

Response of Three Varieties of Potato to Different Fertility Levels on Yield and Grade of Tubers*

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ABSTRACT

A field experiment was conducted during the years 1973-74 and 1974-75 at Gujarat Agricultural University, Anand campus, Anand to compare the performance of three varieties (Kufri Sinduri, Kufri Chandramukhi and Up-to-date) of potato with six different fertility levels (100+100+0, 100+100+100, 150+150+0, 150+150+150, 200+200+0 and 200+200+200 NPK in kg/ha) on yield and grade of tubers. The variety Kufri Sinduri produced significantly more yield of tubers than Kufri Chandramukhi and Up-to-date. Application of NPK @ 200+200+200 and 150+150+150 kg/ha produced significantly higher yield along with superior grade of tubers over other treatments, although these two treatments were at par. Application of NPK @ 150+150+150 kg/ha was found to be the most profitable dose of fertilizers.

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INTRODUCTION

POTATO is grown in India as a vegetable crop with good cash income to the farmers. One of the factors for limiting its yield is inadequate use of essential plant nutrients. Many workers (Ramanujan and Singh, 1956; Hukkeri, 1968; Reddy and Rao, 1968; Singh, Hukkeri and Singh, 1968; Shukla and Singh, 1976) have shown that the potato crop responds well to the application of nitrogenous, phosphorus and potash fertilizers. However, the information regarding the requirement of NPK on potato which is one of the leading commercial vegetable crops of Kheda district of Gujarat is lacking and hence to study those aspects, an investigation was undertaken.

MATERIALS AND METHODS

The experiment was undertaken in the Fertilizer Research Project, Gujarat

Agricultural University, Anand campus, Anand during the years 1973-74 and 1974-75. The crop of potato was followed by green manuring with sann in both the years. The eighteen treatment combinations of six fixed fertility levels (100+100+0, 100+100+100, 150+150+0, 150+150+150, 200+200+0 and 200+200+200 NPK kg/ha) and three varieties of potato (Kufri Sinduri, Kufri Chandramukhi and Up-to-date) were tried in a randomised block design with four replications. The net plot size 7.1 × 2.7 m was employed in this study. The soil under this experiment was sandy loam in texture and is commonly known as "Goradu soil". The total nitrogen, available P_2O_5 and K_2O were 735, 44 and 472 kg/ha, respectively. The entire quantity of phosphorus in the form of diammonium phosphate (DAP) and 50% of the total nitrogen that contained in diammonium phosphate and the rest in

the form of urea and the entire quantity of potash in the form of muriate of potash were applied as basal dose. The remaining 50% of the total *N* was applied in two equal splits viz., (i) three weeks after planting i.e. at the time of first irrigation and (ii) after six weeks of planting in the form of urea.

The cut pieces of Up-to-date and K. Sinduri, K. Chandramukhi purchased from Boriavi Co-operative Society, Boriavi and Ahmedabad Ice and Cold Storage Ltd., Ahmedabad respectively, were planted in the centre of the furrows opened 45 cm apart keeping plant to plant distance of 15 cm after giving a preplanting irrigation in furrows two days before planting. Planking operation was carried out immediately after planting. Planting of tubers was done on 15-11-'73 29-11-'74 and the crop was harvested on 26-2-'74 and 13-3-'75 for the years 1973-74 and 1974-75, respectively. The

yield of potatoes is reported as the fresh weight of tubers at harvest. The produce was cleaned and graded into three different grades on the weight basis as "A" grade (above 100 gm), "B" grade (50 to 100 gm) and "C" grade (below 50 gm). The weight of tubers falling under each grade were recorded.

RESULTS AND DISCUSSION

It may be pointed out that the growth and yield of crop in the second year were relatively poor because of late blight attack (Table 1). This was due to cloudy weather prevailing throughout the month of February 1975. The effect of late blight was comparatively very less in the case of Kufri Sinduri variety.

Relative Performance of Varieties: During both the years the growth characteristics as well as yield of different varieties varied significantly. Among the varieties, Kufri Sinduri was found to be the

TABLE 1

Yield of potato tubers in quintals/ha as affected by different treatments.

Treatments	1973-74				1974-75				Pooled (q/ha)
	A	Grade of Tubers		Total	A	Grade of Tubers		Total	
		B	C			B	C		
<i>Varieties:</i>									
K. Sinduri	66.29	160.60	94.16	321.05	15.18	117.89	99.79	232.86	276.96
K. Chandramukhi	66.22	136.31	65.67	268.20	21.13	97.39	52.43	170.95	219.58
Up-to-date	68.99	131.87	58.21	259.07	37.56	120.08	54.30	211.94	235.51
C.D. at 5%	N.S.	12.00	9.73	5.90	6.07	12.76	6.41	15.92	11.39
<i>Levels of N+P+K (kg/ha):</i>									
100+100+0	55.49	142.00	74.29	271.78	16.07	89.41	64.37	169.85	220.81
100 + 100 + 100	64.90	141.32	72.10	278.32	25.40	106.73	67.08	199.21	238.76
150 + 150 + 0	58.88	135.72	70.44	265.04	19.41	101.67	67.71	188.79	226.92
150 + 150 + 150	80.18	135.13	71.99	287.32	19.16	131.98	73.08	234.22	260.77
200 + 200 + 0	65.45	153.63	71.03	290.10	20.87	102.92	72.87	196.66	243.40
200 + 200 + 200	78.10	149.76	76.23	304.09	36.78	137.92	67.92	242.62	273.36
C.D. at 5%	12.43	N.S.	N.S.	N.S.	8.57	18.11	N.S.	22.47	16.10
C.V. %	22.59	14.50	22.38	10.26	42.31	19.65	16.02	13.33	11.56

best in both the years. Significant difference was not observed between Kufri Chandramukhi and Up-to-date varieties during the first year. While in the subsequent year, Up-to-date proved superior to Kufri Chandramukhi. Overall analysis also revealed the same trend as was observed in the second year. Based on pooled analysis, the variety Kufri Sinduri produced 18.3 and 26.1 per cent higher yield than that obtained from Up-to-date and Kufri Chandramukhi, respectively. Similar results have been reported by Pushkarnath (1965), Pand (1972), Misra and Mohanty (1973), and Verma and Sharma (1973).

In general, the varieties differed significantly in respect of grade of tubers. The percentage of "A" grade tubers in Kufri Sinduri, Kufri Chandramukhi and Up-to-date was 11.59, 9.59 and 12.55, respectively.

The significantly highest number of

tubers per plant was produced by Kufri Sinduri in both the years (Table 2). The other two varieties were at par. Data pertaining to the weight of tubers per plant revealed that Kufri Sinduri produced significantly more yield during the first year of the study, whereas, Up-to-date produced significantly more yield over other in the second year. Regarding plant height Kufri Sinduri attained significantly greater height than Up-to-date and Kufri Chandramukhi during both the years. The minimum plant height was noticed in case of Kufri Chandramukhi. Similar observations have been reported by Panda (1976).

Effect of Different Fertility levels: As far as the response to NPK application is concerned (Table 1 and 3), the fertilizer treatment involving $N\ 200 + P\ 200 + K\ 200$ and $N\ 150 + P\ 150 + K\ 150$ kg/ha gave significantly higher tuber yield than that by the rest of the fertilizer treatments

TABLE 2

Growth as well as yield attributing characters of potato as affected by different treatments.

Treatments	Yield of tubers per plant in g			No. of tubers per plant			Plant height in cm		
	1973-74	1974-75	Mean	1973-74	1974-75	Mean	1973-74	1974-75	Mean
<i>Varieties:</i>									
K. Sinduri	307	227	267	7.2	5.9	6.6	86.8	39.2	63.0
K. Chandramukhi	268	215	242	4.8	4.4	4.6	26.6	11.3	19.0
Up-to-date	255	299	277	4.4	4.9	4.7	27.6	17.2	22.4
C.D. at 5%	36.0	28.0		0.73	0.53		5.09	3.26	
<i>Levels of N + P + K (kg/ha)</i>									
100 + 100 + 0	261	219	240	5.3	5.0	5.2	43.5	18.8	31.2
100 + 100 + 100	262	216	239	4.8	4.6	4.7	43.4	20.7	32.1
150 + 150 + 0	271	234	253	5.5	5.0	5.3	45.3	22.7	34.0
150 + 150 + 150	286	285	286	5.9	5.5	5.7	49.0	23.6	36.3
200 + 200 + 0	274	239	257	5.8	5.1	5.5	49.4	22.8	36.1
200 + 200 + 200	306	286	296	5.5	5.2	5.4	51.4	26.9	39.2
C.D. at 5%	N.S.	40.0		N.S.	N.S.	N.S.	N.S.	4.61	
C.V. %	22.5	19.6		23.2	18.0		18.7	24.8	

TABLE 3

Percentage of "A" grade tubers increase-over control treatment at different levels of fertilization.

Levels of fertilization (kg/ha)	Percentage increase over control		
	1973-74	1974-75	Mean
1 N100+P100+K 0	—	—	—
2 N100+P100+K100	16.96	58.05	37.51
3 N150+P150+K 0	6.11	20.78	13.45
4 N150+P150+K150	44.49	81.46	62.98
5 N200+P200+K 0	17.95	29.87	23.91
6 N200+P200+K200	44.75	128.87	86.81

during the second year of the study. Similar trend was also observed in case of pooled analysis. In the first year also the same trend was maintained but the differences failed to reach the level of significance.

The results reported in Table 1 also indicated that the differences in the yield of "A" grade tubers due to different levels of fertilizers were significant in both the years of the study. The fertilizer treatment $N\ 200+P\ 200+K\ 200$ kg/ha produced significantly more yield of "A" grade tubers than the remaining ones except $N\ 150+P\ 150+K\ 150$ treatment in both the years. The percentage increase in yield of "A" grade tubers over control treatment ($N\ 100+P\ 100+K\ 0$ kg/ha) reported in Table 3 revealed that application of higher levels of *NP* or *NPK* exhibited the beneficial effect on yield of "A" grade tubers in comparison to its lower level. Application of potash was not only responsible for higher yield in this study but also produced more yield of "A" grade tubers which is one of the important quality characters of potato. This agrees with the findings of Hukkeri (1968) and Reddy and Rao (1968).

The yield of "B" and "C" grade tubers did not increase significantly with increasing levels of *NPK* except "B" grade in the second year (Table 1).

The plant height did not exhibit any significant response due to levels of *NPK* in the first year. While significant differences were observed in the succeeding year. The maximum plant height (26.9 cm) was noticed with the application of the highest dose of *NPK*, while the minimum (18.8 cm) with the lowest dose of fertilizer. This is in agreement with the findings of Mishra and Pati (1970) and Misra and Mohanty (1973). Yield of tubers per plant was significantly affected by different levels of fertility during the second year only. The treatments involving $N\ 200+P\ 200+K\ 200$ and $N\ 150+P\ 150+K\ 150$ kg/ha were at par but gave significantly more yield per plant as compared to remaining ones. However, the number of tubers produced per plant was not affected by any of the fertilizer treatments.

Effect of Interaction: The interaction between varieties and fertility levels was not found to be significant in any of the characters under study.

Economics of Fertilization: Economics of different levels of fertilization was worked out on the basis of average tuber yield for both the years under study. The data so obtained are presented in Table 4.

The highest net profit accrued due to application of $N\ 200+P\ 200+K\ 200$ closely followed by $N\ 150+P\ 150+K\ 150$ kg/ha. These two treatments gave Rs. 1,003 and Rs. 997 higher net profit per

TABLE 4

Economics of fertilization.

Fertilizers treatments (N+P+K kg/ha)	Average yield (q/ha)	Additional yield over control (q/ha)	Income due to additional yield (Rs/ha)	Additional cost of fertilizer and its application over control treatment (Rs/ha)	Net profit increase (+) or decrease (-) over control
100 + 100 + 0*	220.81	—	—	—	—
100 + 100 + 100	238.76	17.95	808	211	+ 597
150 + 150 + 0	226.92	6.11	275	475	—200
150 + 150 + 150	260.56	39.75	1789	792	+997
200 + 200 + 0	243.40	22.59	1017	951	+ 66
200 + 200 + 200	273.36	52.80	2376	1373	+1003

* Control treatment

Selling price of tuber

: 45 Rs./q.

Cost of Urea

: 2056 Rs./tonne

Cost of DAP

: 3092 Rs./tonne

Cost of muriate of potash

: 1265 Rs./tonne

hectare, respectively, over N 100+P 100 +K 0 treatment (control). It is interesting to note that increase in levels of NP in absence of potash, decreased the net profit over control treatment. This showed that potash application might be the only responsible factor for increased realization.

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