

Influence of nitrogen and planting geometry on seed yield and nitrogen uptake in radish (*Raphanus sativus*)

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ABSTRACT

A field experiment was conducted during 1996–97 and 1997–98 to study the effect of nitrogen (0, 50, 100 and 150 kg/ha) and planting geometry (60 cm × 30 cm, 60 cm × 45 cm and 60 cm × 60 cm) on seed yield and nitrogen uptake in radish (*Raphanus sativus* L.). The highest seed yield, N content and its uptake were obtained with 150 kg N/ha. Closer plant geometry (60 cm × 30 cm) recorded the highest seed yield, whereas straw yield was highest with 60 cm × 45 cm plant spacing. Nitrogen content was the maximum in widest planting geometry, but its uptake was highest at 60 cm × 45 cm planting geometry.

Key words : Nitrogen, Planting geometry, N uptake, Radish

Radish is a popular vegetable, widely grown in plains and hills of our country. Its cultivation has been extended throughout India owing to development of promising climate-specific genotypes. An information on root production aspect is easily available but that on seed production is still lacking which leads to poor seed yield and economic loss to the farmers. The yield can be increased considerably if suitable agro-techniques are followed. Among the various agro-techniques judicious use of fertilizer (Singh *et al.*, 1990) and optimum plant geometry (Sharma and Lal, 1896) appear to have most significant role in

determining high seed yield of this crop. Hence present study was undertaken to ascertain the effect of nitrogen and planting geometry on growth, seed yield, nitrogen content and its uptake in radish seed crop.

MATERIALS AND METHODS

The field experiment was carried out at experimental farm of Horticultural Research Station, Kandaghat, Solan, Himachal Pradesh during 1996–97 and 1997–98. The soil was sandy loam with low available nitrogen (200 kg/ha) and medium in phosphorus and potassium (18.5 and 230 kg/ha). 'Japanese White' cv of rad-

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ish was tested in combination of 4 nitrogen levels (0, 50, 100 and 150 kg/ha) with 3 planting geometry (60 cm × 30 cm, 60 cm × 45 cm and 60 cm × 60 cm) in randomised block design with 3 replications. The crop was sown in the second week of October and all recommended practices were adopted for quality-root production. The roots were ready for transplanting 60 days after sowing. The plants were uprooted and true-to-the type plants were selected and stecklings were prepared by cutting the plant 10 cm from both the sides and transplanted in the field on 5 and 12 December 1996 and 1997 respectively. Treatment-wise half dose of N and full dose of P and K were given at the time of transplanting and remaining N was top-dressed at flowering. All package of practices as per recommendations were adopted for healthy seed crop of radish. At harvesting growth and yield data were recorded.

RESULTS AND DISCUSSION

Nitrogen

Nitrogen significantly improved the plant height, recording taller plant at 150 kg N/ha. Variation in branches/plant was significant on application of 150 kg N/ha compared with the control and 50 kg N/ha, which were also significantly differ to each other. There was a linear increase in pods/plant up to 150 kg N/ha. The highest seed and straw yields were also realized with 150 kg N/ha during both the years (Table 1). The seed yield with 150 kg N/ha was 92.12, 27.92 and 5.24 % higher over 0, 50 and 100 kg N/ha respectively. The corresponding mean increase in straw yield was 162.31, 90.85 and 20.11% higher over the same order of N doses. These findings are in conformity with the observations of Singh *et al.* (1990) and Panwar *et al.* (1998). The increase in growth and yield with each successive increase in N dose

Table 1. Effect of nitrogen and planting geometry on seed and straw yield in radish

Treatment	Plant height (cm)		Branches/ plant		Pods/ plant		Straw yield (q/ha)		Seed yield (q/ha)	
	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂
Nitrogen (kg/ha)										
N ₀	128.5	122.7	35.34	28.34	273.0	295.5	41.78	47.75	5.53	5.13
N ₅₀	131.3	127.5	40.33	41.67	436.6	358.3	57.12	65.93	7.27	8.74
N ₁₀₀	141.0	148.3	42.67	43.56	499.7	454.3	90.18	105.35	9.38	10.08
N ₁₅₀	149.2	151.3	46.35	46.65	570.5	540.4	116.16	118.69	10.09	10.39
CD (P=0.05)	6.4	4.7	5.65	3.89	35.7	16.8	3.53	6.01	0.58	0.15
Planting geometry (cm)										
60 × 30	142.4	145.8	38.75	37.25	339.1	345.2	74.09	80.87	8.79	8.70
60 × 45	140.6	137.7	44.25	40.75	466.2	417.3	78.27	87.71	7.85	8.62
60 × 60	132.5	128.5	46.01	42.12	498.5	447.1	76.58	84.08	7.56	7.49
CD (P=0.05)	5.0	3.6	4.41	3.12	27.9	13.14	2.76	4.65	0.45	0.11

Y₁, 1996-97; Y₂, 1997-98

might be due the nitrogen role in both cell division and elongation and consequently increase the photosynthetically active surface, which significantly utilize the solar radiation and translated to the sink.

Nitrogen content and its accumulation in seed and straw and total nitrogen uptake significantly increased up to 150 kg N/ha except N content in straw where highest N content recorded at 150 kg N/ha which was on a par with rest of N doses. These results are in conformity with those of Sharma and Kanaujia (1992). The possible reason for increase in N content in plant parts might be owing to increased availability of N in soil. Total uptake of N increased significantly up to 100 and 150 kg N/ha, during 1996–97 and 1997–98 respectively. This may be because of increased N content and yield at increased levels of N application.

Planting geometry

Plant geometry significantly influenced the growth and developmental characters. Plant grew taller at 60 cm × 30 cm planting geometry than others, probably because of highest plant density, resulting in severe competition for space and light. The planting pattern 60 cm × 60 cm recorded the least height, due to ample availability of moisture, nutrients, space and light. As a result of low plant density at wider spacing, there was a significant increase in branches/plant and pods/plant. Sharma and Lal (1986) also reported such type of favourable response to plant spacing. Maximum yield of 8.79 and 8.70 q/ha was found with closer plant spacing (60 cm × 30 cm) during 1996–97 and 1997–98, respectively, and lowest was in wider spacing (60 cm × 60 cm). Maximum dry-matter (straw) was with 60 cm × 45 cm which had significant

Table 2. Effect of nitrogen and planting geometry on N content and its uptake

Treatment	Nitrogen content (%)				Nitrogen accumulation				Total nitrogen uptake	
	Seed		Straw		Seed (kg/ha)		Straw		(kg/ha)	
	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂
<i>Nitrogen (kg/ha)</i>										
N ₀	3.27	3.28	0.61	0.59	18.08	16.82	25.48	28.17	43.56	44.99
N ₅₀	3.39	3.51	0.75	0.73	24.64	30.67	42.84	48.12	64.48	78.79
N ₁₀₀	3.64	3.62	0.77	0.75	34.14	36.48	69.43	78.98	103.57	115.46
N ₁₅₀	3.81	3.86	0.78	0.77	38.44	40.11	70.34	91.39	108.78	131.50
CD (P=0.05)	0.08	0.06	0.10	0.05	4.42	3.72	5.42	7.40	12.54	4.38
<i>Planting geometry (cm)</i>										
60 × 30	3.49	3.57	0.71	0.61	30.67	31.05	52.60	49.33	83.27	80.38
60 × 45	3.59	3.58	0.73	0.72	28.18	30.85	57.14	63.15	85.32	94.00
60 × 60	3.56	3.59	0.76	0.73	26.91	26.88	58.20	61.38	85.11	88.26
CD (P=0.05)	0.06	NS	NS	0.04	3.45	2.90	4.23	5.78	NS	3.42

Y₁, 1996–97; Y₂, 1997–98

edge over the wider spacing, while the lowest was with 60 cm × 30 cm plant spacing.

Plant spacing significantly influenced all the characters shown in Table 2 except N content in straw and total nitrogen uptake during 1996–97 and N content in seed during 1997–98. Maximum values of N content in seed and straw was recorded with plant geometry of 60 cm × 60 cm and 60 cm × 45 cm, but the difference between these geometry was not significant. The accumulation of N in seed being on par with 60 cm × 45 cm was maximum in 60 cm × 30 cm planting geometry but in case of straw it was maximum in 60 cm × 60 cm and 60 cm × 45 cm, during 1995–96 and 1996–97 respectively. However, these geometry were statistically at par during both the years. Likewise, the highest N uptake was recorded at 60 cm × 45 cm planting geometry which was significantly superior to the lowest planting geometry treatment during 1997–98. Similar results were reported by Sharma and Lal (1986).

It may be concluded that an application of 150 kg N/ha in combination with plant

spacing of 60 cm × 30 cm gave the highest seed yield of radish, hence it may be considered optimum for 'Japanese White' radish under mid-hill conditions of Himachal Pradesh.

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