

Cultural Experiments with Sugar Beets in Western Nebraska¹

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Length of growing season is a factor which influences the production of sugar beets in western Nebraska. Short growing seasons have limited sugar beet production on soils of high productivity where the crop has been grown with the best cultural methods. Under these conditions the sugar beet plants have been unable to respond to abundant fertility and good culture because of the limited time for growth. Opportunities for extending the growing season in the fall are rare. However, experience and observation indicate possibilities for taking greater advantage of favorable growing weather in the spring by proper irrigation and planting practices.

Experiments conducted by Nuckols³ in western Nebraska indicate that early planted sugar beets yield two to four tons per acre more than medium or late planted sugar beets. Better stands were obtained with sugar beets planted March 20 than with sugar beets planted April 30. Frost damage to early planted sugar beets was not as great as the damage to stands caused by insufficient soil moisture for germination at the later planting dates. Nuckols further observed that the time of emergence was more important than planting date.

Time of emergence is determined in many instances by soil moisture conditions immediately after the seed is planted. Sugar beet seed planted early in April sometimes lies in dry soil for several weeks before rainfall is sufficient to insure germination and emergence. Under these conditions the possible advantages of early planting are lost. Because sugar beet seed must be planted shallow, adequate soil moisture for favorable seed germination many times is dependent upon either rainfall or irrigation after the seed is planted. The ridge-cover method of planting has been used in an attempt to conserve the soil moisture available at planting time.

A study was initiated in 1948 at the Scotts Bluff Substation to determine the possibilities of increasing the yields of sugar beets by irrigation for emergence and by the use of the ridge-cover method of planting at different planting dates. The use of the ridge-cover method of planting and of irrigation for emergence have the same objective of providing adequate moisture for germination immediately after the seed is planted. Although other factors such as soil temperature and climatic conditions in general influence the

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³Nuckols, S. B. Summary of Date-of-Planting Experiments with Sugar Beets in Nebraska and Wyoming. *Proceedings American Society of Sugar Beet Technologists*, 185-189, 1946.

germination of sugar beet seed and the emergence of the seedlings, soil moisture is a factor which can be controlled in an irrigated region. The influence of the climate is of sufficient importance to warrant the continuation of this study for several years. The results obtained during 1948 and 1949 are presented in this paper.

EXPERIMENTAL PROCEDURE

The factors studied comprised date of planting, method of planting, and irrigation for emergence at planting time. During 1948 sugar beets were planted April 3 (early), April 18 (medium), and May 2 (late). During 1949 the three planting dates were March 26 (early), April 12 (medium), and May 2 (late). Two methods of planting were used at each planting date: (a) surface or regular planting of sugar beets, and (b) surface planting with a ridge cover. Irrigation for emergence was practiced on one-half of the plots in each planting method at each planting date. The treatments were arranged in a split plot design with six replications of each treatment. The major plot consisted of one individual planting date, the major sub-plot of one method of planting and the sub-plot of one irrigation practice. Each sub-plot of sugar beets consisted of four rows spaced 20 inches apart and 150 feet long.

The study in 1948 and 1949 was conducted on a plot of land which received approximately 15 tons of manure per acre prior to planting time each year. Ridges for the ridge-cover method of planting were made with beet cultivator disks after the seed was planted. The irrigation treatment for emergence was applied one to two days after planting. The ridge cover was removed when the seed started to germinate by dragging one section of a harrow lengthwise of the plot. After the sugar beets were thinned, all plots received the same treatment throughout the remainder of the season. There were five irrigations after thinning in 1948 and six irrigations after thinning in 1949.

EXPERIMENTAL RESULTS

Date of Emergence

In 1948, sugar beets planted April 3 and irrigated at planting time emerged April 19, or approximately two weeks earlier than sugar beets planted the same day but not irrigated. There was approximately five days difference in emergence in favor of irrigation at planting time for sugar beets planted April 18. At the late planting date sugar beets emerged May 14 on both the irrigated and nonirrigated plots.

In 1949, sugar beets planted March 25 and irrigated at planting time emerged April 16, while those planted the same day but not irrigated emerged April 18. During the night of April 15 the temperature dropped to 22° F. and killed many of the sugar beet seedlings from the March 25 planting which were near the surface of the ground. Sugar beets planted April 12 emerged April 25 on the irrigated plots and April 28 on the nonirrigated plots. At the late planting date sugar beets emerged May 12 on both irrigated and nonirrigated plots.

Yields of Sugar Beets and Sugar Production

Influence of Planting Date. A striking decline in the yields of sugar

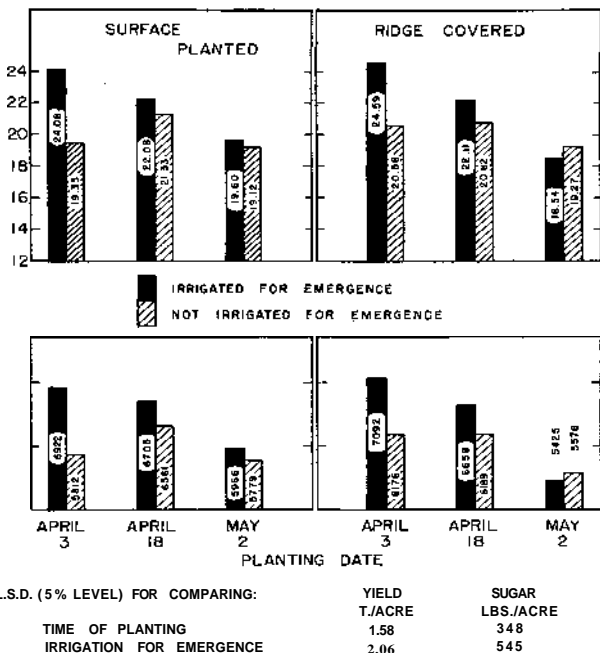


Figure 1. Influence of planting date, planting method and irrigation for emergence on sugar beet production. 1948.

beets and the production of sugar resulted from delayed planting in 1948 where irrigation was practiced for emergence (Figure 1). This was true with both the surface and ridge-cover methods of planting.

Where irrigation was not practiced for emergence, yields of sugar beets with the ridge-cover method of planting were not significantly different at the three planting dates although the yields of sugar from beets planted April 3 and April 18 were significantly larger than the yields from those planted May 2. However, with the surface method of planting sugar beet yields and sugar production were significantly greater at the medium planting date than at the early and late planting date where the sugar beets were not irrigated for emergence.

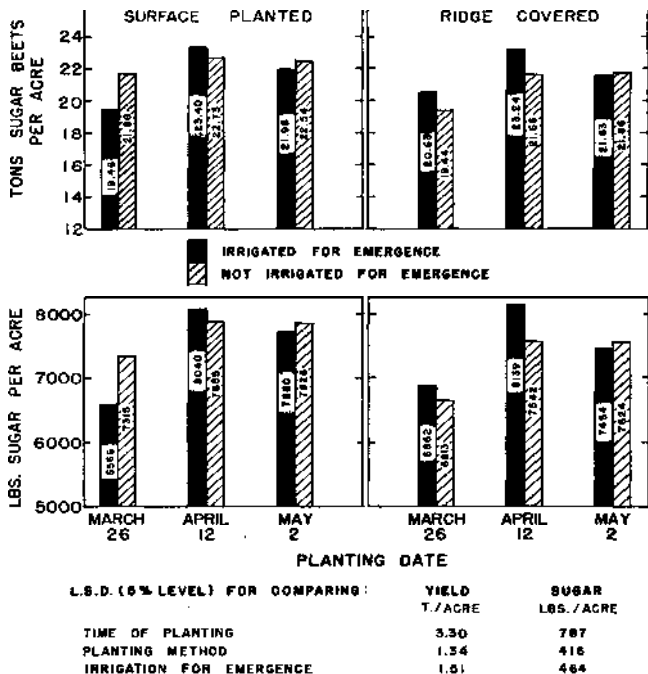
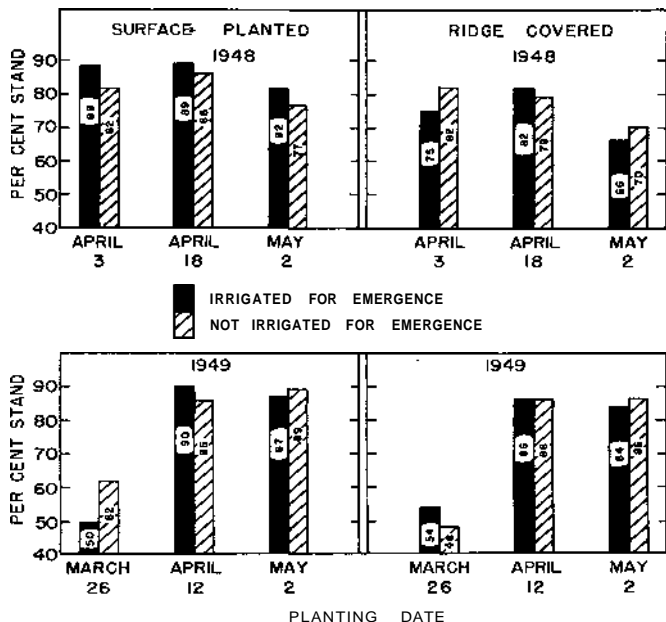


Figure 2. Influence of planting date, planting method and irrigation for emergence on sugar beet production, 1949.

In 1949 yields of sugar beets planted March 26 were lower than those planted April 12 or May 2 (Figure 2). This is in marked contrast to the results obtained in 1948 when the highest yields were obtained from early planting (April 3) and irrigation for emergence (Figure 1). In 1948 the early planted sugar beets emerged without damage from frost whereas in 1949 sugar beet seedlings from the March 26 planting emerged at the time of a severe frost and many were killed.

Value of Irrigation for Emergence. Irrigation for emergence at planting time in 1948 resulted in large increases in the yields of sugar beets and



L.S.D. (5% LEVEL) FOR COMPARING:

	1948	1949
PLANTING DATE	13.9	11.1
PLANTING METHOD	6.6	11.1
IRRIGATION PRACTICE	—	7.5

Figure 3. Influence of planting date, planting method and irrigation for emergence on stands of sugar beets. 1948 and 1949.

sugar at the early planting date, moderate but nonsignificant increases at the medium planting date and small or no increases at the late planting date (Figure 1).

Irrigation for emergence at the early (March 26) planting date in 1949 resulted in a significant decrease in yield of surface planted sugar beets, the

yields being 21.68 tons per acre where no irrigation was practiced and 19.46 tons per acre where irrigation was practiced (Figure 2). Sugar production was influenced in a similar manner. Where the sugar beets were planted with the ridge-cover method of planting there was a small but nonsignificant increase in the yield due to irrigation at planting. These contrasting results due to irrigation for emergence with the two methods of planting may be attributed to differences in stand resulting from variable frost damage under the different treatments.

Irrigation of surface planted beets for emergence produced more rapid and uniform germination than where irrigation was not practiced. Consequently a larger proportion of seedlings on the irrigated plots were near the surface of the ground at the time of the severe frost. This condition appeared to exist also on the ridge-cover planting of March 26, which was not irrigated for emergence. The ridge cover at the early planting date in 1949 appeared to be effective in conserving moisture for seed germination.

There was a moderate increase in yield of sugar beets in favor of irrigation for emergence at the medium planting date in 1949 with both methods of planting although the effect of irrigation was more pronounced with the ridge-cover method than with the surface method of planting (Figure 2). This conforms with the results obtained in 1948 at the medium planting date.

At the late planting date in 1949 the yields on the irrigated and non-irrigated plots under both methods of planting were essentially the same (Figure 2). This conforms with the results obtained during 1948 at the same planting date.

Comparison of Surface Planting with Ridge-Cover Planting. There was no benefit to sugar production in 1948 from the use of the ridge-cover method of planting compared with the common or surface method of planting (Figure 1). The greatest differences in yields of sugar beets and sugar due to methods of planting occurred at the late planting date with sugar beets irrigated for emergence. These differences may have been due to the method of removing the ridges or to climatic conditions prevailing at the time the ridges were removed rather than to any inherent qualities of the ridge cover itself. The use of the harrow lengthwise of the plots was not entirely satisfactory. In some instances too much soil was removed and in others not enough. The ridges which were irrigated proved to be firm and more difficult to remove than those which were not irrigated. Despite these difficulties the ridge-cover method was essentially as effective as the surface method of planting. The ridge-cover method of planting did greatly facilitate the application of irrigation water at planting time.

In 1949 differences in yields of sugar beets due to planting method were significant (Figure 2). For example, differences in favor of surface planting over the ridge-cover method where irrigation was not applied at planting time were 2.24, 1.07 and 0.68 tons per acre and 702, 313 and 302 pounds sugar per acre for the three dates of planting, respectively. In contrast there was no consistent effect of planting method upon yields where irrigation was practiced at planting. Either providing moisture by irrigation at planting time or conserving moisture by the use of a ridge cover for sugar beet seed

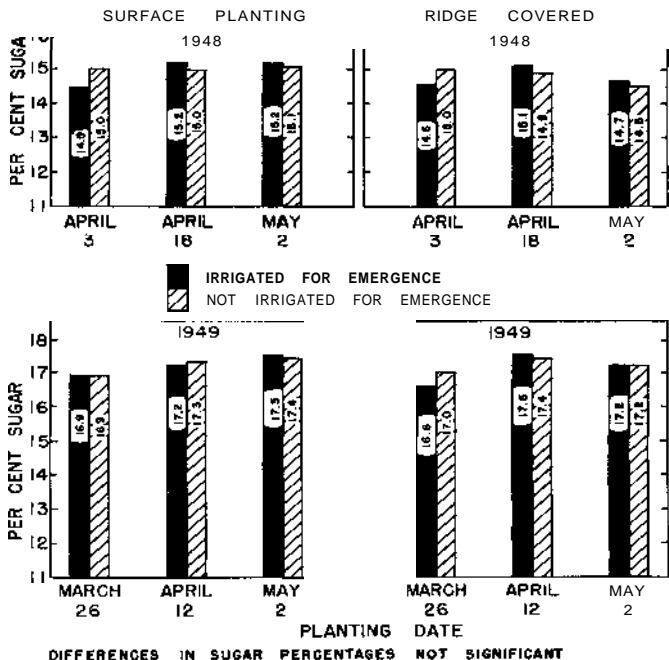


Figure 4. Influence of planting date, planting method and irrigation for emergence on the sugar content of sugar beets. 1948 and 1949.

planted March 26, 1949, proved to be unfavorable practices. Explanations for the contrasting results obtained in 1948 and 1949 have been presented.

Stands of Sugar Beets

In 1948 the poorest stands were obtained at the late planting date (Figure 3). The smallest stand was 66 per cent with the ridge-cover method planted May 2 and irrigated for emergence. The largest stand was 89 per cent for surface planting on April 18 and irrigated for emergence. The trends in stands during 1948 correspond in a general way with the yield trends shown in Figure 1.

In 1949 a great reduction in stand occurred for sugar beets planted March 26 compared with plantings made April 12 and May 2 (Figure 3). This reduction in stand was due to a severe frost on the night of April 15 which killed many of the sugar beet seedlings. The largest stand for the March 26 planting was 62 per cent with the surface planted sugar beets which were not irrigated for emergence. Compared with the irrigated surface planted sugar beets and the ridge-covered sugar beets, fewer of the seedlings were near the surface of the ground and in danger of frost on April 15. Consequently, a better stand was obtained. The stands obtained in 1949 in general correspond with the yield trends shown in Figure 2.

Sugar Content of Sugar Beets

The three factors studied in this experiment during 1948 and 1949 failed to influence the sugar content of sugar beets significantly (Figure 4). During 1948 the sugar content of beets from all treatments was approximately 15 per cent compared with approximately 17 per cent in 1949. As a result, the yields of sugar per acre in 1949 were considerable higher than in 1948.

SUMMARY

A three factor experiment dealing with the production of sugar beets was conducted at the Scotts Bluff Substation in western Nebraska during 1948 and 1949. The three factors studied comprised date of planting, method of planting, and irrigation for emergence at planting time. During 1948 the sugar beets were planted April 3, April 18 and May 2. During 1949 the three planting dates were March 26, April 12 and May 2. Two methods of planting were used at each planting date: (a) surface or regular planting of sugar beets, and (b) surface planting with a ridge cover. Irrigation for emergence was practiced on one-half of the plots in each planting method at each planting date.

In 1948 a marked decline in yield of sugar beets occurred with a delay in planting date where the sugar beets were irrigated for emergence. However, where the sugar beets were not irrigated for emergence differences in yield due to planting date were small. In contrast to the results obtained in 1948, yields of sugar beets in 1949 for the medium and late planting dates were significantly higher than the yields of sugar beets planted March 26. The latter results were due in a large measure to frost injury to the early planted sugar beets as they emerged.

Irrigation at planting of sugar beets compared with no irrigation at planting in 1948 resulted in a large increase in yield at the early planting date, a moderate increase in yield at the medium planting date, and no increase in yield at the late planting date. In 1949, however, irrigation for emergence at the early planting date resulted in a significant decrease in yield of surface planted sugar beets and a small but nonsignificant increase in yield of sugar beets planted with the ridge-cover method of planting. These contrasting results for irrigation at planting in 1949 were attributed to differences in stand which were a consequence of the variable effect of

planting method and irrigation practice upon frost damage. The influences of irrigation for emergence on yields of sugar beets at the medium and late planting dates were similar in 1948 and 1949.

Essentially the same yields of sugar beets were obtained for the ridge-cover and surface methods of planting in 1948. However, where irrigation was not practiced at planting in 1949, the surface method of planting was distinctly superior to the ridge-cover method of planting. An explanation was presented.

Stands of sugar beets obtained during 1948 and 1949 conformed in a general way to the yield trends from the various treatments.

The three factors studied did not influence the sugar content of sugar beets during 1948 and 1949.