

Effect of phosphorus and farmyard manure application on yield, content and uptake of nitrogen, phosphorus and sulphur by potato (*Solanum tuberosum*)

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Received: April 1995

ABSTRACT

In a field experiment conducted during 1990–92 on light-textured soil, the efficiency of farmyard manure (FYM) and phosphatic fertilizer (alone and in combination) was evaluated for potato [*Solanum tuberosum* L.]. Application of P and FYM individually or in combination increased significantly the tuber yield of potato. The concentration of N, P and S in tubers increased with FYM but S content was not affected by applied P. Addition of P and FYM significantly enhanced the uptake of N, P and S by potato tubers.

Potato (*Solanum tuberosum* L.) an important vegetable crop responds significantly to phosphorus (P) and farmyard manure (FYM) application (Grewal and Trehan, 1988). The FYM may not meet the P requirement of potato as the nutrients become gradually available with its decomposition, whereas in fertilizers the availability of P gets reduced in latter stages of crop growth due to fixation in soil. Thus, a combination of fertilizer P and FYM is expected to ensure an adequate supply of the nutrients throughout the cropping period. Hence a field investigation was initiated to evaluate the efficiency of FYM and P fertilizer alone and in combination on potato.

MATERIALS AND METHODS

The field experiment was carried out at Bichpuri, Agra, during 1990–91 and 1991–92 with potato. The experimental soil

was sandy loam (Ustipasament) with pH 8.0, organic carbon 0.39%, available N 130 kg/ha, available P 8.0 kg/ha and available K 150 kg/ha. Combinations of 4 levels each of P (0, 50, 100 and 150 kg/ha) and farmyard manure (0, 5, 10 and 15 tonnes/ha) were tried in randomized block design replicated thrice, adopting a plot size of 2 m × 2 m. A recommended dose of nitrogen and potassium @ 200 kg/ha and 120 kg/ha respectively was applied through urea and muriate of potash. The crop was allowed to grow up to maturity. At harvest the tuber yield was recorded. The tubers, after drying, were digested with diacid mixture (HNO_3 : HClO_4 4 : 1) and analysed for P by vanadomolybdo phosphate method. Sulphur was determined by turbidimetric method (Chesnin and Yien, 1951). Nitrogen in tubers was determined by Kjeldahl's method.

RESULTS AND DISCUSSION

Potato responded significantly up to the application of 100 kg P_2O_5 /ha during both the years (Table 1) which may be attributed to its low initial level in soil. There was no further increase in tuber yield at higher rate of applied P. These results corroborate the findings of Sharma (1991). Application of farmyard manure (FYM) also increased the tuber yield of potato significantly as reported by Sharma (1991). This increase in yield is due to more availability of essential plant nutrients to plants and improvement in physico-chemical properties of soil, resulting in better tuberization. Further, the application of FYM in conjunction with P

also showed an increase in tuber yield in both the years. Generally, application of P in the presence of FYM increased the yield of crop much more than that of P alone. Thus, phosphatic fertilizer can be saved with the application of FYM. Highest tuber yield was observed with the application of 50 kg P_2O_5 /ha and 15 tonnes FYM/ha.

The nitrogen content of tubers increased significantly with the application of graded levels of P (Table 2). Nitrogen content in potato tuber also increased significantly with the application of FYM, as also reported by Sahota and Singh (1988). This increase in N content may be ascribed to higher availability of nitrogen with the addition of FYM. Nitrogen uptake by potato tubers ranged from 382.2 to 591.5 and 325 to 641.9 kg/ha respectively, being lowest in the control and highest with the application of 150 kg P and 15 tonnes FYM/ha during 1990–91. Corresponding increases in N uptake ranged from 354.8 to 574.6 and 309.1 to 6419.9 kg/ha during 1991–92 (Table 2). Thus N uptake increased significantly with increasing levels of P as well as FYM. This increase was due to better utilization of applied N by potato in the presence of applied P. Interaction between P and FYM on N uptake was significant during both the years.

Pooled results showed that the application of P increased the P content in tubers from 0.24 to 0.28%. Phosphorus content was also increased significantly with FYM up to 15 tonnes/ha. The higher P content may be attributed to release of more native and applied soil P which in turn helps in more P absorption by the crop. The increase in P uptake was significant up to 150 kg P_2O_5 and 15 tonnes FYM/ha during both the years owing to the increased tuber production and improvement in P content. Significant increase in P uptake by tubers with P

Table 1. Effect of phosphorus and farmyard manure on potato-tuber yield (tonnes/ha)

P (kg/ha)	Farmyard manure (tonnes/ha)				
	0	5	10	15	Mean
1990-91					
0	24.0	30.0	33.6	36.0	30.9
50	28.3	32.0	36.8	39.3	34.1
100	33.0	35.6	39.0	40.0	37.0
150	31.0	33.7	36.0	37.2	34.2
Mean	29.1	32.8	36.1	38.2	
CD (P = 0.05)					
P or FYM	0.84				
P x FYM	1.68				
1991-92					
0	23.4	29.0	32.8	35.0	30.0
50	27.0	30.5	36.0	37.8	32.8
100	32.5	34.7	37.8	38.5	36.5
150	30.4	32.0	34.3	36.0	33.2
Mean	28.3	31.5	35.2	37.0	
CD (P = 0.05)					
P or FYM	0.74				
P x FYM	1.48				

Table 2. Effect of P and FYM on uptake of N, P and S by potato tubers

Treatment	Uptake (kg/ha)					
	N		P		S	
	1990—91	1991—92	1990—91	1991—92	1990—91	1991—92
<i>S (kg/ha)</i>						
0	382.3	354.8	75.1	70.1	66.7	61.9
50	465.4	432.0	84.3	78.1	70.5	64.9
100	544.8	501.4	96.4	91.6	75.5	71.6
150	591.5	574.6	104.5	99.9	80.6	75.8
CD (P = 0.05)	28.6	29.3	2.8	3.3	3.2	3.3
<i>FYM (tonnes/ha)</i>						
0	325.0	309.1	68.7	65.0	51.6	45.9
5	422.4	398.1	83.2	76.8	67.4	61.6
10	543.6	513.6	97.8	93.7	81.2	77.6
15	692.8	641.0	109.6	104.1	93.0	89.0
CD (P = 0.05)	28.6	29.3	2.8	3.3	3.2	3.3

and FYM application was also reported by Sharma (1991). Application of P did not affect the S content in tubers significantly (Table 2), whereas S uptake by potato crop increased significantly with P application. Increase in S uptake due to P addition can be attributed to increased tuber production. Application of FYM increased the content and uptake of S in tubers over the control. Maximum values of content and uptake of S by potato tubers were recorded in the plots receiving FYM @ 15 tonnes/ha. This might be attributed to the increased availability of S in soil and greater tuber production due to FYM addition.

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