

Response of summer irrigated cotton (*Gossypium hirsutum*) to sources, levels and management of phosphorus

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ABSTRACT

A field experiment was carried out during the summer of 1998 and 1999 on sandy clay-loam soil to investigate the response of cotton (*Gossypium hirsutum*) to sources of phosphorus, levels and their management. Application of rock phosphate was equally effective as single superphosphate in cotton. Among the levels tried, an application of recommended dose of 30 kg P_2O_5 /ha resulted in the highest seed-cotton yield of 1,222 kg/ha. Enrichment of phosphorus with farmyard manure and phosphobacterium was found effective in increasing the seed-cotton yield over no enrichment.

Key words : Cotton, Phosphorus, Enrichment, Phosphobacterium

As cotton is a voracious feeder of nutrients, the improvement in the use efficiency will help in reducing the fertilizer input. Among the major nutrients, elemental phosphorus is essential for good boll development. Response to phosphorus application can be obtained even in soils having high available phosphorus status (Tandon, 1987). As the cost of superphosphate, the widely used phosphatic fertilizer, is on the increase, it is essential to go for cheaper sources of phosphorus. The rock phosphate appears to be cheaper alternative source of phosphorus. The use of phosphobacterium, a phosphorus solubilizing bio-fertilizer, in combination with other sources of phosphorus increase the crop yield. Hence present investigation was carried out

to study the response of summer irrigated cotton to sources and levels of phosphorus and their management.

MATERIALS AND METHODS

The field experiment was carried out in the summer of 1998 and 1999 at Cotton Research Station, Srivilliputtur. The soil was sandy clay loam, with pH of 8.3. It was medium in available nitrogen and phosphorus and high in available potassium. The treatments included 2 sources of phosphorus (S_1 , single superphosphate; S_2 , rock phosphate); 3 levels of phosphorus (P_1 , 100% recommended dose (RD); P_2 , 75% RD; P_3 , 50% RD); and 3 management practices (M_1 , no enrichment of P; M_2 , enrichment with FYM; M_3 , enrichment

with FYM and phosphobacterium). Enrichment was done through mixing of the required quantity of phosphorus and well-decomposed and well-powdered farmyard manure and keeping wet by sprinkling little water and keeping them in polythene gunnies for 30 days. Phosphobacterium was soil applied at the time of sowing @ 1,500 g/ha. The required quantity of phosphobacterium was mixed with well-powdered FYM @ 25 kg/ha and was applied in band along the ridges. The test variety was 'SVPR 2'. During both the years the crop was sown on 15 February. The experiments were laid out in split-plot design with 2 replications. All the agronomic practices were carried out except phosphorus application as per the recommendations of the crop production guide. Need-based plant-protection measures were followed.

The growth characters, yield attributes and yield were recorded at harvest and the pooled data were statistically analysed as per Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Growth and yield attributes

Sources and levels of phosphorus and their management practices did not influence the plant height and the number of sympodia. The sources of phosphorus did not influence bolls/plant. Application of recommended dose of phosphorus (30 kg P_2O_5 /ha) recorded significantly more bolls/plant. With progressive decline in the level of phosphorus from 75% recommended dose to 50% recommended dose, there was a corresponding decrease in bolls/plant, but these were at par with each

other. Significant increase in bolls/plant was recorded with enriching phosphorus with farmyard manure and phosphobacterium (18.8/plant), which was comparable with enrichment of phosphorus with farmyard manure alone, indicating the role of organic matter and phosphorus-solubilizing microorganisms in improving the phosphorus availability to cotton, corroborating the results of Singh *et al.* (1983). Mean boll weight was not influenced by the sources of phosphorus. Application of recommended level of phosphorus to cotton resulted in the highest boll weight of 4.10 g/boll. With decreasing phosphorus levels, boll weight also decreased, the least being recorded with 50% recommended dose. Enrichment of phosphorus with farmyard manure and phosphobacterium recorded a mean boll weight of 4.08 g/boll and was comparable with enrichment of phosphorus with farmyard manure alone and significantly superior to the untreated control (no enrichment). The increased boll weight owing to enrichment was the cumulative effect of increased seed index and lint index. Such increase was possible owing to high phosphate content in cotton throughout the boll-development stage (Dastur, 1959). Continued availability of phosphorus in boll-development stage might have been possible owing to enrichment with farmyard manure.

Seed-cotton yield

Seed-cotton yield was not influenced by the sources of phosphorus indicating that the source of phosphorus is of little importance. Non-response to sources of phosphorus by cereals was highlighted by

Table 1. Effect of sources, levels and management of phosphorus on cotton (Pooled mean)

Treatment	Plant height (cm)	Sympodia (No.)	Bolls/plant	Boll weight (g)	Yield (kg/ha)	Seed index	Lint index	Benefit: cost ratio
S ₁	80.3	14.5	17.8	3.78	1,141	6.89	3.42	2.46
S ₂	84.0	14.0	17.4	3.84	1,107	7.59	4.05	2.51
CD	NS	NS	NS	NS	NS	0.4	0.50	
P ₁	84.5	14.7	18.9	4.10	1,222	7.52	3.92	2.52
P ₂	80.9	14.1	17.7	3.82	1,126	7.09	3.91	2.49
P ₃	81.1	13.9	17.2	3.76	1,126	6.86	3.02	2.48
CD	NS	NS	1.2	0.32	85	0.8	0.50	
M ₁	81.1	14.2	17.3	3.60	1,045	6.81	3.44	2.42
M ₂	81.5	14.2	16.9	3.93	1,138	7.01	3.61	2.52
M ₃	83.9	14.5	18.8	4.08	1,185	7.85	4.01	2.56
CD	NS	NS	1.2	0.32	85	0.8	0.50	

Details of treatments are given in text; NS, non-significant

Subbian *et al.* (1991). Highest seed-cotton yield (1,222 kg/ha) was recorded with the application of recommended dose of phosphorus to cotton and was significantly superior to 75% recommended dose and 50% recommended dose which in turn were at par. Enrichment of phosphorus had a definite impact on seed-cotton yield. Enrichment with farmyard manure and phosphobacterium registered the highest seed-cotton yield (1,185 kg/ha) and was comparable with enrichment with farmyard manure alone. Yield response to phosphorus levels and enrichment was due to the cumulative effect of higher number of bolls, boll weight and seed index. Continued availability of phosphorus at recommended level in combination with enrichment might have resulted in good boll development and seed filling as reflected by seed index.

Analysis of return/per rupee invested revealed that application of rock phosphate

is a viable alternative to single superphosphate. Application of recommended level of phosphorus in combination with phosphobacterium and farmyard manure may be followed for higher seed-cotton yield.

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