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Response of mungbean (*Vigna radiata*) to zinc and iron application through soil and foliar spray

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Abstract
An agronomic investigation entitled 'Fortification of Zinc and Iron through spray in mungbean (*Vigna radiata*)' was carried out at experiment farm Agricultural Research Station, Badnapur, Vasantrao Naik Marathwada Krishi Vidhyapeeth, Parbhani during *kharif*, 2023. The experiment was laid out in randomized block design (RBD) with three replications. The soil was clayey in texture having 30 cm depth with moderate moisture holding capacity which was good for normal growth of the crop. The recommended mungbean cv. BM 2003-2 was used for this experiment along with these eight treatments. The treatment included with (T_1) 0.5% $ZnSO_4$-spray at flower initiation, (T_2) 0.5% $ZnSO_4$-spray at flower and pod initiation, (T_3) 0.5% $FeSO_4$-spray at flower initiation, (T_4) 0.5% $FeSO_4$-spray at flower and pod initiation, (T_5) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower initiation, (T_6) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower and pod initiation, (T_7) 25 kg ha^{-1} $ZnSO_4$-through soil application and (T_8) 10 kg ha^{-1} $FeSO_4$-through soil application. The gross plot size of experiment plot was 5.4 x 5.0 m^2 and net plot size was 4.8 x 4.8 m^2. The crop was sown by dibbling method at spacing 30 × 10 cm^2.
The results showed that growth parameters, including plant height, number of primary and secondary branches, days to 50% flowering and days to maturity, were significantly higher with the application of treatment (T_6) 0.5% $ZnSO_4$ and $FeSO_4$ spray at both flower and pod initiation. This treatment performed similarly to (T_5) 0.5% $ZnSO_4$ and $FeSO_4$ spray at flower initiation across different stages of mungbean growth. The lowest values were observed with (T_1) 0.5% $ZnSO_4$ spray at flower initiation.

Keywords: Mungbean, fortification, zinc sulphate, ferrous sulphate, foliar, soil, flower initiation, pod initiation

Introduction

Mungbean is one of the important pulse crops grown in arid and semi-arid region of the country. Among the pulses grown in India, mungbean ranks third after chickpea and pigeonpea because of its adaptation to short growth duration, low water requirement, soil fertility and is favoured for consumption due to its easy digestibility and low production of flatulence (Sahil and Bandopadhya, 2007) [7]. Mungbean is a valuable green manure crop, benefiting soil health by fixing atmospheric nitrogen at a rate of 30-40 kg N ha^{-1}. After the mature pods are harvested, its green biomass is used as fodder. Known for its high protein content (25%), mungbean is rich in essential amino acids like lysine (4600 mg N^{-1}) and tryptophan (60 mg N^{-1}), making it a nutritious food source consumed both as whole grain and dal in various dishes. Beyond its nutritional value, mungbean helps prevent soil erosion and, due to its short growing period, fits well into diverse intensive cropping systems. It is commonly used in crop rotations, such as within rice-rice or rice-wheat systems, and is often intercropped with sugarcane and maize.

Zinc is essential element for crop production and growth development of plant (Ali and Nesa, 2012) [2]. Zinc deficiency is particularly pronounced in calcareous, organic matter-poor, arid, and semi-arid soils. As an essential micronutrient, zinc is involved in a wide range of plant metabolic processes, including cell wall development, respiration, photosynthesis, chlorophyll synthesis, enzyme activity, and various other biochemical functions.

Iron, on the other hand, is a key structural element in several important molecules, such as porphyrins, cytochromes, heme compounds, hematin, ferrochrome, and leghaemoglobin. These molecules are crucial for oxidation-reduction reactions in both respiration and photosynthesis.

Sulfur also plays an indispensable role in regulating metabolic and enzymatic functions, including photosynthesis, respiration, and nitrogen fixation in legumes through their symbiosis with rhizobia. Additionally, sulfur is involved in energy transformation, enzyme activation, and carbohydrate metabolism, all of which contribute to improved plant growth and higher yields.

Soil application of fertilizer is the most straight forward method for addressing micronutrient deficiencies. However, its success and sustainability are not guaranteed, due to agronomic and economic factors. Challenges include low availability of micronutrient elements caused by top soil drying, sub soil constraints, interactions with diseases, and the high cost of fertilizer, particularly in developing countries. Foliar spraying is a new method for crop feeding in which micronutrients in the form of liquid are used on leaves (Nasiri *et al.* 2010) [3].

Agronomic biofortification provides a fast and effective way to boost micronutrient levels in crops, making it a more accessible option than traditional breeding methods. This approach offers a quick solution to mineral deficiencies while supporting ongoing breeding efforts. Among the various biofortification techniques, foliar application stands out as the most effective method for enhancing micronutrient concentrations in crops.

About 5-55% of all women suffer from breast disorders in their lifetime. Benign disorders of the breast is usually seen in reproductive period of life, is thought to be largely hormone induced and there is a dramatic fall in the incidence, after menopause due to cessation of clinical ovarian stimulation. Benign breast disease is 4-5 times more common than breast cancer [3].

The concept of ANDI-Abberations of Normal Development and Involution is gaining acceptance [4]. Benign proliferation of the breast are often considered as aberrations of normal development and involution. The cyclical changes due to variations in estrogen and progesterone result in increased mitosis around days 22-24 of the menstrual cycle but apoptosis restores the balance across the cycle. ANDI, first proposed by Huges is now universally accepted. This concept allows conditions of the breast to be mapped between normality, through benign.

Materials and Methods

The field experiment was conducted at Experimental farm, Department of Agronomy, Agricultural Research Station, Badnapur. The topography of experimental plot was fairly levelled. The soil was medium black in colour, high moisture retentive, clayey deep and fairly well drained. The soil of experimental plot was clayey in texture, low in organic carbon, low in nitrogen, moderate in available phosphorus, high in potash and slightly alkaline in reaction.

The seed of mungbean variety BM 2003-2 was collected from Agriculture Research Station, Badnapur. Mungbean was sown on 02 July 2023. The sowing was done by dibbling with 2 seeds per hill at a distance of row to row 30 cm and plant to plant 10 cm (30 cm x 10 cm) at about 4.0 cm depth.

The experimental plot was laid out in Randomized Block Design (RBD) design with eight treatments and three replications. The randomly allotted treatments were (T_1) 0.5% $ZnSO_4$-spray at flower initiation; (T_2) 0.5% $ZnSO_4$-spray at flower and pod initiation; (T_3) 0.5% $FeSO_4$-spray at flower initiation; (T_4) 0.5% $FeSO_4$-spray at flower and pod initiation; (T_5) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower initiation; (T_6) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower and pod initiation; (T_7) 25 kg ha^{-1} $ZnSO_4$-through soil application and (T_8) 10 kg ha^{-1} $FeSO_4$-through soil application.

Results and Discussion

Growth attributes of mungbean influenced by various treatments

During the investigation the growth characteristics including plant height, number of primary and secondary branches $plant^{-1}$, days to 50% flowering and days to maturity were influenced by different treatments.

Plant height

The average plant height of mungbean crop at 30 DAS was found to be non-significant. At 45 DAS, 60 DAS and at harvest taller plants of mungbean crop were recorded with (T_6) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower and pod initiation were significantly higher than other treatments but found at par with (T_5) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower initiation and followed by rest of the treatments as shown in Table 1. This might be due to enhanced photosynthesis, chlorophyll production, nitrogen metabolism, increase in cell expansion and division and auxin contents ultimately improving plant height. Similar results were reported by Pise *et al.* (2019) [5], Pal *et al.* (2019) [4] and Purushottam *et al.* (2018) [6] in chickpea by foliar application of zinc and gypsum.

Number of primary and secondary branches $plant^{-1}$

At 45 DAS primary and secondary branches of mungbean crop was recorded with (T_6) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower and pod initiation which was significantly higher than other treatments but found at par with (T_5) 0.5% $ZnSO_4$ and $FeSO_4$-spray at flower initiation as shown in Table 2. It was followed by (T_8) 10 kg ha^{-1} $FeSO_4$-through soil application, (T_7) 25 kg ha^{-1} $ZnSO_4$-through soil application, (T_4) 0.5% $FeSO_4$-spray at flower and pod initiation, (T_2) 0.5% $ZnSO_4$-spray at flower and pod initiation. The shorter primary and secondary branches were recorded with (T_3) 0.5% $FeSO_4$-spray at flower initiation and (T_1) 0.5% $ZnSO_4$-spray at flower initiation. Similar trend of observation was recorded at 60 DAS and at harvest.

The positive impact of foliar application of zinc and iron, in combination with the recommended dose of fertilizers (RDF), enhances metabolic activities such as the synthesis of IAA, auxin metabolism, and the production of nitrate reductase enzyme in leguminous crops. This interaction also improves nutrient uptake and accelerates the translocation of photo assimilates. These findings align with the results of Ali and Mahmood (2012) on mungbean.

Days to 50% flowering

Among the different treatments numerically highest days to 50% flowering was recorded non-significant in (T_7) 25 kg ha^{-1} $ZnSO_4$-through soil application and (T_8) 10 kg ha^{-1} $FeSO_4$-through soil application and followed by rest of the treatments as shown in Table 1.

Days to maturity

Days to maturity were not significantly influenced by the application of treatments. Days to maturity recorded varies between 67 to 65 days. The maximum days to maturity observed with treatment (T_7) 25 kg ha^{-1} $ZnSO_4$-through soil application followed by rest of the treatments as shown in Table 1.

Table 1: Plant height (cm), days to 50% flowering and days to maturity influenced by various treatments of mungbean

Sr. no	Treatment details	Plant Height (Cm)				Days to 50% Flowering (Days)	Days to maturity (Days)
		30 DAS	45 DAS	60 DAS	At harvest		
T_1	0.5% $ZnSO_4$-Spray at flower initiation	19.81	26.19	31.10	31.96	37	65
T_2	0.5% $ZnSO_4$-Spray at flower and pod initiation	20.69	27.04	33.28	34.57	37	66
T_3	0.5% $FeSO_4$-Spray at flower initiation	19.04	26.23	31.20	32.09	38	66
T_4	0.5% $FeSO_4$-Spray at flower and pod initiation	20.04	27.51	33.60	35.61	38	66
T_5	0.5% $ZnSO_4$ and $FeSO_4$-Spray at flower initiation	21.75	33.16	41.17	41.46	36	65
T_6	0.5% $ZnSO_4$ and $FeSO_4$-Spray at flower and pod initiation	21.90	33.75	41.76	42.62	36	65
T_7	25 kg ha^{-1} $ZnSO_4$-through soil application	18.22	30.04	35.08	37.03	39	67
T_8	10 kg ha^{-1} $FeSO_4$-through soil application	18.16	30.14	37.15	38.07	39	67
	SE (m) ±	0.90	1.13	1.43	1.50	1.53	0.52
	C.D. at 5%	N.S.	3.43	4.34	4.50	N.S.	N.S.
	General Mean	19.95	29.30	35.54	36.70	38	66

Table 2: Number of primary and secondary branches $plant^{-1}$ influenced by various treatments of mungbean

Sr. no.	Treatment details	45 DAS		60 Das		At Harvest	
		No of primary branches $plant^{-1}$	No of secondary branches $plant^{-1}$	No of primary branches $plant^{-1}$	No of secondary branches $plant^{-1}$	No of primary branches $plant^{-1}$	No of secondary branches $plant^{-1}$
T_1	0.5% $ZnSO_4$-Spray at flower initiation	4.73	3.48	6.46	4.11	6.49	4.17
T_2	0.5% $ZnSO_4$-Spray at flower and pod initiation	5.22	3.95	7.39	4.68	7.44	4.92
T_3	0.5% $FeSO_4$-Spray at flower initiation	5.11	3.70	6.85	4.22	7.02	4.24
T_4	0.5% $FeSO_4$-Spray at flower and pod initiation	5.43	3.80	7.56	4.75	7.61	4.96
T_5	0.5% $ZnSO_4$ and $FeSO_4$-Spray at flower initiation	6.30	4.80	8.54	5.68	8.62	5.74
T_6	0.5% $ZnSO_4$ and $FeSO_4$-Spray at flower and pod initiation	6.62	4.81	8.69	5.85	8.79	5.92
T_7	25 kg ha^{-1} $ZnSO_4$-through soil application	5.70	3.31	7.67	4.83	7.85	5.02
T_8	10 kg ha^{-1} $FeSO_4$-through soil application	5.90	3.10	7.91	4.94	7.96	5.05
	SE (m) ±	0.22	0.15	0.23	0.30	0.25	0.30
	C.D. at 5%	0.67	0.46	0.71	0.89	0.75	0.89
	General Mean	5.63	3.87	7.63	4.88	7.72	5.00

Conclusion

Results obtained during investigation inferred some conclusions which are furnished below:

1. The application of 0.5% $ZnSO_4$ and $FeSO_4$-Spray at flower and pod initiation was found appropriate for achieving increased growth and yield attributes both in terms of seed yield and stover yield of mungbean.
2. The foliar application of zinc (Zn) and iron (Fe) resulted in favourable changes in the production of mungbean.
3. Based on economics, application of 0.5% $ZnSO_4$ and $FeSO_4$-Spray at flower and pod initiation gave maximum gross monetary return and net monetary return.

References

1. Ali K, Khourgami N, Nesa S. The effect of trace elements spraying on the yield and yield components of dry land wheat in Khorram Abad, Iran. Ann Biol Res. 2012;3(11):5200-5204.
2. Ali EA, Mahmood AM. Effect of foliar spray by different salicylic acid and zinc concentrations on seed yield and yield components of mung bean in sandy soil. Asian J Crop Sci. 2012;5(1):33-40.
3. Nasiri Y, Salmasi ZS, Nasrullahzadeh S, Najafi N, Golezani GK. Effects of foliar application of micronutrients (Fe and Zn) on flower yield and essential oil of chamomile (*Matricaria chamomilla* L.). J Med Plants Res. 2010;4(17):1733-1737.
4. Pal V, Guriqbal S, Salwinder SD. Yield enhancement and biofortification of chickpea (*Cicer arietinum* L.) grain with iron and zinc through foliar application of ferrous sulphate and urea. J Plant Nutr. 2019;42(15):0190-4167.
5. Pise SE, Shende PV, Deotale RD, Raut AD, Blesseena, Hivare VS. Influence of zinc and iron on morph physiological parameters and yield of Lathyrus (*Lathyrus sativus* L.). J Soils Crops. 2019;29(2):360-5.
6. Purushottam, Gupta SK, Saren BK, Sodi B, Rajwade OP. Growth and yield of chickpea (*Cicer arietinum* L.) as influenced by irrigation scheduling and zinc application. Int J Chem Stud. 2018;6(1):1130-1133.
7. Sahil S, Bandopadhya PK. Retaining seed vigour and viability of mungbean by drought dressing treatments. J Food Legumes. 2007;20(8):173-175.