

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.702.018>

Effect of Nitrogen Fertilizer on Population of Aphid [*Brevicoryne brassicae* (L.)] in Radish

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ABSTRACT

Keywords

Radish, Nitrogen,
aphids

Article Info

Accepted:

04 January 2018

Available Online:

10 February 2018

The study was carried out during 2015-2016 at College of Agriculture, Navile, Shivamogga by raising single radish plant per pot. Six levels of Nitrogen, *i.e.* 0, 50, 75, 100, 150 and 200 percent of recommended level of nitrogen per plant (225.00 mg N/plant) were applied twice, before sowing and two weeks after sowing. Sampling for aphid *Brevicoryne brassicae* (L.) was done at weekly interval. The mean incidence of aphids increased as nitrogen level increased which was significantly different among plants receiving different levels of Nitrogen. High level of N application as 337.50 mg N/plant and 450.00 mg N/plant recorded significantly higher incidence of aphids (334.69 and 478.13 aphids/plant, respectively) compared to 225 mg N/plant [Recommended Package of Practices (RPP)].

Introduction

India is the second largest producer of vegetables in the world (ranks next to China) and accounts for about 15 per cent of the world's production of vegetables. The current production level is over 90 MT and the total area under vegetable cultivation is around 6.2 million hectares which is about 3 per cent of the total area under cultivation in the country. Radish (*Raphanus sativus* L.) is an edible root vegetable of the Brassicaceae family that was domesticated in Europe in pre-roman times and originated in Europe and Asia. It is

believed to have originated from *Raphanus raphanistrum* L., which is widely distributed as a weed crop in Europe. There are numerous varieties of radish, varying in size, flavor, color and length of time they take to mature.

Better growth of plants and yield depends upon balanced fertilization, which in turn has indirect effect on pests. Nitrogen fertilizer is an important nutritional element, which affects the severity of aphids as well as yield of the crop. Increase in Nitrogen fertilization resulted in an increase in the soluble nitrogen concentration in plants. Higher nitrogen

fertilization improves the suitability of oilseed rape for cabbage aphid whose performances are then increased. And also it influences the size, color, pre-reproductive period, reproductive period, fecundity and adult longevity of aphids (Muhammad *et al.*, 2004). It was also found that the nutritional quality of the host plant on which the parent generation feeds has a stronger effect on the aphids than that of the quality of their own food plants. Aphid population on nitrogen-fertilized plants were significantly more, aphids were bigger and darker (Muhammad *et al.*, 2004). Since radish is grown intensively, farmers have the tendency of applying more of chemical fertilizers especially nitrogenous fertilizer. Therefore understanding the effect of nitrogenous fertilizers on the aphid population is very much essential.

Materials and Methods

To study the effect of different levels of nitrogenous fertilizers on the incidence of aphids, single plant was raised in pots under green house condition in four replications. Soil used to fill the pots was tested for its available nutrient content in Krishi Vigyan Kendra (KVK), University of Agricultural and Horticultural Sciences, College of Agriculture, Navale, Shivamogga. As the soil was deficient with 10 percent low nitrogen availability, 10 percent (22.50 mg N/plant) of recommended level of nitrogen (225.00 mg N/plant) was added to all the pots. All pots were filled up to 2 cm below the brim with the soil.

Nitrogen fertilization treatments which consists of 0 (0.00 mg N/plant), 50 (112.50 mg N/plant), 75 (168.75 mg N/plant), 100 (225.00 mg N/plant), 150 (337.50 mg N/plant) and 200 (450.00 mg N/plant) percent of recommended level of nitrogen per plant (225.00 mg N/plant) were applied twice, before sowing and two weeks after sowing. Five aphids per plant were released artificially

on 10 days old crop and the plants were covered with nylon mesh (70 X 48 cm) to avoid the entry of natural enemies and movement of a late forms from one plant to another. To have the better plant growth and also to assure that the population variation is due to the nitrogen, the recommended level of P (114 mg PO₄/plant) and K (114 mg K₂O/plant) were applied to the crop.

From each plant, three leaves were selected from upper, middle and lower part for counting the number of aphids per leaf with help of magnifying lens. Crop height was recorded at weekly interval in all the treatments and weight of tubers was also recorded at harvesting. In order to obtain the average number of aphids per plant, the following formula was applied:

$$n = 1/N (r_1 \sum x_1 + r_2 \sum x_2 + r_3 \sum x_3)$$

Where:

n ---- average number of counted aphids per plant

N = number of plants sampled (10 in each case in the present work)

r₁ = average number of upper leaves per plant

r₂ = average number of middle leaves per plant

r₃ = average number of lower leaves per plant

x₁ = number of counted aphid per upper leaf

x₂ = number of counted aphid per middle leaf

x₃ = number of counted aphid per lower leaf

Results and Discussion

The perusal of the data reveals that the different Nitrogen levels have significant

effect on the incidence of aphids. In general the observations taken on aphid incidence at four crop growth stages *viz.*, 17, 24, 31 and 38 DAS irrespective of the Nitrogen levels recorded gradual increase in the aphid population. The aphid incidence gradually increased in all the treatments from 17 to 38 DAS.

The overall mean incidence of aphid in different treatment indicated that the minimum aphid incidence was 33.51 in T1 (0.00 mg N/plant). The mean incidence of aphids increased as nitrogen level increased. High level of N application as 337.50 mg N/plant and 450.00 mg N/plant recorded significantly higher incidence of aphids (334.69 and 478.13 aphids/plant, respectively) compared to 225 mg N/plant [Recommended Package of Practices (RPP)] (Table 1).

The results on the effect of different Nitrogen level on plant height of radish indicated that in general there is gradual increase in plant height from 17 to 38 DAS. The mean plant height in different treatments ranged from 88.63 to 238.88 mm. There was gradual increase in plant height from T1 to T4. Whereas, the plant height was decreased when the N level were increased beyond RPP *i.e.*, 337.50 and 450.00 mg N/plant. This indicates that excess application of N beyond RPP has detrimental effects on the plant growth (Table 1).

The results presented in table 1 reveals that increase in N levels has positive effect on the root yield *i.e.*, as the N levels increased the root yield also increased gradually. The highest root yield was observed in T6 (43.26 g/root) being statistically on par with T5 (41.55 g/root). Whereas, the root yield in T3 (37.39 g/root) and T4 (38.20 g/root) was on par with each other. The percent increase in root yield over untreated check ranged from 31.98 to 88.50. Highest per cent increase of

88.50 was observed in T6 followed by T5 (81.05), T4 (66.45), T3 (62.92) and T2 (31.98) (Table 1).

Better growth of plants and yield depends upon balanced fertilization, which in turn has indirect effect on pests. Nitrogen fertilizer is an important nutritional element, which affects the severity of aphids as well as yield of the crop. The application of N promotes the growth and yield of radish (Barker *et al.*, 1983), with recommended application rates being about 75 kg N ha⁻¹. At higher levels of N, such as 200 kg N ha⁻¹, root size and yield is improved, but N (particularly NO₃⁻) accumulation occurs (Guvenc, 2002; Nieuwhof and Jansen, 1993), which may be considered harmful for human consumption. In this study the effect of rate of N application on the incidence of aphids, growth and yield of radish was evaluated, in a pot experiment under the greenhouse condition, in an attempt to determine the optimal rate of N fertilization for reduced aphid incidence and high yield.

In the present study the incidence of aphids on radish increased as the levels of N application increased. Previously, similar results have been reported by Kalra *et al.*, (1983), Singh *et al.*, (1995), Khattak *et al.*, (1996), Kumar *et al.*, (1998) and Yadu and Dubey (1999) in *Lipaphis erysimi* and Choudhary *et al.*, (2001) in *Lipaphis erysimi* and *Myzus persicae* on *Brassica* species who reported that the aphid population increased as N application increased (Figure 1). Rohilla *et al.*, (1991) reported that infestation of *Lipaphis erysimi* was higher on *Brassica napus* receiving more Nitrogen while response of Nitrogen fertilizer was not significant for aphid infestation. Study of Brason and Simpson (1966) with corn leaf aphid *Rhopaeosiphum maidis* revealed three times higher population buildup of aphid species when fed on sorghum grown under high levels of Nitrogen than those with low levels.

Table.1 Effect of different nitrogen levels on the incidence of aphids, plant height and root yield of radish during 2014-15 under greenhouse condition

Different nitrogen levels (mg N/plant)	Number of aphids per plant				Mean number of aphids/ plant	Mean plant height (mm)	Root yield (g/root)
	17 DAS	24 DAS	31 DAS	38 DAS			
T1- 0.00	17.36 (4.11) ^d	23.33 (4.50) ^f	33.33 (5.70) ^f	60.00 (7.74) ^f	33.51 (5.75) ^f	88.63 ^f	22.95 ^d
T2- 112.50	27.08 (5.16) ^d	63.33 (7.95) ^e	95.42 (9.73) ^e	129.17 (11.36) ^e	78.75 (8.87) ^e	111.00 ^e	30.29 ^c
T3- 168.75	72.33 (8.50) ^c	155.17 (12.45) ^d	164.50 (12.82) ^d	241.50 (15.53) ^d	158.38 (12.58) ^d	167.88 ^d	37.39 ^b
T4- 225.00 (RPP)	145.50 (12.05) ^b	243.75 (15.61) ^c	269.25 (16.40) ^c	380.25 (19.50) ^c	259.69 (16.11) ^c	238.88 ^a	38.20 ^b
T5- 337.50	167.25 (12.91) ^b	314.25 (17.72) ^b	360.75 (18.99) ^b	496.50 (22.28) ^b	334.69 (18.29) ^b	213.88 ^b	41.55 ^a
T6-450.00	250.00 (15.79) ^a	418.33 (20.45) ^a	514.17 (22.63) ^a	730.00 (27.01) ^a	478.13 (21.85) ^a	193.63 ^c	43.26 ^a
SEm ±	0.55	0.66	0.68	0.35	0.37	0.70	0.35
CD @ P= 0.01	1.60	1.90	2.00	1.01	1.06	7.02	3.53
CV %	8.02	7.08	6.67	2.89	3.75	2.04	4.87

RPP – Recommended Package of Practices; Figures in the parentheses are $\sqrt{X + 0.5}$ transformed values
 Figures with same alphabets are statistically on par with each other



Plate 1 Radish plants raised singly in a pot and covered with nylon mesh under greenhouse condition

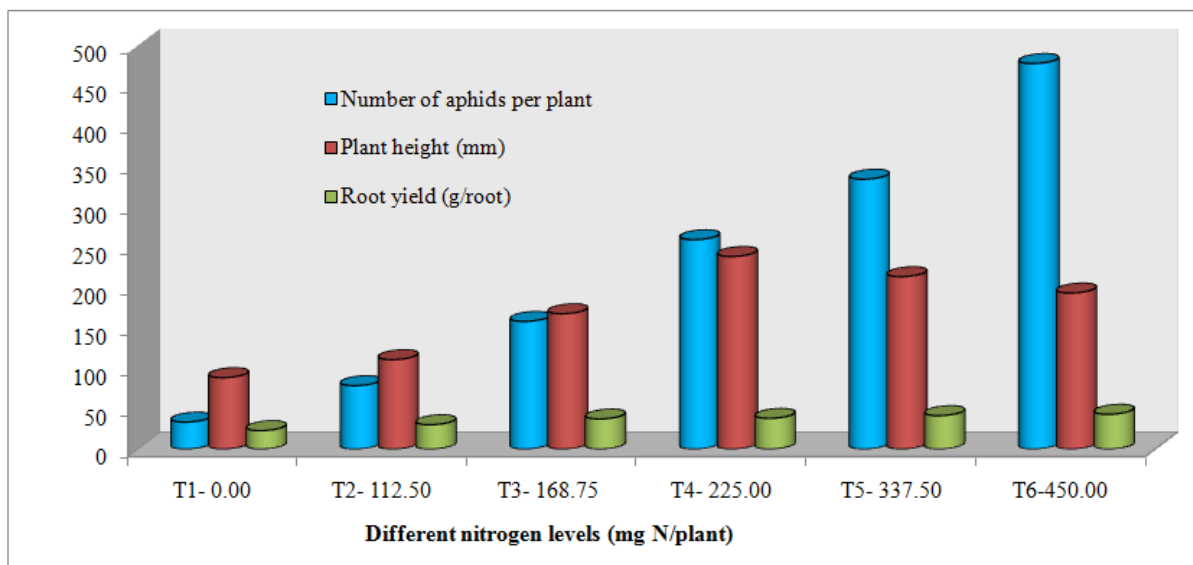


Figure 1. Effect of different nitrogen levels on the incidence of aphids, plant height and root yield of radish during 2014-15 under greenhouse condition

In the present study there was increase in plant height as the N levels increased upto certain limit (225 mg N/plant). The further decrease in plant height was may be due to increase in number of leaves and leaf area which in turn increased the aphid population.

Positive effects of increasing N application rate on plant height were previously reported by Pervez *et al.*, (2004) and El-Desuki *et al.*, (2005) which agrees with the present findings. Further increase in N level was caused reduction in plant height, which in agreement

with the findings of Jadhao *et al.*, (1999) who reported that too much fertilizer application will slow down the plant growth (Figure 1).

In the present study the gradual increase in root yield was noticed with increase in N levels and with high level of aphid incidence, which indicates that radish crop can yield more at high Nitrogen even with high aphid incidence but at the cost of decreased root quality. Increasing Nitrogen NPK rate for radish has marked increases in leaf area, leaf area index, leaf area duration and root yield was reported by Parthasarathi *et al.*, (1999). The yield increase was mainly due to increases in root weight and length and diameter of roots (Figure 1). He found that the highest yield was obtained with the highest N rate. Increasing N rates caused a higher water uptake by the roots, which was thus responsible for the increase in root fresh weight, but at the expense of root firmness.

Although it is well known that radish responds positively to nitrogen fertilization, the effect of N application up to 200 kg N ha⁻¹ on root yield may either be or not, but not detrimental. However, in a pot experiment rates up to 310 kg N ha⁻¹ are reported to affect yield negatively, with maximum yield being observed at 270 kg N ha⁻¹ (Akoumianakis *et al.*, 2011).

The effect of Nitrogen on aphid, *B. brassicae* was clearly evident. Highest population was observed on plants receiving more Nitrogen (450.00 mg N/plant) and minimum population on plants receiving no Nitrogen. Effect of nitrogen on plant height was significant.

The response was higher when N application increased from 168.75 to 225.00 mg/plant later there was decrease in plant height with increase in N application. Root yield was positively related to the rate of Nitrogen application.

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How to cite this article:

Megaladevi, P., D. Pallavi, M. Manjunatha and Sharanabasappa. 2018. Effect of Nitrogen Fertilizer on Population of Aphid [*Brevicoryne brassicae* (L.)] in Radish. *Int.J.Curr.Microbiol.App.Sci.* 7(02): 142-148. doi: <https://doi.org/10.20546/ijcmas.2018.702.018>