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Effect of nutrient combinations on economics of mustard (*Brassica juncea* L.)

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Abstract

A field experiment was conducted to determine the effect of sulphur, zinc and boron treatment combinations on plant growth, yield and its attributes on mustard at Central Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The treatment combinations of the study were as sulphur (0, 30 and 40 kg/ha) zinc (0 and 5 kg/ha) and boron (0% and 0.2% spray) respectively. There were 12 treatments each replicated thrice. Addition of 40 Kg S along with 5 kg Zn and 0.2% Boron spray resulted significant higher seed yield and stalk yield (1893.33 Kg/ha) and (3161.33 Kg/ha) respectively and gross return (₹ 90892.13), net return (₹58396.53) and B:C (1.79) ratio were also recorded higher.

Keywords: Sulphur, boron, zinc, mustard, yield attributes, net return, and B:C ratio

Introduction

Indian mustard (*Brassica juncea* L.) a member of Brassicaceae family and an important oil seed crop of the world. Brassica contains many agriculturally important species, including vegetable, condiment, and oilseed crops.

The genetic relationships between six diploid and allopolyploid cultivated Brassica species were described by Nagaheru. The three diploids are *B. rapa* (2n = 20), *B. nigra* (2n = 16), and *B. oleracea* (2n = 18) (Bayer, 2010)^[1].

The three allopolyploids are *B. juncea* (2n = 36), *B. napus* (2n = 38), and *B. carinata* (2n = 34), which have evolved as a result of hybridization between different mono genomic diploids. *B. juncea* (brown mustard, 2n = 4x = 36) is an allotetraploid species evolved from a spontaneous hybridization of *B. rapa* and *B. nigra* (Bybord and Mamedov, 2010)^[3].

Mustard has primary center of its origin in central Asia with secondary centers in central and western China, eastern India, Burma and through Iran to Near East cultivated for centuries in many parts of Eurasia. However, the principal growing countries are Bangladesh, Central Africa, China, India, Japan, Nepal, and Pakistan, as well as southern Russia in north of the Caspian Sea (Kumar Vineet *et al.*, 2016)^[10].

Mustard seeds are excellent source of minerals such as magnesium, calcium, potassium and phosphorus. It is a great source of dietary folate and Vitamin A (Tripathi *et al.*, 2010)^[22]. Mustard leaves or greens are a great source of essential minerals such as calcium, potassium and phosphorus. It is a great source of dietary fiber and magnesium (Pandey *et al.*, 2006)^[15].

The role of Sin plants is to help in the formation of plant proteins, and it is essential for the formation of chlorophyll and improves root growth. Sulphur is involved in the formation of vitamins and enzymes required for the plant to conduct its biochemical processes (Scherer *et al.*, 2008)^[18]. Sulphur deficiency in the soil can not only reduce grain yield and quality of produce but also make a sharp impact in agro-based economy (Fismesa *et al.*, 2000)^[7]. Sulphur is accumulated in plants in low concentrations compared to N, but is an essential element as a constituent of proteins, cysteine-containing peptides such as glutathione, or numerous secondary metabolites (Kumar *et al.*, 2012)^[11].

Boron plays a prominent role in diverse range of the plants functions including cell wall formation, stability, maintenance of structural and functional integrity of the biological membranes, movement of the sugar products in the plants from source to sink (Brown *et al.*, 2002; Dordas and Brown, 2005)^[2, 6]. Micronutrient Boron (B) has a prominent role in translocation of sugars, carbohydrate metabolism, flowering and regulation of hormones, acts as an activator of starch phosphorylase enzyme which is responsible for synthesis of starch and

seed reserve substances. Foliar application of Boron improves fertilization and enhances the production and productivity of the oilseed legumes (Cara *et al.*, 2002)^[4].

Zinc being one of the micronutrient, plays a significant role in the various enzymatic and physiological activities of the plant system. It is also essential for assimilation and N-metabolism. It is important for stability of the cytoplasmic ribosome, cell division, dehydrogenase, proteinase, peptidase enzymes and helps in the synthesis of the protein and carotene (Das *et al.*, 2005 and Pandey *et al.*, 2006)^[5, 15]. Zn⁺² deficiencies usually results in severe yield losses and in acute cases lead to the death of the crop plant. Kutuk *et al.*, (2000)^[12] also suggested that the application of Zn has become necessary for improved crop yields. Mandal and Sinha, (2004)^[14] recommended application of ZnSO₄ at the rate of 20 kg/ ha for oilseeds including mustard.

Materials and Methods

The experiment was carried out during *Rabi* season of 2019 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.58%), medium in available N (238 Kg/ha), high in available P (32.10 Kg/ha) and low in available K (189 Kg/ha). The treatment consisted of 3 levels of sulphur *viz.* S₁ (0 Kg S/ha), S₂ (30 Kg S/ha), S₃ (40 Kg S/ha), 2 levels of Zinc Z₁ (0 Kg/ha) Z₂ (5 Kg/ha) and 2 levels of Boron B₁ (0% spray) and B₂ (0.2% spray) There are 12 treatments each replicated

thrice. The experiment was laid out in Randomized Block Design. It was sown on 6th December 2019 at spacing 45cm x 20cm recommended doses of nitrogen and potassium were applied.

Results and Discussion

The yield and economics were significantly affected by the application of sulphur, Boron and Zinc.

Yield

Mustard crop fertilized with 40 Kg S along with 5 kg Zn and 0.2% Boron spray resulted significant higher seed yield and stalk yield (1893.33 Kg/ha) and (3161.33 Kg/ha) respectively. Rana *et al.*, (2005)^[16], Gopal *et al.*, (2018)^[8], Rao *et al.*, (2013)^[17] and Jat and Mehra (2007)^[9] reported that the micro nutrients Zn+2 and B also play their significant role in the enzymatic activities, proteins synthesis and show effect on nutrient up taking capacity (Singh and Meena., 2005)^[20]. Application of these treatment combinations, might have increased the microbial activity in the root zone which helped to uptake more nutrients thus maintain the proper nutritional system. As a result, all the growth parameters yield and its attributes increased which raised the Harvest Index (%) than that of control.

Economics

Gross return (₹ 90892.13), Net return (₹ 58396.53) and B:C ratio (1.79) recorded higher with the application of 40 Kg S along with 5 Kg Zn and 0.2% Boron spray.

Table 1: Effect of Nutrient Combinations on Economics of Mustard

Treatment Combinations	Seed Yield (Kg/ha)	Stalk Yield (Kg/ha)	Gross returns (₹/ha)	Cost of Cultivation (₹/ha)	Net Returns (₹/ha)	Benefit cost Ratio(B:C ratio)
T ₁ : 0 Kg S + 0 kg Zn + Boron no spray	1584.33	2477.01	75704.53	30661.6	45042.93	1.46
T ₂ : 0 Kg S + 0 kg Zn + 0.2% Boron spray	1656.33	2919.67	79838.13	30665.6	49172.53	1.60
T ₃ : 0 Kg S + 5 kg Zn + Boron no spray	1692.83	2863.33	81344.08	31411.6	49932.48	1.58
T ₄ : 0 Kg S + 5 kg Zn + 0.2% Boron spray	1724.33	2757.33	82656.73	31415.6	51241.13	1.63
T ₅ : 30 Kg S + 0 kg Zn + Boron no spray	1720.67	2763.33	84909.166	31471.6	53437.56	1.69
T ₆ : 30 Kg S + 0 kg Zn + 0.2% Boron spray	1785.33	2840.02	85411.33	31475.6	53935.73	1.71
T ₇ : 30 Kg S + 5 kg Zn + Boron no spray	1811.67	2941.67	86796.66	32221.6	54575.06	1.69
T ₈ : 30 Kg S + 5 kg Zn + 0.2% Boron spray	1879.67	2906.66	89749.16	32225.6	57523.56	1.78
T ₉ : 40 Kg S + 0 kg Zn + Boron no spray	1706.01	2983.33	82182	31741.6	50440.4	1.58
T ₁₀ : 40 Kg S + 0 kg Zn + 0.2% Boron spray	1717.12	2860.04	82412.5	31745.6	50666.9	1.59
T ₁₁ : 40 Kg S + 5 kg Zn + Boron no spray	1867.67	2971.67	89351.66	32491.6	56860.06	1.74
T ₁₂ : 40 Kg S + 5 kg Zn + 0.2% Boron spray	1893.33	3161.33	90892.13	32495.6	58396.53	1.79
S.Em±	57.29	99.91	-	-	-	-
CD (P = 0.05)	168.02	293.04	-	-	-	-

Conclusion

In conclusion, it is inferred from the present investigation that application of 40 Kg S along with 5 Kg Zn and 0.2% Boron spray in addition to the full doses of nitrogen and potassium is recommended for farmers for receiving higher yield and economic benefits of Mustard.

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