I D A H O

# Potassium Fertilization of Russet Burbank Potatoes

By D.T. Westermann and T.A. Tindall

A recent study re-evaluated the potassium (K) fertilizer requirements of Russet Burbank potato production under today's soil conditions and higher yield potentials. Potassium fertilization rates should be increased over what was previously considered adequate, particularly on coarse textured soils.

Potato tuber yields over 500 cwt per acre are being achieved by many of Idaho's potato growers. At this production level, over 240 lb $K_2O$/A can be removed by the tubers. Historic soil test information shows that extractable K concentrations have declined from more than 400 parts per million (ppm) in the late 1960s to the range of 100 to 200 ppm now.

Five experiments were conducted on growers' fields between 1992 and 1995 with selected K rates, sources, placement or timing variables, including K-fertigation as treatments. Preplant broadcast applications were applied before spring tillage preceding planting, while banded K was placed in a single band 4 to 6 inches adjacent to the seed piece after planting.

Simulated K-fertigation applications were accomplished by spraying K solutions on during a sprinkler irrigation. Potassium sources were potassium sulfate ($K_2SO_4$), potassium chloride (KCl) or potassium thiosulfate (KTS). Soil textures varied from a silt loam to loamy sand, sodium bicarbonate ($NaHCO_3$) extractable soil K concentrations from 85 to 126 ppm in the top 12 inches of soil. The K status of each treatment was monitored by sampling the fourth mature petiole from the growing point, as well as vine, roots and tubers periodically sampled between early tuber growth and vine kill. Tuber yields, grades, and internal quality were determined for each plot at normal harvest.

## Fertilizer Rate Recommendations

Total tuber yields across the experiments ranged from a low of 350 cwt/A to nearly 600 cwt per acre. Yield responses to K fertilization were from none to nearly 100 cwt/A. Tuber external quality parameters were generally high (greater than 70 percent U.S. #1 tubers), except for the lowest yielding experiment where other management factors affected yield. The 1987 University of Idaho fertilizer guide for

**TABLE 1.** Comparison of K fertilization rates at different soil test K concentration in 0 to 12 inches of soil.

| Soil test K, ppm | Recommendations 1987 lb $K_2O$/A | 1992-95 lb $K_2O$/A |
|---|---|---|
| 25 | 250 | 600 |
| 50 | 200 | 500 |
| 75 | 150 | 400 |
| 100 | 100 | 300 |
| 125 | 50 | 200 |
| 150 | 0 | 100 |
| 175 | 0 | 0 |

potatoes contained a critical soil test K concentration of 150 ppm K in the top 12 inches of soil ($NaHCO_3$ extractable). Tuber yield data summarization from our studies showed that the concentration should be increased to 175 ppm K (**Table 1**). While this was not a large change, the K fertilization rate necessary to achieve maximum yields did change significantly. For example, the optimum K fertilization rate at a soil test K concentration (STKC) of 100 ppm was 300 lb $K_2O$/A in our study compared with 100 lb $K_2O$/A recommended in the 1987 fertilizer guide. Similar changes occurred at other STKCs. Growers may want to add 50 lb $K_2O$/A to the rates in **Table 1** for each 100 cwt/A tuber yield above 400 cwt to maintain their soil test K concentrations.

**Potassium deficiency** symptoms on leaves of potato plants.

## Source and Timing Effects

Total tuber yields were generally 5 to 10 percent higher with $K_2SO_4$ than with KCl at the optimum fertilization rate applied preplant. The higher yield was from an increased yield of U.S. #1 tubers greater than 10 oz. Both K sources decreased specific gravities. However, tubers receiving KCl generally had gravities 0.001 to 0.004 units lower than those receiving $K_2SO_4$. At K fertilization rates greater than optimum, both sources had similar effects.

A preplant K application was more effective than splitting the same amount between preplant and fertigation or applying all the fertilizer via fertigation during tuber growth. In addition, preplant broadcasting was more effective than banding the K fertilizer shortly after planting. Spring preplant applications higher than 300 lb $K_2O$ tended to decrease yields, particularly as KCl. Growers should consider other application options if they need to apply more than 300 lb $K_2O$/A such as applying a portion the previous fall or splitting the preplant application between KCl and $K_2SO_4$.

## Fertigation and Petiole K Concentrations

Petiole K concentrations decreased with time after tuber initiation. Concentrations were generally higher with broadcast K compared with either banding or fertigation treatments. Petiole K concentrations should be above 6.5 to 7.0 percent until 30 days before vine kill to prevent K from limiting tuber yields in southern Idaho. Petiole K concentration responses to K-fertigation applications were slow, up to 15 to 20 days after an application. A preferred K-fertigation source was not identified. Individual K-fertigation applications should not exceed 30 lb $K_2O$/A during tuber growth and should not be made within 30 days before vine kill. Potassium fertigation applications may need to be repeated, but should not be closer than a 10 to 14 day internal.

## Summary

Potassium fertilization rates for

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## Summary

Data from the P timing studies, and other P fertilization projects conducted during 1997 on alkaline silt loams, continue to show significant TDM and yield increases from P fertilization. Generally, acidic silt loam soils with acidic pH and following soybean in rotation have not shown rice yield increases from P fertilization in Arkansas. Fields that have been precision graded are an exception, since they typically respond to P fertilization for several years following leveling, regardless of pH. Phosphorus timing studies conducted during 1997 indicate that P should be applied before or during vegetative growth. Phosphorus applications made at MS in these field studies tended to produce lower yields than earlier applications on P responsive soils. Data also indicate that some benefit was obtained from either PF or POF P application at the Wimpy site. Additionally, yield data from the Davis farm indicate that P applied before emergence may be subject to fixation. Phosphorus applied either PF or seven days POF tended to produce the greatest overall yields at sites exhibiting a P response. More studies are needed to establish consistent trends among P application timings. Present and future research efforts are focused on development of more accurate P recommendations for rice. BC


**TABLE 4.** Influence of P fertilizer application timing on rice grain yield from three P timing studies conducted during 1997.

| P Timing | Grain yield, bu/A | | |
|---|---|---|---|
| | Brooks | Davis | Wimpy |
| Preemerge (PE) | 184 | 145 | 150 |
| Preflood (PF) | 171 | 143 | 156 |
| Postflood (POF) | 172 | 157 | 156 |
| Midseason (MS) | 182 | 131 | 147 |
| LSD (0.05) | NS | 18 | NS |
| Pr > F | 0.611 | 0.018 | 0.410 |
| CV % | 14.6 | 15.4 | 9.3 |


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potato production in Idaho should be increased over what was previously considered adequate, particularly on coarse, sandy textured soils. Growers using the information from this study should be able to successfully manage the K needs of Russet Burbank potato production in Idaho. BC


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**Recent Idaho research** indicates need for increased K application for higher potential yields of Russet Burbank potatoes.