Effect of Nitrogen andPotassium on the growth, yield and quality of Potato Crop (*Solanumtuberosum* L.)"

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Abstract –

Field investigation was carried out to study the effect of different nitrogen and potash levels on growth and yield parameters in potatovar. Kufri pukhraj. The experiment was laid out in a randomized block design with treatments consisting of ten nitrogen and potash levels replicated four times. present investigation it can be concluded that application of NPK-150:50:75 kg/ ha-^{1} from the overall experimental finding was proved to be most effective to grow parameters like increased plant height, number of leaves, number of shoots per plant fresh weight and dry weight of shoots , yield attributes and yield of potato *viz.*,maximum number of stolens, fresh weight and dry weight of tuber, number of tuber per plant, grade wisenumber of tuber, number of tuber, grade wise yield of tuber and tuber yield per plot .Therefore, application of NPK-150:50:75 kg/ ha-^{1} can be recommended to potato growers of western Uttar Pradesh for higher yield attributes traits.

Introduction-Potato (*Solanum tuberosum* L.) is one of the most important vegetable crop growing in the world, belongs to family Solanaceae. In India, it was introduced from Europe in early 19th century. It was originated in Peru-Bolivian in the Andes (South America). India is the second largest producer of potato in the world after China, with cultivation in an area of about 2.02 m ha and production of 46 million metric tons2. Potato is grown almost in all the states of India except Kerala. In Chhattisgarh, it is cultivated in an area of about 37,888 ha with a production of 5.5 lakh metric tons3. Due to its suitability and high returns, the area of potato is increasing every year in this state. Uttar Pradesh is the leading state, which produces 13.45 mt of potato from an area of 0.54 mha (Anonymous, 2009). In India, seed tuber play very important role in potato production. About 50-60 per cent of cost comes on seed alone (Somani and Chauhan, 2001). It has been identified as a whole some food and richest source of energy.

Potato is not only a rich source of carbohydrates and calories but also furnishes high quality of amino acids, Vitamin B, Vitamin C and minerals. One hundred grams of potato tuber contains 80% moisture, 20% dry matter, 14% starch, 20% sugar, 2% protein, 1% mineral salts, 0.61% fiber and 0.1% fat (Anonymous, 2002). It is used in the preparation of chips, puffs and raw material to produce alcohol. Considering the nutritive value and potential for higher yield, FAO has rightly identified this crop as food of future and declared 2008 as the International Potato Year.

Potato is a sensitive crop to application management of nitrogen and amounts less or more than its requirements or early and late application of nitrogen will affect quantitative and qualitative yield of tuber (Rezaei and Soltani, 1996). Sufficient use of nitrogen fertilizers in early growth season will expand leaf area and increase photo assimilates. Deficiency of nitrogen will decrease tuber yield via affecting the tuber production. Nitrogen is one of the essential elements for plant growth and is one of main components of proteins. When plant is in abnormal conditions like over use of nitrogen fertilizer, protein production will decrease and nitrogen will be stored as non-protein form. Nitrate is one of the non-protein forms which are poisonous for human or stock. Molerhagen (1993) reported different reflexes of cultivars to various amounts of nitrogen. In his study, effect of four pure nitrogen levels (0, 50,100 and 150 kg/ha) on three cultivars (Danva, Matilda and Bit) was evaluated and for Bit cultivar, increase in nitrogen raised the tuber yield but Danva and Matilda cultivars produced their highest yield in 100 kg/ha nitrogen. High amounts of nitrogen produced large tubers in that study. Prosba (1993) reported also that increase in nitrogen fertilizer raised mean weight of tubers. This study was conducted to evaluate relationship of nitrogen amount and nitrate accumulation in Agria and Marphona cultivars and also to find the most appropriate quantity of nitrogen to produce a healthy crop in cold central regions of Iran.

MATERIALS AND METHODS

The present investigation was carried out at the School of Agriculture and Environmental Sciences, Shobhit University Gangoh Saharanpur during the *rabi* season of 2014-15. Gangoh, Saharanpur the place of investigation, is situated in central part of Uttar Pradesh. Saharanpur is situated in the alluvial belt of gang etic plain in West U.P. It falls in the altitude and longitude range of 79.30 to 84.34 East and 25.28 to 28.50 North, respectively. The mean elevation of farm form sea level is 125.90 meters.The experiment was laid out in randomized block design with ten treatments consisting of different levels of nitrogen phosphorus and potash viz., 0 (control), 50,100,150, kg N and 50 kg P_2O_5 and 45, 60 and 75 kg K_2O/ha which were replicated four times. Nitrogen phosphorus and potash was applied in the form of Urea, S.S.P. and M.O.P, respectively. Recommended dose of phosphorus i.e. 50 kg/ha of each was applied. The test variety used was Kufri Pukhraj planted on ridges of 60 cm apart with a spacing of 20 cm. The soil of experimental field was clayey loam with low level of NPK. Full dose of phosphorus @ 50 kg/ha was applied through single super phosphate respectively as basal dose at the time of planting, whereas nitrogen and potash was applied in eachplot in split doses as per the treatments. Half dose of the nitrogen and potash of each treatment was applied through urea and muriate of potash as basal dressing and remaining half dose was applied at 30 days after planting. All the three fertilizers used for basal dressing were mixed before application and was applied in the middle of ridges before planting the tubers. Thirty days after planting the remaining dose of nitrogen and potash wasapplied through urea and muriate of potash as top dressing just before earthlingup. Earthling up was done at 30 days after planting (DAP). Weeding was done at the time of earthling to remove the weeds. Eight irrigations were provided during the entire crop growth period. Although, irrigation was given by flood irrigation method, . All the recommended package and practices were followed to raise a healthy crop. After harvesting the potato, tubers were graded into four groups for each plot in all the replication on the basis of tuber weight as <25g, 25-50g, 51-75g and >75g and weighed separately to record yield.

3. Results and Discussion

1. **Growth Parameters**

Data presented on growth parameters in Table 1 revealsthat the treatment effect was found to be significantlydifferent for plant height. Increasing trend in case ofplant height was observed with the increase in nitrogen and potashlevels. At 45, 60 and 75 DAP, similar trend was observedfor plant height with maximum plant height (45.55, 48.62, and51.07 cm, respectively) recorded less than150 kg N, 50 kg phosphorus, and 75 kg potash /hectare. In general, an increase in nitrogen and potash influencedthe number of leaves per plant. Significantly maximumnumber of leaves was found on application of 150 kg N, 50 kg phosphorus, 75 kg potash / hectare. Maximum number of leaves recorded at 45, 60 and 75 DAP were47.05, 48.94 and 51.05 respectively. Maximum number of shoot per plant, at 45 and60and 75 DAP, significant difference among the treatmentswas found. At 75 DAP, significantly maximum numberof shoot per plant (6.28) was recorded with nitrogen, phosphorus and potash was having at par effect with treatments150 kg N/ha,50 kg P/ha and 75 kg K. The increase in plant height, number of leaves and shoot with increase in nitrogen phosphorus andpotash. Enhancing the fresh weight of shoot with maximum being recorded under 150 kg N/ha 50 kg P/ha and 75 kg K/ha (300 g). Maximum dry weight of shoot per plant (30.00 g) was noted in thetreatment 150:50:75 NPK/ha.

Table 1. Effect of nitrogen and phosphorus and potash levels on vegetative parameters of potato

NPK Levale	Plant height (cm			Number of leaves per plant			Number of shoot per plant			Dry wt of shoot (g)	Freshwt. of shoot (g)
	45 DAP	60 DAP	75 DAP	45 DAP	60 DAP	75 DAP	45 DAP	60 DAP	75 DAP		
NPK@0:50:0	27.1	31.65	34.58	36.21	40.23	43.56	4.59	4.63	4.65	152.75	14.02
NPK@50:50:0	35.7	40.29	42.41	41.57	42.45	45.69	4.57	5.02	5.46	184.86	18.83
NPK@100:50:0	38.4	44.56	46.72	42.11	44.15	47.43	4.87	5.53	5.53	189.10	19.12
NPK@150:50:0	40.2	46.34	47.23	43.40	45.96	49.15	5.11	5.71	5.59	205.21	21.56
NPK@0:50:45	31.4	38.78	40.23	39.35	41.54	44.30	4.69	5.01	5.02	191.32	19.02
NPK@0:50:60	32.1	40.8 0	41.87	40.31	42.67	45.33	4.80	5.11	5.61	212.12	20.99
NPK@0:50:75	32.0	41.96	43.26	40.90	43.64	46.32	4.90	5.31	5.61	233.25	21.54
NPK@50:50:45	41.2	44.28	45.99	44.57	45.28	48.34	4.82	5.24	5.88	239.88	23.56
NPK@100:50:60	43.2	44.87	47.73	45.37	46.34	49.25	4.79	5.58	6.04	278.99	25.58
NPK@150:50:75	45.5	48.62	51.07	47.05	48.94	51.05	5.47	6.12	6.28	300.26	30.00

3. Yield and Yield Attributing Parameters

On the perusal of yield attributing data presented inTable 2, it is evident that the maximum number of stolonper plant (17.08) was recorded under the treatment 150:50:75 kg NPK/ha. The minimum number of stolon per plant (11.45) was counted in thetreatment 0 kg N/ha, 50 kg P and 0 kg potash. At harvest, fresh weight of tuberper plant ranged from minimum of 392 g to maximumof 602 g. The maximum dry weight of tuber perplant (22.23 g) was noted on application of 150:50:75 kg NPK/ha. Thehighest number of tuber per plant (8.15) was recorded with150:50:75 kg NPK/ha which was having statistically equal effectwith rest of the treatments but significantly superior overcontrol. The observed tuber number increase in responseto NPK fertilization could be attributed to an increase in stolonfindings. Data regarding to grade wise number of tuberper plot revealed that this attribute was significantlyaffected by the nitrogen phosphorus and potash levels only for grades 50-75 g and>75 g tuber. The highest number of tuber per plot (95.38)for grade 50-75 g tuber was obtained under150:50:75 kg NPK/hafollowed by 100 kg N/ha, 50 kg P/ha, 60 kg K/ha and, all significantly superior to control. Similartrend was observed in the grade >75 g tuber, whereinhighest number of tuber per plot (103.55) was noticedin 150:50:75 kg NPK/ha. .The present resultsare in conformity. In case of total number of tuber per plot, highest numberof tuber (360.00) was noted in 150:50:75 kg NPK/ha .With regard to the yield data, presented in Table 3, itcan be inferred that highest tuber yield per plot (0.44 kg and3.45 kg) inthe grade 0-25 g and 25-50g was obtained under

150:50:75 kg NPK/ha, whereasin case of 50-75 g and >75 g grade tuber, the highest yieldper plot (7.30 kg and 11.65 kg, respectively) was obtainedunder 150:50:75 kg NPK/ha which had at par effect with all theother treatments, but significantly superior over control.

Table 2. Effect of nitrogen levels on yield attributing parameters of potato

NPK Levale	No. of of tuber per plant	Fresh wt. of tuber plant(g)	Dry wt.of per plant (g)	No. of tuber per plant at harvest	Grade-wise number of tuber per plot				Per plot total no.of tuber
					0-25g	25-50g	50-75g	>75g	
NPK@0:50:0	10.58	151.24	14.85	6.59	24.00	50.00	60.00	75.00	209
NPK@50:50:0	12.25	182.36	18.65	6.82	25.00	51.00	61.00	83.00	220
NPK@100:50:0	13.88	196.32	19.54	7.03	26.00	53.00	63.00	87.00	229
NPK@150:50:0	14.85	208.21	21.56	7.29	28.00	54.00	65.00	90.00	237
NPK@0:50:45	13.85	197.34	18.57	6.65	29.00	51.00	62.00	85.00	227
NPK@0:50:60	14.25	213.21	19.59	7.14	28.00	51.00	62.00	88.00	229
NPK@0:50:75	14.11	237.81	21.65	7.23	29.00	52.00	63.00	92.00	236
NPK@50:50:45	14.85	250.30	22.89	7.48	30.00	53.00	64.00	94.00	241
NPK@100:50:60	15.75	285.64	24.97	7.84	31.00	55.00	68.00	96.00	250
NPK@150:50:75	16.84	298.25	28.69	7.99	32.00	56.00	70.00	100.00	258

Table 3. Effect of nitrogen levels on yield parameters of potato

NPK Levale	Grade-wise number of tuber per plot (kg/plot)				Tuber yield (kg/plot)			Tuber yield (q/ha)		
	0-25g	25-50 g	50-75g	>75g	M*	U*	Total	M*	U*	Total
NPK@0:50:0	0.25	3.82	5.01	6.85	15.18	.85	16.03	150.21	8.24	158.45
NPK@50:50:0	0.32	3.68	6.02	8.95	19.16	.70	19.86	190.12	5.26	195.38
NPK@100:50:0	0.34	3.71	6.38	9.24	19.25	.73	19.98	192.54	5.14	197.68
NPK@150:50:0	0.39	3.75	6.70	9.71	20.29	.55	20.84	210.24	4.25	214.49
NPK@0:50:45	0.33	3.69	6.50	9.67	19.94	.60	20.54	204.32	4.85	209.17
NPK@0:50:60	0.35	3.70	6.60	9.87	20.24	.57	20.81	207.23	4.68	211.91
NPK@0:50:75	0.38	3.76	6.89	10.12	20.60	.40	21.00	213.81	3.54	217.35
NPK@50:50:45	0.39	3.77	6.93	10.52	21.71	.30	22.01	221.13	3.21	224.34
NPK@100:50:60	0.41	3.78	7.10	10.83	22.28	.24	22.52	223.51	2.15	225.66
NPK@150:50:75	0.44	3.83	7.25	11.01	22.66	.18	22.84	228.94	1.28	230.22

The highest yield of marketable tuber (22.66 kg/plot) wasrecorded on the application of 150, 50, 75 kg NPK/ha whereas, Highest unmarketable yield of tuber (0.85 kg/plot) wasrecorded with 0, 50, 0 kg NPK/ha which was observed to have at pareffect with 150, 50, 75 kg NPK/ha. The highest totaltuber yield (22.84 kg/plot) was recorded in 150, 50, 75 kg NPK/ha.However, no significant difference was observed betweenthe treatments 150, 50, 75 kg NPK/ha and other treatments viz., 100, 50, 60 kg NPK/ha for this attribute.The highest yield of marketable tuber (228.94 q/ha) as Well as total tuber yield (230.22 q/ha) was recorded under 150, 50, 75 kg NPK/ha. However, no significant difference was Observed between 150, 50, 75 kg NPK/ha and 100, 50, 60 kg NPK/ha,. The highest unmarketabletuber yield was recorded with the lowest nitrogen level 0,50,0 kg NPK/ha,. A decreasein unmarketable yield was observed with higher levelsof NPK. Higher yield obtained with application of higher dose of NPK would have helped in increase in Tuberization as well as increased duration of tuber bulkingwhich would have resulted in higher production.Moreover, with increasing NPK application, numberof stolon, number of tuber and consequently yieldwere increased. Revealed that tuber yield per unit area increased withincreasing NPK fertilizer up to a suitable level only.

4. Conclusion

It can be inferred from the present findings that, optimum NPK application is essential to improve potato Tuber yield. Although with the increase in NPK levels, vegetative parameters of crop growth increasedwith maximum values achieved on application of 100, 50, 60 kg NPK/ha but application of 100, 50, 75 kg NPK/ha proved to besuperior for obtaining higher yield and yield attributingcharacters. Thus, application of optimum dose of 150, 50 and 75 kgNPK/ha was observed to be superior in terms of yield, as wellas more profitable and can, therefore, be economicallyrecommended for cultivation of potato variety Kufripukhraj underUttar Pradesh plains agro-climatic zone.

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