

1961 FERTILIZER STUDIES WITH RUSSET BURBANK POTATOES

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I. Fertilizer studies:

- A. Fertilizers and fertilizer placement: Nitrogen at 80, 160, and 240 lbs. per acre, phosphorus at 0, 80, and 160 lbs. per acre, and potash at 0, 200 and 400 lbs. per acre were applied singly and in all possible combinations on a farm known to be deficient in nitrogen, phosphorus and potash. Each treatment was used in a split-plot arrangement to test the effect of fertilizer placement. In half of each plot all the fertilizer was applied in bands, through the planter, at planting time. In the other half of the plot, half of the fertilizer was broadcast by hand disked lightly and then plowed under, and the other half of the fertilizer was applied in bands through the planter at planting time.

Results: 1. The highest rate of application was 240 lbs. of N, 160 lbs. of P_2O_5 and 400 lbs. of K_2O per acre. The fertilizer was compounded from ammonium nitrate, treble-superphosphate and muriate of potash. The rate was equal to a 1783-pound application of a 12-8-20 fertilizer. The average yield when the fertilizer was half plowed down and half banded was 394 CWT per acre. When it was all banded at planting, the average yield was 415 CWT per acre. This would indicate that whatever detrimental effects might have resulted from banding such a large amount of fertilizer, the depressing effect was less than the inefficiency in the use of fertilizer which occurred when the fertilizer was half plowed down and half banded.

2. Potash deficiency symptoms of various degrees of severity occurred in this experiment. When the fertilizer was all banded, the leaves were deep green, had a crinkly surface, and dark brown dead areas occurred between the veins. When the fertilizer was half plowed down and half banded, the leaves were yellowish green with a pronounced bronzing, a crinkly surface, and tan-colored dead areas between the veins, a syndrome frequently observed in localized areas in numerous potato fields throughout the Columbia Basin.

3. Samples are in storage for testing the effect of the treatments on specific gravity, chip color, blackspot and russetting.

4. The highest yield (446 CWT per acre) resulted from banding 240 pounds of nitrogen, 160 pounds of P_2O_5 , and 200 pounds of K_2O per acre.

- B. Fertilizers and the smooth-skin problem: According to reports, the problem of smooth skin at the basal end of potatoes is becoming more prevalent. In an experiment conducted last year it was found that three fertilizer mixtures greatly increased the amount of smooth skin at the basal end of a tuber. These fertilizers were 14-14-14, 16-16-8, and 18-10-10. Not much was said publicly about these findings because theoretically, it should not have happened, but it did.

This year a comprehensive experiment of 20 treatments was put on a farm which had many smooth-skinned tubers in 1959. The treatments were used on two dates of planting, April 11 and May 2, to test the effect to date of planting. A split-plot arrangement was used so that the same fertilizer was applied to rows next to each other on each planting date.

The fertilizers used were 14-14-14, 16-16-8, 20-20-20, 20-10-0, 16-48-0, 16-20-0, and a 1-1-1 made from ammonium nitrate, treble-superphosphate and muriate of potash.

Results: Most of the data are still to be tabulated and all measurements except yield, grade and netting are still to be made, but the following are obvious:

1. April 11 planting slightly increased the yield over May 2 planting.
2. May 2 planting generally gave a slightly higher percentage grade-out than the April 11 planting, but numerous exceptions among individual plots occurred.
3. The percentage of No. 1 grade potatoes varied among the five plots receiving the same fertilizer from about 50 per cent to 70 per cent for the same fertilizer treatment.
4. When the data were arranged in rows as the treatments were located in the field, it was found that some rows averaged 70 per cent No. 1 potatoes regardless of fertilizer and others averaged 50 per cent regardless of fertilizer. The implication is that some factor which goes the length of the potato row is far more important in controlling grade than are fertilizers. Irrigation is a possibility.
5. The most astonishing fact was that there was no great effect on russetting regardless of the fertilizer used or the dates on which the potatoes were planted.
6. As in the past, soil tests were taken from individual plots. A part of the experimental area was found to be low in potash. In a plot testing 183 lbs. of potassium, the leaves showed heat scorch during a hot day, the vines died prematurely, and the total yield was 334 CWT per acre. In another plot which received the same fertilizer treatment, but which has a soil test of 416 lbs. of potassium, no heat effects were noted on the leaves, the plants were still green at the time the vines were beaten off, and the total yield was 534 CWT per acre. The syndrome was similar to those seen in numerous localized areas throughout the Basin.
7. In general, the soil tests for the experimental area would be rated from medium to high and on the basis of these tests no potash would be recommended. This emphasizes the necessity of obtaining soil samples for testing which are representative of the area. Samples taken from localized areas where during past years crop response has not been typical of the area, generally should be kept separate and in many cases treated separately. If, however, due to leveling there are numerous small areas which are different, then applying phosphorus and/or potash over the entire field is the only practical solution.

The amount to apply is best determined by a soil test, but generally 80 to 160 pounds per acre of P₂O₅ and 100 to 150 pounds per acre of K₂O should be adequate. On the average, 100 to 150 pounds per acre of K₂O probably will lower the specific gravity very slightly, increase very slightly the amount of smooth skin, and decrease very slightly the tendency of the tubers to blackspot when bruised.

C. Anhydrous ammonia in the irrigation water: The use of anhydrous ammonia in the irrigation water as a supplement to banded and broadcast nitrogen has been controversial. In this study, nitrogen was applied at the rate of 140 lbs. per acre. It was all banded at planting time in some plots, half banded at planting time and half applied in the irrigation water in others, and all applied in the water in other plots. Those plots receiving half the nitrogen in the water received 10 lbs. per week for 7 weeks and those receiving all the nitrogen in the water received 20 lbs. per week for 7 weeks.

Three periods of starting the anhydrous application were included: when the plants were 2 to 4 inches high (40 days after planting), at blossom time (60 days after planting), and 80 days after planting.

Phosphorus and potash were applied at the rate of 140 lbs. per acre. Results: Most of the results are still to be analyzed statistically, but a few averages will suffice to show some of the differences.

Table 1. Effect of time and rate of applying anhydrous ammonia in the irrigation water. P and K all banded at planting time.

Nitrogen application	CWT / acre	Per cent No. 1
<u>Early, 40 days after planting</u>		
All at planting	495	40
Half banded, half in water	434	34
All in water	361	18
<u>60 days after planting, blossom time</u>		
Half banded, half in water	505	40
All in water	355	6
<u>80 days after planting</u>		
Half banded, half in water	444	28
All in water	340	7

The purpose of this experiment was to see if it was possible to lower the yield or the grade of potatoes by applying nitrogen in the irrigation water. The data when tabulated as fertilizer treatments indicate that it is possible to lower both yield and grade. However, applying nitrogen at the rate of 10 pounds per week for seven weeks starting at blossom time produced as high a yield and grade as did applying all of the fertilizer in bands at planting time, (Table 1). The data were tabulated (Table 2) to measure the effect of nitrogation on yield and grade according to the distance from the head ditch, which is the average of all fertilizer treatments and the time of beginning nitrogation. Indications are that yield is about equal with both of these:

1. Banding all fertilizer at planting time.
2. Banding half the N and all the P and K at planting time and applying half the N at the rate of 10 lbs. per week.

Applying half the nitrogen in the water reduced the percentage of No. 1 grade potatoes about 10 per cent. Withholding nitrogen until after 80 days after planting, at which time the vines were yellowish and vine growth had definitely stopped, reduced yield about 117 CWT per acre and the percentage of No. 1 grade potatoes by about 36 per cent.

Much more study must be given this method of applying nitrogen before any recommendations can be made.

Table 2. Effect of applying anhydrous ammonia in the irrigation water on yield and grade as influenced by the distance from the head ditch.

Distance from head ditch	All banded		$\frac{1}{2}$ banded, $\frac{1}{2}$ in water		All in water	
	CWT	% No. 1	CWT	% No. 1	CWT	% No. 1
40'	453	43	495	32	334	18
80'	451	50	428	31	311	19
120'	505	46	536	38	320	13
160'	513	50	503	29	405	9
200'	493	50	507	36	395	8
240'	507	50	482	39	399	7
Average	486	48	491	38	369	12