Northern California Sugar Beet Quality Survey

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Many fields of sugar beets being harvested in Holly Sugar Corporation's Northern California districts in 1958 were considerably lower in quality than in previous years. The percent sugar and percent purity of beets in many fields had decreased to a critically low point. During the fall of 1958 and again in the summer and fall of 1959 extensive field sampling was conducted throughout the Northern California District to determine, if possible, some of the factors responsible for this low quality. Fields were sampled throughout the district to obtain beet and petiole samples for analysis. Information was compiled regarding disease and insect conditions, cultural practices, growth characteristics, and many other factors that would contribute to the study of the fields. Company fieldmen and their growers cooperated with the workers conducting the survey and contributed the desired field information.

This paper will describe the procedures used in the survey, the general disease and insect observations compiled, and a summary of the initial data derived from the program in 1958 and 1959. Results are based on data from field samples taken at or near harvest time.

Procedure

Holly's Northern California District was divided into four areas to be surveyed: South San Joaquin, Tracy-Stockton, Sacramento and Hamilton City. In 1958 sampling began on September 10 and was completed by November 13. In the 1959 program, sampling began on July 8 and ended December 2. The main difference between the two years was that fewer fields were sampled in 1959, however, each field was sampled at about three week intervals until harvest. Only the results of the last sampling date will appear in this report. The following numbers of fields were sampled in each area:

	1958	1959
South San Joaquin area	66	60
Tracy-Stockton area	48	31
Sacramento area	55	31
Hamilton City area	60	30
Total Northern California	229	152

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From each field in the survey, four beet root samples (10 feet of row per sample) were dug and sent to the laboratory for sugar (polarity) and purity (apparent) determinations. Petioles were obtained from the beets in each sample and were later analyzed for nitrate-nitrogen content by the Holly Sugar Research Department Laboratory. Growth characteristics, soil moisture conditions, insect and disease damage, and type of planting were recorded at the time of sampling.

During the period of the survey, fieldmen also obtained information regarding fertilizer usage, crop history and other items pertinent to each field sampled. Data were computed in a manner to furnish an average figure for petiole nitrate-nitrogen (p.p.m), sugar percent, purity percent, weight per beet and calculated yield (tons/acre) for each field. The initial data derived from the survey for both 1958 and 1959 are presented and summarized.

Observations

In 1958 two diseases were of major importance in this district. In the Hamilton City area *Cercospora* leafspot was extensive in all fields sampled and harvested early in the season. In over half of the fields in the South San Joaquin area leafspot symptoms were present. Virus yellows occurred in the South San Joaquin and Tracy-Stockton areas with light to heavy infestations.

Empoasca leafhopper damage was believed to be of a moderate nature in all of the areas in the survey. A few fields contained noticeable root aphid populations and/or nematode damage. Other disease and insect damage was slight.

Disease and insect damage in the fields included in the 1959 survey was somewhat less than in 1958 and probably had little effect on production.

Results

From the 1958 field samplings, petiole nitrate-nitrogen (p.p.m.), sugar content, purity, average weight of beets, units of nitrogen applied, and the number of days between the last application of nitrogen, and the sampling date were recorded for each field. Following this analysis, the fields were divided on the basis of the amount of nitrate-nitrogen contained in the petioles at harvest. For both years the fields were separated into ones high in No_3-N and low in No_3-N. Table 1 is a summary of the results of analysis of samples from the two categories in the Northern California district. All figures in the table are averages for the number of fields sampled. In 1958, the fields in the low nitrate-nitrogen (less than 500 p.p.m.) category, with an average of 337 p.p.m., were higher in percent sugar and purity

Table 1.—Summary of Field Sampling and Survey of Sugar Beet Fields in the Holly Sugar Corporation in Northern California, 1958 and 1959.

NO_3-N Level	No. Fields	NO_3-N	Sugar	Purity	Beet Avg. Wt.	Tons/A.	Units N/Acre	Days-Last N to Sampling
		p.p.m.	%	%	lbs.		lbs.	
1958								
Low	76	337	15.54	85.06	1.54	23.9	126[1]	133[1]
High	153	2337	13.25	80.32	1.67	23.7	139[2]	126[2]
Difference		2000	2.29	4.74	.13	.2	13	7
1959								
Low	61	842	15.01	82.22	1.66	28.40	128[3]	51[3]
High	91	3090	13.84	80.18	1.76	28.42	124[4]	54[4]
Difference		2248	1.17	2.04	.10	.02	4	3

[1] Average of 65 fields
[2] Average of 145 fields
[3] Average of 51 fields
[4] Average of 69 fields

than the fields in the high nitrate-nitrogen category with an average of 2337 p.p.m. The low nitrate-nitrogen fields averaged 2.29% higher sugar and 4.74% higher in purity. Difference in average weight per beet was .13 pound in favor of the high nitrate-nitrogen fields. Yield was nearly the same for the two categories with only .2 ton per acre difference. Even though nitrate usage and days between application and sampling were similar for the low and high categories, the high nitrate-nitrogen levels appeared to be at least partially responsible for the differences obtained in the sugar and purity percentages.

In 1959 the data were secured on a similar basis and compiled for direct comparisons. The separation point for nitrate-nitrogen was somewhat higher than the 500 p.p.m. used in 1958. The low NO_3-N class included approximately two-fifths of the fields, and the high NO_3-N class approximately three-fifths of the fields. Fields averaging as high as 1200 p.p.m. NO_3-N were included in the low category.

Table 1 also shows the low and high averages determined by petiole nitrate-nitrogen level for all the fields studied in 1959. Percent sugar and percent purity in the low NO_3-N class were both higher than at the high NO_3-N level. The percent sugar averaged 15.01% for the 61 fields with a 842 p.p.m. average NO_3-N level. However, the 91 fields averaging 3090 p.p.m. NO_3-N tested only 13.84% sugar or 1.17% less than the fields

in the low nitrogen category. Purity percentages were similar in that the fields in the high nitrogen category averaged 2.04% less in purity than in the low nitrogen category. Beets in the high nitrogen fields weighed .10 pound heavier than the beets from low nitrogen fields but this was not considered significant. Differences between calculated yield (tons/acre), units of N, and days between last N application and sampling were also quite small. Although the difference in sugar percent between the two categories (low and high NO_3-N) was lower in 1959 than in 1958 it was concluded that nitrogen in the petioles at harvest time was the main factor responsible for this difference.

Summary

Although units of nitrogen applied and the days between nitrogen application and sampling were very close between the high and low categories in both 1958 and 1959, low sugar content and purity was always associated with high nitrate-nitrogen in the petioles. The average yield (tons/acre) for both 1958 and 1959 was not significantly affected by the difference in the nitrate-nitrogen level.

It was found that in 1958 two diseases, *Cercospora* leafspot and virus yellows, were of major importance in three of the areas in the Northern California District. Undoubtedly, these two diseases were responsible for some of the low quality beets harvested in 1958. In 1959 diseases were moderate in comparison to 1958 and were not considered as being responsible for any large reduction in quality. However, additional data in Table I has shown that excess nitrate-nitrogen in the plants at harvest time was partially responsible for the low quality beets harvested in both 1958 and 1959. In the areas surveyed, all fields in the low sugar-low purity category averaged considerably higher than 1,000 p.p.m. nitrate-nitrogen at harvest time. This would indicate that excess nitrogen was present and should be considered an important factor in causing low quality beets in our Northern California District.