RESPONSE OF MESA RUSSET POTATO TO POTASSIUM FERTILIZER SOURCE AND TIME OF APPLICATION

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ABSTRACT

Research studies have shown that the source of potassium (K) fertilizer can influence potato tuber yield and quality. Most of the K fertilizer studies conducted have focused on muriate of potash (MOP) and sulfate of potash (SOP). Potassium Acetate (Bio-K) has been introduced as a new source of K fertilizer. Field studies were conducted at the San Luis Valley Research Center, Colorado State University, to evaluate the yield and quality response of potato cultivar Mesa Russet to source and time of application of two K fertilizers. Treatments included a) application of Bio-K pre-plant (Bio-K Pre), b) Bio-K Pre, followed by foliar application of Bio-K (Bio-K Pre + foliar), c)foliar application of Bio-K (Bio-K foliar), d) application of muriate of potash pre-plant (MOP Pre), and e) application of MOP pre-plant , followed by foliar application of Bio-K (MOP Pre + Bio-K foliar). A control treatment was included where no K fertilizer was applied. Results from the studies showed that Bio-K Pre and Bio-K foliar enhanced tuber bulking. Pre-plant application of Bio-K increased marketable tuber (> 4 oz) yield by 20% and 6%, compared to the control and MOP Pre-treatments, respectively. Foliar application of Bio-K increased tuber specific gravity. Data from this study indicate that pre-plant application of Bio-K as source of K fertilizer can increase marketable tuber yield.

INTRODUCTION

Potatoes have a relatively high potassium (K) requirement and can remove more than 240 lb. K/acre in a 500 cwt/acre crop.

Studies conducted with K fertilizers suggest that the source of K fertilizer can influence potato tuber yield and quality (Panique et al. 1997; Roberts and McDole 1985). Other studies conducted by Kelling et al. (1994) indicate that in-season K fertilizer application do not enhance potato yields or quality over pre-plant applications.

A new source of K fertilizer, known as Bio-K has been introduced. Bio-K is a unique form of an inorganic salt reacted with an organic acid to form potassium acetate fertilizer. Information on the effect of Bio-K as source of K fertilizer on performance of potato has not been documented.

The objective of this study was to evaluate the yield and quality response of Mesa Russet potato to MOP and Bio-K as source of K fertilizer, and to determine whether Mesa Russet will respond to foliar application of Bio-K.

MATERIALS AND METHODS

The field study was conducted at the San Luis Valley Research Center, Colorado State University, on a gravely sandy loam. Mesa Russet was used as the potato cultivar for the study.

The study was laid out as a randomized complete block design. There were six treatments, each replicated four times. Treatments included 1. Application of Bio-K pre-plant (Bio-K Pre); 2. Application of Bio-K pre-plant, followed by foliar application of Bio-K (Bio-K Pre + foliar); 3. Foliar application of Bio-K (Bio-K foliar); 4.Application of muriate of potash pre-plant (MOP Pre); 5.Application of muriate of potash pre-plant, followed by foliar application of Bio-K (MOPPre + Bio-K foliar). A control treatment was included where no K fertilizer was applied. Foliar application of Bio-K was done at tuber initiation and during tuber bulking.

Tubers were sampled from each plot during mid tuber bulking (99 DAP) to evaluate the effect of the treatments on earliness of tuber bulking.At harvest, tubers from each plot were weighed for total yield. The harvested tubers were separated into various size distribution groups based on weight (> 4 oz., > 6 oz., and > 10 oz.).

Tubers harvested from each plot were evaluated for external (growth cracks, knobs, and misshapes) and internal (hollow heart) defects.Ten large tubers were randomly selected from each plot for tuber specific gravity evaluation. Tuber specific gravity was measured using the weight-in-air/weight-in-water method.

RESULTS AND DISCUSSION

Tuber Bulking

The application of Bio-K pre-plant or foliar application of Bio-K increased the rate of tuber bulking. This is evidenced by the higher tuber fresh weight observed at mid tuber bulking (99 DAP) when Bio-K was applied pre-plant or as a foliar application (fig 1).

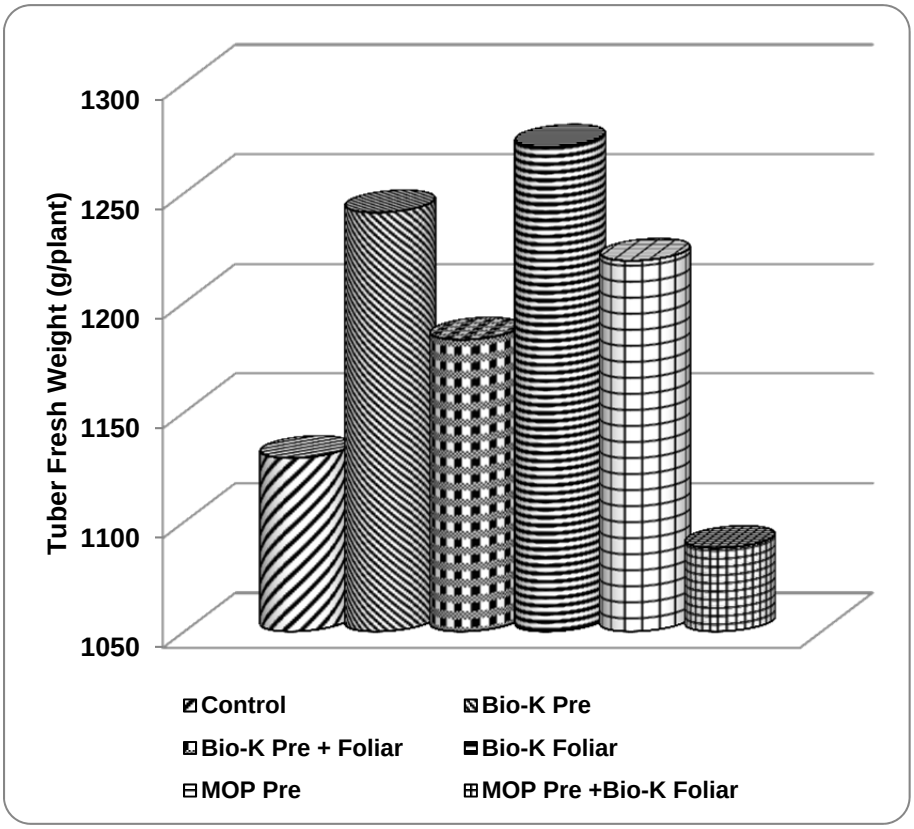

Figure 1. Effect of source and time of potassium fertilizer application on tuber fresh weight at mid tuber bulking.

Tuber Yield and Tuber Size Distribution

The application of potassium (K) fertilizer, irrespective of source or time of application did influence total tuber yield. All K fertilizer application treatments did increase total tuber yield compared to the control (Table 1). Differences in K fertilizer treatments were observed for marketable (> 4 oz.), large marketable (> 6 oz.), and premium size (> 10 oz.) tuber yield, indicating that the source and time of K fertilizer application did influence tuber size distribution and tuber quality. In this study, the application of Bio-K pre-plant did increase marketable, large marketable and premium size tuber yield by 20, 34, and 18%, respectively, compared to the control treatment (Table 1). The yield increases observed for Bio-K pre-plant in each of the size distribution groups were also higher than the yields obtained from all other treatments (Table 1). The application of Bio-K pre-plant did increase the percentage of tubers in the marketable (> 4 oz.) and large marketable (> 6 oz.) tuber size groups (Table 1).

Even though there was no statistical difference among K fertilizer treatments in total tuber yield, the yield obtained from Bio-K pre-plant treatment plots were higher than the yields from all other treatments. It should be noted that for premium size (> 10 oz.) tubers, the yields obtained were statistically similar when K fertilizer was applied as Bio-K pre plant (48 cwt/ac), Bio-K applied pre plant and followed with foliar application (36 cwt/ac), and Bio-K applied as foliar only (47 cwt/ac). These premium size tuber yields from Bio-K application were higher than the yields obtained for other treatments (Table 1).

Table 1 Effect of source and time of potassium fertilizer application on potato tuber yield and tuber size distribution.

Treatment	Total	> 4 oz	> 6 oz.	> 10 oz.
		Yield (cwt/acre)		
Control	381*b*[x]	276*c* (72)[y]	164*bc* (43)	22*b* (6)
Bio-K Pre	430*a*	332*a* (77)	220*a* (51)	48*a* (11)
Bio-K Pre + Foliar	407*a*	309*bc* (76)	185*b* (45)	36*ab* (9)
Bio-K Foliar	407*a*	311*bc* (76)	188*b* (46)	47*a* (12)
MOP Pre	424*a*	314*b* (74)	181*b* (43)	28*b* (7)
MOP Pre + Bio-K Foliar	410*a*	292*c* (71)	156*c* (38)	27*b* (6)

[x] figures in the same column and bearing the same letters are not significantly different at the 0.05 level of probability

[y] figures in brackets represent percent of total yield.

Tuber External and Internal Defects and Tuber Specific Gravity

In this study, the highest tuber external defects (1.4%) were observed when MOP was applied pre plant and later followed with foliar application of Bio-K (MOPPre + Bio-K foliar) –

Table 2. An evaluation of tuber internal defects showed that 1.8% of the tubers from the Bio-K Pre- treatment plots had hollow heart, compared to tubers from the Bio-K foliar (0.5%), and control (0.6%) plots. All other treatments did not show hollow heart in the tubers evaluated (Table 2).

Specific gravity was highest for tubers harvested from the Bio-K Pre + foliar (1.091) and Bio-K foliar (1.090) treatment plots (Table 2).

Table 2 Effect of source and time of potassium fertilizer application on potato tuber external and internal defects, and on tuber specific gravity.

Treatment	Tuber External Defects[x]	Hollow Heart	Specific Gravity
	%		
Control	0	0.6	1.089
Bio-K Pre	0.4	1.8	1.088
Bio-K Pre + Foliar	0	0	1.091
Bio-K Foliar	0.5	0.5	1.090
MOP Pre	0.6	0	1.088
MOP Pre + Bio-K Foliar	1.4	0	1.089

[x] Includes growth cracks, knobs, and misshapes.

SUMMARY

Data from this study clearly indicate that the source and time of potassium fertilizer application do influence tuber bulking, tuber yield and tuber quality of russet potato. In the present study, the application of Bio-K pre plant increased the rate of tuber bulking. Also, the yield of marketable and premium size tubers were significantly increased when Bio-K was applied pre plant.

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