Nutrient Management for Enhancing Growth and Yield of Mustard (Brassica juncea L.) in Rajasthan, India

Abstract

A field experiment was conducted at experimental farm, Department of Agronomy, Facultyof Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan)duringRabiseasonof2023-24to effectofdifferent nutrient managementongrowth and yield of mustardvariety "NRCHB-506" wasused in this study. The required quantities of fertilizers as per treatments were applied. Theexperiment was laid out in randomized block design with three replications consisting of ten treatments.The data recorded maximum growth parameters such as plant population (19.65 per m^2), plant height (134.85 cm), number of branches per plant (11.95), dry matter accumulation (38.65 g), length of siliqua (4.72 cm), days required for maturity (130.45 days), leaf area index (2.48) and yield parameter such as number of siliqua per plant (265.08), number of seed per siliqua (11.95), seed yield (2120.44 kg/ha), straw yield (5125.12 kg/ha), biological yield (7245.56 kg/ha)recorded with treatmentT_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter.Therefore, conclude that application 100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter superior among all treatments.

Keywords: -Sulphur;Zinc;Yield, Mustard; Azotobacter

1. Introduction

Oilseed crops are next to cereals in production of agricultural commodities in India, and they play a critical role in the Indian economy.Indian mustard (*Brassica juncea*L.) is predominantly cultivated in the states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, and West Bengal, out of which about 46.0% of total production contributed by Rajasthan state alone. Domestic production of edible oils meets only 50% of the total requirements, while rest is imported (Kumar *et al.* 2011). It is one of the most important edible oils of northern and eastern parts of India and traditionally grown everywhere in the country due to their high adaptability in conventional farming systems. It is the second most important edible oilseed after groundnut, with a total area of 6.23 m ha and an output of 9.34 mt (Anonymous, 2019). It covers area 2.37 m ha in Rajasthan, with production and productivity of 4.08 mt and 1720 kg ha^{-1}, respectively (Anonymous, 2019).

Nitrogen is an important element for the growth and development of most plants. Nitrogen is also an integral part of chlorophyll, which is the primary absorber of light energy needed for photosynthesis. Phosphorus is second most critical plant nutrient. But for pulses, it assumes primary importance, owing to its important role in root proliferation, which are the seat of biological N fixation and helps plants to draw nutrients from lower layers and consequently thrive under moisture stress conditions (Taliman *et al.*, 2019). Sulphur is an essential important component in deciding the seed yield of mustard. The amount of oil content and tolerance to various biotic and abiotic stresses. Besides encouraging the formation of chlorophyll and the processing of oil, It's component of seed protein, amino acids, enzymes and glucosinolate.Zinc is essential in formation of a large number of enzymes and plays an essential role in DNA transcription. It plays a vital role especially translocation of nitrogen and synthesis of protein (Bisht *et al.* 2018).

2. MaterialsandMethods

A field experiment was conducted during Rabi season of 2022-23 at experimentalfarm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, MewarUniversity Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient inavailable zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) andphosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment waslaid out in randomized block design with three replications consisting of tentreatments*viz.*T_1-Control, T_2-100% RDF, T_3-100% RDF + Sulphur (40 kg/ha), T_4-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha), T_5-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha), T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter, T_7-75% RDF + Sulphur (40 kg/ha), T_8-75% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha), T_9-75% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha)and T_{10}-75% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter. The required quantities of fertilizers as per treatments were applied. The doses ofNPKwereappliedintheformofurea,diammoniumphosphate,murateofpotashrespectively. The half dose of nitrogen gives basal dose and remain two split doses after irrigation and full dose of phosphorus and potassium at basal dose. Vermicompost apply in field at field preparation before sowing.

3. ResultsandDiscussion

3.1 Growth attributes

Application of different nutrient management practices was noticed significant effect on growth attributes of mustard. The data presented in Table 1.0 – 2.0. The maximum plant stand with T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (19.65 per m^2). The minimum plant population recorded with control treatment (15.25 per m^2). The maximum plant height was recorded with treatment was recorded T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (105.48 and 134.84 cm). The minimum plant height was recorded with control treatment (78.25 and 98.35 cm) at 60 DAS and at harvest, respectively. Thethe maximum number of branches per plant was recorded with treatment was recorded T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (9.85 and 11.95). The minimum number of branches per plant was recorded with control treatment (7.12 and 9.15). The maximum dry matter accumulationwas recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (38.65 g). The minimum dry matter accumulationwas recorded with control treatment (29.58 g). The maximum length of siliquawas recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (4.72 cm). The minimum length of siliquawas recorded with control treatment (4.25 cm). The maximum days required for maturity was recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (130.45 days). The minimum days required for maturity was recorded with control treatment (120.36 days). The maximum leaf area index was recorded with treatment T_5-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) (2.48). The minimum leaf area index was recorded with control treatment (1.85). These findings also supported byChoudhary (2006), Kumar *et al.* (2011), Chauhan *et al.* (2012), Kumar *et al.* (2017), Yadav *et al.* (2017) and Bisht *et al.* (2018).

3.2 Yield attributes and yield

Application of different nutrient management practices was noticed significant effect on yield attributes and yield of mustard. The data presented in Table 3.0 and Figure 1.0. The maximum number of siliqua per plant was recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (265.08). The minimum number of siliqua per plant was recorded with control treatment (170.36).The maximum number of seed per siliqua was recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (11.95). The minimum number of seed per siliqua was recorded with control treatment (10.20). The maximum seed yield was recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (2120.44 kg/ha). The minimum seed yield was recorded with control treatment (985.36 kg/ha).The maximum straw yield was recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (5125.12 kg/ha). The minimum straw yield was recorded with control treatment (3600.25 kg/ha). The maximum biological yield was recorded with treatment T_6-100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter (7245.56 kg/ha). The minimum biological yield was recorded with control treatment (4585.61 kg/ha). Similar result also reported by Fuller*et al*. (2008), Sahoo *et al*. (2010), Dubey *et al*. (2013), Bhati *et al*. (2014), Dashora*et al*. (2014) and Mondal *et al*. (2015)

Conclusion

The findings of present investigation revealed that effect of different nutrient management practices on growth and yield of mustard(*Brassica juncea*L.). Among different treatment 100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter registered the maximum production and productivity. So, the treatment. 100% RDF + Sulphur (40 kg/ha) + Zinc sulphate (25 kg/ha) + Boron (1 kg/ha) + Azotobacter superior among all treatments.

Table.1.0Effect of different nutrient managementon growth attributes of mustard

Treatments	Plant population per m^2		Plant height (cm)			Number of branches per plant		
	20 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
T_1	24.33	15.25	11.85	78.25	98.35	3.25	7.12	9.15
T_2	25.66	16.25	12.08	89.25	110.36	3.58	8.35	10.45
T_3	25.85	16.48	12.25	92.25	113.45	3.65	8.55	10.52
T_4	25.96	17.45	12.95	98.02	125.02	3.95	8.92	10.90
T_5	26.50	18.52	13.45	102.45	132.14	4.15	9.48	11.40
T_6	26.85	19.65	12.78	105.48	134.85	4.25	9.85	11.95
T_7	26.65	16.65	12.02	82.65	105.45	3.55	8.30	10.35
T_8	26.12	16.85	12.45	94.25	118.25	3.75	8.75	10.70
T_9	26.10	17.02	12.68	95.12	121.47	3.82	8.80	10.85
T_{10}	26.45	17.85	13.08	100.02	128.66	4.02	9.18	11.20
S. Em. (±)	0.55	0.65	0.89	1.86	2.45	0.15	0.24	0.28
C.D.(P=0.05)	NS	1.96	NS	5.60	7.32	NS	0.75	0.82

Table.2.0Effect of different nutrient managementon growth attributes of mustard

Treatments	Dry matter accumulation per plant at harvest (g)	Length of siliqua at harvest (cm)	Days required for maturity	Leaf area index
T_1	29.58	4.25	120.36	1.85
T_2	34.36	4.35	123.55	2.05
T_3	34.45	4.38	124.25	2.12
T_4	35.86	4.52	126.03	2.32
T_5	36.82	4.65	128.65	2.48
T_6	38.65	4.72	130.45	2.41
T_7	33.25	4.31	124.12	2.08
T_8	34.52	4.45	125.33	2.18
T_9	35.02	4.48	125.89	2.25
T_{10}	36.52	4.58	127.36	2.38
S. Em. (±)	0.72	0.05	1.12	0.04
C.D. (P=0.05)	2.15	0.15	3.32	0.12

Table.3.0Effect of different nutrient managementon yield attributes of mustard

Treatments	Number of siliqua per plant	Number of seed per siliqua	Seed yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)
T_1	170.36	10.20	985.36	3600.25	4585.61
T_2	202.12	10.45	1352.65	4355.32	5707.97
T_3	215.32	10.62	1485.25	4458.42	5943.67
T_4	240.33	11.05	1753.66	4752.11	6505.77
T_5	255.14	11.65	1985.33	4952.22	6937.55
T_6	265.08	11.95	2120.44	5125.12	7245.56
T_7	208.36	10.55	1378.65	4325.33	5703.98
T_8	222.77	10.68	1558.78	4562.88	6121.66
T_9	228.02	10.89	1632.69	4632.33	6265.02
T_{10}	250.14	11.25	1865.78	4855.77	6721.55
S. Em. (±)	5.14	0.26	88.66	92.36	102.81
C.D. (P=0.05)	15.40	0.77	264.02	276.18	308.65

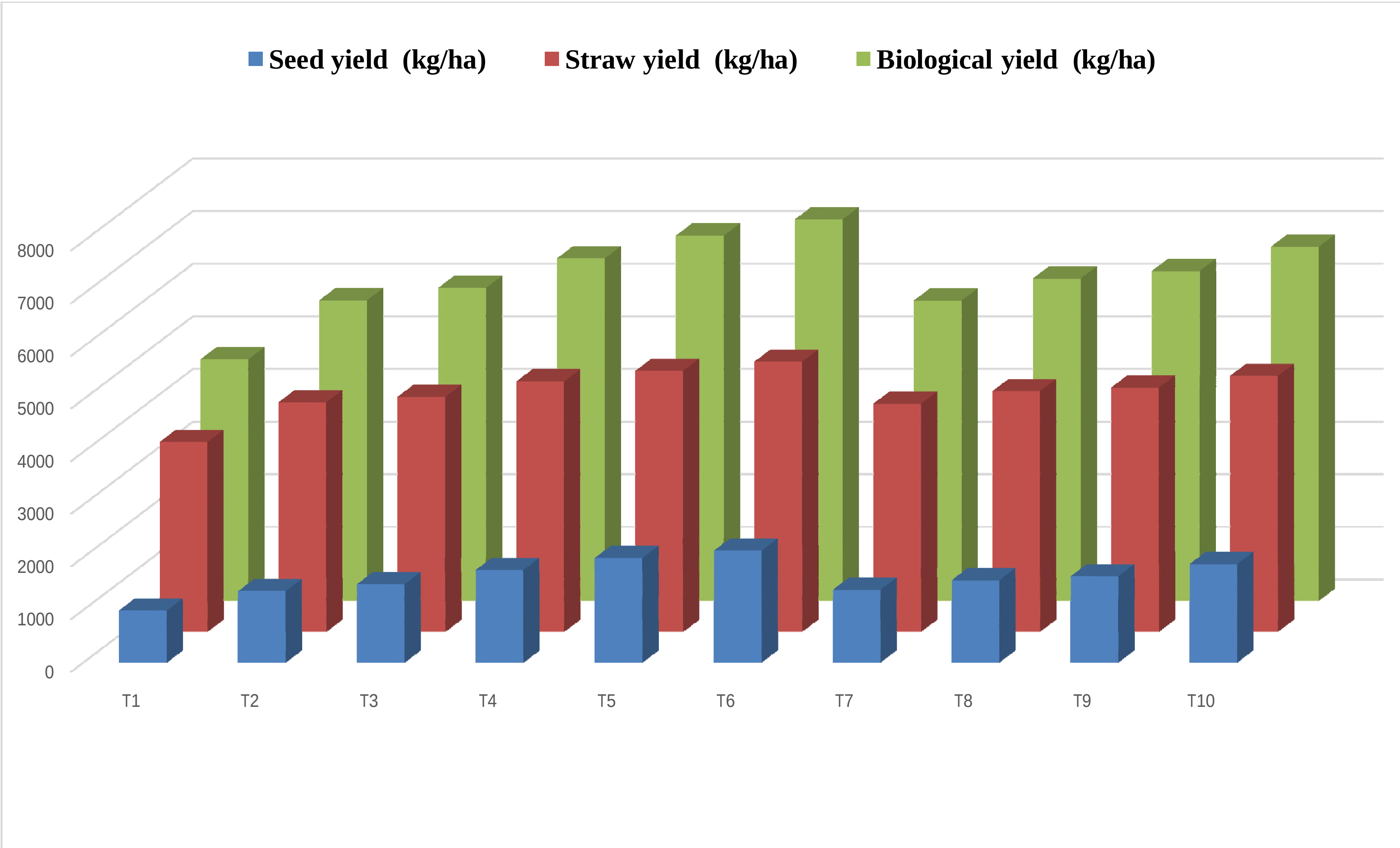

Figure 1.0 Effect of different nutrient management on yield of mustard

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