The Pharma Innovation Journal 2022; 11(7): 2279-2282

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(7): 2279-2282

www.thepharmajournal.com
Received: 19-05-2022
Accepted: 28-06-2022

Pankaj Kumar
Department of Agronomy, Rama University Mandhana Bithoor Kanpur, Utter, Pradesh India

Ram Niwas
Department of Agronomy, C.S.A University Kanpur, Utter Pradesh, India

Shaurya Singh
Department of Agronomy, Rama University Mandhana Bithoor Kanpur, Utter Pradesh, India

Corresponding Author:
Pankaj Kumar
Department of Agronomy, Rama University Mandhana Bithoor Kanpur, Utter, Pradesh India

Effect of different level of nitrogen and sulphur on growth and yield of Indian mustard (*Brassica juncea* L.) in central plain zone of UP

Pankaj Kumar, Ram Niwas and Shaurya Singh

Abstract
Nitrogen is primary nutrient that impact on green colour of plant that encourage vegetative growth of mustard. Sulphur is the secondary nutrient and is the essential constituent of amino acid. The factor A (nitrogen level) have four combinations i.e. No nitrogen, 40 kg, 80 kg and 120 kg and factor B (sulphur level) have also 4 combinations i.e. No sulphur, 15 kg, 30 kg and 45 kg. The highest oil yield was recorded in nitrogen treatment N3 (Nitrogen 120 kg) 679.338 kg/ha and in sulphur treatment S3 (Sulphur 45 kg) 574.166 kg/ha. The lowest oil yield was recorded in both control of nitrogen and sulphur treatments. It was found that nitrogen level of 120 kg/ ha and sulphur level of 45 kg/ha have significant result in terms of growth, yield and quality parameters because both of these nutrients directly regulate the photosynthesis. Its deficiency shows low chlorophyll contents in plants that facilitate poor growth and yield.

Keywords: Indian mustard, nutrients, oil seed, soil properties

Introduction
Oilseed crops serve as an important pillar of Indian agricultural economy next to cereals. The Indian mustard commonly known as Rai and botanically *Brassica juncea* L. Itis an annual growing perennial herb that belongs to the family Crucifereae (Brassicaceae). Indian mustard has 36 chromosomes (2n) and is amphidiploid in nature.
Nitrogen is the most important nutrient, which determines the growth of the mustard crop and increases the amount of protein and the yield. Phosphorus and potash are known to be efficiently utilized in the presence of nitrogen. It promotes flowering, setting of siliqua and in increase the size of siliqua and yield. Sulphur is also an important nutrient andplays an important role in physiological functions like synthesis of cystein, methionine, chlorophyll and oil content of oil seed crops. It is also responsible for synthesis of certain vitamins (B, biotin and thiamine), metabolism of carbohydrates, proteins and oil formation of flavoured compounds in crucifers.

Objective
1. To find out the best level of nitrogen and sulphur in improvement of growth and yield of Indian mustard.
2. To access the effect of nitrogen and sulphur on growth, yield attributes and yield of Indian mustard.
3. To find out the interaction effect of different levels of nitrogen and sulphur on performance of Indian mustard.
4. To work out the economics of different treatment combinations.

Material and Methods
The details of the materials used and experimental procedures adopted during the course of investigation have been described in this chapter under appropriate headings and subheadings.

Treatments
Treatments consisted 15 with 3 replication of each treatment combinations of four levels of Bio-Organics and four levels of Mineral nutrients to mustard.

Design and layout of experiment
Field experiments having 15 treatment combinations and replicated three times were laid out in Randomized Blok Design (RBD).

Growth and yield attributes
Plant height
Five plants selected randomly from each plot were tagged. The height was measured at 30, 60, 90 DAS and at maturity in cm with the help of meter scale from the base of the plant to the top of the plant and mean values were computed.

Primary and secondary branches per plant
Primary and secondary branches of five random plants under each treatment were counted at 60 and 90 days after sowing and at maturity. Total number of branches were counted and mean values have been calculated.

No of siliquae per plant
The numbers of siliquae of the five randomly selected plants were counted and their means were computed to express as number of siliquae per plant.

Length of siliqua
Length of five randomly selected siliqua from plants taken for siliquae plant-1 were measured and average value were expressed as length of siliqua in centimeter.

Number of seeds per siliqua
Numbers of seeds per siliqua were recorded at harvest by counting the seeds of ten randomly selected siliquae from five tagged plants of each plot and average was worked out.

Test weight
One thousand seeds were counted from samples of each plot and their weight was recorded as test weight (g).

Seed yield
After threshing and winnowing, the clean seeds obtained from the produce of individual plot, were weighed and weight was recorded as seed yield kg plot-1.

Stover yield: Stover yield was obtained by subtracting the seed yield (kg ha-1) from the biological yield (kg ha-1).

Harvest index
The harvest index was computed on the basis of seed yield and total biomass production and presented in term of per cent. The harvest index was calculated by following formula:

$$\text{Harvest index (\%)} = \frac{\text{Grain yield}}{\text{Biological yield}}$$

Chemical analysis
Nutrient content
For estimation of nutrient content from representative samples of seed and stover were taken at the time of threshing. Each dried seed and stover samples were ground to fine powder in an electric grinder. Nitrogen, phosphorus, potassium and sulphur in seed and stover were estimated by using standard methods.

Nutrient uptake
The uptake of nitrogen, phosphorus, potassium, sulphur and zinc at harvest in seed and stover were estimated by using the following formula:

$$\frac{\text{Nutrient content in seed(\%)x } \textit{Seed yield}\left(\frac{kg}{h}\right) \text{ x Nutrient in strover(\%)x} \textit{Strover yield}\left(\frac{kg}{h}\right)}{100}$$

Protein content
Protein content in seed was determined by multiplying per cent nitrogen in seed with a constant factor 6.25 (A.O.A.C., 1960).

Oil content and oil yield
Oil content in mustard seed was determined by using Soxhlet's Ether extraction method (A.O.A.C., 1955). The oil yield was calculated by using following expression:

$$\text{Oil yield } \left(\frac{\text{kg}}{\text{h}}\right) = \frac{\text{Seed yield } \left(\frac{\text{kg}}{\text{h}}\right) \text{ x Oil content (\%)}}{100}$$

Results
The experimental findings described in the preceding chapter are discussed herein with the supporting evidences on the subject which are available to the author.

Effect of Nitrogen and Sulphur on growth parameters
Initial Plant Population (per meter row length)
In the present investigation, the different levels of nitrogen and sulphur did not influence the initial plant population. The data was recorded at 20 DAS and showed insignificant result. The nitrogen level (N3- 120 kg) and sulphur level (S3- 45 kg) have highest initial plant population of 13.058 and 11.500 respectively.

Table 1: The data of IPP have been summarized

Treatments		Plant Height (cm)				No. of primary branches			No. of secondary branches		
	1PP	30 DAS	60 DAS	90 DAS	Maturity	60 DAS	90 DAS	Maturity	60 DAS	90 DAS	Maturity
Nitrogen Level											
No (Control)	9.075	21.033	64.425	104.200	117.567	5.083	5.667	6.000	8.250	13.667	14.500
NI (40)	10.233	22.442	72.508	109.525	129.000	6.250	7.083	7.250	10.000	16.083	16.083
N2(80)	10.700	23.717	76.175	117.208	135.150	6.583	7.083	7.250	11.833	17.250	17.917
N3(120)	13.058	25.075	81.858	125.750	144.583	7.917	8.833	9.250	13.667	20.083	21.667
SE(m)	0.194	0.028	0.173	0.278	0.174	0.160	0.356	0.182	0.282	0.327	0.511
C.D.	NS	NS	0.611	0.980	0.613	0.563	1.256	0.641	0.993	1.154	1.804
Sulphur level											
So (Control)	10.150	22.517	68.81	110.258	124.908	5.917	6.500	6.750	10.000	14.750	15.417
SI (15)	10.308	22.900	73.208	113.142	131.025	6.250	7.083	7.333	10.083	16.917	17.417

S2(30)	11.108	23.217	75.108	115.183	133.85	6.583	7.333	7.750	11.500	17.333	18.333
S3(45)	11.500	23.633	77.833	118.100	136.517	7.083	7.750	7.917	12.167	18.083	19.000
SE(m)	0.232	0.017	0.318	0.242	0.260	0.251	0.238	0.223	0.355	0.301	0.499
CD	NS	NS	0.933	0.711	0.765	0.737	0.699	0.655	1.043	0.885	1.466

Plant height (cm)

At 60 DAS stage, the highest plant height was observed in the nitrogen level of N3- 120 kg and in the sulphur level of S3 - 45 kg which is 81.858 cm and 77.833 cm respectively. This result is significant over control.

At 90 DAS stage, the control of nitrogen and sulphur level have least plant height which is 104.200 cm and 110.258 cm respectively. The significant plant height of nitrogen level was 81.858 (N3-120 kg) and sulphur level was 77.833 cm (S3-45 kg). Best combination is nitrogen N3 and S3

At maturity, the maximum plant height was recorded in the nitrogen and sulphur combination were 125.750 cm (N3) and 136.517 cm (S3) respectively. This mentioned data is significant over control.

No. of primary branches per plant

At 60 DAS, the maximum no. of primary branches in nitrogen and sulphur level were recorded in N3 (7.917) and S3 (7.083) respectively. This is significant over control.

At 90 DAS, the minimum no. of primary branches was recorded in the control of nitrogen level N0 (5.667) and sulphur level S0 (6.500). The highest no. of primary branches was observed in nitrogen level of N3 (8.833) and sulphur level S3 (7.750).

At maturity, the highest no of primary branches 9.250 and 7.917 were in the nitrogen level of N3-120 kg and sulphur level of S3- 45 kg respectively. This is significant over control.

No. of secondary branches per plant

At 60 DAS, the maximum no. of secondary branches (13.667) was recorded in factor nitrogen level N3 (Nitrogen 120 kg) followed by 11.833 in N2 (Nitrogen 80kg) and maximum branches (12.167) in factor sulphur level S3 (S- 45kg).

At 90 DAS and maturity there in nominal difference in secondary branches. At maturity, the highest no. of secondary branches was observed i.e., 21.667 and 19.000 which were in N3 (N120 kg) and S3 (S-45kg).

Effect of different level nitrogen and sulphur on yield attributes

No. of Siliquae per plant

The data on no. of siliqua per plant of mustard as influenced by different level of nitrogen and sulphur and data have been presented in Table 2. The maximum no. of siliqua was recorded in the factor nitrogen N3 (N- 120 kg) and factor sulphur S3 (Sulphur- 45 kg) were 213.750 and 186.167 respectively followed by N2 (Nitrogen 120 kg) and S2 (Sulphur- 30 kg). This data is significant over control.

Length of siliqua (cm)

The length of siliqua of mustard as affect by the application of different levels of nitrogen and sulphur. The data of length of siliqua have been presented in Table 2. The highest length of siliqua was recorded in facter A nitrogen level N3 (Nitrogen 120 kg) 6.658 cm followed by N2 and facter B sulphur level S3 (Sulphur 45kg) 6.325 cm followed by S2 (Sulphur 30 kg). The lowest length of siliqua was found in control.

No. of seeds per siliqua

Seeds per siliqua shows influence yield by different level of nitrogen and sulphur. The data of no. of seeds per siliqua have been presented in Table 2. The least no. of seeds in a siliqua observed in an average of 8.833 and 10.167 which were in N0 (control) and S0 (control) respectively. The more count of seeds in a siliqua were recorded in the nitrogen level 13.500 (N3 Nitrogen -120 kg) and in sulphur level 11.667 (S3 Sulphur 45 kg) that is significant over control.

Test weight (g): The test weight shows the Wight of 1000 seeds of mustard. The data of test weight have been summarized in the Table 2. The maximum test weight of 4.350 g and 3.875 g were recorded in the treatment nitrogrn level (N3 – Nitrogen 120 kg) and treatment sulphur (S3 – Sulphur 45 kg). The least weight of test weight was found in control i.e., 3.567 and 3.800 which were in control of factor nitrogen and sulphur respectively.

Table 2: Shows Treatments No of siliquae per plant Length of siliqua (cm) Number of seeds per siliqua Test weight (g) Seed yield (q/ha) Stover yield K Biological yield (q/ha) a) Harvest Index

Treatments	No of siliquae per plant	Length of siliqua (cm)	Number of seeds per siliqua	Test weight (g)	Seed yield (q/ha)	Stover yield K	Biological yield (q/ha) a)	Harvest Index
Nitrogen Level								
No (Control)	119.333	4.858	8.833	3.567	8.625	22.208	30.833	27.698
Ni (40)	172.333	5.442	10.083	4.000	12.067	35.775	47.842	25.266
N2(80)	182.083	6.383	11.583	3.792	13.100	42.408	55.508	23.551
N3 (120)	213.750	6.658	13.500	4.350	16.458	49.633	66.092	24.905
SE(m)	0.673	0.082	0.161	0.135	0.077	0.101	0.132	0.135
C.D.	2.375	0.290	0.c69	NS	0.273	0.356	0.467	0.476
Sulphur level								
So (Control)	158.583	5.258	10.167	3.800	10.842	33.350	44.192	24.660
SI (15)	166.250	5.625	10.833	3.958	12.225	36.983	49.208	25.087
S2 (30)	176.500	6.133	11.333	4.075	13.092	38.942	52.033	25.532
S3 (45)	186.167	6.325	11.667	3.875	14.092	40.750	54.842	26.141
SE(m)	0.343	0.090	0.219	0.134	0.103	0.243	0.278	0.213
C.D.	1.006	0.266	0.644	NS	0.301	0.712	30.833	0.626

Seed yield (q/ha)
The seed yield per hectare of mustard as influenced by nitrogen and sulphur application in various combinations. The data have been presented in the Table 2. The highest seed yield recorded in nitrogen treatment N3 (Nitrogen 120kg) was 16.458 q/ha and in sulphur treatment S3 (Sulphur 45 kg) was 14.092 q/ ha. The presented data is significant over control.

Stover yield (q/ha)
The sover yield per hectare of mustard also affected by the different level of nitrogen and sulphur combinations. The data of stover yield have been summarized in the Table 2. The least stover yield of 22.208 q/ha and 33.350 q/ hac were recorded in different nitrogen combination of N0 (control) and sulphur combination of S0 (control) respectively. The significant yield (49.633q/ha and 40.750 q/ha) were recorded in N3 (Nitrogen 120 kg) and S3 (Sulphur 45 kg)

Biological yield (q/ha)
The combined yield of seed and Stover called biological yield which as influenced by the different nitrogen and sulphur treatment combinations. The highest biological yield was recorded in N3 (Nitrogen- 120 kg) and S3 (sulphur -45 kg) i.e 66.092 q/ha and 54.842 q/ha respectively. The above-mentioned data have significant effect over control.

Harvest index
Harvest index is the ratio of seed yield and biological yield. Harvest index also influenced by the different level of nitrogen and sulphur combinations. The highest index were recorded in N0 (control) 27.698 and S3 (sulphur 45 kg) 26.141. That is because nitrogen is the major nutrient required for the growth, development and yield of plants control of nitrogen produced lowest seed yield so the ratio of harvest index have been increased in zero nitrogen treatment.

Effect of different level Nitrogen and Sulphur on quality parameters

Oil content (%)
Oil content is most important factor in term of quality of mustard seeds. The oil content is affected mostly by sulphur level and least by nitrogen level combinations. The data of oil content have been presented in Table 3. The highest amount of oil content was recorded in the nitrogen treatment N3 (Nitrogen 120 kg) and sulphur treatment S3 (Sulphur 45 kg) i.e 37.517% and 37.517% respectively. In the treatment combination which have zero nitrogen and sulphur was used, had least oil content.

Protein content (%)
Protein content is most important factor in term of quality of mustard seeds. The protein content is affected mostly by nitrogen level and least by sulphur level combinations. The data of protein content have been summarized in the table 3. The highest protein content have been record in the N3 (nitrogen 120 kg) and S3 (Sulphur 45 Kg) i.e 22.536% and 20.283% respectively. The lowest amount of protein were observed in control of nitrogen and sulphur that is 16.652% and 19.542% respectively.

Oil yield (kg/ha)
Oil yield is the economic quality parameter of mustard. The oil content and yield both are proportional to each other. The data of oil yield have been presented in the Table 3. The highest oil yield was recorded in nitrogen treatment N3 (Nitrogen 120 kg) 679.338 kg/ha and in sulphur treatment S3 (Sulphur 45 kg) 574.166 kg/ha. The lowest oil yield were recorded in both control of nitrogen and sulphur treatments.

Table 3: Show Treatments Oil content (%) Protein content (%) Oil yield (kg/ha)

Treatments	Oil content (%)	Protein content (%)	Oil yield (kg/ha)
A. Nitrogen Level			
No (Control)	33. 533	16.652	302.733
Ni (40)	35.250	19.687	453.227
N2(80)	36.925	21.123	519.636
N3 (120)	37.517	22.536	679.338
SE(m)	0.132	0.524	4.778
C.D.	0.446	1.098	16.856
B. Sulphur level			
So (Control)	34.775	19.542	385.003
Si (15)	35.835	19.632	476.123
Sz (30)	35.975	20.24	519.641
S3(45)	37.517	20.283	574.166
SE(m)	0.130	0.562 0.	4.939
C.D.	0.382	NS	14.503

Reference

1. Prabhu, Uma Keni. Stimulus needed for the growth of India's edible oilseed economy in TSG Sunday Guardian Live Prakash Ajnarand Suvarna Namdeo, 2021.
2. Effect of integrated nutrient management on Indian mustard yield attributes and yield. Journal of Pharmacognosy and Phytochemistry. 2021;10(2):545-548.
3. Sahoo1 RC, Purohit HS, Prajapati OP. Integrated Nutrient Management in Mustard (*Brassica juncea* L.) Int. J Microbiol. App. Sci. 2018;Special Issue-7:3545-3549.
4. Saurabh Bisht, Saxena AK, Suneeta Singh. Effect of integrated nutrient management on growth and yield of mustard (*Brassica juncea* L.) cultivar T-9 under Dehradun region (Uttarakhand) International Journal of Chemical Studies. 2018;6(4):1856-1859.
5. Shankar G, Verma LP, Singh R. Effect of integrated nutrient management on yield and quality of Indian mustard (*Brassica juncea*)' and properties of soil. Indian J Agri. Sd. 2002;72(9):551-552.
6. Tripathi MK, Chaturvedi Sumit, Mahapatra Vikas S. Yield performance and quality in Indian mustard (*Brassica juncea*) as affected by integrated nutrient management Indian Journal of Agronomy. 2010;55(2):138-142.