

Original Research Article

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Effect of Different Levels of Zinc and Farm Yard Manure on the Physico-Chemical Properties of Soil and Yield of Green Gram (*Vigna radiata* L.) VAR. Laxmi-151

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ABSTRACT

The field experiment was carried out at Department of Soil Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, India during *summer season* (March to May) of 2016. The experiment was laid out in 3×3 factorial randomized block design with 9 treatments in three replications. It is concluded that the best yield attributes characters in treatment T₈ [Zinc@100% + FYM@100%] in respect to different days intervals i.e. 25, 50 and 75 days after sowing (DAS). Plant height was 9.05, 30.66 and 48.05 cm found to be significant at 25 and 75 DAS but non-significant at 50 DAS, leaf length were 6.94, 7.86 and 8.77 cm found to be significant at 30, 50 and 90 DAS, no. of leaves plant⁻¹ were 8.66, 19.55 and 22.99 found to be significant at 75 DAS but non-significant at 25 and 50 DAS, Highest number of pods was found in T₈ [Zinc@100% + FYM@100%] which was 28.44 found to be significant. Highest pod length was found in treatment T₈ [Zinc@100% + FYM@100%] which was 8.88 cm found to be significant. T₈ [Zinc@100% + FYM@100%] found highest seed yield (q ha⁻¹) and number of seed pod⁻¹ which were 8.20 and 11.11 respectively found to be significant. The economy of different treatment concerned, the treatment T₆ (Z₂ + FYM₀) provides highest net profit of 16498.00 with cost benefit ratio is 1: 1.47. However, since these findings are based on one year experiment and therefore, further research may be conducted to substantiate it under Allahabad agro climatic conditions.

Keywords

Zinc, FYM and Growth, Yield, Green gram

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Introduction

Green gram (*Vigna radiata* L.) commonly known as Mung bean, is an important conventional pulse crop of India. Its grain contains 24.20% protein, 1.3% fat, 60.4% carbohydrates; calcium and phosphorus are 118 and 340 mg per 100 g of seed. It is capable of fixing atmospheric nitrogen

through *Rhizobium* species. It has a wide range of adaptability due to short growth period, high tonnage capacity and outstanding nutritional values of food, feed and forage. The yield level of *rabi* Mung is high as compared to *Kharif*. It can be grown during summer. It is one of the major protein rich pulse crop grown principally for both human and animal. Green gram can supplement the

cereal-based diet to improve the nutritional value of food and has a special importance in intensive crop production system of the country for its short growing period (Ahmed *et al.*, 1978).

Pulses are the main source of protein particularly for vegetarians and contribute about 14% of the total protein of average Indian diet. Production of pulses in the country is far below the requirement to meet even the minimum level per capita consumption. The per capita availability of pulses in India has been continuously decreasing which is 32.52 g per day against the minimum requirement of 80 g day⁻¹ per capita prescribed by Indian Council of Medical Research (ICMR) (Anonymous, 2009). Therefore, it is necessary for agricultural scientists to evolve strategy for increasing production of pulses to meet the protein requirements of increasing population of the country.

India is a major pulse growing country of the world, sharing about 36 and 28% in the area and production of pulses, respectively. Green gram is one of the widely cultivated short duration grain legumes in India and occupies third place after Chickpea and Pigeon pea. In our country, green gram gives the highest yield under summer planting (Satter *et al.*, 1995). Food insecurity in the 21st century will even increase due to heat and drought stress induced by climate change, particularly in tropical and subtropical regions. Legumes are good and relatively cheaper source of proteins, carbohydrate, and minerals for developing countries including India (Meiners *et al.*, 1976).

The basic concept of integrated nutrient management is the supply of the required plant nutrients for sustaining the desired crop productivity with minimum deleterious effect on soil health (Balasubramanian, 1999). Integrated use of organic and inorganic

fertilizers guarantee improved soil health and fertility (Satyanarayana *et al.*, 2002).

FYM helps to improve and conserve the fertility of soil. FYM imparts dark color to the soil and thereby help to maintain the temperature of soil. The activity and population of beneficial soil organisms increased on application of FYM in soil. FYM is one of the oldest manure used by the farmer is growing crops because of its early availability and presence of almost all the nutrient required by plant (Nair 2000).

Zinc play important role in the correct functioning of many enzymatic systems, the synthesis of nucleic acids and auxins (plant hormones) metabolisms, protein analysis and normal crop development and growth (Mengel and Kirkby, 1982, Havlin *et al.*, 2006). This may be as a result of slower rate of translocation of Zn from roots to tops, i.e. zinc accumulation in the roots and lower Zn uptake (Stukenholtz *et al.*, 1966).

Materials and Methods

The experiment was conducted during *summer* season 2016 on crop research farm of Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Allahabad. The area is situated on the south of Allahabad on the right side of the river Yamuna on the South of Rewa road at a distance of about 6 km from Allahabad city. It is situated at 25024'23" N latitude, 81050'38" E longitude and at the altitude of 98 meter above the sea level (MSL).

The treatment consisted of different levels of zinc and farm yard manure T₀ (T₀=Z₀+FYM₀) Control, T₁ [Zinc@0%+ FYM@50%], T₂ [Zinc@0%+ FYM@100%], T₃ [Zinc@50%+ FYM@0%], T₄ [Zinc@50%+ FYM@50%], T₅ [Zinc@50%+ FYM@100%], T₆ [Zinc@100%+ FYM@0%], T₇ [Zinc@100%

+ FYM@50%], T₈ [Zinc@100% + FYM@100%]. The trial was laid out in a factorial randomized block design with three replication; plot size was 2 x 2 m for crop seed rate is 12-15 kg ha⁻¹ (*Vigna radiata* L.) Cv. Laxmi-151.

Applies the recommended dose of nitrogen, phosphorus and potassium with source of Urea, SSP, MOP, respectively, Basal dose of fertilizer was applied and Zinc and Farm Yard Manure applies in respective plots according to treatment.

All the agronomic practices were carried out uniformly to raise the crop. Soil samples were collected from the soil 0-15 cm depth, air dried kept in an oven at 105⁰C for 48 hrs for drying, pass through 2 mm sieve, soils were analysis by using standard procedures as described for Bulk density (Mg m⁻³), Particle density (Mg m⁻³), Pore space (%) and Water holding capacity (%) (Muthuaval 1992), Soil texture (Bouyoucous 1927), Soil pH (1:2) soil water suspension (Jackson 1958), Soil EC dSm⁻¹ (Wilcox, 1950), Organic Carbon % Rapid titration method (Walkey and Black 1947), Available Nitrogen kg ha⁻¹ Alkaline permanganate method (Subbiah and Asija 1956), Available Phosphorus (kg ha⁻¹) Colorimetric method (Olsen *et al.*, 1954), Available Potassium (kg ha⁻¹), Flame photometric method (Toth and Prince, 1949), Available Zn ppm (Shaw and Dean, 1952 and Holmes, 1945).

Physical and chemical analysis of soil samples (pre-sowing)

Results and Discussion

Growth parameters

Table 3: shows the interaction effect of Zinc and FYM the important growth parameters of green gram.

Plant height (cm)

Increase in plant height due to increasing of Zinc and FYM may be due to adequate an nutrient which is turns help in vigorous vegetative growth of plants and subsequently increase the plant height through cell elongation cell division photosynthesis and turbidity of plant cell. The maximum height recorded as 9.05, 30.66 and 48.05 respectively at 25, 50 and 75 DAS in treatment T₈ [Zinc@100% + FYM@100%].

Number of leaves plant⁻¹

The effect of Zinc and FYM on number of leaves plant⁻¹ was found significant at 50 and 75 DAS, whereas found non-significant at 25 DAS. The maximum number of leaves plant⁻¹ was recorded as 8.66, 19.55 and 22.99 respectively at 25, 50 and 75 DAS in treatment T₈ [Zinc@100% + FYM@100%].

Leaf length (cm)

The effect of Zinc and FYM on Leaf length was found to be significant. The maximum leaf length was recorded as 6.94, 7.86 and 8.77 respectively at 25, 50 and 75 DAS in treatment T₈ [Zinc@100% + FYM@100%]. Table 4: Shows the interaction effect of Zinc and FYM the important yield attributes parameters of green gram. Higher yield response in comparison of Zinc and FYM was recorded with balanced application of Zinc and FYM. The maximum number of pods was recorded as 28.44 in treatment T₈ [Zinc@100% + FYM@100%], and minimum number of pods was recorded as 15.10 in treatment T₀ (Control) and were found to be significant. The maximum pods length of plant was recorded as 8.88 cm in treatment T₈ [Zinc@100% + FYM@100%], and minimum pods length of plant was recorded as 5.94 cm in treatment T₀ (Control) and were found to be significant.

Table.1 Physical analysis of soil

Ingredient	Percentage	Method employed
Sand (%)	60	Bouyoucos Hydrometer method Bouyoucos (1927)
Silt (%)	25	
Clay (%)	15	
Textural class	Sandy loam	
Bulk density (Mgm ⁻³)	1.23	Graduated measuring cylinder (Muthuaval 1992)
Particle density (Mgm ⁻³)	2.22	Graduated measuring cylinder(Muthuaval 1992)
Pore space (%)	48.33	Graduated measuring cylinder (Muthuaval 1992)
Water holding capacity (%)	54.89	Graduated measuring cylinder (Muthuaval 1992)

Table.2 Chemical analysis of soil

Particulars	Method employed	Results
Soil pH (1:2) soil water suspension (w/v)	Digital pH meter (Jackson 1958)	7.23
Soil EC (dSm ⁻¹)	Digital Conductivity Meter (Wilcox, 1950)	0.16
Organic Carbon (%)	Rapid titration method (Walkey and Black 1947)	0.50
Available Nitrogen (kg ha ⁻¹)	Alkaline permanganate method (Subbiah and Asija 1956)	251.63
Available Phosphorus (kg ha ⁻¹)	Colorimetric method(Olsen et al., 1954)	20.41
Available Potassium (kg ha ⁻¹)	Flame photometric method (Toth and Prince 1949)	130.64
Available Zn (ppm)	(Shaw and Dean 1952 and Holmes 1945)	0.72

Table.3 Plant growth parameter

Treatment	Plant height (cm)			Number of leaf plant ⁻¹			Leaf length plant ⁻¹ (cm)		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
T ₀	6.88	26.83	39.16	5.44	16.55	18.88	4.66	6.75	6.60
T ₁	7.83	28.11	42.11	6.44	18.10	20.44	4.83	7.19	7.38
T ₂	8.27	29.28	42.94	6.44	18.33	20.10	5.41	7.11	7.44
T ₃	8.66	28.99	43.38	7.11	17.88	20.44	5.37	7.35	7.71
T ₄	8.38	28.84	44.44	7.44	17.88	19.99	5.99	7.14	7.66
T ₅	8.71	29.79	45.16	7.88	18.99	21.21	6.55	7.68	7.99
T ₆	8.71	29.38	45.60	7.99	18.33	20.55	6.54	7.21	7.66
T ₇	8.72	29.77	47.11	8.10	18.99	21.55	6.66	7.67	8.16
T ₈	9.05	30.66	48.05	8.66	19.55	22.99	6.94	7.86	8.77
F-test	S	NS	S	NS	NS	S	S	S	S
S.Ed. (±)	0.15	0.32	0.19	0.13	0.23	0.28	0.09	0.07	0.09
C.D. (at 05%)	0.46	-	0.59	-	-	0.86	0.29	0.22	0.27

NS: Non Significant,* significant at 5% and** Significant at 1%

Table.4 Plant yield attributes parameter

Treatment	No. of pods plant ⁻¹	Pods length (cm)	No. of seed pod ⁻¹	Yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	B:C Ratio
T ₀	15.10	5.94	6.22	5.64	21.75	1:1.18
T ₁	18.10	6.99	7.99	6.10	20.12	1:1.08
T ₂	18.44	7.27	8.88	6.76	24.06	1:1.07
T ₃	19.55	7.55	8.88	6.69	23.86	1:1.33
T ₄	21.55	7.77	8.88	7.28	23.70	1:1.26
T ₅	26.21	8.72	10.66	7.62	22.75	1:1.15
T ₆	25.77	8.27	9.77	7.76	23.56	1:1.47
T ₇	27.44	8.60	10.44	7.86	23.95	1:1.30
T ₈	28.44	8.88	11.11	8.20	24.75	1:1.20
F-test	S	S	S	S	-	-
S.Ed. (±)	0.28	0.10	0.19	0.09	-	-
C.D. (at 5%)	0.86	0.32	0.58	0.27	-	-

NS: Non Significant,* significant at 5% and** Significant at 1%

The maximum number of seed pod⁻¹ was recorded as 11.11 in treatment T₈ [Zinc@100% + FYM@100%], and minimum number of seed pod⁻¹ was recorded as 6.22 in treatment T₀ (Control) and were found to be significant. The maximum seed yield 8.20 q ha⁻¹ was recorded T₈ [Zinc@100% + FYM@100%], and minimum seed yield 5.64 q ha⁻¹ was recorded in T₀ (Control) and were found to be significant. The maximum straw yield 24.75 q ha⁻¹ was recorded T₈ [Zinc@100% + FYM@100%], and minimum seed yield 21.75 q ha⁻¹ was recorded in T₀ (Control). Among the different treatments studied with respect of maximum C: B ratio, the maximum B: C ratio was recorded in T₆ [Zinc@100%+ FYM@0%], and the minimum was recorded T₂ [Zinc@0%+ FYM@100%].

It is concluded that the best yield attributes characters in treatment T₈ [Zinc@100% + FYM@100%] in respect to different days intervals i.e. 25, 50 and 75 days after sowing (DAS). Plant height was 9.05, 30.66 and 48.05 cm found to be significant at 25 and 75

DAS but non-significant at 50 DAS, leaf length were 6.94, 7.86 and 8.77 cm found to be significant at 30, 50 and 90 DAS, no. of leaves plant⁻¹ were 8.66, 19.55 and 22.99 found to be significant at 75 DAS but non-significant at 25 and 50 DAS, Highest number of pods was found in T₈ [Zinc@100% + FYM@100%] which was 28.44 found to be significant. Highest pod length was found in treatment T₈ [Zinc@100% + FYM@100%] which was 8.88 cm found to be significant. T₈ [Zinc@100% + FYM@100%] found highest seed yield (q ha⁻¹) and number of seed pod⁻¹ which were 8.20 and 11.11 respectively found to be significant. The economy of different treatment concerned, the treatment T₆ (Z₂ + FYM₀) provides highest net profit of 16498.00 with cost benefit ratio is 1: 1.47.

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