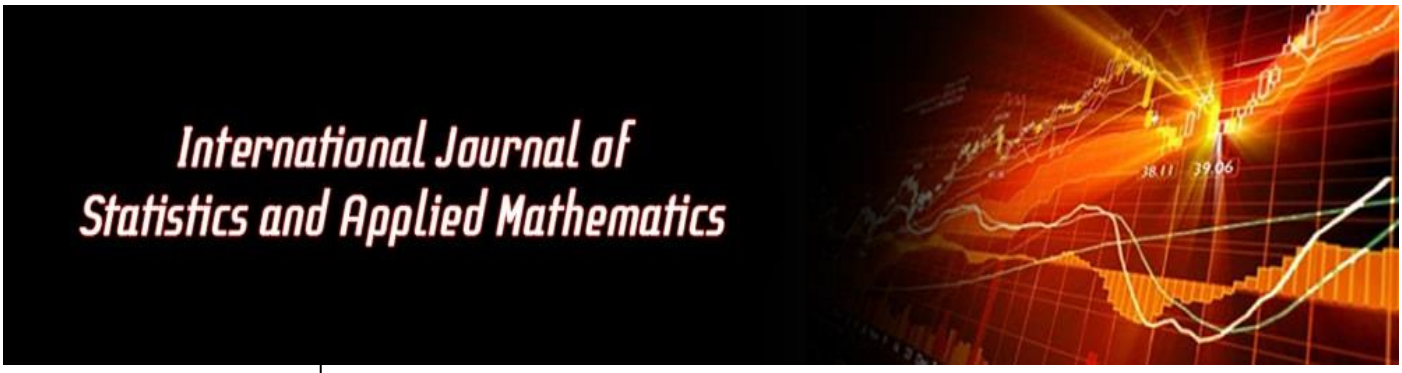

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Impact of different sources of nitrogen on growth and economics of potato (*Solanum tuberosum* L.)

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Abstract
A field experiment entitled "Impact of different Sources of Nitrogen on Growth and Economics of Potato (*Solanum tuberosum* L.)" was conducted during *rabi* season 2018-19 at, Fruit Research station, Entkhedi, Bhopal, Madhya Pradesh. Bhopal is located at $26^0 13^{'}$ north latitude and $74^0 4^{'}$ east longitude and 208 m above mean sea level. It lies in the central part of Madhya Pradesh state enjoying sub-tropical climate. The topography of the experimental field was plain with good irrigation facilities. The experiment laid down in seven treatments with control i.e. T_0- Nitrogen 00 kg/ha, T_1- Nitrogen 20 kg/ha, T_2- Nitrogen 60 kg/ha, T_3- Nitrogen 100 kg/ha, T_4- Nitrogen 140 kg/ha, T_5- Nitrogen 180 kg/ha and T_6- Nitrogen 220 kg/ha with three replication. The experiments was analyzed at Randomized Block Design. Growth Characteristics i.e. Days of germination, Number of shoots per plant at 25 and 50 days after sowing, Height of plant (cm) at 25, 50 and 75 days after sowing, Number of compound leaves/ plant at 25, 50 and 75 days after sowing and net returns and B:C ratio of potato. The result revealed that the application of nitrogen in the form of treatment (T6) Nitrogen 220 kg/ha + Kufri Chipsona-3 was found to be superior to other nitrogen levels in all potato growth and economics parameters.

Keywords: Potato, Kufri Chipsona-3, B:C ratio and Nitrogen

Introduction
A tuberous crop is the potato (*Solanum tuberosum* L.). It is a member of the Solanaceae family. The part that can be eaten is a modified stem that develops underground and is called a "tuber." Among all the crops, tubers are a major crop and play a significant part in our daily diet. It is a major supply of carbs and starch. Based on Das's 1999 [3] analysis, the typical composition of a 100 g edible part of potato tubers is as follows: moisture (74.7 g), protein (1.6 g), fat (0.1 g), carbs (22.6 g), energy (97 kcal), calcium (10 mg), phosphorus (40 mg), iron (0.70 mg), carotene (24µg), thiamine (0.10 mg), riboflavin (0.01 mg), and vitamin C (17 mg). According to Mehdi *et al.,* (2008) [8], potatoes are a nutritious food with low energy content and good nutritional quality, comprising protein, essential vitamins, and minerals, as well as trace elements.

Purin-pyrimidins, which create the RNA and DNA necessary for photosynthesis, contain nitrogen as a crucial component. It binds to the chlorophyll porphyrine ring. N is essential for cell elongation and multiplication as well. According to studies done at Modipuram, the maximum rate of net photosynthesis was raised by nitrogen fertilizer (Shekhawat *et al.,* 1999) [14]. Early application of nitrogen promotes early vegetative development. A sufficient amount of nitrogen contributes to the rapid growth of plants, as well as their resistance to leaf spots, total sugar content, tuber size, protein content, and leaf area (Pandey, 2002) [10].

Materials and Methods
A field experiment entitled "Impact of different Sources of Nitrogen on Growth and Economics of Potato (*Solanum tuberosum* L.)" was conducted during *rabi* season 2018-19 at, Fruit Research station, Entkhedi, Bhopal, Madhya Pradesh. Bhopal is located at $26^0 13^{'}$ north latitude and $74^0 4^{'}$ east longitude and 208 m above mean sea level. It lies in the central part of Madhya Pradesh state enjoying sub-tropical climate. The topography of the experimental field was plain with good irrigation facilities. The experiment laid down in seven treatments with

control i.e. T_0- Nitrogen 00 kg/ha, T_1- Nitrogen 20 kg/ha, T_2- Nitrogen 60 kg/ha, T_3- Nitrogen 100 kg/ha, T_4- Nitrogen 140 kg/ha, T_5- Nitrogen 180 kg/ha and T_6- Nitrogen 220 kg/ha with three replication. The experiments were analyzed at Randomized Block Design. Growth Characteristics i.e. Days of germination, Number of shoots per plant at 25 and 50 days after sowing, Height of plant (cm) at 25, 50 and 75 days after sowing, Number of compound leaves/ plant at 25, 50 and 75 days after sowing and net returns and B:C ratio of potato.

Gross return (Rs. /ha.)
The cost of cultivation was calculated by factoring in the costs associated with tractor plowing, planting, fertilizer costs, earthing up, dehalming, seed costs, harvesting, and treatment.

Net return (Rs. /ha.)
Net returns were calculated by deducting cost of cultivation from gross return.

Benefit: Cost ratio
It is the ratio of gross return to cost of cultivation treatment wise.
B:C ratio = Gross Income / Total Cost of Cultivation

Results and Discussion

Days of germination

The result revealed that the, minimum days to germination was found in treatment T_6 (Nitrogen 220 kg/ha + Kufri Chipsona- 3) 5.12 days, while the maximum days to germination was found in Control T_0. Fertilizer levels generally had very little effect on germination. The current results are consistent with those of Adhikari (2009) [2], who found that during the first 30 days after planting, there was non-uniform germination in potato treatments with a 100:100:100 NPK kg ha^{-1} treatment mix. However, by the time the crop reached that point, most of the plots had about 95% germination (data not shown). In the control plots, germination occurred uniformly and early. Additionally, it was shown that the appearance of tubers was delayed by increasing fertilizer levels.

Number of shoots per plant

The, maximum no. of shoots per plant at 30 and 50 DAS was found in treatment T_6 (Nitrogen 220 kg/ha + Kufri Chipsona-3) (5.00 and 4.67), while the minimum no. of shoots per plant at 30 and 50 DAS was found in Control T_0 (2.67 and 2.33). The vast majority of the stems in each hill are chosen by the varietal character. But in this particular study, there was no discernible relationship between the amount of fertilizer and the number of stems. In comparison to the shorter duration (90 days) variety similarly observed in potatoes (Adhikari 2009) [2], the long duration (120 days) variety Kufri Sindhuri had a much higher number of stems. Desire between DAP 60 and 75 in latter stages of plant growth. It was also demonstrated by Nandekar *et al.*, (1991) [9] and Sharma and Singh (1988) [13] that no amount of nutrients could appreciably alter the number of stems.

Plant height (cm): The, maximum height of plant at 25, 50 and 75 DAS was found in treatment T_6 (Nitrogen 220 kg/ha + Kufri Chipsona-3), (26.50, 37.67 and 64.81 cm), while the minimum height of plant was found in Control T_0 (18.67, 30.83 and 40.78 cm) at 30 DAS. Plant height increased gradually as nitrogen dosages were increased to as high as 160 kg/ha. As previous researchers have already noted, a notable rise in plant height with growing plant populations can be linked to greater competition between stems for light and space (Singh *et al.* 1993, Singh *et al.* 1997) [16, 15]. Similarly, the results of Kushwah (1989) [5] and Malik *et al.* (1999) [7] support the idea that plants grow taller as their nitrogen dose increases. This is because higher doses of nitrogen make nutrients like nitrogen more readily available. This is because a comparatively large nitrogen application dose causes the plant to grow vigorously. Similarly identical results have previously been obtained by Madhikarmy (1979) [6] and Sharma and Upadhaya (1993) [12]. At every stage of plant growth, increasing the P and K rates had no influence on plant height. According to Jagirdar *et al.* (1984) [18] and Singh *et al.* (1993) [16], there was no correlation between plant height and increases in P and K levels. The plant grows vigorously when there is high soil fertility and nitrogen treatment (Sharma and Upadhaya 1993) [12].

Number of compound leaves per plant

The, maximum number of compound leaves per plant at 25, 50 and 75 DAS was found in treatment T_6 (Nitrogen 220 kg/ha + Kufri Chipsona- 3), (47.37, 52.27 and 66.67), while the minimum number of compound leaves per plant was found in Control T_0 (17.70, 39.08 and 36.44) at 25, 50 and 75 DAS. Nitrogen contributes to the growth of complex leaves. According to results of N application, plant height, fresh weight of leaves and stems, and increased yield of potato tubers were found to be correlated. Sharma and Singh (1988) [13] and Rykbost *et al.*, (1993) [11] observed increased yield of potato tubers as a result of N application.

Economical parameters

The maximum gross return was found in treatment T_6 (Rs. 252622.2) and minimum was found in T_0 (129215.1). The maximum net profit of Rs. 183382.2 ha^{-1} was obtained under treatment combination T_6 which was closely followed by treatment T_5 with net profit of Rs. 159219.3 ha^{-1} and treatment combination T_4 with net profit of Rs. 136508.1 ha^{-1}. Minimum net profit was found in treatment combination T_0 with net profit of Rs. 69215.1 ha^{-1}. The net profit from cultivation under different treatments was worked out after subtracting the cost of cultivation from gross return. The treatment T_6 resulted in the highest B:C ratio of (2.6:1) which was closely followed by treatment T_5 (2.4:1) and T_3 (2.2:1) whereas minimum benefit cost ratio (1.2:1) was obtained T_0. According to what the other workers have said, dry matter should make up more than 20% of processing variations. According to Ezekiel *et al.*, (1999) [4], the tuber dry matter content of chips, French fries, and dried goods must exceed 20%. The amount of dry matter in tubers varies greatly amongst cultivars and is mostly determined by genetics (Toolangi, 1995; Abbas *et al.*, 2011) [17, 1].

Table: Response of nitrogen on growth parameters and economics of potato crop

Treat.	Days of germination	No. of shoots per plant		Height of plant (cm)			Number of compound leaves per plant		
		30 DAS	50 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
T_0	8.19	2.67	2.33	18.67	30.83	40.78	17.70	39.08	36.44
T_1	8.19	3.33	3.33	21.00	31.70	41.30	27.14	42.93	40.33
T_2	7.16	3.67	3.33	21.17	33.03	42.44	32.03	43.27	48.00
T_3	6.14	3.67	3.67	21.67	34.67	43.96	33.54	43.27	51.00
T_4	6.14	4.00	4.33	24.67	37.49	58.67	45.37	51.19	63.00
T_5	6.14	4.13	4.67	26.00	37.50	62.29	46.03	51.60	63.67
T_6	5.12	5.00	4.67	26.50	37.67	64.81	47.37	52.27	66.67
S.Em.±	0.042	0.853	0.724	1.586	1.020	1.130	5.951	2.432	2.702
CD at 5%	0.130	2.628	2.230	4.887	3.144	3.482	18.337	7.495	8.325

Table 2: Response of nitrogen on economics of different treatments of potato crop

Treat.	Treatment Cost	Common Cost	Total Cost	Seed yield (ha^{-1})	Gross return (Rs ha^{-1})	Net return ($Rsha^{-1}$)	B: C Ratio
T_0	0	60000	60000	184.59	129215.1	69215.1	1.2
T_1	280	60280	60840	219.44	153605.9	92765.9	1.5
T_2	840	60840	62520	254.28	177997	115477.0	1.8
T_3	1400	61400	64200	289.13	202388.1	138188.1	2.2
T_4	1960	61960	65880	289.13	202388.1	136508.1	2.1
T_5	2520	62520	67560	323.97	226779.3	159219.3	2.4
T_6	3080	63080	69240	360.89	252622.2	183382.2	2.6

Conclusion

On the basis of one year experiment the result concluded that, the application of nitrogen in the form of treatment (T6) Nitrogen 220 kg/ha + Kufri Chipsona-3 was found to be superior to other nitrogen levels in all potato growth and economics.

References

1. Abbas G, Farooq K, Hafiz IA, Hussain A. Assessment of processing and nutritional quality of potato genotypes in Pakistan. Pak J Agri Sci. 2011;48(3):169-175.
2. Adhikari RC. Effect of NPK on vegetative growth and yield of desire and Kufri sindhuri potato. Nepal Agric. Res. J. 2009;9.
3. Das PC. Potato in India. First Edition, Kalyani Publishers, New Delhi; c1999, p. 1-3.
4. Ezekiel R, Virma SC, Sukumaran NP, Shekhawat GS. A Guide to Potato Processor in India. Central potato Research Institute, Shimla, India. Technical Bulletin No. 1999;48:14-39.
5. Kushwah VS. Effect of different levels of nitrogen and planting density on production of seed potato (*Solanum tuberosum*). Indian Journal of Agricultural Sciences. 1989;59(9):561-5.
6. Madhikarmy SG. Effect of NPK fertilization on the performance of Kufri Jyoti potato (*Solanum tuberosum*). Nepalese J Agric. Nepal Agricultural Association. 1979;14:125-31.
7. Malik YS, Bhatia AK, Singh Narendra, Nehra BK, Khurana SC. Effect of nitrogen, seed size and spacing on seed potato production in cv. Kufri Sutlej. Potato global research and development Proceedings of the Global Conference on Potato, New Delhi, India. 1999-02;2:861-865.
8. Mohd M, Tahir S, Rai HK, Mir MS, Rai G. Effect of nitrogen and FYM interactrion on yield and yield traits of potato (*Solanum tuberosum* L) genotypes under Ladakh condition. Potato J. 2008;35(3-4):126-129.
9. Nandekar DN, Sharma TR, Sharma RC, Sawarkar SD. Fertilizer requirements of potato cv. Kufri Badshah in Madya Pradesh. J Indian Potato Assoc. 1991;16(2/3):123-126.
10. Pandey RP. The Potato. First Edition, Kalyani Publishers, New Delhi; c2002. p. 91-92.
11. Rykbost KA, Christensen NW, Maxwell J. Fertilization of russet Burbank in short-season environment. Ameri. Potato J. 1993;70:699-708.
12. Sharma RC, Upadhaya NC. Nitrogen nutrition of potato. In: Advances in horticulture 7 (KL Chadha and JS Grewal, eds). Malhotra Publishing House, New Delhi; c1993. p. 231-259.
13. Sharma UC, Singh K. Response of potato N, P and K in acidic hill soil of Meghalaya. J Indian Potato Assoc. 1988;15(1-2):40-44.
14. Shekhawat GS, Lal SS, Pandey SK, Singh BP, Ezekiel R, Sukumaran NP, *et al*. Potato physiology. Potato Research. In India. A success story of Fifty years, CPRI, Shimla; c1999, p. 50-55.
15. Singh A, Nehra BK, khurana SC, Singh N. Influence of potato density and geometry on growth and yield in seed crop of potato. Journal of Indian Potato Association. 1997;24(1-2):24-30.
16. Singh Jagroop, Singh Mohan, Saimbhi MS, Kooner KS. Growth and yield of potato cultivars as affected by plant density and potassium levels. Journal of the Indian Potato Association. 1993;20(3-4):279-282.
17. Toolangi TK. Potatoes: factors affecting dry matter. Agriculture notes, April. State of Victoria, Department of Primary Industries, USA; c1995.
18. Jagirdar SAP, Laghari MH, Panhwar MS. Effect of fertilizer on growth and yield of potato. Pakistan J. Agri. Research. 1984;5(3):162-164.