

SUGARBEET RECOMMENDATIONS FOR OHIO
RESULTING FROM RESEARCH ^{1/}

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This report will consider some results from research in Ohio and relate these research results to recommendations. Also, a few studies in progress that do not have specific recommendations resulting from these studies at the present time. The work being reported includes work done on state owned land and also on growers fields. Some of the work was done by a specific research on University staff and other work was done cooperatively by University and sugar company personnel.

This report will consider research on pH adjustment, nitrogen rates, potassium rates, phosphorus, manganese, tillage, rotations, weed control, use of asphalt mulch, irrigation and random survey of beet growers in Ohio.

Ohio State University recommendations for growing sugarbeets occur primarily in the "Agronomy Guide", an annual publication by our agronomy extension staff.

pH Adjustment

Ohio's recommendation calls for a pH of 6.5 to 7.0 for sugarbeets. A survey study in 1967 indicated growers are generally maintaining this pH level for sugarbeets. The results tend to justify a pH recommendation at least to this level of 6.5 to 7.0.

In the survey of Buckeye Growers in 1967, soil pH was highly associated with clear juice purity and associated with percent sugar. The Mean pH in the study was 6.6 with a Standard Deviation of ± 0.4 . The 1967 study of Northern Ohio growers did not show any association with percent sugar, but clear juice purity was not available for comparisons. The 1965 summary of data from potassium rate plots showed soil pH highly associated with tons per acre. The pH range in the potassium study was 6.3 to 7.7. Replicated plots at Buckeye Sugars, Inc. on silty clay loam soil shows the value of liming.

<u>Tons/Acre</u>	<u>Topsoil pH</u> <u>1966</u>	<u>Recoverable Sugar</u> <u>Lbs./Acre 1966</u>
0	6.1	2305
2	6.5	3874
4	6.4	3620
8	7.0	4046

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Nitrogen

Based on recent field trials, the nitrogen recommendations found in the Ohio Agronomy Guide should be high enough for most conditions and are probably on the high side where large carry-over of nitrogen occurs. The recommendations are as follows:

<u>Following</u>	<u>Lbs. N/Acre</u>	
	<u>Less</u> <u>25 Tons</u>	<u>25 Tons</u> <u>Or More</u>
Alfalfa or Sweet Clover	40	60
Other legumes except soybeans	60	80
All other crops	80	100

Test on four farms in 1966 in cooperation with Phil Brimhall of Northern Ohio Sugar Company, Fred Russell of Buckeye Sugars, Inc., Dr. Walter Schmidt, Area Extension Agent, Agronomy at Fremont and this author agreed with nitrogen studies conducted prior to and after these tests. The results showed tonnage peaking out at 90 lbs. nitrogen per acre, gross sugar at 60 to 90 lb. rates and recoverable sugar was as high at zero rate but was not hurt by 90 lbs. of nitrogen. The results for 1966 are shown here with the averages being for four farms in the study. Each rate was replicated five times on each farm. Previous crop on three farms was corn and other farms soybeans. Soils were Hoytville clay on three farms and black sand on other farm. Soil type or previous crop did not affect trends from nitrogen rates.

<u>Lbs. N/Acre</u>	<u>Tons/</u> <u>Acre</u>	<u>%</u> <u>Sugar</u>	<u>Gross</u> <u>Sugar</u>	<u>%</u> <u>CJP</u>	<u>Recoverable</u> <u>Sugar</u>
0	21.34	16.63	7178	92.73	6067
30	21.04	16.60	7060	92.27	5908
60	21.66	16.62	7243	92.17	6042
90	22.19	16.12	7235	91.89	5997
120	21.80	15.74	7022	90.75	5643

The depression of yield with the 30 lbs. rate has been common in Ohio test but unexplainable.

Plant analysis indicates why yield response was not obtained from nitrogen in our study. Nitrogen level was sufficient in the plant with no nitrogen above what was added in row fertilizer. Sufficient level for nitrogen is 3.0% in the leaf blade and 1.5% in the stem or petiole. Plant analysis from these four farms show following level of nitrogen in the blade and stem in July:

<u>Nitrogen Rate</u>	<u>% N Blade</u>	<u>% N Stem</u>
0	4.54	2.62
30	4.37	2.70
60	4.62	2.81
90	4.59	2.87
120	4.60	2.88

From the results of these studies, the risk of going over the recommended rate of nitrogen is greater than being under the recommended rate.

Potassium

Our potassium recommendations found in the Agronomy Guide range from 60 to 350 lbs. of K₂O per acre. The following table shows the Ohio recommendations:

<u>Soil Test Value</u> <u>Exchangeable K/Acre</u>	<u>Less 25 Tons</u>			<u>25 Tons +</u>		
	<u>Clay</u>	<u>Silt</u>	<u>Sand</u>	<u>Clay</u>	<u>Silt</u>	<u>Sand</u>
0 - 99	220	275	320	250	300	350
100 - 149	180	225	270	200	250	300
150 - 199	140	185	230	160	200	250
200 - 399	100	135	170	120	160	200
400 +	60	95	130	80	120	160

Potassium rate plots were established on eleven farms in 1965 and 1966 in cooperation with same people involved in nitrogen studies. Plots were replicated four times on each farm. Both sandy and clay texture soils were used in the study. The average soil K test for all plots was 210 lbs. Yield peaked with 100 lbs. of K₂O per acre indicating the recommendations in the Agronomy Guide are very realistic. These potassium rate studies showed the following results:

<u>Lbs. K₂O</u> <u>Applied</u>	<u>Recoverable</u> <u>Sugar/Acre</u>
0	6695
100	6843
200	6800
300	6754

Phosphorus

Recent phosphorus rate studies in Ohio have not been conducted, but results of 1967 survey indicate rates are sufficient to meet the need. The Agronomy Guide recommends the following rates of phosphorus:

<u>Soil Test Value</u> <u>Lb. P/Acre</u>	<u>Lbs. P₂O₅/Acre</u>	
	<u>Less 25 Tons</u>	<u>25 Ton +</u>
0 - 9	180	200
10 - 19	160	180
20 - 29	140	160
30 - 59	120	140
60 - 89	100	120
90 +	80	100

Bray P₁ Test

The 1967 survey study showed average soil P test value of 140 for Northern Ohio growers and growers used 140 lbs. of P₂O₅ per acre on the average. Leaf blade composition was .36% P. Buckeye growers had average soil P test of 145, average P₂O₅ usage of 82 lbs. per acre and level of .27% P in the leaf blade. While .26% P is considered sufficient, yield was not related to P level in the plant in either study and it would appear that both Buckeye and Northern Ohio growers were doing a satisfactory job of providing needed phosphorus to the plant.

Manganese

Manganese deficiency is a common problem for most crops grown on the lake bed soils of Northwest Ohio. This deficiency has been regularly observed on sugarbeets and many growers spray beets with manganese sulfate to correct the deficiency. Our spray recommendation of 4 to 6 lbs. of manganese sulfate per acre has been a sufficient rate to correct manganese deficiency in sugarbeets. We recommend this in 20 gallons of water per acre to reduce burning of foliage, but using the airplane with very low rates of water has proven satisfactory.

Manganese deficiencies are likely to occur on soils with high pH, probably over 7.0, and on clay and sand textured soils in the lakebed. For growers who expect manganese deficiency to occur because of high pH and soil type, a recommendation of 3 lbs. of manganese (12 lbs. of manganese sulfate) per acre in starter fertilizer placed under the seed is made. Work in 1966 on soils where manganese was not limiting to the crop showed the 3 lb. rate may not be sufficient to get manganese to the plant. Eleven (11) parts per million manganese is considered sufficient in the stem.

	PFM
	Mn
	<u>Stem</u>
No Manganese	21
1½ lbs. Mn sprayed	24
3 lbs. Mn row fertilizer	22

Average of 16 plots (July samples)

More work is needed on rates of manganese to apply in row fertilizer and then will have to sample early in growing season to measure manganese uptake by the plant.

Tillage

On the clay textured soils in Northwest Ohio the tillage recommendation is fall plowing with some leveling in the fall and then very little or no additional tillage in the spring. Dr. H. J. Mederski of The Ohio Agricultural Research and Development Center at Wooster, Ohio conducted a computer study of Northern Ohio growers field records in the early 1960's and again reaffirmed the importance of early planting of sugarbeets. Dr. Mederski realized that fall plowing was not always possible so he set out to see what other tillage systems might be used on clay textured soil to accomplish early planting when

fall plowing was not possible. A report on his work appeared in the September-October 1967 issue of "Ohio Report" published by the O.A.R.D.C. at Wooster. The three year summary of his work using soybeans as a previous crop showed some other possibilities when fall or winter plowing cannot be accomplished. Yield summaries of work at the Northwest and Northcentral Branch follows for the three years in study shows:

<u>Tillage</u>		<u>Tons/A</u>	<u>Average Planting Date</u>
<u>Fall</u>	<u>Spring</u>		
Plow	Disked	19.0	April 12
Plow, Disked	None	20.0	March 22
Disked	None	20.0	March 22
None	Disked	18.5	April 12
None	None	19.0	March 22

Rotation

Dr. Glover Triplett of O.A.R.D.C. is conducting a 20 year rotation study that includes corn, soybeans, sugarbeets and alfalfa in the rotation in various combinations. Unpublished results from the years 1962 through 1966 show the following trends:

<u>Rotation</u>	<u>Tons/Acre</u>
AAB	17.5
CCB	19.5
CB	18.7
SB	18.5
SCB	19.7
BB	17.4

LSD - .8 T

Generally, three year rotation looks better than two year rotation except when alfalfa is in the three year rotation ahead of beets. Corn and soybeans are a better crop than alfalfa to grow ahead of beets. This indication that soybeans is a satisfactory crop ahead of beets gives us more tillage options and reduces chances of having a herbicide residue problem.

This work was done on clay soils at the Northwest Branch on some plots with both surface and tile drainage and others with surface drainage only. The plots with both tile and surface drainage outyielded the plots with only surface drainage 1.4 tons per acre.

Weed Control

Dr. Edward Stroube, Extension Agronomist and Research Agronomist, recommends primarily Pyramin and TCA at a 4 + 6 rate. He, also, includes Pyramin, H-273, Endothal, and Dalapon as post-emergence applications for specific weed problems.

Dr. Stroube conducts research trials at the Northwest Branch near Hoytville each year. The Pyramin TCA recommendation came from this work and success with this combination by growers. The 1968 trials included some work to get season long weed control with herbicides. Dr. Stroube was fairly successful in getting

season long control with using Pyramin and TCA pre-emergence and then applying Pyramin post-emergence. While this was an expensive herbicide program, the results were encouraging enough to continue investigations into season long weed control with herbicides. Also, this Pyramin is a violation of present Pyramin label.

Asphalt Mulch

Jim Henry of the Department of Agriculture Engineering at O.A.R.D.C. made some observations using asphalt mulches at Northwest and Northcentral Branches in 1968. The material used was EN-CAP produced by Armour Agricultural Chemical Company. He applied the material in a six inch band using an over-all rate of 500 gallons per acre. The results are quite different at the two locations. The results for 96 feet of rows counting 6 feet at 16 locations are as follows:

	Beets Per 96 Ft. Row	
	<u>Spray Mulch</u>	<u>No Mulch</u>
Northwest Branch	392	229
Northcentral "	322	309

When they counted feet of gaps, using more than one foot between emerged seedlings as gaps, they found 6.9 feet on sprayed area at Northwest Branch and 24.7 feet on unsprayed area. At Northcentral Branch, the feet of gaps was 7.0 feet on spray area and 8.0 for unsprayed area. These figures are for 96 feet of row.

No recommendations on using asphalt mulches are presently made by the Ohio Cooperative Extension Service.

Irrigation

Irrigation observations were made on tillage plots at the Northwest Branch in 1968. Rainfall was below normal in 1968. A total of 3.75 inches of water was applied at four different times. This was about the amount of rainfall below normal. The last irrigation was August 18 and very likely benefits could have been obtained from a later irrigation. The yields from these plots in 1968 are as follows:

	<u>Tons/Acre</u>	<u>% Sugar</u>	<u>Gross Sugar</u>	<u>CJP</u>	<u>Recoverable Sugar/Acre</u>
Non irrigated	14.36	21.27	6108	93.66	5356
Irrigated	19.17	19.03	7298	95.80	6659

This is only one year of observations and no recommendations are presently made on irrigation of sugarbeets in Ohio.

Survey

During 1967 and 1968, a survey of grower practices was conducted in Ohio. A random survey of growers was used with Northern Ohio Sugar Company growers, with one grower for every 90 acres used, the same as they use in their pre-harvest sample. Buckeye Sugar Company selected 200 growers in 1968 at random or one per 50 plus acres. A total of 523 growers was used in the 1968 study.

The company agriculturalist or fieldmen collected top soil samples, sub-soil samples, plant samples at two or three times, and provided cultural practice information. Yield information was obtained including tons per acre, percent sugar, clear juice purity and extractable sugar per tons. The laboratories of Michigan Sugar Company also analyzed beet samples for sodium, potassium, amino nitrogen and invert in the beet sample. All this information will be analyzed by computer at O.A.R.D.C. in the near future.

This type of analysis helps to recognize important grower practices and identify possible problem areas in beet production. This technique does not eliminate the need for plot type research on specific practices.

Some observations picked up from the 1967 study may best illustrate the type of information that can be obtained from this procedure. They include:

1. Growers were divided in four yield groups. Total nitrogen used by each group was about the same, but those with high yields pre-planted most of their nitrogen and those with low yields side-dressed most of their nitrogen.
2. Plant leaf composition indicated fertilizer programs and soil test levels were supplying adequate nutrients to the plant.
3. Higher yields were obtained on the black sandy soil than on the clay textured soil.
4. Planting date accounted for one-half of the total yield variance.
5. The K content in the leaf blade was highly correlated with the potassium soil test used by Ohio State University. The percent K saturation in the soil was not related to K level in leaf blade.
6. Both soil pH and soil manganese test was highly associated with manganese level in leaf blade.

This is only a few of the observations but the 1967 study gives an idea of the type of analysis possible with grower information.

This report covers some of the research in Ohio and resulting recommendations. No attempt was made to include all available research and cover all sugarbeet recommendations.