BEET PRODUCTION ON THE GISBORNE PLAINS

M.H. Gray and S.J. McCormick
Agricultural Research Division, Ministry of Agriculture and Fisheries,
Gisborne and Hamilton

ABSTRACT

Sugar beet cultivars, Amono and Monoire, were grown successfully in 1980 and 1981 despite establishment being hindered by unusually dry spring weather and some herbicide failure under these conditions. Similar yields of 132 t/ha root fresh weight (28 t/ha dry matter) were obtained with populations of 90,000 plants/ha in 1980 and 68,000/ha in 1981. The trials were sown in September and harvested in mid May. Sugar yield was estimated at 23 t/ha. Although high seeding rates (120,000 - 320,000/ha) aided stand establishment under dry conditions in 1980, there was no evidence that populations greater than 70,000-90,000 plants/ha would increase yield. Delay in harvest from May to July, 1981 increased fresh weight root and sugar yields by 10% but the later harvest led to greater difficulties in harvesting and increased crop soilage.

It was concluded that under normal spring weather conditions, the crop could be established readily in the district and weeds effectively controlled with herbicides. Yields in the order of 100 t/ha fresh weight and 16 t/ha of sugar could be expected.

INTRODUCTION

The possibilities of producing sugar from beet in New Zealand have been raised on several occasions over a long period. Greenwood (1980), when summarising trials done in Otago and Southland, mentioned talk of a Government subsidised industry as early as 1871. He also quotes Gray who in 1895, after collating work done in Southland, Otago, Canterbury, Wellington and Waikato, commented that "the results are sufficiently low to cast doubt as to the successful culture of sugarbeet in New Zealand". In those days, Imperial was the main cultivar sown. Greenwood's summary of the results of various workers in the South Island up until the early 1970's indicated yields had increased greatly over the years due to improved husbandry and higher yielding cultivars. Drewitt's work (1976), done in Canterbury between 1970 and 1973, showed similar improvements in yield from new cultivars. He demonstrated also the importance of early sowing as yields dropped off markedly when sowings were made later than the end of August. However, the interest in sugar beet growing in the late 1970's has been directed towards the use of the sugar as a substrate for ethanol production as a liquid fuel. It is in this context that trial crops were grown in the Gisborne region in 1980 and 1981 to assess the potential for sugar production.

MATERIALS AND METHODS

Trial 1 compared the production of sugar and fodder beet sown at different times and populations. Trial 2 studied the growth pattern of early-sown sugar beet. The trials were sown on the fertile, alluvial soils of the Gisborne Plains (Makaraka clay loam and Matawhero silt loam respectively) after permanent pasture though trial site 1 had been briefly cropped several years previously.

Trial 1

The trial consisted of a 4 replicate, split plot design with times of sowing (17 September and 15 October, 1980) as the main plots and three populations (80,000, 160,000 and 320,000 plants/ha) of Amono sugar beet and Monoblanc fodder beet as sub plots. The sub plots were 24 m long with 8 rows at 0.5 m centres. The herbicides, lenacil at 1 kg ai/ha and cycloate at 4 kg ai/ha, were applied preplant in 340 l/ha of water and incorporated. Seed was sown 3-4 cm deep with a Stanhay precision seeder at populations 30% higher than required. Disulfoton was applied at 1.7 kg ai/ha for aphid control and 250 kg/ha boron-supplemented serpentine superphosphate was broadcast prior to emergence. The herbicides, metamitron at 4.5 kg ai/ha and phenmedipham/desmedipham at 0.23/0.23 kg ai/ha were applied in 340 l/ha of water to the first and second planting on 21 October and 11 December respectively. Assessments of root and top fresh weight yields, percentage dry matter and root sugar contents were made on 12 May.

Trial 2

Monoire sugar beet was sown on 10 September 1981 at 116,000 seeds/ha with a Nodet vacuum precision seeder in rows spaced 0.5 m apart. Four replicates each of 5 m^2 sub plots were sown to provide sequential sampling throughout the season. Cycloate at 5.7 kg ai/ha was incorporated preplant and the metamitron/phenmedipham/desmedipham mix, as in trial 1, applied on 11 November for weed control. The trial was irrigated on 7 October and lindane applied on 9 October at 0.8 kg ai/ha in 340 l of water to control a heavy infestation of aphids. Five harvests were taken in 2 weekly intervals starting 23 December, followed by three further harvests at 6 weekly intervals.

RESULTS

Crop establishment and weed control

In both years, unusually dry weather in spring impeded germination. With no supplementary water in 1980 and warm, dry windy conditions persisting from September to December, establishment was protracted and patchy and ranged from 34 to 47% of the seed planted to give established populations of 89,000-150,000 plants/ha. The irrigation in 1981 resulted in a 60% survival of the seed planted and a population of 68,000 plants/ha.

The major problem weeds following pasture were fathen (*Chenopodium album*), redroot (*Amaranthus powellii*), black nightshade (*Solanum nigrum*) and docks (*Rumex* spp.) with very few grass weeds. In 1980, weeds were well controlled up until the first heavy rainfall in early December. Subsequently, weed growth swamped the low density, September planting and all of the October plantings where the post emergence herbicides had been applied just prior to rain falling. This left only the medium and high density plantings of the September sowing available for yield measurements. In 1981, the preplant use of cycloate alone followed by the metamitron/phenmedipham/desmedipham mix applied post emergence two months later, gave good weed control throughout the season. This result was confirmed by weed control trials carried out in the district at that time (Rahman *et al.*, 1982).

Yields and the effect of plant population

Despite the erratic stands established in 1980, good yields were obtained in May 1981 from both sugar and fodder beet (Table 1). Monoblanc fodder beet outyielded Amono sugar beet by 30% in fresh weight root production but its lower sugar content resulted in the same sugar yield. There was no significant difference in yield or sugar content between the two densities. By April 1982, the fresh weight root yield and sugar content of Monoire sugar beet were within 3 and 6% respectively of the levels reached by Amono sugar beet in May 1981 (Fig. 1). Increases in both fresh weight yield and sugar content in the following six weeks resulted in the sugar yield in May being the same as that taken from Amono in the previous year. From May to July 1982, the root sugar content remained unchanged but root fresh weight increased by a further 10% bringing a similar rise in sugar yield. The dry matter percentage of the roots at that time was 22%.

TABLE 1: Fresh weight root and sugar yields from sugar and fodder beet at two plant densities.

Cultivar and type	Plant density 000's/ha	Fresh root t/ha	Brix value	Sugar yield t/ha
Amono S-B	120	133 A*	17 A	22.6 a
Monoblanc F-B	103	173 B	13 B	21.7 a
	92	152 a	15 a	21.5 a
	131	155 a	15 a	22.7 a

*Different capital letters show values significantly different $P < 0.01$; lower case letters $P < 0.05$.

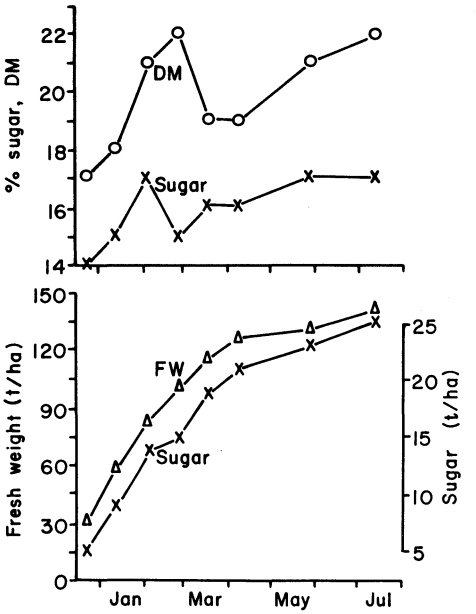

Figure 1: Change in root dry matter and sugar content and fresh weight and sugar yield with time.

DISCUSSION

It is unclear whether, under the dry conditions prevailing the full yield potential of the beet crop was expressed. As a result of the high density plantings in 1980 and the irrigation in 1981, adequate plant stands were achieved which allowed good yield expression. The resulting high yields obtained with sugar beet in each year compared favourably with yields obtained in other regions (Dunn, 1976; Wrightson, 1977). This suggests that production problems relating to the dry spring conditions were restricted to establishment of the crop and a reasonable estimate of production potential was gained.

Extrapolation between the two years suggests that a stand of 70,000-90,000 plants/ha would suffice for maximum yield. This is similar to the 75,000 plants/ha recommended by Dunn (1965). Under normal conditions, a stand of this density should be readily established and the weeds adequately controlled by cycloate incorporated before planting and a post emergence application of a metramitron/phenmedipham/desmedipham mix.

Sugar beet was clearly superior to fodder beet for sugar production although it had been thought that higher yields of fodder beet might more than compensate for the lower sugar content. With the same yield of sugar, the disadvantages of carting and processing a higher tonnage with fodder beet compared to sugar beet are apparent.

Harvesting the sugar beet in July rather than May did increase the sugar yield by 10%. However, under the wetter soil conditions normally experienced on these heavy alluvial

soils in July, the yield gain would have to be weighed up against a more difficult harvest and greater crop soilage.

CONCLUSIONS

Under normal spring weather conditions there would appear to be no problem in establishing satisfactory sugar beet stands of 70,000-90,000 plants/ha and controlling weeds with herbicides. A reasonable expectation of yield from a crop sown in September and harvested in May would be 100 t/ha fresh weight roots at 22% dry matter yielding 16 t/ha of sugar.

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