Korean J. Soil Sci. Fert. 44(2), 303-305 (2011)

Note

Effect of Soil Organic Matter Content and Nutrition Elements on Yield of Potato

Young Bae Park* and Jae-Seung Noh

National Institute of Horticultural and Herbal Science, RDA, Suwon 440-706, Korea

A study of different levels of Nutrition Elements and the chemical properties of the soil was conducted to determine the yield performance of potato. Application of sulfur, potassium, and Magnesium significantly affected final height, dry matter content, and crispiness of potato. The final pH, organo-nitrogen, phosphorus, potassium, and magnesium content in the soil were significantly affected by S-K-Mg application.

Key words: Soil Organic Matter, Nutrition Elements, Potato Yield

Introduction

Potato (solanum tuberosum) is one of the leading root crops as one of the most common sources of carbohydrates, protein, minerals, vitamin, and small amount of calcium. Continuous cultivation of this crop, however has led to serious fertility depletion due soil erosion, leaching and volatilization among others. Proper plant nutrition is the key to high-yielding and high quality potatoes especially for processing. S-K-Mg is produced to replace the continuous loss of sulfur and magnesium, which are not replaced by today's high analysis fertilizer (Hyllton, 1999; Lindhauer, 1985; Mengel, 1997). The study was concerned mainly in determining the effects of S-K-Mg on the yield and chipping quality of potato.

Materials and Methods

PO3 variety were used selected with different fertilizer sources such as urea (16-20-0), Triple 14, S-K-Mg (21-21-11) as well as application insecticides and fungicides during the experiments. Soil samples were collected from the sampling sites for initial analysis of pH, OM, N, P, K and Mg (Table 1). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. All cultural practices such as watering, spraying, weed control and others were strictly implemented.

Results and Discussion

In table 2, the yield results were shown. Potatoes applied with different rates of S-K-Mg showed no significant differences on the final height of plants. It was observed that S-P-Mg application enhanced plant growth of potato. This is due to sulfur present in S-K-Mg, which is highly soluble. This element aids initial growth, and helps sustain vigorous growth throughout the growing period. On the other hand, magnesium increased chlorophyll production, phosphorus absorption and stimulated plant growth, resulting in that taller plants were obtained compared to the control and farmer's practice. The combined effects of sulfurous and magnesium lead to faster growth.

Table 3 shows the chemical properties of soils after harvest. Application of S-K-Mg at higher level (200 kg ha^{-1}) significantly lowered the final pH of the soil. This attributed to the 21% sulfur content of the S-P-Mg, that is a significant decrease in acidity can be observed through the use of sulfur containing fertilizers. For organic matter content of the soil after harvest, there were significant increases on the final OM contents of the Soil except for the soil applied with 200 kg ha^{-1} S-K-Mg alone and the control. Statistical analysis revealed that the application of different rates of S-K-Mg have significantly affected N content for the respective treatment plots (Table 3). For P content in soils after

Received : December 29. 2010 Accepted : March 1. 2011
*Corresponding author : Phone: +82312403648
E-mail: ybpark6291@hanmail.net

Table 1. Treatments to investigate the potato yield.

Treatment	S-K-Mg	$N-P_2O_5-K_2O$	Chicken dung
Control	-	-	-
T1	140	140-140-140	5
T2	200	140-140-0	5
T3	50	140-140-0	5
T4	100	-	5
T5	150	-	5
T6	200	-	5
T7	200	-	0

Table 2. Treatments to investigate the potato yield.

Treatment	Height	Yield	Tuber yield		Dry matter
			Marketable	Non-marketable	
	cm	Ton ha^{-1}	---------------- Ton ha^{-1} ----------------		%
Control	39.85ba†	5.94da	2.25c	0.72aba	19.24abd
T1	58.80a	12.80ab	5.90a	0.50abc	17.35b
T2	67.87a	12.80ab	5.63ab	0.78a	16.63b
T3	68.27a	13.00ab	5.87a	0.63abc	16.58b
T4	61.53a	13.60a	6.30a	0.52abc	17.65ab
T5	64.53a	11.10bc	5.38ab	0.50abc	16.67ab
T6	69.00a	12.80ab	6.33a	0.08c	17.18b
T7	62.87a	9.60c	4.63b	0.17bc	20.17a

†Means followed by a common letter within a column are not significantly different by DMRT ($p<0.05$).

Table 3. Chemical properties of soils after potato harvest.

Treatment	pH	OM	T-N	T-P	K	Mg
		-------------- % --------------		---------------------- mg kg^{-1} ----------------------		
Control	5.47a	2.33bc	0.117bcf	1.26d	136.67f	0.46b
T1	5.15b	6.40a	0.125ab	6.32a	25.00d	0.35bcd
T2	5.08c	2.49ab	0.125ab	4.14b	440.00a	0.29cd
T3	5.05cd	2.51ab	0.126ab	4.37b	283.33c	0.24d
T4	5.03d	2.61ab	0.131a	2.07cd	273.33b	0.76a
T5	5.00d	2.47ab	0.124ab	2.55c	373.33b	0.84a
T6	4.83f	2.16c	0.124ab	2.41cd	356.67b	0.48b
T7	5.5a	2.43ab	0.12ab	1.84c	183.33c	0.41bc

a Means followed by a common letter within a column are not significantly different by DMRT ($p<0.05$).

harvest, a decrease of 141.30% was obtained from soil applied with 200 kg ha^{-1} S-K-Mg alone, over the initial P-content. This indicates that P-utilization is enhanced by the application of S-K-Mg. For potassium content of the soil after harvest, it was noted that the T7 (200 kg ha^{-1} S-K-Mg alone) had the lowest potassium content among those applied with inorganic fertilizer containing potassium. This could be attributed to the utilization of K from the applied amounts from S-K-Mg fertilizer. For magnesium, the significant differences on the magnesium content of the soil after harvest was observed by S-K-Mg application.

Conclusion

S-K-Mg application helped initial growth, and helps sustain vigorous growth throughout the growing period. Especially magnesium increased chlorophyll production, phosphorus absorption and stimulated plant growth. The combined effects of sulfurous and magnesium lead to faster growth. S-K-Mg application enhanced P-utilization. However, the significant differences on the magnesium content of the soil after harvest was observed by S-K-Mg application.

References

Hyllton, M.C. 1999. Potassium. Magnesium and Sulfate and Its Role in Balanced. Plant Nutrition. IMC Global, Bannockburn, Ill, USA. p.14.

Lindhauer, M.G. 1985. The Role of Potassium in Plant with Emphasis on stress conditions, water, Temperature, salinity. In: Proceedings of the Potassium Symposium.

Mengel, K. 1997. Impact on Potassium on Crop yield and Quality with regard to Economical and Ecological Aspects. In: Proceedings of the IPI Regional Workshop on: Food Security in the WANA region, the essential need for balanced fertilization, held at bornova Izmir, Turkey. 26-390 May 1997 International Potash Institute, Bern Switzerland. pp. 157-174.