RESEARCH ARTICLE

EFFECT OF MICRONUTRIENT APPLICATION ON NODULATION AND QUALITY PARAMETERS OF URDBEAN (*VIGNA MUNGO* L.)

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Abstract: A field experiment was conducted during the summer, 2019 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to study the effect micronutrient application on yield attributes and yield of Urdbean (*Vigna mungo* L.). The soil of the experimental field was well drained, sandy loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus, potassium and sulphur and slightly alkaline in reaction. The nine treatments of nutrient management *viz*., Control**,** foliar spray of water at 20 & 40 DAS, foliar spray of zinc sulphate (0.5%) at 20 & 40 DAS, foliar spray of ferrous sulphate (0.5%) at 20 & 40 DAS, foliar spray of copper sulphate (0.1%) at 20 & 40 DAS, foliar spray of zinc sulphate (0.5%)+ ferrous sulphate (0.5%) at 20 & 40 DAS, foliar spray of zinc sulphate (0.5%)+ copper sulphate (0.1%) at 20 & 40DAS, foliar application of ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS and foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS were laid out in RBD with three replications. Results revealed that the higher number of nodules and nodule dry weight were recorded with foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS while lowest was recorded in control. Similarly, foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS is also advantageous for obtaining higher protein content and protein yield in urd bean crop.

Keywords: Effect, Micronutrient, Nodulation, Urdbean

INTRODUCTION

Urdbean (*Vigna mungo* L.) is a widely grown annual pulse crop belongs to family fabaceae. It is extensively grown under varying climatic conditions and soil types in India. It is also cultivated in many tropical and sub-tropical countries of Asia, Africa and Central America, although, India, Pakistan, Bangladesh, Burma and Sri Lanka are the principal countries contributing to the world production. India is the world largest producer as well as consumer of blackgram. It is 3rd most important pulse crop of the country after chickpea and pigeon pea. The urdbean is mainly grown in the states of Madhya Pradesh, Uttar Pradesh, Rajasthan, Bihar, Punjab, Maharashtra, West Bengal and Tamil Nadu. It is mostly grown as a rain fed during *Kharif* and *summer* in Northern India and in winter in Peninsular and Southern India. Its seed contain 25-26% protein, 60% carbohydrate, 1.5% fat, and considerable amount of minerals, amino acids and vitamins and thereby important for food and nutritional security point of view. It is also capable of maintaining and restoring soil fertility through biological nitrogen fixation (BNF). It's also improves physical, chemical and biological properties of soil.

Micronutrients play an important role in increasing legume yield through their effect on the plant, nitrogen fixing process and effective use of major and minor nutrients. Among micronutrients iron plays an important role by involving electron transport, redox reactions and functions as cofactors. Iron is a constituent of nitrogenase the enzyme essential for N_2 fixation by rhizobia and other microorganisms. Zinc plays a significant role in various enzymatic and physiological activities of the plant body. Zinc catalyses the process of oxidation in plant cells and plays a vital role in transformation of carbohydrates, regulates the consumption of sugar, increases the source of energy for the production of chlorophyll, adds in the formation of auxins and promotes absorption of water. Zinc is recognized as a key element in protein synthesis besides it activates several enzyme systems and auxins. It is also involved in nitrogen fixation and better root growth. Zinc is an important micronutrient for nodulation and nitrogen fixation (Smith, 1982). Deficiency of zinc in legumes is reported to reduce the number and size of nodules as it involved in leghaemoglobin synthesis (Marsh and Waters, 1985). Copper is also one of the essential micronutrients for plant growth. It is involved in numerous physiological functions as a component of several enzymes, mainly those which participate in electron flow, catalyze redox reactions in mitochondria and chloroplasts. Therefore, keeping in view the study was planned on the effect of micronutrients (especially Zn, Fe and Cu) application on nodules, protein content and protein yield of urd bean.

MATERIALS AND METHODS

The proposed study was at the Crop Research Centre, SVP University of Agriculture and Technology,

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Meerut (U.P) to study the effect of micronutrient application on nodulation and quality parameters of Urdbean (*Vigna mungo* L.). The experiment was laid out in randomized complete block design (RCBD) with three replication having net plot size 4.0 m x 3.0 m. The variety PU-31 was sown on March 18 and harvested on June 16, 2019. Recommended dose of fertilizer was applied at the rate of 20:50:0 kg/ha using DAP as the source. The treatments are T_1 Control (No spray), T_2 Foliar spray of water at 20 & 40 DAS, T_3 Foliar spray of Zinc sulphate (0.5%) at 20 & 40 DAS, T_4 Foliar spray of Ferrous sulphate (0.5%) at 20 & 40 DAS, T_5 Foliar spray of Copper sulphate (0.1%) at 20 & 40 DAS, T_6 Foliar spray of Zinc sulphate (0.5%) + Ferrous sulphate (0.5%) at 20 & 40 DAS, T_7 Foliar spray of Zinc sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS, T_8 Foliar application of Ferrous sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS, and T_9 Foliar application of Zinc sulphate (0.5%) + Ferrous sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS and replicated three times

The soil of the experimental field was well drained, sandy loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus, potassium and slightly alkaline in reaction. Certified seed of PU-31 variety of urdbean was procured from local market and sown @ 25 kg ha^{-1} with row to row distance 30 cm and plant to plant distance 10 cm. Plant population was maintained by thinning after the emergence count. All other practises were kept normal and uniform for all the treatments. Weeds were controlled in the field by hand weeding. Irrigations were applied at critical stages and crop was harvested when 80 to 90 percent pods were ripened. After sun drying threshing was done.

RESULTS AND DISCUSSION

The number of nodules and their dry weight (Table 4.1) were greatly influenced by various foliar application of combined micronutrients application. Highest number of nodules and nodule dry weight were observed with foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS while lowest was recorded in control plot. It could be possibly because iron and other nutrients is an integral part of nitrogenase enzyme which plays an important role in nodulation and symbiotic nitrogen fixation. Increase in nodule number could be due to increased infection and rhizobial colonization in rhizosphere due to greater availability of iron. Similar findings are given by Usman *et al.* (2014) and Shete *et al.* (2018). And also increase in nodulation might be due to the enhanced rooting system with the application of zinc. Application of zinc has shown good response on nodulation in blackgram (Pavadai *et al*., 2004). The increased IAA due to Zn increased the nodule number (Soundararajan *et al.*, 1985). Mo and Zn which are the metallic components of one or more enzymes are involved in various physiological functions, growth, development and productivity of the plant. Hence, positive response of their application with respect to nodulation was found.

The significantly higher protein content and protein yield (Table 4.2) was recorded in treatment with foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS and lowest protein content and yield were recorded incontrol. This increase in protein content might be due to combined application of micronutrients improved the nutrient availability to crop, which increased the nitrogen content in grains resulting in higher protein content in grains. Higher protein content and grain yield under treatment with foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS resulted into higher protein yield. The increase in protein content could be assigned to increased uptake of nitrogen with increase in its application which was in turn transferred from the non-grain to grain portion. Higher nitrogen content is directly responsible for higher protein content because it is a primary component of amino acids which constitutes the basis of protein. Similar findings are given by Salih *et al.* (2013). Application of micronutrients mixture ensures the balanced supply of nutrients which in turn helps in improving the nutritional quality of urd bean.

Table 1. Effect of micronutrient application on number of nodules $plant^{-1}$and dry weight of nodules $plant^{-1}$ at different stages of crop growth.

Treatment	Number of nodules $plant^{-1}$			Dry weight of nodules $plant^{-1}$		
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
Control (No spray)	32.4	63.5	36.4	2.60	10.08	8.04
Foliar spray of water at 20 & 40 DAS	33.3	67.1	37.3	2.71	10.72	8.15
Foliar spray of Zinc sulphate (0.5%) at 20 & 40 DAS	34.3	76.0	39.2	2.80	13.61	9.17

Foliar spray of Ferrous sulphate (0.5%) at 20 & 40 DAS	34.2	75.6	40.5	2.75	12.55	8.92
Foliar spray of Copper sulphate (0.1%) at 20 & 40 DAS	34.1	74.9	39.7	2.68	12.54	8.73
Foliar spray of Zinc sulphate (0.5%)+ Ferrous sulphate (0.5%) at 20 & 40 DAS	35.8	82.5	47.1	3.32	14.22	10.48
Foliar spray of Zinc sulphate (0.5%)+ Copper sulphate (0.1%) at 20 & 40DAS	35.6	81.2	46.2	3.10	13.93	10.26
Foliar application of Ferrous sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS	35.5	80.0	45.7	3.08	13.74	10.11
Foliar application of Zinc sulphate (0.5%) + Ferrous sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS	36.4	86.0	51.0	3.70	14.60	10.75
SEm (±)	**0.30**	**1.01**	**1.00**	**0.05**	**0.10**	**0.08**
C.D. (p=0.05)	**0.9**	**3.1**	**3.0**	**0.15**	**0.30**	**0.23**

Table 2. Effect of micronutrients application on protein content (%) and protein yield (kg ha^{-1}) of urdbean

Treatments	**Protein content (%)**	**Protein yield (kg ha^{-1})**
Control (No spray)	19.03	132.06
Foliar spray of water at 20 & 40 DAS	20.00	149.67
Foliar spray of Zinc sulphate (0.5%) at 20 & 40 DAS	22.25	195.59
Foliar spray of Ferrous sulphate (0.5%) at 20 & 40 DAS	21.66	183.53
Foliar spray of Copper sulphate (0.1%) at 20 & 40 DAS	21.19	170.36
Foliar spray of Zinc sulphate (0.5%)+ Ferrous sulphate (0.5%) at 20 & 40 DAS	23.23	227.31
Foliar spray of Zinc sulphate (0.5%)+ Copper sulphate (0.1%) at 20 & 40DAS	22.81	219.56
Foliar application of Ferrous sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS	22.06	209.28
Foliar application of Zinc sulphate (0.5%) + Ferrous sulphate (0.5%) + Copper sulphate (0.1%) at 20 & 40 DAS	24.31	257.66
SEm (±)	**0.30**	**4.24**
C.D. (p=0.05)	**0.92**	**12.83**

CONCLUSION

The data pertaining to the different treatments, it may be concluded that the maximum number of nodules and nodule dry weight were recorded with foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS. Similarly, foliar application of zinc sulphate (0.5%) + ferrous sulphate (0.5%) + copper sulphate (0.1%) at 20 & 40 DAS is also advantageous for obtaining higher protein content and protein yield which was significantly higher than rest of the treatments.

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