Sugar Beets in Imperial Valley

effects of preharvest irrigation and nitrogen fertilization studied in relation to increasing sugar yield in hot climate

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Approximately 23% of the sugar beets in California—and 6% of those in the United States—are produced in the Imperial Valley.

Because the beets are planted in late summer or early fall, grown during the winter and harvested early the following summer, there are problems in preharvest irrigation and fertilization that are unique to the valley.

Wet and Dry Plots Used

The relationships between the last irrigation and root production and percentages of sucrose were studied in irrigation experiments at the Imperial Valley Field Station. Beets from wet plots—where adequate soil moisture was maintained until harvest—were compared with beets from dry plots—no irrigation after late May. Root yields and sucrose percentages were determined every two weeks, and the nutrient status, particularly that of nitrogen, was followed by petiole sampling and by chemical analyses.

In order to study effects of irrigation independent of nitrogen deficiency, a final application of nitrogen—at 80 pounds per acre—was applied to experimental plots in early May. Tissue analysis indicated that the beets did not become nitrogen deficient until mid-July. The terminal irrigation of the dry plots was in late May.

In the dry plots, root yields did not increase after June 21, four weeks after the terminal irrigation. From that date on, the beets wilted severely during the day but recovered at night.

Root yields in the wet plots, irrigated every two weeks through the summer, continued to increase up to August 2, when the highest yield, 40.4 T/A—tons per acre—was obtained. The yield increase from June 7 to August 2 equalled 10.1 T/A, or 7.2 T/A more than that from the dry plots.

Sucrose Concentrations

The initial sucrose concentration was 14.0% on June 7, when differential treatments began with the first supplemental irrigation of the wet plots. Sucrose concentrations in the dry plot beets increased to 14.9% by July 5 and then declined, whereas in the wet plot beets the concentrations declined from June 7 on. The maximum sucrose concentration in the experiments was 14.9%, as compared with the valley average of 16%–17% obtained in fields without late nitrogen fertilizer applications.

The decline in per cent sucrose in dry plot beets leveled off in late July, probably in response to nitrogen depletion. Petiole analyses indicated that both wet and dry plots ran out of nitrogen at about the same time. The wet plot beets undoubtedly exhausted the soil of its readily available supply of nitrogen, but dry plot beets were probably prevented from obtaining nitrogen because of the low soil moisture.

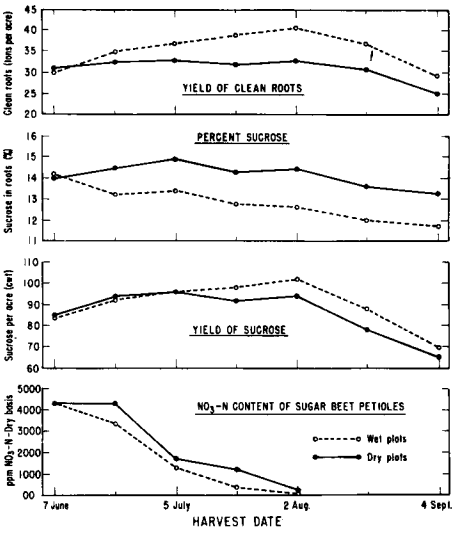
The increased sucrose concentrations of the dry plot beets were due in part to simple root dehydration, but part may have been due to reduced growth resulting in conservation of the sucrose produced by the plant.

Plant Growth

Under high temperature conditions, the life of the beet leaf is rather short and the plant depends on the continued production of new leaves to maintain an adequate photosynthetic area for support of root growth. The wet plot beets maintained vigorous top development until after August 2 when they began a rapid decline, due in part to curly top virus, so that by September 4 only one half to two thirds of the plants retained a few green leaves. In contrast, leaf development was checked in the dry plots by June 21, and by August 2 the plants retained only a few green leaves.

The results of the experiments indicate that by setting the terminal irrigation 4–6 weeks or more before harvest a lower tonnage of beets with higher sucrose content can be expected. In previous experiments with an early May water cutoff date and low nitrogen beets, the dry plots yielded less sugar per acre than wet plots. With the later cutoff date and high nitrogen beets of the present experiment, dry plot sucrose yields did not lag behind wet plot yields until more than six weeks after cutoff date. Thus far, it does not appear that greater total sugar production can be obtained by limiting water prior to harvest.

Harvest results from a sugar beet irrigation experiment conducted at the Imperial Valley Field Station. Wet plots were irrigated every two weeks until harvest. Dry plots received their last irrigation on May 24.



Other Factors

Other production factors to be considered are the cost of continuing irrigations and the economy in harvesting and hauling lower tonnages. On heavy soils, maintaining soil moisture at harvest will reduce draft and lessen the number of clods harvested, but will increase soil compaction. However, crisp beets from moist fields can be handled more efficiently by the processor, though the price of beets depends upon the sucrose content.

Apparently sugar beets can be maintained at adequate growth rates during the hot summer months in the Imperial Valley provided the plants have sufficient moisture and nutrients. However, growth and high sucrose content appear incompatible.

Studies are being continued to ascertain the true effect of climate and nitrogen depletion on sugar beets grown in the Imperial Valley.

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