Original Research Article

Influence of sulphur and foliar spray of iron on growth and economics of maize

ABSTRACT

"Afield experiment was conducted at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, UP, during the Zaid season of 2022 on sandy loam soil. The experiment was laid out in Randomized Block Design, consisting of three levels of sulphur (10 kg/ha, 15 kg/ha &25 kg/ha) and three levels of iron as a foliar spray (1500,2000 &2500ppmmg/kg)." The maize variety Kanchan was sown in April 2022. The results of the experiment revealed that the application of 25 kg/ha of sulphur along with 2500 ppm mg/kgof iron significantly increased the growth parameters viz., plant height (196.4 cm), and dry weight (71.15 g/plant),whereas, application of 25 kg/ha of sulphur and iron at 2500 ppm mg/kgalso showed a positive effect on economics viz., gross returns (121644.00INR/ha), net returns (84843.00 INR/ha), and B: C (1:2.30).

Keywords: Economics, Growth parameters, Iron,Sulphur, Maize.

INTRODUCTION

Cereal grains provide majority of its food calories and protein they are good sources of micronutrients such as calcium, Iron and vitamins of group B. Maize (*Zea mays*) is the most versatile crop that can be successfully grown in varied agro-ecologies ranging from sea level to high altitudes up to 3000 m. It has highest genetic yield potential among the food grain crops. In India, maize is the third most important crop after rice, wheat and is cultivated throughout the year in different parts of the country for various purposes including grain, fodder, green cobs, sweet corn, baby corn, popcorn etc.Handbook of Agriculture (2019) [1].

Comment [RT1]: Calcium is a secondary nutrient not micronutrient?
Plz check

As per the data provided by Agricultural statistics at a glance (2021) [2], ~~i~~In India maize is cultivated in 9.86 million hectares, production 31.51 million tonnes and productivity 3.1 tonnes/ha (2020-2021). The maize growing states are Karnataka (16.45%), Madhya pradesh (11.3%), Maharashtra (10.91%), Tamil Nadu (8.63%).~~Agricultural statistics at a glance (2021) [2].~~

"Sulphur is an essential constituent ofamino acids", viz. cysteine which involved in Kreb's cycle, cystine and methionine used in the formation of Anthocyanin, chlorophyll, lignin and pectin of cell membrane(Crop Nutrition-Principles and Practices,Dr. Rajendra Prasad, ~~(~~2014)[3]. Sulphuris a precursor of the plant hormone ethylene. Salisbury and Ross, (1986)[4]. It plays an important role in electron transfer reactions and in metabolic activities of vitamins, biotin, thiamine, co-enzyme.Handbook of Agriculture (2019)[1]. However,

~~I~~iron is a constituent of Haem and non-Haem proteins,Haem protein contains Fe-porphyrin complex molecule, a prosthetic group of cytochromes, haematin, ferrochrome, oxidase, catalase, peroxidase, leghaemoglobin enzymes. The non-haem contains stable Fe-S protein, the ferrodoxin which is a compound of photosynthetic electron transport chain. It is necessary for synthesis and maintenance of chlorophyll and nucleic acid (Handbook of Agriculture,~~(~~2019) [1]. Fe has a vital role in formation

ALA, the precursor of porphyrins. Fe is involved in protein, nucleic acid, lipid (lipoxinase) metabolism.

MATERIAL AND METHODS

"The field trial was conducted during the *Zaid* season from April to July 2022 in Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, U.P. which is located at 25^0 24' 42" N latitude, 81^0 50' 56" E longitude and 98 m altitude above the mean sea level. This area is located on the right side of river Ganga which is 11 km away from Prayagraj city". The soil of the experimental field is slightly alkaline in nature with a (~~PH~~ pH of 7.1). Ithad a sandy loam texture, high in Nitrogen (N), Potassium (K) and medium in Phosphorous (P). The experiment was laid out in Randomized Block Design consisting of ten treatment combinations ~~viz~~which were replicated thrice. The experimental field was ploughed thoroughly and brought to a fine tilth by removing stubbles. 30 plots of each 3.0 m x 3.0 m were made.

1. Sulphurat 10kg/ha+iron at 1500ppm
2. Sulphurat 15kg/ha+iron at1500ppm
3. Sulphurat 25kg/ha+iron at1500ppm
4. Sulphurat 10kg/ha+iron at2000ppm
5. Sulphurat 15kg/ha+iron at2000ppm
6. Sulphurat 25kg/ha+iron at2000ppm
7. Sulphurat 10kg/ha+iron at2500ppm
8. Sulphurat 15kg/ha+iron at2500ppm
9. Sulphurat 25kg/ha+iron at2500ppm
10. Blanket application of 120:60:40 kg/ha NPK

Formatted: Font: Not Italic

Comment [RT2]: Plz check the pH value, if it 7.1 then it is not slightly alkaline (neutral pH value ranged from 6.5 to 7.5)

Comment [RT3]: Add the values of NPK of the start of experiment

Formatted: Font: Not Italic

Comment [RT4]: Write mg/kg in place of ppm

~~were replicated thrice. The experimental field was ploughed thoroughly and brought to a fine tilth by removing stubbles. 30 plots of each 3.0 m x 3.0 m were made.~~ Major nutrients were applied in 30-60-50 kg/ha amount through urea, SSP, and ~~Mop~~MOP, to all treatments after opening the furrows and covered with soil while sulphur was applied as elementalsulphur, Iron as chelated form. Kanchan variety was sown by line sowing method in furrows with the spacing of 45 cm between rows and 30 cm between plants. The growth parameters *viz.*, plant height (cm), dry weight (g/plant), were recorded at 15 days-time intervals till physiological maturity and yield parameters *viz.*,cobs per plant (No), cob length(cm), cob weight (g), no. of rows/cob (No), no. of grains/row (No), seed yield (t/ha), stover yield (t/ha) were recorded at the time of harvesting on per hectare basis and data was statistically analysed by using ANOVA technique. Gomez and Gomez (1994)[5].

Formatted: Indent: First line: 0.17"

Comment [RT5]: Here potassium dose is 50 kg and treatment details 40 kg, which is correct, plz check

Comment [RT6]: Write S content in elemental sulphur fertilizers

RESULT AND DISCUSSION

Observations of growth attributes *viz.*, plant height and, dry weight were presented in table 1. The ~~S~~significantly highest plant height (196.4 cm) was recorded with the application of 25kg/ha of sulphur and iron at 2500 ppm.However, the application of 25 kg/ha and iron at 2000 ppm in plant height (194.3 cm) was statistically at par with the highest. Similarly, the highest dry weight (71.15g/plant) at 60 DAS was recorded with the application of 25kg/ha of sulphur and iron at 2500 ppm. However,with the application of 15kg/ha sulphur and iron at 2500 ppm,dry weight (70.39 g/plant) was statistically at par with the highest. The increase in plant height, and dry weight, might be because the application of a higher dose of both sulphur and iron had a positive role in metabolic activities, ferrodoxin an iron containing protein lead to an increase in photosynthetic activities and nitrate, sulphate reduction thereby increased plant height. An increase in plant height with an increase in sulphur levels might be due to the increase in uptake of NPK during knee high stage and silking stage is influenced by application of sulphur.Crop Nutrition-Principles and Practices, Dr. Rajendra prasad, (2014) [3].

The ~~Economics~~ economics of maize were presented in table no 2. Gross returns (89235.6 INR/ha), net returns (60235.6INR/ha) and B:C (2.07) ratio were highest with the application of sulphur at 25 kg/ha and 2500 ppm of iron.

SUMMARY AND CONCLUSION

Under Irrigated conditions,~~inceptisol soil order,~~ cultivation of maize during *Zaid* season with the application of sulphur at 25 kg/ha and iron at 2500 ppm was more desirable in terms of growth when compared to other treatments atInceptisol. It also fetched good net returns and B:C ratio.

REFERENCES

1. Hand Book of Agriculture. 12th reprint of 6th Ed. New Delhi, India.
2. Agricultural statistics at a glance, 2021 https://eands.dacnet.nic.in.
3. Crop Nutrition-Principles and Practices,1st Edition Dr. Rajendra prasad,2014
4. Salisbury, F.B. and Ross, C.W. (1985) Plant physiology. Wadsworth Publishing Co., Belmont
5. Gomez, K.A. and Gomez, A.A. (1984) Statistical Procedures for Agricultural Research. 2nd Edition, John Wiley and Sons, New York, 680 p.

Table 1. Influence of sulphur and iron on growth attributes of maize

S.no	Treatments	At 60 DAS	
		Plant height (cm)	**Dryweight (g/plant)**
1	Sulphur at 10 kg/ha and iron at 1500 ppm	176.2	72.70
2	Sulphur at 15 kg/ha and iron at 1500 ppm	184.7	76.17
3	Sulphur at 25 kg/ha and iron at 1500 ppm	191.3	80.47
4	Sulphur at 10 kg/ha and iron at 2000 ppm	177.7	74.70
5	Sulphur at 15 kg/ha and iron at 2000 ppm	184.9	74.40
6	Sulphur at 25 kg/ha and iron at 2000 ppm	194.3	79.50
7	Sulphur at 10 kg/ha and iron at 2500 ppm	178.0	75.83
8	Sulphur at 15 kg/ha and iron at 2500 ppm	184.7	76.37
9	Sulphur at 25kg/ha and iron at 2500 ppm	196.4	83.03
10	Control (120:60:40 kg/ha NPK)	178.1	72.00
	S.Em(±)	1.05	1.42
	CD(5%)	3.13	4.22

Table 2. Influence of Sulphur and foliar application of iron on economics of maize

Sl no.	Treatments	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	Sulphur at 10 kg/ha and iron at 1500 ppm	86328.00	51002.00	1.40
2.	Sulphur at 15 kg/ha and iron at 1500 ppm	94176.00	58400.00	1.60
3.	Sulphur at 25 kg/ha and iron at 1500 ppm	111834.00	75158.00	2.04
4.	Sulphur at 10 kg/ha and iron at 2000 ppm	90252.00	54676.00	1.50
5.	Sulphur at 15 kg/ha and iron at 2000 ppm	92214.00	56238.00	1.57
6.	Sulphur at 25 kg/ha and iron at 2000 ppm	115758.00	79032.00	2.15
7.	Sulphur at 10 kg/ha and iron at 2500 ppm	88290.00	52839.00	1.49
8.	Sulphur at 15 kg/ha and iron at 2500 ppm	103986.00	68025.00	1.89
9.	Sulphur at 25 kg/ha and iron at 2500 ppm	121644.00	84843.00	2.30
10.	Control (120:60:40 kg/ha NPK)	84366.00	50565.00	1.49

ETHICAL STATEMENT: Not applicable

COPY RIGHT STATEMENT: The article does not contain any copyright protected material

LIST OF ABBREVIATION

g	gram
kg	kilogram
ha	hectare
ppm	Parts per million
S	Sulphur
Fe	Iron
N	Nitrogen
P	Phosphorous
K	Potassium
INR	Indian rupees

Comment [RT7]: Not required