

Short Communications

Effect of Phosphorus Levels and its Methods of Application on Yield and Uptake by Wheat (*Triticum aestivum*) on a Heavy Black Soil

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The heavy soils of South Gujarat are known for their high phosphorus fixing capacity (Pandya, 1948). For such soils, low availability of phosphorus necessitates application of P in a way to reduce its fixation for both satisfactory crop yield and its effectiveness.

The field experiment was conducted during 1976-77 using four levels of phosphorus viz. $O(P_0)$, $30(P_{30})$, $60(P_{60})$ and $90(P_{90})$ kg P_2O_5 /ha in the form of superphosphate, and four methods of its placement viz. broadcast (BC), top-dressing (TD), below seed (BS) and during seedbed preparation (SP) on a deep black (Inseceptisols) clayey soil (Desai and Patel, 1970) of Navsari Farm with wheat (sonalika) in a randomized block design with three replications. Available P_2O_5 was rather low (26.0 kg/ha). Available potash was adequate (702 kg/ha) while the level of organic carbon was medium

(0.44 per cent). Phosphorus fixation capacity of the soil was 78.45 per cent (Waugh and Fitts, 1966). Wheat was sown on 3rd December and harvested on 15th March. In BC method, required quantity of superphosphate was evenly spread and mixed with the surface soil (5 cm) prior to sowing, while in SP method, phosphate was broadcast but not mixed with the soil. In case of TD, phosphate was applied in line 5 cm deep on both sides of the plant 15 days after sowing, while in case of BS, it was applied below the seed at the same depth at the time of sowing. Nitrogen @ 100 kg/ha in the form of urea was given to all treatments. The crop received five irrigations. Grain and straw yields were recorded (Table 1). Both straw and grain samples were analysed for N, P, K, Ca and Mg contents (Jackson 1967).

With increasing dose of phosphorus fertilizer, the grain yield was significantly increased (Table 1). The highest production of grain was obtained at 60 kg P_2O_5 /ha. Tiwari *et al.* (1974) reported significant response upto 60 kg P_2O_5 /ha by Kalyansona wheat on soils having low and medium P availability. Although different methods of P application did not differ significantly, the highest yields of grain (50.3 q/ha)

and straw (61.5 q/ha) were obtained when phosphatic fertilizer was applied below seed. Tiwari *et al.* (1968) reported that in black soils placement of P ferti-

lizer at 6.3 cm below the seed or in bands was superior to broadcast application.

TABLE 1

Yield (q/ha), nutrient uptake by whole plant and phosphorus status in soil as influenced by phosphorus and its methods of placement.

Treatment	Yield		Nutrient uptake, kg/ha					Av. P_2O_5 (kg/ha) in soil (after harvest)
	Grain	Straw	N	P_2O_5	K_2O	Ca	Mg	
P_2O_5 kg/ha	39.0	52.7	110.14	31.99	112.76	69.67	41.17	20.49
P_0								
P_{30}	50.0	64.3	140.73	42.05	134.62	83.57	53.58	20.24
P_{60}	52.0	63.8	139.86	40.56	132.87	80.94	54.90	25.34
P_{90}	44.9	65.9	137.24	41.87	122.38	79.46	49.65	30.77
S.Em. $\pm$	1.55	3.87	1.49	1.23	41.00	30.40	32.94	2.23
C.D. at 5%	5.3	N.S.	6.64	5.51	N.S.	N.S.	N.S.	7.10
Methods of Placement of P_2O_5:								
BC (Broad cast)	46.1	59.6	132.87	40.21	128.50	77.97	51.49	21.16
TD								
(Top dressing)	48.3	62.6	127.62	38.46	128.50	76.40	47.38	25.09
BS (Below seed)	50.3	63.5	142.48	41.96	125.87	81.73	53.58	25.34
SP (Seedbed Preparation)	47.0	61.1	125.00	36.71	129.76	75.52	46.94	24.92
S. Em. +	2.06	2.91	7.95	2.90	71.50	47.63	26.25	2.18
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Application of phosphorus increased the N uptake by plant (Table 1). The dose of 30 kg P_2O_5 /ha produced significantly greater N uptake over control, but did not differ at higher levels of P application. Ninety kg P_2O_5 /ha decreased the N uptake as compared to P_{30} and P_{60} probably due to imbalance of N and P in the soil solution. Mallik *et al.* (1965) observed in the case of

wheat that at lower levels, application of nitrogen and phosphorus was more effective than nitrogen alone in increasing N concentration which indicated beneficial effect of phosphorus on nitrogen uptake. Sharma *et al.* (1971a) reported that application of 50 kg P_2O_5 /ha to Kalyansona wheat gave significantly higher N uptake than control. Regarding the methods of application of phos-

phatic fertilizer, the highest N uptake by crop was observed with BS treatment (142.48 kg/ha).

The uptake of P_2O_5 was influenced significantly by P application (Table 1). Applied levels of P_2O_5 produced significantly greater uptake than that of control, but they did not differ significantly among themselves. Phosphorus application by different methods did not increase P uptake significantly. However, BS method gave higher P_2O_5 uptake (41.96 kg/ha) as compared to others. Phosphorus applied @ 30 kg/ha through BS method resulted in the maximum P uptake by grain (Table 2).

TABLE 2

Effect of phosphorus levels and its methods of placement on uptake of P_2O_5 (kg/ha) by grain.

Treatment	P_0	P_{30}	P_{60}	P_{90}
BC				
(Broad cast)	24.06	31.95	33.70	34.88
TD				
(Top dressing)	23.60	32.73	29.81	30.24
BS				
(Below seed)	28.58	34.88	34.79	34.44
SP				
(Seedbed Preparation)	20.63	32.91	26.83	31.64
S.E.m.±	2.62	C.D. at 5%		8.36

Phosphorus application did not significantly increase the uptake of K_2O , Ca and Mg by the plant.

Available P_2O_5 in soil decreased by 5.51 kg P_2O_5 /ha than that at initial level when P was not applied (Table 1). Available P content after

the harvest of wheat was close to the initial level of P in the soil when 60 kg P_2O_5 /ha was applied. An increase in available P by 4.71 kg/ha over the initial P level of the soil was noted in plot receiving 90 kg P_2O_5 /ha. This indicates that for getting optimum yield and maintaining the available P status of soil, application of 60 kg P_2O_5 /ha appears to be optimum dose for wheat in heavy soil of Navsari.

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