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Performance of Potato Varieties for Growth, Yield, Quality and Economics under Different Levels of Nitrogen

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Authors' contributions

This work was carried out in collaboration between all the authors. Author ASJ took observations during the study and performed statistical analysis. Author SSK designed and planned the experiment, arranged material, finalised the methodology of the present study and also wrote this article. Author ISN also helped during designing and planning of the experiment and checked the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This experiment was conducted to study the performance of different varieties of potato under various nitrogen levels for growth, yield and quality as well as their economics.
Study Design: Sixteen treatment combinations comprising of four varieties (V_1-Kufri Jyoti, V_2-Kufri Chipsona-2, V_3-Kufri Chipsona-1 and V_4-Kufri Pushkar) and four nitrogen doses (N_1-100 kg/ha, N_2-125 kg/ha, N_3-150 kg/ha and N_4-175 kg/ha). The experiment was laid in Factorial Randomized Block Design with three replications.
Place and Duration of Study: A field experiment was conducted at research field, Department of Vegetable Science College of Horticulture, Mandsaur during rabi season 2010-11.
Methodology: The healthy, uniform size tubers were planted at a spacing of 60×20 cm on 21 October, 2010. Phosphorus (P_2O_5 80 kg/ha), potassium (K_2O 100 kg/ha) and different doses of nitrogen (as per treatment) were provided through Urea, DAP and Muriate of Potash. Full dose of phosphorus, potash and half dose of nitrogen were applied as basal in furrows at the time of

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planting. While the remaining quantity of nitrogen was applied in two split doses, 1st at first earthing-up and 2nd at second earthing-up (25 and 45 days after planting, respectively). Thereafter recommended package of practices were followed to raise the healthy crop. The crop was harvested on 15 February, 2011.

Results: The findings of present study revealed that among the varieties, Kufri Pushkar recorded maximum yield showing its superior performance over other varieties. With respect to quality attributes, variety Kufri Chipsona-2 exhibited high dry matter content, high starch content and low reducing sugar content which are the desired attributes for processing. Variety Kufri Chipsona-1 and Kufri Jyoti were next to Kufri Chipsona-2. Among the different doses of nitrogen, application of 150 kg N/ha resulted in maximum growth and yield attributes as well as total yield. It has also exhibited better quality parameters except reducing sugar. Combined effect of varieties and nitrogen levels showed highest economic return under application of 150 kg N/ha with variety Kufri Pushkar.

Conclusion: It may be concluded that combination of potato variety Kufri Pushkar along with application of nitrogen 150 kg/ha had proved to be superior over other combinations for growth, yield and economic returns.

Keywords: Potato; nitrogen; varieties; growth; yield; quality; economics.

1. INTRODUCTION

Potato (*Solanum tuberosum* L.) is an important crop among all vegetables and has an important role in our daily diet. It is a balanced food containing less energy but nutritionally high quality protein, essential vitamins and minerals including trace elements [1]. The cost of potato cultivation is generally high due to seed, fertilizer and labour. Nutritional requirement is much more due to high bulking rate [2]. The potato crop has special significance to the developing countries as it has high production potential per unit area and time, and has high nutritional value to sustain burgeoning population and to overcome malnutrition and hunger [3].

Genetic architecture has great influence on yield and quality of potato. Various varieties of potato having wide variation in their yield potential and quality attributes have been evolved. These varieties further show variation in their attributes under different agroclimatic conditions.

Nitrogen is a key element in growth and development of crop plants. It influences the yield mainly through leaf area expansion, crop development, crop quality, and susceptibility to lodging and can also influence the behavior of other elements [4]. Nitrogen is an integral part of purin-pyrimidins which forms RNA and DNA essential for photosynthesis. Experiments conducted at Modipuram showed that nitrogen fertilizer increased the maximum rate of net photosynthesis [5]. Nitrogen application, in beginning helps in early vegetative growth. It has been observed that N application helps in rapid bulking of tubers and produces tubers of large size resulting in high yields. The increased nitrogen dose helps in vigorous plant growth, increase leaf area, tuber size, total sugars, reducing sugars, protein content and resistance to leaf spots and decrease starch content [3]. Singh and Raghav [6] reported that increasing levels of nitrogen produced significantly higher tuber yield. Different variety of potato has different nitrogen use efficiency [7]. Hence, keeping above facts in view present experiment was conducted to study the performance of different varieties of potato under different nitrogen levels for growth, yield and quality as well as their economics.

2. MATERIALS AND METHODS

A field experiment was conducted at research field, Department of Vegetable Science College of Horticulture, Mandsaur during rabi season 2010-11. Sixteen treatment combinations comprising of four varieties (V_1-Kufri Jyoti, V_2-Kufri Chipsona-2, V_3-Kufri Chipsona-1 and V_4-Kufri Pushkar) and four nitrogen doses (N_1-100 kg/ha, N_2-125 kg/ha, N_3-150 kg/ha and N_4-175 kg/ha). The experiment was laid in Factorial Randomized Block Design with three replications. The soil of the experimental field was light alluvial with sandy loam texture having sand 55%, silt 30% and clay 15% and uniform topography. The soil of the experimental plot had 7.15 pH and 0.53 dSm^{-1} EC. The nutrient analysis of the soil revealed that it contain available nitrogen 190 kg/ha, available phosphorus 8.04 kg/ha and available potassium 406 kg/ha. The healthy, uniform size tubers were planted at a spacing of 60×20 cm on 21 October, 2010. The crop was harvested on 15 February,

2011. Phosphorus (P_2O_5 80 kg/ha), potassium (K_2O 100 kg/ha) and different doses of nitrogen (as per treatment) were provided through Urea, DAP (Di Ammonium Phosphate) and Muriate of Potash. The full quantity of phosphorus, potash and half dose of nitrogen were applied as basal in furrows at the time of planting. While the remaining quantity of nitrogen was applied in two split doses, 1st at first earthing-up and 2nd at second earthing-up [25 and 45 days after planting (DAP)], respectively). Thereafter recommended package of practices were followed to raise the healthy crop. The observations were recorded at various successive growth stages for plant height, number of leaves per plant, fresh weight of shoot, root and tuber per plant, number of tuber per plant, total tuber yield. For each observation five tagged plants were chosen from each plot. Tuber quality was adjudged with respect to TSS, reducing, non reducing and total sugars, tuber dry matter content and starch content. Total Soluble Solids of fresh potato tuber were measured at room temperature with the help of Hand Refrectometer at 0-32° Brix scale. Starch content (%) on fresh weight basis was estimated by the method as suggested [8]. Reducing sugar (mg/100g) on fresh weight basis was estimated by Nelson-Somogyi method as given [9]. The dry matter content of tuber was determined by oven drying method. Fresh tuber sample was weighed from each treatment and dried in oven at 80℃ till constant weight than dry weight of tuber was measured and calculated in percentage. Economics of various treatments was worked out on the basis of prevailing prices of inputs and output. The prices of fertilizers were as DAP @ Rs. 1056 /q, Urea @ Rs. 563 /q, MOP @ Rs. 520/q. The prices of potato seed tuber was Rs. 1500 /q. Tubers were sold @ Rs. 600 /q. The data recorded under the study were subjected to statistical analysis as per standard procedure as suggested by Panse and Sukhatme [10].

3. RESULTS AND DISCUSSION

3.1 Effect of Varieties

Growth of the potato plant was studied (Table 1) with respect to plant height, number of sprout per plant, number of leaves per plant, fresh weight of shoot and root per plant. There was significant effect of varieties on all the growth parameters. Plant height showed increase with advancement of stage upto 60 days after planting. Thereafter, decline was observed which may be due to commencement of maturity and drooping of the plant. Maximum plant height was observed in Kufri Chipsona-2 which was at par to Kufri Chipsona-1 at 60 days after planting. Later on at 90 DAP no significant difference in plant height was observed among the varieties Kufri Chipsona-2, Kufri Chipsona-1 and Kufri Pushkar. Though, all these varieties were superior over Kufri Jyoti. Kumar et al. [11] also reported non significant difference in plant height of varieties Kufri Chipsona-1 and Kufri Chipsona-2. Number of sprouts per plant was differed significantly among the varieties. Highest number of sprouts was observed in case of Kufri Pushkar which was followed by Kufri Jyoti and Kufri Chipsona-1 with non significant difference. Similar findings have been reported by Kumar et al. [11]. Number of leaves was maximum under Kufri Pushkar followed by Kufri Chipsona-1 and Kufri Jyoti. Minimum number of leaves was found in case of Kufri Chipsona-2. Kumar et al. [12] also found significant difference in varieties for number of leaves per plant. Fresh weight of shoot, root and tuber was recorded maximum with variety Kufri Pushkar. However, at early stage i.e. 30 DAP highest fresh weight of tuber was observed in case of Kufri Chipsona-1 followed by Kufri Jyoti. More number of leaves might have accompanied with more photosynthesis and accumulation of food material resulting in higher fresh and dry weights. Kumar et al. [13] also found significant influence of varieties on fresh biomass yield in potato.

Yield parameters viz., fresh weight of tuber, number of tuber as well as total tuber yield was recorded (Table 2) at the time of harvesting. Fresh weight of tuber was recorded maximum with variety Kufri Pushkar. However, at early stage i.e. 30 DAP highest fresh weight of tuber was observed in case of Kufri Chipsona-1 followed by Kufri Jyoti. Number of tuber exhibited significant influence of varieties. Variety Kufri Pushkar recorded maximum number of tuber per plant followed by Kufri Chipsona-1 with non significant difference. Minimum number of tuber per plant was found with Kufri Chipsona-2. Similar results were observed previously [13,14]. Among the varieties, Kufri Pushkar recorded maximum yield followed by Kufri Jyoti and Kufri Chipsona-1. Variety Kufri Chipsona-2 yielded least. The difference between Kufri Chipsona-1 and Kufri Jyoti was non significant. Better performance of Kufri Pushkar for number of sprouts, fresh weight and number of tubers per plant might have contributed for yield. These findings are in accordance to the observations of previous workers [15,16,17].

Table 1. Effect of varieties and nitrogen levels on growth of potato

Treatments	Plant height (cm)			No of leaves			Number of sprout per plant	Average fresh weight of root (g) per plant			Fresh weight of shoot (g) per plant		
	30 DAP	60 DAP	90 DAP	30 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
Varieties													
V_1	30.73	43.27	41.65	47.83	67.53	60.40	6.07	5.48	8.88	10.19	84.33	165.33	145.75
V_2	35.88	54.97	49.72	38.57	57.11	51.45	5.10	4.88	9.23	10.19	79.21	131.13	106.79
V_3	35.53	49.52	47.13	49.37	70.75	66.09	5.65	5.06	9.58	11.38	93.63	178.06	155.60
V_4	32.48	46.16	45.37	54.43	71.68	68.12	6.23	5.69	10.25	13.38	102.58	186.48	157.90
S.Em ±	**1.22**	**1.70**	**2.00**	**2.78**	**2.54**	**2.24**	**0.31**	**0.23**	**0.32**	**0.53**	**3.13**	**6.07**	**6.65**
C.D.at $_{5\%}$	**3.53**	**4.92**	**5.79**	**8.02**	**7.34**	**6.48**	**0.89**	**0.67**	**0.93**	**1.52**	**9.02**	**17.54**	**19.21**
Nitrogen levels													
N_1	29.15	42.20	39.15	34.87	55.17	49.37	4.53	3.52	6.10	7.19	67.10	137.68	90.29
N_2	33.08	47.93	43.86	45.64	65.03	56.63	5.36	5.15	8.54	9.44	83.42	154.54	119.71
N_3	37.87	53.40	52.35	57.78	72.02	65.45	7.18	6.77	12.77	16.38	109.38	196.10	203.42
N_4	34.53	50.38	48.50	51.90	74.87	74.61	5.97	5.67	10.52	12.13	99.85	172.69	152.63
S.Em ±	**1.22**	**1.70**	**2.00**	**2.78**	**2.54**	**2.24**	**0.31**	**0.23**	**0.32**	**0.53**	**3.13**	**6.07**	**6.65**
C.D.at $_{5\%}$	**3.53**	**4.92**	**5.79**	**8.02**	**7.34**	**6.48**	**0.89**	**0.67**	**0.93**	**1.52**	**9.02**	**17.54**	**19.21**

DAP- Days after planting

V_1-Kufri Jyoti, V_2-Kufri Chipsona-2, V_3-Kufri Chipsona-1, V_4-Kufri Pushkar

N_1-100 kg/ha N, N_2-125 kg/ha N, N_3-150 kg/ha N, N_4-175 kg /ha N

Table 2. Effect of varieties and nitrogen levels on yield and quality of potato

Treatments	Average fresh weight of tuber (g) per plant			Number of tuber per plant	Total tuber yield (q/ha)	TSS (°Brix) in tuber	Starch content (%) on fresh weight basis	Reducing sugar content (mg/100g) on fresh weight basis	Total sugar content (mg/100g) on fresh weight basis	Dry matter content (%) in tuber
	30 DAP	60 DAP	90 DAP							
Varieties										
V_1	9.04	173.12	354.52	10.98	212.86	5.99	29.50	34.87	41.13	20.05
V_2	6.54	106.60	214.02	9.28	142.77	6.92	32.25	32.10	45.02	22.15
V_3	9.56	194.52	374.79	12.32	189.17	6.74	29.25	30.80	39.29	21.59
V_4	7.40	203.92	499.81	12.68	259.08	5.73	26.50	56.44	64.96	18.42
S.Em ±	**0.29**	**8.94**	**12.05**	**0.41**	**8.15**	**0.11**	**0.44**	**0.61**	**0.67**	**0.79**
C.D.at $_{5\%}$	**0.82**	**25.83**	**34.81**	**1.18**	**23.54**	**0.32**	**1.28**	**1.75**	**1.94**	**2.29**
Nitrogen levels										
N_1	6.50	130.08	244.33	8.78	171.17	5.91	25.25	33.87	43.63	17.79
N_2	7.73	144.60	315.33	10.98	184.50	6.25	28.25	37.79	45.85	19.20
N_3	10.04	213.33	478.95	13.80	229.63	6.78	34.00	39.97	49.18	23.82
N_4	8.27	190.15	404.52	11.70	218.57	6.45	30.00	42.58	51.73	21.41
S.Em ±	**0.29**	**8.94**	**12.05**	**0.41**	**8.15**	**0.11**	**0.44**	**0.61**	**0.67**	**0.79**
C.D.at $_{5\%}$	**0.82**	**25.83**	**34.81**	**1.18**	**23.54**	**0.32**	**1.28**	**1.75**	**1.94**	**2.29**

DAP- days after planting,

V_1-Kufri Jyoti, V_2-Kufri Chipsona-2, V_3-Kufri Chipsona-1, V_4-Kufri Pushkar

N_1-100 kg/ha N, N_2-125 kg/ha N, N_3-150 kg/ha N, N_4-175 kg /ha N

Table 3. Combined effect of varieties and nitrogen levels on growth, yield, quality and economics of potato

Treatments	Fresh weight of shoot (g) per plant		Average fresh weight of tuber (g) per plant		Total tuber yield (q/ha)	Starch content (%) on fresh weight basis	Total sugar content (mg/100g) on fresh wt. basis	Total Cost of Cultivation Rs./ha	Gross Income Rs./ha	Net Income Rs./ha	C:B Ratio
	60 DAP	90 DAP	30 DAP	90 DAP							
V_1N_1	146.83	113.92	7.00	264.17	194.56	25.50	36.97	55365.24	116734	61368.76	1:2.10
V_1N_2	158.00	124.08	8.17	327.50	202.08	28.50	38.07	55671.18	121246	65574.82	1:2.17
V_1N_3	186.25	195.67	11.17	419.33	234.37	34.83	41.47	55977.17	140622	84644.83	1:2.51
V_1N_4	170.25	149.33	9.83	407.08	220.42	29.17	48.03	56280.91	132254	75973.09	1:2.34
V_2N_1	114.13	71.17	5.33	153.08	128.54	27.50	42.80	55365.24	77126	21760.76	1:1.39
V_2N_2	125.83	102.50	6.00	172.08	140.93	30.83	44.83	55671.18	84556	28884.82	1:1.51
V_2N_3	145.57	137.17	8.50	339.25	153.34	38.50	46.33	55977.17	92006	36028.83	1:1.64
V_2N_4	139.00	116.33	6.33	191.67	148.26	32.17	46.10	56280.91	88958	32677.09	1:1.58
V_3N_1	133.17	91.42	8.50	272.42	168.93	26.50	36.20	55365.24	101356	45990.76	1:1.83
V_3N_2	146.67	120.00	9.17	306.92	180.09	27.83	36.90	55671.18	108052	52380.82	1:1.94
V_3N_3	223.33	252.50	12.00	508.67	209.58	32.17	40.87	55977.17	125750	69772.83	1:2.24
V_3N_4	209.08	158.50	8.58	411.17	198.08	30.50	43.20	56280.91	118848	62567.09	1:2.11
V_4N_1	156.58	84.67	5.17	287.67	192.63	21.50	58.57	55365.24	115580	60214.76	1:2.08
V_4N_2	187.67	132.25	7.58	454.83	214.92	25.83	63.60	55671.18	128954	73282.82	1:2.31
V_4N_3	229.25	228.33	8.50	648.57	321.24	30.50	68.07	55977.17	192542	136564.8	1:3.43
V_4N_4	172.42	186.33	8.33	608.17	307.53	28.17	69.60	56280.91	184516	128235.1	1:3.27
S.Em ±	**10.52**	**11.52**	**0.49**	**20.88**	**14.12**	**0.77**	**1.16**				
C.D.at $_{5\%}$	**30.37**	**33.27**	**1.43**	**60.29**	**40.77**	**2.22**	**3.36**				

Quality of potato tuber was studied with regard to TSS, starch content, reducing sugar content, total sugar content and dry matter content at harvesting stage. The findings revealed significant effect of varieties on TSS content in potato tuber. Highest TSS content was observed in case of Kufri Chipsona-2 which was at par to Kufri Chipsona-1. Lowest TSS content was found in Kufri Pushkar. Among the varieties, Kufri Chipsona-2 recorded maximum starch content in tuber which was significantly higher than all other varieties. Varieties Kufri Chipsona-1 and Kufri Jyoti were at par. Significantly lower values of starch content were observed in Kufri Pushkar. It indicated that genetically varieties were different for starch content. Highest reducing sugar content was found in variety Kufri Pushkar, which was significantly higher than other varieties. Variety Kufri Chipsona-1 showed lowest values of reducing sugar content with non significant difference to Kufri Chipsona-2. Kumar et al. [11], Kumar et al. [18] and Sandhu et al. [19] also reported similar findings. Total sugar content was recorded maximum in case of variety Kufri Pushkar, which was significantly higher than other varieties. It was followed by Kufri Chipsona-2, Kufri Jyoti and Kufri Chipsona-1 in descending order. Though the difference between Kufri Jyoti and Kufri Chipsona-1 was non significant. Dry matter content indicated significant influence of varieties. Variety Kufri Chipsona-2 recorded highest dry matter content followed by Kufri Chipsona-1 and Kufri Jyoti with non significant difference. Significantly lower values of dry matter content were observed in case of Kufri Pushkar. Kumar et al. [11], Baishya et al. [14], Kumar et al. [18] and Sandhu et al. [19] also found significant difference among varieties for dry matter content in tuber.

3.2 Effect of Nitrogen

Application of nitrogen exerted significant influence on all the growth parameters studied. Plant height showed increase with increasing levels of nitrogen upto150 kh/ha. Further increase in nitrogen had no significant influence on plant height at all the stages. These findings are in line with [13,20,21]. Maximum number of sprouts was observed with application of 150 kg N/ha, which was significantly superior over other nitrogen levels. Singh et al. [20] and Zamil et al. [21] also reported positive effect of nitrogen on number of sprout. Application of nitrogen enhanced the number of leaves per plant. Highest number of leaves were recorded with application of 150 kg N/ha at 30 days after planting. Whereas, at 60 DAP highest number of leaves per plant were found with application of 175 kg N/ha. But statistically both treatments were at par. At 90 DAP there was decreases in number of leaves as compared to 60 DAP and highest numbers of leaves were observed with application of 175 kg N/ha, which was significantly superior over other nitrogen levels. It clearly indicated that higher dose of nitrogen promoted and retained more number of leaves at later stage of growth of potato. Kumar et al. [13] and Bose et al. [22] also found higher number of leaves with higher dose of nitrogen. Fresh weight of shoot and root increased with increasing dose of nitrogen upto150 kg/ha, which declined at further higher level of nitrogen i.e. 175 kg/ha. Though, the decrease in fresh weight of shoot was non significant at harvesting stage. Zamil et al. [21] also reported higher fresh weight of haulm with increasing dose of nitrogen.

Application of nitrogen showed significant positive effect on fresh weight of tuber and number of tuber per plant. Fresh weight of tuber increased with increasing dose of nitrogen upto150 kg/ha, which declined at further higher level of nitrogen i.e. 175 kg/ha. Highest number of tuber were recorded with application of 175 kg N/ha. Though, it was at par to application of 150 kg N/ha, which indicated that beneficial effect of nitrogen in the present study was obtained upto150 kg N/ha. These findings are in support of Mehdi et al. [1]. Total yield of potato tuber revealed significant effect of nitrogen application. Increasing dose of nitrogen upto150kg N/ha enhanced the tuber yield which showed non significant effect with further increase in the nitrogen dose i.e. at 175 kg/ha. Nitrogen being a part of chlorophyll is important for photosynthesis and enhanced the food material which affects the more assimilation and accumulation of the food material which might have been the reason of the increase in yield. Increase in tuber yield with higher doses of nitrogen have been found previously [16,17,19,22] also.

Nitrogen application upto150 kg/ha showed increase in TSS content. Further increase in nitrogen showed decrease in TSS content as compared to 150 kg N/ha. There was increase in starch content with increasing dose of nitrogen upto150 kg/ha, which was declined at 175 kg N/ha significantly. Banu et al. [23] also found increase in starch content with higher nitrogen dose. Increasing dose of nitrogen resulted in significant increase in reducing sugar content as well as total sugar content in potato tuber under all the levels. Highest total sugar content was found under 175 kg N/ha. Sandhu et al. [19] also

reported increase in reducing sugar content with higher dose of nitrogen. Increasing dose of nitrogen upto150 kg/ha enhanced the dry matter content significantly. But further increase in nitrogen levels resulted in significant decline in dry matter content of potato tuber. Similar findings have been reported earlier [19,22].

3.3 Combined Effect of Varieties and Nitrogen

Combined effect of varieties and nitrogen levels (Table 3) showed significant influence on fresh weight of shoot at 60 and 90 DAP, fresh weight of tuber at 30 and 90 days after planting. Fresh weight of shoot at 60 and 90 DAP recorded maximum values with V_4N_3 and V_3N_3, respectively. Fresh weight of tuber was recorded maximum with V_3N_3 at 30 DAP and V_4N_3 at 90 DAP. At 90 DAP V_4N_3 was followed by V_4N_4 with non significant difference. Higher genetic potential along with higher dose of nitrogen promoted more photosynthesis and accumulation of dry matter resulting in these findings.

Total tuber yield exhibited significant influence of combined effect of varieties and nitrogen levels. There was increase in yield under each variety with increasing dose of nitrogen upto 150 kg N/ha. All the varieties showed non significant influence on tuber yield with 175 kg N/ha as compared to their yield at 150 kg N/ha. It indicated that 150 kg N/ha was the appropriate dose for the given conditions. The best combination for total tuber yield was V_4N_3 which was followed by V_4N_4 with at par performance. These finding are in agreement with those of Trehan [17] and Sandhu et al. [19].

Combined effect of varieties and nitrogen levels recorded maximum starch content in tuber under V_2N_3, which was followed by V_1N_3, V_2N_4, V_2N_2 and V_4N_3. Lowest values of starch content were determined with V_4N_1. Total sugar content had exhibited significant influence of combined effect of varieties and nitrogen levels. Maximum total sugar content was estimated with V_4N_4 followed by V_4N_3, V_4N_2, and V_4N_1. Lowest total sugar content was observed under V_3N_1.

There was increase in cost of cultivation with increasing dose of nitrogen application under each variety. Economic evaluation of different treatments exhibited highest cost of cultivation in case of application of 175 kg N/ha with each variety due to higher cost of cultivation for highest nitrogen dose. Maximum gross income was obtained with V_4N_3 followed by V_4N_4. Similar trend was observed for net income. Cost: benefit ratio was found highest with V_4N_3 followed by V_4N_4. Higher yield under these treatments resulted in higher gross income, net income as well as cost: benefit ratio. Similar findings have been reported by Bose et al. [22] and Kumar et al. [24].

4. CONCLUSION

From the findings of present study it may be concluded that among the varieties, Kufri Pushkar recorded maximum yield showing its superior performance over other varieties. With respect to quality attributes, variety Kufri Chipsona-2 exhibited high dry matter content, high starch content and low reducing sugar content which are the desired attributes for processing. Variety Kufri Chipsona-1 and Kufri Jyoti were next to Kufri Chipsona-2. Among the different doses of nitrogen, application of 150kg N/ha resulted in maximum growth and yield attributes as well as total yield. It had also exhibited better quality parameters except reducing sugar. Combined effect of varieties and nitrogen levels showed highest economic return under application of 150 kg N/ha with variety Kufri Pushkar.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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