1946 RESULTS ON THE FERDEN ROTATION EXPERIMENT

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The Ferden rotation experiment is located in Saginaw County, 4 miles south of Chesaning. The soil is classified as a Brookston sandy clay loam and is typical of much of the soil where sugar beets are grown. While the soil is tile drained, its compact nature makes it drain slowly.

Seven five-year rotations, shown in table 1, are being studied. The plots are arranged in a split-plot, randomized block design. All crops appear each year and the treatments are replicated four times. Two crops, sugar beets and barley, appear in all the rotations. Corn is included in all but one rotation.

Table 1 - Rotations in the Ferden Experiment

Rotation Number	Crop Sequence
1	Barley, Alfalfa, Alfalfa, Corn, Sugar Beets
2	Barley, Alfalfa, Alfalfa, Sugar Beets, Corn
3	Barley, Alfalfa, Alfalfa, Beans, Sugar Beets
4	Barley, Oats, Alfalfa, Corn, Sugar Beets
5	Barley, Oats, Clover-timothy, Corn, Sugar Beets
6	Barley, Beans, Wheat, Corn, Sugar Beets
7	Barley, Sweet clover,* Beans, Wheat, Sweet Clover,* Corn, Sugar Beets

*Seeded with the small grain and plowed under the following Spring.

Each rotation is being conducted at two levels of fertility. The "high fertility" plots receive 1,000 pounds of a 2-16-8 fertilizer per rotation and the "low fertility" plots 400 pounds 2-16-8 per rotation. One-half of the fertilizer is used for the sugar beets and the other half is divided equally and used for the small grains. In the rotations having only one small grain crop, namely barley, the one-half portion of fertilizer is placed on it. The corn, bean, and hay crops receive no commercial fertilizer. A more detailed explanation of the experimental procedure was reported in the 1945 proceedings.

Weather Conditions

After a very dry April, the 1946 growing season was, on the whole, favorable to all crops. The Spring was dry and warm as shown by the data in Table 2. After the middle of May almost ideal moisture conditions prevailed until the early part of October. The October rainfall occurred after the middle of the month, too late to be of much benefit to the beet crop.

Table 2 - Climatological Data - Ferden Farm

	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Inches of rainfall	1.27	0.59	3.71	2.94	3.45	1.76	3.50	1.69	1.98
Maximum temperature F°	68	90	81	92	98	93	96	87	64
Minimum temperature F°	16	19	23	36	40	39	28	30	17
Mean temperature F°	44	47	54	65	71	67	64	56	42

Sugar Beets

The sugar beets were planted on April 12, in a seed bed that was considered to be in excellent physical condition. The soil was dry and the seed was planted shallow. Dry weather then prevailed until the middle of May with the result that germination was very slow. The final stands were good and preblocking and thinning stand counts showed that it would be possible to obtain a nearly perfect stand. The beets were blocked and thinned on June 10 and 11. Post-blocking and thinning stand counts showed a 92 per cent stand for the high fertility plots and a 91 per cent stand for the low fertility plots. (A perfect stand, for purposes of calculation and comparison, was considered to contain 100 beets per 100 feet of row.)

Figure 1 shows the effect that the two rates of fertilization have on maintenance of stand after blocking and thinning. The larger quantity of fertilizer resulted in a better stand of beets throughout the growing season. Just after blocking and thinning is the time when the mortality rate of seedlings is at its highest.

The effect of the systems of farming on yield of beets is shown in Table 3. In general, there is little disagreement with results for previous years. A highly significant difference in yield as a result of the two fertilizer levels occurred again in 1946. The widest spread occurred where beets followed alfalfa in rotation 2. There seems to be a logical explanation for this, although it did not occur during the past years. Beets require a large amount of nitrogen and this was supplied by the alfalfa in rotation 2. In the other rotations, such a large supply was not available. Hence, a lack of nitrogen limited growth and the beets did not efficiently use the phosphate and potash supplied in the fertilizer. The half-ton spread in yield obtained in rotation 6 was probably due mostly to the 6 pounds of nitrogen in the larger quantity of fertilizer. The phosphate and potash in the fertilizer helped establish a good stand, but probably did little to influence the yield because of an insufficient supply of nitrogen. The beets on the rotation 6 plots showed severe nitrogen deficiency symptoms and the tissue tests for nitrate were low or blank after the middle of August.

The tissue tests made on all other rotations, including 7 where sweet clover is included, showed the plants to be in need of larger supplies of nitrogen before the end of the growing season. It is interesting to note that the low fertility plots in rotation 2 outyielded the high fertility plots in all the other rotations except number 3 where sugar beets follow beans.

Greenhouse experiments on the same rotations have shown that rotation 3 has outyielded all other rotations. There is a trend in this

direction on the Ferden farm. Averages for the first three years show rotation 2 to have the highest yields in the experiment, while averages for the second three year period show that yields from plots in rotation 3 have exceeded those in rotation 2. This is probably due to the good physical condition of the soil in rotation 3 as a result of the preceeding bean crop.

Table 3 - The Effect of System of Farming on Yield of Sugar Beets in 1946. (Tons per Acre)

	Rotation Number						
Level of Fertility	1	2	3	4	5	6	7
High	13.3	16.4	14.8	14.1	13.2	10.8	12.3
Low	12.0	14.3	13.3	12.6	11.7	10.3	10.8
Difference for Significance -- Rotation**				.25 tons			
Level**				.18 tons			

The highest yields in 1946 were obtained on the plots in rotation 2 where beets followed alfalfa. Second highest yields were obtained where beets followed beans, with two years of alfalfa preceeding the beans. It is interesting to note that yields were significantly higher on the plots in rotation 4, where alfalfa is left for only one year, than in rotation 1, which includes two years of alfalfa. That sweet clover green manure was beneficial in rotation 7 is shown by the fact that beets on the plots in that rotation outyielded those in rotation 6, but they did not yield as high as did plots in the rotations which included alfalfa or clover. Sweet clover stands have not been good, because of an insect which devours the young plants. This may account for the relatively low yields in that rotation. As a possible correction for this situation alsike and mammouth clover were mixed with the sweet clover in the rotation 7 seedings in 1946.

These plots for the past two years have been used to make comparisons between whole seed and segmented (sheared) seed. A study of labor requirements, as affected by normal and segmented seed, and data on rate of seeding of segmented seed are being presented in another paper. The yields and number of marketable beets as affected by kind of seed are shown in table 4.

The highest yield was produced on the rows sown with segmented seed at the high rate. The yields from the segmented seed plots varied with the stand of beets (the number of marketable beets). The plots sown with the whole seed yielded lower than did the plots sown with segmented seed at the highest rate although they had a larger number of marketable beets. The damage from blocking and thinning was greater on the plots seeded with whole seed than on those seeded with segmented seed. This, of course, affected growth rates and yields. This slight and significant increase in yield, together with the saving of labor, even at so heavy a rate of seeding, makes it seem advisable to recommend segmented seed. There was no significant difference between the stand counts taken immediately before harvest and the number of marketable beets at harvest time.

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Table 4 - The Effect of Seed Rates on Yield and Number of Marketable Beets

Kind of Seed	Pounds of Seed Sown per Acre	Yield (tons per acre)	Marketable Beets Per 5,040 ft. of row
Whole	11.5	13.1	4,453
Segmented	4.3	13.3	4,229
Segmented	3.3	12.8	3,993
Segmented	2.8	12.1	3,846
Difference required for significance **		.05 tons	

Another new comparison was made possible this year when the plots were split into two parts to compare Spring and Fall plowing. The comparisons made in this experiment are much better than those made in other experiments in years past in that several types of farming are considered on this set of plots. The results of this years experiment are shown in table 5 and are significantly in favor of Spring plowing. Previous experiments

Table 5 - A Comparison of Sugar Beet Yields on Spring and Fall Plowed Land

Season Plowed	Tons Per Acre
Spring	13.2
Fall	12.5
Difference for significance**	.03 tons

conducted at other locations have failed to show any difference in yield in favor of either Spring or Fall plowing. The agronomist and soil conservationist prefers Spring plowing to Fall plowing for several reasons and if Spring plowing will produce higher yields, this fact may be used as another argument in favor of Spring plowing.

SUMMARY

The 1946 data for sugar beets show rotation 2 to be the highest yielding rotation and the most responsive rotation to fertilizer. Spring plowed land produced larger yields than did fall plowed land. The yields from the segmented seed plots varied with the number of marketable beets. The plots sown at the high rate of seeding of segmented seed, 4.3 lbs. per acre, yielded significantly more than did the whole-seed plots which were planted at 11.5 lbs. per acre.

Figure 1. - The effect of fertilizer rates on stand of beets during the growing season.