INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 1)
Available online at: www.ijariit.com

Effect of different doses of nitrogen and phosphorus on growth and yield potato (Solanum tuberosum L.)

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ABSTRACT

A field experiment was conducted during the spring season of 2014-15 on clayey soils of Agriculture Faculty of Baghlan University, to study the effect of different doses of nitrogen and phosphorus on growth, yield and economics of potato (Solanum tuberosum L.). The experiment was laid in a randomized block design (RBD) comprised of 3 replication and sixteen treatments. Application of Nitrogen 250 kg+ Phosphorus 175 kg/ha produced taller plants (41.83cm), higher number of leaves (30.41 per plant), number of branches (4.73 per plant), significantly wider leaf area (113.43 cm), higher tuber weight (216.11 g per plant), number of tuber (4.14 per plant) significantly higher tuber yield (14.70 ton/ha) and B:C (5.49).

Keywords— *Nitrogen, Phosphorus, Potato*

1. INTRODUCTION

Potato (*Solanum tuberosum L.*) is one of the most important food crops which is ranked the fourth position after maize, wheat and rice in the world. It is cultivated in the area of 19 million ha with an annual production of 321 million tonnes (FAO 2008). Potato (*Solanum tuberosum* L.) is originated in the Andean region of high hills of South America and brought to Europe in the 18th century (Popal 2003). Potato is cultivated in different parts of Afghanistan with the area of 14 thousand ha with the productivity of 16.8 tonnes per ha. In common potato is cultivated in provinces like Bamyan, Kabul, Baghlan, Logar, Wardak, Ghazni and Logar with 1800-2400 above the sea level. Bamyan produces more than 50% of the total potato in Afghanistan. Baghlan is also one of the major provinces which have a favourable environment for potato production. It is cultivated in districts of Dehsala, Pul-i-Hisar, Bano, Baghlan Markazi, Nahrin, Khost etc. with the average productivity of 10.5 tonnes per ha. Besides diseases management, application of recommended doses of fertilizer is one of the major problems of Afghan farmers in Afghanistan which results in low yield even crop losses every year. Hence the present investigation will help Afghan farmers to find the recommended and economic rate of fertilizer for achieving of higher yield.

2. MATERIAL AND METHODS

A field experiment was conducted during the *spring* season of 2014-15 on Clayey soils of Agriculture Faculty of Baghlan University, to study the effect of different doses of nitrogen and phosphorus on yield and economics of potato (*Solanum tuberosum* L.). The crop was cultivated on March 2014 and 2015 in clayey soil with pH of 8.3 and available nitrogen of 105 kg ha^{-1}, phosphorus of 37.18 kg/ha and potassium of 415 kg ha^{-1}. The experiment was laid in a randomized block design (RBD) with three replication and sixteen treatments viz., T1. Control, T2. Phosphorus 75 kg /ha, T3. Phosphorus 125 kg/ha, T4. Phosphorus 175 kg /ha, T5. Nitrogen 100 kg/ha, T6. Nitrogen 100 kg+Phosphorus 75 kg/ha, T7. Nitrogen 100 kg+Phosphorus125 kg/ha, T8. Nitrogen 100 kg+ Phosphorus 175 kg/ha, T9. Nitrogen 175 kg/ha, T10. Nitrogen 175 kg+Phosporus 75 kg/ha, T11. Nitrogen 175 kg+Phosphorus 125 kg/ha, T12. Nitrogen 175 kg+Phosphorus 175 kg/ha, T13. Nitrogen 250 kg/ha, T14. Nitrogen 250 kg+Phosphorus 75 kg/ha, T15. Nitrogen 250 kg+Phosphorus 125 kg/ha, T16. Nitrogen 250 kg+Phosphorus 175 kg/ha. 10 tones FYM was applied equally for each treatment. The fertilizer sources were applied through Urea, SSP and DAP. Nitrogen was applied as per the treatments in two equal splits viz., at basal and at before flowering through urea. The crop was irrigated at 7 days interval. All other operations were performed as per recommendation for the crop. The local variety of Garma Bamyan was used with the furrow spacing of 65cm ×25 cm. Manual weeding was performed thrice in all over crop growth period. The tubers were collected after physiological maturity of the crop. The data on growth, yield attributes and yield was recorded in different stages of the crop as per treatments.

3. RESULT AND DISCUSSION

3.1 Growth parameters

The pooled mean of two years data (2014-15) revealed that application of nitrogen 250 kg + phosphorus 175 kg/ha produced taller plant height (41.83 cm), which was at par with T10, T11, T12, T13, T14 and T15.

Table 1: Effect of different doses of nitrogen and phosphorus on growth potato

Treatments	Plant height (cm) at 70 DAS	Number of leaves per plant at 70 DAS	Number of branches per plant at 70 DAS	Leaf area (cm^2)
T1. Control	22.94	14.16	2.87	39.41
T2. Phosphorus 75 kg /ha	27.44	16.25	3.38	44.98
T3. Phosphorus 125 kg/ha	28.51	16.89	3.34	53.50
T4. Phosphorus 175 kg /ha	28.39	17.09	3.17	53.56
T5. Nitrogen 100 kg/ha	36.89	17.98	3.48	61.95
T6. Nitrogen 100 kg+Phosphorus 75 kg/ha	38.99	20.00	3.70	67.83
T7. Nitrogen 100 kg+Phosphorus125 kg/ha	38.93	19.86	3.69	65.30
T8. Nitrogen 100 kg+ Phosphorus 175 kg/ha	38.28	20.27	3.72	78.90
T9. Nitrogen 175 kg/ha	39.02	19.51	3.56	83.54
T10. Nitrogen 175 kg+Phosporus 75 kg/ha	40.39	24.52	4.66	92.27
T11. Nitrogen 175 kg+Phosphorus 125 kg/ha	40.99	30.02	4.44	97.83
T12. Nitrogen 175 kg+Phosphorus 175 kg/ha	41.77	30.26	4.54	101.61
T13. Nitrogen 250 kg/ha	40.51	20.09	4.29	87.78
T14. Nitrogen 250 kg+Phosphorus 75 kg/ha	40.75	25.27	4.13	93.99
T15. Nitrogen 250 kg+Phosphorus 125 kg/ha	40.77	29.13	4.35	95.25
T16. Nitrogen 250 kg+Phosphorus 175 kg/ha	41.83	30.41	4.73	113.43
SEm ±	0.14	0.36	0.02	0.12
CD. at 5%	1.66	4.18	0.20	1.35

Note: FYM was applied 10 ton per ha for all treatments

Whereas the significantly lowest plant height (22.94 cm) was recorded from control. A higher number of leaves per plant (30.41) was registered with T16 (Nitrogen 250 kg + Phosphorus 175 kg/ha), which was at par with T11, T12 and T15 (Table-1). A significantly higher number of branches (4.73 per plant) and leaf area (113.43 cm) were observed with T16, (Nitrogen 250 kg+Phosphorus 175 kg/ha). Whereas the control plot produced significantly the lowest number of branches (2.87 per plant) and leaf area (39.41 cm).

The increase in plant height, number of leaves and number of branches per plant with T16, (Nitrogen 250 kg+Phosphorus 175 kg/ha) is attributed due to higher availability of required nutrient and better interaction of nitrogen and phosphorus fertilizers which supplied the required nutrient from source to sink at vegetative stage. A similar result was reported by Anchal et al., (2008) in potato and Tannia and Suja (2009) in tomato. The significantly wider leaf area is due to fact that a higher amount of nitrogen and phosphorus increased the uptake of these nutrients by crop which increased more chlorophyll content in leaf thereby increased the photosynthetic efficiency of the crop.

3.2 Effect on yield

Under present investigation, the mean pooled two years data indicates that a significant increase in tuber weight (216.11 g per plant) and numbers of tuber per plant (4.14) were noticed with the application of nitrogen 250 kg+phosphorus 175 kg/ha. The significantly higher yield was recorded with treatments receiving nitrogen 250 kg+phosphorus 175 kg/ha.

Table 2: Effect of different doses of nitrogen and phosphorus on yield attributes, yield and B:C of potato

Treatments	Tuber weight (g) per plant	Number of tuber per plant	Tuber yield ton/ha	B:C
T1. Control	36.25	1.45	2.56	1.19
T2. Phosphorus 75 kg /ha	43.59	1.54	3.41	1.55
T3. Phosphorus 125 kg/ha	42.11	1.42	4.56	1.97
T4. Phosphorus 175 kg /ha	48.89	1.65	5.02	2.09
T5. Nitrogen 100 kg/ha	40.33	1.32	3.76	1.68
T6. Nitrogen 100 kg+Phosphorus 75 kg/ha	65.08	1.90	8.38	3.48
T7. Nitrogen 100 kg+Phosphorus125 kg/ha	80.29	2.39	7.83	3.20
T8. Nitrogen 100 kg+ Phosphorus 175 kg/ha	83.32	2.85	8.30	3.32
T9. Nitrogen 175 kg/ha	75.21	2.01	5.05	2.17
T10. Nitrogen 175 kg+Phosporus 75 kg/ha	114.66	3.20	8.57	3.46
T11. Nitrogen 175 kg+Phosphorus 125 kg/ha	170.55	3.59	8.63	3.98
T12. Nitrogen 175 kg+Phosphorus 175 kg/ha	200.30	3.96	11.61	4.44
T13. Nitrogen 250 kg/ha	81.22	2.05	4.89	1.97
T14. Nitrogen 250 kg+Phosphorus 75 kg/ha	162.19	3.54	8.79	3.45
T15. Nitrogen 250 kg+Phosphorus 125 kg/ha	188.16	3.98	9.41	3.61
T16. Nitrogen 250 kg+Phosphorus 175 kg/ha	216.11	4.14	14.70	5.49
SEm ±	0.07	0.04	0.49	
CD. at 5%	0.85	0.46	1.43	

The increase in yield and yield attributing characters and final yield are mainly governed by vegetative growth such as plant height, number of leaves per plant, number of branches per plant and leaf area which were higher with the application of nitrogen

250 kg+phosphorus 175 kg/ha. The higher yield is also attributed due to sufficient availability of balanced nutrient and their positive interaction together. The higher B:C (5.49) was obtained from T16 which the higher yield in this treatment not only compensated the higher cost of cultivation but resulted in higher B:C.

4. REFERENCES

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