UNIVERSITY OF IDAHO AND USDA-ARS PROGRESS REPORT

POTASSIUM MANAGEMENT IN IRRIGATED POTATO SYSTEMS OF SOUTHERN IDAHO

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OBJECTIVES:

1. Determine the extent of soil available K in Southern Idaho soils related to growers yield goals and soil test K levels.

2. Determine K uptake efficiency of sprinkler applied K during mid-season application.

3. Determine soil K release variables for soil test correlations.

4. Develop a final report at the conclusion of this project to address each of the objectives stated above.

An initial survey (Fig. 1) was completed for southern Idaho to correlate soil test K levels with % K concentrations in potato petioles. Twenty-eight fields were sampled across the major production areas of the state during potato bulking. A positive correlation (R^2 = 0.66) was observed between soil test K (stK) levels and petiole K concentrations. The K values ranged from 105 ppm stK to almost 600 stK. Petiole K % ranged from 7.5% to 12%. The present Univ. of Idaho critical value for Russet Burbank is set at about 7%. Unfortunately this value has not been completely substantiated because of insufficient low stK sites.

Experimental plots were established in the spring of 1992 on a cooperators field located east of Burley/Heyburn, Id. Each plot was sampled throughout the growing season (whole plants and petioles). These samples were analyzed for all critical nutrients and will be available at the conclusion of this study.

Yield and quality including specific gravity were determined for each treatment (Tables 1-5). Total yield ranged from 378 cwt/A to 451 cwt/A. The control plot (0 K) yield was 418 cwt/A. Both of the lower yielding plots were KCl where the applications were split over the growing season. We are not completely sure why this reduction occurred. It may have been due to damage from topical applications of fairly high K rates to the tissue, although the K was applied when the sprinkler system was on in an attempt to avoid any salt damage. Maximum yield (451 cwt/A) was obtained when KCl was banded at 100 lb/A or when K_2SO_4 was broadcast at 200 lbs/A. When KCl was broadcast preplant incorporated at rates of 100 or 200 lb/A yields were increased above the control, but not to the extent of banding KCl. Potassium did affect the percentage of tubers above 10 oz (Table 3). Values ranged from 19.5 to 29.4%. Potassium thiosulfate (KTS) improved

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oversize (> 10 oz) yields the greatest. Banding KCl at 100 lbs/A appeared to reduce the percentage of large potatoes even though this treatment had the maximum yield. Both broadcast and injecting KCl increased the percentage of large potatoes compared to banding KCl. Broadcasting K_2SO_4 at 200 lbs/A increased the percentage of large potatoes slightly above KCl treatments. Splitting (broadcast + injecting) and applying K with the irrigation water appeared to reduce the % of large potatoes compared to broadcasting KCl or K_2SO_4. However, when KCl was applied strictly through the irrigation water the % large potatoes increased above similar rates of KCl banded.

Specific gravity (SG) was also affected by potassium with ranges from 1.080 to 1.084. The general trend is for K applications to decrease SG no matter what source was used with the exception of KTS. The KTS treatments did not appear to have a negative affect on SG at either the 25 or 100 lb/A K. This observation needs to be studied more in depth. The lowest SG were observed with KCl applied at 400 lb/A K. These observations should tend to caution growers and land managers that higher levels of K may tend to decrease quality of potatoes. These impacts would be of greater concern to processors then fresh pack markets.

Potassium applications influenced the concentration of K in the petioles (Fig. 2). Higher K fertilizer rates resulted in increased petiole K concentrations. Three samplings, 6/24, 7/15 and 8/12 were made with about 40 petioles (fourth petiole from the growing tip) obtained from each treatment. Petiole K decreased during the growing year for all treatment applications. The highest concentrations corresponded with higher K fertilizer rates. The University of Idaho has suggested a critical K concentration of 7%, if that is true these potatoes were short of K by the middle of July for most of the treatments. The only fertilizer rate with a petiole K concentration above 7% was KCl at 400 lb/A. On 8/12 concentrations ranged from 1.8 to 4.5% corresponding to K rates of 0, 100, 200, and 400 lb/A K.

PLANNED 1993 CHANGES

Treatment changes for 1993 will include an adjustment upward of the highest K fertilizer rate applied. Maximum yield was not obtained with the 1992 treatments. An additional KTS treatment will probably be incorporated to evaluate more completely KTS impact on specific gravity. The K_2SO_4 rate may also be expanded to better define K_2SO_4 response to yield and quality.

INTERPRETIVE STATEMENT

This work begins a series of projects related to potassium use and application in Idaho potato production areas. There is a concern among growers and agriculture consultants regarding yield and quality of K application rates. This is the first time that a public Idaho institution has observed increased yields with K fertilizer applications. Yield increases have been observed in seed producing areas of the state where high quality water is used for irrigation. Yields are much lower than the traditional production areas of the Snake River Plain. Growers who have similar soil conditions can expect yield increases with applications of K fertilizer. Growers need also be aware that higher K applications will probably reduce the overall quality for processing. Injecting K through the irrigation water did not provide positive yield increases. These trends however, should be further investigated prior to any summary statements that would be used for management considerations.

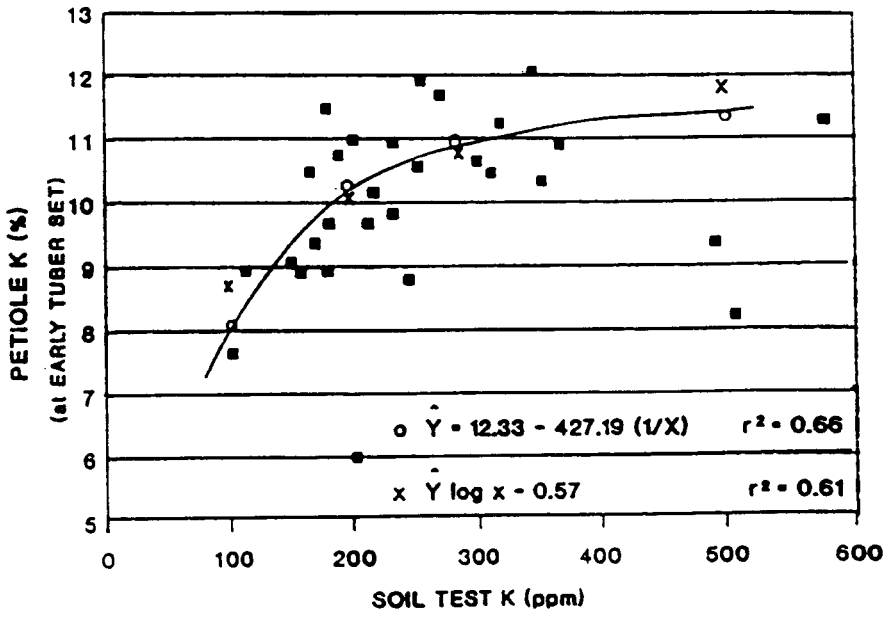

Figure 1. Potassium survey of potato fields in Southern Idaho - 1991

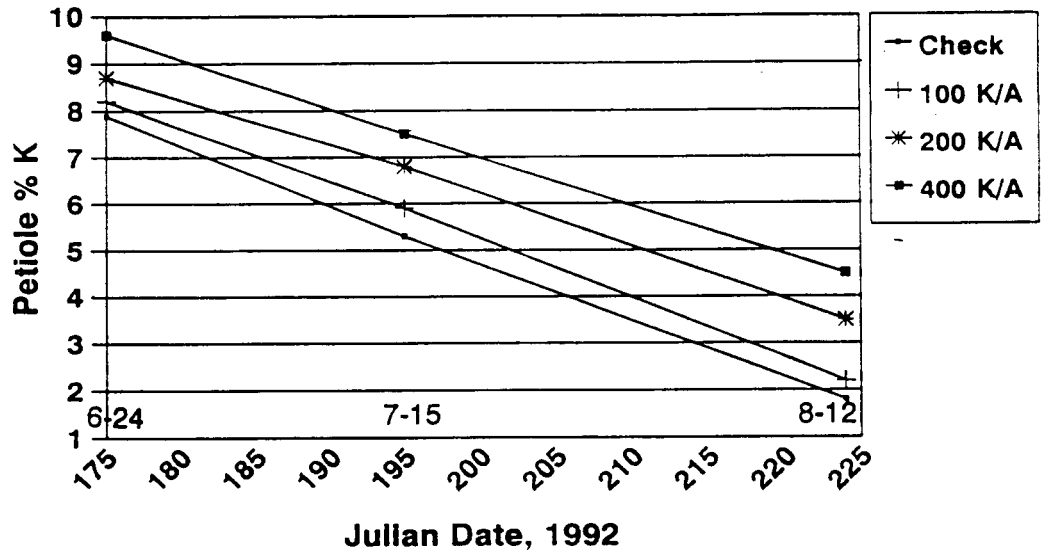

Figure 2. K effect on petiole % K, KCl broadcast

Table 1

1992 K Study, Total Tuber Yields.

	K Fertilization Rate, lbs K/A		
	25	100	200
	---------- cwt/A ----------		
KCl (ba)	-	451	-
KCl (bc)	-	429	430
K_2SO_4 (bc)	-	-	451
KCl (inj)	-	378	-
KCl (split)	-	-	388
KTS (inj)	431	417	-

Check = 418, STKC = 108 ppm K

Table 2

1992 K Study, Total U.S. #1's.

	K Fertilization Rate, lbs K/A		
	25	100	200
	---------- cwt/A ----------		
KCl (ba)	-	383	-
KCl (bc)	-	351	337
K_2SO_4 (bc)	-	-	375
KCl (inj)	-	315	-
KCl (split)	-	-	298
KTS (inj)	333	337	-

Check = 327, STKC = 108 ppm K

Table 3

1992 K Study, % > 10 oz. Tubers.

	K Fertilization Rate, lbs K/A		
	25	100	200
	----------	%	----------
KCl (ba)	-	21.8	-
KCl (bc)	-	25.9	26.4
K_2SO_4 (bc)	-	-	27.7
KCl (inj)	-	26.2	-
KCl (split)	-	-	21.9
KTS (inj)	19.5	29.4	-

Check = 19.9, STKC = 108 ppm K

Table 4

1992 K Study, KCl Rate Effect.

K Rate(bc)	Total	Ones	> 10 oz.	S.G.
lbs K/A	cwt/A	cwt/A	%	
0	415	327	19.9	1.083
100	429	351	25.9	1.082
200	430	338	28.4	1.081
400	445	373	29.8	1.080

STKC = 108 ppm K

Table 5

1992 K Study, Specific Gravity.

	K Fertilization Rate, lbs K/A		
	25	100	200
KCl (ba)	-	1.083	-
KCl (bc)	-	1.082	1.081
K_2SO_4 (bc)	-	-	1.082
KCl (inj)	-	1.082	-
KCl (split)	-	-	1.081
KTS (inj)	1.084	1.084	-

Check = 1.083, STKC = 108 ppm K