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Response of summer irrigated cotton *(Gossypium hirsutum)* to phosphorus management

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Abstract: Field experiment was carried out during summer 1999 and 2000 to investigate the response of cotton to sources of phosphorus, levels and their management. The results revealed that application of rock phosphate is equally effective as single super phosphate in cotton. Among the levels tried, application of 100 per cent recommended dose of P_2O_5 (30 kg ha^{-1}) registered the highest mean seed cotton yield of 1660 kg ha^{-1}. Enrichment of phosphorus with farm yard manure and phosphobacterium was found to be effective in increasing the seed cotton yield over no enrichment. *(Key words: Cotton, Phosphorus, Enrichment Phosphobacterium.)*

Cotton is a voracious feeder of nutrients and improvement in enhancing the use efficiency will help in reducing the fertilizer bill. Among the major nutrients, elemental phosphorus is essential for good boll development. Response to phosphorus application can be obtained even in soils having high in available phosphorus status (Tandon, 1987). As the cost of super phosphate - the widely used phosphatic fertilizer is on the increase, it is essential to go for cheaper sources of phosphorus. Use of 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 increases the crop yield. Hence the present investigation was carried out to study the response of summer irrigated cotton to sources of phosphorus, levels and their management.

Materials and Methods

Field experiment was carried out in summer 1999 and 2000 to investigate the response of cotton to sources of phosphorus, levels of phosphorus and phosphorus management at Cotton Research Station, Srivilliputtur. The experimental field was sandy clay loam with pH of 8.3. The soil of the experimental field was medium in available nitrogen and phosphorus and high in available potassium. The treatments include 2 sources of phosphorus (S_1: Single super phosphate; 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 at 1: 10 ratio; M_3: Enrichment with FYM and phosphobacterium). Enrichment was done by thorough mixing of the required quantity of phosphorus and well-decomposed and well powdered farm yard manure and keeping by sprinkling little water and keeping them in polythene gunnies for 30 days. The test variety was SVPR-2. The experiment was laid out in split plot design with two 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 was recorded at harvest and the pooled data was statistically analyzed adopting the procedure of Gomez and Gomez, (1984).

Results and Discussion

Growth and yield attributes

During both the years of study (Table.1 and Table.2), sources of phosphorus, levels and their management practices did not influence the plant height and the number of monopodia and sympodia. The sources of phosphorus did not influence the number of bolls $plant^{-1}$. Application of 100 per cent recommended dose of phosphorus (30 kg P_2O_5 ha^{-1}) recorded significantly more number of bolls $plant^{-1}$. With progressive decline in the level of phosphorus from 75% recommended dose to 50% recommended dose, there was a corresponding decrease in the number of bolls $plant^{-1}$ but were on par with each other. Significant increase in the number of bolls $plant^{-1}$ was recorded with enriching phosphorus with farm yard manure

Table 1. Effect of sources, levels and management of phosphorus on cotton (Summer, 1999)

	Plant height (cm)	Sympodia (No.)	Bolls (No. plant^{-1})	Boll weight (g)	Yield (kg ha^{-1})	Seed Index	Lint Index	BC ratio
S_1	83.0	17.3	15.3	3.29	1450	6.89	3.42	2.51
S_2	85.7	16.5	15.3	3.25	1410	7.59	4.05	2.49
SEd	2.8	0.70	0.22	0.2	20	0.6	0.7	
CD	NS	NS	NS	NS	NS	NS	NS	
P_1	86.3	17.7	16.9	3.36	1610	7.52	3.92	2.52
P_2	82.9	16.9	15.9	3.09	1500	7.01	3.91	2.49
P_3	83.8	16.1	15.3	3.01	1440	6.96	3.27	2.48
SEd	3.5	1.1	0.61	0.07	60	0.9	1.4	
CD	NS	NS	1.2	0.15	120	NS	NS	
M_1	82.0	16.3	14.3	3.01	1360	6.98	3.44	2.42
M_2	83.1	17.6	15.5	3.08	1470	7.01	3.32	2.52
M_3	88.0	16.9	16.2	3.24	1540	7.43	3.37	2.56
SEd	3.5	1.1	0.61	0.07	60	0.9	1.4	
CD	NS	NS	1.2	0.15	120	NS	NS	

NS: Non significant

Table 2. Effect of sources, levels and management of phosphorus on cotton (Summer, 2000)

	Plant height (cm)	Sympodia (No.)	Bolls (No. plant^{-1})	Boll weight (g)	Yield (kg ha^{-1})	Seed Index	Lint Index	BC ratio
S_1	91.3	13.2	23.2	3.31	1661	6.91	3.39	2.42
S_2	94.1	12.7	22.5	3.21	1637	7.60	4.01	2.41
SEd	1.9	0.6	0.21	0.03	44	0.61	0.69	
CD	NS	NS	NS	NS	NS	NS	NS	
P_1	93.6	12.8	23.7	3.38	1709	7.49	3.89	2.43
P_2	91.6	12.8	18.0	2.98	1640	6.99	3.90	2.40
P_3	92.9	13.2	19.6	3.00	1504	6.94	3.27	2.39
SEd	2.3	11	0.59	0.08	68	0.88	1.38	
CD	NS	NS	1.20	0.16	137	NS	NS	
M_1	92.2	11.8	20.5	2.96	1503	6.96	3.47	2.34
M_2	93.1	13.2	21.6	3.09	1681	6.99	3.37	2.44
M_3	93.9	12.1	22.5	3.24	1749	7.46	3.37	2.47
SEd	2.3	1.1	0.59	0.08	68	0.88	1.38	
CD	NS	NS	1.20	0.16	137	NS	NS	

NS: Non significant

and phosphobactenium (16.2 and 22.5 No. plant^{-1} respectively in 1999 and 2000) and was comparable with enrichment of phosphorus with farm yard 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 registered the highest boll weight of 4.10 g/ boll. With decreasing phosphorus levels, boll weight also decreased with the least being recorded with 50% recommended dose. Enrichment of phosphorus with farm yard manure and phosphobacterium recorded a mean boll weight of 4.08g /boll and was comparable with enrichment of phosphorus with farm yard manure alone and were significantly superior to untreated control (no enrichment). The increased boll weight due to enrichment was the cumulative effect of increased seed index and lint index. Such increase was possible due 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 due to enrichment with phosphobacterium and farm yard manure.

Seed cotton yield

Seed cotton yield was not influenced by the sources of phosphorus indicating that the sources of phosphorus is of little importance. Non response to sources of phosphorus by cereals was highlighted by Subbian *et al.* (1991). The results indicated that rock phosphate is an alternate source of P to cotton. Highest seed cotton yield was recorded with the application of 100 per cent recommended dose of phosphorus to cotton during both the years and was comparable with 75 per cent recommended dose and was significantly superior to 50 per cent recommended dose of phosphorus. Enrichment of phosphorus had a definite impact on seed cotton yield. Enrichment with farm yard manure and phosphobacterium registered the highest seed cotton yield of 1540 and 1749 kg ha^{-1} respectively during 1999 and 2000 and was comparable with enrichment with farm yard 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 returns per rupee invested revealed that application of rock phosphate is a viable alternative to single super phosphate. Application of recommended level of phosphorus in combination with phosphobacterium and farm yard manure can be advocated for higher seed cotton yield.

References

Dastur, R.H. (1959). Physiological studies on the cotton crop and their practical applications, pp70-73. Scientific monograph. No.3. Indian Central Cotton Committee, Bombay.

Gomez, K.A. and Gomez, A.A. (1984). Stastistical procedures for agricultural research, p.680 IRRI Philippines.

Singh, B., Sharma, K.N., Rana, D.S., Sodk, G.S. and Kapur, M.L. (1983). Available P and K and soil organic matter content as influenced by long term application of fertilizers and FYM to wheat-maize rotation. *J. Indian Soc. of Soil Sci.* **81**: 49

Subbian, P., Premsekar, M. Thangamuthu, G.S. and Palaniappan, S.P. (1991). Effect of different levels and sources of phosphorus fertilization on a cereal based crop sequence. *Indian J. Agron.* **36**: 580-582.

Tandon, H.L.S. (1987). Phosphorus research and agricultural production in India, ppl66. Fertilizer Development and Consultation Organization, NewDelhi.

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