

## Comparative efficacy of different sources and doses of phosphorus on the growth attributes and nodulation of Chickpea in Rice-Chickpea cropping sequence

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### ABSTRACT

The invention was carried out to study the response of chickpea cv. Mahamaya – I to the rock phosphate, single super phosphate and phosphate solubilizers. The results revealed that the residual effect of rock phosphate along with phosphate solubilizers proved significantly superior to residual effect of single super phosphate with respect to plant height, dry matter accumulation and dry root weight. The residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate and phosphate solubilizing bacteria, applied to *kharif* rice, gave the maximum plant height, dry matter accumulation and nodulation of chickpea.

**Key Words :** Rice, chickpea, phosphorus, PSB, growth attributes and nodulation.

In Indian agriculture, phosphorus (P) is second in importance next to nitrogen (N). Its deficiency and non-availability is wide spread because of high P fixing capacity. This calls for application in high amount to compensate the crop removal and fixation by soil. At present, water soluble P sources like diammonium phosphate (DAP) and single super phosphate (SSP) are being widely used which are costly and require import of sulphuric acid for production. Recently emphasis has been laid to the possibilities of greater utilization of low cost, indigenously available rock phosphate sources and making it more efficient by addition of P solubilizing micro-organisms and organic and chemical amendments. However, there is a need to generate more research information on use of rock phosphate and phosphate solubilizing bacteria in chickpea. Keeping these views in mind the present investigation was carried out to study the residual effect of different doses and sources of P and phosphate solubilizers on growth and nodulation of chickpea.

### MATERIAL AND METHODS

A field experiment was carried out during winter season of 2004 – 05 and 2005 – 06 at Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Nadia (West Bengal) under irrigated condition. The soil was clay loam with pH – 7.5, having 0.050% and 0.052% available N ha<sup>-1</sup>, 20.00 and 21.25 kg P ha<sup>-1</sup> and 150.35 and 152.76 kg K ha<sup>-1</sup> during 2004 – 05 and 2005 – 06 respectively. The design of the experiment was split plot with 10 main plot treatments (residual effect of 10 treatments applied in *kharif* rice viz. T<sub>1</sub> – 0 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, T<sub>2</sub> – 0 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> + PSB, T<sub>3</sub> – 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP, T<sub>4</sub> – 30 kg

P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate, T<sub>5</sub> – 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP + PSB, T<sub>6</sub> – 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate, + PSB, T<sub>7</sub> – 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP, T<sub>8</sub> – 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate, T<sub>9</sub> – 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP + PSB and T<sub>10</sub> – 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate + PSB) and 2 subplot treatments (PSB<sub>0</sub> – No application of PSB and PSB<sub>1</sub> – application of PSB through seed treatment). Vermicompost was applied @ 10 q ha<sup>-1</sup> at the time of final land preparation. Mixture of *Bacillus polymyxa* and *Pseudomonas striata* was applied as phosphate solubilizing bacteria as seed treatment. Observations were recorded on five randomly selected plants at different dates of observation and at harvest.

### RESULTS AND DISCUSSION

#### Growth attributes

##### Plant height

The data presented in Table – 1 revealed that the residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate along with PSB gave the maximum plant height at all the dates of observations. The interaction effect between the m.height significantly where PSB was applied in previous season.

##### Dry matter accumulation

Maximum dry matter accumulation was found with the residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate + PSB. The increase in dry matter production with P solubilizers along with rock phosphate might be due to better nodulation of chickpea (Table –1) owing to better availability of P. the improvement in nodulation might have resulted in higher amount of nitrogen fixation and there by better vegetative growth and dry matter production. This result corroborated with the findings of Mukherjee and Rai, 2000.

**Table 1. Growth attributes and nodulation in chickpea as influenced by different treatments (pooled data)**

Treatments	Plant height at harvest (cm) (g m <sup>-2</sup> )	Dry matter accumulation at harvest (g m <sup>-2</sup> )	Root Dry weight at harvest	No. of nodules/plant		Nodule dry weight (mg)	
				30 DAS	60 DAS	30 DAS	60 DAS
T <sub>1</sub>	34.55	277.03	12.36	9.79	20.54	12.18	39.78
T <sub>2</sub>	34.22	289.32	12.86	9.89	20.45	13.95	40.03
T <sub>3</sub>	42.39	327.78	16.74	12.97	24.24	19.58	45.10
T <sub>4</sub>	45.02	337.78	17.78	14.03	25.28	22.42	46.46
T <sub>5</sub>	43.74	342.03	18.46	14.02	24.68	23.01	47.00
T <sub>6</sub>	45.46	345.88	19.94	14.76	25.95	24.46	48.31
T <sub>7</sub>	49.43	367.19	22.49	15.13	26.32	26.63	52.82
T <sub>8</sub>	50.17	373.95	23.47	16.05	29.23	27.14	56.11
T <sub>9</sub>	49.95	374.63	23.82	15.97	27.24	28.68	56.87
T <sub>10</sub>	51.22	383.89	24.65	16.84	30.67	28.37	59.62
SEm (±)	0.424	13.50	1.80	1.08	1.05	0.656	1.27
C.D at 5%	1.26	40.11	5.37	3.21	3.11	1.95	3.77
P.S.B levels	-	-	-	-	-	-	-
PSB <sub>0</sub>	43.45	333.43	18.09	13.13	24.28	20.70	46.89
PSB <sub>1</sub>	45.78	350.46	20.42	14.77	26.63	24.38	51.40
SEm (±)	0.677	5.52	0.589	0.407	0.676	0.737	0.707
C.D at 5%	1.99	16.23	1.75	1.21	2.01	2.19	2.10
Interaction	Sig	Sig	Sig	Sig	Sig	Sig	Sig

T<sub>1</sub> – Residual effect of 0 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, T<sub>2</sub> – Residual effect of 0 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> + PSB, T<sub>3</sub> – Residual effect of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP, T<sub>4</sub> – Residual effect of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate, T<sub>5</sub> – Residual effect of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP + PSB, T<sub>6</sub> – Residual effect of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate + PSB, T<sub>7</sub> – Residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP, T<sub>8</sub> – Residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate, T<sub>9</sub> – Residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP + PSB, T<sub>10</sub> – Residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate + PSB.

### Root dry weight

The maximum root dry weight was recorded with the residual effect of 60 kg P<sub>2</sub>O<sub>5</sub>/ha as rock phosphate along with PSB (Table –1). This could be due to increased availability of phosphorus through the solubilization of fixed phosphorus by *Pseudomonas striata* and *Bacillus polymyxa*.

### Nodulation

Both the number and weight of nodules were maximum with the residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as rock phosphate along with PSB at 30 and 60 DAS (Table –1). This might be due to greater availability of nutrients for bacterial population, nitrogen fixation and crop growth with this treatment. This result corroborated with the findings of Joseph and Sawarkar (1999).

Therefore the residual effect of rock phosphate @ 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> along with PSB is better than the residual effect of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> as SSP with or without PSB with regards to growth of chickpea crop. Application of PSB is not necessary when it was applied in previous season.

### REFERENCES

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