

Original Research Article

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Effect of Different Fly Ash and Nitrogen Levels on Growth and Yield of Indian Mustard (*Brassica juncea* L.)

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ABSTRACT

The field experiment entitled Effect of different levels of fly ash and nitrogen on growth and yield in Indian mustard (*Brassica juncea* L.) was conducted at the experimental farm of the University College of Agriculture, Guru Kashi University, Talwandi Sabo during *rabi* season 2018. The experiment was conducted in split plot design with combination of two levels of fly ash (control, fly ash @ 10 t/ha) in main plots and four levels of nitrogen (0, 75, 100 and 125 kg N/ha) in sub plots, replicated three times. Application of nitrogen@ 125 kg N/ha significantly increased the plant height (227cm), leaf area index (4.72), no. of seed/silique (604) as compared to other levels of nitrogen. Significant interaction effect between fly ash and nitrogen was observed for number of siliquae per plant. Application of fly ash @ 10t/ha with 125 kg N/ha recorded higher seed yield. The results showed that application of 10 t/ha fly ash gave significantly higher seed yield (20.8 q/ha) and increase was 11.8% over control. The application on nitrogen @ 125 Kg/ha increased the seed yield with 20.8, 11.7 and 5.9 % increase over control, 75 and 100 kg N/ha, respectively.

Keywords

Indian mustard, Fly ash, Growth, Nitrogen and seed yield

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Introduction

Mustard (*Brassica juncea* L.) is an essential edible oil seed crop of the world and rank third after soybean and oil-palm. It belongs to the family *Brassicaceae*. In India, oilseeds comprise the second largest agriculture commodity after cereals; accounting for about 5% of gross national product and 10% of the value of all agriculture products. Raya is valued for its intense flavors and healing properties. This plant is cultivated mainly as

an oil crop. All over the world, mustard is used for its delicious flavor and preservative value and the seeds are used largely for tempering food in recent times. It has been explored for its biodiesel potential. The oil content varies from 38 to 50%. Its tender leaves, tender stem with leaves are used for cooking (Saag).

Fly ash, a by- product of the thermal power plants. The use of coal is becoming not only a problem for pollution of environment, but

also for storage. Therefore investigation is needed for its use in crop production. It contains oxides, hydroxides, carbonates, silicates, and sulfates of calcium, iron, aluminum and other metals in trace amount (Thanunathan *et al.*, 2001). The mineralogical, physical, and chemical properties of fly ash depend on the nature of the parent coal, conditions of the combustion, type of emission control devices and storage and handling methods. The earlier studies have revealed the beneficial effect of fly ash in combination with recommended dose of fertilizers on seed yield of sunflower (Jambagi *et al.*, 1995). Presence of essential plant nutrients such as N, P, K, Ca, Mg, S and micronutrients make it a source of plant nutrients and increase yield of several crops by 20-25% with high nutritional value and found beneficial for soil and crop when it was applied in minimal quantity.

Nitrogen is an essential major nutrient for increasing the productivity of Raya (*Brassica juncea L.*) to low yield. Lower doses of nitrogen lead to lower yield, whereas excessive dose of nitrogen lead to attack of diseases and insects. Nitrogen plays an important role in oilseed production because of the nutrients requirement of oilseeds, in general is high. The P compounds (ADP and ATP) in fact as energy currency within the plant. It plays a vital role in plant metabolism. Narang and Singh (1985) observed linear increase in various growth parameters of Indian mustard with increasing doses of N from 0-150 kg/ha in sandy loam soil. Keeping the above considerations in view, the present study was planned to work out the appropriate dose of nitrogen, where applied with different levels of fly ash.

Materials and Methods

The present investigation entitled "Effect of different fly ash and nitrogen levels on growth

and yield of Indian mustard" was conducted at the research farm, Guru Kashi University, Talwandi Sabo (Bathinda) during *Rabi* 2018-19. Talwandi Sabo Bathinda is located at 29°57' N latitude and 75°7' E longitude at height of 213 meters above the mean sea level. It is characterized by semi-arid climate, where both summers and winters are acute. A maximum temperature of about 45° is not uncommon during summer, while freezing temperature accompanied by frost happening may be in the months of December and January. The monsoon normally starts from the first week of July. The composite soil sample of 0-15 cm depth was analyzed for pH, EC, OC and available nutrients to know their status before sowing of crop. The soil of experimental field was low in nitrogen, medium in nitrogen and also medium in potassium.

Results and Discussion

The data related to plant height have been presented in Table 1. Perusal of data showed that application of fly ash does not show significant influence on plant height of raya. Application of nitrogen significantly influenced the plant height at maturity. Amongst the different nitrogen levels, the maximum plant height (227cm) was observed with the application of 125kg N/ha which was significantly higher over the control but it was statically at par with treatment 100kg N/ha. This might be due to increased nitrogen supply to plants resulted in more photosynthetic activities. Bhari *et al.*, (2000) reported that application of 120kg N/ha significantly increased the plant height of mustard. Application of fly ash and interaction effect between fly and nitrogen levels on plant height of Indian mustard was also found to be non-significant effect.

Application of fly ash @ 10t/ha significantly increased the dry matter accumulation of

Indian mustard than control. The maximum dry matter accumulation (75.5 q/ha) was recorded in fly ash (10 t/ha). Amongst the different nitrogen levels, significantly higher dry matter accumulation (79.3 q/ha) was observed with the application of 125kg N/ha which was higher as compared to other nitrogen levels. Kuchanwar and Matte (1997) reported that application of fly ash (10 t/ha) increased the growth attributes. Similarly, Ram *et al.*, (2013) reported that application of 120kg N/ha significantly higher dry matter accumulation in Indian mustard. The interaction effect between fly ash and nitrogen levels on dry matter accumulation was non significant. Application of Fly ash and nitrogen significantly influenced the leaf area index at 120 DAS. Application of fly ash (10 t/ha) recorded the maximum leaf area index (4.49) than control. Amongst the different nitrogen levels, the maximum leaf area index (4.72) was observed with the application of 125kg N/ha which was significantly higher as compared to other nitrogen levels. This might be due to increasing nitrogen supply to plants resulted in increase in no. of branches/plant. Bhari *et al.*, (2000) reported that application of 120kg N/ha significantly increased the leaf area index of mustard. Similarly, Kene *et al.*, (1991) reported that application of fly ash 10% significantly increased the plant height of sunflower. The interaction effect between fly and nitrogen levels on leaf area index of Indian mustard was also found to be non-significant effect. The data related to no. of branches have been given in Table 1. Application of nitrogen significantly influenced the no. of branches at maturity. Amongst the different nitrogen levels, the maximum no. of branches (20.8) was observed with the application of 125kg N/ha which was significantly higher over control. This might be due to increasing nitrogen supply to plants resulted in more photosynthetic activities. Singh and Singh

(2002) reported that application of 120kg N/ha significantly increased the no. of branches of mustard. Application of fly ash and interaction effect between fly and nitrogen levels on no. of branches of Indian mustard was also found to be non-significant effect.

Data on no. of siliqua/plant have been presented in Table 2. Application of fly ash on no. siliqua/plant of Indian mustard was also found to be non-significant effect. Amongst the different nitrogen levels, significantly higher no. of siliqua/plant (604) was observed with the application of 125kg N/ha which was significantly higher as compared to other nitrogen levels. The interaction effect between fly ash and nitrogen levels on no. of siliqua/plant was also significant. The significantly higher no. of siliqua/plant (622) was recorded with fly ash (10 t/ha) in combination with N125 kg/ha as compared to other combinations. This may be increase with increase in no. of branches/plant, leaf area index and better nutrient supply to plants. Sharawat *et al.*, (2002) reported that application of N120 kg/ha increased the number of siliqua per plant as compared to other nitrogen levels in mustard.

Application of Fly ash and nitrogen significantly influenced the no. of seeds/siliqua at maturity. Application of fly ash (10 t/ha) recorded the maximum no. of seeds/siliqua (12.2) than control. Amongst the different nitrogen levels, the maximum no. of seeds/siliqua (12.8) was observed with the application of 125kg N/ha which was significantly higher as compared to other nitrogen levels. This might be due to increasing nitrogen supply to plants resulted in increase in no. of seeds/siliqua. Bhari *et al.*, (2000) reported that application of 120kg N/ha significantly increased the no. of seeds/siliqua of mustard. Similarly,

Thanunathan *et al.*, (2001) reported that the fly ash application in combination with organic and inorganic fertilizers has resulted higher number of seed/capsules when fly ash was applied at 30 t/ha along with FYM. The interaction effect between fly and nitrogen levels on no. of seeds/silique of Indian mustard was also found to be non-significant effect.

The data related to 1000 seeds weight given in Table 2 clearly shows non-significant results in fly ash levels. Amongst the different

nitrogen levels, the maximum test weight (5.36gm) was observed with the application of 125kg N/ha which was significantly higher as compared to other nitrogen levels. This might be due to increasing nitrogen supply to plants resulted increase in test weight. Reager *et al.*, (2006) reported that application of N110 kg/ha significantly increased the 1000 seed weight of mustard. The interaction effect between fly and nitrogen levels on test weight of Indian mustard was also found to be non-significant effect.

Table.1 Effect of different fly ash and nitrogen levels on growth parameters of Indian mustard

Treatments	Plant height(cm)	Dry matter accumulation (q/ha)	Leaf area index(cm)	No. branches per plant
Fly ash levels (t/ha)				
0	209	70.3	3.74	15.0
10	213	75.5	4.49	17.0
LSD at P=0.5%	NS	NS	0.12	NS
Nitrogen levels (kg/ha)				
0	187	66.0	3.45	11.5
75	211	71.1	3.84	14.6
100	224	75.2	4.45	18.5
125	227	79.3	4.72	20.8
LSD at P=0.5%	5.5	NS	NS	1.7

Table.2 Effect of different fly ash and nitrogen levels on yield parameters of Indian mustard

Treatments	No. of silique/plant	No. seeds per pod	Test weight (g)
Fly ash levels (t/ha)			
0	482	11.1	5.12
10	513	12.2	5.13
LSD at P=0.5%	NS	0.2	NS
Nitrogen levels (kg/ha)			
0	293	10.5	4.87
75	529	11.4	5.09
100	564	12.5	5.19
125	604	12.8	5.36
LSD at P=0.5%	16.8	NS	0.07

Table.3 Effect of different fly ash and nitrogen levels on productivity of Indian mustard

Treatments	Seed yield (q/ha)	Stover yield (q/ha)	Harvest index (%)
Fly ash levels (t/ha)			
0	18.6	68.8	21.2
10	20.8	74.2	21.7
LSD at 0.5%	1.0	4.4	NS
Nitrogen levels (kg/ha)			
0	16.2	64.9	20.0
75	19.0	69.7	21.4
100	20.1	73.5	21.3
125	23.6	77.9	23.1
LSD at 0.5%	4.3	2.6	NS

Application of Fly ash and nitrogen significantly influenced the seed yield of Indian mustard. Application of fly ash (10 t/ha) recorded the maximum seed yield (20.8 q/ha) and increase was 11.8% over control. This may be due to increase the yield attributes character with application of fly ash resulted in more mustard seed yield. Amongst the different nitrogen levels, the maximum seed yield (26.0 q/ha) and increase the seed yield was 45.6, 24.2, 17.4 % over control, 75 and 100kg N/ha but it was statically at par with treatment 100kg N/ha. This might be due to increasing in no. of siliqua/plant and no. of seeds/siliqua with adequate nitrogen supply to plants. Ram *et al.*, (2013) reported that application of N120 kg/ha obtained significantly higher seed yield of mustard. Similarly, Patil *et al.*, (1996) reported that application of fly ash @ 20 t/ha along with recommended dose of fertilizers increased the seed yield of sunflower. The interaction effect between fly and nitrogen levels on seed yield of Indian mustard was also found to be non-significant effect. Application of Fly ash and nitrogen significantly influenced the stover yield of Indian mustard. Application of fly ash (10 t/ha) recorded the maximum stover yield (74.2 q/ha) and increase was 7.8% over control. Amongst the different nitrogen levels, the maximum stover yield (80.6 q/ha) and

increase 20.8, 11.7, 5.9% over control, 75 and 100 kg N/ha. This might be due to increasing in plant height, leaf area index and dry matter accumulation with adequate nitrogen supply to plants. Ram *et al.*, (2013) reported that application of 120 kg N/ha obtained significantly higher stover yield of mustard. The interaction effect between fly and nitrogen levels on stover yield of Indian mustard was also found to be non-significant effect. The data related to harvest index presented in table 3. The data clearly showed that application of fly ash showed non-significantly effect on harvest index of Indian mustard. Application of nitrogen and the interaction effect between fly and nitrogen levels on harvest index of Indian mustard was also found to be non-significant effect.

Based on the above results, the following conclusion are drawn. Application of fly ash @10t/ha significantly increased the growth and yield attributes of Indian mustard and gave 11.8 % higher seed yield over control. The Nitrogen application significantly increased the growth and yield attributes resulting percent increased in seed yield to the extent of 45.6, 24.2, 17.4 % over control 75, 100kg N/ha but it was statically at par with treatment 100kgN/ha. The combined application of fly ash @ 10t/ha in

combination with 125 Kg N/ha give maximum seed yield (26.0 q/ha) But showed non- significant effect on seed yield.

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