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) [10]. 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) [10]. Zinc being one of the micronutrients, 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 Pandy et al., 2006) [8, 9]. Zn deficiency 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 45 cm x 20 cm 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.

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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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) |
|------------------------|-------------------|-------------------|---------------------|--------------------------|------------------|-----------------------------|
| T1: 0 Kg S + 0 Kg Zn + Boron no spray | 1584.33 | 2477.01 | 75704.53 | 30661.6 | 45042.93 | 1.46 |
| T2: 0 Kg S + 0.2% Boron spray | 1656.33 | 2919.67 | 79388.13 | 3066.5 | 49172.53 | 1.60 |
| T3: 0 Kg S + 5 Kg Zn + 0.2% Boron spray | 1692.83 | 2863.33 | 81344.08 | 31411.6 | 49932.48 | 1.58 |
| T4: 0 Kg S + 5 Kg Zn + 0.2% Boron spray | 1724.32 | 2757.33 | 82656.73 | 31415.6 | 52141.13 | 1.63 |
| T5: 30 Kg S + 0 Kg Zn + Boron no spray | 1720.67 | 2763.33 | 84909.16 | 31476.1 | 53437.56 | 1.69 |
| T6: 30 Kg S + 0.2% Boron spray | 1785.33 | 2840.02 | 85411.33 | 31475.6 | 53935.73 | 1.71 |
| T7: 30 Kg S + 5 Kg Zn + Boron no spray | 1811.67 | 2941.67 | 86796.66 | 32221.6 | 54575.06 | 1.69 |
| T8: 30 Kg S + 5 Kg Zn + 0.2% Boron spray | 1879.67 | 2906.66 | 89749.16 | 32225.6 | 57523.56 | 1.78 |
| T9: 40 Kg S + 0 Kg Zn + Boron no spray | 1706.01 | 2983.33 | 82182 | 31741.6 | 50400.4 | 1.58 |
| T10: 40 Kg S + 0.2% Boron spray | 1717.12 | 2860.04 | 82412.5 | 31745.6 | 50666.9 | 1.59 |
| T11: 40 Kg S + 5 Kg Zn + Boron no spray | 1867.67 | 2971.67 | 89351.66 | 32491.6 | 56860.06 | 1.74 |
| T12: 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 (F = 0.05) | 168.02 | 293.04 | - | - | - | - |
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