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FERTILIZING DEEP-CUT PORTNEUF SILT-LOAM SOILS IN SOUTHCENTRAL IDAHO

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In southcentral Idaho, deep cutting and filling are often necessary when fields are leveled for irrigation. Cutting exposes a highly calcareous subsoil which is less productive than the surface soils. Little is known about the best cropping and fertilizer practices to bring these deeply cut soils back into full production.

In 1965, part of a newly leveled field was made available to the Twin Falls Branch Station for fertilizer experiments. Depth of cut in this field ranged from 12 to 30 inches. The site was mostly sterile subsoil with a mixed, heterogeneous surface soil. In appearance, the surface granules were typical of the deeper subsoils in the Portneuf series of southern Idaho.

For this trial, 14 different fertilizer treatments (Table 1) were broadcast and worked into the experimental site with a roller harrow. One test was planted with a mixture of 40 percent Lemhi wheat and 60 percent Gem barley together with alfalfa. The other was seeded with Great Northern beans.

Data on plant stands, plant height and yield were obtained where possible (Table 1). Plant response to some fertilizer treatments was so poor that harvest was not necessary. Tests indicate that:

- **Nitrogen alone was detrimental. It reduced stands and growth of both grain and alfalfa.**
- **Phosphorus alone produced good stands and vigorous growth of alfalfa but grain stands and yields were poor.**
- **Balanced combinations of nitrogen and phosphorus produced best yields of grain and dry matter.**
- **Potassium, zinc, manganese and sulfur fertilization effects were inconclusive.**

Results of the tests are summarized in the following paragraphs:

Alfalfa

Large differences were noted between treatments in alfalfa stands, plant height and plant vigor. The best stands and most vigorous growth were evident in plots fertilized with phosphorus alone. The check plots had good stands but plant growth was severely suppressed, resulting in dwarf, rosetted plants. Plots which received nitrogen alone had both reduced stand and slow plant growth.

Grain

Stands of grain were variable both between and within treatments which involved combinations of fertilizers. In plots receiving no fertilizer or only nitrogen, all surviving plants were dwarfed. They formed minute heads in which few kernels developed. Grain fertilized with phosphorus alone had reduced stands caused by the strong competition from the vigorous alfalfa growth. These plants were about two-thirds as tall as the other treatments where grain ranged from 26 to 33 inches in height.

Grain Yields

Highest yields were produced by high rates of nitrogen and phosphorus in combination. Low yields from the plots with high nitrogen and low phosphorus were probably due to an imbalance of nutrients. There may have been too little phosphorus present to utilize the nitrogen.

Total Yield of Dry Matter

High rates of nitrogen and phosphorus produced the highest yields of total dry matter — grain, straw and alfalfa — regardless of other elements added. Lower, balanced rates of nitrogen and phosphorus also produced good yields. The combination of high nitrogen with low phosphorus meant a lower yield, again suggesting an imbalance of nutrients.

Phosphorus alone produced the highest yields and best stands of alfalfa. Hay from these plots could have been harvested two to three weeks earlier but haying was deferred so all plots could be harvested at the same time. If harvesting had not been delayed, yields of dry matter would have been considerably higher since these treatments would have produced regrowth in the latter part of the growing season.

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Table 1. Response of grain and alfalfa to fertilizer treatments applied to cut soils on the Dave Alldritt farm, Kimberly, Idaho, in 1965.

Treatment				Stand*		Plant Height (inches)		% Wheat	Yield Per Acre	
N	P	K	Zn	Grain	Alfalfa	Grain	Alfalfa	in grain	Grain (bu.)	Dry Matter (lb.)
0	0	0	0	Sparse	23	11	1	----	0	0
0	66	0	0	Sparse	24	21	9	----	0	4100
0	132	0	0	Sparse	21	21	21	----	0	4800
60	33	0	0	Sparse	11	28	9	23	53.8	6560
60	70	83	15**	Fair	8	30	10	20	60.6	7410
120	0	0	0	Sparse	7	11	1	----	0	0
120	66	0	0	Fair	4	29	6	21	61.2	7360
120	66	83	0	Good	5	32	10	15	59.0	7860
120	132	0	0	Good	4	28	6	17	70.4	7650
240	0	0	0	Sparse	3	10	1	----	0	0
240	66	0	0	Sparse	5	29	7	20	39.7	5220
240	132	0	0	Fair	5	32	10	14	77.2	9640
240	132	166	0	Fair	2	33	9	20	82.8	9640
240	132	166	10	Good	3	30	8	15	68.8	8410
		Ave.			9	25	7	18	41.0	5560
		L.S.D.	.05		9	----	----	----	19.7	3100

*Stand estimate of grain made June 28. Stand counts in plants per sq. ft. of alfalfa made July 7.
**15 lb. Mn, 100 lb. sulfur, and 40 lb. sulphate sulfur (SO_4) per acre were also included in this treatment.

Beans

No yield data could be obtained from the trials planted to Great Northern beans. The beans emerged slowly in all plots and produced only about 10 percent of normal foliage during the growing season. Very few blossoms or pods were produced in any plot. Some differences in plant color were observed but there was no apparent response in plant growth to any treatment.

Nitrogen Rates

Response to nitrogen over all levels of phosphorus and other fertilizers is shown graphically in Figure 1. Yield responses of grain and total dry matter parallel each other, increasing gradually as the amount of nitrogen increased. No grain was produced without nitrogen, but some dry matter was harvested from alfalfa which had not received nitrogen.

Phosphorus Rates

Response to phosphorus over all levels of nitrogen and other fertilizers is shown in Figure 2. Each additional amount of phosphorus produced higher yields of both grain and dry matter. Neither grain nor dry matter was obtained without phosphorus.

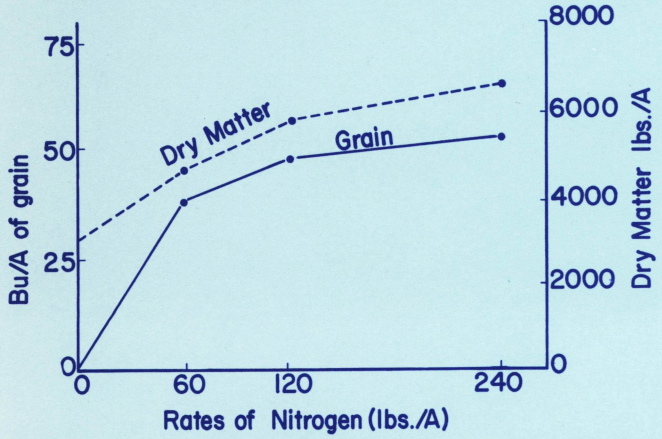

Figure 1. Response to niitrogen over all rates of other fertilizers.

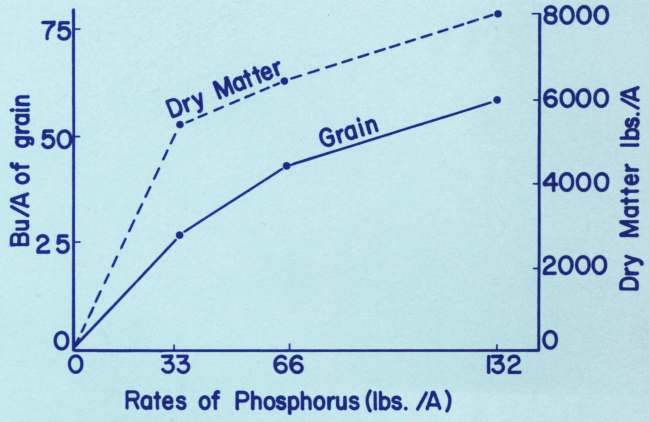

Figure 2. Response to phosphorus over all rates of other fertilizers.

Potassium and Minor Elements

Potassium apparently produced favorable response in several treatments but results are variable and somewhat confused by the use of zinc and other minor elements. Adding high rates of potassium to high rates of nitrogen and phosphorus did not increase total dry matter.

No yield response was evident from zinc application, but this test does not provide a good evaluation of zinc.

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