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Effect of Nitrogen and Phosphorus on the Growth, Yield Attributes and Seed Yield of Late Sown Toria (*Brassica rapa* L.) under Punjab Conditions

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Abstract

The field experiment was conducted at Agriculture Research Farm of School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh (Punjab) during the autumn season of 2019 to study the effect of nitrogen and phosphorus on the growth, yield attributes and yield of Toria (*Brassica rapa* L.). The treatments consisted of three N levels viz. 50, 62.5 and 75 kg N/ha and three levels of P viz. 15, 20 and 25 kg P_2O_5/ha. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The growth parameters and yield attributes were significantly influenced with the application of nitrogen. The 75 kg N/ha recorded maximum plant plant height (111.6 cm), branches/plant (11.5), siliquae/plant (147.1), seeds/siliqua (20.3), 1000 grain weight (2.64 g). The seed yield of Toriaincreased significantly with the application of 75 kg N/ha over 50 (10.4 q/ha) and 62.5 (12.5 q/ha) kg N/ha which was 46.1% and 21.6% higher, respectively. The maximum harvest index (29.4%) was obtained from 75 kg N/ha. Phosphorus application at 25 kg P_2O_5/ha also increased the highest plant height (109 cm), siliquae/plant (136.6) which was significantly higher than15 kg P_2O_5/ha and 20 kg P_2O_5/ha. The phosphorus application did not influence the seed yield of Toria. The highest seed yield of Toria was observed with the application of 25 kg P_2O_5/ha (13.8 q/ha) which was significantly higher than 15 kg P_2O_5/ha (11.5 q/ha) but was at par with 20 kg P_2O_5/ha (12.9 q/ha). The increase in seed yield of Toria with the application of 25 kg P_2O_5/ha over 15 and 20 kg P_2O_5/ha was 20.0 % and 6.97%, respectively. The interaction between different levels of N and P was non significantly in almost all morphological parameters and yield contributing characters.

Key words : *Nitrogen, phosphorus, toria, growth, yield attributes, yield.*

Introduction

Oilseed crops play a major role in agricultural economy of the country. Next to cereals, oilseeds occupy a large area of the country. Among the oilseed crops, *Toria* (*Brassica rapa* L.) is the third most important edible oilseed in the country. It contains about to 44 per cent oilseed with a well-balanced amino acid, phytic acid 1.5 per cent and sinapine 1.0 to 1.5 per cent. Besides, its oil value, its seeds are also used as condiments in preparation of pickles and flavoring curries and vegetables but the seed yield of *Toria* is very low as compared to developed countries which can be increased to some content with the use of optimum fertilizers. Nitrogen is considered to be the most important nutrient for the crop to activate the metabolic activity and transformation of energy, chlorophyll and protein synthesis. It also affects the uptake of other essential nutrients and helps in the better partitioning of photosynthesis to reproductive parts which increase the seed. Nitrogen showed an important role in seed protein and physiological functions of the plant and supports the plant with rapid growth, increasing seed and fruit production and enhancing quality of leaf and oil seed yield. Phosphorus plays a great role in enhancing and sustaining crop productivity worldwide. Continuous supply of phosphorus through manure and fertilizer is indispensable for crop production sustenance (1). It is also responsible for synthesis of certain vitamins, metabolism of carbohydrates, proteins and oil formation. Phosphorus promotes flowering, setting of siliqua and also increase the size of siliqua and yield. Keeing in view the above, the present study was undertaken to study the effect of nitrogen and phosphorus, on the growth, yield attributes and seed yield of *Toria.*

Materials and Methods

The present investigation was carried out during the autumn season of 2019 at Agriculture Research Farm of School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh (Punjab). Geographically it is located at 30.6642°N latitude and 76.2914°E longitude at an altitude of 268 meters above mean sea level. The Experiment was laid out in an Randomized Complete Block Design (RCBD) with three replications. The experimental site was low in organic carbon (0.38%) and avilable soil nitrogen (144.6 kg N/ha), medium in available soil phosphorus (17.3 P_2O_5/ha) and high in available soil potassium (168 kg K_2O/ha). The treatments comprised three levels of nitrogen viz. 50, 62.5 and 75 kg N/ha and three levels of phosphorus 15, 20, and 25 kg P_2O_5/ha. The whole N and P was applied as basal dose irrespective of the treatments. The all other cultural practices were

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Table-1 : Effect of nitrogen and phosphorus on the growth, yield attributes and yield of late sown Toria.

Treatments	Plant stant (%)	Plant height (cm)	Branches/ plant	Siliqua/ plant	Seeds/ siliqua	1000 grain weight (g)	Seed yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
Nitrogen levels (kg N/ha)									
50.0	91.9	98.2	7.49	113.9	15.5	2.36	10.4	29.7	23.7
62.5	94.7	106.2	9.30	133.6	17.5	2.53	12.5	32.3	26.7
75.0	95.0	111.6	11.5	147.1	20.3	2.64	15.2	34.3	29.4
CD at 5%	NS	1.79	1.04	2.89	1.33	NS	1.28	1.20	1.05
Phosphorus levels (kg P_2O_5/ha)									
15.0	93.3	102.9	8.76	126.7	16.8	2.39	11.5	31.2	25.8
20.0	94.7	105.6	9.39	131.3	17.8	2.52	12.9	32.2	26.6
25.0	94.8	109.0	10.1	136.6	18.7	2.64	13.8	33.0	27.4
CD at 5%	NS	2.15	1.04	2.89	1.33	NS	1.28	1.20	1.05
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	13.9	4.30	11.3	6.26	9.73	1.56	12.7	4.42	4.11

followed uniformally in the treatments. The gross plot size was 3.6 × 3.0 m and net plot size was 3.0 × 2.7 m. The crop was sown on October 15, 2019 and harvest on January 15, 2020.

Results and Discussion

Growth attributes : The application of both nitrogen and phosphorus did notinfluence the plant stand of *Toria* significantly (Table-1). (2) also reported no change in plant stand with the application of N and P.

The plant height was influenced significantly with the application of N and P (Table-1). Nitrogen application increased the plant height of *Toria* significantly upto highest level of 75 kg N/ha (111.6 cm). The 62.5 kg N/ha (106.2 cm) significantly recorded higher plant height over 50 kg N/ha (98.2 cm). The height of *Toria* with the application of 25 kg P_2O_5/ha was 5.92% and 3.21% higherover 15 and 20 kg P_2O_5/ha, respectively. The increase in plant height due to nitrogen application may be ascribed to its role in cell elongation and cell multiplication in plant structure. (3) also reported significant increase in plant height (139.5 cm) with increasing levels of nitrogenupto 200 kg N/ha. Phosphorus application also influenced the plant height significantly upto the highest level of phosphorus i.e. 25 kg P_2O_5/ha (109 cm) over 15 kg P_2O_5/ha (102.9 cm) and 20 kg P_2O_5/ha (105.6 cm). The height of *Toria* with the application of 25 kg P_2O_5/ha was 5.92% and 3.21% higherover 15 and 20 kg P_2O_5/ha, respectively. The increase in plant height with higher phosphorus level was might be due to reason that P is major component chlorophyll which enhance the process of photosynthesis which leads to a better vegetative growth of a plant. (4) also obtained the maximum plant height (147 cm) by the application of 50 kg P_2O_5/ha.

Yield attributes : The application of nitrogen influenced the branches/plant of *Toria* (Table-1) significantly upto highest level of 75 kg N/ha (11.5). The 62.5 kg N/ha (9.30) significantly recorded higher branches/plant over 50 kg N/ha (7.49). The increase in branches/plant of *Toria* with the application of 75 kg N/ha over 50 kg N/ha and 62.5 kg N/ha was 53.5% and 23.6%, respectively. The increase in branches/plant was due to reason that nitrogen application may be ascribed to its role in breaks the lateral bud dormancy and encourage branching. (4) also obtained highest number of branches/plant with application of 150 kg N/ha. Branches/plant of *Toria* was not influenced significantly with the application of phosphorus levels. The highest branches/plant of *Toria* was observed with the application of 25 kg P_2O_5/ha which was significantly higher than 15 kg P_2O_5/ha but was at par with 20 kg P_2O_5/ha. (5) also reporded similar results.

The highest siliquae/plant of *Toria* were obtained significantly upto highest level of 75 kg N/ha (147.1). The increase in siliquae/plant of Toria with the application of 75 kg N/ha over 50 kg N/ha and 62.5kg N/ha was 29.1% and 10.1%, respectively. The 62.5 kg N/ha (133.6) significantly recorded higher branches/plant over 50 kg N/ha (113.9). The increase in siliquae/plant was due to reason that N application promotes vigorous vegetative growth leading to better canopy architecture on which more siliquae can develop and also facilitates adequate supply of photosynthates for more siliquae formation. (6) reported higher siliquae/plant (275.7) with application of 75 kg N/ha. Phosphorus application influenced the siliquae/plant significantly (Table-1). The highest siliquae/ plant of *Toria* was observed with the application of 25 kg P_2O_5/ha (136.6) which was significantly higher than 15 kg P_2O_5/ha (126.7) and 20 kg P_2O_5/ha (131.3). The increase insiliquae/plant of *Toria* with the application of 25 kg P_2O_5/ha over 15 kg P_2O_5/haand 20 kg P_2O_5/ha was 7.81% and 4.03%, respectively. The increase in siliquae/plant was due to reason that P application promotes vigorous vegetative growth which develop more siliquae. (7) also obtained similar results with application of P upto 60 kg P_2O_5/ha.

The 75 kg N/ha significantly increased the seeds/ siliqua of *Toria* than 50 kg N/ha and 62.5 kg N/ha (Table-1). The increase in seeds/siliqua of *Toria* with the application of 75 kg N/ha (20.3) over 50 kg N/ha (15.5) and 62.5 kg N/ha (17.5) was 30.9% and 16.0%, respectively. The increase in seeds/siliqua was might be due to reason that nitrogenis main constituent of protein and nucleic acid which play an important role in seed development and had favorable effect on number of seeds/siliqua. (4) also reported increase in seeds/siliqua (17.0) with the application of N up to 100 kg N/ha. Seeds/ Siliqua were not influenced significantly with the application of phosphorus levels (Table-1). (5) also reported no significant difference in seeds/siliqua with the application of P.

The application of nitrogen and phosphorus did not influence the thousandgrain weight of *Toria* significantly (Table-1). (5) also reported no change in 1000 grain weight with application of N and P.

Yield Parameters : The seed yield of *Toria* increased significantly with 75 kg N/ha (Table-1). The increase in seed yield of *Toria* with the application of 75 kg N/ha over 50 (10.4 q/ha) and 62.5 (12.5 q/ha) kg N/ha which was 46.1% and 21.6% higher, respectively. The increase in seed yield with higher nitrogen level was might be due to increase in branches/plant, number of siliquae/plant and 1000 grain weight. (4) also obtained higher yield (1516 kg/ha) with the application of nitrogen 100 kg N/ha. Seed yield of *Toria* was not influenced significantly with the application of phosphorus levels (Table-1). (5) also reported no significant effect on seed yield.

Straw yield was influenced significantly with the application of nitrogen levels (Table-1). The application of nitrogen increased the straw yield of *Toria* significantly upto highest level 75 kg N/ha (34.3 q/ha). The increase in straw yield of *Toria* with the application of 75 kg N/ha over 50 and 62.5 kg N/ha was 15.4% and 6.2%, respectively. The 62.5 kg N/ha (32.3 q/ha) significantly recorded higher straw yield over 50 kg N/ha (29.7 q/ha). The increase in straw yield of *Toria* was might be due to the favourable effect of N on plant height and number of branches/plant (6) also obtained higher straw yield (29.6 q/ha) with the application of 100 kg N/ha. Phosphorus application did not influence straw yield significantly (Table-1). (5) also reported similar results.

Harvest index was influenced significantly with the application of nitrogen levels (Table-1). The application of N increased the harvest index of *Toria* significantly upto highest level of 75 kg N/ha (29.4%). The 62.5 kg N/ha significantly recorded higher harvest index (26.7%) over 50 (23.7%) kg N/ha. (6) also reported similar results. Phosphorus application did not influence harvest index significantly. The application of P increased harvest index significantly upto highest level of 25 kg P_2O_5/ha (27.4%) which was significantly higher than 15 kg P_2O_5/ha (25.8%) but was at par with 20 kg P_2O_5/ha (26.6%). (5) also reported higher harvest index with the application of higher phosphorus levels.

Conclusion

It may be concluded that higher seed yield of late sown *Toria* can be obtained with the application of 75 kg N/ha and 25 Kg P_2O_5/ha under Punjab conditions.

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