THE POTENTIAL FOR GROWING SUGARBEET IN THE MACKAY AND BURDEKIN SUGARCANE AREAS

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Summary. Preliminary trials conducted in the Burdekin in 1991 indicated that there could be an opportunity for growing sugarbeet on salt-affected areas where sugarcane was grown. Twenty seven sugarbeet varieties were evaluated in seven replicated experiments conducted on sodic/saline soils in the Mackay and Burdekin sugarcane areas during 1993 and 1994. Sugarbeet has the potential to accumulate sugar at 2.1 t/ha/month which exceeds the rate for sugarcane by 17%. The root rot *Sclerotium rolfsii* caused extensive damage and death to sugarbeet during hot and humid conditions, particularly in the Mackay area, and to a lesser extent in the drier Burdekin area. Leaf damage by the beet webworm (*Hymenia recurvalis)* was the main insect problem which proved difficult to control. The need to grow sugarbeet as a winter crop means that the growing of sugarbeet does not rotate well with sugarcane production. There would be a need for a long fallow after the sugarbeet was harvested in October/November that would reduce the production of sugar compared to a sugarcane monoculture. Sugarbeet was successfully processed through an unmodified sugarcane mill. Forty-five tonnes of sugarbeet were mixed into the cane supply at a ratio of 15:85 with little effect on mill performance. Future evaluation of sugarbeet should target other areas like the Atherton Tablelands where growers are skilled in growing delicate crops.

INTRODUCTION

In 1990, two heat tolerant sugarbeet varieties were trialed in the Burdekin to see if the sugar mill season could be extended by milling beet outside the cane crushing season from June to November. Pest and disease problems showed this was not possible with summer cropping. However, a 1991 winter-grown sugarbeet trial at Kalamia Estate near Ayr showed that sugar yields of 1.7 t/ha/month could be achieved compared to a long term production of sugar from sugarcane of only 1.2 t/ha/ month. Although these sugarbeet yields were impressive, Burdekin sugarcane could still accumulate more sugar per annum on fertile soils than sugarbeet. However, many sugarcane soils in the Burdekin and Mackay areas are considered marginal and have levels of sodicity/salinity which would restrict sugarcane production (1, 2). It was reasoned that sugarbeet could have a competitive advantage over sugarcane on these marginal soils given it's high tolerance to salinity (3).

Other advantages could be realised if sugarbeet was grown in rotation with sugarcane. Sugarbeet could help to break the monoculture of sugarcane in Australia which is believed to have caused yield decline in recent times. Also sugarbeet could provide a quicker return to growers and may help to reduce the amount of sodium in the soil if the leaf material was removed from the cropping area and used for livestock feed elsewhere. Growers in Australia would also be able to benefit from overseas technology in industrialised countries that support large R&D programs for sugarbeet, unlike sugarcane, which is mainly a third world crop.

The major objectives of this research were to:

- evaluate a number of sugarbeet varieties from overseas on salt-affected areas in the Mackay and Burdekin sugarcane regions
- to become familiar with the growing requirements of sugarbeet in the tropics
- evaluate the co-processing of a quantity of sugarbeet with sugarcane through a commercial sugarcane factory.

MATERIALS AND METHODS

Replicated sugarbeet variety trials were conducted, two in the Mackay (21? 09'S, 149? 11'E) and five in the Burdekin (19? 34'S, 147? 24'E) areas, in 1993 and 1994. Full details are in (4). Soils affected by sodicity and/or salinity at levels which would reduce sugarcane yields were used. Exchangeable sodium percentages (ESP) ranged from 9.1 to 40.3 and 17.3 to 45.0 in top (0-250mm) and sub (250-500mm) soils respectively. Specific electrical conductivity in 1:5 soil/water extracts ranged from 0.1 to 8.6 and 0.1 to 11.2 in top and sub soils. There was also a wide range of soil pH values in water from 5.7 to 8.0 and 6.4 to 8.9 in top and sub soils. Top soil textures were clay loams to clays with clay subsoils.

A total of 24 varieties were evaluated. Time of planting ranged from 1 April to 17 May and harvesting from 14 October to 10 November. Trial 1 at Mackay, 1993, had 13 varieties (Apr, Beta 1996, Beta 2988, HH41P, HH WSPM 9, HM 5892, Sophie, Beta 440435, HH 1616, HH 37 P, HH WS 91, Hills 2, HM 8351); Trial 2 & 3 at Burdekin 1993, had only the first 6 varieties listed above; Trial 4 at Mackay, 1994, and Trials 5 & 6 at Burdekin, 1994 had 14 new varieties (Seedex Aus 1, Del 941, Cerema, Beta 5315, Marathon, Kristall, Beta 3580, Beta 4454, , Seedex Aus 2, Del 942, Del 943, Gisella, Monodoro and Freja) and the variety Beta 2988 which yielded well in the 1993 trials. Trial 7 had only the first 4 varieties of the above fourteen and was located on fertile alluvial soil. Seed was supplied by Betaseed, Delitzsch UK Ltd., Hillesh?g, Maribo and Seedex Inc.

Randomised complete block designs were used with 2 or 3 replicates. Plot size varied: 4 rows x 3 m (Trials 2, 3, 5, 6); 3 rows x 10 m (Trial 1); 4 rows x 18 m (Trial 4). Number of plants per hectare were 80,000 for Trials 1,4 and 100,000 for Trials 2, 3, 5, 6, 7. Trials 2 and 3 used a 0.5 m row spacing. All the other trials used a 0.76 m row spacing so machinery could be used.

Sugarbeet yield was measured in the centre two rows of all except Trial 1 where the centre row was weighed. The full plot length was hand-harvested in every trial and root yields were estimated using clean, topped beet. Sugar content was measured in duplicate using five beet per sample from each plot. Samples were cutter-ground, a sub sample pressed to extract juice, which was analysed for sugar content by Queensland sugarcane industry methods (5). Juice clarification required a double quantity of lead acetate. Fibre was determined from a separate sub-sample. The sugar content of beet was calculated by the sugarcane method used for sugarcane payment, which uses pol in juice, fibre content and a factory efficiency factor. All data were analysed statistically for variance.

A factory trial was conducted by loading 45 tonnes of sugarbeet into rail bins used to transport sugarcane to the factory in the ratio of 15:85 sugarbeet to sugarcane. The mixture of cane and beet was processed normally at Kalamia sugar mill and the effect on factory performance monitored.

RESULTS AND DISCUSSION

Sugarbeet accumulated sugar at 1.8 t/ha/month which was equal to or greater than that for commercial sugarcane adjoining trials 1 and 6 (Table 1). The mean production of 9.5 and 10.3 t sugar/ha in trials 1 and 6 are similar to the best yields in beet growing countries. Sugar content of beet is over 17% in Europe and in trials 4 and 5 this level was exceeded, but with reduced yields.

Table 1 Mean yields of sugarbeet and sugar contents for seven variety trials.

Trial No.	Yield of beet[1] (t/ha)	Sugar content[1] (%)	Yield of sugar[1] (t/ha)	Yield of sugar[2] t/ha/month
1	61 (21)	15.7 (0.9)	9.5 (3.2)	1.8 (0.9)
2	57 (13)	11.5 (2.0)	6.5 (0.9)	1.0 (1.6)
3	20 (8)	16.8 (1.1)	3.4 (1.3)	0.5 (0)

4	33 (19)	17.6 (1.5)	5.8 (3.3)	1.2 (0.9)
5	34 (10)	19.2 (1.8)	6.5 (1.1)	1.1 -
6	70 (23)	14.9 (3.0)	10.3 (3.1)	1.8 (1.8)
7	56 (24)	17.0 (2.6)	9.4 (4.0)	1.6 -

[1] ( ) l.s.d. at 5%

[2] ( ) production of commercial sugarcane growing adjacent to the trial

There were no significant yield differences between varieties for trials 1,4 and 7. This was surprising, but could be explained by the high variances at these trials (error CV's up to 27%) for beet yield, and that varieties were highly selected and were the leading commercial varieties in the countries of origin. The leading variety in each trial was HH WSPM 9, Beta 2988, Beta 2988, Del 943, Cerema, Monodoro and Aus 1 for trials 1-7 respectively. The highest sugar yield was 12.0 t/ha for Monodoro in trial 6 with a root yield of 75 t/ha at 16.2% sugar content. Sugar accumulation was at 2.1 t/ha/month which out performed Q117 plant cane. The Q117 sugarcane variety produced commercial yields of 1.8 tonnes sugar/ha/month from replicated strips in an adjacent field beside the trial.

Mean yields were adversely affected by saline irrigation water (2.5 dS/m) in Trial 3, poor water penetration associated with high soil sodicity in Trial 4 and late planting (15 May) in Trial 5.

Root rot caused by *Sclerotium rolfsii* cannot be commercially controlled and there is no genetic resistance in the gene pool. Damage was worst in trials 1 & 4 at Mackay but less in the Burdekin trials. Root rot reduced yields significantly in Trial 4 and the harvest date was advanced to prevent further losses. Trials on a soil pH less than 6.5 appeared to have an increased incidence of root rot. The addition of lime to increase the soil pH to 7 or more may have helped control root rot (6). Beet webworm (*Hymenia recurvalis*) at Trial 4 required five insecticide applications.

Total water used by sugarbeet was 2.6 Ml/ha from rainfall plus irrigation in Trial 1. This efficiency of water use was 3.7 t/sugar/ha/Ml which exceeds the efficiency for sugarcane which is around 1.7 t/sugar/ha/Ml (6). Efficiency of water use for sugarbeet is probably higher than for sugarcane as sugarbeet is grown in the winter period when irrigation losses to surface evaporation and transpiration are a lot less.

Processing sugarbeet with sugarcane through Kalamia Mill at a ratio of 15:85 caused no major problems during a 40 minute trial run. Bagasse moisture increased from 50% to 58% at the final mill which would affect boiler operation. There was some clogging of the rotating filter screens. This was associated with the fine material from sugarbeet as 46% passed through 1mm sized screens. Pol in open cells is used as a measure of the efficiency of swing hammers used to prepare sugarcane before crushing. A test showed that 97% of pol was in open cells for beet prepared in this manner.

'Fangy roots' is the term used to describe multiple tap roots. The effect was evident in all trials using transplanted seedlings and may have been compounded by soil acidity in trials 1 and 4. Fangy roots make beets difficult to separate from soil. Soil content on fangy beet was up to 8% which is unacceptable in a sugar factory. The co-processing of sugarcane/sugarbeet would need to address the soil contamination problem.

CONCLUSIONS

- Sugarbeet can accumulate sugar at a faster rate than sugarcane and use less water

- Sugarbeet can only be grown as a winter crop as *Sclerotina rolfsii* can seriously affect summer crops of sugarbeet

- Sugarbeet does not fit into the sugarcane long fallow period so a sugarbeet/sugarcane rotation would reduce the production of sugar compared to sugarcane monoculture

- Sugar-beet can tolerate higher levels of soil sodicity and salinity than sugarcane

- Sugarbeet is a delicate crop to establish and requires specialised skills and machinery

- Sugarbeet can be co-processed with sugarcane providing sugarbeet dirt levels are low. This confirms earlier work stated by (8) and also shown by (9).

- Further research should target other sugarcane areas that have growers experienced with cropping delicate crops like sugarbeet (e.g. the Atherton Tablelands).

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