Fertilizer Trials in Southeastern Colorado

C. E. Cormany, E. P. Pattison, and J. T. Alexander[1]

For the past several years, the sucrose percentage of beets grown in the lower Arkansas Valley of Colorado has been unusually low.

Previous studies (1), (2), indicated that phosphoric acid was the plant-food element most deficient for sugar beet production in this area.[2] Nitrogen was found to be deficient in the lighter textured soils. Little response had been observed from applications of potassium.

This study was designed to determine the effect of different fertilizer applications on the gross yield of sugar per acre for the lower Arkansas Valley of Colorado.

Two fields located near Bristol, Colorado, were used for these tests. The soil on each field was classified as a silt loam. They had a pH of 8.1. Each test consisted of eleven different fertilizer treatments in comparison to the check. In addition, one field received 10 tons of barnyard manure per acre. Phosphate treatments consisted of 43 percent treble-superphosphate applied at planting time. Nitrogen treatments consisted of sulfate of ammonia applied as a side-dressing after thinning. The potash treatment was applied at planting time. The unmanured field had an insufficient amount of irrigation during the growing season. (This undoubtedly accounts for the low yields produced, and for the erratic response obtained from the fertilizer treatments on this field.)

The treatments were replicated three times on the unmanured field and four times on the manured field. Analysis of variance was applied to a randomized block design in the statistical analysis of the data. In order to better summarize the results, the data from both fields were combined and another analysis was made. The results for the unmanured field are shown in table 1; those for the manured in table 2; and those for the two fields combined in table 3. (Tables 1, 2, 3 appended).

Discussion

Although the results of this test are not highly significant statistically, some definite trends are apparent. It is of interest to note that the manured field utilized more nitrogen than was formerly believed necessary for optimum yield. The highest yield in sugar per acre was obtained from the treatment having the most nitrogen present; namely, 400 pounds of 4-24-4 mixture side dressed with 300 pounds of sulfate of ammonia, a total of 77 pounds of nitrogen. The ratio of nitrogen to phosphorus is only 1:1.2. It is of interest to note that a rather narrow N/P ratio is exhibited in the

[1]Chief Agronomist, Agricultural Mechanization Superintendent, and Associate Agronomist, respectively, Holly Sugar Corporation.

[2]The numbers in parentheses refer to literature cited.

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treatments ranked in the upper five. The reverse trend is evident in the unmanured field. The treatments having the widest N/P ratios show the greatest yield in sucrose per acre. The manured field was much more active biologically and probably made more efficient use of nitrogen added in the fertilizers.

No response was observed for the treatment containing potassium on either field.

The combined analysis of the two fields shows that a response can be expected from the addition of both phosphorus and nitrogen. The combined analysis does not show any definite trend in the relationship of nitrogen to phosphorus.

Summary

The efficiency of the commercial fertilizer was increased by the addition of manure to the soil.

A definite response from side-dressing with complete fertilizers and fertilizers containing nitrogen and phosphorus was noted.

A definite response was secured from applications of phosphate fertilizers.

The most satisfactory treatment for this local area, considering both economy and plant response, appears to be an application of 400 pounds per acre of 43 percent treble-superphosphate with a side-dressing of 300 pounds per acre of sulfate of ammonia applied after thinning.

Table 1.—Results of fertilizer tests on an unmanured field in the Lower Arkansas Valley of Colorado, 1947.

Treatment	Sucrose		Gross sugar per acre order			
			Yield per acre		Gross sugar per acre	
	Percent	Percent of check	Tons	Percent of check	Pounds	Percent of check
400 pounds 0-43-0	11.07	96	13.779	117	3062	111
600 pounds 0-43-0	11.47	99	13.315	113	3058	111
300 pounds 20.5-0-0 + 600 pounds 0-43-0	10.75	93	13.291	113	2898	105
Check (no treatment)	11.57	100	11.747	100	2749	100
200 pounds 0-43-0	10.98	95	12.113	103	2665	97
300 pounds 20.5-0-0 + 400 pounds 4-24-4	9.85	85	13.453	115	2656	97
300 pounds 20.5-0-0 + 200 pounds 0-43-0 + 100 pounds 0-0-50	10.50	91	12.266	104	2597	94
200 pounds 4-24-4	11.47	99	11.431	97	2597	94
300 pounds 20.5-0-0 + 200 pounds 0-43-0	9.97	86	12.340	105	2424	88
400 pounds 4-24-4	10.25	89	11.427	97	2321	84
300 pounds 20.5-0-0 + 200 pounds 4-24-4	9.37	81	12.030	102	2260	82
300 pounds 20.5-0-0 + 400 pounds 0-43-0	9.88	85	11.167	95	2188	80
General mean	10.59		12.363		2623	
F value	1.6823*		*		*	
5 percent point	>2.23		*		*	
1 percent point	>3.12		*		*	
S. E. mean	.5672		*		*	
Difference required for significance	1.66		*		*	

*No significant differences.

Table 2.—Results of fertilizer tests on a manured field in the Lower Arkansas Valley of Colorado, 1947.

Treatment	Gross sugar per acre order: Sucrose Percent	Sucrose Percent of check	Yield per acre Tons	Yield per acre Percent of check	Gross sugar per acre Pounds	Gross sugar per acre Percent of check
300 pounds 20.5-0-0 + 400 pounds 4-24-4	13.42	111	18.718	137+	5010	149+
300 pounds 20.5-0-0 + 400 pounds 0-43-0	13.08	108	18.856	138+	4948	148+
300 pounds 20.5-0-0 + 600 pounds 0-43-0	12.95	107	18.650	137+	4828	144+
300 pounds 20.5-0-0 + 200 pounds 0-43-0	12.72	105	17.945	132+	4566	136+
300 pounds 20.5-0-0 + 200 pounds 4-24-4	12.26	101	18.258	134+	4476	134+
200 pounds 4-24-4	13.64	113	16.351	120+	4406	131+
300 pounds 20.5-0-0 + 200 pounds 0-43-0 + 100 pounds 0-0-50	12.50	103	17.540	129+	4366	130+
600 pounds 0-43-0	13.39	111	16.323	120+	4355	130+
400 pounds 4-24-4	12.90	107	16.742	123+	4315	129+
200 pounds 0-43-0	13.01	108	15.692	115	4079	122
400 pounds 0-43-0	13.01	108	15.221	112	3969	118
Check (no treatment)	12.10	100	13.644	100	3352	100
General mean	12.92		16.995		4389	
F value	1.2783*		4.6280		2.8824	
5 percent point	>2.04		<2.27		<2.27	
1 percent point	>2.74		<3.17		2.84	
S. E. of a mean	.4088		.7544		268.4384	
Difference required for significance	1.18		2.179		775	

*No significant difference.

Where treatments differ significantly from the check (no treatment) they are marked + or —, indicating whether they are above or below the check.

Table 3.—The combined results of fertilizer tests on manured and unmanured fields in the Lower Arkansas Valley of Colorado, 1947.

Treatment	Gross sugar per acre order: Sucrose Percent	Sucrose Percent of check	Yield per acre Tons	Yield per acre Percent of check	Gross sugar per acre Pounds	Gross sugar per acre Percent of check
300 pounds 20.5-0-0 + 400 pounds 4-24-4	11.89	100	16.462	128+	4001	129
300 pounds 20.5-0-0 + 600 pounds 0-43-0	12.01	101	16.353	127+	4001	129
600 pounds 0-43-0	12.56	106	15.034	117+	3799	123
300 pounds 20.5-0-0 + 400 pounds 0-43-0	11.71	99	15.561	121+	3765	122
300 pounds 20.5-0-0 + 200 pounds 0-43-0	11.54	97	15.543	121+	3648	118
200 pounds 4-24-4	12.71	107	14.242	111	3631	117
300 pounds 20.5-0-0 + 200 pounds 0-43-0 + 100 pounds 0-0-50	11.64	98	15.280	119+	3608	117
400 pounds 0-43-0	12.18	103	14.603	114	3580	116
300 pounds 20.5-0-0 + 200 pounds 4-24-4	11.02	93	15.589	121+	3527	114
200 pounds 0-43-0	12.14	102	14.158	110	3473	112
400 pounds 4-24-4	11.76	99	14.464	113	3460	112
Check (no treatment)	11.87	100	12.831	100	3094	100
General mean	11.92		15.010		3632	
F value	1.7320*		2.2621		1.2087*	
5 percent point	>1.89		<2.10		>1.89	
1 percent point	>2.45		>2.45		>2.45	
S. E. of a Mean	.3442		.6779		225.7305	
Difference required for significance	.97		1.917		638	

*No significant difference.

Where treatment differs significantly from the check (no treatment) they are marked + or —, indicating whether they are above or below the check.

Literature Cited

(1) HURST, L. A., AND SKUDERNA, A. W.
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