem and roots imbedded in the soil) were then planted in the field. The single stools which grew from these parts were harvested at 13½ months of age and the mass of cane of each single stool was determined.

In the second year the seedlings were grown in larger pots (volume 1,1 ℓ) and were not trimmed. The aerial part of each plant was weighed, and the brix content of juice squeezed from the bottom of the stalk with a pair of pliers was determined. The underground parts of each seedling were planted in the field, and in addition the stalks of 52 seedlings were planted in the field after cutting off the ends from which juice had been squeezed. These stalks were planted at the normal depth for setts, but at the usual spacing for single stools, 1,0 m apart in the row. Only the single stools which originated from setts were measured at the time of harvest, because of the poor germination from the underground parts; single stool cane mass was measured and the brix content of juice from the middle part of each of three stalks taken from the centre of the stool was determined.

In the third year the seedlings were grown in the usual way in airbricks, but were not trimmed; each seedling produced only one stalk. Mass of the aerial parts of the plants and brix contents were determined in the same way as before. Single stools of the 120 seedlings were established from stalks planted in the same way as in the previous year, the underground parts being discarded. These single stools have not yet reached harvesting age.

Simple correlation coefficients were calculated between mass of the above ground part in potted seedlings, and mass of cane in single stools for the first two years, and between brix contents in juice from potted seedlings and single stools, respectively, for the second year.

Results and Discussion

Propagation

The remaining underground parts of harvested seedlings proved to be unsatisfactory for the propagation of single stools, with only 58 and 45 per cent of plants surviving in the first and second years, respectively. In contrast, when setts were used 98 and 82 per cent survived to produce single stools in the second and third years respectively. A shallower depth of planting than that used might further improve establishment, because setts from potted seedlings are small (Fig. 1) and probably do not all have sufficient reserves for germination. Thus, emerging primary shoots were obviously less vigorous than those obtained from normal seedcane setts, presumably because the seedling setts were smaller, particularly in the third year, owing to the pot volume being only about half of that used in the second year.

Selection

In the first year there was little correlation between cane mass of single stools and above ground mass of potted seedlings ($r = 0,09$). This may have been due to the poor establishment when the underground parts were used for propagation, which resulted in uneven growth and missing plants, as well as the

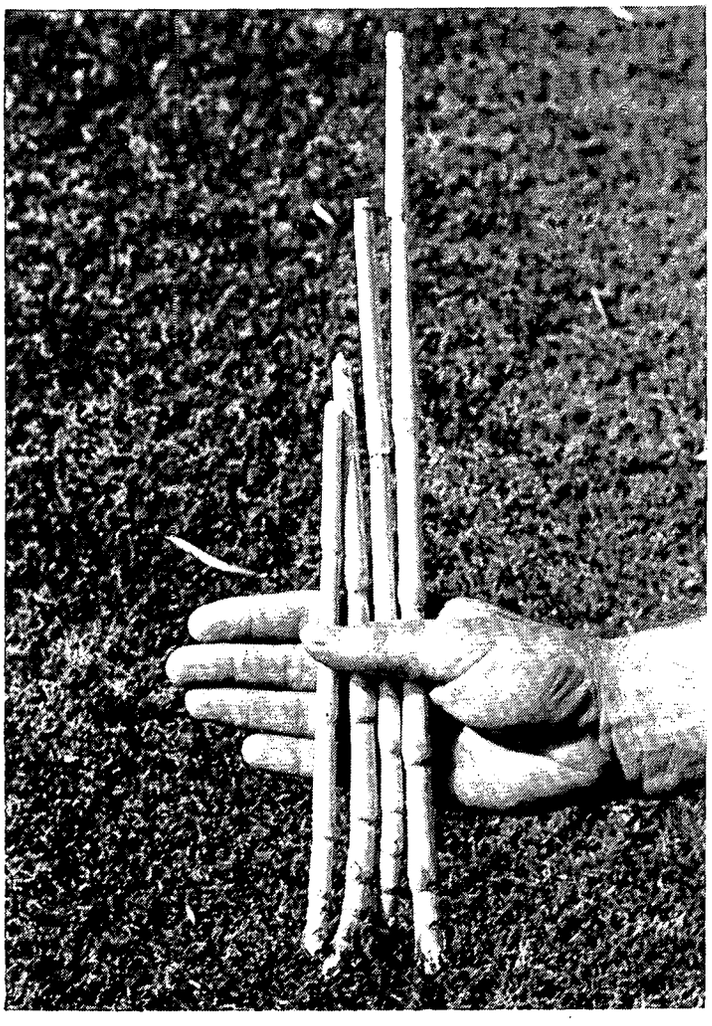

Figure 1: Stalks grown in pots.

resultant variation in the amount of competition to which single stool plants were subjected.

Considerably better correlations between potted seedlings and single stools were obtained in the second year when setts were planted (Table 1). The correlation coefficient for mass was significant ($P<0,05$), and that for brix value was also significant ($P<0,05$) when one apparently anomalous variate was omitted.

TABLE 1

Coefficients of correlation (r) between potted seedlings and single stools for the second year (1976)

Variable	r
Mass	0,34
Brix	0,24 (0,32)*

***Omitting one anomalous value**

These correlation coefficients compare fairly favourably with those obtained by certain other workers, particularly that for mass (see Table 2). However, it is possible that the correlation for mass obtained here was biased upward by differences in the size of sett planted. Size of sett could presumably have been positively related to mass of the above ground part of the plant in potted seedlings. In turn, cane mass in the single stools might have been influenced by size of sett planted. It seems doubtful, however, if any such influence could have been large, considering that single stools were nearly a year old when measured; by this time the effect of any early difference in single stool size resulting from differences in size of sett could well have disappeared.

TABLE 2

Some published coefficients of correlation between successive early selection stages

Authors	Mass	Brix
Daniels and Stevenson[3]	0,10	0,34
Ladd et al[4]	0,35 (Volume)	0,35
Walker[6]	0,14	0,35

The potential benefit of selection in potted seedlings can perhaps be best assessed by comparing the single stools that would have been selected by this means with the whole population of single stools. It is probably undesirable to practise more than mild selection at the initial stage of a selection programme, so that not more than, say half the seedlings should be discarded at the time of transplanting to the field. The average mass of cane of the single stools derived from the heaviest 50 per cent of potted seedlings was 9,4% greater than the average mass of cane of all the single stools. Similarly, there was a difference of 1,4% in mean brix content between single stools derived from the 50 per cent of potted seedlings having the highest brix contents and the population of single stools as a whole. These changes in means are fairly small, but selection in potted seedlings could nevertheless be worthwhile, because only a comparatively small effort would be required to grow twice the usual number of potted seedlings, so as to allow the best 50 per cent to be selected. Alternatively, the method could be used to decrease the number of single stools grown, so saving on the amount of land and work required at this stage of the selection programme. On the other hand, it could prove to be impracticable to determine the brix values of many thousands of seedlings, so that selection would have to be based on mass only. Moreover, further results are needed to verify the size of the improvements which can be expected from selection at this stage. Those from the seedlings planted in the third year of this study should be available late in 1978.

Acknowledgements

I thank Messrs. R. S. Bond, R. L. Harding, E. Edwards and M. J. Schwikkard for their advice and assistance, and Dr. J. C. S. Allison for commenting on the paper.

REFERENCES

1. Anon. (1959). BWI Cent Sug Cane Breeding Sta Ann Rept 1958-59 : 23-26.
2. Breggar, T. (1932). Some notes on selection of cane seedlings in the early stages of the first year. ISSCT Proc 4 : 114.
3. Daniels, J. and Stevenson, N.D. (1971). The reduction of the inter-generation interval in the Fiji breeding programme. ISSCT Proc 14 : 195-204.
4. Ladd, S. L., Heinz, D. J., Meyer, H. K. and Nishimoto, B. K. (1974). Selection studies in sugarcane. 1. Repeatability between selection stages. ISSCT Proc 15 (1) : 102-105.
5. Stevenson, N. D., Galuinadi, J. K. and Pederson, D. G. (1974). An evaluation of pot methods for clonal selection in sugarcane. ISSCT Proc 15 (1) : 106-113.
6. Walker, D. I. T. (1967). Some correlations in sugarcane selection in Barbados. ISSCT Proc 12 : 950-955.