Progress Report on Irrigation Experiment—Rader Farm, Saginaw, Michigan

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This is a progress report on an experiment to determine the effects of supplemental irrigation on a soil-building rotation with sugar beets as one of the crops. The experiment is designed around a three-year rotation consisting of a small grain seeded to alfalfa, alfalfa used as a green manure crop with the first cutting left lying on the ground and second cutting allowed to grow through it with the entire growth, thus two cuttings being plowed under around August 15. Sugar beets are planted the following spring. Thus, one-third of the land area is devoted to the growing of alfalfa to be plowed under as a green manure crop.

For this experiment, an 18-acre area was divided into three six-acre fields. The soil was a Brookston loam, an excellent sugar beet soil. The field was tiled in 1949 at 4-rod intervals. Each field was again divided to compare rates of fertilization, the rates being 2,500 pounds of complete fertilizer on the high side and 1,250 pounds of complete fertilizer on the low side. The plots were further divided so that one-half of each fertilizer plot received supplemental overhead irrigation.

The fertilizer application by crops is shown in Table 1.

Table 1

Small Grains (Seeded)		Alfalfa (Green Manure)		Sugar Beets	
High	**Low**	**High**	**Low**	**High**	**Low**
500 lbs. (4-16-16)	500 lbs. (4-16-16)	500 lbs. (Top Dressed) (0-20-20)	**0**	250 lbs. (4-16-16+ B)[1] 1250 lbs. (0-20-20)	250 lbs. (4-16-16+B) 500 lbs. (0-20-20)

[1] 5 percent Borax

In 1953, the fertilizer application was changed so that additional fertilizer was applied on the small grain and less on the sugar beets as shown in Table 2.

Table 2.

Small Grains (Seeded)		Alfalfa (Green Manure)		Sugar Beets	
High	**Low**	**High**	**Low**	**High**	**Low**
1500 lbs. (5-20-20)	750 lbs. (5-20-20)	500 lbs. (0-20-20)		250 lbs. (5-20-20+B)[1] 250 lbs. (0-20-20)	250 lbs. (5-20-20+B)

[1] 5 percent Borax

Bouyoucos moisture blocks were placed at 5 inch and 10 inch depths in all crops. When these moisture blocks indicated an available soil moisture

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content of 50 percent or less, irrigation was applied with an overhead sprinkling system as shown in Figure 1. In 1950, irrigations were made on the oats on June 19-23 and July 9-11. Sugar beets were irrigated July 9-11 and August 24 and 25. It should be pointed out that each irrigation preceded a good rain by only a few days.

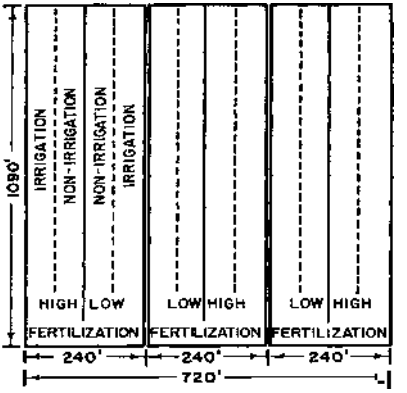

Figure 1.—Field layout.

Oats were harvested with a combine and sack samples taken. Since there was no difference *in* treatment this first year, the irrigated plots were averaged together and yielded 57 bushels per ace, while the non-irigated plots averaged 67 bushels per acre. No visual difference could be noted in the standing grain with the possible exception of increased incidence of rust in the irrigated area.

Table 3.—Irrigation Statistical Summary for Sugar Beets, Rader Farm, 1950.

	High Fertility	Low Fertility	Difference Required for Significance at the 5% Level
Tons/Acre	19.65	19.05	1.53
Sucrose Percent	16.30	16.21	1.09
Gross Sugar	6410	6176	728
	Irrigated	Non-Irrigated	
Tons/Acre	18.66	20.04	1.53
Sucrose Percent	16.22	16.29	1.09
Cross Sugar	6057	6530	728

	Higl Fertility		Low Fertili ty		
	Irrigated	Non-Irrigated	Irrigated	Non-Irrigated	
Tons/Acre	19.30	20.00	18.03	20.08	2.17
Sucrose Percent	16.38	16.22	16.08	16.35	2.56
Gross Sugar	6312	6509	5802	6550	1033

Sugar beets were harvested with a Scott-Urschel sugar beet combine in one-row strips for the length of each plot (1,090 feet). The statistical summary is presented in Table 3.

The yields of alfalfa were not taken. It was felt that any benefit from the extra fertilization or irrigation on the alfalfa should be measured in terms of increased yields in the following crops of sugar beets and oats.

The same procedures were followed and the same general results secured in 1951 and 1952. The yields were the same in all treatments. In the sugar beet plots, however, it was observed that more disease in the form of root rot during the summer was occurring in the irrigated plots. This disease was probably a factor in offsetting any yield benefits from the extra fertilizer and/or irrigation. The stand of sugar beets on the irrigated plots at harvest time averaged about 25 percent less than the non-irrigated plots.

In 1952, 1/2 inch of water was applied to the sugar beet irrigation plots prior to emergence due to extremely dry soil conditions. These plots emerged 10 days sooner than the non-irrigated plots.

In 1952, irrigation was not applied until the Bouyoucos moisture blocks gave an indicated moisture content of 20 percent or less.

During this three-year period it was further observed that at no time did the sugar beets appear to be suffering for the lack of moisture even though the soil moisture content at the 10 inch depth got below the 20 percent level.

In 1953, Bouyoucos moisture blocks were placed at 6 inch, 12 inch, 24 inch and 36 inch depths. Adequate moisture was received until August, followed by a rather dry August and September. The rainfall for this period is shown in Table 4.

Table 4.

1953

August	7 and 8	1.96"	
	12	.04	
	21	.07	
		Total	2.07"
September	4	.45	
	6	.05	
	12	.56	
	19	1.20	
	26	.83	
		Total	3.09"
October	4	.48	
	6	.30	
	27	.37	
		Total	1.15"

Conclusion

By the 20th of August, moisture blocks in the sugar beet plots gave an indicated available moisture content reading of 0 percent at the 6 inch depth. By the 15th of September, all moisture blocks in the sugar beet

plots read zero with the exception of the 36 inch depth. The moisture reading at the 36 inch depth remained at a 100 percent level throughout the entire growing season. Again it was observed that at no time did the sugar beets show any symptoms of suffering for the lack of moisture throughout the 1953 growing season. No supplemental irrigation was applied to any crop during the 1953 season. Very little root rot was evident in the sugar beet plots in 1953.

From Table *4*, you will note that during 1953 the last heavy rains occurred on August 7 and 8. A rainfall of 1.20 inches fell on September 19. However, the ground was so dry that this moisture did not penetrate much below the 5 inch depth. Four rows in each treatment were harvested with a Marbeet Midget harvester and loaded directly into trucks to obtain yield results in 1953.

The yields obtained are shown in Table 5.

Table 5.

	High Fertilization	**Low Fertilization**
Tons/Acre	15.22	15.20
Tons/Acre	13.78	14.52
	14.58	14.86

1. No increased yields have been secured to date from extra fertilization or supplemental irrigation.

2. Supplemental irrigation as applied to the sugar beets caused excessive root rot during the summer. Harvest stands in the irrigated plots were reduced by as much as 25 percent.

3. Early irrigations to get the beets up and off to a good start may be more important in normal years than late summer irrigations.

4. Sugar beets have the ability to draw moisture from the subsoil when no moisture is available in the surface area.

5. At no time during the growing season of 1950, 1951, 1952 and 1953 did the soil moisture get low enough to cause excessive wilting of the beet leaves as often occurs in the irrigated areas of the west.

6. It would appear that too much moisture may be more of a factor for decreased yields in this area than a lack of moisture when the soils are high in organic matter and adequate amounts of commercial fertilizer are used in the rotation.