

Original Research Article

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Effect of Different Levels of NPK and FYM on Growth and Yield of Potato

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ABSTRACT

Keywords

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The present experiment was conducted at the, Department of Horticulture, College of Agriculture, RVSKVV, Gwalior (M.P.) during the *Rabi* season of two consecutive years 2017-18 and 2018-19, to study the response of growth and yield parameters potato crop under different levels of NPK fertilizers and farm yard manure (FYM). The experiment was laid out in Randomized Completely Block Design (RCBD) with three replications and variety under test was potato cultivar Kufri chipsona-1. Growth parameters under observation were plant height, shoots per plant, leaf area (cm²), diameter of stem (cm), fresh weight of shoots and roots per plant, were recorded. The findings of present study revealed that among the good response of growth and yield parameters was observed with the advancement in levels of NPK from 50% upto 100% NPK at 30, 60 and 90 days after sowing. Highest graded tuber yield, marketable yield (19.9 t/ha), processing yield and highest total yield of 21.1 t/ha was recorded under treatment 100%NPK. Whereas among FYM treatments, highest yield of 18.8 t/ha was obtained with treatment (FYM 20 t/ha).

Introduction

Potato (*Solanum tuberosum* L.) is a herbaceous annual dicotyledonous plant in which underground stems give rise to tubers. It belongs to the family Solanaceae and it is grown across the world for its edible tubers. Originally it is an important temperate crop, but well adopted for sub-tropical conditions. As compared to cereal crops, potato produces much more dry matter in a shorter cycle

(Singh and Trehan, 1998). This high rate of dry matter production results in large amounts of nutrients removed per unit time, which generally most of the soils are not able to supply. In earlier days, chemical fertilizers were considered as the main source of nutrients for potato crop. However, continuous application of chemical fertilizers leads to nutritional imbalance which can be rectified through the use of organic manures. Therefore to check the effects of inorganic fertilizers and

farm yard manure (FYM), the present experiment was carried out to study the response of growth and yield parameters potato crop under different levels of NPK fertilizers and FYM.

Materials and Methods

The experiment was conducted at the, Horticulture research area, Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) during the *Rabi* season of two consecutive years 2017-18 and 2018-19. The Experimental site College of Agriculture, Gwalior is situated at 26° 13 N latitude and 78° 14' E longitudes at an altitude of 211.5 m from mean sea level in central part of Madhya Pradesh and it has a semi-arid subtropical climate. The soil of the experimental field was clay in texture with uniform topography. The treatments comprised of three levels of NPK fertilizers viz., (100% NPK), (75%NPK) and (50%NPK) and two levels of farm yard manure viz., (FYM10 t/ha), (FYM 20 t/ha) tested on potato cultivar Kufri chipsona-1. The experiment was laid out in Randomized Completely Block Design (RCBD) with three replications. Nitrogen was given in the form of urea. Phosphorus and potassium were applied through single super phosphate and muriate of potash, respectively. Pre-planting seed treatment was done with Mancozeb 0.2% solution. The tubers of uniform size were sown in plots of size 3 x 3 m at a spacing distance of 60 x 20 cm. The observations for plant growth parameters like plant height, number of shoots per plant, number of leaves per plant, leaf area (cm²), diameter of stem (cm), fresh weight of shoots per plant, fresh weight of roots per plant (g), were recorded on five randomly selected plants from each plot of each replication separately. Similarly, observations for yield parameters were taken at the time of harvest to obtain the viz., grade wise yield of

tubers(kg/plot), Processing grade tuber yield (T/ha), Marketable tuber yield and Total yield (T/ha) of potato tubers. The grade wise yield of tubers was obtained by sorting out total yield into four grades. The grading was done based on weight basis viz., A (>75 g), B (50-75 g), C (25-50g) and unmarketable tubers (<25 g) and tubers of each grade were weighed separately and graded yield was expressed in kilograms (kg/plot). Processing grade tuber yield (T/ha) was obtained by taking weight of tubers weighing (above 75 g). Similarly, Marketable tuber yield (T/ha)(A'+B'+C grade tubers) was obtained by adding yield of "A (>75 g), "B (50-75 g) and "C (25-50g) grade tubers and total yield (T/ha) was obtained as a sum total of all tuber yield obtained from each treatment and each replication at the time of harvest. The data recorded under the study were subjected to statistical analysis as per standard procedure as suggested by Panse and Sukhatme (1985).

Results and Discussion

Effects of NPK

Growth of the potato plant was studied (Table-1) with respect to plant height(cm), leaves per plant, Per cent emergence, number of shoots per plant, diameter of the stem (cm), leaf area per plant (cm²), fresh weight of shoot and root per plant (g), days to haulm cutting and days to harvest (Table-2). There was significant effect of NPK on all the growth parameters. Plant height and number of leaves per plant were increased with advancement of levels of NPK from 50% upto 100% NPK at 30, 60 and 90 days after sowing. The above results are in close proximity with the finding of Raghav *et al.*,(2008), Gavit *et al.*, (2010) and Marthha *et al.*, (2017). Similarly maximum number of shoots per plant and fresh weight of shoot and root per plant (g), was also observed under the treatment I₃ (100%NPK) while it was recorded lowest in the treatment I₁ (50% NPK). This

may be due to higher uptake of nutrients at higher dose of NPK which may have resulted in increased vegetative growth of plants and increased shoots and root weight per plant, similar findings were reported by Kumar *et al.*, (2015) and Jatav *et al.*, (2017).

Yield parameters:-The graded tuber yield increased with increase in level of NPK fertilizers (Table-3).

Similarly, maximum marketable tuber yield (A'+B'+C grade tubers) and highest yield total tuber yield of tubers was observed in the treatment (100%NPK) followed by treatment (75%NPK).

Response of high grade tubers at high fertilizer rates in this study may be due the good bulking tuber efficiency at this level of NPK. Whereas, treatment (50% NPK) had resulted in more unmarketable tubers (0-25 g) and gave less yield of large sized tubers per plot as compared to other treatments (100%NPK) and treatment (75%NPK). Which could be due to less availability of nutrients and hence tubers could not have bulked properly.

These findings are in close association with findings made by Singh *et al.*, (2007) who reported that there was significant increase in production of large sized tubers under fertility level (150 N:150 P:100 K kg/ha), and more number of medium size tubers were obtained from medium fertility level (100 N:100 P: 50 K kg/ha). Kumar *et al.*, (2011) also disclosed that the crop receiving 100% NPK was the best treatment capable of affecting yield of different grades (A, B and C) of tubers. Kumar *et al.*, (2015) obtained highest chips grade tubers from potato chipping variety Kufri Chipsona-4 under fertilizer treatment of (100% NPK). Kumar *et al.*, (2017) obtained the highest marketable tubers yield of (20.86 kg/plot) total tuber yield (21.05 kg/plot) with

the application of 100%NPK/ha. Similarly, Swaroop *et al.*,(2018) also concluded that with the application of 100% NPK a yield of (24.1.t/ha) was obtained in potato.

Effects of FYM

There was no significant differences noticed among the results shown by both the farm yard manure treatments(FYM 20 t/ha) and (FYM10 t/ha) on various growth parameters of plants(Table-1) and (Table-2), like height of the plant, leaves per plant, number of shoots per plant, diameter of the stem, leaf area and per fresh weight of root and shoot per plant at 30, 60 and 90 days after sowing, which can be due to low quantity of nutrients present in FYM. Similar, results were also reported by Gavit *et al.*, (2010) and Banafar *et al.*, (2005) reported that with the application of 15 ton FYM, maximum fresh weight of shoot per plant (361.40 g) were recorded.

Whereas, the yield differed among the two FYM levels doses (Table-3). Highest graded tuber yield, marketable tuber yield, processing ('A'grade) yield and total yield was obtained with treatment (FYM 20 t/ha)than with treatment (FYM10 t/ha), which can be due to FYM provided porosity and space in soil for tuber growth and provided nutrients and also facilitated their good absorption leading to increase in increase in more number of large sized tubers and thus increasing their yield. More availability of nutrients supply increased the yield also.

These results are in confirmation with findings of Jaipaul(2011) who found that FYM at 20 t/ha resulted in highest yield of 'A' grade tubers (41 %).Kumar t/ha of 'A" grade tubers, (11.68 t/ha) of B" grade tubers and (3.41 t/ha) of C" grade tubers yield. Similar findings were also noticed by Khurana and Bhutani (2005) and Sandhu *et al.*, (2010) with the application of 20 t FYM/ ha.

Table.1 Effect of different levels of NPK and FYM on growth parameters of Potato.

Treatment	Plant emergence %	Plant height (cm)			Number of leaves per plant			Shoots per plant		Diameter of stems (cm)	
	30 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS
50%NPK	85.41	19.23	40.71	52.27	20.15	42.28	65.83	3.62	4.76	1.52	3.86
75%NPK	86.33	21.92	40.7	58.93	22.1	45.09	68.04	3.8	5.31	1.58	4.07
100%NPK	88.4	23.09	45.1	58.9	23.09	43.38	72.16	4.02	5.33	1.66	4.24
SE(m)	0.779	0.280	0.448	0.656	0.228	0.556	0.807	0.104	0.074	0.039	0.052
CD at 5%	2.199	0.790	1.264	NS	0.812	0.589	0.671	0.212	0.210	0.110	0.145
10 T FYM	86.04	21.5	41.48	58.13	21.60	44.30	67.74	3.83	5.01	1.57	4.02
20 T FYM	86.4	21.7	42.88	58.60	22	46.21	69.6	3.87	5.2	1.61	4.09
SE(m)	0.636	0.229	0.366	0.535	0.186	0.464	0.659	0.085	0.061	0.032	4.042
CD at 5%	NS	NS	NS	NS	0.592	0.614	0.714	NS	0.171	NS	NS

(DAS- days after sowing, NPK-Nitrogen, Phosphorus, Potassium)

Table.2 Effect of different levels of NPK and FYM on growth parameters of Potato.

Treatment	Days to Harvest	Leaf area per plant (cm ²)			Average fresh weight of roots			Average Fresh weight of Shoots		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
50%NPK	118.4	140.3	321.1	405.5	3.92	7.9	12.11	82.93	155.6	182.8
75%NPK	118.5	145.4	316.1	414.0	4.40	9.07	13.56	85.75	155.4	191.2
100%NPK	117.8	148.6	343.0	418.2	4.83	9.22	15.21	88.9	166.6	197.03
SE(m)	0.373	1.35	3.118	4.04	0.077	0.114	0.166	0.904	1.607	1.971
CD at 5%	NS	0.312	0.259	NS	0.217	0.323	0.469	7.142	NS	5.561
10 T FYM	118.4	143.8	323.8	410.9	4.27	7.97	13.26	84.87	158.0	188.04
20 T FYM	118.56	144.9	329.7	414.2	4.50	9.07	13.99	86.8	162.4	192.7
SE(m)	0.305	1.109	2.54	3.29	0.063	0.093	0.136	0.738	1.312	1.609
CD at 5%	NS	NS	NS	NS	0.177	0.613	0.383	NS	NS	4.541

(DAS- days after sowing, NPK-Nitrogen, Phosphorus, Potassium)

Table.3 Effect of levels of NPK and FYM on yield parameters of Potato.

Treatments	Processing grade tuber yield (T/ha)	Grade wise tuber yield (kg/plot)				Marketable tuber yield (T/ha)	Total yield (T/ha)
		'A' grade	'B' grade	'C' grade	Unmarketable yield		
50%NPK	4.70	4.25	4.55	4.29	1.35	14.60	16.17
75%NPK	6.12	5.54	5.45	4.20	1.13	16.86	18.20
100%NPK	8.20	7.38	6.73	3.90	0.84	19.91	21.02
SE(m)	0.091	0.081	0.113	0.075	0.048	0.165	0.212
CD at 5%	0.257	0.227	0.318	0.211	0.099	0.466	0.502
10 T FYM	6.03	5.45	5.33	4.1	1.16	16.59	17.96
20 T FYM	6.6	6.01	5.83	4.09	1.06	17.71	18.8
SE(m)	0.074	0.066	0.092	0.061	0.039	0.135	0.173
CD at 5%	0.210	0.186	0.259	NS	NS	0.380	0.410

(DAS- days after sowing, NPK-Nitrogen, Phosphorus, Potassium)

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