

NODULATION, GROWTH AND SEED YIELD OF MOONG IN RESPONSE TO RHIZOBIUM INOCULATION AND APPLICATION

BY

T. K. BASU, A. K. BARUI AND S. BANDYOPADHYAY

Nodule Research Laboratory, Bidhan Chandra Krishi Viswavidyalaya
Mohanpur, West Bengal, India

Pot trials were conducted taking ten different strains of *Rhizobium* in order to select most efficient ones for moong (B₁ variety) having good nodulation ability. Two such strains namely, JCa-1 and M-10 were selected for field experiment. The field experiment was carried out during rainy season of 1988 in the District Seed Farm, Kalyani, West Bengal in order to study the effect of inoculation and of nitrogen on the nodulation, dry matter accumulation and seed yield of moong. Inoculation with *Rhizobium* strain in general significantly increased number and weight of nodules, dry weight of shoot and seed yield of moong. Between the two inoculants JCa-1 strain was superior to M-10 strain in respect of nodulation, shoot dry weight and yield. Application of nitrogen increased yield over control upto 30 kg N/ha beyond which it decreased.

Key words : Rhizibium, Nodulation, Strain, Nitrogenase activity

INTRODUCTION

Among the grain legumes moong (*Vigna radiata* (L) Wilezek) is grown during kharif season. It is a good source of high quality protein. Hectare yield of grain legumes can be increased through use of improved better yielding varieties, timely sowing, application of fertilizer and irrigation with scientific water management practices. Influence of fertilizers on yield and its components of green gram (Gowda and Gowda, 1978), effect of nitrogen on the yield of green gram (Nagre, 1982) have been reported. Singh *et al.* (1975) reported increase in yield of pulse crop with the application of starter dose of nitrogen. Inoculation with *Rhizobium* culture influences growth of moong (Srivastava and Varma, 1981 and 1982), yield and yield components of legumes (Sharma *et al.*, 1981; Sharma and Singh, 1986). *Rhizobium* inoculation along with the basal application of 15 kg N/ha as starter dose increased the nodule formation and nitrogen assimilation in grain (Raju and Varma, 1984).

In the present investigation the effect of *Rhizobium* inoculation along with application of nitrogen as a starter dose on the growth, nodulation and yield of moong has been investigated.

MATERIALS AND METHODS

The investigation was carried on in kharif season of 1988 on a silt loam soil with 6.2 pH under low topographical situation with good drainage facility at District Seed Farm of the Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal. The farm was situated at 23.5°N latitude and 89°E longitude with an average altitude of 9.75 metre above the mean sea level.

Prior to conducting the field experiment, pot culture experiment was carried out at Nodule Research Laboratory, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur. M-10 and JCa-1 were found to be efficient *Rhizobium* strains and both were selected for the field experiment.

The experiment was laid out in Randomised Block Design, with three replication. The plot size was 3 m x 2 m. B₁ variety of moong was used. For seed bacterization, seeds were sprinkled with water and then mixed with inoculum powder (Charcoal powder used as carrier of the *Rhizobium*). Doses of nitrogen, applied in this experiment, were 10 kg, 20 kg, 30 kg and 40 kg of N/ha. Control plots were maintained in case of nitrogen application as well as *Rhizobium* strains inoculation also.

In case of seed rate (15 kg/ha) spacing (20 cm apart from one line to another) crop management, harvesting and threshing, normal agronomical practices were followed. No irrigation was given as this crop was grown in kharif season.

Biometrical observations were recorded on the basis of average nodule number per plant, dry weight of nodule per plant, shoot and root length per plant and dry weight of shoot per plant.

Seed yield in quintal per hectare was calculated from the yield data those were obtained from the net plot harvested.

RESULTS AND DISCUSSION

Effect on nodular number

Data presented in the Table 1 showed that inoculation with *Rhizobium* significantly increased nodulation over control. Inoculation with JCa-1 strain was found to be most efficient and it produced about double numbers of nodules than that produced by either control or M-10 strain. M-10 strain produced significantly higher number of nodule over control. Similar observations were made by Gupta *et al.*, (1976).

Significant influence of N-fertilization on nodulation was observed (Table 2). Number of nodules per plant increased from 21.63 at control to 27.02 at 20 kg N/ha after which the number decreased and 40 kg N/ha gave the minimum nodulation which was significantly lower than control. Application of nitrogen increased root length and total root surface, which might have been the reason for increased nodulation. At higher doses due to availability of sufficient nitrogen

Table 1. Effect of *Rhizobium* inoculation on growth, nodulation and seed yield of moong.

Rhizobium	Shoot length (cm)	Root length (cm)	Dry wt. of shoot/plant (g)	No. of nodules/plant	Dry wt. of nodules/plant (g)	Seed yield (q/ha)
No Rhizobium	46.69	11.51	2.74	21.71	0.017	7.99
JCa-1	46.88	11.88	3.48	42.86	0.024	9.17
M-10	46.80	11.40	2.95	24.86	0.020	8.75
S. Em $\pm$	0.171	0.494	0.048	0.241	0.0004	0.137
C.D. at 5%	N S.	N.S.	0.13	0.69	0.0012	0.40

Table 2. Effect of levels of nitrogen on growth, nodulation and yield of moong.

Levels of nitrogen	Shoot length (cm)	Root length (cm)	Dry wt. of shoot/plant (g)	No. of nodules/plant	Dry wt. of nodules/plant (g)	Seed yield (q/ha)
0	42.80	10.60	1.845	21.63	0.019	7.00
10	43.91	10.70	2.220	24.26	0.019	8.26
20	48.37	12.50	3.090	27.02	0.021	9.15
30	48.93	12.82	4.270	23.08	0.020	9.78
40	47.94	11.37	3.860	19.16	0.017	9.00
S.Em $\pm$	0.220	0.637	0.108	0.311	0.0005	0.177
C.D. at 5%	0.64	N.S.	0.31	0.90	0.0015	0.51

from outer source nodulation was probably less. Similar results were recorded by Singh (1977) and Raju and Varma (1984).

Effect on dry weight of nodule

Dry weight of nodules per plant increased significantly with inoculation over control. Significant difference was observed between the two strains with regard to dry weight of nodules per plant, JCa-1 strain being superior to M-10 strain. This has conformity with the findings of Rai and Singh (1978) and Srivastava and Varma (1982).

Significant influence of application of nitrogen (Table 2) on the dry weight of nodules per plant of moong was observed over control. Dry weight of nodules per plant showed significant difference among nitrogen levels. Forty kg N/ha recorded significantly lower than control. Ten kg N/ha did not increase the dry weight of nodule per plant over control.

Effect on dry weight of plant

Inoculation with *Rhizobium* strains increased the dry weight of plant of moong significantly over control. JCa-1 strain produced significantly greater dry weight of plant than that recorded with inoculation with M-10 strain (Table 1). Similar observations were also recorded by Srivastava and Varma (1982) and Prasad and Ram (1982; 1984).

Influence of nitrogen application (Table 2) on the dry weight of plant of moong was found to be significant over control. Thirty kg N/ha level was found to produce the maximum dry weight of plant which was significantly higher than that of other levels of nitrogen (Table-2). Significant differences among other levels of nitrogen were also observed with regard to production of dry weight of plant. Shoot length and root length increased with application of nitrogen and ultimately dry matter accumulation per plant also increased. Similar observations were obtained by Raju and Varma (1984).

Effect on yield of the crop

Inoculation with *Rhizobium* strain significantly influenced the seed yield of moong over control (Table 1). Inoculation with JCa-1 strain was found to be most effective and produced the highest seed yield (9.97 q/ha) which was significantly more than the seed yield (8.75 q/ha) recorded with M-10. Inoculation with JCa-1 influenced nodulation of moong, number of branches per plant, dry matter accumulation, some yield attributes and ultimately the final yield of moong. The increase in seed yield of moong with *Rhizobium* inoculation has the conformity with the finding of several workers (Gupta, *et al.*, 1981, Jauhri, *et al.* 1979 and Sharma, *et al.* 1981).

Application of nitrogen (Table 2) favourably influenced the seed yield of moong and significant increased in seed yield with nitrogen application was recorded over control. The seed yield of moong increased progressively with successive doses of nitrogen upto 30 kg N/ha, beyond which it decreased at 40 kg N/ha. Seed yields at 20 kg N/ha and 40 kg N/ha were at par with each other. Thirty kg N/ha produced significantly higher seed yield over other levels of nitrogen. Application of nitrogen produced significant influence on nodulation growth and yield characters of moong which was reflected in the final seed yield. Similar results were also obtained by Gowda and Gowda (1978) ; Nagre (1982), Balasubramanian *et al.* (1983) ; Vaishya *et al.* (1983) and Raju and Varma (1984).

REFERENCES

- Balasubramanian, A., Udayasuriyan, V. and Hameed, M. S. (1983). Bio-efficiency of *Rhizobium* inoculation on pulses production in Tamil Nadu. *Newsletter*, Tamil Nadu Agricultural University, 13 : 1.
- Gowda, S. T. and Gowda, K.T.K. (1978). Influence of fertilizers on yield and its components of green gram. *Ind. J. Agron.* 23 : 374.
- Gupta, R.P., Chahal, V.P.S. Chahal, D.S. and Kalra, M.S. (1976). Effect of inoculation and pelleting on moong. *Journal of Research*, Punjab Agricultural University 13 : 395.397.
- Gupta V. and Singh, R.S. (1982). Response of Bengal gram to N P.K. and S in light textured alluvium of Central U.P. *Agric.-Sci-Digest*, 2 : 35-37.
- Jauhri, K.S., Bhatnagar, R.S. and Iswaran, V. (1979). Associative effect of inoculation of different strains of *Azotobacter* and homologous *Rhizobium* on the yield of moong (*Vigna radiata*). *Plant and Soil*, 53 : 105-108.

- Nagre, K.T. (1982). Effect of Rhizobium and nitrogen on the yield of green gram. *Agril. Sci. Digest*, 2 : 27-28.
- Prasad, J. and Ram, H. (1982). Variation in varietal response to rhizobial strains for nodule character, chlorophyll and protein content in green gram. *J. Agric. Sci. U.K.* 102 : 245-246.
- Raju, M.S. and Varma, S.C. (1984). Response of green gram (*Vigna radlata*) to rhizobial inoculation in relation to fertilizer nitrogen. *Legume Research*. 7 : 73-76.
- Sharma, B.B. and Singh, R.R. (1986). Rooting and nodule pattern in lentil under different rates of sowing and seed inoculation, N and P fertilization. *Legume Research*, 9 : 69-72.
- Sharma, L.C., Reddy, B.N. and Saxena, S. (1981). Rhizobium inoculants for pulses in Rajasthan. *Pulse Crop Newsletter*, 1 : 106.
- Singh, K.K., Hasan, W., Singh, S.P. and Prasad, R. (1965). Response of moong to graded levels of N and P. *Indian J. Agron.* 20 : 187-188.
- Singh, S.D. (1977). Effect of Rhizobium Inoculation on nodulation and yield of moong, *Annals of Arid Zone* 16 : 79-84.
- Srivastava, S.N.L. and Varma, S.C. (1981). Effect of biological and inorganic fertilization on the yield and yield attributes of green gram. *Indian J. Agric. Res.* 15 : 25-29.
- Srivastava, S.N.L. and Varma, S.C. (1982). Effect of bacterial and inorganic fertilization on the growth, nodulation and quality of green gram. *Indian J. Agric. Res.* 16 : 223-229.
- Vaishya, U.K., Gajendragadker, G.R. and Pandey, R. (1983). Effect of *Rhizobium* inoculation on nodulation and grain yield of mungbean. *Indian J. Microbiol.* 23 : 228-230.

(Accepted for publication September 18 1989)