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Integrated use of fertilizer, biofertilizers and manure on growth and yield of green gram (*Vigna radiata* L. Wilzeck)

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Abstract
A field experiment was conducted in *Rabi* 2009-2010 to Integrated Use of Fertilizer, Bio fertilizer and manure on Growth and Yield of Green Gram (*Vigna radiata* L. wilzeck) the experiment was laid out in randomized block design (RBD) with 5 treatments. The results revealed that highest significant grain yield of 15.5 q ha^{-1} and straw yield 40 q ha^{-1} were recorded in the treatment T_5 = (N, P + B @ 2 kg ha^{-1}+*Rhizobium*+ FYM @ 10t ha^{-1}) as compared to all other treatments. Addition of different N levels with and without P and B, caused significant increase in plant height, number of branches $plant^{-1}$ (primary and secondary), Number of leafs $plant^{-1}$, straw yield, grain yield, q ha^{-1}. On the basis of results obtained it can be concluded that the balanced fertilization and high dose of nitrogen with P and B was found superior than alone application of treatments due to synergetic effect of N with P and B by green gram in terms of growth and yield parameters significantly.

Keywords: NPB, growth, yield, acquisition, balanced fertilization, biofertilizers, manure and green gram

Introduction
Green gram also known as "Mungbean" (*Vigna radiata* L. Wilzeck) is a leguminous crop which is originated from. India. Pulse owe a strategic position in agricultural economy in India being major source of protein in vegetarian human diet and also improving the soil fertility through their nitrogen fixing capability (Upadhyay 2002). Among pulses green gram is widely considered an excellent source of high quality protein with good digestibility and also contain water soluble vitamins and minerals of dietary significant. It is grown in about 3.1 million ha with the total production of about 1.1 million tonnes of grain (Anonymus, 2009). Green gram normally produce a large number of flowers but only a few are retained and develop into pods. This crop also suffers from excessive vegetative growth due to nitrogenous fertilizers. Although the inflorescence is profuse the yield is low due to poor pod setting and harvest index (Kumar and Kumar, 2004). The synthetic fertilizers are harmful for soil and aerial environment. because the inorganic fertilizers mainly contain major nutrients N.P.K. in large quantities and are neglecting the use of organic manures and biofertilizers and hence have packed the way for deterioration of soil health and in turn ill-effect on plants human being and livestock (Chaudhry, 2005).

Materials and Methods
The details of methods employed and materials used during the course of this investigation have been discussed in this chapter.
A field experiment was conducted during rabi season of 2009-2010 at Department of Agricultural Chemistry and Soil Science, Udai Pratap Autonomous Collage, Varanasi. Integrated use of fertilizer, biofertilizer and manure on growth and yield of green gram. The soil of the experimental field was sandy loam in texture, low in available nitrogen, available phosphorus and medium in available potassium. Initial soil properties of experimental soil is presented. Six treatments combinations comprising of all possible treatments of three levels. Nitrogen 20, 5 and 2 kg ha^{-1} through urea, phosphorus 40, 5 and 2 kg ha^{-1} through SSP boron 10, 5 and 2 kg ha^{-1} through borax, 10t ha^{-1} FYM and seed was inculcated with rhizobium culture. Seed was sowing 20 kg ha^{-1} plot size 4m×4m, respectively. All the recommended cultural practices and plant protection measures were followed throughout the experimental periods. The height of plant, number of branches number of leaves effective nodules, dry matter, pod $plant^{-1}$, yield and yield contributing characters were recorded from all plots at pertinent stages. All obtained data from experiment were statistically analyzed by analysis of variance (ANOVA) according to randomized block design as prescribed by (Panse and Sukhatme, 1978).

Standard error of mean in each case and critical difference only for significance cases were computed at 5% levels of probability.

Critical difference= SEM±×2xt (at error degree of freedom)

Results and Discussion

1. Growth attributes

Plant height

The plant height at 60 days after sowing varied between 22.5 and 32.2 cm. The highest plant height was observed when boron was applied at 2 kg ha^{-1} with combination of N, P, *Rhizobium* and FYM. Though the different treatments were able to increase the plant height as compared to control but effect was statistically non-significant.

Table 1: Details of the experimental Design and layout

Variety	Sam rat
Test crop	Green gram
Experimental design	RBD
Number of treatments	6
Number of replications	3
Number of total plots	18
Net plot area	4 m^2
Net total area	72 m^2
Width of main irrigation channel	1 m
Bund	0.50 m
Variety	0.30 m
Test crop	20 × 30 cm

Experimental treatment details

T_0 = Control (no input)
T_1 = N, P (20, 40 kg ha^{-1})
T_2 = B @ 10 kg ha^{-1}
T_3 = N, P + B @ 5 kg ha^{-1} + FYM @ 10t ha^{-1}
T_4 = N, P + B @ 5 kg ha^{-1} + *Rhizobium*
T_5 = N, P + B @ 2 kg ha^{-1}+*Rhizobium*+ FYM @ 10t ha^{-1}

Number of branches $plant^{-1}$

The second observation related to number of branches was recorded at 45 days after sowing. Application of different treatments significantly increased the number of branches as compared to control. The maximum number of branches $plant^{-1}$ were recorded in case of treatment T_5 (16) and minimum was with treatment T_0 (6.9). T_5 registered significant superiority over other treatments. Application of nitrogen + phosphorus and boron alone and in combination of *Rhizobium* and FYM played significant role in increasing the number of branches at 60 days after sowing. T_5 was found to be significantly superior over others.

Number of leaves plant

The observation recorded at 60 DAS exhibits that number of leaves $plant^{-1}$ varied from 39.5 to 70.7. Application of nitrogen + phosphorus and boron alone and in combination of *Rhizobium* and FYM increase that leaf number as compared to control. Maximum number of leaves $plant^{-1}$ were observed in case of treatment T_5 followed by the treatments T_4, T_3, T_2, T_1 and T_0. Significant difference was observed among different treatments. T_5 recorded significantly highest increase over other treatments.

2. Yield attributes

Grain yield

It can be seen from the data that integrated use of nitrogen, phosphorus, boron, *Rhizobium* and FYM significantly increased the yield as compared to application of nitrogen + phosphorus and boron alone and control. Maximum yield was recorded with application of nitrogen, phosphorus, boron @ 2 kg ha^{-1} with *Rhizobium* and FYM. Minimum yield was recorded with control.

Straw yield

Revealed that straw yield varied from 24.2 to 40.2 q ha^{-1}. Highest straw yield was found with treatment combination of nitrogen, phosphorus, boron @ 2 kg ha^{-1} with *Rhizobium* and FYM. The effect of different treatments were statistically non significant.

Table 2: Initial Properties of Soil under Study

S.N	Parameters	Value
1	Bulk density (Mg m^{-3})	1.25
2	Particle density (Mg m^{-3})	2.65
3	Water holding capacity (%)	60
4	Porosity (%)	55
5	pH (1:2.5)	7.2
6	EC (dS m^{-1})	0.98
7	Organic carbon (%)	0.68
8	Available nitrogen (kg ha^{-1})	180.20
9	Available phosphorus (kg ha^{-1})	10.15
10	Available boron (kg ha^{-1})	0.308

Table 3: Effect of treatments on number of branches at different stages of plant growth

Treatments	Number of branches		
	30 DAS	45 DAS	60 DAS
T_0	4.6	6.9	13.1
T_1	6.0	10.0	17.4
T_2	5.0	8.7	15.6
T_3	6.9	12.3	19.4
T_4	8.5	14.7	20.8
T_5	11.0	16	23.1
CD (P=0.05)	1.27	1.11	3.01

DAS = Days after sowing

Table 4: Effect of treatments on number of branches at different stages of plant growth

Treatments	Number of branches		
	30 DAS	45 DAS	60 DAS
T_0	4.6	6.9	13.1
T_1	6.0	10.0	17.4
T_2	5.0	8.7	15.6
T_3	6.9	12.3	19.4
T_4	8.5	14.7	20.8
T_5	11.0	16	23.1
CD (P=0.05)	1.27	1.11	3.01

DAS = Days after sowing

Table 5: Effect of treatments on number of leaves at different stages of plant growth.

Treatments	Number of leaves		
	30 DAS	45 DAS	60 DAS
T_0	14	20.7	39.5
T_1	18.8	31.3	52.6
T_2	15	25.5	47
T_3	21.8	37.1	58.4
T_4	26.7	44.5	69.9
T_5	34.4	49.7	70.7
CD (P=0.05)	2.58	3.89	2.23

DAS = Days after sowing

Table 6: Effect of treatments on grain and straw yield

Treatments	Yield q ha^{-1}	
	Grain	Straw
T_0	8.3	24.2
T_1	9.4	27.8
T_2	8.7	24.3
T_3	11.3	30.6
T_4	13.8	38.3
T_5	15.5	40
CD (P=0.05)	1.4	NS

NS = Non Significant

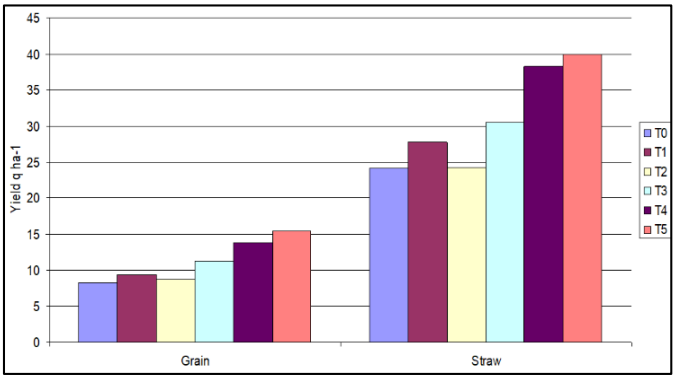

Fig 1: Yield q ha-1 as shown above

Conclusion

From the study it can be concluded that to evaluate the response of integrated use of nitrogen, phosphorus, boron, *Rhizobium* and FYM on the growth and yield of green gram. The height of plant increased as compared to control by application of nitrogen, phosphorus, *Rhizobium* FYM and boron and maximum height was recorded with T_5 (NP + B @ 2 kg ha^{-1} + *Rhizobium* + FYM). Number of leaves and branches were significant increased by the all the treatments as compared to control. Maximum number was registered with T_5. Grain and straw yields increased with the application of nitrogen, phosphorus, boron, *Rhizobium* and FYM. Maximum yield, were recorded with T_5. Individual application of boron at 10 kg ha^{-1} level noticed less response when compared with lower dose in combination of *Rhizobium* N, P and FYM.

Therefore it is concluded from the study that green gram favorably responded to nitrogen phosphorus boron, bio fertilizer and manure fertilization. A dose of 2 kg ha^{-1} boron in combination of N, P, *Rhizobium* and FYM was found best treatment agro-ecological condition of Varanasi.

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