

The Effect of Various Preceding Crops on Sugar Beets

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Introduction

Sugar beets occupy a large acreage in southern Alberta as compared with other irrigated cash crops. This crop receives special consideration in rotation planning because of its extent and high return per acre. Most sugar beet rotations are planned to provide the maximum production of the primary crop. The beneficial effects of barnyard manure, commercial fertilizer, timely irrigation, and legumes also receive consideration in deciding upon cropping practices (1, 4, 8)².

The sequence of cropping also has a marked effect on the yield of certain crops (5, 6, 7) and, therefore, is an important phase of rotation planning. In southern Alberta information was needed on the effect of crop sequence on the yield of sugar beets, irrespective of other rotational factors. An experiment was set out at the Lethbridge Experimental Farm in 1947 to study the effects on the following crop of some of the important crops grown under irrigation in southern Alberta. The results of this experiment are presented in this paper.

Procedure

In 1947 seven crops—canning peas, canning corn, potatoes, barley, soft spring wheat, sugar beets, and field beans—were grown in adjacent strips at four locations at the Lethbridge Experimental Farm. The crop varieties recommended for southern Alberta were used throughout the test. In 1948 these crops were grown transversely across the preceding strips and a summer-fallow strip, allowing each crop to be grown after itself, after fallow, and after the other six crops. The following year, the crops were grown crosswise to the 1948 plots, thus providing two years of sequence crops, and completing one cycle. All of the plots were seeded to oats in 1950, after which the experiment was repeated until two sequence cycles were completed.

To obtain maximum crop yields and yet maintain relatively uniform fertility, ammonium phosphate (11-48-0) fertilizer, at the rate of 100 pounds per acre, was applied each spring over the whole area of each location prior to seeding. No further fertilizer applications were made.

The size of each plot was 19 feet by 40 feet, and appropriate samples of each crop were harvested. In the calculation of the data for the analysis of variance, the locations were treated as replicates. All of the crops were irrigated with a perforated-pipe sprinkler system.

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² Numbers in parentheses refer to literature cited.

Results and Discussion

The yields of sugar beets for the four sequence years (1948, 1949, 1952, and 1953) following the different preceding crops appear in Table 1. Comparable results of the percentage sucrose of sugar beets are shown in Table 2. In Figure 1, the yields of each crop, excepting sugar beets, following the various preceding crops are depicted graphically. The gross returns per acre per year following each preceding crop, as calculated from the four-year average annual returns of the seven succeeding crops, are depicted graphically in Figure 2.

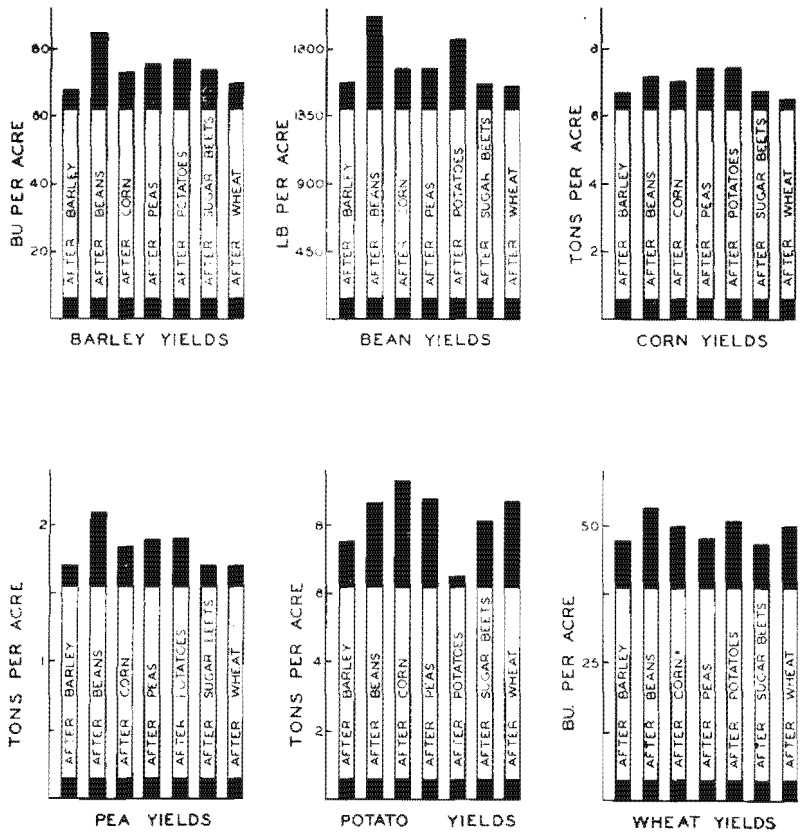


Figure 1.—Four-year (1948-49, 1952-53) average yields of each crop, excepting sugar beets, following the various preceding crops in a crop sequence test, Lethbridge, Alberta.

During three of the four sequence years (Table 1) the yields of sugar beets were highest after beans. In 1948 and in 1952 the yields of beets after beans were higher by more than one ton than the yields following any of the other six crops. Analysis of the four-year data revealed that the yields of sugar beets were significantly higher following beans than the

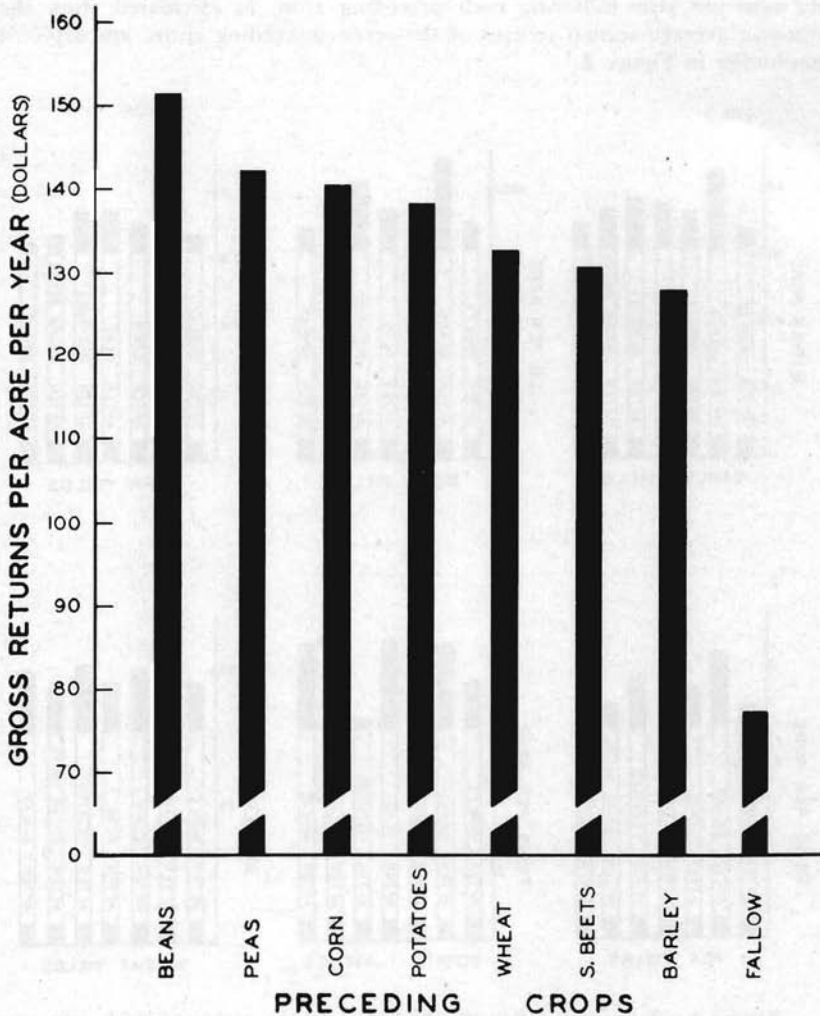


Figure 2.—Gross returns per acre per year following each preceding crop as calculated from the four-year average annual returns of the seven succeeding crops in a crop sequence test, Lethbridge, Alberta.

Table 1.—Yields of Sugar Beets for Four Sequence Years (1948, 1949, 1952, 1953) Following Different Preceding Crops and Summer-fallow in a Crop Sequence Test, Lethbridge, Alberta.

Year	Barley	Beans	Corn	Peas	Potatoes	Sugar Beets	Wheat	L.S.D.	Fallow
1948	11.02	14.18	11.57	11.91	12.76	11.72	10.52		13.13
1949	8.97	10.68	10.29	9.61	10.82	9.01	9.00		
1952	15.18	18.56	14.80	17.49	17.54	14.08	15.97		19.10
1953	7.46	8.45	9.82	10.04	9.20	7.87	8.42		
Mean	10.66	12.97	11.62	12.26	12.58	10.67	10.98	1.32	

Table 2.—Percentages of Sucrose of Sugar Beets for Four Sequence Years (1948, 1949, 1952, 1953) Following Different Preceding Crops and Summer-fallow in a Crop Sequence Test, Lethbridge, Alberta.

Year	Barley	Beans	Corn	Peas	Potatoes	Sugar Beets	Wheat	Fallow
1948	16.2	15.5	15.7	16.0	15.9	16.0	15.2	15.7
1949	14.4	13.2	13.7	13.2	13.4	14.4	14.2	-
1952	16.8	16.2	16.0	16.3	16.8	16.0	16.3	16.4
1953	16.8	16.6	16.2	16.2	16.4	17.0	17.0	--
Mean	16.0	15.4	15.4	15.4	15.6	15.8	15.7	--

yields obtained following sugar beets, corn, wheat, and barley. Significant yield increases of barley, beans, and peas also were obtained after beans. Hence, on the basis of yields of succeeding crops, field beans were the outstanding preceding crop in the test.

The beneficial effect of beans as a preceding crop possibly is due to the additional nitrogen made available to the subsequent crops by this annual legume. This is in agreement with the findings of Guttay and Cook (3), who reported that additional nitrogen was not so beneficial in a sequence in which sugar beets followed beans as in other crop sequences.

There were no significant differences in the yields of sugar beets when grown after beans, potatoes or canning peas. The superiority of beans and potatoes as preceding crops for sugar beets was observed by Carlson (2). He attributed this superiority to the early rapid absorption of nutrients by the root crop when grown after beans and potatoes.

None of the preceding crops had a significant effect on the percentage sucrose of sugar beets in any year as shown in Table 2.

There were no significant differences in yields of canning corn and wheat following the various other crops as shown in Figure 1. Because of this lack of response to the various sequence treatments, corn and wheat apparently could be grown satisfactorily in any rotation sequence and thus add flexibility to a rotation. From a management standpoint, because of better weed control in intertilled crops, canning corn could be favored over wheat as a preceding crop.

Barley was the least effective preceding crop. The tendency of barley to shatter, with the subsequent volunteer growth, is an undesirable feature in rotation management. This is especially true where sugar beets follow barley, because of the labor cost for weeding.

About 40 percent of the beets in southern Alberta are planted on summer-fallowed land because of the higher yields obtained. Crop yields after summer-fallow are available for two years in this test. When it is considered that, with the use of summer-fallow, it takes two years to produce one crop, the yield increases are not great enough to warrant a summer-fallowing program. The average annual gross returns after fallow were \$77 per acre, as compared with \$151 from crops grown after beans. From Figure 2 it is apparent that the comparative cash returns after fallow are not very encouraging. However, fallowing may be justified for other reasons, such as a serious weed problem or a land-leveling program.

Sugar beets are considered by many farmers in southern Alberta to be a good preceding crop because of high yields of some crops on beet land. The results from this experiment indicate that sugar beets are not a favorable preceding crop for any of the seven crops used. Beets ranked only slightly better than barley, which was the poorest preceding crop in this test. The reasons for the high regard held for sugar beets as a preceding crop in this area may be that beets (a) help to control weeds because of hoeing, (b) are usually planted on the best land, and (c) are frequently the only crop receiving fertilizer and fall irrigation. Other crops, as evidenced by the results of this study, could perhaps be more favorable preceding crops than sugar beets if they received some of the management advantages just mentioned.

Summary

Four-year average yield data are presented for sugar beets when grown after themselves, after summer-fallow, and after six other preceding crops.

Field beans, followed by potatoes and canning peas, were found to be the best preceding crops for sugar beets.

Barley and sugar beets were the least effective preceding crops, and the subsequent volunteer growth of barley added to the problem of sequence management.

There were no significant differences in yields of wheat and canning corn when grown after the other six crops and after themselves.

Summer-fallow operations on irrigated land are not justified on the basis of comparative yearly gross returns.

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