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## Response of Potato Crop to Various Levels of NPK

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**Abstract:** Field experiment was conducted to assess the effect of different doses of NPK on growth and yield of potato crop. Five different combinations of NPK with control were studied. Results revealed that the fertilizer application increased the potato yield significantly (29-110%) over control (21 t ha<sup>-1</sup>). The highest % of marketable tubers (87.33) and yield (44.1 t ha<sup>-1</sup>) was obtained when 200:150:75 NPK kg ha<sup>-1</sup> was applied.

**Key words:** Potato, NPK response, soil coverage, yield and marketable yield, potato response to NPK

### Introduction

Potato (*Solanum tuberosum*) is an important crop of the world. It can produce 3-4 time more yield per unit area as compared to cereals. The average yield of potato crop is low (16.9 tons ha<sup>-1</sup>) in Pakistan as compared to advanced countries of the world (Anonymous, 1999). The reasons for low yield are many but unavailability of quality seed and inadequate and injudicious use of fertilizer are of prime importance.

Supply of nutrients plays an important role in growth and yield. Nitrogen is an essential constituent of protein and chlorophyll, where phosphorus fertilization contributes to early crop development and tuberization and enhances tuber maturation, whereas potassium influences both yield and tuber quality and also enhances plant resistance to withstand stress against drought and frost. In Northern Areas of Pakistan potato is grown on an area of 4700 ha (Anonymous, 2000). High altitude valleys of Northern Areas are ideal for production of disease free seed potato. Zaroni (1991) reported that the potato growers in Northern Areas do not use the chemical fertilizer. However, the contract growers of seed companies apply 1 to 2 bags of nitrophosphate (N:P=23:23) per one bag (50 kg) of potatoes planted for seed multiplication as recommended by the seed company. Undoubtedly fertilizer plays a remarkable role in increasing the yield of crops. Grewal and Sharma (1980) recommended fertilizer for potato in Indian Punjab as 150 Kg N, 80 Kg P<sub>2</sub>O<sub>5</sub> and 120 Kg K<sub>2</sub>O. Malik (1995) reported recommended dose of fertilizers for Kalam valley as 200:150:75 NPK kg ha<sup>-1</sup>.

In Northern Areas the soils are different from the plains in their composition, physical properties and fertility status. Therefore, the present study was carried out to evaluate the effect of various levels of NPK on the growth and yield of potato crop.

### Materials and Methods

The experiment was conducted at Daril valley district Diamer, Chilas during summer 2000. Potato variety Desiree (certified) was used as seed. Previous crops on the experimental plot were beans and maize. Experiment was planted on 20th of May 2000 using a seed rate of 2 tons ha<sup>-1</sup> at row to row and plant to plant spacing 75 and 15 cm respectively. Experiment was layout in randomized complete block design with three replication having net plot size of 2.25 X 4 m<sup>2</sup>. Full dose of P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and half dose of nitrogen were applied at planting time. The remaining half dose of nitrogen was applied 45 days after planting (DAP). Crop was harvested on 15-10-2000. Following observations were recorded during the course of study.

Germination (%), soil coverage (%), no of stems/m<sup>2</sup>, plant height (cm), No. of tubers/m<sup>2</sup>, tuber size (three grades i.e. <35 mm (small), 35-55 mm (medium) and >55 mm (big), average tuber weight (g) and yield tons ha<sup>-1</sup>. Data on these parameters were recorded as described by Farooq *et al.* (2001) and Mahmood *et al.* (2002).

The detail of treatments is given below

Treatments	N (kg ha <sup>-1</sup> )	P <sub>2</sub> O <sub>5</sub> (kg ha <sup>-1</sup> )	K <sub>2</sub> O <sub>5</sub> (kg ha <sup>-1</sup> )
T <sub>1</sub>	0	0	0
T <sub>2</sub>	100	0	0
T <sub>3</sub>	100	50	0
T <sub>4</sub>	100	50	50
T <sub>5</sub>	150	100	50
T <sub>6</sub>	200	150	75

Data were analyzed statistically through variance (based on randomized block design) and correlation was calculated using MSTAT main computer programme version 4.0 (Freed *et al.*, 1987).

## Results and Discussion

Data (Table 1) showed that maximum emergence 94.67 was recorded in T<sub>4</sub> followed by 93.67 in T<sub>6</sub> and lowest 90 in T<sub>5</sub>. Soil coverage was affected by fertilizer application at 60 days after planting (DAP). Treatments, T<sub>5</sub> and T<sub>6</sub> were significantly (0.05) different from other treatments. At 75 DAP there was no statistical difference between T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub>. At 90 DAP and 105 DAP all the treatments when fertilizer was applied at any rate was significantly different than control (T<sub>1</sub>). Number of stems m<sup>-2</sup> was also lowest in control. The plant height (cm) increased linearly with the increase in fertility level (Table 1, Fig. 1). It was maximum in T<sub>6</sub> (59.33 cm) and lowest in T<sub>1</sub> (38.40 cm) control. Singh and Raghar (2000) reported that plant height was significantly affected by various doses of nitrogen. Maximum height (55.1 cm) was recorded with 160 kg N ha<sup>-1</sup>. In this study, plant height was 54.37 cm when 150 kg N ha<sup>-1</sup> was applied and plant height was 59.33 cm when 200 kg N ha<sup>-1</sup> was applied. The result revealed (Table 2) that maximum number of tubers/m<sup>2</sup> was recorded in T<sub>6</sub> (51.67) and lowest in T<sub>2</sub> (41) and T<sub>1</sub> (42), respectively. The % age of small size tubers (<35 mm) was higher in T<sub>1</sub> (control) and T<sub>2</sub> where only 100 kg N ha<sup>-1</sup> was applied. Barches *et al.* (2000) reported that large size tubers were obtained when 175.5-125-125 Kg NPK ha<sup>-1</sup> was applied along with 500 ppm cycocel, while medium size tubers with 112.5-75-75 kg NPK ha<sup>-1</sup> with 250 ppm cycocel, where as with the application of 150-100-100 kg NPK ha<sup>-1</sup> small tubers were produced.

Kumar *et al.* (2001) reported similar type of results that significant increase in yield from 100 to 150% of all grades was recorded with increase in recommended dose of NPK (160-60-120 kg NPK ha<sup>-1</sup>). It is evident from the data (Table 2) that all the fertilizer treatments increased the average tuber weight and yield over the control (Fig. 1), but among the treatments T<sub>3</sub> and T<sub>4</sub> were non-significant with each other in respect of yield. Highest yield of 44.10 tons ha<sup>-1</sup> was recorded in T<sub>6</sub> (200-150-75 kg NPK ha<sup>-1</sup>) which was significantly (0.05) higher with rest of treatments, followed by T<sub>5</sub> (150-100-50 kg NPK ha<sup>-1</sup>), where yield of 38.50 tons ha<sup>-1</sup> was recorded. These results are in conformity with the findings of Kushwah (1999) that yield increased linearly with the increase in fertility level.

All the fertilizer applications have shown marketable yield increase, however, the better responses and trends were observed with the use of fertilizers in the ratio of 200 kg N, 150 kg P and 75 kg K ha<sup>-1</sup> under the soil condition prevailing in district Diamer.

Sultan *et al.* (1989) concluded that all fertilizer treatments showed considerable yield increasing with 135 kg N plus 120 kg P<sub>2</sub>O<sub>5</sub> and 120 kg K<sub>2</sub>O under the soil condition prevailing in Mansehra district. The application of NPK (200:150:75 kg ha<sup>-1</sup>) is in accordance with the finding of Malik (1995).

The results of this study revealed that the fertilizer dose of NPK (200:150:75 kg ha<sup>-1</sup>) is found suitable in Darail valley (high hills of Northern Areas, Pakistan) to get the

Table 1: Effect of NPK on growth characteristics of potato crop

Treatments	Emergence (%)	Soil coverage (%)					No of stems m <sup>-2</sup>	Plant height (cm)
		45 DAP	60 DAP	75 DAP	90 DAP	105 DAP		
T <sub>1</sub>	92.00a-c	6.00	26.33d	61.00c	75.33b	88.67b	22.6c	38.40e
T <sub>2</sub>	91.00bc	7.33	35.33c	94.67b	100.00a	100.00a	23.73ab	47.67d
T <sub>3</sub>	90.33c	7.00	40.00b	97.33ab	100.00a	100.00a	24.20a	49.07cd
T <sub>4</sub>	94.67a	7.00	41.00b	98.67a	100.00a	100.00a	23.13bc	49.87c
T <sub>5</sub>	90.00c	7.00	47.33a	98.33a	100.00a	100.00a	24.30a	54.37b
T <sub>6</sub>	93.67ab	7.00	48.33a	99.67a	100.00a	100.00a	24.23a	59.33a
LSD (0.05%)	3.249	1.870	3.462	3.664	1.870	1.135	0.6169	2.145

DAP = Days after planting. Means followed by different letters are significantly different at P < 0.05

Table 2: Effect of NPK on yield components of potato crop

Treatments	No. of tubers m <sup>-2</sup>	% of small tubers <35 mm	% of medium tubers 35-55 mm	% of big tubers >55 mm	Av. tuber wt. (gm)	Yield (tons ha <sup>-1</sup> )	% or marketable yield
T <sub>1</sub>	42.00d	33.67a	58.67b	7.66d	67.23e	21.00e	66.33d
T <sub>2</sub>	41.00d	26.67b	59.00b	14.33c	96.50d	27.17d	73.33c
T <sub>3</sub>	45.00c	20.00c	66.00a	14.00c	103.5c	33.00c	80.00b
T <sub>4</sub>	46.33bc	14.00d	67.67a	18.33b	110.9b	35.67c	86.00a
T <sub>5</sub>	48.00b	13.67d	66.33a	20.00ab	116.2a	38.50b	86.33a
T <sub>6</sub>	51.67a	12.67d	65.33a	22.00a	118.2a	44.10a	87.33a
LSD (0.05%)	2.508	2.609	2.395	2.478	2.846	2.681	2.609

Means followed by different letters are significantly different at P < 0.05

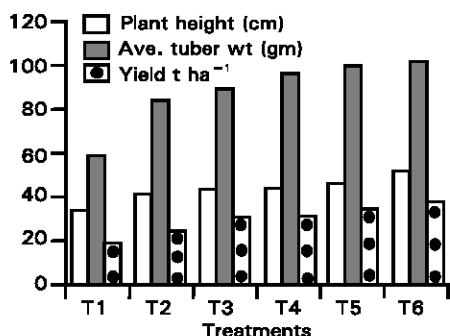


Fig. 1: Response of plant height (cm), average tuber wt. (g) and yield (t ha<sup>-1</sup>) to different levels of NPK

higher yields of potato crop. Khan (1993) suggested 200 kg N, 100 kg P<sub>2</sub>O<sub>5</sub> and 75 kg K<sub>2</sub>O ha<sup>-1</sup> to be economical combination, partially supported the results of present study. Where, higher dose of P<sub>2</sub>O<sub>5</sub> 150 kg ha<sup>-1</sup> also give significance results along with N and potash combination. Therefore, it is suggested to the growers of this area to use the balance doses of NPK 200-150-75 kg ha<sup>-1</sup> for better yields.

#### References

- Anonymous, 1999, Agricultural Statistics of Pakistan. Government of Pakistan, Ministry of Food, Agriculture and Livestock Division, (Economic Wing) Islamabad, Pakistan.
- Anonymous, 2000, Department of Agricultural, Diarrhoeal Diseases Quarantine Check Post, Basri. Northern Areas.
- Barches, S., R.N.S. Banafar and N.K. Gupta, 2000. Response of potato to fertility levels and plant growth regulators in black cotton soil. J. Maharashtra Agric. Univ., 25: 215-216.
- Farooq, K., M.M. Mahmood and R. Sher, 2001. Evaluation of Dutch potato varieties for yield during autumn in Islamabad. Pak. J. Biol. Sci., 4: 455-457.
- Freed, R., S. P. Eisensmith, S. Goetz, D. Rekosky, V. M. Small and P. Wolberg, 1987. MSTAT. A micro-programme for design, management and analysis of agronomic research experiments (version 4.0). Michigan State University, East Lansing MI 48824.
- Grewal, J.S. and R.C. Sharma, 1980. Fertilizer needs of potato. Fertilizer News, pp: 49-59.
- Khan, J., 1993. Effect of different levels of NPK fertilizer on potato tuber yield. Sarhad J. Agric., 9: 543-550.
- Kumar, D., C.S. Praharaj, R.C. Sharma and S.M.P. Khurna, 2001. Response of potato varieties to fertility levels in indo-gangetic plains of Bihar. J. Indian Potato Assoc., 28: 56-57.
- Kushwah, V.S., 1999. Response of potato cultivars to low inputs in alluvial soil of Patna. J. Indian Potash Assoc., 26: 103-106.
- Mahmood, M.M., K. Farooq, A. Hussain and R. Sher, 2002. Comparison of different method of fertilizer (NPK) application. Asian J. Pl. Sci., 1: 140-141.
- Malik, N.J., 1995. Potato in Pakistan, a Hand Book, PSPDP, PARC, Islamabad, Pakistan, pp: 87.
- Singh, N.P. and M. Raghar, 2000. Response of potato to nitrogen and Potassium fertilization under U.P. Tarai conditions. J. Indian Potato Assoc., 27: 47-48.
- Sultan, M., I. Maluk, G. Jehangiri, M. Basir and R. Shah, 1989. Effect of various levels of nitrogen, phosphorus and potash on yield of potato. Sarhad J. Agric., 5: 627-630.
- Zanoni, U., 1991. Potato Atlas and Compendium of Pakistan, Potato Production by Agro-ecological Zones. PSPDP and PARC, Islamabad, Pakistan, pp: 187-207.