

Response of Wheat Cultivars to Different Levels of Phosphorus Using ^{32}P as a Tracer

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In a pot culture experiment, response of three wheat cultivars to four levels of phosphorus was studied. A significant increase in drymatter production was recorded upto 90 $\mu\text{g P/g}$ soil resulted in about 3.5 times greater drymatter over control. Uptake of ^{32}P was also increased significantly with increasing levels of phosphorus upto 90 $\mu\text{g P/g}$ soil. Per cent utilization of applied phosphorus increased due to first increment in phosphorus but it was reduced considerably with additional increment in phosphorus. Percent utilization of applied P was maximum in wheat variety S-308 (6.63 percent) followed by HD-1593 (5.98 percent) and HD-4502 (4.84 per cent) respectively during their growth for 45 days.

Phosphorus fertilization to wheat is important as the beneficial effect of nitrogen is nullified in absence of this element. Although there are several reports (Verma *et al.* 1970) that wheat responds well to phosphorus the magnitude of response of dwarf wheat to this nutrient has recently been understood and studied in detail (Sinha and Rai, 1976). In the present study an attempt has been made to investigate by radio-tracer technique the rate of response of three popular wheat cultivars viz. S-308, HD-1593 and HD-4502 to different levels of P ranging from 45 to 135 $\mu\text{g P/g}$ soil with a view to study the relationship between the drymatter yield, uptake of P and utilization of applied fertilizer.

MATERIAL AND METHODS

A pot culture experiment was conducted during Rabi season 1978, using clay loam soil having pH 8.2, with

organic carbon 0.68 percent, available P 6.25 $\mu\text{g/g}$ soil and 7.5 percent CaCO_3 . Three wheat cultivars viz. S-308; HD-1593 and HD-4502 were treated with four levels of phosphorus (0, 45, 90 and 135 $\mu\text{g P/g}$ soil) in the plastic buckets containing 5 kg soil each. A basal application of 270 $\mu\text{g N/g}$ soil (as urea) and 135 $\mu\text{g K}_2\text{O/g}$ soil (as muriate of potash) was applied along with the specified dose of P at the time of sowing. The specific activity of the labelled single superphosphate was 0.9 mCi/g P, which was procured from Bhabha Atomic Research Centre, Trombay. Five plants in each pot were grown, harvested after 45 days and total P in triacid extract was determined colorimetrically as vanadomolybdate method. The radioassay of plant samples was done by briquent method (Mackenzie and Dean 1950) using G. M. counter.

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RESULTS AND DISCUSSION

Dry matter Production :

The results in table I show that the drymatter yield of all the three wheat cultivars increased significantly with P application over check treatment. The dose effect was significant for all the cultivars upto 90 μg P/g soil. A significant reduction in yield was recorded due to third increment in P. Variability in drymatter production among these three cultivars was observed. Highest drymatter accumulation occurred in S-308 followed by HD-1593 and HD-4502. Application of 90 μg P/g soil resulted in about 3.5 times greater drymatter accumulation over control. These three cultivars responded significantly upto 90 μg P/g soil. Sinha (1973) also reported the beneficial effect of P on growth and yield of wheat crop with the levels upto 110 μg P/g soil.

A significant higher P uptake was observed at 90 μg P/g soil in all the three cultivars. Application of 35 μg P/g soil showed some reduction in the P uptake by wheat plants as compared to 90 μg P/g soil, which was mainly due to lower drymatter production. Distinct variability in total P uptake was not observed. Mean maximum P (24.35 mg/pot) was removed by S-308 followed by HD-1593 (24.30 mg/pot) and HD-4502 (23.09 mg/pot) at 90 μg P/g soil level.

Per cent fertilizer P uptake :

There was an enormous increase in the per cent fertilizer P uptake (Table II) with the first increment in

phosphorus. Application of 135 μg P/g soil also increased the fertilizer P uptake, but the magnitude of increased P uptake was very less. Significant variability was recorded within these three wheat cultivars. S-308 extracted 36 per cent P from fertilizer as against 33 per cent by HD-1593 and 29.50 per cent by HD-4502. This was owing to higher utilization of fertilizer P at lower rate of P application.

Per cent utilization of applied fertilizer :

Per cent utilization of applied P was increased with increasing levels of phosphorus only upto 90 μg P/g soil. It is interesting to note that the per cent utilization of applied fertilizer lowered considerably beyond 90 μg P/g soil, suggesting that the application of the higher doses of phosphorus are not properly utilized by the wheat plants. At higher rate of P application however, the plants were unable to utilize most of the applied nutrient resulting lower recovery. Similar results were also reported by Oomen and Oza (1968) and Sinha (1973). The varietal ability for utilization of applied phosphorus was distinctly observed. S-308 utilized more phosphorus (6.63 per cent) as compared to HD-1593 (5.98 per cent) followed by HD-4502 (4.84 per cent).

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Table I. Drymatter yield (g/pot) of wheat cultivars at varying levels of phosphorus

P Levels ($\mu\text{g/g}$ soil)	Cultivars			Mean
	S-308	HD-1593	HD-4502	
0	2.77	2.18	2.06	2.33
45	4.86	3.48	3.16	3.83
90	8.52	7.85	7.85	8.07
135	6.86	6.50	5.31	6.55
Mean	5.75	5.00	4.84	
	P	V	P x V	
S. E. \pm	0.341	0.295	0.591	
C. D. at 5 %	0.976	0.868	N. S.	

Table II : Per cent P derived from applied phosphate.

P Levels ($\mu\text{g/g soil}$)	Cultivars			Mean
	S-308	HD-1593	HD-4502	
45	26.27	22.85	21.30	23.47
90	40.12	36.73	31.77	36.22
135	45.08	39.27	35.50	38.95
Mean	36.17	32.95	29.52	
	P	V	P x V	
S. E. \pm	0.550	0.550	0.954	
C. D. at 5%	1.650	1.650	N. S.	

Table III : Utilization of applied phosphate by wheat cultivars (Per cent).

Levels ($\mu\text{g/g soil}$)	Cultivars			Mean
	S-308	HD-1593	HD-4502	
45	4.96	4.17	3.22	4.05
90	9.54	8.92	7.31	8.59
135	5.60	4.85	3.94	4.80
Mean	6.63	5.98	4.84	
	P	V	P x V	
S. D. at \pm	0.120	0.120	2.208	
C. D. at 5%	0.367	0.367	N. S.	