

OPTIMUM IRRIGATION FOR RUSSET BURBANK POTATOES

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This is a report concerning research conducted in 1964 on Experimental Unit No. 1 at Othello, Washington. Goals of the study were to determine the optimum irrigation treatment for Russet Burbank potatoes and their water requirements. The results obtained in 1964 compared favorably with results obtained in a similar but less carefully controlled experiment conducted during the summer of 1962. Hence, a fair degree of confidence can be placed in the results.

Previous experiments have shown potatoes to be sensitive to irrigation treatment. Irrigation was scheduled for the experiments with the same Irrigation Scheduling Board in use by many farmers in the Columbia Basin (Washington Extension Circular 341). This procedure uses measured evaporation from an evaporation pan to interpret the amount of water used by the crop, day by day. The procedure is simple, highly accurate, and provides the user with the record of irrigations throughout the season.

The crop uses very little water from below the two-foot depth of soil if heavy yields of high quality potatoes are to be obtained. The usable soil moisture reservoir in this research was defined to be two-feet. The capacity of this two-foot reservoir was 5.3 inches depth of water. This was the quantity of water held between Field Capacity and Wilting Point in the two-foot rooting depth (see Fig. 1).

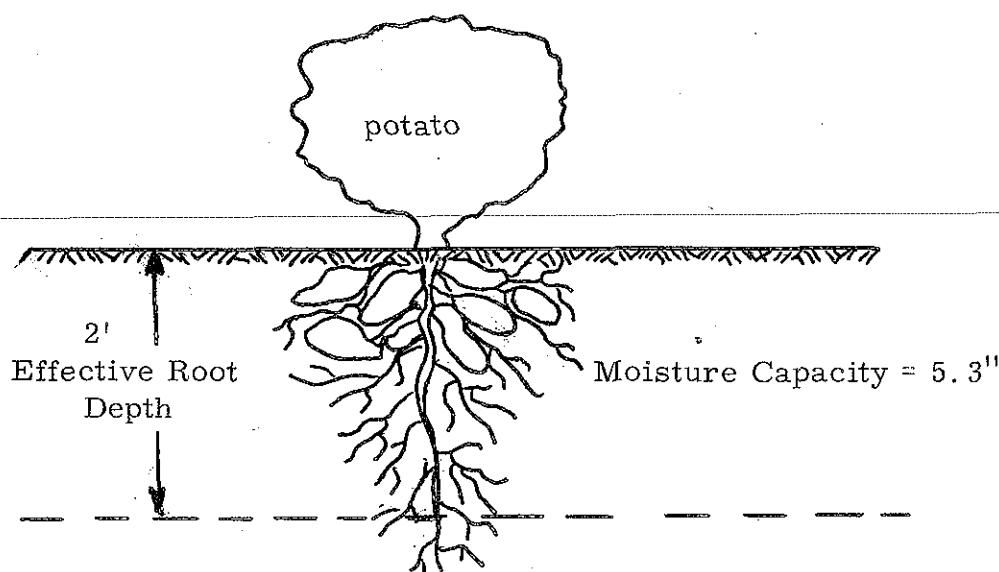


Fig. 1... The Soil Moisture Reservoir

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The magnitude and quality of the harvested potato crop depends on a combination of several influences. Conditions caused by irrigation, fertilization, temperature, etc. all have important effects. Great care was used to minimize influences other than irrigation in this study. As an example, fertilizer was applied by broadcast and plowed under in the fall of 1963 in the amount computed from soil tests to prevent soil nutrient deficiencies. Then in the spring, at planting time, the following amounts of fertilizer were banded in (see Fig. 2):

309 lbs. per acre of available nitrogen
 200 lbs. per acre of available phosphate
 300 lbs. per acre of available potash
 12 lbs. per acre of available zinc
 19 lbs. per acre of available sulphur
 2.5 lbs. per acre of available manganese

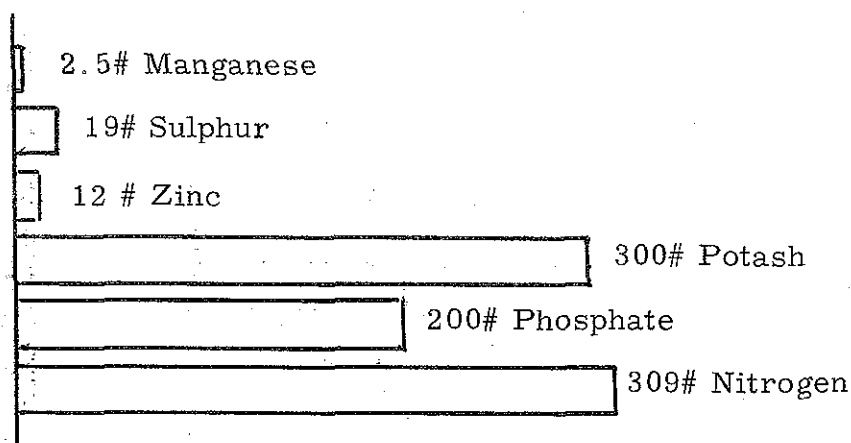


Fig. 2... Fertilizer Applied (in pounds of available)

The potatoes were planted on April 17 in rows three feet apart with the seed pieces spaced approximately eight inches apart. The soil moisture reservoir was essentially full at the time of planting. Moisture had been depleted approximately one inch by the last week in May and a one-inch irrigation was applied at that time. The moisture reservoir was down approximately two inches on June 18 and two inches of water were applied at that time so that the reservoir was full when irrigation treatments were started. Irrigation treatments were carefully applied through July and August and until September 2 when the crop was essentially matured. The soil moisture reservoir was filled for all treatments on September 2 to terminate the irrigation period. The potatoes were harvested October 3.

Figure 3 shows the irrigation treatments which were tested. Each treatment was applied with sprinkler irrigation and with furrow irrigation. The treatments were:

1. Irrigate every day, the amount which was used the previous day.

2. Irrigate when 30 percent of the available moisture had been removed from the soil moisture reservoir.
3. Irrigate when 45 percent of the soil moisture had been removed from the soil moisture reservoir.
4. Irrigate when 60 percent of the water was utilized from the soil moisture reservoir.
5. Irrigate when 75 percent was removed.

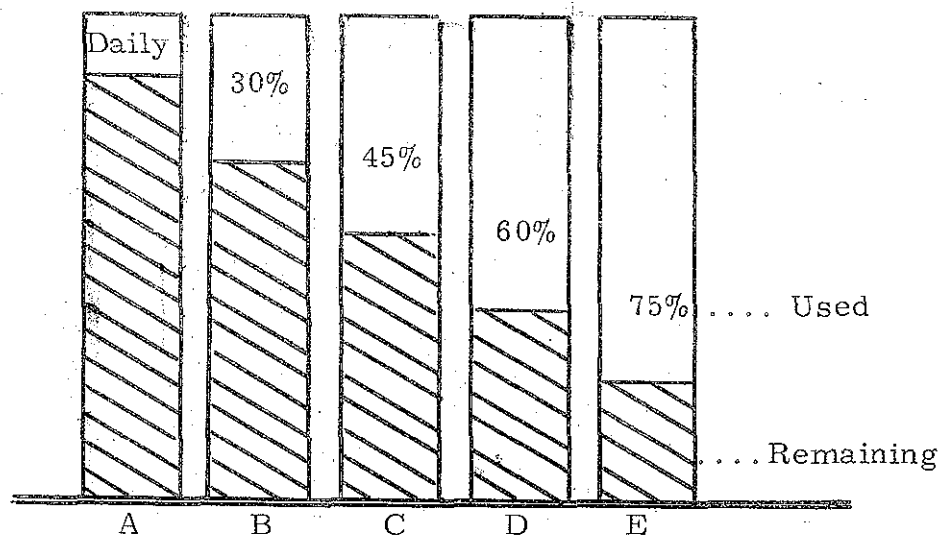


Fig. 3... Water Use Between Irrigations by Treatment

The soil moisture reservoir was filled each time that irrigation water was applied. Because of it being impossible to apply water with 100 percent efficiency, more water was applied than the reservoir would hold so that the reservoir was filled at the lowest application area. By test, we found our application efficiency exceeded 90 percent. We allowed 90 percent efficiency when irrigating.

Figure 4 shows potato yields, by treatment, for each of the two irrigation methods. One concludes that the maximum yield would be obtained if water were supplied exactly at the rate that potatoes use it and thus keep the moisture reservoir always full. Further, daily irrigation will result in more potatoes than will delaying irrigation for more than a day. Although not appreciably significant, there was some advantage to sprinkler irrigation, although yields were essentially the same for both methods for daily irrigation and for the driest treatment. The differences in the three intervening treatments resulted in sprinkler irrigation showing some advantage. One concludes that to obtain the same yield with furrow irrigation, water needs to be applied more frequently than with sprinkler irrigation.

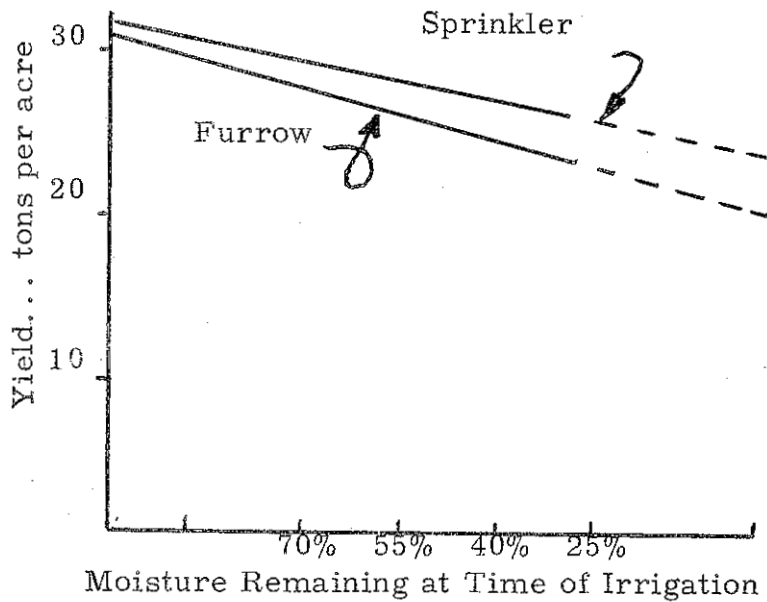


Fig. 4...Potato Yield by Irrigation Method

Figure 5 combines yields from both irrigation methods by treatments and compares total yields and quantity of U. S. No. 1 potatoes for the irrigation treatment. It emphasizes that yield decreases as the length of time between irrigations increases. It shows that the amount of U. S. No. 1 potatoes decreases more rapidly than does total yield as the interval between irrigation is extended. Hence, the longer the period between irrigations, the lower the percentage of U. S. No. 1 potatoes will be.

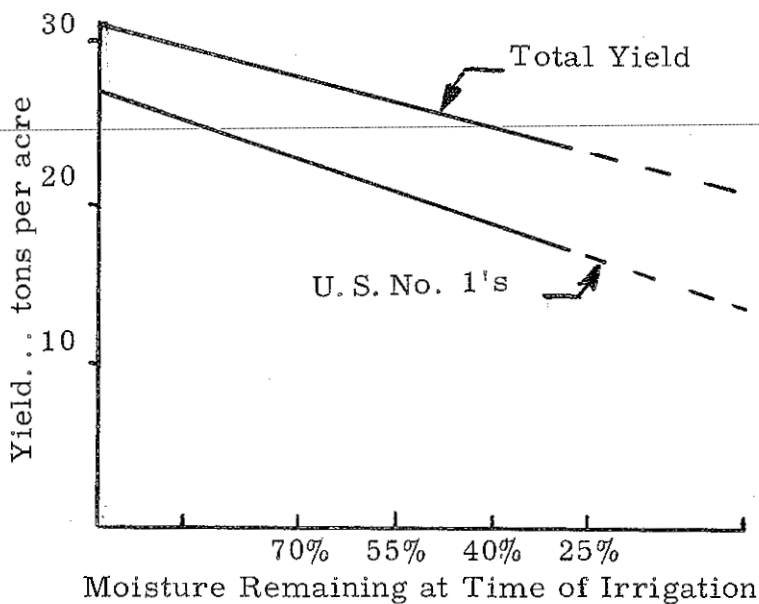


Fig. 5...Potato Yield and Grade Yield

Figure 6 shows yield and quality information more vividly. The comparison in Figure 6 is based on the yield and quantity of U. S. No. 1 potatoes for the

daily irrigation treatment being 100 percent of the obtainable yield. Yields and quantity of No. 1 potatoes for the other four treatments are then compared to the 100 percent yield. Note that requiring potatoes to use three-quarters of the usable water decreases the total yield 23 percent and decreases the quantity of No. 1 potatoes 43 percent.

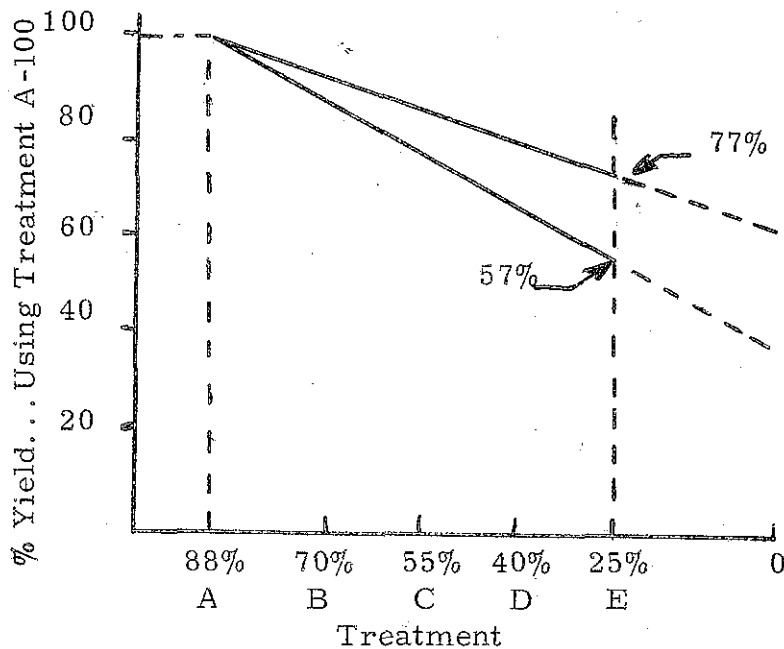


Fig. 6... Percent Yield by Treatment

Figure 7 compares the total irrigation water applied in each of the treatments. All treatments used essentially the same quantity of irrigation water. Note that the water consumed by the potato crop amounted to only about 20 inches. Three additional inches of water were necessary to apply the 20 inches needed. This required amount -- slightly less than two acre feet per acre -- is about one-third as much water as is commonly used by farmers in the Othello area.

When the experimental potatoes were graded, enlarged lenticels were observed on many tubers from each of the treatments. Enlarged lenticels are normally associated with over-irrigation. We know that over-irrigation did not occur in this experiment. Also, enlarged lenticels did not occur in the similar experiments two years ago. The essential difference between experiments two years ago and the experiments in 1964 was that a considerably higher quantity of fertilizer was applied for the 1964 crop. One can conclude that the fertilizer applied in 1964 was the fertilizer which had been found to give optimum response under over-irrigation conditions. Thus, fertilizer was applied for over-irrigation but only the water needed was applied. It appears that enlarged lenticels can apparently be stimulated by fertilizer. Possibly similarly high yields could have been obtained without the enlarged lenticels with lower fertilizer application.

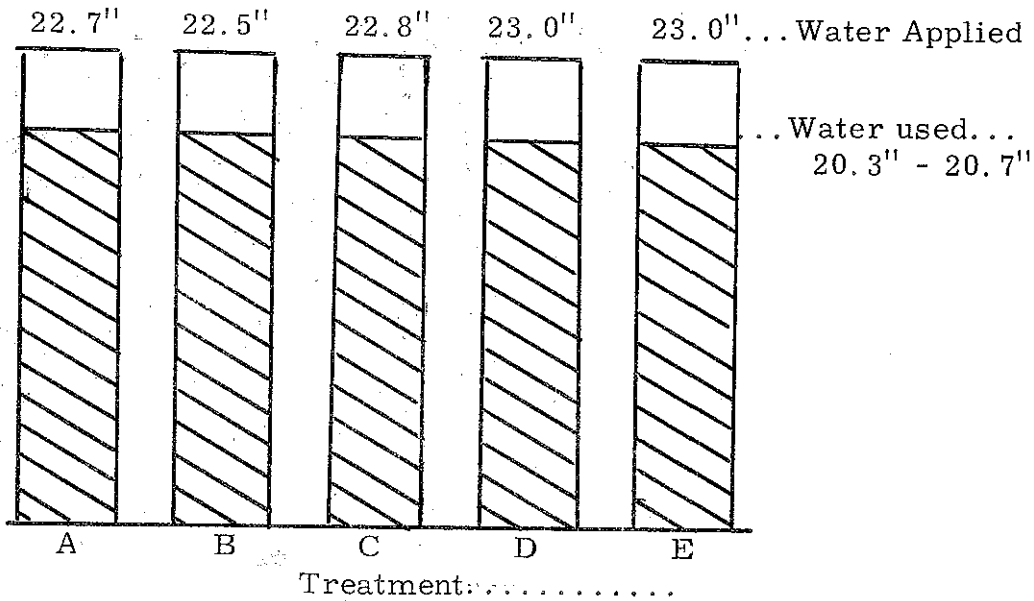


Fig. 7... Total Irrigation Water Applied by Treatment

The potatoes are now in storage and will be graded again this spring to determine differences in keeping quality which might occur because of the irrigation treatments. Observations in January showed the stored potatoes to be in excellent condition.