Indian Journal of Hill Frmg 16 (1&2) : 77-81 (2003)

EFFECT OF COMBINATION OF INORGANIC N AND RHIZOBIUM CULTURE ON YIELD, AVAILABLE N STATUS IN SOIL AND ECONOMIC VIABILITY OF PEA (*PISUM SATIVUM*)

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ABSTRACT

A field experiment was conducted during (1999-2001) and 2000-01 in *rabi* season to judge the performance or rhizobium biofertilizer in combination with inorganic urea N on green and yield of per crop, available N status in soil at harvest of pea and economic viability in per that inoculation of pea seeds with rhizobium culture and application of 15 Kg N/ha as urea not only fetch higher production of green pods, but also increased nodulation, reduced cost over the recommended dose of 20kg urea N/ha, increased income and enhanced ruturn per rupee invested on nutrient N.

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the most important pulse vegetable crops. It is commercially cultivated in tropical, subtropical and temperate parts of the country for its green pods as well as grains (choudhury, 1987). Rhizobium is a nitrogen fixing bacteria living in symbiotic association with root nodules of many leguminous crops. These bacteria can fix 50-300 Kg atmospheric N/ha/season for the benefit of the plant in which they live. It increases the crop productivity by 10 to 60% and replaces 50% of chemical nitrogen requirement of the crop. Patel and Paul (1985) observed that legumes in intercropping systems modify the response of succeeding cereals to nitrogen due to their restorative effects on soil N. Pea is a leguminous crop and as such responds to application or rhizobium culture. The present investigation was designed to study the role of rhizobium biofertilizer in combination with inorganic N on yield, residual available N content in soil and economic viability of use of combinations of rhizobium culture with urea N in pea.

MATERIALS AND METHODS

A field experiment was conducted at Horticultural Reseach Station, Assam Agricultural University, Kahikuchi, during rabi season of 1999-2000 and 2000-01. The initial soil samples of the experimental soil was found to be sandy loam in texture, slightly acidic in reaction (PH 5.20), high in organic carbon content (0.78%) and available N (278 Kg/ha), P_2O_5 (34 Kg/ha) and K_2O (291 Kg/ ha). The experiment was laid in a randomized block design with four replications and six treatments as under:

T_0 = No - N + no rhizobium (control)

T_1 = No - N + rhizobium (@ 1 kg/ha)

T_2 = 5 Kg N/ha + rhizobium (@ 1 Kg/ha)

T_3 = 10 Kg N/ha + rhizobium (@ 1 kg/ha)

T_4 = 15 Kg N/ha + rhizobium (@1 Kg/ha)

T_5 = 20 Kg N/ha (recommended) as standard check

The recommended dose of P_2O_5 (46 Kg/ha), K_2O (10 Kg/ha). FYM (10 t/ha) and urea N as per treatment was applied as basal dose to each treatments. Seeds of pea were uniformly coated with the slurry of rhizobium culture and the treated seeds were allowed to dry in shade for about half an hour. After drying, the treated seeds were sown at a spacing of 30 cm × 10 cm in the month of November, 1999. A light irrigation was done in three days after sowing due to prevailing drought conditions. The plucking of matured green pod started in January and ended in the last part of March. Records on average seeds per pod and pod length were taken from a sample of 10 pods in each treatment and each harvest. Average nodulation per plant was also counted from each treatments. The soil samples after harvest of pea in each year was collected for analysis of available N content in soil (Jackson, 1973). The economic viability of rhizobium culture in combinations with urea N in pea crop was estimated by deducting cost of additional produce from the additional income over the control.

RESULTS AND DISCUSSION

The green pod yield of pea was significantly influenced by the inoculation of pea seeds with rhizobium culture and application of N levels in both the years. The maximum green pod yield of pea was found to be significantly highest with application of 15 Kg N/ha as urea in combination with rhizobium during both the seasons (Table 1). The yield, seeds/pod and pod length increased with increasing levels of N combined with rhizobium biofertilizer, which however, decreased at the recommended level of 20 Kg N/ha alone during both the years. It was also noticed that the yield and other characters were higher in the second year than the first year in all the treatments, due to relatively less drought condition.

Results on the status of available N in soil after harvest of pea crop (Table 2) indicated that seed inoculation when combined with 10 to 15 Kg urea N/ha and application of 20 K urea N/ha alone was at par, and failed to bring any difference in soil N content. All the three treatments resulted in more that 18% increase in available soil N content after harvest. The highest yielding treatment 15 Kg N/ ha + rhizobium could not prove its superiority to the other treatments probably due to higher yield of green pods which might have increased the plant uptake. The value of available N in soil was more in the second year that that in the first year. Application or rhizobium in combination with 15 Kg urea N/ha produced the highest nodules/plant during both the years, while application of 20 Kg urea N/ha produced similar nodules with those of rhizobium alone (Table 2). This clearly indicates the importance of rhizobium in encouraging nodulation in pulses, with great impact on soil fertility improvement and production of the succeeding crop.

The additional yield over control was the highest in urea N @ 15 Kg/ha + rhizobium (17.4 qt/ha) and even higher that the standard check (9.21 qt/ha). while the cost of production over control was the highest with the recommended practice of 20 Kg urea N/ha (Table 3). The additional income either over control or over standard check was the highest with application of 15 Kg urea N/ha along with rhizobium culture. The return per rupee invested on nutrient (N) for additional production over control was the highest (Rs. 45.39) with the same treatment as above. Similarly the same treatment of 15 Kg urea N/ha combined with rhizobium resulted in increase of Rs. 24.02 per rupee invested on nutrient N over the standard check.

It may therefore be concluded that inoculation of pea seeds with rhizobium and application of 15 Kg N/ha as urea not only fetch higher production of green pods, but also increases nodulation,

reduces cost over the recommended dose of 20 Kg N/ha, increases income and enhances return per rupee invested on nutrient N.

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Table 1. Effect of rhizobium biofertilizer in combination with urea N on yield and other characters of pea crop.

Treatments	Yield of pea (q/ha)		No. of seeds /pod		Pod length (cm)	
	1999-2000	200-2001	1999-2000	2000-2001	1999-200	2000-2001
No - N + no rhizobium	43.8	44.3	5.6	5.9	7.6	7.9
No - N + rhizobium	44.2	44.6	6.0	5.9	7.9	8.0
5 - Kg N/ha + rhizobium	46.50	47.7	6.0	6.11	8.62	
20 - Kg N/ha (recommended)	52.5	52.0	6.0	5.9	9.5	9.7
CD (0.05)	3.8	2.4	NS	0.5	0.8	0.6

Table 2. Root nodulation of pea crop as affected by rhizobium and status of available soil N at harvest of pea crop

Treatments	No. of nodules/plant		Available N status In soil after harvest of pea (Kg/ha)		Increase of available N in soil over initial (Kg/ha)		Percent increase over initial N status	
	1999-2000	200-2001	1999-2000	2000-2001	1999-200	2000-2001	1999-2000	2000-2001
No - N + no rhizobium	11.5	14.7	288.8	290.7	10.8	12.7	3.9	4.6
No - N + rhizobium	12.2	15.9	294.3	295.0	16.3	27.0	5.5	9.7
5 Kg N/ha + rhizobium	17.9	19.3	301.9	307.7	23.9	29.7	8.6	10.7
15 Kg N/ha + rhizobium	24.3	31.0	328.6	323.4	50.6	51.4	18.2	18.5
20 Kg N/ha (recommended)	14.4	15.3	329.4	330.7	51.4	52.7	18.5	18.9
CD (0.05)	4.4	3.6	13.1	7.2				

* Initial available N status in soil 278.00 Kg/ha.

Table 3. Economic viability of inorganic N and rhizobium biofertilizer in pea crop

Treatments	Treatment wise average yield (qt/ha) (2 years)	Additional yield (qt/ha) over		Cost of production (Rs.) over		Additional income (Rs.) over		Return/Rs. invested for additional production (Rs.)	
		control	Standard check	Control	Standard check	Control	Standard check	Control	Standard check
No - N + no rhizobium	44.1	-	-	-	-	-	-	-	-
No - N + rhizobium (1 Kg/ha)	44.4	0.3	-	50.0	-	180.0	-	3.60	-
5 Kg N/ha + rhizobium (1 Kg/ha)	45.4	1.4	-	110.0	-	828.0	-	7.52	-
10Kg N/ha + rhizobium (1 Kg/ha)	47.1	3.1	-	170.0	-	1836.0	-	10.80	-
15 Kg N/ha + rhizobium (1 Kg/ha)	61.6	17.4	9.2	230.0	230.0	10440.0	5526.0	45.39	24.02
20 Kg N/ha (recommended)	52.2	8.2	-	240.0		4914.0	-	20.48	-

*cost of production relates to cost of nutrient N only.
** Income relates to price of out put only.