EFFECT OF *RHIZOBIUM* INOCULATION TO DIFFERENT VARIETIES OF GARDENPEA (*Pisum sativum* L.)

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ABSTRACT

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A pot experiment was carried out at the net house of Soil Science Division, BARI, Joydebpur, Gazipur during rabi season of 2005-2006 and 2006-2007 to find out the response of inoculation with different plant genotypes of gardenpea. Three varieties of gardenpea viz. BARI Motorshuti-1, BARI Motorshuti-2, BARI Motorshuti-3 and rhizobial inoculum (BARI RPs-502) were used in this experiment. Each variety was tested with and without inoculation. Inoculated plants gave significantly higher nodule number, nodule weight, root weight, shoot weight, stover yield and seed yield compared to non-inoculated plants. Among the three varieties, BARI Motorshuti-1 produced the highest yield in both the years. The seed yield of variety BARI Motorshuti-1 were 35% and 31% higher for inoculated plants compared to uninoculated ones for the years 2005-06 and 2006-07, respectively.

Key words: *Rhizobium*, varieties of gardenpea, nodulation formation

INTRODUCTION

Gardenpea (*Pisum sativum* L.) is a protein rich vegetable grown in Bangladesh. It belongs to the family *Fabaceae* and is capable of using atmospheric nitrogen. However, per hectare yield of garden pea in Bangladesh is very low. The high demand of pea can only be meet up by increasing its per hectare yield. This can be done by many ways of which the most important are the introduction of high yielding varieties and judicious application of fertilizer along with bio-fertilizer. Garden pea is one of the winter beans in Bangladesh. Though the cultivated area is small but it has a wide scope for cultivation in Bangladesh (BBS, 2004). There is a great possibility to increase production of gardenpea by exploiting better colonization of their root and rhizosphere through rhizobial inoculation, which can fix atmospheric nitrogen and protect nature from pollution.

According to Vincent (1974) *rhizobium* inoculation is necessary in soil where the rhizobia are ineffective or where they are absent or sparse. Bangladesh Agricultural Research Institute has been developing a good number of varieties of gardenpea. Some of these varieties are waiting for cultivation in the farmer's level but were not screened in respect to nodulation, nitrogen fixation and as well as yield. Experiment evidences showed that Phosphorus and Potassium was very much beneficial for boosting up production of pea (Pershak and Tishchenko, 1987 and Singh *et al*., 1992b). Using high yielding varieties/advanced lines of gardenpea in combination with effective rhizobial strains along with management practices including manures and fertilizers can enhance the yield. The present investigation was undertaken to study the response of inoculation with different plant genotypes and to find out the effective plant genotypes of gardenpea with rhizobial inoculation.

MATERIALS AND METHODS

Gardenpea was sown on 11 and 05 November 2005 and 2006, respectively at the net house of Soil Science Division BARI, Joydebpur, Gazipur**.** Three varieties of gardenpea viz. BARI Motorshuti-1, BARI Motorshuti-2, BARI Motorshuti-3 and rhizobial inoculum (BARI RPs-502) were used in this experiment. Peat based rhizobial inoculum was used containing 10^8 cell g^{-1} inoculum. Ten kg of silted soils from the bank of Turag River at Kodda, Gazipur mixed with cowdung at 5:1 ratio was used per pot as the potting media. The soil was analyzed for physico-chemical properties (Hunter, 1984) and the native rhizobial population (Miles and Misra, 1938).The general characteristics of pot soil are given in Table 1. The experiment was designed in RCBD having 5 replications in each treatment.

During the course of the experiment, growth and developments of plants in the pot were carefully observed. Intercultural operations and other management practices were done as per requirements. Plants along with roots were collected at 50% flowering stage from each pot and dry weight of roots, shoots and nodules including nodule numbers were recorded. Plants were harvested on 28 and 13 February 2006 and 2007, respectively. Dry weight of stover and seed for each plant were also recorded. The collected data were then analyzed statistically.

Table 1. Physical and chemical properties of the soil used as potting media

Soil variable	Content	Critical level
Texture	Sandy clay loam	
pH	7.4	
Organic matter (%)	0.53	
Total N (%)	0.03	
Avaiable P (ppm)	11.0	14
Exchangeable K (meq/100g)	0.15	0.2
Exchangeable Ca (meq/100g)	3.80	2.0
Exchangeable Mg (meq/100g)	1.10	0.8
Available Zn (ppm)	2.50	2.0
Available Cu (ppm)	2.10	1.0
Available Fe (ppm)	35	10
Available Mn (ppm)	11	5.0

RESULTS AND DISCUSSION

Effect of variety

Results on effects of different varieties on nodule number plant^{-1}, nodule weight (mg plant^{-1}), root weight (g plant^{-1}), shoot weight (g plant^{-1}), stover yield (t ha^{-1}) and seed yield (t ha^{-1}) have been presented in Table 2. Among the 3 varieties studied, BARI Motorshuti-1 gave the significantly higher nodule number (15.8 plant^{-1}) and nodule weight (163 mg plant^{-1}) in the year 2005-06. But in 2006-07, BARI Motorshuti-2 gave the significantly higher nodule number (24.4 plant^{-1}) and nodule weight (365 mg plant^{-1}). Root weight, shoot weight and stover yield were recorded the highest in the variety BARI Motorshuti-2 for both the year. The highest seed yield (1.06 t ha^{-1}) and (1.35 t ha^{-1}) were also recorded in BARI Motorshuti-1 for the year 2005-06 and 2006-07, respectively.

Table 2. Effects of different varieties on nodulation, growth and yield of gardenpea

Variety	Year	Nodule no. plant^{-1}	Nodule weight (mg plant^{-1})	Root weight 50 DAS (g plant^{-1})	Shoot weight 50 DAS (g plant^{-1})	Stover yield (t ha^{-1})	Seed yield (t ha^{-1})
BARI Motorshuti-1		15.8a	163a	0.169a	1.79	1.32b	1.06a
BARI Motorshuti-2		14.7a	143b	0.172a	2.52	1.81a	0.91a
BARI Motorshuti-3	2005-06	3.60b	65c	0.085b	1.56	0.65c	0.47b
SE(±)		0.735	8.32	0.008	NS	0.204	0.147
BARI Motorshuti-1		16.9 b	296 b	0.14 b	1.42 b	1.32 b	1.35 a
BARI Motorshuti-2		24.4 a	365 a	0.20a	2.05 a	1.82 a	1.02 b
BARI Motorshuti-3	2006-07	6.80 c	78 c	0.08c	0.73 c	0.86 c	0.68 b
SE(±)		1.727	0.445	0.004	0.019	2.713	0.023

Means followed by common letter are not significantly different at 5% level by DMRT

Effect of inoculation

Results on effects of rhizobial inoculation on nodule number plant^{-1}, nodule weight (mg plant^{-1}), root weight (g plant^{-1}), shoot weight (g plant^{-1}), stover yield (t ha^{-1}) and seed yield (t ha^{-1}) have been presented in Table 3. Inoculated plants gave significantly higher nodule number (14.2 plant^{-1}), nodule weight (167 mg plant^{-1}), root weight (0.157 g plant^{-1}), shoot weight (2.08 g plant^{-1}) and higher seed yield (1.03 t ha^{-1}) in the year 2005-06. The similar trend was recorded in the year 2006-07. The results are in agreements with the results of Singh *et al.* (1992a and 1992b), Eusuf Zai *et al.* (1999), Khanam *et al.* (1999) and Bhuiyan *et al.* (2001) who worked on lentil, mungbean and garden pea.

Table 3. Effects of rhizobial inoculant on nodulation, growth and yield of gardenpea

Inoculant	Year	Nodule no. plant^{-1}	Nodule weight (mg plant^{-1})	Root weight 50 DAS (g plant^{-1})	Shoot weight 50 DAS (g plant^{-1})	Stover yield (t ha^{-1})	Seed yield (t ha^{-1})
Uninoculated		9.13b	108b	0.127b	1.82b	1.12b	0.60b
Inoculated	2005-06	14.2a	167a	0.157a	2.08a	1.57a	1.03a
SE(±)		0.60	8.23	0.006	2.70	0.166	0.04
Uninoculated		14.1 b	202 b	0.13 b	1.24 b	1.30 b	0.92 b
Inoculated	2006-07	18.0 a	291 a	0.15 a	1.56 a	1.36 a	1.12 a
SE(±)		1.41	0.363	0.003	0.003	2.22	0.018

Interaction effects

Results on interaction effects of different varieties and rhizobial inoculation have been presented in Table 4. All the varieties of gardenpea, receiving rhizobium inoculum produce higher nodule number plant^{-1}, nodule weight (mg plant^{-1}), shoot weight (g plant^{-1}), stover yield (t ha^{-1}) and seed yield (t ha^{-1}) over uninoculated plants. The highest nodule number (19.4 plant^{-1}) was recorded in the BARI Motorshuti-1 for the year 2005-06. In the year 2006-07, it was recorded (30.2 plant^{-1}) for inoculated BARI Motorshuti-2. Shoot weight and stover yield were also recorded higher in the inoculated BARI Motorshuti-2 for both the year. In case of seed yield the highest seed yield (1.32 t ha^{-1} and 1.53 t ha^{-1}) were observed in inoculated BARI Motorshuti-1 in the year 2005-06 and 2006-07, respectively, which was 35% and 31% higher over uninoculated plants. Similar results are found by many workers like Das *et al.* (1997 and 1999), Eusuf Zai *et al.* (1999), Khanam *et al.* (1999) and Bhuiyan *et al.* (2001) who worked on lentil, mungbean and garden pea.

Table 4. Interaction effects of different varieties and rhizobial inoculant on nodulation, growth and yield of gardenpea

Treatment	Year	Nodule no. plant^{-1}	Nodule weight (mg plant^{-1})	Shoot weight 50 DAS (g plant^{-1})	Stover yield (t ha^{-1})	Seed yield (t ha^{-1})	% yield increase over control
BARI Motorshuti-1xU		12.2	140	1.34	1.20	0.84	-
BARI Motorshuti-1xI		19.4	186	1.77	1.87	1.32	35.0
BARI Motorshuti-2xU		13.4	128	2.35	1.70	0.76	-
BARI Motorshuti-2xI	2005-06	16.0	168	2.68	1.92	1.06	28.3
BARI Motorshuti-3xU		2.4	48	1.76	0.45	0.39	-
BARI Motorshuti-3xI		4.4	82	1.81	0.86	0.54	27.0
SE (±)		NS	NS	NS	NS	NS	
BARI Motorshuti-1xU		16.2	268	1.16	1.28	1.17	-
BARI Motorshuti-1xI		17.6	324	1.68	1.35	1.53	31.0
BARI Motorshuti-2xU		18.6	291	1.95	1.78	0.91	-
BARI Motorshuti-2xI	2006-07	30.2	440	2.15	1.87	1.13	13.3
BARI Motorshuti-3xU		4.1	47	0.63	0.83	0.59	-
BARI Motorshuti-3xI		6.3	110	0.82	0.89	0.76	29.0
SE (±)		NS	NS	NS	NS	NS	

U=Uninoculated, I=Inoculated, NS=Not significant

Overall results revealed that the variety BARI Motorshuti-1 showed better performance among the three varieties. The *Rhizobium* strain BARI RPs-502 is suitable for all the varieties. Because it proved its efficiency in nodulation, plant growth and yields equally in all the varieties.

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