Original Research Article

Economics of potato cv. Kufri Lima under different plantingdates and nitrogen levels

ABSTRACT

The experiment entitled "Effect of planting dates and nitrogen levels on potato cv. Kufri Lima" was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, India during winter season of 2020-21. The treatments comprising of three planting dates (25th September, 10th October and 25th October) and four levels of nitrogen (0, 75, 100 and 125% of recommended dose of nitrogen, RDN) were laid out in a randomized block design (factorial) with three replications. Results of study revealed that significantly increase in growth and yield on 10th October planting as compared to earlier and late planting. Total marketable yield was recorded with 10th October planting with 100% RDN application (408 q/ha), closely followed by 125% RDN application (407.7 q/ha) and minimum was recorded under control. It can be concluded that 10th October with application of 100% of RDN (150 kg N/ha) provided with highest marketable yield and benefit to cost ratio (1.82).

Comment [AM1]: ??

Comment [AM2]: ??

KEY WORDS: Potato tuber, nitrogen, planting date, marketable yield,economics.

1. INTRODUCTION

Potato (*Solanum tuberosum* L.), also known as king of vegetables, belongs to the family Solanaceae. It is most important vegetable crops in the world and in terms of human consumption. Whenever there has been a scarcity of food grains, it has come to the rescue of people, as it yields higher up to 40-50 t/ha.Potato is one of the main cash crops among vegetables, which is grown and consumed all round the world.It contains high protein-calorie ratio and yields more edible energy, protein (3 kg/ha/day) and dry matter per unit area and time (47.6 kg/ha/day) compared to cereals (Ezekiel and Pandey, 2008). Potato can be grown on soil having pH in the range of 5.5-7.5 for e.g., alluvial, black, red and laterite soil (Pandey, 2007) but the best soil type for better growth of tubers is sandy loam soil. It exceptionally yields high and completely fits in multi-cropping systems which is prevalent under tropical as well as subtropical agro-climatic conditions.

India ranks 2nd in potato production after china, with cultivation over an area of 2.17 million hectares with the total production of 50.19 million tons and a productivity of 23.1 metric

tons per hectare during 2018-19.In Haryana it is cultivated over an area of 34.72 thousand hectares with a production of 813.80 thousand metric tons (Anonymous, 2018).

Nitrogen and planting time plays very crucial role for higher potato tuber yield. Widely fluctuating N levels result in irregular tuber growth and often end in the formation of internal (brown center and hollow heart) and external (misshapen) tuber deformities. Adequate nitrogen at tuberization produces large size tubers which increase marketable yield whereas, deficiency at this stage causes smaller tuber formation, hence reduces marketable tubers. Excessive application of nitrogen translocates the photosynthates from tops to tubers which directly affects the growth and yield. Timing of nitrogen fertilizer application had a direct impact on potato fertilizer efficiency and nitrate leaching. A higher nitrogen proportion at pre-planting tended to reduce potato tuber size; whereas a high proportion of nitrogen supplied at tuber initiation resulted in lower yield and higher residual soil mineral nitrogen at season's end (Zotarelli, 2015).

The rate of development of seed depends on soil temperature. The optimum soil temperature for initiating tubers growth is 16-19°C, it declines as soil temperatures rise above 20°C and tuber growth practically stops at soil temperature above 30°C. The yield remains maximum when the average daytime temperature is about 21°C. The cool night is important because they affect the accumulation of carbohydrates and dry matter in the tubers. Among various factors playing important role in deciding the production, productivity and keeping quality of the potato, the date of planting is most dominant ones. Therefore, the present study was undertaken to study the economics of potato cv. Kufrilima tuber production under optimum planting date and nitrogen level for sustainable agriculture.

2. MATERIAL AND METHODS

The experiment was carried out at vegetable research farm of CCS Haryana Agricultural University (HAU), located at Hisar in Haryana State, India during 2020-21. This region is characterized by semi- arid climate with hot winds in summer and dry severe cold in winter.The soil of field was sandy loam having 10.05 % clay and EC 0.27 dSm^{-1} in 0-30 cm layer. The soil pH and organic carbon content was 7.95 and 0.47% respectively. The experiment was laid in Randomized Block Design (Factorial), keeping three planting dates S_1- 25th September, S_2- 10th October, S_3- 25th October and four fertilizer levels, *i.e.*, N_1-0 % of RDN, N_2- 112.5 kg N/ha (50% of RDN), N_3- 150 kg N/ha (75% of RDN) and N_4- 187.5 kg N/ha (100% of RDN) which were replicated thrice. The recommended dose of fertilizer for the state is 150 kg/ha nitrogen, 50 kg/ha phosphorus and 100 kg/ha potassium. The benefit-cost ratio (B:C) was calculated as (Gross return ÷ Cost of cultivation). Statisticalanalysis of data collected during the study was done by applying

the technique of analysis of variance (ANOVA) as suggested by Panse and Sukhatme (1987). All the statistical analysis was carried out by using OPSTAT statistical software.

3. RESULTS AND DISCUSSION

3.1. Yield parameters

The data (Table 1.1)demonstrated that different planting dates and nitrogen levels significantly affected the total marketable tuber yield (q/ha) was recorded maximum with 10th October planting as compared to early and late planting dates. As the temperature is one of the most dominating factors in yield contribution in potato croptemperatures during vegetative as well as reproductive growth phase might have suitable towards getting better vegetative growth and higher yield in this planting date. The present results are similar to the finding of Thongam*et al*. (2017), recorded the highest tubers yield with 10th October planting as compared to delayed planting. Early planting from October 20 to October 30 can be used for maximum marketable yield (Kumar *et al*., 2009).

Among the different nitrogen levels, weight of marketable tuber yield were recorded in the range 187.3 to 285.1 q/ha, which were observed significantly highest for the 125% of RDN application, it was at par with 100% of RDN. Total marketable tuber yield increased with increase in nitrogen levels upto 100% of RDN, higher than this level of nitrogen application has no significant effect on tuber yield.

Table 1.1: Effect of planting dates and nitrogen levels on total marketable yield (q/ha).

Planting dates	**Nitrogen levels (% of RDN)**				**Mean**
	N_0	**N_{75}**	**N_{100}**	**N_{125}**	
25th September	71.4	102.3	119.1	124.5	**104.3**
10th October	273.7	311.1	408.0	407.7	**350.1**
25th October	217.0	282.5	322.4	323.0	**286.2**
Mean	**187.3**	**232.0**	**283.2**	**285.1**	
CD at 5%	Planting dates: 29.8Nitrogen levels: 34.4Interaction: N.S.				
SE(D)	Planting dates: 10.1Nitrogen levels: 11.6Interaction: 20.2				

Inadequate supply of nitrogen fertilizer to potato crop leads to poor growth and yield, while excessive application of nitrogen, especially as mineral fertilizer, leads to luxury consumption for plant growth, occasionally a reduction in yield and quality of tubers, delayed maturity and leaching of excessive nitrate in soil (Arriaga *et al.*, 2009; Cerny*et al.*, 2010). Yield of any crop is a function of intergraded metabolic plant processes, which depend on adequate and

balanced supply of nutrients. Nitrogen improves leaf chlorophyll content and plant growth, *i.e.*, plant height, number of stems, leaf number and leaf area, which thereby might have encouraged much more metabolites to produce higher total yield. The result of present investigation are in line with the findings of Banjaree*t al.* (2014)and Sahu*et al.* (2016),~~and Banjare *et al.* (2014),~~they noticed the maximum marketable as well as total tuber yield with nitrogen dose of 225 kg/ha.

Comment [AM3]: But these authors indicate a nitrogen dose so high respect the dose used for you with good results. I believe that you demonstrated here the importance of the planting dates. You have good results using less RDN

3.2. Economics

The data on economics of different treatments of planting dates and nitrogen levels have been presented in table 1.2. Among different treatments, the maximum net income (Rs. 1,62,342/ha) was obtained from combination of 10th October planting with application of 100% of RDN (150 kg/ha), followed by application of 125% of RDN on same date of planting (Rs. 1,62,111), and in these treatments, the cost of cultivation was Rs. 89432 and Rs. 89917/ha, respectively.

Table 1.2: Effect of planting dates and nitrogen levels on economics of different treatments

Treatments	Common cost (Rs./ha)	Treatment cost (Rs./ha)	Total cost (Rs./ha)	Yield (q/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
25th September							
0	87505	0	87505	75.8	45474	-42031	-0.48
75 % of RDN	87505	1442	88947	104.1	62484	-26463	-0.30
100 % of RDN	87505	1927	89432	121.2	72713	-16719	-0.19
125% of RDN	87505	2412	89917	126.3	75806	-14111	-0.16
10th October							
0	87505	0	87505	288.7	173202	85697	0.98
75 % of RDN	87505	1442	88947	326.3	195758	106811	1.20
100 % of RDN	87505	1927	89432	419.6	251774	162342	1.82
125% of RDN	87505	2412	89917	420.0	252028	162111	1.80
25th October							
0	87505	0	87505	228.1	136834	49329	0.56
75 % of RDN	87505	1442	88947	294.5	176717	87770	0.99
100 % of RDN	87505	1927	89432	335.1	201088	111656	1.25
125% of RDN	87505	2412	89917	335.7	201412	111495	1.24

Cost of seed @ Rs. 1000/q; Potato sold@ Rs. 600/q; Cost of fertilizer: Urea @ Rs. 5.91/kg; SSP @ Rs. 7/kg; MOP @ Rs. 15/kg

In terms of benefit to cost ratio, again the treatment 10th October planting with application of 100% of RDN nitrogen gave the maximum benefit cost ratio (1.82) and it was closely followed with 125% of RDN application on 10thOctober planting (1.80).

The highest net income (Rs. 1,62,342 ha^{-1}) and benefit to cost ratio (1.82) was obtained from the cultivarietyKufri Lima planting on 10th October with application of 100% of RDN.This may bedue to higher marketable and total tuber yield under these treatments. The results of the present investigation are similar with the results of Banjare*et al*. (2014) and Mozumder*et al*. (2014), they obtained maximum gross as well as net returns and benefit to cost ratio with the treatment where tuber yield was recorded maximum. Sahu*etal*. (2016) also reported the maximum gross as well as net returns and benefit to cost ratio from the cultivarvarietyKufriPukhraj supplied with nitrogen at the rate of 225 kg/ha.

4. CONCLUSION

Based on research carried out during winter season of 2020-21 at research farm of Department of Vegetable Science, CCS HAU, Hisar, it is concluded that the potato cultivarietyKufri Lima planting on 10th October with application of 100% of RDN(150 kg N/ha) provided with highest marketable yield (408 q/ha), net return (Rs. 1,62,342/ha) and benefit to cost ratio (1.82).

Comment [AM4]: ??

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APPENDIX-I

Sr. No.	Operations/Particulars	No. of units	Rate (Rs.)/unit	Value in Rs.
COMMON COST				
1	Preparatory tillage	4	1000 ha^{-1}	4000
2	Planting	1	2500 ha^{-1}	2500
3	Seed	25 q	1000 q^{-1}	25000
4	Fertilizer application (Labour)	2	350 $labour^{-1}$	700
5	SSP	312 kg	7.00 kg^{-1}	2184
6	MOP	166 kg	15.00 kg-^{1}	2656
7	Labour for irrigation	7	350 $labour^{-1}$	2450
8	Hoeing and weeding/ herbicide	1	3000	3000
9	Plant protection	1	2000 ha^{-1}	2000
10	Harvesting	30 (labour)	350 $labour^{-1}$	10500
11	Miscellaneous	-	-	800
12	Working capital (1 to 11)			**55785**
13	Interest on working capital @ 12% per annum	4 month	-	2231
14	Transportation	-	10000 ha^{-1}	10000
15	Management charge (10% of 15)			5578
16	Risk charges (10%)			5578
17	Rental value of land	4 months	25000/ha/year	8333
Total				**87505**
TREATMENT COST				
Sr. No.	**Operations/Particulars**	**Amount of Urea (kg)**	**Rate**	**Value in Rs.**

1	Nitrogen 0 kg/ha	0	Rs. 5.91/kg	0
2	Nitrogen 112.5 kg/ha	244	Rs. 5.91/kg	1442
3	Nitrogen 150 kg/ha	326	Rs. 5. 91/kg	1927
4	Nitrogen 187.5 kg/ha	408	Rs. 5.91/kg	2411
OUTPUTS				
Particulars		**Price Rs./unit**		
Tuber yield		600/q		