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Effect of micronutrients on seed quality of green gram (*Vigna radiata* L.)

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Abstract
Applications of 25 kg $ZnSO_4$/ha, 10 kg borax/ha and micronutrients mixture resulted in enhancement of seed quality characteristics *viz.* Germination (%), shoot and root length (cm), shoot and root dry weight(mg), seedling vigour index and 100 seed weight. The highest 100 seed weight 25.65 gm was observed with application of micronutrients mixture followed by the application of Mo @ 5 g/kg seed (25.44 g). Moderate effects were observed with application of borax @ 10 kg/ha in respect of these traits. In general, applications of Zn, B and Mo in combinations were found effective in enhancing seed quality in this crop.
An investigation was undertaken during *kharif* 2017-18 in the Department of Agricultural Botany, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani to find out the response of micronutrients application on plant growth and seed yield attributes in green gram cv.BM-2003-2. Five different micronutrients *viz.* zinc, boron, molybdenum, manganese and cobalt were applied in different concentrations, singly and in combination consisting of ten treatments viz., soil application of Zn (10 & 25 kg/ha zinc sulphate, zinc chelate @ 500 g/ha) and B (5 & 10 kg borax/ha), seed treatment of Mo (Ammonium molybdate @ 5 g/kg) and Co (Cobalt nitrate @ 1 g/kg), foliar spray of Mn (Manganese dioxide @ 0.5%), mixture of all micronutrients and a control were found effective in enhancing yield in this crop.

Keywords: Green gram, micronutrients, plant growth, seed yield

Introduction
Next to cereals, pulses play a vital role in agriculture as these provide proteins, minerals, vitamins rich vegetables and fodder. As the legume crops have self nitrogen fixing capacity, their contribution has an added advantage in the present day of fertilizer crisis in the country. Pulses are second largest source of dietary protein, besides their caloric contribution, not only in India but also in another developing country. Pulses are also considered as important source of minerals, macro and micro nutrients as well as health promoting secondary metabolites and considered poor man's only source of protein. Green gram (*Vigna radiata* L.) is one of the oldest pulse crops and is the most nutritious. Apart from high level of protein (25%), green gram also contains fat (1.3%), one of the predominant sources of protein and certain essential amino acids like lysine tryptophan in vegetarian diets.
Green gram is an excellent source of high quality protein with easy digestibility, consumed as whole grains, dal and sprouted in variety of ways. As value addition, split and dehusked, fried in fat, fetch good value as snacks. After harvesting the pods, green plants are fed to the cattle. The husk of the seed also used as cattle feed. Micronutrient deficiency in Indian soils has emerged as one of the major constraints to crop productivity. While zinc, iron, boron and manganese deficient areas are vast, copper and molybdenum deficiency has also been observed in many districts of the country.

Materials and Methods
The present investigation was undertaken "Effect of micronutrients on plant growth and seed yield in green gram" at experimental farm of Dept. of Agril. Botany, VNMKV, Parbhani during *kharif* 2017. The soil was medium deep black and well drained. The topography of the experiment fields was fairly uniform and levelled. BM-2003-2 variety of green gram in a plot size 3.15 m X 2 m^2 with spacing of 45cm ×10cm. The experiment was laid in randomized block design with three replications. Appropriate production technology was adopted to raise the crops. Fertilizer was applied @ 25 kg N, 50 kg P2O5. The pods of different treatments stage and seeds after threshing were sun dried.

Observations were recorded on five plant growth characteristics *viz* field emergence ,days to 50% flowering, plant height, number of branches, two seed characteristics *viz* number of pods per plant , number of seeds per pod and 1000 test weight, two yield parameters *viz.* seed yield per plant and per hectare. It was analyzed by statistical method used by Panse and Sukhatme. (1961) [5].

Table 1: Treatment details

Sr. No.	Treatment symbol	Micronutrients	Name of the salt used	Concentration/dose of application	Mode of application/Stages of application
1	T_1	Control	-	-	-
2	T_2	Zinc (Zn)	Zinc sulphate	10kg/ha	Soil application (At the time of sowing)
3	T_3	Zinc (Zn)	Zinc sulphate	25kg/ha	Soil application (At the time of sowing)
4	T_4	Boron (B)	Borax	5kg/ha	Soil application (At the time of sowing)
5	T_5	Boron(B)	Borax	10kg/ha	Soil application (At the time of sowing)
6	T_6	Molybdenum (Mo)	Ammonium molybdate	5g/kg seed	Seed treatment
7	T_7	Cobalt (Co)	Cobalt nitrate	1g/kg seed	Seed treatment
8	T_8	Manganese (Mn)	Manganese dioxide	0.5%	Foliar spray (20-30 DAS)
9	T_9	Zinc (Zn)	Zinc Chelate	500g/ha	Soil application (At the time of sowing)
10	T_{10}	Mixture	$T_3 + T_5 + T_6 + T_7 + T_8 + T_9$	*	All the methods

Results and Discussion

a) Seed quality attributes one month interval after harvest

Seed is basically used for sowing or raising crops. Maintenance of sowing quality of seed is therefore, the most important consideration of any seed programme. The planting value of seed is assessed in terms of various physiological parameters *viz.* laboratory germination, seedling growth rate, seed vigour, field emergence and storability. In the presents study seed quality was assessed by different parameters. The tests were conducted using freshly harvested seeds one month interval.

1. **Seed moisture (%):** The seed moisture of seeds did not differ significantly during storage period of five months. The seed moisture declined gradually with the advancement of storage period. Treatment T3 recorded highest seed moisture followed by T10 and T9. Lowest seed moisture was recorded by T1. The mean seed moisture recorded at the beginning and end of storage period was **(**7.97%) and (6.90%), respectively
2. **Germination (%):** The germination of seeds did not differ significantly during storage period of five months. The germination declined gradually with the advancement of storage period. Treatment T10 recorded highest seed germination followed by T3 followed by T5. The mean germination recorded at the beginning and end of storage period was **(**86.80%) and (76.90%), respectively
3. **Shoot length (cm):** The shoot length of seeds did not differ significantly during storage period of five months. The shoot length declined gradually with the advancement of storage period. Treatment T3 recorded highest shoot length followed by T8 followed by T6. The mean shoot length recorded at the beginning and end of storage period was **(**26.28cm) and (20.35 cm), respectively.
4. **Root length (cm):** The root length of seeds did not differ significantly during storage period of five months. The root length declined gradually with the advancement of storage period. Treatment T10 recorded highest root length followed by T3 followed by T5. The mean root length recorded at the beginning and end of storage period was **(**13.21cm) and (11.67 cm), respectively.
5. **Seedling fresh weight (mg):** The data pertaining to seedling fresh weight presented in the Table.15 indicated non significant difference between the treatments during storage. The seedling fresh weight declined gradually with the advancement of storage period. Treatment T10recorded highest seedling fresh weight followed by T5 followed by T3 and T4. The mean seedling fresh weight recorded at the beginning and end of storage period was **(**47.44 g) and (43.74 g), respectively.
6. **Seedling dry weight (mg):** The data pertaining to seedling fresh weight presented in the Table.15 indicated non significant difference between the treatments during storage. The seedling dry weight declined gradually with the advancement of storage period. Treatment T10 recorded highest seedling fresh weight followed by T5 followed by T3 and T4. The mean seedling fresh weight recorded at the beginning and end of storage period was **(**47.44 g) and (43.74 g), respectively.
7. **Seedling vigour I:** The data pertaining to seed vigour I presented in the Table indicated non significant difference between the treatments during storage. Among the treatments T10 recorded higher seed vigour followed by (T3) followed by (T5) over the T1. The average seed I vigour recorded at the beginning and end of storage period was 3436.2 and 1241.7 respectively.
8. **Seedling vigour II:** The data pertaining to seed vigour II presented in the Table indicated non significant difference between the treatments during storage. Among the treatments T10 recorded higher seed vigour followed by (T5) followed by (T3) over the T1. The average seed vigour II recorded at the beginning and end of storage period was (1241.7) and (1038.5) respectively.
9. **1000 seed weight (gm):** The data on 1000 seed weight indicated no significant difference among the treatments during storage. treatment T10 recorded relatively higher value as compared to all treatments. Followed by T6 followed by T5. The average thousand seed weight recorded at the beginning and end of storage period was (27.08 g) and (21.81 g), respectively.

b) Biochemical parameters

1. **Tetrazolium test:** The tetrazolium test of seeds did not differ significantly during storage period of five months. The viability of seed declined gradually with the

advancement of storage period. Treatment T10 recorded highest seed germination followed by T3 followed by T5. The mean of tetrazolium test recorded at the beginning and end of storage period was **(**88.90%) and (80.60%), respectively.

2. **Electrical conductivity (dsm^{-1}):** The electric conductivity of seeds did not differ significantly during storage period of five months. The electric conductivity of seed increased gradually with the advancement of storage period. Treatment T10 recorded highest seed germination followed by T4 followed by T8. The mean of electric conductivity recorded at the beginning and end of storage period was **(**0.65 dsm^{-1}) and (1.21 dsm^{-1}) respectively.

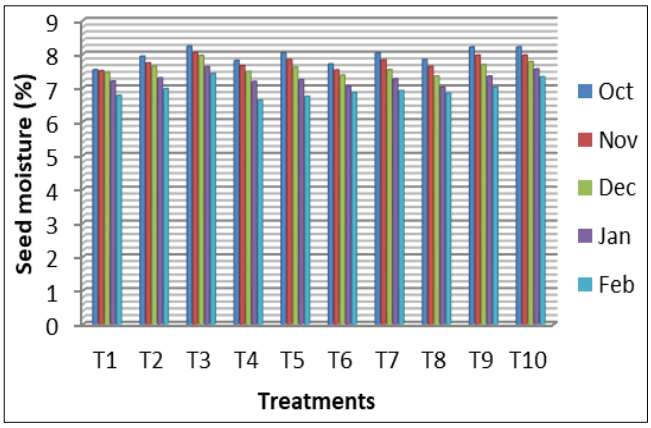

Fig 1: Effect of micronutrients on seed moisture (%) in green gram

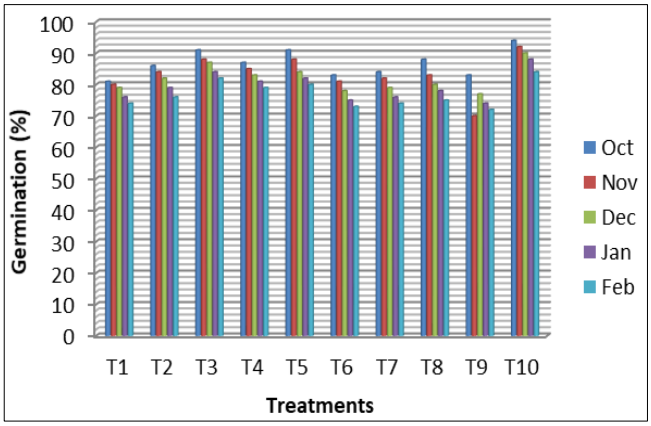

Fig 2: Effect of micronutrients on Germination (%) in Green gram

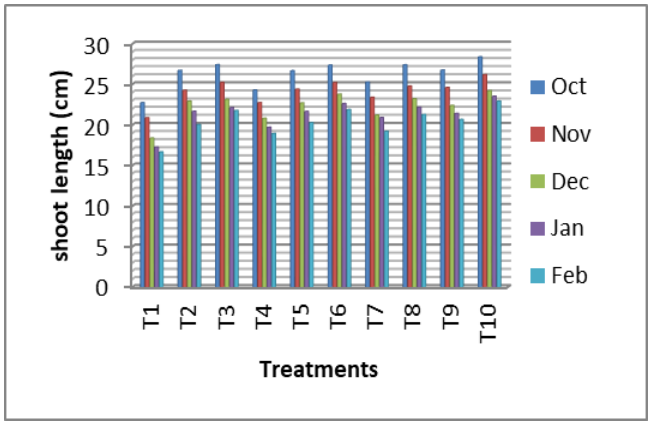

Fig 3: Effect of micronutrients on Shoot Length in Green gram

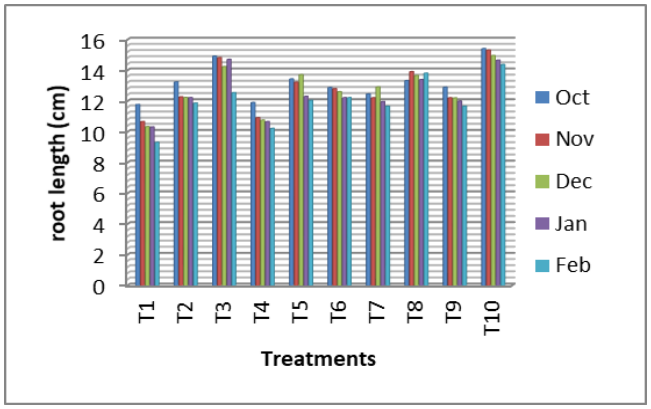

Fig 4: Effect of micronutrients on Root Length in Green gram

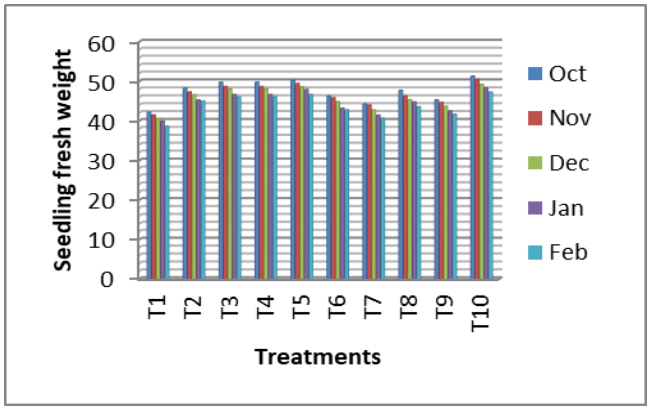

Fig 5: Effect of micronutrients on Seedling Fresh Weight (gm) in Green gram

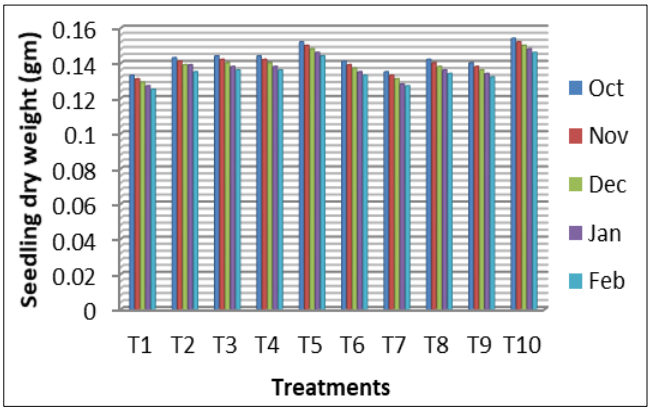

Fig 6: Effect of micronutrients on Seedling Dry Weight (gm) in Green gram

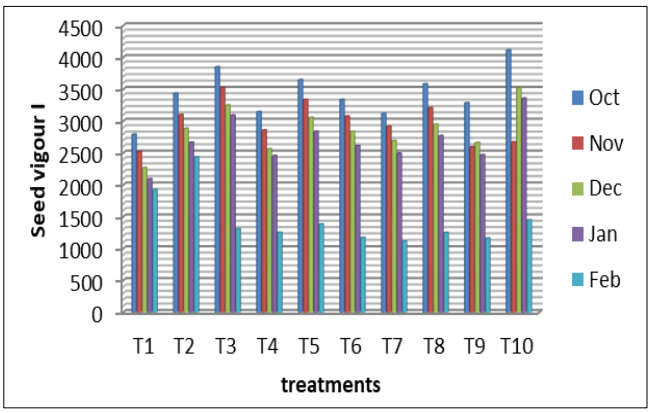

Fig 7: Effect of micronutrients on Seed vigour I in Green gram

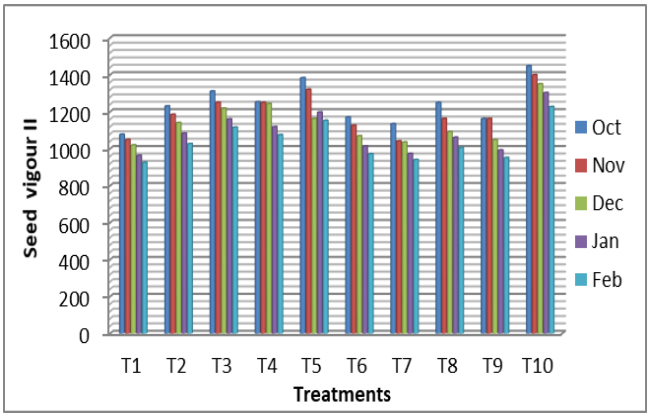

Fig 8: Effect of micronutrients on Seed vigour II in Green gram

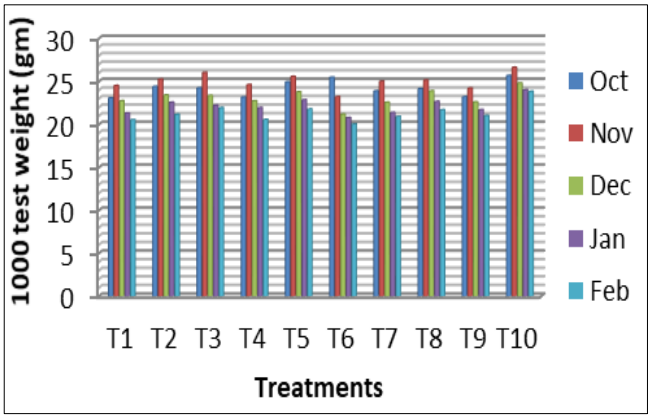

Fig 9: Effect of micronutrients on Test weight (gm) in Green gram

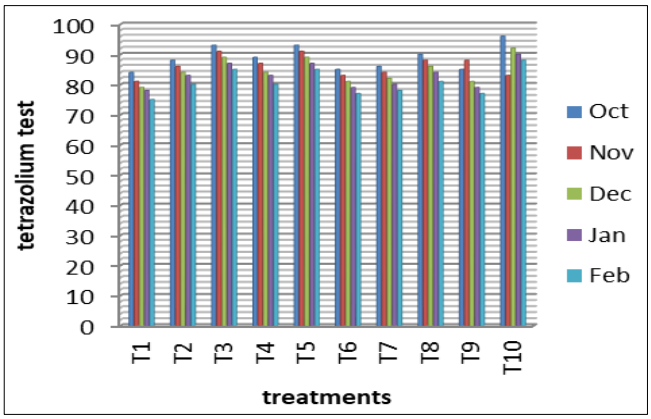

Fig 10: Effect of micronutrients on tetrazolium test in Green gram

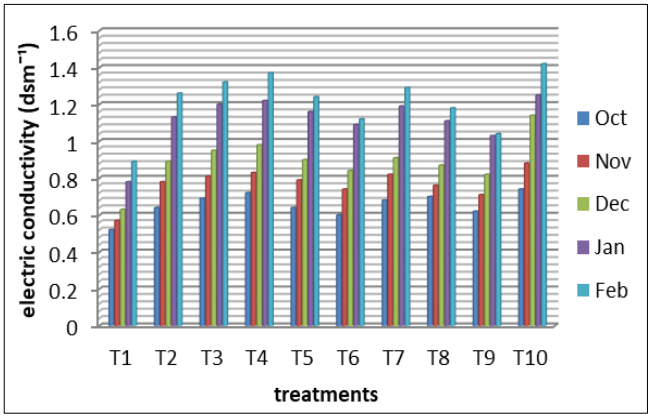

Fig 11: Effect of micronutrients on electric conductivity (dsm/1) in Green gram

Conclusion

In the present investigation, it was concluded that application of micronutrients enhanced seed quality attributes i.e. seed moisture, germination percentage, root length, shoot length, seedling fresh weight, seedling dry weight, electric conductivity and tetrazolium test. Among all the treatments Zn, B, Mo and their mixture had produced significant enhancing effect on seed quality attributes.

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