

Effect of Rate and Date of Nitrogen Application on Sugar Beets

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Tests to study the effects of varying rates and time of nitrogen application on sugar beets were conducted in Colorado, Wyoming and Montana during the summer of 1949.

Procedure

A single test embodying both time and rate of application was conducted at Swink, Colorado, whereas separate tests for each variable were conducted in each of the two other locations—Sheridan, Wyoming, and Sidney, Montana.

Varying dates of nitrogen application were arranged in a Latin square design in the tests conducted at Sidney and Sheridan. Seven treatments, as listed in Table 1, made up the test. Harvested plots were 4 rows wide and 25 feet long. Two 12-beet samples were taken from each plot for sucrose determinations.

Five application rates in the tests conducted at Sidney and Sheridan were arranged in a randomized block of ten replications. Rates are listed in Table 2. Sucrose samples and plot size were the same as in the date-of-application test.

Plots in the Colorado test were 4 rows wide and 53 feet long. The two center rows of each plot were harvested for yield and two 12-beet sugar samples were taken. A split plot design was used and the nine treatments in the test were replicated eight times. The treatments are listed in Table 3.

Results

The time of application in the Colorado test did not influence yield of sugar percent significantly. Nitrogen applied at the rate of 120 lbs. per

Table 1.—Effect of Time of Nitrogen Application on Sugar Beets at Sheridan, Wyoming, and Sidney, Montana, 1949.

	Wyoming Test ¹			Montana Test ²		
	Sugar per acre	Tons per acre	Percent sucrose	Sugar per acre	Tons per acre	Percent sucrose
Ammonium sulfate side-dressed at planting 300 lbs. per acre ³	6.556	18.768	16.87	4.448	15.477	14.36
Ammonium sulfate side-dressed at 300 lbs. per acre before: ⁴						
1st irrigation	6.602	19.498	16.92	4.717	15.771	14.62
2nd irrigation	6.265	18.641	16.80	4.521	15.755	14.34
3rd irrigation	6.333	19.113	16.57			
4th irrigation	6.201	18.934	16.37			
Split application ⁴	6.463	19.128	16.89	4.703	16.119	14.59
Check (no treatment)	6.167	18.314	16.85	4.518	15.421	14.65
General Mean	6.538	18.914	16.75	4.538	15.607	14.47
Sig. Diff.	ns	ns	.35	ns	ns	ns

¹ In the Wyoming test the dates of irrigation were June 20, July 8, July 25 and August 10.

² In the Montana test the dates of irrigation were July 18 and August 8.

³ Ammonium sulfate used was 20.5 per cent nitrogen.

⁴ Sheridan applications before 1st and 3rd irrigations. Sidney at planting and before 2nd irrigation.

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 Table 2.—Effect of Rate of Nitrogen Application on Sugar Beets, Sheridan, Wyoming, and Sidney, Montana, 1949¹

	Wyoming Test			Montana Test		
	Sugar per acre	Tons per acre	Percent sucrose	Sugar per acre	Tons per acre	Percent sucrose
400 lbs/A of Ammonium sulfate side-dressed ²	6,584	19.201	17.14	4,898	15.818	14.88
300 lbs/A of Ammonium sulfate side-dressed	6,581	19.402	16.96	4,762	15.872	15.01
200 lbs/A of Ammonium sulfate side-dressed	6,285	18.519	17.15	4,472	14.872	15.06
100 lbs/A of Ammonium sulfate side-dressed	6,278	18.194	17.26	4,310	14.728	14.66
Check (no treatment)	6,530	18.922	17.26	4,107	13.788	14.86
General Mean	6,452	18.808	17.15	4,170	15.016	14.90
Sig. Diff.	ns	.831	ns	346	1.138	ns

¹ All plots, including check, received 200 lbs. of treble superphosphate at planting time.

² All side-dressings of ammonium sulfate were applied just before the first irrigation.

³ Ammonium sulfate used was 20.5 per cent nitrogen.

acre, one-half being applied after thinning, mid-June, and the remainder two weeks later, lowered the sugar percent below that obtained when 40 lbs. of nitrogen per acre was applied in a similar application. No significant yield response was observed when the rates of nitrogen application were 40 lbs., 80 lbs., or 120 lbs. per acre.

Fertilizer added to the soil at a rate of 60 lbs. of nitrogen per acre as side-dressing, just previous to a mid-August irrigation, depressed significantly sugar percent in the Wyoming tests. Nitrogen rates of 20 lbs., 40 lbs., 60 lbs., and 80 lbs. per acre failed to influence yield in these tests.

In the Montana tests, varying the time of application of nitrogen fertilizer did not influence significantly the yield of sugar percent of beets. An

Table 3.—Effect of Rate and Date of Nitrogen Application on Sugar Beets at Swink, Colorado, 1949.

Treatment	Sugar per acre	Tons per acre	Percent sucrose
120 lbs/A of Ammonium nitrate ¹			
A ¹	4,353	14.329	15.21
B ²	5,044	16.013	15.72
C ³	5,310	17.321	15.26
240 lbs./A of Ammonium nitrate ⁴			
A ¹	5,010	16.575	15.05
B ²	5,008	16.640	15.07
C ³	5,583	18.192	15.38
360 lbs/A of Ammonium nitrate ⁴			
A ¹	5,289	17.692	14.91
B ²	4,956	16.891	14.68
C ³	5,240	17.531	14.91
General Mean	5,088	16.799	15.13
Sig. Diff. (19:1) within groups	ns	ns	ns
Sig. Diff. (19:1) between groups	ns	ns	.72

¹ A: side-dressed all 6-15;

² B: side-dressed 1/2 amount 6-15, 1/2 amount 7-1.

³ C: side-dressed 1/2 amount 6-15, 1/3 on 7-1, 1/3 on 8-15.

⁴ Ammonium nitrate used was 33 per cent nitrogen. All side-dressings were followed immediately by an irrigation.

increase in yield was obtained by the application of 40, 60 and 80 lbs. of nitrogen per acre.

Discussion

Results of these tests indicate that the time of application is apt to affect unfavorably the sugar percent of beets, especially when heavy rates of nitrogen are applied late in the season. On the other hand, very little increase in yield was obtained from a split or late fertilizer application over a single early application.

This test illustrates the fact that, because of numerous environmental factors which may be encountered, it is very difficult to anticipate the responses to be obtained by varying rates of nitrogen fertilizer. Factors such as length of growing season, mean temperature and inherent soil fertility all exert important influences on fertilizer response.

Summary

Tests conducted during 1949 in Colorado, Wyoming and Montana indicate, in general, that the time of application did not influence yield and sugar content significantly except for an application as late as August 10.

No significant yield responses were observed in Colorado and Wyoming by increased application up to 120 lbs. and 80 lbs. nitrogen per acre respectively, although the 120 lbs. rate depressed the sucrose slightly. However, in Montana increased yields are noted for 40, 60 and 80 lbs. nitrogen per acre.

No increase in yield was obtained from split application as compared to a single early application.