Tracing During the Growing Season the Nitrogen, Phosphate, Potash and Refractometer Solids of Beets from Plots Receiving Varying Amounts of Nitrogen

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A total of 45 test plots was established on sugar beets during the 1949 growing season. These plots received varying amounts of nitrogen ranging from 40 pounds to 200 pounds of elemental nitrogen per acre in mulitples of 40 pounds. Several sources of nitrogen were compared. Among these were anhydrous ammonia, sulphate of ammonia, ammonium nitrate and ammonium chloride.

Nitrogen was applied as a side-dressing in July after blocking and thinning. Starting August 1, the relative amounts of nitrogen, phosphorus and potash were determined at weekly intervals by means of tissue tests. Refractometer readings were made at weekly intervals starting August 15 and interpreted into approximate sugar content.

When anhydrous ammonia was applied at the rate of 40 pounds of nitrogen per acre during early July, the sugar beet plants showed a lack of nitrate nitrogen, as determined by tissue tests, in about six weeks depending upon available nitrogen in the soil. Added amounts of nitrogen *in* 40-pound increments were available to beets for about two weeks longer for each 40 pounds added over and above the original 40. For example, good nitrate tests were obtained for a period of two weeks longer for a 40-pound application over no application, for an 80-pound application over 40 pounds and 120-pound application over 80 pounds.

When different forms of nitrogen carriers were used at equal rates of elemental nitrogen per acre, the tissue tests indicated plant utilization of ammonia nitrate first, sulphate of ammonia second, with anhydrous ammonia a close third and ammonium chloride last. Blank tests occurred indicating lack of available nitrogen to plants in the same order. Ammonium nitrate showed up in tissue tests in less than a week after application and also left quickly. Ammonium chloride was very slow to show up in tissue tests.

The test for excessive nitrate in tissues was never very high where ammonium chloride was used and lasted much longer, up to six weeks longer, than any other nitrogen-carrying compound. It was interesting to note that, when tissue tests indicated an accumulation of nitrate nitrogen, the percent of sugar was three to four points lower than in beets from check plots which received no nitrogen side-dressing, and showed no excess of nitrate in the leaf tissues. Such beets low in sugar will catch up to beets having higher sugar content in approximately ten days after the petioles *give* a blank test for nitrate nitrogen indicating the available supply of nitrogen is becoming limited.

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Table 1 shows the relationship between tissue tests for nitrate nitrogen and sugar content. The elemental nitrogen per acre was applied in the form of anhydrous ammonia as a side-dressing at the time of blocking and thinning.

Table 1.

	August 29		Sept. 17		Oct. 1		Oct. 8	
N₂ per A	Tissue Test	% Sugar	Tissue Test	% Sugar	Tissue Test	% Sugar	Tissue Test	% Sugar
0	Blank	16.0	Blank	16.5	Blank	17.0	Blank	17.8
40 lb.	Low	13.0	Blank	14.5	Blank	17.0	Blank	17.5
80 lb.	Med.	12.0	Trace	13.0	Blank	17.5	Blank	18.0
120 lb.	High	13.0	Low	14.0	Trace	13.0	Blank	17.0

This table indicates the caution required to apply only enough nitrogen so that it will be used by the sugar beets by at least two weeks prior to harvest. This amount will obviously vary with the ability of the soil to supply nitrogen to the crop throughout the growing season. This table is indicative of the reaction of all nitrogen carriers used with the exception of ammonium chloride. It took a considerably longer period for nitrates to show up in the plants as determined by tissue tests from those plots receiving ammonium chloride than from any other nitrogen carrier. These tests never got to a point where they indicated a high nitrate content. Also, it is interesting to note that even though there was a test for nitrate nitrogen in the tissues of beets grown on plots receiving ammonium chloride, their sugar content was not affected adversely as it was on plots receiving other nitrogen carriers.

The relative phosphate content of plants, as indicated by tissue tests, was variable throughout the growing season and showed no definite trends. Relative potash content of plants showed a tendency to diminish with nitrate nitrogen although not nearly as fast. From observations relative to this work, it has been concluded that some very interesting relationships could be observed between plant nutrients and sugar content if such tests were designed so that both tissue tests and soil tests could be made simultaneously at weekly intervals throughout the growing season. It is also believed that as a result of this work, and other work conducted by our research staff, it may be advisable to conduct tissue and soil tests on crops for information concerning proper management and fertilization for crops to follow. It is on this basis that further tests will be made in 1951.