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Effect of nitrogen levels and sulphur levels on growth and yield of yellow mustard (*Brassica juncea* L.)

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Abstract
A field experiment was conducted during *Rabi* 2024-25 at Crop Research Farm, Department of Agronomy, PRSU, Prayagraj (U.P). The experimental plot's soil had a sandy loam texture, a pH of 7.1 that was almost neutral, a low amount of organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha), and available K (232.5 kg/ha). Nine treatments were used in the Randomized Block Design experiment, each of which was reproduced three times over the course of a year of testing. T1: Nitrogen 30 kg/ha + Sulphur 20 kg/ha, T2: Nitrogen 30 kg/ha + Sulphur 25 kg/ha, T3: Nitrogen 30 kg/ha + Sulphur 30 kg/ha, T4: Nitrogen 40 kg/ha + Sulphur 20 kg/ha, T5: Nitrogen 40 kg/ha + Sulphur 25 kg/ha, T6: Nitrogen 40 kg/ha + Sulphur 30 kg/ha, T7: Nitrogen 50 kg/ha + Sulphur 25 kg/ha, and T9: Nitrogen 50 kg/ha + Sulphur 30 kg/ha are used. Plant height (97.37 cm), number of branches/plant (12.62), plant dry weight (18.41 g/plant), Siliuae/plant (159.32), seeds/siliquae (40.57), days to maturity (88.95), test weight (3.14 g), seed yield (1.71 t/ha), oil content (42.38%), gross returns (Rs.10280.00/ha), net return (Rs.72240.00/ha), and benefit cost ratio (2.36) were all significantly increased when nitrogen 50 kg/ha). However, as compared to other treatments, the treatment Nitrogen 50 kg/ha + Sulfur 30 kg/ha had the noticeably highest crop growth rate (3.75 g/m2/day).

Keywords: Nitrogen, sulphur, growth, yield and economy

Introduction
Plant height (97.37 cm), number of branches/plant (12.62), plant dry weight (18.41 g/plant), Siliuae/plant (159.32), seeds/siliquae (40.57), days to maturity (88.95), test weight (3.14 g), seed yield (1.71 t/ha), oil content (42.38%), gross returns (Rs.10280.00/ha), net return (Rs.72240.00/ha), and benefit cost ratio (2.36) were all significantly increased when nitrogen 50 kg/ha). However, as compared to other treatments, the treatment Nitrogen 50 kg/ha + Sulfur 30 kg/ha had the noticeably highest crop growth rate (3.75 g/m2/day). The states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, and Gujarat are the main places in India where mustard is grown. With 2.50 million hectares of land and 3.71 million tons of produce, Rajasthan leads the world in both acreage and mustard and rapeseed production. Mustard oil is used as a condiment in pickles, to flavor vegetables and curries, to make hair oils, to make medications, to make soap, and in the tanning industry to soften leather. The mustard cake is mostly utilized for manure and animal feed. Although it is primarily grown in subtropical climates in India, recent statistics show that it may also flourish in cool, dry climates. It needs to be between 100 and 250 degrees Celsius. The crop needs 625–1000 mm of annual rainfall to flourish properly because it is quite vulnerable to cold conditions. Its deep root structure allows it to be grown in light to heavy loamy soils with a pH of 6-7.5. It is typically mixed planted with lentils, wheat, and gram in the tropics, primarily during the Rabi seasons. Mustard is responsive to sulphur in comparition to other crops. Sulphur fertilization has also been shown to increase the oil content in seeds of rapeseed-muustard.

The importance of sulphur is obvious in oilseed production as it is required for the synthesis of sulphur containing amino acids methionine (21%), cysteine (26%) and cystine (27%), Because of its volatile nature, a large amount of Sulphur has become dispersed in the atmosphere. Such atmospheric fraction contributes significantly to the plant growth and nutrition. The crop can be raised well under both irrigated and rainfed conditions. Rapeseed-mustard is reported to tolerate annual precipitation of 500 to 4200 mm, annual temperature of 6o to 27 oC and pH of 4.3 to 8.3. Rapeseed-mustard follows C3 pathway for carbon assimilation. Therefore, it has efficient photosynthetic response at 15-20 oC temperature. At this temperature the plant achieve maximum CO2 exchange range which declines thereafter. Nearly 20% area under these crops is rainfed.

Soil Analysis

Materials and Method

The materials, methodology and techniques adopted during the course of investigation entitled, "Effect of Nitrogen Levels and Sulphur Levels on Growth and Yield of Yellow Mustard (*Brassica juncea* L.)" with a brief description regarding site of experiment, soil properties, sampling techniques, climatic conditions during crop growing period, cropping history, calendar history, calendar operations and statistical analysis are described in this chapter under the following headings. The field experiment was carried out during the Rabi season of 2025–26 at the Crop Research Farm, Department of Agronomy, Prof. Rajendra Singh (Rajju Bhaiya) University (PRSU), Prayagraj, Uttar Pradesh. The research farm is geographically located at 25.28° N latitude and 81.54° E longitude, with an elevation of 98 m above mean sea level (MSL). It is situated on the right bank of the Yamuna River, alongside the Prayagraj–Mirzapur Road, nearly 10 km from the main Prayagraj city.

Treatment	Detail
T_1	Nitrogen 30 kg/ha + Sulphur 20 kg/ha
T_2	Nitrogen 30 kg/ha + Sulphur 25 kg/ha
T3	Nitrogen 30 kg/ha + Sulphur 30 kg/ha
T4	Nitrogen 40 kg/ha + Sulphur 20 kg/ha
T5	Nitrogen 40 kg/ha + Sulphur 25 kg/ha
T6	Nitrogen 40 kg/ha + Sulphur 30 kg/ha
T7	Nitrogen 50 kg/ha + Sulphur 20 kg/ha
T8	Nitrogen 50 kg/ha + Sulphur 25 kg/ha
T9	Nitrogen 50 kg/ha + Sulphur 30 kg/ha
T10	Control

Result and Discussion

The findings of all the attributes were recorded in the present experiment entitled, "Effect of Nitrogen Levels and Sulphur Levels on Growth and Yield of Yellow Mustard (*Brassica juncea* L.)" have been critically analyzed and discussed in this chapter. Data on pre-harvest, post-harvest and economics of the experiment are being presented and scientific reason is stated to clarify the results.

Plant height (cm)

As perusal of the data reveals that there is steady increase in plant height from 20 DAS to At Harvest. At 60, 90 DAS and At Harvest due to different treatment combinations plant height was significantly influenced.

At 30 DAS, there was no significant difference among the treatments. However, highest plant height (9.16 cm) was recorded with the application of Nitrogen 50 kg/ha + Sulphur 30 kg/ha, whereas minimum plant height (6.80 cm) was recorded with the treatment Nitrogen 50 kg/ha + Sulphur 30 kg/ha.

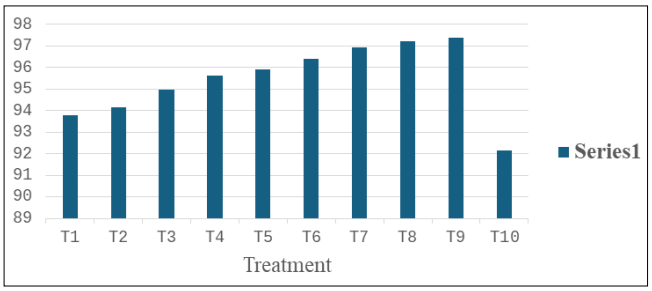
At 60 DAS, treatment with Nitrogen 50 kg/ha + Sulphur 30 kg/ha recorded significantly higher plant height (59.24 cm). However, the treatment Nitrogen 50 kg/ha + Sulphur 25 kg/ha (58.79 cm) and Nitrogen 50 kg/ha + Sulphur 20 kg/ha (58.57 cm) which was found to be at par with Nitrogen 50 kg/ha + Sulphur 30 kg/ha as compared to all other treatments.

At 90 DAS, significantly highest plant height (86.03 cm) was recorded in the treatment with Nitrogen 50 kg/ha + Sulphur 30 kg/ha over all the other treatments. However, the treatments with application Nitrogen 50 kg/ha + Sulphur 25 kg/ha (85.65 cm) and Nitrogen 50 kg/ha + Sulphur 20 kg/ha (85.44 cm) which was found to be at par with treatment Nitrogen 50 kg/ha + Sulphur 30 kg/ha as compared to all the treatments.

At Harvest, significantly highest plant height (97.37 cm) was recorded in the treatment with Nitrogen 50 kg/ha + Sulphur 30 kg/ha over all the other treatments. However, the treatments with application of Nitrogen 50 kg/ha + Sulphur 25 kg/ha (97.20 cm) and Nitrogen 50 kg/ha + Sulphur 20 kg/ha (96.87 cm) which were found to be at par with treatment Nitrogen 50 kg/ha + Sulphur 30 kg/ha as compared to all the treatments. The application of Nitrogen (Urea) might have favored better root proliferation, more solubility of phosphorous which consequently favored higher biological nitrogen fixation and uptake of nutrients and availability of all plant nutrients during the crop growth period. Which resulted in the higher plant height.

Table 1: Plant height (*Brassica juncea* L.) (30,60,90 DAS and at harvest).

S. No	Treatment	Growth Parameter
T_1	Nitrogen 30 kg/ha + Sulphur 20 kg/ha	93.79
T_2	Nitrogen 30 kg/ha +Sulphur 25 kg/ha	94.14
T3	Nitrogen 30 kg/ha + Sulphur 30 kg/ha	94.97
T4	Nitrogen 40 kg/ha + Sulphur 20 kg/ha	95.62
T5	Nitrogen 40 kg/ha + Sulphur 25 kg/ha	95.90
T6	Nitrogen 40 kg/ha + Sulphur 30 kg/ha	96.41
T7	Nitrogen 50 kg/ha + Sulphur 20 kg/ha	96.94
T8	Nitrogen 50 kg/ha + Sulphur 25 kg/ha	97.20
T9	Nitrogen 50 kg/ha + Sulphur 30 kg/ha	97.37
T10	Control	92.15
	F-test	S
	SE m (±)	2.17
	CD at 0.05%	6.50



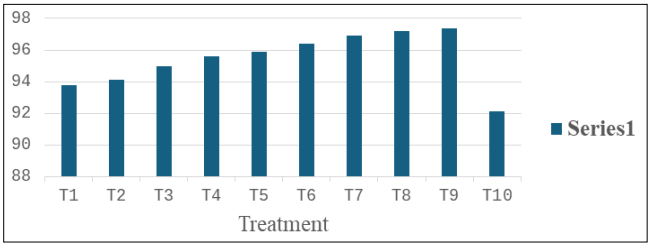
(Plant height)

Evaluation of Nitrogen Levels and Sulphur Levels er on Oil Content (%) of Yellow Mustard.

The perusal of the data of Oil Content (%) was recorded at harvest, is presented in Table 4.7. The data reveals that there was a significant difference among the treatments of Oil Content.

Significantly highest Oil Content (42.38%) was recorded with the treatment application of Nitrogen 50 kg/ha + Sulphur 30 kg/ha over all the treatments. However, the treatments with (42.23%) in Nitrogen 50 kg/ha + Sulphur 25 kg/ha and Nitrogen 50 kg/ha + Sulphur 20 kg/ha (42.13%) which were found to be statistically at par with Nitrogen 50 kg/ha + Sulphur 30 kg/ha.

S. No	Treatment	Oil Content (%)
T_1	Nitrogen 30 kg/ha + Sulphur 20 kg/ha	40.98
T_2	Nitrogen 30 kg/ha +Sulphur 25 kg/ha	41.75
T3	Nitrogen 30 kg/ha + Sulphur 30 kg/ha	41.22
T4	Nitrogen 40 kg/ha + Sulphur 20 kg/ha	41.86
T5	Nitrogen 40 kg/ha + Sulphur 25 kg/ha	42.38
T6	Nitrogen 40 kg/ha + Sulphur 30 kg/ha	42.23
T7	Nitrogen 50 kg/ha + Sulphur 20 kg/ha	41.60
T8	Nitrogen 50 kg/ha + Sulphur 25 kg/ha	42.13
T9	Nitrogen 50 kg/ha + Sulphur 30 kg/ha	41.94
T10	Control	39.53
	F-test	S
	SE m (±)	0.08
	CD at 0.05%	0.25



Economics

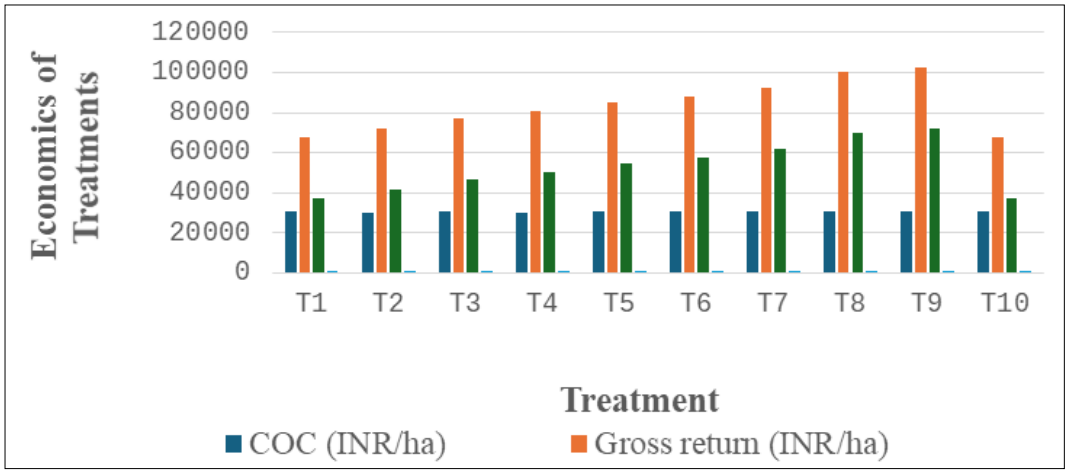
Gross returns, Net returns and Benefit cost ratio were significantly influenced due to different treatments.

Higher Gross returns have been recorded with the Nitrogen 50 kg/ha + Sulphur 30 kg/ha (Rs.102800.00/ha) over rest of the treatments followed by Nitrogen 50 kg/ha + Sulphur 25 kg/ha (Rs.100600.00/ha) whereas minimum gross return was recorded with Nitrogen 50 kg/ha + Sulphur 30 kg/ha (Rs.67800.00/ha).

Higher Net returns have been recorded with the treatment Nitrogen 50 kg/ha + Sulphur 30 kg/ha (Rs.72240.00/ha) over rest of the treatments followed by Nitrogen 50 kg/ha + Sulphur 30 kg/ha (Rs.70100.00.00/ha) whereas minimum gross return was recorded with Nitrogen 50 kg/ha + Sulphur 30 kg/ha (Rs.37340.00/ha).

Higher Benefit cost ratio have been recorded with the treatment Nitrogen 50 kg/ha + Sulphur 30 kg/ha (2.36) over rest of the treatments followed by Nitrogen 50 kg/ha + Sulphur 30 kg/ha (2.30) whereas lower Benefit cost ratio was recorded with Nitrogen 50 kg/ha + Sulphur 30 kg/ha (1.23).

T.No	Treatment	Cost of cultivation	Gross returns	Net return	B:C Ratio
T_1	Nitrogen 30 kg/ha + Sulphur 20 kg/ha	30460.00	67800.00	37340.00	1.23
T_2	Nitrogen 30 kg/ha + Sulphur 25 kg/ha	30300.00	72200.00	41900.00	1.38
T_3	Nitrogen 30 kg/ha + Sulphur 30 kg/ha	30560.00	77000.00	46440.00	1.52
T_4	Nitrogen 40 kg/ha + Sulphur 20 kg/ha	30360.00	80600.00	50240.00	1.65
T_5	Nitrogen 40 kg/ha + Sulphur 25 kg/ha	30660.00	85200.00	54540.00	1.78
T_6	Nitrogen 40 kg/ha + Sulphur 30 kg/ha	30400.00	88200.00	57800.00	1.90
T_7	Nitrogen 50 kg/ha + Sulphur 20 kg/ha	30460.00	92600.00	62140.00	2.04
T_8	Nitrogen 50 kg/ha + Sulphur 25 kg/ha	30500.00	100600.00	70100.00	2.30
T_9	Nitrogen 50 kg/ha + Sulphur 30 kg/ha	30560.00	102800.00	72240.00	2.36
T10	Control	30460.00	67800.00	37340.00	1.22
F-test		S	S	S	NS
Sem(±)					
CD at 5%					



(Leaf area)

Conclusion

It is concluded that application of treatment Nitrogen 50 kg/ha + Sulphur 30 kg/ha was recorded significantly higher Seed yield (1.71 t/ha), higher gross returns (Rs.102800.00/ha), net returns (Rs.72240.00/ha) and benefit cost ratio (2.36) as compared to other treatments. Since, the findings based on the research done in one season.

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