Online at: https://researchtrendsjournal.com ISSN No: 2584-282X

INTERNATIONAL JOURNAL OF TRENDS IN EMERGING RESEARCH AND DEVELOPMENT

Volume 2; Issue 3; 2024; Page No. 43-45

Received: 17-02-2024
Accepted: 29-03-2024

Effect of Nitrogen and Sulphur on growth, yield and quality of Mustard [*Brassica juncea* (L.) Czern and Coss] varieties

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Abstract

An experiment entitled, "Effect of nitrogen and sulphur on growth, yield and quality of mustard [*Brassica juncea* (L.) Czern and Coss] varieties was conducted during rabi seasons of 2016-17 and 2018-19. The experiment was conducted in a split plot design with three replications taking three levels of nitrogen (0, 50 and 100 kg N ha^{-1}) three sulphur levels (0, 25 and 50 kg S ha^{-1}) and three mustard varieties (Vardan, Bio 902 and RH 30). The soil of the field was low in nitrogen and medium in phosphorus and potassium and slightly alkaline in reaction.

Keywords: Nitrogen, Sulphur, yield, Mustard, *Brassica juncea* (L.)

Introduction

Oilseeds occupy an important place in Indian economy as well as in human life. They are not only rich sources of energy and carriers of fat-soluble vitamins A, D, E, and K but are major sources of raw materials for a wide range of industrial products also. More than 80 percent of our country's requirements of vegetable oils and fats are derived from seven annual oilseeds crops *viz*. ground nut, rapeseed mustard, sesamum, safflower, sunflower, niger, soybean and two non-edible oilseeds, linseed and castor.

The average annual production of oilseeds in four years (2013-17) after launching of Technology Mission on Oilseeds, had increased from 12.0 to 16.7 million tonnes, a record annual 10 percent increase. To meet the edible oil requirement of the burgeoning population, the present level of oilseeds production (21.3 million tonnes in the year 2016-17-Economic Survey) will have to be boosted to 26.0 million tonnes by the end of this century.

The rapeseed and mustard is the second important oilseed crop, contributed about 29 percent of total oil seed production in the country during 2014-15. Area under this group of crops is spread over the states of Uttar Pradesh, Rajasthan, Punjab, Haryana, Madhya Pradesh, Bihar, Gujarat, West Bengal and Assam. However, its productivity remains low, because it is grown mostly as rainfed crop under low fertility conditions with traditional varieties. To enhance the productivity, we should bring more area under irrigation, use of balanced fertilizers and introduce newly developed promising varieties.

Among the nutrients, nitrogen and sulphur have important role in seed protein and oil synthesis. Work so far done indicated positive role of both of these nutrients in promoting yield and quality of seed of mustard. However, the quantum effect varies depending upon agro-ecosystem occupied by the crop. Among the primary nutrients, these crops have shown higher response to nitrogen fertilization compared to phosphorus (Gangasaran and Giri, 2015) [7]. Response to nitrogen upto 80-100 kg/ha has been reported by Chahal *et al*. 2011 [2].

Sulphur deficiency of late has been widely recognised under light textured soils and especially in areas where intensive agriculture is done. A large number of alluvial soils where mustard is mostly cultivated, contains less than 10 ppm available S (Naik and Das, 2014) [13]. Oleiferous brassicae in general have high sulphur requirement owing to high sulphur containing amino acids in them. Sulphur is a key element in rapeseed-mustard oil and its deficiency causes a significant reduction in the oil content (Herath and Ormrol, 2011) [12]. The combined effect of nitrogen and sulphur on brassicae yield (Vaidya *et al*., 2011 and Tiwari, 2015) [19, 18]

and quality (Aulakh *et al*. 2010) [1] have been reported. However, the work so far done has been insufficient and calls for concerted efforts to improve of this crop.

Recently a number of varieties have been developed by different centres but their performance varies from place to place depending upon soil and climate. These varieties also reacts to various inputs including nitrogen and sulphur applications. Much information is not available on these aspects especially under western parts of Uttar Pradesh.

Objective of the study

- To study the comparative performance of mustard varieties under semi-arid conditions.
- To study the effect of nitrogen, sulphur and their interaction on the growth, yield and quality of mustard varieties.
- To work out the economic optimum doses of nitrogen and sulphur for mustard.

Review of Literature

The literature on the work proposed pertaining to the effect of nitrogen and sulphur nutrition on the growth, yield and quality of mustard varieties has been briefly reviewed here:

Effect of Varieties

Gaur and Bansal (2013) [10] showed that higher Chlorophyll and iron content of Pusa Bold leaves clearly indicated the effect of increased uptake of nitrogen under variety Pusa Bold compared to that of T-59 and Kranti. Similar results were reported by Gangasaran and Giri (2014) [9] who found better response of Pusa Bold to nitrogen as compared to other mustard cultivars. Gaur *et al*. (2013) [10] reported on the basis of two years experimentation that different cultivars significantly affected the fatty acid composition of mustard oil. Mustard variety T-59 recorded increase in erucic acid by 3.9 percent and a decrease in oleic acid content by 4.11 percent of oil over that of variety RL-18. Singh *et al*. (2013) [11] found that BR 40 was most susceptible to Zink deficiency whereas Pusa Bold was relatively tolerant, among six mustard varieties tested at Samastipur, Bihar. The relative susceptibility of the mustard varieties was rated as: RAUT-5-17 > BR 40 > BR 23 > Varuna > Kranti > Pusa Bold, on the basis of seed and oil yield response. Chandrakar *et al.* (2013) [13] reported that the seed yield of all the varieties of mustard showed similar yields with November 23 sowing over later dates.

Effect of Nitrogen

Repeseed and mustard need adequate supply of nitrogen for their growth. Its application enhances vegetative growth which is manifested through better plant height, branches and number of silique/plants which lead to higher seed yield.

Gangasaran and Giri (2017) [8] reported that application of 80 kg N/ha, half at sowing and another half at 30 DAS resulted in significantly higher seed yield of irrigated mustard cv. Pusa Bold over other levels of nitrogen during Rabi 2015-16 and 2016-17. Aulakh *et al*. (2010) [1] conducted field experiments for 3 years to test the effect of nitrogen on yellow mustard and black mustard on soils deficient in available nitrogen and reported that in all the 3 years seed yield of both mustard crops increased with increasing nitrogen levels. Sounda *et al*. (2009) [17] observed that 90-100 kg N/ha was optimum for seed yield of irrigated mustard grown in sandy loam soil at Bichpuri, Agra (U.P.) reported that 90 kg N/ha benefited yield attributes and produced more amount of seed of irrigated mustard compared to other lower levels of nitrogen *viz*. 0, 30 and 60 kg N/ha.

Effect of Sulphur

Sulphur has long been recognised as essential for plant growth although much is to be learned about the function of this element. Sulphur is a constituent of the amino acid, methionine, cysteine and cystine. Plants that are sulphur deficient are characteristically small and spindly. The younger leaves are light green to yellowish.

Vaidya *et al*. (2011) [19] conducted trails at Udaipur in 2015-16 on mustard, grown on non-calcic brown soils and given 0-50 kg S/ha and found that average effect of sulphur was significant in increasing seed yield. Aulakh *et al*. (2010) [1] reported that sulphur fertilizer significantly increased the concentration and uptake (kg/ha) of sulphur in grains of yellow and black mustard. Application of 60 kg S/ha increased the oil content by 12.0 percent in yellow mustard.

Sawarkar *et al*. (2017) [15] found that increasing the rates of applied sulphur 0-60 kg/ha increased the average oil content in mustard from 40.46 to 45.05 percent, decreased average protein content from 18.84 to 17.48 percent, and also decreased S content from 0.28 to 0.26 percent. Dubey and Khan (2013) [5] concluded that 90 kg N and 30 kg S/ha would be the optimum doses for realizing the best growth of plant, seed yield, oil yield and N contents of mustard crop under irrigated condition of deep vertisol in Central Narmada Valley. Pathak and Tripathi (2009) [14] reported from Kanpur that the seed yield of B. juncea was the highest with the application of 80 kg S/ha.

Materials and Methods

Technical programme of the work

Details of Experiments

Crop	:	Mustard (*Brassica juncea* L.)
Design	:	Split Plot Design
Replication	:	3

Treatments

Main Plot

(A) Varieties

V_1	:	Vardan
V_2	:	Jai Kisan (BIO 902)
V_3	:	R H - 30

(B) Nitrogen levels (kg N/ha)

N_0	:	0
N_1	:	50
N_2	:	100

Sub Plot: Sulphur levels (kg S/ha)

S_0	:	0
S_1	:	25
S_3	:	50

Treatment combinations

3 × 3 × 3 = 27

Total Number of Plots
= 27 × 3
= 81

Plot Size
Gross = 5.0 m × 3.15 m
Net = 4.0 m × 1.35 m

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