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# EFFECT OF NITROGEN AND SILICON ON ALTERNARIA BLIGHT DISEASE OF MUSTARD (*BRASSICA JUNCEA* L.)

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**ABSTRACT**

Mustard is the important oil seed crop component of the agricultural economy, next to food grains, in terms of area, production and value. The experiment was conducted during rabi season of 2017-18, at experimental farm of IFTM University, Lodhipur Rajput Moradabad, Uttar Pradesh. Results indicated a gradual increase in plant height at 30, 60 and at 90 DAS stage (17.98 cm, 103.90 cm and 180 cm), number of primary and secondary branches (5.83 Plant$^{-1}$, 23.83 Plant$^{-1}$), number of siliqua (445 Plant$^{-1}$), siliqua length (5.85 Plant$^{-1}$) were recorded in $T_7$. Minimum percent disease incidence (38.53%) and maximum percent disease control (28.18 %) were also recorded in $T_7$. Maximum seed yield (20.65 q ha$^{-1}$), biological yield (72.72 q ha$^{-1}$ ), test weight (7.09g), cost of cultivation (21882),gross return (83605),net return 83605 and benefit cost ratio 2.82 were also recorded in same treatment.
***Keywords:*** Nitrogen, silicon, Alternaria ,blight and mustard

## Introduction

Mustard *(Brassica juncea* L.*)* is one of the commercially important edible oilseed crops in India. The estimated area, production, and yield of rapeseed-mustard in the world were 36.59 Mha, 72.37 Mt, and 1980 kg/ha, respectively, during 2018–2019. India contributed 9.8% to global acreage and production, respectively (USDA, 2020).

Low productivity is the major concern which is adversely affected by biotic and abiotic stresses. In biotic stresses, Alternaria blight (*Alternaria brassicae*) is one among major diseases that has no resistant cultivar until now (Meena, *et al.,* 2020). Alternaria is a key pathogenic genera of the family Brassicaceae, causing severe damage to host plants and one of the major yield-limiting factors (Singh *et al.,* 2021).

Indian mustard is susceptible to a number of diseases. Alternaria blight, downy mildew and white rust play an important role in disease-induced reduction in the yield of the oilseed crop (Sangeetha and Siddaramaiah, 2007). Alternaria blight caused by the necrotrophic pathogen, *Alternaria brassicae* (Berk.) Sacc. is an important disease of mustard worldwide. Yield losses due to this disease in different species of oilseed brassicas vary between 35 to 70% in different parts of the world (Srivastava *et al.*, 2011). Judicious use of fertilizers is most important for the disease management. Severity of *Alternaria* blight of different crops can be minimized by applying the nutrients at suitable doses (Singh *et al.,* 1992).

Application of silicon (Si) enhances the growth and increases plant tolerance to various abiotic stresses (Ali *et al.*, 2019 and Zhang *et al.,* 2017). Silicon (Si) has been found to serve as a beneficial element for growth and development of plant. It is the second most abundant element on the earth surface and soil (Ma *et al.,* 2001). Silicon is also known as essential constituent of plants and fertilizers and its accumulation in plants is helpful in maintaining sustainable production (Epstein, 1994). Si has also been proven to be an "agronomically essential" element which could improve the yields and qualities of a large group of crops (Vulavala *et al.*, 2016). Silicon (Si) is a quasi-essential multifaceted micronutrient known to exert a direct and indirect effect on plant growth and development under stress and non-stress conditions (Bhat *et al*., 2019). Many studies have confirmed that Si not only provides strength and rigidity to the plants but also improves growth performance of plants by suppressing adverse effects of different environmental stresses (Zargar *et al.*, 2019 and Singh *et al.*, 2019). Therefore, it is important to study the effect of nitrogen and silicon on the natural incidence of the Alternaria blight disease of mustard (*Brassica juncea* L.).

## Methods and Materials

To study effect of nitrogen and Silicon levels on Alternaria blight disease in mustard, an experiment was conducted during 2017 at the experimental site (IFTM University) is situated at Moradabad, Uttar Pradesh at the banks of Ram-Ganga River. The geographical co-ordinates of the experimental site is longitude 78°4´ to 79° East and latitude lies between 28°21´ to 28°16´ North at altitude of 193.23 meters above mean sea level in the heart of the Indogangetic plains of North India. The climate of this place is tropical to sub-tropical and of slightly semi-arid in nature and is characterized by very dry summer, moderate rainfall and very cold winter. The normal rainfall is about 1407 mm (10 years average) which is uni-mode type mostly precipitating during middle of June to middle of October, where potential evaporation transpiration is lower than the precipitation. Susceptible plant variety Keshri-5111 was sown in 2x3 m plot size with normal spacing in randomized block design with three replications and eight treatments *viz.,* T1- absolute control , $T_2$-100Kg Nitrogen+Two foliar sprays of 500ml Si/ha, $T_3$-120Kg Nitrogen+Two foliar sprays of 5000mlSi/ha, $T_4$-120Kg Nitrogen+Two foliar sprays of 1000ml Si/ha, $T_5$-140Kg Nitrogen+Two foliar sprays of 1000ml Si/ha, $T_6$-120Kg Nitrogen+Two foliar sprays of 2000ml Si/ha, $T_7$-100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha and $T_8$-100Kg Nitrogen+Two foliar sprays of 4000ml Si/ha. Half dose of nitrogen and full dose of phosphorus was applied as basal dose and remaining half dose of nitrogen at 40 DAS after first irrigation. Observation on Alternaria leaf blight severity (%) was recorded at 90-100 days after sowing and Alternaria pod blight severity (%) at 15 days before harvest. The disease severity was calculated by using 0-6 disease rating scale (Conn *et al*., 1990).

**Per cent disease incidence**

The percent disease severity was calculated by using following formula:

$$\text{Per cent disease intensity (PDI)} = \frac{\text{Sum of all numerical value}}{\text{Total number of leaves examined x maximum grade}} \times 100$$

**Per cent disease control =** $\frac{C-T}{C} \times 100$

Whereas: C = Per cent disease incidence in untreated (control)

Plant, T = Per cent disease incidence in treated plants

**Seed yield (kg/ha):** The crop was harvested at maturity and threshed each treatment plot separately and individual plot yield was recorded. The individual plot yield was then converted to yield per hectare.

**1000 seed wt (g):** A lot of seeds were drawn at random from each treatment replication wise. 1000 seeds were counted from each sample, weighed separately and expressed in grams.

## Results and Discussion

Data presented in Table 1 indicate the significant effects of all the treatments on management of white rust disease of mustard. The results showed that plant height gradually increased with the increasing dose of the fertilizers treatments in the combination of nitrogen and silicon were found significantly superior over the control. Maximum plant height was found in the treatment of at 30 DAS, 60 DAS and 90 DAS (17.98 cm, 103.90 cm and 180 cm) followed by T7, T6, T4, T8, T3 and $T_2$. These treatments were observed significant differ over the rest treatment. The result showed primary and secondary branches gradually increased with the increasing dose of the fertilizers treatments. At 45 DAS primary branches showed that higher in T7(5.83) followed by T2, T3, T8, T4, T6, and T5 while the secondary branches at 90 DAS were found maximum in T7 (23.83) followed by T2, T3, T8, T4, T6 and T5. The maximum numbers of seed per siliqua were found greater in T7 (15.88). Next best treatment was T5 (15.39) followed by T6, T4, T8, T3, T2 and T1 which was significantly differed over the rest treatments. The maximum Siliqua length (cm) and maximum number of siliqua was observed in Treatment T7 (445 per plant) followed by T6, T4, T8, T3, T2 and T1These results are conformity with those already reported by Ahmad *et al*., 2013, Javeed *et al.,* 2017 and Singh *et al.,* 2020. In control plot, the gradual increase in disease incidence was recorded (38.53%). On the other hand, the treatment applied with 100Kg Nitrogen +Two foliar sprays of 3000ml Si/ha recorded minimum disease incidence 38.53 per cent. The maximum per cent disease control (28.18 per cent) was recorded in treatment $T_7$-(100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha). It is attributed due to the Si confers rigidity and strength, resistance against pests and diseases, improves water economy by reducing transpiration rate, alleviates the ill effects of a biotic stresses and enhances crop yield. The same findings also reported by Vasanthi *et al*., 2014, the percent disease incidence (PDI) and percent disease control (PDC) of rice blast disease in aromatic rice field was significantly influenced with the application of RDF levels and Si spray. Lowest PDI (34.72%) and maximum PDC (39.4%) in aromatic rice was found in treatment T10 - (100 % RDF + two Si Spray @ 2 ml/ liter of water at 15 and 40 DAT) Satybhan Singh *et al*., 2022.

There are several reports of the effect of N on disease development that are inconsistent and contradict each other; the cost of cultivation was worked out by considering all the expenses gross return was worked out by multiplying grain and straw yield by its price prevailing in the market on per hectare basis under various treatments. The money value of grain and straw yields was added together. Net returns were calculated by subtracting the cost of cultivation from the gross return of the treatment. The maximum biological yield was observed in treatment $T_7$- [100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha (72.72 q/ha)] and followed by $T_5$-[140Kg Nitrogen+Two foliar sprays of 1000ml Si/ha (70.64 q/ha)]. Maximum seed yield was recorded in treatment $T_7$-[100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha (23.66 q/ha)]. These results are similar with Tahir *et al.* (2003), Jasmin *et al.* (2014) and Singh *et al.* (2018), they reported that various yield components such as number of pods/plant, seeds/pod and 1000-seed weight were affected significantly by different levels of N, P and K. The highest seed yield and net income was obtained in treatment with 100-60-50 kg NPK/ha may be due to optimum improvement in components of yield. Nutrient management significantly influenced the economics of mustard cultivation. Maximum gross returns were recorded in T7 (83605). Maximum benefit: cost ratio was observed in T7 (2.82) with the application of 100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha. The similar finding was reported by Singh *et al.* (2017) and Kumar *et al.* (2017 and the real causes of this inconsistency are poorly understood (Hoffland *et al.,* 2000). In conclusion, our studies have indicated that the combined application of nitrogen and phosphorus influences the soil environment/microclimate, yield, development of pathogen and sporulation of pathogen.

**Table 1:** Effect of nitrogen and silicon on plant height, primary branches, secondary branches, number of siliqua, length of siliqua, number of siliqua/plant, PDI and PDC of mustard.

| Treatment | Plant Height | | | Primary Branches at 45 DAS | Secondary Branches at 60 DAS | No. of seed/ siliqua | Length of silqua (cm) | No of siliqua /plant | PDI | PDC |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | | | | | | | |
| $T_1$- control | 16.02 | 95.03 | 165.0 | 4.90 | 19.74 | 12.65 | 4.75 | 357.5 | 49.92 (44.94) | 00 (00) |
| $T_2$-100Kg Nitrogen+Two foliar sprays of 500ml Si/ha | 16.89 | 97.7 | 171.7 | 5.27 | 20.56 | 13.72 | 4.77 | 412.0 | 43.51 (41.27) | 12.80 (20.86) |
| $T_3$-120Kg Nitrogen+Two foliar sprays of 5000ml Si/ha | 16.93 | 98.5 | 173.0 | 5.35 | 21.33 | 13.60 | 4.88 | 415.0 | 43.07 (41.03) | 13.70 (21.72) |
| $T_4$-120Kg Nitrogen+Two foliar sprays of 1000ml Si/ha | 17.92 | 100.5 | 174.0 | 5.53 | 22.50 | 14.82 | 5.15 | 429.5 | 41.56 (40.16) | 16.70 (24.12) |
| $T_5$-140Kg Nitrogen+Two foliar sprays of 1000ml Si/ha | 17.98 | 103.9 | 180.0 | 5.80 | 22.96 | 15.39 | 5.78 | 436.5 | 39.67 (39.06) | 20.70 (27.06) |
| $T_6$-120Kg Nitrogen+Two foliar sprays of 2000ml Si/ha | 16.97 | 101.0 | 175.0 | 5.69 | 22.47 | 15.25 | 5.56 | 434.0 | 40.54 (39.52) | 18.80 (25.70) |
| $T_7$-100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha | 17.69 | 102.2 | 176.3 | 5.83 | 23.83 | 15.88 | 5.85 | 445.0 | 38.76 (38.53) | 22.30 (28.18) |
| $T_8$-100Kg Nitrogen+Two foliar sprays of 4000ml Si/ha | 16.97 | 99.10 | 172.0 | 5.53 | 21.40 | 14.25 | 5.13 | 429.0 | 42.12 (40.40) | 14.40 (22.90) |
| | 0.03 | 0.12 | 0.97 | 0.05 | 0.11 | 0.10 | 0.11 | 2.36 | 0.11 | 0.23 |
| | 0.10 | 0.38 | 2.86 | 0.15 | 0.32 | 0.31 | 0.33 | 7.17 | 0.34 | 0.67 |

**Table 2:** Effect of nitrogen and silicon on biological weight, seed yield, test weight, cost of cultivation, gross return, net return and B:C ratio of mustard.

| Treatment | Biological yield (q/ha) | Seed yield (q/ha) | Test weight | Cost of cultivation Rs/ha | Gross return Rs/ha | Net Return Rs/ha | B:C Ratio |
|---|---|---|---|---|---|---|---|
| $T_1$- control | 47.42 | 10.80 | 6.42 | 18706 | 44660 | 25954 | 1.38 |
| $T_2$-100Kg Nitrogen+Two foliar sprays of 500ml Si/ha | 52.62 | 12.50 | 6.47 | 19216 | 51450 | 32234 | 1.67 |
| $T_3$-120Kg Nitrogen+Two foliar sprays of 5000ml Si/ha | 58.74 | 13.66 | 6.62 | 19926 | 56342 | 36416 | 1.82 |
| $T_4$-120Kg Nitrogen+Two foliar sprays of 1000ml Si/ha | 64.64 | 16.39 | 6.75 | 20106 | 67643 | 46937 | 2.33 |
| $T_5$-140Kg Nitrogen+Two foliar sprays of 1000ml Si/ha | 70.64 | 19.22 | 7.05 | 21266 | 77914 | 56648 | 2.66 |
| $T_6$-120Kg Nitrogen+Two foliar sprays of 2000ml Si/ha | 68.84 | 18.10 | 6.78 | 20902 | 73970 | 53068 | 2.53 |
| $T_7$-100Kg Nitrogen+Two foliar sprays of 3000ml Si/ha | 72.72 | 20.65 | 7.09 | 21882 | 83605 | 61723 | 2.82 |
| $T_8$-100Kg Nitrogen+Two foliar sprays of 4000ml Si/ha | 62.72 | 14.50 | 6.72 | 20476 | 59850 | 39374 | 1.92 |
| | 0.10 | 0.10 | 0.04 | | | | |
| | 0.29 | 0.28 | 0.13 | | | | |

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