RESULTS OF THE 1963-1964 FERTILIZER TRIALS WITH RUSSET BURBANK POTATOES

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The 1963 fertilizer experiment consisted of 100, 200, 300 and 400 pounds of nitrogen per acre; 0, 133, 267, and 400 pounds of P_2O_5 per acre; and 0, 133, 267 and 400 pounds of K_2O per acre. These rates of N, P and K were used in all possible combinations to make a total of 64 different fertilizer treatments. Each treatment was replicated 11 times.

The experiment was conducted on the WSU Othello Experimental Farm on land which had been in potatoes the previous year and which was known to be low in fertility.

The potatoes were planted with the WSU press wheel potato planter on April 29 and 30, 1963. Irrigation was stopped on September 11. The vines were beaten off on October 2, at which time the plants receiving the highest rates of fertilizer were still green. The potatoes were harvested October 15 to 18.

The 1964 experiment was designed the same as the 1963 experiment. Eight replications were used instead of eleven. The land used in 1964 had been planted to corn the previous year and the stover was plowed under in the spring.

The potatoes were planted with the WSU press wheel potato planter on April 8 and 9, 1964. The soil was relatively dry and the potatoes were irrigated "up" by running water in alternate furrows for 24 hours.

By May 26 the plants had been frozen off twice and were just beginning to come up for the third time by June 2. Irrigation was stopped on September 10. The vines were beaten off on October 5, but most of the plants had been dead since September 30. The potatoes were harvested on October 14 and 15.

The fertilizer was banded about two inches on each side and two inches below the seed piece at planting time in all experiments cited in this report.

The two growing seasons were very different. The 1964 season was much cooler than the 1963 season.

Results

Effect of fertilizer on plant emergence: Before 1964, no marked detrimental effects were noticed on the time of plant emergence or rate of growth of the plants as a result of banding large quantities of fertilizer. Before 1964 all planting was done in soil well supplied with water, either as a result of rainfall or irrigation before tillage. In 1964 the potatoes were planted in relatively dry soil and under these conditions applying fertilizer in bands, regardless of the amount, delayed plant emergence and retarded plant growth

early in the season. This effect was noticeable in all 1964 experiments, except one, where fertilizer rates were used so comparisons could be made on the effect of fertilizer rates on early growth. In one experiment, where the soil was irrigated before planting, a depressing effect was also observable but not to the same degree as in the other experiments.

Effect of nitrogen on total yield and grade: It can be seen (Table 1) that the yields of potatoes in 1964 were considerably higher than in 1963, even though the same fertilizers were used. The differences in yield may have been due to the cooler growing season, differences in land history, or a combination of both.

The highest total yields were obtained from the highest rate of nitrogen used. The highest economical rate was estimated at about 300 pounds of nitrogen per acre in these two experiments.

As the amount of nitrogen applied in the fertilizer increased, the percentage of No. 1 tubers decreased. The rate of decrease in No. 1 tubers with increasing amounts of nitrogen was somewhat greater in 1964 than in 1963, but the total yields were also much larger. At the 300 pound rate of nitrogen there were more No. 1 potatoes in 1964 than in 1963, even though the percentage grade-out was lower.

Effect of phosphorus on total yield and grade: The highest total yields were produced both years from the highest rate of P_2O_5 applied, (Table 2). However, on the basis of the main effects in the experiment, it took a lot of phosphorus to bring about a relatively small increase in yield after the first 133 pounds per acre of P_2O_5 were applied.

As the amount of P_2O_5 in the fertilizer increased in 1963, there was a decrease in the percentage of No. 1 grade tubers. The tendency of high levels of phosphorus in the fertilizer to decrease the percent of No. 1 grade tubers was indicated also in 1964 but to a much lesser degree. It should be emphasized that the land on which the 1963 experiment was conducted was fertilized in 1962 with about 160 pounds per acre of nitrogen and 200 pounds per acre of P_2O_5 but no potash. The 1962 crop was potatoes which are heavy users of potash. The land used in 1964 was in corn in 1963 and received a lesser amount of phosphate. The 1963 experiment would therefore be expected to show effects of phosphorus and potash of different magnitude than occurred in 1964.

Effect of potash on yield and grade: Potash applications affected yields more in 1963 than in 1964. This is not surprising, since the land used for the 1963 experiment had grown potatoes the previous year without potash having been added in the fertilizer.

Increasing the amount of potash up to 267 pounds per acre in the fertilizer tended to improve the percentage grade-out in 1963. In 1964 the trend was reversed and for every increment increase of potash in the fertilizer, there

was a corresponding decrease in the percentage grade-out (Table 3).

Each value presented for 1963 in tables 1, 2 and 3 is the mean of 176 plots. Each value presented for 1964 in tables 1, 2 and 3 is the mean of 128 plots, indicating that as far as these experiments are concerned the results are well established.

High yielding treatments: The data presented thus far indicate what might be expected to happen on the average when nitrogen, phosphorus and potash are partially limiting at each level of the nutrient designated. For example, the response to nitrogen (Table 1) is conditioned by the fact that the average amount of P_2O_5 and of K_2O was only 200 lb/acre of each. What happens when all nutrients are present at high levels is shown in Table 4.

The most important general conclusion which can be made from the data in Table 4 is that large yields require large quantities of plant nutrients and that the response to the same fertilizer treatment can vary from field to field, and possibly from season to season.

The seasonal effect should not be underestimated. Potash deficiency symptoms appeared at about the normal time in 1964 but the plants failed to die as quickly as was observed during seasons of high temperatures.

On the basis of the 1963 data, and for convenience, 350 pounds of nitrogen, 390 pounds of P_2O_5 and 312 pounds of K_2O/acre were applied to a 1964 potato variety trial. The top yielding variety averaged 1003 cwt. per acre with 91% No. 1 grade tubers and a specific gravity of 1.082. A Russet Burbank check from Idaho seed averaged 790 cwt./acre with 83% No. 1 grade tubers, with a specific gravity of 1.096.

In a third experiment, Ortho triple-16 fertilizer was applied at rates shown in Table 5. The values in the table for total yield, percentage grade and specific gravity are the means of 16 plots. The values for chip color are the means of six plots.

The highest yield was obtained with the highest rate of fertilizer used. As the rate of fertilizer increased there was a steady decline in the percentage of No. 1 grade potatoes, but even the lowest grade-out would be considered good for the Columbia Basin. The effect of the fertilizer rates on specific gravity was nil. The effect on chip color was considerable. Contrary to popular opinion and much published data, (but consistent with much data from the Columbia Basin and the Yakima area) the highest fertilizer rates produced potatoes which made chips with the most desirable color.

Summary

On Columbia Basin soils which are in a relatively low state of fertility, nitrogen, phosphorus and potash can be used at rates as high as 300 to 400 pounds per acre of each nutrient without serious loss of grade or culinary quality.

These levels of fertilization are for maximum yields, which require a long growing season. Potatoes which are to be harvested for summer markets should receive lesser amounts of fertilizer.

Fertilizer is only one of many factors contributing to yield and quality. Should other factors be limiting, the response to fertilization will be conditioned by the limitation of those factors.

Table 1. Effect of levels of nitrogen on total yield and percentage No. 1 grade potatoes in 1963 and 1964.

Nitrogen* lb/acre	CWT/acre 1963	CWT/acre 1964	Percent No. 1 1963	Percent No. 1 1964
100	331	541	68	70
200	437	644	69	67
300	498	673	66	62
400	527	686	63	59

* Used with an average rate of 200 lb/acre of P_2O_5 and K_2O.

Table 2. Effect of levels of phosphorus on total yield and percentage No. 1 grade potatoes in 1963 and in 1964.

P_2O_5 lb/A*	CWT/acre 1963	CWT/acre 1964	Percent No. 1 grade 1963	Percent No. 1 grade 1964
0	425	585	70	65
133	448	649	67	65
267	454	652	66	64
400	466	658	64	64

* Used with an average of 200 lb/acre of nitrogen and K_2O.

Table 3. Effect of levels of potassium on total yield and percentage No. 1 grade potatoes in 1963 and in 1964.

	CWT/acre		Percent No. 1 grade	
K_2O lb/A*	1963	1964	1963	1964
0	364	597	65	67
133	454	649	68	66
267	490	654	68	64
400	486	646	66	62

*Used with an average of 200 lb/acre of nitrogen and P_2O_5.

Table 4. Effect of nitrogen, phosphorus and potash on the yield and grade of Russet Burbank potatoes in 1963 and 1964.

Nutrients, lb/acre			CWT per acre		Percent No. 1	
N	P_2O_5	K_2O	1963	1964	1963	1964
400	400	400	620[1]	710[2]	59	52
400	267	267	610	768	65	57
400	400	267	594	752	59	58
400	267	400	588	768	65	59
300	400	400	584	698	63	64
300	267	267	566	737	69	62
300	400	267	567	700	65	58

1. Means of 11 plots.

2. Means of 8 plots.

Table 5. Effect of increasing amounts of Triple 16 fertilizer on yield, grade and tuber quality in 1964.

Nutrients, lb/acre			Yield	Percent	Specific	Chip
N	P_2O_5	K_2O	CWT/A	No. 1	Gravity	Color
100	100	100	440	77	1.098	7.4
200	200	200	583	78	1.097	6.7
300	300	300	671	74	1.098	6.4
400	400	400	690	72	1.100	5.6
500	500	500	710	69	1.098	5.8