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INFLUENCE OF NITROGEN AND PHOSPHORUS ON SEED YIELD OF RADISH (*RAPHANUS SATIVUS L.*) UNDER MID HILL CONDITIONS OF HP HIMALAYAS

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ABSTRACT

A field experiment was conducted during rabi season of 1995 and 1996 to study the effect of nitrogen and phosphorus on growth and seed yield of radish *(Raphanus sativus L)*. The treatments comprised of five nitrogen levels (0, 50, 100, 150 and 200 kg/ha) in combination with four phosphorus levels (0, 30, 60 and 90 kg/ha) were tested in RBD with three replications. The yield attributes and seed yields of radish were significantly improved with the application of different levels of nitrogen and phosphorus. Application of 150 N and 60 kg P_2O_5/ha recorded significantly highest yield attributes and yield. Further increase in N and P_2O_5 i.e., at 200 and 90 kg/ha, respectively, did not bring any significant increase as compared with their respective lower doses. The interaction of nitrogen and phosphorus were significant only for seed yield recording highest seed yield (11.89 q/ha) at 150 kg N/ha along with 60 kg P_2O_5 / ha. The response of additional dose of nitrogen application increased only up to 100 kg N/ha, while in case of phosphorus it was found in decline order with the increase in phosphorus doses. The regression equation developed for nitrogen doses in the presence/absence of phosphorus indicated optium nitrogen level of 164.35 kg/ha in the presence of 60 kg P_2O_5/ha with an expected seed yield of 12.10q/ha.

INTRODUCTION

Radish (*Raphanus sativus L*) is an important root crop grown through out the year, which require large quantities of seed. Among the various factors contributing towards the attainment of potential growth and yield of radish is mineral nutrition, especially nitrogen and phosphorus are of considerable importance. The information on the response of nitrogen and phosphorus is very meagre. Therefore, an attempt was made to evaluate the effect of nitrogen and phosphorus on yield attributes and yield of radish under mid hill conditions of Himachal Pradesh.

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MATERIAL AND METHODS

The field experiment was carried out at experimental farm of Horticultural Research Station, UHF, Kandaghat, Solan, HP, during 1995-96 and 1996-97. The soil was sandy loam with low available nitrogen (200kg/ha) and medium in phosphorus and potassium (18.5 and 230 kg/ha). Japanees white cv. of radish was tested in combination of five nitrogen doses (0, 50, 150 and 200 kg/ha) and four phosphorus levels (0, 30, 60 and 90 kg/ha) arranged in randomised block design with three replications, The root crop for steckling purpose was sown in second week of October and all recommended practices were adopted for quality root production. The roots were ready for transplanting after 60 days of sowing. At this stage the plants were uprooted and true to the type plants were selected and stecklings were prepared by cutting them 10 cm from both the sides and transplanted in the field on 10th and 15th Dec. 1995 and 1996, respectively. Half dose of nitrogen and full dose phosphorus treatment wise and 40 kg K_2O /ha to all plots were given at the time of transplanting and remaining half nitrogen was top dressed at flowering. At harvesting, growth and yield data were recorded year wise and pooled over two years, analysed according to standard analysis of variance techniques. The pooled values are presented in the tables.

RESULTS AND DISCUSSION

Effect of Nitrogen

Application of nitrogen at increased levels significantly increased plant height up to 150 kg/ha. While No. of primary branches/plant and 1000 seed weight increased only up to 100 kg/ha, thereafter, it increased or decreased but the difference was not significant (Table 1). Application of 200 kg N/ha being at par with 150 kg N/ha produced maximum LAI, while nitrogen dose 100 and 150 kg/ha were on par and superior to rest of the lower nitrogen doses. All the nitrogen doses being on par significantly increased the number of seed/pod as compared to control. A cumulative effect of this, the seed yield increased linearly up to 150 kgN/ha producing seed yield to the tune of 11.27 q/ha which was 3.78 and 1.06 per cent higher and lower to 100 and 200 kg N/ha doses, respectively. Increase in the seed yield with the application of 150 kg N/ha might be due to optimum dose which helped in proper growth and checking of undue lengthening of stem and ultimately effective pods of sufficient seeds with increased plumpness in grains were developed. These results also find support with the finding of Panwar *et al.* (1998) and Sharma and Lal (1994). Higher dose of nitrogen was not effective as excess of nitrogen caused lodging by inducing undue lengthening of the stem, which delayed the maturation and also affected the seed weight (Anon, 1980).

Effect of Phosphorus

Increasing levels of phosphorus application increased the yield parameters and yield except number of seeds/pod, up to 90 kg/ha but the response was recorded significant only up to 60 kg P_2O_5/ha. The yield of 10.01 q/ha recorded at 60 kg P_2O_5/ha was 3.75 and 12.25% more over that obtained with 30 and 0 kg P_2O_5/ha, respectively. The increase in the seed yield of radish due to increasing phosphorus levels may be attributed to the favourable improvement in all yield attributes leading to significant increase in yield. The analysis of data (Table 2) also revealed that the interaction between nitrogen and phosphorus was significant for seed yield of radish. It was observed that the seed yield increase significantly with the increase in nitrogen

only up to 100 kg/ha in the presence of 60 and 90 kg P_2O_5 /ha. Thereafter, up to 200 kg N/ha the response was not significant. Highest yield recorded at 200 kg N/ha with 60 and 90 kg P_2O_5 /ha was at par with 150 kg N/ha + 60 kg P_2O_5 /ha indicated that $N_{150}P_{60}$ was the economically best treatment.

The response to applied nitrogen increased up to 100 kg N/ha and then decreased gradually up to 200 kg N/ha (Table 3), while in case of phosphorus the highest response was observed with lower dose of phosphorus i.e. 30 kg P_2O_5/ha, which decreased gradually up to 90 kg P_2O_5/ha.The response equations to nitrogen dose for seed yield of radish in the presence/ absence of phosphorus doses were quadratic (Table-4), indicating an optimum nitrogen level of 164.35 kg/ha with expected seed yield of 12.10 q/ha in the presence of 60 kg P_2O_5/ha. While without phosphorus, a optimum nitrogen level worked out to be 179.40 kg/ha with a yield potential of 11.05 q/ha only. Which make it safe to deduced that optimum phosphorus level (60 P_2O_5/ha) not only save the nitrogen to the tune of 15 kg N/ha but increase the yield by 10 per cent in radish seed production under mid hill conditions of Himachal Pradesh.

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Table 1. Effect of nitrogen and phosphorus on growth and yield of radish

Treat ments	Plant height (cm)	No. of Primary Branches /plant	LAI	Number of pods/plant	No. of seed /pod	1000 seed weight (g)	Seed yield (q/ha)
Nitrogen Levels (kg/ha)							
N_0	141.3	9.68	276.3	288.3	3.76	16.23	6.04
N_{50}	164.6	12.28	312.5	482.7	4.65	16.95	8.30
N_{100}	171.7	15.12	350.3	544.8	4.85	17.14	11.08
N_{150}	176.0	15.32	363.2	600.5	5.05	18.49	11.51
N_{200}	178.2	15.36	367.5	615.7	5.11	17.28	11.64
CD (P = 0.05)	4.3	2.68	13.8	23.7	1.16	0.94	0.29
Phosphorus Levels (kg/ha)							
P_0	156.1	11.64	301.0	473.6	4.29	16.13	9.08
P_{30}	168.1	13.88	326.6	795.5	4.78	16.83	9.65
P_{60}	170.1	14.33	348.4	532.1	4.81	17.67	10.01
P_{90}	171.2	14.55	359.4	524.4	4.88	17.16	10.11
CD (P = 0.05)	3.8	1.68	12.3	21.3	NS	0.83	0.26

DAT : Days after transplanting.

Table 2. Interaction effect of nitrogen and phosphorus on seed yield of radish

Treatments	N_0	N_{50}	N_{100}	N_{150}	N_{200}	CD (P = 0.05)
P_0	5.16	7.95	10.23	10.98	11.06	
P_{30}	5.90	8.06	10.95	11.46	11.89	
P_{60}	6.15	8.57	11.56	11.89	11.90	
P_{90}	6.94	8.60	11.58	11.72	11.70	0.57

Table 3. Response to added dose of fertilizer.

Nitrogen dose (kg/ha)	Response to additional fertilizer levels (kg/ha N)	Phosphorus dose (kg/ha)	Response to additional fertilizer levels (kg/ha P_2O_5)
50	4.52	30.	1.90
100	5.04	60	1.55
150	3.65	90	1.44
200	2.80		

Table 4. Response functions and coefficient of determinations of radish seed yield.

Treatments	Equation	r^2	Optimum dose (kg/ha)	Expected Yield (q/ha)
P_0	$y = 5.1811 + 0.063340\ N - 0.00017057\ N^2$	0.97	179.40	11.05
P_{30}	$Y = 5.7134 + 0.066583\ N - 0.00018571\ N^2$	0.98	173.51	11.67
P_{60}	$Y = 5.9814 + 0.072383\ N - 0.00021371\ N^2$	0.96	164.35	12.10
P_{90}	$Y = 6.6943 + 0.060709\ N - 0.00017714\ N^2$	0.95	165.33	11.88