"Effect of micronutrient application on growth, yield and quality of green gram growing Iron and Zinc deficient soils of RenapurTahsil, Latur."

Abstract

The present investigation entitled "Effect of micronutrient application in green gram growing iron and zinc deficient soils of RenapurTahsil, Latur" during *Kharif*season of the year, 2022-2023 at AFieldexperimentwasconductedat farmers field At. Post-DawangaonTq-RenapurDist-Latur. The experiment was layout in RBD with three replications and a recommended variety of green gram BM 2003-2 as a test crop along with ten treatments.Among the various treatments the application of RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ (T_7) significantly increased the growth parameters *viz.*,highest plant height (52.19 cm at 60 DAS), number of branches(10.64 at 60 DAS), leaf area(540.67 cm^2 $plant^{-1}$at 60 DAS), dry matter content(9.54 g $plant^{-1}$at 60 DAS), total chlorophyll content(9.93 mg g^{-1} at 45 DAS) and number of nodules per plant (19.70), Yield parameters *viz.*, higher number of pods $plant^{-1}$(15.43), number of grains pod^{-1}(11.88), seed yield kg ha^{-1}(1575.46) and straw yield kg ha^{-1}(1864.68) at harvest and the improvement in quality parameters *i.e.* test weight (35.23 g), protein content (22.37 %) and protein yieldkg ha^{-1} (347.27) at harvest and was found at par with treatments T_4 (RDF + S.A. Grade- I micro-nutrient @ 25 kg ha^{-1} + F.A. Grade- II micro-nutrient @ 0.5 % at 25 and 40 DAS) and treatment T_2 (RDF + S.A. Grade- I micro-nutrient @ 25 kg ha^{-1}).

(**Keywords:**green gram**,** iron, zinc,growth, quality and yield)

1. Introduction

Green gram (*Vignaradiata* L.) is a well-known domesticated legume crop grown widely all over the world providing an important economy for marginal farmers in the developing countries and a high-value commodity crop with high nutritional quality in the developed nations. Green gram comes under the family *Fabaceae*, subfamily *Papilionaceae*, genus *Vigna*and species *radiata*. This family is widespread as it occupies the third largest family of flowering plants with approximately 650 genera and nearly 20,000 species (Doyle, 1994). Green gram is alternatively known as golden gram, mungbean, moong bean, haricot mungo, mash bean, etc. It is an annual, semi-erect to erect or sometimes twining, up to 100 cm tall, deep-rooted herbaceous plant. In India, green gram is mostly grown in Andhra Pradesh, Maharashtra, Orissa, Rajasthan, Gujarat, Punjab, Uttar Pradesh, etc. India ranks first in both area and production of all important pulses grown in the world. Pulses are grown on about 30.4 million ha. area in India with production of 14.77 million tonnes and productivity pulses is 617 kg ha^{-1}. The total area under pulses in Maharashtra is 32.69 lakh ha, with a total production of 21.44 lakh tones and productivity of 217 kg ha^{-1}. Green gram ranks third among all the pulses in India after chickpea and pigeon pea. India accounts for almost 65 percent area and 54 percent production of world mung bean. Green gram grown on about 3.57 million ha. Area in India with a total production of 17.89 metric tonnes and productivity of green gram is 500 kg ha^{-1} (Anonymous, 2021).

Micronutrient deficiencies in soil and crop plants are widespread because of increased micronutrient demand from intensive cropping practices and adaptation of high-yielding crop cultivars, enhanced crop production on marginal soils that contain low levels of essential micronutrients, increased use of high analysis fertilizers with low amounts of micronutrients, decreased use of animal manures, composts, and crop residues, use of soils low in micronutrient reserves, use of liming in acid soils, involvement of natural and anthropogenic factors that limit adequate supplies and create elemental imbalance in soil. Boradkar*et al.* (2023) reported that as much as 48, 12, 5, 4, 33, 13, and 41 percent of soils in India are affected by deficiency of Zn, Fe, Mn, Cu, B, Mo, and S, respectively.In general, farmers applied only major nutrients and not the micronutrients are lacking. Micronutrients like Iron, Zinc, Manganese, Copper, Molybdenum, and Boron play an important role in increasing legume yield through their effect on the plant itself, nitrogen-fixing symbiotic process and effective use of major and secondary nutrients. However, they are used in lower amounts as compared to macronutrients. They have a major role in cell division, development of meristematic tissues, photosynthesis, respiration, and acceleration of plant maturity. Nowadays micronutrient deficiencies are found limiting factors for crop growth and optimum yield. Hence, optimum yield potential attained through nutrient management including micronutrient iron and zinc is a basic requirement for major crops and mung bean.

2. Materials and Methods

Afieldexperimentwasconductedat the farmer's field of Shri. PrabhakarRamraoNagargoje, At/Post-DawangaonTq-RenapurDist- Latur,during*Kharif*,2022-2023 , college of Agriculture, Latur, Maharashtra. It lies between 76°30'31'' E Longitude and 18°35'26'' N Latitude. Withtentreatmentsandthreereplications in randomized block design.T_1: Recommended Dose of Fertilizers N: P_2O_5: K_2O (25:50:25 kg ha^{-1}), T_2: RDF + S.A. Grade-I micro-nutrient @ 25 kg ha^{-1}.

T_3: RDF + F.A. Grade-II micro-nutrient @ 0.5 % at 25 and 40 DAS. T_4: RDF + S.A. Grade-I micro-nutrient @ 25 kg ha^{-1} + F.A. Grade-II micro-nutrient 0.5 % at 25 and 40 DAS. T_5: RDF + S.A. $FeSO_4$ @ 25 kg ha^{-1}. T_6: RDF + S.A. $ZnSO_4$ @ 25kg ha^{-1}. T_7: RDF + S.A. $FeSO_4$ + $ZnSO_4$ @ 25kg ha^{-1}. T_8: RDF + F.A. $FeSO_4$ @ 0.5 % at 25 to 40 DAS. T_9: RDF + F.A. of $ZnSO_4$ @ 0.5 % at 25 to 40 DAS. T_{10}: RDF + F.A. $FeSO_4$ + $ZnSO_4$ @ 0.5 % at 25 to 40 DAS.*i. e.* Recommended Dose of Fertilizers $N:P_2O_5:K_2O$ (25:50:25 kg ha^{-1}) + FYM were applied to green gram. The experimental soil was deep, black in colour, and good drainage, clayey in texture, highly calcareous in nature (18.45 %), moderately alkaline reaction (8.38 pH), and low in content of organic carbon (2.41 g kg^{-1}), available nitrogen (165.55 kg ha^{-1}), available phosphorous (17.13 kg ha^{-1}), high in available potassium (435.45 kg ha^{-1}), deficient in DTPA iron (2.16 mg kg^{-1}), zinc(0.48 mg kg^{-1}) sufficient in DTPA copper and manganese.Soil sample was collected before sowing of green gram and analysed as per standard methods. The data on growth parameters, quality parameters were recorded at 30, 45 and 60 DAS and yield parameters recorded at harvest stage. The data on leaf area measured by a leaf area meter, dry matter determined by oven dry at 50-53 ºC, chlorophyll contents determined by the dimethyl sulphoxide oven at 50-53 ºC at 45 flowering stages likeparameters recorded during the period of investigation were tabulated and statistically analysed (Panse and Sukhatme, 1996).

3.1 Results and discussion

Growth parameters

The data related to different growth parameters like plant height, number of branches, leaf area, chlorophyll content, dry matter and number of nodules as influenced by the application of micronutrient sources with certain treatments is shown below.

3.1. Plant height

Data presented in Table 1 revealed that the plant height of green gram was significantly increased due to soil application of micronutrients in combination. The highest plant height was recorded with treatment T_7 (RDF + Soil application $FeSO_4$ + $ZnSO_4$ @ 25 kg ha^{-1}), increased the plant height of green gram by 39.70 cm, 46.87 cm and 52.19 cm at 30, 45 DAS and at harvest respectively, and was found at par with treatment T_4 and treatment T_2. The treatment T_1 (RDF) recorded the lowest plant heights 28.60, 33.17 and 38.97 cm at 30, 45 DAS and at harvest.

Application of micronutrients as soil application along with foliar application might have enhanced the availability of nutrients, activation of nutrients increases the vegetative growth and higher chlorophyll content in the respective treatment that would help to increase the plant height. Similar results were recorded by Gidaganti*et al.* (2019) in green gram. Ajjannavar*et al.* (2021) in chickpea. Almad*et al.* (2020) noticed that in pigeon pea.

3.2 Number of branches per plant

The data regarding the number of branches per plant of green gram as affected by application of micronutrient was recorded during three growth stages at 30, 45 DAS and at harvest are presented in table 1.

Branching is a crucial aspect of crop growth, bearing the plant's pods and ultimately increasing crop yield. The findings showed that the application of micronutrients might have a significant impact on the number of branches plant^{-1} in green gram. The maximum number of branches per plant (5.93, 9.47 and 10.64 at 30, 45 DAS and at harvest) were observed in the treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) respectively and was found at par with treatment T_4 and treatment T_2 and significantly superior over rest of the treatments. A minimum number of branches per plant (3.57, 6.27 and 7.87 at 30, 45 DAS and at harvest) were observed in treatment T_1 (RDF).

This might be due to the superiority of iron and zinc sulphate in maintaining higher iron and zinc concentrations in the rhizosphere. The beneficial role of synthesis of IAA, metabolism of auxin, biological activity, stimulating effect on photosynthetic pigments and enzyme activity in turn encourage vegetative growth of plants. Similar results were also reported by Almad*et al.* (2020) in pigeon pea, Ajjannavar*et al.* (2021) in chickpea. Sudhanshu*et al.* (2022) in green gram.

Table 1: Effect of micronutrient application on plant height and Number of Branches (plant^{-1}) of green gram.

Treatments	Plant height (cm)			Number of Branches (plant^{-1})		
	30 DAS	45 DAS	At Harvest	30 DAS	45 DAS	At harvest
T_1	28.60	33.17	38.97	3.57	6.27	7.87

T_2	38.73	45.87	50.48	5.50	9.27	10.16
T_3	34.95	38.90	48.15	4.10	8.53	9.51
T_4	38.94	46.83	50.89	5.30	9.34	10.17
T_5	37.40	43.55	48.17	5.37	9.27	9.50
T_6	34.48	40.01	46.35	4.97	9.10	9.47
T_7	39.70	46.87	52.19	5.93	9.47	10.64
T_8	34.25	38.40	45.58	4.13	8.23	8.73
T_9	33.41	39.30	46.10	3.87	7.73	8.38
T_{10}	34.26	39.79	46.23	3.93	8.13	9.20
SE(m)±	**1.28**	**0.94**	**1.18**	**0.28**	**0.30**	**0.33**
CD at 5%	**3.81**	**2.79**	**3.51**	**0.85**	**0.91**	**0.98**

3.3 Leaf area

The data regarding leaf area of green gram as affected by application of micronutrient was recorded during three growth stages at 30, 45 DAS and at harvest are presented in table 2.

The highest leaf area cm^2 $plant^{-1}$ 485.07, 532.97 and 540.67 at 30, 45 DAS and at harvest was recorded with treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$+25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) respectively and was found at par with treatment T_4 and treatment T_2 and significantly superior over rest of the treatments in green gram. The lowest leaf area 315.57, 326.41 and 344.33 at 30, 45 DAS and at harvest was recorded with treatment T_1 (RDF).

This might be due to increased metabolic activity by the increased supply of nutrients, more dry matter accumulation in leaves helped the photosynthetic area to remain active for a longer period. Similar kinds of results were noticed by Almad*et al.* (2020) in pigeon pea. Gowda *et al.* (2014) in pigeon pea.

3.4 Dry matter content

The data on dry matter content g $plant^{-1}$ of green gram as affected by application of micronutrient was recorded during three growth stages at 30, 45 DAS and at harvest are represented in table 2.

The higher dry matter was observed with the treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) 4.78, 7.27 and 9.54 g $plant^{-}$ at 30, 45 DAS and at harvest respectively and was found at par with treatment T_4 and treatment T_2 and significantly superior over rest of the treatments. Further data revealed that the treatment T_1 (RDF) produced lower dry matter content 2.95, 5.41, and 7.17 g $plant^{-}$ at 30, 45 DAS and at harvest respectively.

Higher dry matter production might be due to the increased photosynthetic rate accelerated nutrient uptake from soil, increased availability of major nutrients, and micronutrient (Zn and Fe) which increases vegetative growth and plant height. Similar findings were reported by Sudhanshu*et al.* (2022) in green gram. Ajjannavar*et al.* (2021) in chickpea and Meena*et al.* (2013) in mung bean.

Table 2: Effect of micronutrient application on Leaf Area (cm^2 $plant^{-1}$) and Dry Matter Content (g $plant^{-1}$) of green gram.

Treatments	Leaf Area (cm^2 $plant^{-1}$)			Dry Matter Content (g $plant^{-1}$)		
	30 DAS	45 DAS	At Harvest	30 DAS	45 DAS	At harvest
T_1	315.57	326.41	344.33	2.95	6.27	7.87
T_2	484.36	496.13	513.08	4.49	9.27	10.16
T_3	411.43	419.00	465.33	3.84	8.53	9.51
T_4	495.77	504.45	515.63	4.58	9.34	10.17
T_5	492.40	507.33	514.67	4.23	9.27	9.50
T_6	406.30	419.87	425.67	3.90	9.10	9.47
T_7	485.07	532.97	540.67	4.78	9.47	10.64
T_8	415.33	434.79	446.30	3.70	8.23	8.73
T_9	399.03	409.98	413.67	3.48	7.73	8.38
T_{10}	419.10	436.16	443.67	3.77	8.13	9.20

SE(m)±	**14.14**	**10.46**	**16.35**	**0.19**	**0.30**	**0.33**
CD at 5%	**42.01**	**31.10**	**48.59**	**0.57**	**0.91**	**0.98**

3.5 Chlorophyll content

The data about total chlorophyll analysed at 45 DAS are presented in Table 3.

Among all the treatments, T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) resulted in significantly higher chlorophyll content (9.93, 9.71 and 9.31 mg g^{-1}) at 45 DAS respectively and at par with treatment T_4 and treatment T_2 and significantly superior over rest of the treatments. The lowest chlorophyll content was observed with control T_1 RDF (6.39 mg g^{-1}) at the flowering stage of the crop.

These results might be due to chlorophyll being a green pigment in the chloroplast of the green plants. It helps plants to create their food through photosynthesis. Iron plays a crucial role during electron transport and chlorophyll formation and zinc also plays an important role in the synthesis of chlorophyll its enzymatic role in starch formation and protein synthesis. This increase in the availability of zinc to plants might have stimulated the metabolic and enzymatic activities thereby increasing the growth of the crop. Similar findings were reported by Lokhande (2018) in green gram. Bhadru*et al.* (2019) and Meena*et al.* (2013) in green gram crop.

3.6 Nodulation

The data about Nodules at flowering stage (plants^{-1})are presented in Table 3.

The maximum number of nodules per plant was obtained under the treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) which was (19.70, 19.83 and 19.50) respectively and were fund at par with treatment $T_4$and treatment T_2 and significantly superior over rest of the treatments. The minimum number of nodules per plant was obtained under the treatment T_1 (RDF) which was (11.57) respectively.

The increase in several nodules might be due to increased rhizobial colonization in the rhizosphere because of the increased availability of iron, zinc plays a vital role in cellular growth, differentiation and metabolism which results in vigorous growth of plants and extensive root system leading to increased growth parameters. Similar results were also reported by Kumar *et al.* (2020) in black gram and Meena*et al.* (2013)

Table 3. : Effect of micronutrient application on Total chlorophyll Content (mg g^{-1}) and Root nodules at flowering stage (plants^{-1}) of green gram.

Treatments	Total chlorophyll Content (mg g^{-1})	Root nodules at flowering stage (plants^{-1})
T_1	6.39	11.57
T_2	9.31	19.50
T_3	7.53	16.67
T_4	9.71	19.83
T_5	7.46	18.38
T_6	7.07	17.57
T_7	9.93	19.70
T_8	7.06	16.30
T_9	7.08	14.93
T_{10}	7.20	16.43
SE(m)±	**0.43**	**0.51**
CD at 5%	**1.28**	**1.54**

Yield parameters

The data related to different yield parameters like numberof pods plant^{-1}, numberofgrainspod^{-1}, seed and straw yield (kg ha^{-1}) as influenced by the application of micronutrient sources with certain treatments has shown below.

3.7 Number of pods plant^{-1}

Data on the mean number of pods per plant of green gram as influenced by various micronutrient treatments are presented in Table 4.

There was a significant increase in the number of pods plant^{-1} with all the treatments over T_1 (RDF). The highest number of pods plant^{-1} was recorded with treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$) at harvest (15.43) respectively which was found at par with treatment T_4 and T_2 having a number of pods per plant 15.35 and 15.33, respectively.

These results are in confirmatory with Banoth*et al.* (2022) in green gram, Gidaganti*et al.* (2019) in green gram and Meena*et al.* (2013) with green gram crop.

3.8 Number of grains pod^{-1}

Data presented in table 4. were not affected significantly with respect to the number of grains pod^{-1} at the harvest stage.

The maximum number of grains pod^{-1} observed in treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) which were 11.88 grains pod^{-1} respectively and the minimum number of grains pod^{-1} (10.92) wear observed in the treatment T_1 (RDF) in green gram.

The results obtained might be due to the application of micronutrients, iron and zinc which are playing an accumulative effect of growth characters and also yield attributes as it contains zinc which is involved in IAA synthesis and also different metabolic processes in plants. IAA promotes the prevention of pod abscission and cell elongation at suppression of pod abscission of pod was the major determining factor of the seed yield. On the other hand, auxin indirectly controlled the ethylene activity which accelerated the abscission. It also suppressed the cellulase activity, a cell-degrading enzyme that favored the abscission process. These results are in line with Gidaganti*et al.* (2019) in green gram, Banoth*et al.* (2022) in green gram, Kareti and George (2017) in chickpea and Sudhanshu*et al.* (2022 in green gram.

3.9 Seed yield

The data on the seed yield of green gram as influenced by the application of micronutrients are presented in table 4.

The seed yield of green gram ranged between 1020.32 kg ha^{-1} to 1575.46 kg ha^{-1}. The highest seed yield (1575.46 kg ha^{-1}) was recorded in treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) respectively which was at par with treatment T_4 and T_2 and significantly superior over rest of the treatments. Whereas, the lowest seed yield (1020.32 kg ha^{-1}) was recorded in the treatment T_1 (RDF) in green gram.

The increase in yield might be due to fulfilment of the demand for the crop by higher assimilation and translocation of photosynthates from source to sink and better role of iron and zinc during the reproductive phase of crop growth. However, the combined effect of iron and zinc provided sufficient nutrition to the plant and thereby more yield attributes and yield were recorded.

Similar findings were observed by Gidaganti*et al.* (2019) in green gram. Sudhanshu*et al.* (2022) in green gram. Meena*et al.* (2013 in green gram crop. Gahlot*et al.* (2020) in mungbean crop. Ajjannavar*et al.* (2021) in chickpea.

3.10 Straw yield

The data on the straw yield of a green gram as influenced by the application of micronutrients are presented in table 4.

Straw yield is directly related to an increase in vegetative growth of the plants. Data indicated that the application of iron and zinc markedly influenced the straw yield in the range of (1238.41 kg ha^{-1} to 1864.68 kg ha^{-1}). The maximum straw yield (1864.68 kg ha^{-1}) was recorded in treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) respectively which was found at par with treatment T_4 and treatment T_2 and significantly superior over rest of the treatments. Whereas, the lowest straw yield (1238.41 kg ha^{-1}) was recorded in the treatment T_1 (RDF).

The higher straw yield might be due to improved vegetative growth and growth parameters through adequate availability of major and micronutrients in soil, which in turn, favourably influenced the physiological process and buildup of photosynthates.Similar findings were shown by Misal (2018) in green gram, Meena*et al.* (2013) in green gram crop and Gahlot*et al.* (2020) with mung bean crop.

Table 4: Effect of micronutrient application on Yield parameterof green gram.

Treatments	**No. of pods** (plant^{-1})	**No. of grains** (pod^{-1})	**Seed yield** (kg ha^{-1})	**Straw yield** (kg ha^{-1})
T_1	11.19	10.92	1020.32	1238.41
T_2	15.33	11.51	1362.58	1820.32
T_3	14.05	11.21	1094.42	1401.73
T_4	15.35	11.69	1414.87	1832.96
T_5	14.48	11.45	1236.93	1658.49
T_6	14.42	11.32	1183.40	1594.30
T_7	15.43	11.88	1575.46	1864.68
T_8	13.23	11.15	1038.66	1341.26
T_9	13.29	11.48	1033.46	1381.41
T_{10}	13.44	11.00	1063.20	1365.30

SE(m)±	**0.04**	**0.21**	**104.95**	**83.05**
CD at 5%	**0.12**	**NS**	**311.81**	**246.78**

Quality parameters

The data related to different quality parameters Test weight, Protein content and Protein yield (kg ha^{-1}) as influenced by the application of micronutrient sources with certain treatments is shown below.

3.11 Test weight

Data regarding the effect on test weight was tabulated in table 5 indicating that the application of micronutrients markedly influenced the test weight in the range of (32.01 to 35.23 g).

Test weight was not significantly influenced by the application of iron and zinc and the maximum test weight (35.23 g) was found under the treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) respectively which was highest over rest of the treatments. Whereas, the lowest test weight (32.01 g) was recorded in the treatment T_1 (RDF) in green gram.

An increase in test weight due to greater mobilization of photosynthesis to the developing seeds by application of micronutrients might be the reason for the increase in seed weight. An increase in this attribute by soil application might be due to the involvement of iron and zinc in enzyme activation, membrane integrity, chlorophyll formation, stomatal balance and starch utilization at early stages which enhanced accumulation of assimilate in the grains resulting in heavier grains.

Similar findings were recorded by Misal (2018) in green gram, Gidaganti*et al.* (2019) in green gram.

3.12 Protein content and protein yield

The data on protein content and protein yield of green gram are presented in table 5. The mean protein content was (22.37 %). The mean protein content was not affected significantly due to different micronutrient treatments. The numerically higher protein content (22.37 %) recorded with treatment T_2 (RDF + S.A. Grade-I micro-nutrient @ 25 kg ha^{-1}) respectively followed by treatment T_4 (22.35 %), T_5 (22.25 %), T_6 (22.18 %), T_7 (22.04 %) respectively significantly superior over rest of the treatments. While, minimum protein content (21.37 %) was recorded at treatment T_1 (RDF) in green gram.

Table No. 5: Effect of micronutrient application on Test weight, Protein content and Protein yield of green gram.

Treatments	Test weight (g)	Protein content (%)	Protein yield (kg ha^{-1})
T_1	32.01	21.37	218.02
T_2	35.04	22.37	304.59
T_3	34.95	21.79	238.62
T_4	35.11	22.35	315.33
T_5	34.96	22.25	275.19
T_6	34.30	22.18	262.82
T_7	35.23	22.04	347.27
T_8	33.36	21.52	223.60
T_9	33.76	21.58	223.00
T_{10}	34.47	21.68	230.55
SE(m)±	**0.73**	**0.25**	**27.77**
CD at 5%	**NS**	**NS**	**67.65**

The higher protein yield (347.27 kg ha^{-1}) was observed with treatment T_7 (RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$ kg ha^{-1}) respectively which was found at par with treatment T_4 (315.33 kg ha^{-1}), T_2 (304.59 kg ha^{-1}), and significantly superior over rest of the treatments. Whereas, a lower protein yield (218.02 kg ha^{-1}) was recorded in treatment T_1 (RDF) in green gram. The increase in protein content might be due to iron and zinc which are two important elements in enzyme structure involved in amino acids are the bases of protein synthesis, protein content increases with the application of iron and zinc. Similar findings were observed by Misal*et al.* (2018) in green gram and Lokhande*et al.*(2018) in green gram.

4. Conclusion

1. Green gram crop fertilized with the application of RDF + $FeSO_4$ + $ZnSO_4$@25 kg ha^{-1} improved growth parameters like plant height, number of branches plant $^{-1}$, leaf area, dry matter content, total chlorophyll content and number of root nodules.
2. Significantly higher, number of pods $plant^{-1}$, number of grains pod^{-1}, seed yield $plot^{-1}$, seed yield ha^{-1}, straw yield $plot^{-1}$, and straw yield ha^{-1} with the application of RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$.
3. The improvement in quality parameters was recorded with the application of RDF + 25 kg ha^{-1} $FeSO_4$ + 25 kg ha^{-1} $ZnSO_4$*i.e.* Test weight, protein content, protein yield.

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