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Performance of Green Gram (*Vigna Radiata* L.) as Influenced by Sulphur and Iron Application

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ABSTRACT

Background: The present study was carried out on "Performance of Green gram as Influenced by Sulphur and Iron Application" to increase the grain quality and helps in synthesis of protein, vitamins, enzymes and flavoured compounds in the plant.

Methods: A field experiment was conducted during *kharif* season of 2018 at the Crop Research Farm, Department of Agronomy, Suresh Gyanvihar University, Jaipur. To study the influence of sulphur and iron on the performance of green gram. This experiment was done in randomized block design with eight treatments which are replicated thrice. Treatments consists of T_1 control, T_2 1.0% $FeSO_4$ as foliar spray at 25 DAS, T_3 25 kg S ha^{-1} as $ZnSO_4$, T_4 25 kg S ha^{-1} as SSP, T_5 25 kg S ha^{-1} as $ZnSO_4$ + 1.0% $FeSO_4$ as foliar spray at 25 DAS, T_6 25 kg S ha^{-1} as SSP + 1.0% $FeSO_4$ as foliar spray at 25 DAS, T_7 12.5 kg S ha^{-1} as $ZnSO_4$ + 12.5 kg S ha^{-1} as SSP and T_8 12.5 kg S ha^{-1} as $ZnSO_4$ + 12.5 kg S ha^{-1} as SSP + 1.0% $FeSO_4$ as foliar spray at 25 DAS.

Result: The results indicated that application of 12.5 kg S ha^{-1} as $ZnSO_4$ + 12.5 kg S ha^{-1} as SSP + 1.0% $FeSO_4$ as foliar spray at 25 DAS is suitable to get higher green gram yield, compared to other treatments.

Key words: Growth, Green gram, Iron, Sulphur, Yield.

INTRODUCTION

Pulses are an important part of profitable agriculture because a large section of population relies on them as they are low priced source of proteins (Usman *et al.,* 2007). The protein from pulses is easily digestible, relatively cheaper and have higher biological values.

India is the largest producer of green gram where it is grown in an area of 40.70 lakh hectares of land with an average production of 19.01 lakh tons (Anonymous 2018). In India, it is mainly grown as *kharif* crop in the states of Rajasthan, Maharashtra, Karnataka and Andhra Pradesh. Rajasthan is major green gram growing state of India where green gram is grown in an area of 17.19 lakh hectare of land with an average production of 7.42 lakh tons [Directorate of Economics and Statistics, Ministry of Agriculture and Farmers welfare (DAC and FW), Government of India; 2017-18. Sulphur and iron are one of the most important nutrients for all plants and animals. Sulphur is considered as the fourth major nutrient in increasing agricultural crop production after nitrogen, phosphorus and potassium. As being rich source of proteins, green gram needs to be judiciously fertilized with sulphur as this element plays a key role in protein synthesis and chlorophyll development. Sulphur is a constituent of essential amino acids *viz*., methionine, cysteine and cysteine-the building blocks of protein. Therefore, sulphur fertilization is considered as critical for seed yield and protein synthesis and for improvement in quality of produce in legumes through their enzymatic and metabolic effects (Bhattacharjee *et al.,* 2013). In addition, sulphur is required by the rhizobia bacteria in legumes including green gram for nitrogen fixation. Foliar application of Fe solutions is one of the most widely used methods for correcting Fe deficiency in many crops. This method of application usually circumvents the problems associated with Fe application to the soil. Goos and Johnson (2000) reported that foliar sprays of Fe significantly reduced iron-deficiency chlorosis, while increased seed yield in soybean. Therefore, balanced fertilization of macro and micro nutrients particularly in combination is very important for proper growth, development and high yield production of crop plants including green gram (Sawan *et al.,* 2001).

MATERIALS AND METHODS

Green gram crop experiment was conducted in *kharif* season during 2018 on a sandy loam soil having pH 8.48, organic carbon 0.40%, available NPK (28.00, 42.00, 290.00 kg ha^{-1}) electrical conductivity (EC) of 0.32 dS/m, at the Crop Research

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Farm, Department of Agronomy, School of Agriculture, Suresh Gyanvihar University, Jaipur (Rajasthan). Climate of the region is sub-tropical and semi-arid climate with the monsoon commencing from July and withdrawing by September. For the intended study 8 treatments were tested under three replications by using randomized block design. The treatments consist of T_1 control, T_2 1.0% $FeSO_4$ as foliar spray at 25 DAS, T_3: 25 kg S ha^{-1} as $ZnSO_4$, T_4 25 kg S ha^{-1} as SSP, T_5 25 kg S ha^{-1} as $ZnSO_4$+1.0% $FeSO_4$ as foliar spray at 25 DAS, T_6 25 kg S ha^{-1} as SSP+1.0% $FeSO_4$ as foliar spray at 25 DAS, T_7 12.5 kg S ha^{-1} as $ZnSO_4$+12.5 kg S ha^{-1} as SSP and T_8 12.5 kg S ha^{-1} as $ZnSO_4$+12.5 kg S ha^{-1} as SSP+1.0% $FeSO_4$ as foliar spray at 25 DAS. Nutrient management was done through SSP, $ZnSO_4$ and $FeSO_4$ to supply the required S, Fe and other. Full dose of inorganic source N, 20 kg ha^{-1} was applied in two spilt doses. The data on various growth and yield were recorded in different treatments. All the data were statistically analysed.

RESULTS AND DISCUSSION

Growth attributes

Plant height, number of root nodules $plant^{-1}$ and number of branches $plant^{-1}$ were significantly affected by various treatments (Table 1). The results revealed that treatment T_8 (12.5 kg S ha^{-1} as $ZnSO_4$+12.5 kg S ha^{-1} as SSP+1.0% $FeSO_4$ as foliar spray at 25 DAS) recorded significantly greater plant height (54.81 cm), number of root nodules $plant^{-1}$ (73.82), dry weight $plant^{-1}$ (21.54 gm) and number of branches $plant^{-1}$ (7.13) at 60 DAS. All growth qualities consistently increase following seeding of crop establishment till physiological maturity in all the treatments over the duration of inquiry. These findings are in accordance with the results reported by (Piri *et al.,* 2012) and (Sahu *et al.,* 2008).

Grain yield

The maximum grain yield (7.90 q ha^{-1}) was achieved by the treatment T_8 (12.5 kg S ha^{-1} as $ZnSO_4$+12.5 kg S ha^{-1} as SSP+1.0% $FeSO_4$) and it was 59.87% greater compared to the lowest grain yield (4.73 q ha^{-1}) seen in treatment T_1 (Control). It was followed by application of $ZnSO_4$+1.0% $FeSO_4$ as foliar spray at 25 DAS (T_5) Table 2. The results are in line with the study described by Khorgamy and Farin, (2009) and Valenciano *et al*., (2010), who claimed that the higher grain yield attained in green gram may be related to improved metabolic processes in plants owing to sulphur treatment using $ZnSO_4$ and SSP. The iron in ferrous sulphate also assists in absorption of nutrients, which are believed

Table 1: Influence of sulphur and iron on growth attributes of green gram (*Vigna radiata* L.).

Treatments	Plant height (cm)	Number of root nodules $plant^{-1}$	Dry weight (g $plant^{-1}$)	Number of branches $plant^{-1}$
Control	42.91	51.98	14.38	4.67
1% $FeSO_4$ as foliar spray at 25 DAS	45.10	54.66	16.11	5.80
25 kg S ha^{-1} as $ZnSO_4$	49.51	60.08	16.45	6.07
25 kg S ha^{-1} as SSP	47.68	55.68	16.23	5.92
25 kg S ha^{-1} as $ZnSO_4$ + 1% $FeSO_4$ as foliar spray at 25 DAS	52.48	72.77	20.63	6.47
25 kg S ha^{-1} as SSP + 1% $FeSO_4$ as foliar spray at 25 DAS	51.08	61.44	17.10	6.27
12.5 kg S ha^{-1} as $ZnSO_4$ + 12.5 kg S ha^{-1} as SSP	51.83	69.87	18.37	6.33
12.5 kg S ha^{-1} as $ZnSO_4$ ha^{-1} + 12.5 kg S ha^{-1} as SSP + 1% $FeSO_4$ as foliar spray at 25 DAS	54.81	73.82	23.54	7.13
F- test	S	S	S	S
S. Ed. (±)	2.47	3.47	0.93	0.35
C.D. (P=0.05)	5.29	7.44	2.00	0.78

Table 2: Influence of sulphur and iron on yield of green gram.

Treatments	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})
Control	4.73	5.88
1% $FeSO_4$ as foliar spray at 25 DAS	5.43	6.53
25 kg S ha^{-1} as $ZnSO_4$	6.45	6.97
25 kg S ha^{-1} as SSP	5.47	6.86
25 kg S ha^{-1} as $ZnSO_4$ + 1% $FeSO_4$ as foliar spray at 25 DAS	7.79	7.72
25 kg S ha^{-1} as SSP + 1% $FeSO_4$ as foliar spray at 25 DAS	6.79	7.20
12.5 kg S ha^{-1} as $ZnSO_4$ + 12.5 kg S ha^{-1} as SSP	7.17	7.29
12.5 kg S ha^{-1} as $ZnSO_4$ ha^{-1} + 12.5 kg S ha^{-1} as SSP + 1% $FeSO_4$ as foliar spray at 25 DAS	7.90	8.02
F- test	S	S
S. Ed. (±)	0.34	0.38
C.D. (P=0.05)	0.74	0.81

to have an effective photosynthetic mechanism and be better prepared for efficient translocation of photosynthates from source to sink, subsequently leading in higher grain production (Singh *et al.,* 1999).

Stover yield

The maximum stover yield (8.02 q ha^{-1}) was produced by application of 12.5 kg S ha^{-1} as $ZnSO_4$+12.5 kg S ha^{-1} as SSP+1.0% $FeSO_4$ (T_8) and it was 73.31 per cent greater compared to the lowest stover yield (5.88 q ha^{-1}) seen in treatment T_1 (Control). It was followed by T_5 (25 kg S ha^{-1} as $ZnSO_4$+1.0% $FeSO_4$ as foliar spray at 25 DAS). According to Nadergoli *et al.,* (2011), sulphur nutrition enhances cell multiplication, elongation, expansion and is known to impart a deep green colour to leaves due to better chlorophyll synthesis, which in turn increases the effective area for photosynthesis and thus, results in an increase in stover yield of a plant. In addition to sulphur, the availability of iron also helps in absorption of nutrients, which are expected to have an efficient photosynthetic mechanism and be better equipped for efficient translocation of photosynthates from source to sink, consequently resulting in increased stover yield (Singh *et al*., 1999).

CONCLUSION

The experiment “Performance of Green gram as Influenced by Sulphur and Iron Application” conducted during *kharif* season of 2018 concluded that application of 12.5 kg S ha^{-1} as $ZnSO_4$ +1 2.5 kg S ha^{-1} as SSP +1% $FeSO_4$ as foliar spray at 25 DAS registered highest growth and yield parameters observed, *viz.,* plant height (54.81 cm), number of root nodules $plant^{-1}$ (73.82), dry weight $plant^{-1}$ (23.54 g), number of branches $plant^{-1}$ (7.13) grain yield (7.90 q ha^{-1}) and stover yield (8.02) compared with the other treatments.

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