Research Report

ARS Sugarbeet Conference, Fort Collins, Colorado

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Prepared by A. D. Halvorson, January 3, 1974

A. Location of Project: Western Region
Utah-Idaho-Montana Area
Northern Plains Soil and Water Research Center
Sidney, Montana 59270

B. Work Reporting Unit Title: Soil Management Practices

C. Work Reporting Unit: 5710-12320-001

D. SMY's for Past Year at Location: 0.4 SMY

E. Names of Scientists in Project at Location: A. D. Halvorson

F. Mission of Research:

To develop principles and methods for integrating soil, water, and fertilizer management practices into systems for most efficient utilization of crop and range lands.

G. Objective of Research:

To determine the influence of various inorganic and organic nitrogen fertility treatments and climate during the growing season on yield and quality of sugarbeets; to determine the effect of inorganic and organic nitrogen fertility treatments on the level of NO_3-N in the petioles of sugarbeets during the growing season and to evaluate sugarbeet petiole analysis as a possible diagnostic tool for nitrogen fertilizer management on sugarbeets in the Lower Yellowstone Valley of eastern Montana and western North Dakota; and to examine the effects of residual fertilizer nitrogen on the yield, total N, and protein content of spring wheat grown after sugarbeets.

H. Research Accomplishments:

Research emphases have been directed toward evaluating the long-term effects of sources (ammonium nitrate, barnyard manure and green manure crops) and rates of nitrogen (N) on sugarbeet yield and quality, petiole NO_3-N, and effect of residual soil N on spring wheat yields and protein content. During a 2-year evaluation of a long-term sugarbeet-small grain rotation study (initiated in 1953), the highest sugar yield was obtained with the application of 22.4 (m)t/ha barnyard manure. This treatment resulted in relatively high sugar purity, low petiole NO_3-N approximately 6 weeks before harvest, and highest dry matter root/top ratio. A high barnyard manure application rate of 67.2 (m)t/ha with/without inorganic N resulted in lower sugar yields, low sugar purities, and low dry matter root/top ratios. Application of 112 kg/ha ammonium

nitrate resulted in the best sugar yields of the inorganic N treatments. The green manure treatments (alfalfa and biennial sweetclover) resulted in sugar yields and sugarbeet quality similar to the 112 kg/ha inorganic N treatment. A budget system, based on soil organic matter, soil NO_3-N and a sugarbeet yield goal, was successful in estimating the N needs of sugarbeets in the Lower Yellowstone Valley. A quick method for semi-quantitatively estimating the petiole NO_3-N content on a dry-weight basis showed a highly significant correlation with known accepted procedures.

With the exception of a 56 kg/ha inorganic N treatment, yield and protein content of spring wheat grown after sugarbeets increased progressively as a function of residual N resulting from nitrogen fertilizer applied on the beets.

I. Impact of Research Accomplishments on Science and General Public:

Potential benefits derived from present research accomplishments are maximum sugar production, high sugarbeet purity which facilitates processing and sugar extraction, efficient use of inorganic and organic N fertilizers, reduction in NO_3-N pollution of groundwater, and increased profits for both growers and processors. Present research results demonstrate that green manure and barnyard manure can be used to grow quality sugarbeets, maintain high sugar production, and allow the disposal of a potential pollution product (barnyard manure) should our supplies of inorganic N fertilizers become short. The quick method for assessing petiole NO_3-N makes it possible on a daily basis for growers and processors to select sugarbeet fields to be harvested first and to evaluate fertility programs throughout the growing season easily and rapidly.

J. Obstacles to Achieving Objectives:

Although 10 years of sugarbeet root yields, sucrose %, and sugar yield have been collected from this long term sugarbeet-small grain rotation study, the influence of climatic factors are difficult to evaluate because of varietal differences in the beets grown each year.

K. Future Plans and Needs:

Several treatments in the long-term sugarbeet-small grain rotation will be altered in 1974 because of NO_3-N accumulations in the soil profile of several of the high N treatments. A nitrogen budget will be used to predict the fertilizer needs of these treatments in 1974. Plans also exist to evaluate Stanford's method of determining the N-mineralization potential of soils for use in our N budget system. A need exists to evaluate the budget system on various soil types and under different irrigation practices. Present studies have been conducted using sprinkler irrigation which minimized leaching of NO_3-N, however, flood and furrow irrigation are the methods used in the Lower Yellowstone Valley which probably results in over irrigation and leaching of NO_3-N from the root zone. A definite need exists for studies on how irrigation management affects N fertility programs in the Lower Yellowstone Valley. However, until additional funding and personnel are made available, this phase of research will not likely be pursued.