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Study the effect of different nitrogen levels on growth and yield of mustard crop at Ambikapur (Chhattisgarh)

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Abstract
The field experiment entitled "Effect of Different Rates of Nitrogen and Sulphur on Growth and Yield of Indian Mustard (*Brassica juncea L.*) Under Northern Hill Zone of Chhattisgarh." was conducted at Instructional-cum-Research Farm, Rajmohini Devi College of Agriculture & Research Station, Ambikapur (C.G.). During *rabi* 2019-20. The study was conducted in factorial randomized block design in three replications with four doses of nitrogen (30, 60, 90 and 120 kg/ha). Application of nitrogen significantly increased Growth parameters like plant population, plant height, number of leaves/ plant, number of branches/ plant. Nitrogen application significantly increased Yield attributing characters like siliquae per plant, seeds per siliqua. The maximum number of siliiqua/plant, length of siliiqua, seeds/ siliiqua, test weight, oil content (%), oil yield (kg /ha.) were found in dose of 120kg N+ 40Kg S/ha. The minimum number of number of siliiqua/plant, length of siliiqua, seeds/ siliiqua, test weight, oil content (%), oil yield (kg /ha.) were observed in dose of 30kg N/ha. The maximum seed yield were found in dose of 120kg N/ha. And minimum seed yield were observed in dose of 30kg N/ha. Effect of nitrogen (120 kg N / ha) was observed higher in net return. Single dose of nitrogen 120 kg S/ha. Suggested of Indian mustard (*Brassica jancea* L.) under the northern hill zone of Chhattisgarh.

Keywords: biological, harvest, siliiqua, weight, yield, nitrogen, oil content

Introduction

Indian mustard [*Brassica juncea (L.)* Czern & Cosson.] Is an important oilseed crop, next to sunflower? Mustard (*Brassica juncea*) is commonly known as rai. Out of six cultivated oilseed species of genus *Brassica,* more than 80 per cent of total area is occupied by Indian mustard (*B. juncea*) alone (Chandrashekar *et al.*, 2013). Rapeseed-mustard, its oil and its oil meal may contain anti-nutritional factors such as goitrogens (thioglucosides or glucosinolates), tannic acid, erucic acid, sinapine (cholinester), pectins and oligosaccharides. Mustard stimulates digestion and salivary secretion.

Mustard is the 3rd most important edible oilseed crop of the world after the Soybean and palm oil. The mustard and rapeseed are used in various ways. The oil and seed are used as condiments in the preparation of vegetables, curries, pickles so also as the used as, hair oil, in medicines and manufacturing of grease. The mustard oil cake is considered as the best animals feed and organic manures. The leaves are consumed as green vegetables. In the leather industries-mustard oil is used for softening of leather. It is second cultivating crop after the cereals. Although, India is the leading oil producing country in the world, but it is unable to meet the requirement of edible oil for its large growing human community.

The oil seed crop is cultivated mainly in the rainfed conditions for resource scarce regions of the nation, but this contribution in source of income for security of the small and marginal farmers in these regions is very important. The increase in the oil seed crop production, gradually import substitution can be achieved and socio-economic level of farmers can be uplifted. In India, the attainment of self-adequate in edible oil is possible for the production potential of our per year edible oil seed crop harnessed by adopting improved technologies of nutrients, management and weed management, resulting into the higher yield of the crop and transfer of these improved technologies to the oil seed cultivators.

Materials and Methods

The experiment entitled "Effect of Different Rates of Nitrogen and Sulphur on Growth and Yield of Indian Mustard (*Brassica juncea L.*) Under Northern Hill Zone of Chhattisgarh." was conducted during *Rabi* 2019-20 at research farm of Raj Mohini Devi College of Agriculture & Research Station, Ambikapur. The detail of the materials used, procedure followed and techniques adopted throughout investigation are presented while considering all the variability present in climate, soil and cropping pattern of the experimental site and have been carefully documented in this chapter. The detailed information of weekly total rainfall, temperature, relative humidity, sunshine duration, wind speed and evaporation during crop season (26th November, 2019 to 19th March, 2020) were recorded properly at the meteorological observatory of Research farm, Ambikapur. The weekly mean maximum and minimum temperature during crop growth varied from 18.74 to 28.06°C and 5.71 to 14.86 °C, respectively. The mean maximum temperature (28.06°C) was recorded during 3rd week of March, 2020 (week No. 12) whereas mean minimum temperature (5.71°C) was recorded during 4th week of December, 2019. The investigation was carried out with 16 treatment combinations in factorial randomized block design (factorial RBD) with two factors, each having 4 levels and 3 replicated thrice, The field was laid out with plot size of 4.0 m X 3.0 m with ridges and furrows prepared at a row to row distance of 30 cm. The experiment consisted of the following treatments involving different percentage to substitute the recommended dose of fertilizer on nitrogen basis. The recommended fertilizer dose is 30 kg N/ha, 60 kg N/ha, 90 kg N/ha and 120 kg N/ha. The trials were laid out in Factorial Randomized Block Design (FRBD). The data obtain from the various characters in study were analyzed by the technique of study of variance as described by Panse and Sukhatme (1967). The level of significance uses in 'f' test,'t' test CV and CD was given at five per cent level. The skeleton of analysis of variance

Results and Discussion

a. Growth Parameter

Plant population was not significantly affected by different rates of nitrogen. Numerically the maximum plant population was observed in the plot treated with 120 kg N ha^{-1} (30.49 and 29.00 plants m^{-2} at 25 DAS and at harvest, respectively) followed by 90 kg N ha^{-1} (29.77 and 28.36 plants m^{-2} at 25 DAS and at harvest, respectively), 60 kg N ha^{-1}(28.67 and 27.34 plants m^{-2} at 25 DAS and at harvest, respectively) and 30 kg N ha^{-1}(27.82 and 26.96 plants m^{-2} at 25 DAS and at harvest respectively).

At all stages of crop viz., 30, 60, 90 DAS and at harvest, there was maximum improvement in plant height with increment in rate of nitrogen application. Among the different N levels, the tallest plants (22.1, 135.2, 160.3 and 167.3 cm at 30, 60, 90 DAS and at harvest, respectively) were recorded with the application of N @ 120 kg ha^{-1} followed by 90 kg N ha^{-1} i.e. 22.0, 133.9, 159.2 and 166.8 cm at 30, 60, 90 DAS and at harvest respectively, were found significantly superior over 60 kg N ha^{-1}, 18.4, 128.7, 141.6 and 154.4 cm at 30, 60, 90DAS and at harvest, respectively and 30 kg ha^{-1} N, 18.3,127.3, 140.0 and 151.7 cm at 30, 60, 90 DAS and at harvest, respectively were observed.

It is evident from data that the crop recorded maximum number of leaves plant^{-1} in treatment supplied with 120 kg N ha^{-1} (7.79, 34.85, 27.11 and 3.98 leaves plant^{-1} at 30, 60, 90 DAS and at harvest, respectively) being at par with 90 kg N ha^{-1} (7.77, 34.62, 26.89 and 3.89 leaves plant^{-1} at 30, 60, 90 DAS and at harvest, respectively) and was significantly higher over 60 kg N ha^{-1} (7.36, 28.57, 26.36 and 2.97 leaves plant^{-1} at 30, 60, 90 DAS and at harvest, respectively) and 30 kg N ha^{-1} (7.31, 27.87, 21.37 and 2.95 leaves plant^{-1} at 30, 60, 90 DAS and at harvest, respectively).

There was significant increase in number of branches plant^{-1} with increasing amount of N. 120 kg ha^{-1} N exhibited maximum statistical value of number of branches plant^{-1} (17.13 and 22.17 branches plant^{-1} at 60 DAS and at harvest, respectively) which was found at par from 90 kg N ha^{-1} (16.85 and 21.19 branches plant^{-1} at 60 DAS and at harvest, respectively) Significantly the lower number of branches plant^{-1} was recorded with 60 kg N ha^{-1} (14.29 and 17.92 branches plant^{-1} at 60 DAS and at harvest, respectively) followed by 30 kg N ha^{-1} (13.33 and 16.95 branches plant^{-1} at 60 DAS and at harvest, respectively). The result is in close accordance with findings of Bhari *et al.* (2000) [2].

Different rates of nitrogen significantly influenced the total dry matter production plant^{-1} at all growth stages of test crop. The maximum dry matter accumulation plant^{-1} was observed with N @ 120 kg ha^{-1} (4.07, 31.56, 54.04 and 72.57 g plant^{-1} at 30, 60, 90 DAS and at harvest, respectively) and was found to be on parity with 90 kg ha^{-1} (3.89, 30.54, 53.59 and 71.82 g plant^{-1} at 30, 60, 90 DAS and at harvest, respectively),

Table 1

Treatments		Plant population	
		25 DAS	At harvest
Nitrogen levels (kg ha^{-1})			
N_1	30 kg ha^{-1}	27.82	26.96
N_2	60 kg ha^{-1}	28.67	27.34
N_3	90 kg ha^{-1}	29.77	28.36
N4	120 kg ha^{-1}	30.49	29.00
Sem±		0.40	0.39
C.D. (P=0.05)		1.15	1.13

Table 2

Treatments		Plant height (cm)			
		30 DAS	60 DAS	90 DAS	At harvest
Nitrogen Levels (Kg ha^{-1})					
N_1	30 kg ha^{-1}	18.3	127.3	140.0	151.7
N_2	60 kg ha^{-1}	18.4	128.7	141.6	154.4
N_3	90 kg ha^{-1}	22.0	133.9	159.2	166.8
N4	120 kg ha^{-1}	22.1	135.2	160.3	167.3
Sem±		0.05	0.05	0.52	0.62
C.D. (P=0.05)		0.14	0.14	1.50	1.79

Table 3

Treatments		Number of leaves plant^{-1}			
		30 DAS	60 DAS	90 DAS	At harvest
Nitrogen levels (Kg ha^{-1})					
N_1	30 kg ha^{-1}	7.31	27.87	21.37	2.95
N_2	60 kg ha^{-1}	7.36	28.57	23.36	2.97
N_3	90 kg ha^{-1}	7.77	34.62	26.89	3.89
N4	120 kg ha^{-1}	7.79	34.85	27.11	3.98
Sem±		0.02	0.75	0.78	0.15
C.D. (P=0.05)		0.07	2.16	2.25	0.44

Table 4

Treatments		Number of branches plant^{-1}	
		60 DAS	At harvest
Nitrogen levels (Kg ha^{-1})			
N_1	30 kg ha^{-1}	13.33	16.95
N_2	60 kg ha^{-1}	14.29	17.92
N_3	90 kg ha^{-1}	16.85	21.19
N4	120 kg ha^{-1}	17.13	22.17
Sem±		0.36	0.36
C.D. (P=0.05)		1.04	1.03

Table 5

Treatments		Dry matter accumulation plant^{-1}			
		30 DAS	60 DAS	90 DAS	At harvest
Nitrogen levels (Kg ha^{-1})					
N_1	30 kg ha^{-1}	2.81	21.98	44.63	62.21
N_2	60 kg ha^{-1}	3.05	22.54	45.04	62.61
N_3	90 kg ha^{-1}	3.89	30.54	53.59	71.82
N4	120 kg ha^{-1}	4.07	31.56	54.04	72.57
Sem±		0.12	0.38	0.39	0.33
C.D. (P=0.05)		0.34	1.11	1.12	0.96
C.D. (P=0.05)		0.34	1.11	1.12	0.96

b. Yield Parameter

Amongst four rates of N, the highest number (301.93) of siliqua plant^{-1} was recorded with the application of 120 kg N ha^{-1} followed by 90 kg N ha^{-1} (275.78) but found significantly superior over 60 kg N ha^{-1} (189.2) and 30 kg N ha^{-1} (164.51). The results were found to be in close conformity with those of Dubey and Khan (1993) [4].

Maximum siliqua length (4.99 cm) was observed with 120 kg ha^{-1} N application followed by siliqua length of 4.96 cm obtained from plot supplied with 90 kg ha^{-1} and were significantly superior over 60 kg N ha^{-1} (4.72 cm) and 30 kg N ha^{-1} (4.69 cm) respectively. Similar results were also reported by Singh *et al*. (2000)

The data revealed that maximum number (13.97) of seeds siliqua^{-1} was recorded with the treatment nourished with 120 kg N ha^{-1} which was at par with 90 kg N ha^{-1} (13.88) but significantly higher with the application 60 kg N ha^{-1} (12.44) and 30 kg N ha^{-1} (12.10). The findings of the present study are in corroboration with those reported by Bhari *et al.* (2000) [2].

It is noted that application of nitrogen @ 120 kg ha^{-1} gave higher test weight (3.63g) followed by 90 kg N ha^{-1} (3.57) but remained significantly superior over other nitrogen rates as 60 kg N ha^{-1} and 30 kg N ha^{-1} has recorded (3.01 g) and (2.92 g) respectively. Similar opinion was expressed by Dubey and Khan (1993) [4] and Akhtar and Bohra (2000) [1].

The highest seed yield of 1644.34 kg ha^{-1} was recorded with application of 120 kg N ha^{-1} found to be on parity with 90 kg N ha^{-1} (1630.24 kg ha^{-1}) but significantly higher over 60 kg N ha^{-1} (1215.64 kg ha^{-1}) and 30 kg N ha^{-1} (1178.29 kg ha^{-1}).

Comparison of means indicated that increase in rates of nitrogen improved stover yield. It was recorded significantly higher (4451.04 kg ha^{-1}) with the application of 120 kg N ha^{-1} found to be on parity with 90 kg N ha^{-1} (4390.75 kg ha^{-1}) over 60 kg ha^{-1} (3529.77 kg ha^{-1}). The lowest stover yield was recorded with 30 kg ha^{-1} (3489.11 kg ha^{-1}). These results are in conformity with the findings of Akhtar and Bohra (2000) [1].

The biological yield was Maximum (6095.38 kg ha^{-1}) when plot was supplied with N @ 120 kg ha^{-1} followed by 90 kg ha^{-1} (6020.99 kg ha^{-1}) but significantly higher over 60 kg N ha^{-1} (4745.41 kg ha^{-1}) and 30 kg N ha^{-1}(4667.40 kg ha^{-1}). Similar result was observed by Kumar *et al.* (2012) [3].

Numerically the highest harvest index (27.12%) was recorded with the application N @ 90 kg ha^{-1} closely followed by 120 kg ha^{-1} (27.02%) and 60 kg ha^{-1} (25.66%). The treatment with 30 kg ha^{-1} recorded numerically the lowest (25.24%) harvest index. This result is found to be in close conformity with Kumar *et al*. (2011) [8].

Table 6

Treatments		Number of siliqua Plant^{-1}	Length of siliqua (cm)	Seeds siliqua^{-1}	Test weight (1000) (g)
Nitrogen levels (kg ha^{-1})					
N_1	30 kg ha^{-1}	164.51	4.69	12.10	2.92
N_2	60 kg ha^{-1}	189.2	4.72	12.44	3.01
N_3	90 kg ha^{-1}	275.78	4.96	13.88	3.57
N4	120 kg ha^{-1}	301.93	4.99	13.97	3.63
Sem±		9.08	0.01	0.12	0.03
C.D. (P=0.05)		26.21	0.03	0.34	0.09

Table 7

Treatments		Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Nitrogen levels (kg ha^{-1})					
N_1	30 kg ha^{-1}	1178.29	3489.11	4667.40	25.24
N_2	60 kg ha^{-1}	1215.64	3529.77	4745.41	25.66
N_3	90 kg ha^{-1}	1630.24	4390.75	6020.99	27.12
N4	120 kg ha^{-1}	1644.34	4451.04	6095.38	26.99
Sem±		18.41	30.75	35.69	0.31
C.D. (P=0.05)		53.16	88.81	103.06	NS

Conclusions

In the present experiment it was observed that growth, yield attributes and seed yield and stover yield of mustard (*Brassica jancea* L.) were found in significantly higher with the application of nitrogen 120 kg N/ha followed by 90 kg N/ha with all observation in mustard crop.

The maximum number of siliiqua/plant, length of siliiqua, seeds/ siliiqua, test weight, were found in dose of 120kg N /ha.

The minimum number of number of siliiqua/plant, length of siliiqua, seeds/ siliiqua, test weight, were observed in dose of 120 kg N /ha. The maximum seed yield were found in dose of 120kg N/ha. The maximum biological yield were found in dose of 120kg N/ha. And minimum biological yield were observed in dose of 30kg N/ha. The maximum harvest index (%) were found in dose of 120kg N/ha. the minimum harvest index(%)were observed in dose of 30kg N/ha.

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