# A Guide to Replanting Sugarbeets on the Texas High Plains*

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Early planting of sugarbeets is recognized as a good gamble because of yield and pest control advantages (5,8). However, if weather or other factors become unfavorable, a less than desirable stand commonly occurs. Replanting may then be necessary; however, many factors must be considered. Replanting is expensive and there is no guarantee of improved stand. Each grower must evaluate his own conditions for emergence and establishment when replanting. Weeds, diseases, and insects may be more or less of a problem in replanted sugarbeets compared to the original planting. It is important how soon replanting can be accomplished and, in many areas, how soon the replanted sugarbeets can be irrigated for emergence. The Texas High Plains has a long growing season (mid-March to mid-November); therefore, stand density is important relative to the loss of part of the growing season that accompanies replanting. Areas with a short growing season will need to achieve a greater improvement in stand to justify replanting than will long-season areas.

Published research on replanting sugarbeets is not specific enough to be of much help. Jones et al (6) found that the original planting with somewhat less than one-half of a normal stand remaining (about 15,000 plants/A) yielded better than replanting at the four-leaf stage. Deming (1) concluded that the original planting with one-half stand was superior to replanting 4-weeks late.

Assuming that the grower can make some reasonable judgment as to cost, establishment potential, and pest problems of replanting, there still remains the question of yield potential. Both late planting and thin stand are known to reduce yield (5,7,8). The objective of this

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research was to develop a guide to replanting sugarbeets for the Texas High Plains area by comparing yield potential over a range of seeding dates and stand densities.

## Materials and Methods

Field experiments were conducted at Bushland, Texas, in 1976 and 1977 on Pullman clay loam soil. Experimental variables were planting date and seeding rate. The first planting date each year (10 April 1976 and 22 March 1977) was an early, timely date for the area and prevailing weather conditions. Later planting dates were seeded when the previous planting reached the late two-leaf stage. All plantings were irrigated immediately after sowing to assure prompt germination. At all planting dates both years, 10 seeding rates from 99 to 926 seeds/100 feet were used. Plots were four rows wide (30-inch rows), and 30 feet long with all data collected from the center two rows. A randomized complete block design with split plots and three replications was used. Planting dates were main plots and seeding rates were sub plots. The cultivar 'Mono Hy D2' was used for all experiments.

The sugarbeets were managed for high yield. They were irrigated as needed to maintain soil moisture above 50% of field capacity. Herbicides and hand hoeing were used to control weeds. Fungicides and insecticides were used as needed to control other pests. Nitrogen was added to provide 300 pounds per acre total available nitrogen. This level of nitrogen is considered adequate for 30T/A sugarbeet yield.

Data collected from the field experiments included sucrose percent, root yield, harvest loss, tare factor, stand density at two-leaf stage and at harvest, and unoccupied area within the row over 18 inches in length. Skips over 18 inches were used to calculate unoccupied area which has been shown to be a good measure of sugarbeet stands (2). Tare factor is the ratio of field root weight to clean, properly-topped root weight.

Harvest was in early November each year. A single row, puller-wheel type harvester with revolving-disk topper was used to harvest the

plots. A growth chamber study was conducted in May and June, 1978. The cultivar 'Mono Hy D2', of the same seed lot as used in the field studies, was planted 1.0-inch deep in Pullman clay loam A-horizon soil. Seven seeding dates at 3-day intervals were used. The growth chamber was maintained at a constant 70°F during 16-hour light periods and 50°F during 8-hour dark periods for the duration of the study. Data were collected to relate stage of growth with time after seeding.

All data were analyzed by standard analysis of variance and multiple regression techniques.

## Results and Discussion

Sugarbeet sucrose yield is directly proportional to the length of the growing season when length of growing season is calculated on the basis of plant development. Reducing the growing season by the time required for sugarbeets to progress from planting to the late two-leaf stage, reduced sucrose yield by about 0.76 T/A (Table 1). These sugarbeets were free of all obvious yield reducing factors as evidenced by the good yields achieved. Frequently, different planting dates would suffer different degrees of damage from pests, adverse weather, etc. If such were the case, yield would not be so closely related to length of growing season.

Table 1. Harvested sucrose yield of sugarbeets with optimum stand density as affected by length of growing season (planting date) at Bushland, Texas.

| Year | Planting Date [a] | Harvested sucrose yield [b] | Yield loss from previous planting |
|---|---|---|---|
| | | T/A | T/A |
| 1976 | 10 April | 4.68 a | |
| | 12 May | 3.90 b | 0.78 |
| | 1 June | 3.20 c | 0.70 |
| 1977 | 22 March | 4.58 a | |
| | 28 April | 3.78 b | 0.80 |
| | 20 May | 3.01 c | 0.77 |

a Each year the second and third planting dates were seeded when the previous seeding reached the late 2-leaf stage of development.

b This yield was predicted by regression analysis for the optimum stand density.

Sucrose percentage was linearly related to stand density but was not affected by planting date. With a full stand, sucrose percentage was 15.2 in 1976 and 16.8 in 1977. With half of the area unoccupied, sucrose percentage fell to 13.2 in 1976 and 15.4 in 1977. Lower sucrose percentage with thin stand has been frequently observed in past research (3,4).

Replanted sugarbeets must have a better stand than the original planting to have the same yield potential. In these studies, replanted sugarbeets yielded equal to the original planting if the replanted sugarbeets had about 15 percentage points less unoccupied area (Table 2). For example, the original planting with 25% unoccupied area and replanted sugarbeets with 10% unoccupied area both had a relative yield of 74%.

Table 2. Relative harvested sucrose yield and harvest loss of original and replanted sugarbeets at Bushland, Texas.

| Unoccupied area [a] | Relative harvested sucrose yield [b] | | Approximate stand [c] | Harvest loss [d] |
|---|---|---|---|---|
| | Original planting | Replanted | | |
| % | % | % | beets/100 ft. | % |
| 0 | 100 | 83 | 178 | 1.6 |
| 5 | 95 | 78 | 147 | 2.4 |
| 10 | 90 | 74 | 121 | 4.1 |
| 15 | 84 | 69 | 102 | 6.9 |
| 20 | 79 | 64 | 87 | 9.2 |
| 25 | 74 | 60 | 76 | 11.5 |
| 30 | 69 | 55 | 65 | 15.0 |
| 35 | 63 | 51 | 55 | 19.0 |
| 40 | 58 | 46 | 48 | 23.0 |
| 45 | 53 | 42 | 42 | 27.5 |
| 50 | 48 | 37 | 37 | 35.0 |

a Percent of field area not occupied by sugarbeets. Calculated as % of row length represented by skips over 18 inches long.

b All yields are a % of the highest yielding situation, namely, the original planting with no unoccupied area. These yields are the harvested portion only, i.e., roots lost at harvest are not included here.

c This is roughly the stand in 30-inch rows which would be equivalent to the given corresponding % unoccupied area.

d The relationship between harvest loss and stand density was the same for the original planting and for replanted sugarbeets. Thus, the values given here apply to both situations.

Obviously a grower would not be wise to replant if the best that he could hope to achieve would be a yield equal to the original planting. The cost of replanting in the Texas High Plains area would be equal to about 5% of the original yield potential. If the grower then assumed that he could achieve a stand with 5% area unoccupied by replanting, he could break even by replanting a stand with 25% unoccupied area. However, the grower should remember that replanting does not guarantee a good stand and, in fact, the replanted sugarbeets could have a worse stand. To cover the risks and costs involved, it would appear that a Texas High Plains grower should not replant at the late two-leaf stage of the original planting unless the original planting has at least 30% unoccupied area or roughly 65 beets/100 feet in 30-inch rows. It is quite common at the present time on the Texas High Plains for the grower to replant stands of 100 beets/100 feet.

Table 3. Estimated loss in yield potential if sugarbeets are replanted at the given growth stages of the original planting.

| Growth stage of original planting | Loss in sucrose yield potential | |
|---|---|---|
| | T/A | % |
| Early cotyledon | 0.29 | 6.3 |
| Mid cotyledon | 0.37 | 8.0 |
| Late cotyledon | 0.47 | 10.2 |
| Early 2-leaf | 0.57 | 12.3 |
| Mid 2-leaf | 0.66 | 14.3 |
| Late 2-leaf | 0.76 | 16.4 |
| Early 4-leaf | 0.82 | 17.7 |

If a grower can replant prior to the late two-leaf stage, better results can be achieved (Table 3), because less growing season is lost. Commercially it would be difficult to evaluate tne stand, do the necessary tillage, replant, and water for emergence before the original stand would have achieved the late two-leaf stage. Often the original stand will be much larger.

A factor of considerable importance that arose in these studies is the matter of harvest losses. Harvesting equipment used in these studies

caused heavy losses during the topping operation in thin stands (Table 2). When stands are thin the sugarbeets tend to grow high above the soil surface. The topper often pushed these roots over, so that they were missed by the lifter wheels. Better harvesting equipment could considerably reduce harvesting loss with thin stands. Potentially, this could allow the grower to retain original stands with as much as 10 or 15 percentage points more unoccupied area than would be indicated in Table 2.

Length of growing season is a major factor in the replanting question. This results because replanting, at the two-leaf stage, costs a certain increment of yield that should be nearly constant for all regions. A given poor stand, on the other hand, costs a certain percentage of the potential yield so the yield loss in tons/acre will be greater for a long-season area than for a short-season area. Thus, for an area with a significantly shorter growing season than the Texas High Plains, the relative yield of replanted sugarbeets is likely to be lower than given in Table 2. In such a case, poorer original stands would be necessary before a grower could profitably replant.

## Conclusion

The general conclusion from this study is that the original sugarbeet stand must be very poor before replanting will be profitable. In most sugarbeet growing areas of the U.S., under most conditions, at least 30% unoccupied area in the original stand will be necessary before sugarbeets can be profitably replanted.

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