Research Report

Sugarbeet Conference, Fort Collins, Colorado

February 5, 6, 1974

Prepared by Grace W. Maag, January 7, 1974

A. Location of Project: Western Region
Colorado-Wyoming Area
Crops Research Laboratory, CSU
Fort Collins, Colorado

B. Work Reporting Unit Title: Improved Sugarbeet Varieties and Sugarbeet Production Practices

C. Work Reporting Unit: No. 401-5602-10710

D. SMY's for Past Year at Location: 1 SMY

E. Names of Scientists in Project at Location: G. W. Maag, also cooperating with R. J. Hecker, G. A. Smith, and E. G. Ruppel

F. Mission of Research:

Our research mission is to aid the sugarbeet grower to deliver a higher quality product and to aid the processing industry to maintain higher quality in stored beets; to study quality related biochemical processes taking place during sugarbeet growth, storage, and factory processing; and to conduct research on the biochemical nature of resistance to Cercospora leaf spot and Rhizoctonia root rot in sugarbeet. Our sugarbeet biochemistry research is coordinated and integrated with sugarbeet research in genetics, breeding, pathology, and weed control.

G. Objectives of Research:

To evaluate the role of nonsucrose constituents on sugarbeet quality; to evaluate the effect of certain biochemical changes during sugarbeet growth, storage, and factory processing on recoverable sucrose; to establish the relationship of certain compounds in sugarbeet to Cercospora leaf spot and Rhizoctonia root rot resistance; and to develop an accurate method for sucrose determination in sugarbeet juices to replace the prevantly used polarimetric method which is subject to inaccuracies due to the varying presence of other rotatory compounds.

H. Research Accomplishments:

Extensive research has been done on nonsucrose components in sugarbeet juices, leaves, and petioles, and evaluation of their importance to sugarbeet quality and disease resistance has been made. Biochemical changes during sugarbeet growth, storage, and processing also have been studied in relation to quality. Results show that nitrogen components, especially those containing alpha amino and nitrate nitrogen, are highly deleterious to sugarbeet quality. Sodium, potassium, and chloride ions

are classified as deleterious ions also. Betaine, a significant nitrogenous base in sugarbeet juices, apparently has a smaller effect on quality. Over 90% of the total nitrogen in sugarbeet juices has been accounted for in measured nitrogen components, including almost thirty individual amino acids and amides. Some biochemical changes occurring during storage and processing have adverse effects on factory purification and sucrose recovery. The amino acid, DOPA, was found to be positively correlated to Cercospora leaf spot resistance in sugarbeets. Phenolic compounds also were studied in relation to disease resistance, and some phytoalexin studies are underway. Gas liquid chromatography (GLC) has proved to be an accurate method for sucrose determination in sugarbeet juices. In most cases, sucrose determined by polarization was slightly higher than CLC sucrose determinations in sugarbeet juice extracts. However, in factory thick juice, standard liquor, and molasses samples the GLC determinations are much higher.

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

1. Fifteen publications in various journals plus almost thirty other reports have made our research accomplishments available to fellow scientists and the sugarbeet industry. 2. Research information is being utilized in selective sugarbeet breeding studies for quality improvement. 3. The relationship of true sucrose content to certain nonsucrose components is an important step toward improving estimations of recoverable sucrose in sugarbeets. 4. Information about the biochemical changes which occur during storage and processing should result in establishment of more favorable processing conditions which will lead to a higher percentage of recoverable sucrose. 5. Our investigations on disease resistance mechanisms should lead to better biological control of sugarbeet diseases and to development of more highly disease resistant genotypes.

J. Obstacles to Achieving Objectives:

Although considerable progress has been made on sugarbeet quality studies and some on disease resistance, there is a continuing need for a well trained plant physiologist or, even better, one who is trained in plant biochemistry and physiology.

K. Future Plans and Needs:

Development of more accurate yet more simple methods of sugarbeet quality determination will be continued. At the same time information on the relationship of sugarbeet quality to methods of culture, breeding, storage, and processing will continue to be developed with the objective of maximizing sugar recovery for the benefit of both beet grower and processor. Experiments will be expanded to provide information about the biochemical nature of resistance to Cercospora leaf spot and Rhizoctonia root rot in order to improve more rapidly the biological control of these diseases.

These plans, of course, would be contingent upon my replacement with a plant physiologist following my retirement during the last half of FY-74.