

Study on Growth of Potato Varieties under Different Potassium Levels

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Research Article

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ABSTRACT

To find out the effect of different doses of potassium fertilizer on growth characteristics, tuber production and gross margin analysis a study was carried out in local and improved varieties of potato in Dang valley. Local variety (locally called as tharu potato) and improved cardinal variety was used for the study. A Factorial Randomized Completely Block Design (RCBD) was prepared for the trial. Study was carried out using 30, 40, 50, 60, 80, and 100 kg/ha doses of potassium on two varieties of potato. The highest plant canopy, stem diameter, leaf length, tuber number, and tuber weight was found for cardinal variety with an application of 100 kg potassium per hectare. However, higher gross margin was found for local variety because of the higher price.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is an important food and cash crop grown worldwide. It is the world's fourth-largest staple food crop. Globally, potato contributes about 80% of calorie intake by human. Therefore, it is considered important for food security. Further, potato is enriched with vitamins (vitamin C, B) and minerals (like potassium and iron) (Lister and Munro, 2000). Potato contributes to improve the livelihood in the rural areas because it is a source of food and income. In Nepal, potato is cultivated since 200 years. Currently, the area under potato cultivation is 185,879 ha and productivity is 13.94 t/ha. Potato imparts 6.57 percent of total Agricultural Gross Domestic Product (AGDP).

Potato is a soil exhaustive crop. For appropriate growth and maturation of the plant, it requires a poised and adequate amount of plant nutrient. The essential elements for potato productivity are Nitrogen (N), Phosphorus (P), and Potassium (K). Most of the farmers apply Nitrogen and Phosphorus in a greater extent and the application of Potassium is usually ignored. Potassium is an important element that is absorbed by the plant in larger quantity after nitrogen. It helps in photosynthate translocation, enzymes, photosynthesis activation and starch synthesis, which helps in higher productivity of potato tubers. Insufficiency of potassium makes the plant susceptible to disease and pest and consequently reduces the yield and quality. The occurrence of potassium deficiency is majorly seen in the acidic soil where there is high rainfall that causes leaching of K. In Nepal, most of the soil is sought to be acidic. The growth of potato under such condition may get hindered. Specially, under the farmer-managed condition, where the application of K fertilizer is quite low. This study is carried out to know the effect of different doses of potassium fertilizer on the growth parameter of potato in Dang.

MATERIALS AND METHODS

Study site

The study was conducted in the Dang inner valley in the vegetable farm of Prithu Agricultural College. The study area lies in 28 degrees 00' 00" N latitude and, 82 degrees 15' 60" E longitude and an altitude of 701 meters above sea level. The soil of the study site was silt loam and had a pH of 6.2.

Experimental design

This study was carried out using factorial RCBD. The trail was replicated three times and has the combination of two treatments of varieties (local and cardinal) and five treatments of potassium doses (30, 40, 60, 80 and 100 kg K₂O/ha). About 120 kg N/ha and 100 kg P/ha was applied in each plot. The sprouted potato tubers were planted in the field on by ridge and furrow method of planting. As per recommendation, basal dose of fertilizer was applied at the planting time. The spacing between the plants was 60 cm × 25 cm. Total of forty plants was placed in each plot of size 2.4 m × 2.5 m. Plants were planted in the month of October 2018. Irrigation was provided after planting the tubers and during the critical growth stages. The intercultural operations were carried out in similar manner for all the treatments.

Data collection and analysis

When the plant reached maximum vegetative growth, growth parameters like plant canopy, stem diameter, and length of leaves were recorded. The number of tuber and weight of tuber per plant and tuber yield per hectare was measured. The data analysis was done through GENSTAT software.

Gross margin analysis

The total variable cost of potato cultivation was computed from the sum of all variable costs incurred during the cultivation. Similarly, the gross revenue from potato was estimated by multiplying mean tuber yield per hectare and the mean price per quintal of potato. And gross margin was computed as follows:

Gross margin = Total Variable Cost – Total Revenue

RESULTS

Growth components

Different potassium levels and potato varieties had significant effects on plant canopy, stem diameter, and leaf length. The interaction of potassium doses and varieties had a significant effect only on plant canopy. Maximum plant canopy, stem diameter and leaf length per plant were in the plots treated with 100 kg potassium per hectare and minimum growth components were obtained from the control plot. The interaction of several potassium levels and different varieties had significant ($p < 0.005$) consequence for plant canopy. Both the varieties responded positively for the application potassium at increasing doses. The improved variety cardinal had greater plant canopy, stem diameter, and, leaf length than that of local variety of potato.

K ₂ O (kg/ha)	Average Plant canopy per plant (cm)		Average Stem diameter per plant (cm)		Average Leaf length per plant (cm)	
	Local	Cardinal	Local	Cardinal	Local	Cardinal
40	37.82	41.58	2.98	3.08	4.80	5.31
60	40.12	42.78	3.03	3.28	4.91	5.46
80	43.67	44.80	3.30	3.55	5.32	5.52
100	45.54	45.87	3.56	3.76	5.50	5.73
Control (30)	37.61	40.38	2.53	3.05	4.60	5.28
CV (%)	1.8		8.7		7.4	
LSD (F-value)						
Fertilizer	0.899 (0.001)		0.3358 (0.001)		0.4680 (0.035)	
Variety	0.568 (0.001)		0.2124 (0.020)		0.2960 (0.004)	
Fertilizer x variety	1.271 (0.005)		0.4749 (0.725)		0.6619 (0.730)	

Tuber production

The treatments and their interaction had a considerable effect on the number of tuber and mean weight of tuber per plant, and the weight per tuber. With increasing potassium level, all the production parameter increases significantly. The highest number of tuber per plant, weight per tuber and per plant was obtained from the field with the application of 100 kg/ha potassium while the lowest was from the control plot. Also, there was a highly significant difference between the variety for the number of the tuber, and weight of tuber/plant, and the mean weight/ tuber. The interaction between varieties and doses of the potassium results considerable difference for the number of the tuber, mean weight per tuber and mean weight of tuber per plant. For both the varieties, the

increasing dose of potassium increases the tuber number and weight. The minimum number and weight of tuber were found in the control plot.

Gross margin analysis

Variable cost of production like fertilizers, seeds, electricity, labor, and others was calculated. Fixed cost of production is constant for all the treatment, therefore, it was not accounted. The gross margin was higher for the local variety of potato because of the greater price. However, the statistical difference between the varieties for gross margin was found non-significant. The study showed that with increasing potassium dose, the gross margin increases significantly at 1% level of significance. Maximum gross margin was obtained from the local variety at the 100 kg/ ha potassium application.

DISCUSSION

Growth components

The growth and development of potato plant increases with the raising dose of potassium fertilizer, and thus the plant canopy, stem diameter and leaf length increases also reported that leaf area of potato plant increases with the application potassium fertilizer. This could be due to the enzymatic activity of potassium for starch synthesis, and N metabolism. Different variety of potato has significant effect on the growth parameter. The highest plant growth parameters were found from improved variety cardinal. The differences in the growth pattern of varieties may be due to the genetic make-up of the plants.

Tuber production

Adhikary also reported that use of potassium fertilizer in potato up to 100 kg/ha increase the number of tuber per plant and the mean weight of tuber per plant. The increase in tuber number with the application of potassium may be due to the contribution of potassium in photosynthesis. Potassium helps for water absorption and nutrient translocation, which result in more photosynthate to produce more number of tubers.

Gross margin analysis

The increasing gross margin with raising potassium level is because of the positive yield the response of the varieties.

CONCLUSION

The finding revealed that raising the dose of potassium in potato plants up to 100 kg/ha, significantly and positively increases the vegetative growth and tuber production. A significant difference was found among the potato varieties in their performance. Similarly, the combined effect/ interaction of potato variety and potassium doses was also found significant for plant canopy, the mean number of tuber per plant and mean weight per tuber and mean weight of tuber per plant. The gross margin analysis indicated that the potato growers can reap a greater return from the use of potassium. Careful consideration of potassium fertilizer is recommended for the potato growers for gaining higher yield from potato.

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