POTATO RESPONSE TO NITROGATION

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Summary:

As used in this report, nitrogation refers to the addition of nitrogen carrying compounds to the irrigation water. The practice is not new in the West. Many growers in the Columbia Basin have tried it on potatoes with varying degrees of success.

On the basis of the evidence obtained and until more precise information is available, it can be assumed that a sizable portion of the required nitrogen can be applied by nitrogation without damaging the crop if it is applied before vine growth has stopped because of a lack of nitrogen. When a change in the color of the foliage is distinct it may already be too late.

There is no reason to believe at this time that one source of nitrogen is any better than another for nitrogation.

Introduction:

The production of potatoes in the Columbia Basin is different from most other potato growing areas. Seed planting extends from early March until June and harvest extends from early July until November. Under such conditions there is no such thing as an early or a late crop but rather a progressive planting period of 90 days and a progressive harvest period of 120 days.

As the seed becomes older more plants develop from a seed piece. Therefore, there may be more plants to feed in May than in March even though the same number of seed pieces are planted per acre. The exact number to be fed cannot be determined until after the plants emerge and they can be counted. With nitrogation additional nitrogen can be added as needed to feed the plant population. This is quite effective in increasing yield providing ample phosphate and potash were applied at planting or before.

At times it may be advantageous to extend plant growth until a later harvest date. This can also be done by nitrogation if ample phosphorus and potash are available to the plant. Neither phosphorus nor potash can be effectively applied by nitrogation and must be adequately provided for ahead of time.

In our first nitrogation experiment, phosphorus and potash were banded on at planting time. In some plots all the nitrogen was banded on with the phosphorus and potash and none was added by nitrogation. In other plots half the nitrogen was banded on with the phosphorus and potash and half was added by nitrogation. In still other plots the phosphorus and potash were banded on at planting and all the nitrogen was added by nitrogation.

Nitrogation applications began 40, 60 and 80 days after planting. Those plots wherein half the nitrogen was applied at planting received an additional 10 lbs. of nitrogen each week for seven weeks. Those plots with no nitrogen applied at planting received 20 lbs. of nitrogen each week for seven weeks. After the final nitrogation all the plots had received a total of 140 lbs. of nitrogen per acre.

Applying all the nitrogen at planting as opposed to applying half the nitrogen at planting and half by nitrogation produced almost identical yields - 495 and 505 cwt/acre respectively - and No. 1 grade potatoes were identical - 40 per cent. Delaying the start of nitrogation to 80 days after planting even with the 10 lb/acre/week application reduced the percentage of No. 1 potatoes to 28 per cent.

Adding all the nitrogen by nitrogation reduced the total yield about 150 cwt/acre. When nitrogation began 40 days after planting the percentage of No. 1 grade potatoes was 18 per cent. Delaying nitrogation to 60 and 80 days after planting reduced the percentage of No. 1 grade tubers to 6 per cent. The appearance of the tubers indicated growth had ceased and was started again by the addition of nitrogen.

The following year, 120 lbs. of nitrogen, 200 lbs. of phosphorus and 200 lbs. of potash per acre were banded on at planting time. An additional 120 lb/acre of nitrogen was added in solution by injecting it directly into the root zone with a fumigun with a 7 inch long probe.

Injecting the solution with a probe seemed desirable because large quantities of nitrogen would be immediately placed in the root zone for rapid uptake of nitrogen with a minimum of root damage. We found that the amount of reduction in yield due to root damage was 30 cwt. and could be expected to vary depending upon the size of the plants and the equipment used.

The liquid nitrogen solutions were applied at rates and times as follows:

	Days After Planting					
	30	40	50	60	At Planting	Total N
Pounds of Nitrogen Applied	120	--	--	--	120	240
	60	60	--	--	120	240
	40	40	40	--	120	240
	30	30	30	30	120	240

Aqua, ammonium nitrate and ammonium sulphate solutions were used.

Planting was done on April 30; 28 days after that the plants were well up.

The total yields averaged 536 cwt/acre with no statistical differences among them. The percentage of No. 1 grade potatoes averaged 68% with no statistical differences among them. The three sources of nitrogen gave almost identical results for total yield and percentage grade.

In 1968 nitrogen solutions were applied through a solid set sprinkler irrigation system. The treatments were as follows: there were two plant spacings - 6.6 inches and 9.3 inches apart for plant populations of 29,714 and 21,311 plants/acre respectively. High levels of phosphorus and potash were also applied.

Times of N Application

	At Planting		May 28		June 6		June 14		June 21		June 28		Total	
Spacing	6.6"	9.3"	6.6"	9.3"	6.6"	9.3"	6.6"	9.3"	6.6"	9.3"	6.6"	9.3"	6.6"	9.3"
Pounds	560	400	--	--	--	--	--	--	--	--	--	--	560	400
Per	304	200	28	28	43	43	60	60	100	100	--	--	535	431
Acre	0	0	28	28	43	43	60	60	100	100	226	226	457	457

Relatively low rates of nitrogen were applied early because the plants were small. As the size of the plants increased the amount of nitrogen applied also increased. The high rates of nitrogen were a deliberate

attempt to produce all No. 2 and cull potatoes by inducing knobs, growth cracks and other grade defects. Though the final amounts of nitrogen applied were not as precise as hoped for, the results are, never the less, of interest. The average yield of the plots receiving all the nitrogen at planting time was 568 cwt/acre. The average yield for all the plots receiving half the nitrogen at planting and half by nitrogation was 537 cwt/acre. The average yield of the plots receiving all the nitrogen by nitrogation was 566 cwt/acre. This suggests that the lower yield for the split application was not due to the method of nitrogen application.

The average yield for the 6.6 inch spacing between plants was 581 cwt. compared to 534 cwt. for the 9.3 inch spacing.

The potatoes were not graded but there were no obvious differences in grade as the potatoes were going over the combine and into the sacks. There were noticeably more tubers of smaller size with the 6.6 inch spacing than with the wider spacing.

1969 Experiment: This experiment was conducted on land which had been in alfalfa for six years and had never grown potatoes. P_2O_5 and K_2O were broadcast at the rate of 540 lb/acre of each and zinc from ZnMnS at the rate of 10 lb/acre ahead of rotovating the alfalfa stubble. Later the land was plowed 10-12 inches deep. The seed was planted April 18 with 32 inches between the rows and 8.3 inches between the seed pieces. The variety was Russet Burbank.

The nitrogen was applied as follows through a solid set sprinkler system:

Pounds N/acre by Nitrogation

N At Planting	June 26	July 31	Sept. 11	Sept. 17	Total
100	86	110	25	5	326
200	--	100	25	5	330
300	--	--	25	5	330

The objective of this experiment was to fertilize potatoes for a mid July harvest, a mid August harvest and a mid September harvest and then keep the potatoes growing until mid October by nitrogation. The vines began turning yellow before the end of September and additional nitrogen treatments might have increased the yield. The potatoes were harvested October 23. The yields resulting from the different nitrogen treatments were almost identical and averaged 722 cwt/acre of potatoes with 82% No. 1 grade tubers.