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Effect of Nitrogen and Phosphorus Levels on the Growth and Yield of Mustard (*Brassica Juncea L.*)

Rajvir Singh, Uma and Tapendra Kumar
Deptt. of Agronomy, Raja Balwant Singh College, Bichpuri, Agra -283105 (U.P.)
Corresponding author : drrajjcb@gmail.com

Abstract

A field experiment on mustard was conducted at R.B.S. College Agriculture Research Farm, Bichpuri, Agra during Rabi season of 2017-18 with four levels of nitrogen as control, 40, 80 and 120 kg ha^{-1} and four levels of P_2O_5 as control, 30, 60 and 90 kg ha^{-1} . The results revealed that crop fertilized with 120 kg N ha^{-1} and 90 kg P_2O_5 ha^{-1} closely followed by 120 kg N ha^{-1} and 60 kg P_2O_5 ha^{-1} gave maximum seed yield (1431 kg ha^{-1}) and minimum with control (838 kg ha^{-1}). The maximum net return of Rs. 38143 ha^{-1} and B : C ratio of 2.84 was obtained with 120 kg N ha^{-1} + 90 kg P_2O_5 ha^{-1} treatment.

Keywords : Phosphorus levels, mustard, Net return, yield.

Introduction

In order to get maximum benefit from nitrogen use, it should not only be applied in right quantity but also at right time according to the growth stages of the crop. The low nitrogen content of Indian soils further accentuate this problem. Hence, it requires optimum application of nitrogen fertilization for the crop of better yield and quality. Phosphorus is one of the major plant nutrients which is essential for the growth of normal plants. As a component of every living cell, phosphorus controls all living processes including heredity and energy transport system[1]. Most agricultural soils contain larger amount of fixed form of P than available P, a considerable part of which has accumulated as a consequence of regular application of P fertilizers. However, a large proporation of soluble inorganic phosphate added to soil is rapidly fixed as in saluble forms soon after application and become unavailable to the plants. Higher yield along with good qualify seed can be produced by proper packages of agronomic practices. It is, therefore, important to determine a suitable dose of nitrogen and phosphorus for higher yield of mustard.[8]

Materials and Methods

The field experiment was conducted to study the effects of nitrogen and phosphorus levels on growth and yield of mustard at R.B.S. College, Agriculture Research Farm, Bichpuri, Agra during Rabi season of 2017-18 with four levels of nitrogen as control (N_0), 40 kg N ha^{-1}(N_1), 80 kg N ha^{-1} (N_2) and 120 kg N ha^{-1} (N_3) and four levels of phosphorus namely control (P_0) 30 kg ha^{-1} (P_1), 60 kg P_2O_5 ha^{-1} (P_2) and 90 kg P_2O_5 ha^{-1} (P_3), in randomized block design using four

replications and sixteen treatment combinations. The experimental initial soil had pH 7.84, EC 0.40 dsm^{-1}, organic carbon 0.34 per cent, available nitrogen 174.40 kg ha^{-1}, available phosphorus (P_2O_5) 25.80 kg ha^{-1}, available potash (K_2O) 220.70 kg ha^{-1} and sandy loam texture. Starter dose of 30 kg K_2O ha^{-1} was given in all plots. Full amount of nitrogen and P_2O_5 as per treatment through urea (46% N) and S.S.P. (16% P_2O_5) along with 30 kg K_2O ha^{-1} through M.O.P. (60% K_2O) as a starter dose were applied in all plots at the time of sowing as a basal dressing. Bharat-2 variety was used for sowing on Nov. 1 during 2017-18.

Results and Discussion

Effect of Nitrogen levels on growth, yield attributes and yield :

All the growth and development characters such as, plant height, number of green leaves $plant^{-1}$, number of primary and secondary branches $plant^{-1}$ and dry matter accumulation (g) $plant^{-1}$ were significantly differ much themselves due to different doses of N at various stages of crop growth except, germination count and crop stand, (Table 1). The germination count and crop stand did not modify due to different levels of nitrogen. However, maximum crop stand $meter^{-1}$ row length was recorded with 120 kg N ha^{-1} (N_3) followed by 80 kg N ha^{-1} (N_2). Every increase in the levels of nitrogen significantly increase the plant height upto 120 kg N ha^{-1} (N_3). The number of green leaves $plant^{-1}$ increased significantly with every increase in the level of nitrogen upto 80 kg N ha^{-1} (N_2). When the level of nitrogen was increased from 80 to 120 kg ha^{-1}, the green leaves $plant^{-1}$ increased marginally. In comparing the trends in final yield data and growth, observation there seems to be positive correlation in relation to response to the increasing levels of nitrogen application. It may be seen that the plant height, number of branches per plant and dry matter accumulation were improved due to application of 40, 80 and 120 kg nitrogen ha^{-1} ones. Control (no) same findings were observed by many others.[2, 7]

All the yield components i.e. number of siliqua $plant^{-1}$, length of siliqua and number of seed $siliqua^{-1}$ improved with the increase in, the level of nitrogen upto 120 kg ha^{-1} (N_3) (Table 2).

These yields contributing characters influenced the seed yield per plant, which in turn was responsible for higher seed yield per hectare with increasing levels of nitrogen. Similar results were obtained earlier also[6, 7]. The bio-mass production, seed and stover yields increased considerably with every increase in level of nitrogen up to 120 kg ha^{-1} (N_3). Application of 40, 80 and 120 kg nitrogen per hectare resulted a considerable improvement in seed yield producing nearly 19, 22 and 27 per cent higher seed yield per hectare respectively over control (No.). Similarly, with the increase in nitrogen levels i.e. 40, 80 and 120 kg N ha^{-1} produced 9.79, 15.64 and 16.13 per cent higher stover yield, respectively over control (N_0). These results were in close proximity with the results reported in the past[3, 4].

Table 1 Growth attributes of mustard as affected by nitrogen and phosphorus levels

Treatments	Plant height (cm) at 120 DAS	No. of green leaves plant^{-1} at 120 DAS	No. of Primary branches plant^{-1} at 120 DAS	No. of secondary branches plant^{-1} at 120 DAS	Dry matter accumulation (g) plant^{-1} at 120 DAS
Nitrogen levels (Kg ha^{-1})					
0 (N_0)	155.50	7.45	5.19	14.46	34.87
40 (N_1)	160.40	8.37	5.78	15.80	40.41
80 (N_2)	171.56	9.24	5.96	15.95	41.66
120 (N_3)	175.48	9.45	5.98	15.99	42.14
SEm±	1.279	0.26	0.16	0.36	0.88
CD at 5%	3.635	0.74	0.46	1.02	2.54
Phosphorus levels (Kg ha^{-1})					
0 (P_0)	161.34	7.89	5.16	14.54	34.21
30 (P_1)	163.21	8.18	5.34	14.56	37.45
60 (P_2)	166.85	9.06	6.09	16.54	42.72
90 (P_3)	171.54	9.38	6.32	16.56	44.70
SEm±	1.279	0.26	0.16	0.36	0.80
CD at 5%	3.635	0.74	0.46	1.02	2.50

Table 2 Yield attributes and yield of mustard as affected by Nitrogen and Phosphorus levels

Treatments	No. of Siliquae plant^{-1}	Length of Siliqua (cm)	No. of Seeds Siliqua^{-1}	1000-seed weight (g)	Biological yield (kg ha^{-1})	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
Nitrogen levels (Kg ha^{-1})								
0 (N_0)	180.28	4.89	11.75	4.58	3472	870	2602	25.05
40 (N_1)	197.27	5.25	12.45	4.89	4028	1097	2931	26.23
80 (N_2)	200.19	5.28	12.55	5.25	4582	1226	3356	26.75
120 (N_3)	202.03	5.31	12.89	5.62	4932	1431	3501	29.01
SEm±	4.51	0.12	0.21	0.15	1.78	0.45	0.99	1.15
CD at 5%	12.82	0.34	0.60	0.43	5.06	1.28	2.80	NS
Phosphorus levels (Kg ha^{-1})								
0 (P_0)	185.72	5.11	10.80	4.84	3282	806	2476	24.55
30 (P_1)	187.17	5.14	11.93	4.87	3900	1050	2850	26.92
60 (P_2)	202.46	5.22	12.71	5.14	4688	1290	3398	27.51
90 (P_3)	204.42	5.26	12.98	5.49	4884	1350	3534	27.64
SEm±	4.51	0.12	0.21	0.15	1.78	0.45	0.99	1.15
CD at 5%	12.82	NS	0.60	0.43	5.06	1.28	2.80	NS

Effect of phosphorus levels on growth, yield attributes and yield:

The data presented in Table 1 showed that the germination count and crop stand at various stages of crop growth remained practically unaffected due to varying levels of phosphorus. However, maximum crop stand meter^{-1} row length was recorded with application of 90 kg P_2O_5 ha^{-1} (P_3) followed by 60 kg P_2O_5 (P_2). Plant height appreciably increased with every increase in the rate of phosphorus application upto 90 kg P_2O_5 ha^{-1} (P_3) at all the stages of crop growth except at 30 DAS. The number of green leaves per plant, number of primary and secondary branches plant^{-1} also appreciably improved with the application of phosphorus upto 60 kg P_2O_5 ha^{-1}. Application of 90 kg P_2O_5 ha^{-1} (P_3) was at par with 60 kg P_2O_5 ha^{-1}(P_2). But both the levels had significantly higher dry matter accumulation in plant than that of 30 kg P_2O_5 ha^{-1} (P_1) and control (P_0) at all the stages of crop growth.

The data recorded on number of siliquae plant^{-1} length of siliqua (cm), no of seeds siliqua^{-1} and 1000-seed weight (g) (Table – 2) indicated that number of siliquae plant^{-1} increased significantly with application of 90 kg P_2O_5 ha^{-1} as compared to control. While, highest number of seed siliqua^{-1} was obtained with 90 kg P_2O_5 ha^{-1} (P_3) but this was found statistically at par with 60 kg P_2O_5 ha^{-1} (P_2). The maximum 1000 – seed weight was obtained with 90 kg P_2O_5 ha^{-1} (P_3) and minimum with control (P_0).

An examination of data presented in Table 2 showed that biological yield (kg ha^{-1}) was significantly influenced due to application of different levels of phosphorus. Application of 90 kg P_2O_5 ha^{-1} (P_3) did not differ significantly with 60 kg P_2O_5 ha^{-1} (P_2) but both the levels significantly produced 17.67, 28.10 and 12.43, 22.40 per cent higher biological yield than that of recorded with 30 kg P_2O_5 ha^{-1} (P_1) was significantly superior over control (P_0). The maximum seed yield and stover yield were obtained with 90 kg P_2O_5 ha^{-1} (P_3) which was found to be statistically at par with 60 kg P_2O_5 ha^{-1} (P_2) and minimum with control (P_0). The different levels of phosphorus had no significant effect on harvest index (Table 2), however, the highest harvest index (27.64%) was recorded with the application of 90 kg P_2O_5 ha^{-1} (P_3). Similar results have been recorded by other investigators[2, 5].

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