ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2018; 4(5): 09-11
www.allresearchjournal.com
Received: 05-03-2018
Accepted: 07-04-2018

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Effect of different levels of nitrogen and intra row spacing on growth and yield of radish (*Raphanus sativus* L.) variety red to under Green House condition

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Abstract
Filed experiment was held on "Effect of Radish (*Raphanus sativus* L.) Variety Red to different levels of Nitrogen and intra row spacing under Green House of Condition during the winter season 2017. The experimental field located, at Ghazni University Agriculture Research form (GARF) located 20 m. near to Unit mountain, the weather of experimental area is 15 and 20 ºC, receiving an annual rainfall of 500-650 mm and sandy loam soil. The experiment investigated the Effect of Radish (*Raphanus sativus* L.) Variety Red to different levels of Nitrogen and intra row spacing under Green House of Condition. The treatments were three level of Nitrogen (50, 75 and 100 kg/ha) and two levels of spacing (10 and 15 cm). The treatments were laid down in a factorial randomized block design (FRBD). Yield and yield components were measured and data were analyzed using ANOVA. Intra-row spacing significantly affected root diameter. The result of the study indicated that increasing level of nitrogen fertilizer from 50 to 100 kg/ha increased significantly yield components. Increasing intra-row spacing. This research was held by finical help of Committee.

Keywords: nitrogen levels, intra spacing

Introduction
Radish (*Raphanus sativus* L.) belong to family Brassicaceae. The area of maximum diversity of radish lies between the Mediterranean and Caspian Sea, which original gene center for this species [Umar *et al*. 2017] [2].

Radish an ancient as well as popular vegetable of tropical and temperate regions of the world, widely used as root vegetable, tender leaves and shoots as green [Alam, *et al*, 2010] [1].

It is an excellent source of carbohydrates, protein and vitamins A & C [Bakhsh. *et al*, 2006] [3]. In Afghanistan the average yield of radish is very low, the main cause of low yield is lack of improved production technologies. Besides other factors of declining the yield as well as quality of radish, the role of essential nutrients is negligible as their application help to increase the yield per unit area of any crop (Jilani, *et al*, 2010) [11].

Among the major essential nutrients required by the plants for their normal growth, development and yield [Singh, *et al*, 2003] [22], the role of nitrogen is acceptable as it is a necessary component of protein, nucleic acids, chlorophyll and certain important enzymes [Pervez *et al*, 2004 [16]. While, excessive use of nitrogen negatively affects the quality as well as yield of agricultural crops [Chen *et al*, 2004] [7]. Nitrogen is very essential for leafy vegetable production [Brintha I. and TH. Seran, 2009] [6].

As in Afghanistan not enough researches work has been conducted towards recommending most appropriate dose of nitrogen and intra-row spacing, it is necessary to conduct an experiment in order to make farmers and research workers to take a decision for adequate dose of nitrogen and intra-row spacing of radish. Therefore the present study is to find out the outcome of different levels of nitrogen and intra spacing on growth and yield.

Materials and Methods

Filed experiment was held on "Effect of Radish (*Raphanus sativus* L.) Variety Red to different levels of Nitrogen and intra row spacing under Green House of Condition during the winter season of 2017. The experimental field located, at Ghazni University Agriculture Research Form (GARF) during 2018 located 20 m. near to Unet mountain, the weather of experimental area is 15 and 20 ºC, receiving an annual rainfall of 500-650 mm and sandy loam soil.

The experiment was laid out in FRBD with six treatments replicated four time using a plot size of 1 m x 90 cm. The seeds were sown plots with row to row distance of 10 and 15 cm and plant to plant distance of 30 cm. three nitrogen levels (50, 75 and 100 kg N/ha) were tried. Urea was used as a source of nitrogen fertilizer and was applied in two split doses, first half at the time of sowing and remaining half 35 days after sowing. Phosphorus and potash were also applied as constant doses @ 60 and 120 kg per hectare, respectively at the time of sowing. All required cultural practices like irrigation, hoeing, weeding, pest and disease control, etc. were given uniformly whenever necessary. The crop was harvested when most of the leaves turned and after reaching full size root. The experimental plot was regularly observed and ten plants were randomly selected. Data were recorded for number of leaves, leaf length (cm), weight of leaves (g), root length (cm), root diameter (cm), root weight (g), root to shoot ratio and yield. The data were analyzed with Duncan's multiple range test (DNMRT) 5 percent probability level was applied to compare different treatment means, using excel program.

Table 1: Treatment Details

A. Nitrogen levels:	B. Intra-row spacing
N_1: 50 Kg ha^{-1}	S_2: 10 cm
N_2: 75 Kg ha^{-1}	S_3: 15 cm
N_3: 100 Kg ha^{-1}	

Table 2: effect of radish (*Raphanus sativus* l.) Variety red to different levels of nitrogen and intra row spacing under green-house condition

No.	Notations	Treatments	Treatments combination
1	T^1	$N_1 \times S_1$	N 50 × 10 cm
2	T^2	$N_1 \times S_2$	N 50 × 15 cm
3	T^3	$N_2 \times S_1$	N 75 × 10 cm
4	T^4	$N_2 \times S_2$	N 75 × 15 cm
5	T^5	$N_3 \times S_1$	N 100 × 10 cm
6	T^6	$N_3 \times S_2$	N 100 × 15 cm

Result and Descation

The increase in dry matter production per plant of radish with increasing rate of N fertilizer up to 100 kg/ha could be attributed to the positive influence of nitrogen on cell division, cell elongation, cell expansion synthesis of amino acids enzymes and chlorophyll which might increase the growth, the vigour of the crops.

Root diameter exhibited significant variation with N level (Table 3). The biggest root diameter (34.26 cm) resulted from 50 kg/ha which was significantly greater than those of the remaining doses of N, these results were in agreement with [Parraga 1995] [15] who reported that application of Organic matter with N increased the diameter of root per plant, in general the treatments produced taller plant height and higher number of leaves per plant and higher roots diameter.

Table 3: Effect of Radish (*Raphanus sativus* L.) Variety Red to different levels of nitrogen and intra row spacing under Green House Condition on root diameter

Treatments	Weeks after sowing			
	2	4	6	8
N 50	12.61 a	18.12b	25.4a	34.24a
N 75	12.76a	19.08ab	23.63a	27.60c
N 100	11.83a	18.02b	26.58a	32.24ab
SED	0.3664	0.524	1.153	0.998
Spacing (cm)				
10	7.30 c	12.92c	18.33b	23.02c
15	8.33	14.17 b	20.92a	26.09b
SED	0.257	0.371	0.815	0.706
Interaction				
FxS	NS	*	*	NS

SED= Standard Error of Difference, F= Nitrogen, S= Spacing, means followed by same letter within a set of interaction are not statistically different at 5% level of significance DNMRT test.

Time taken by the roots to attain edible size, the number of days to reach edible size of radish plant due to N levels application ranges from 39.29 to 40.09 days (Table 4). Application of N fertilizer at 100 kg/ha significantly influenced attaining edible size earlier at 39.29. These results are in conformity with the findings of [Sharma AK. (2000) and Shoe Maker JS. (1949).] that the minimum time is 5.56 weeks and the slight difference can be attributed to differences in ecological as well as climatic conditions.

The Radish yield result is presented in Table 4. The highest yield (8.83 t/ha) was attained from 100 kg/ha. The increased in yield of radish root might be attributed to higher individual root weight, higher number of leaves per plant and higher dry matter content of root. [Juen H *et al.* (2010)] [12] Reported that N level at 80 Kg/ha gave the best yield and quality in radish [Juen H *et al.* (2010)] [12] mentioned that maximum yield of 35.9 t/ha was obtained when N was applied at the ration 120:120:60 kg/ha to carrot. Similarly. Also found that the highest yield (27.82) t/ha was obtained from nitrogen applied to carrot at 150 kg/ha which was significantly different from other nitrogen levels [Sharma *et al.* (1990)] [19]. Also found that combination of fertilizer 120-45-120-30 kg/ha of NPK 5 t/ha could produce the highest root yield of 27.22 t/ha.

The increase in plant height, leaf number per plant, leaf length and dry matter production per plant of radish with increasing intra-row spacing from 10 or 15 to 20 cm, could be probably due to the fact that, radish plants grown at wide intra-row spacing are less expose to intra-specific competition for nutrients, moisture, height and spaces, therefore tended to grow vigorously. High plant populations associated with narrow intra-row spacing tended to exert pressure on scarce growth resources such as light and nutrients there by leading to poor growth. This agreed with the findings of [Sharma *et al.* (1990)] [19].

Table 4: Effect of Radish (*Raphanus sativus* L.) Variety Red to different levels of Nitrogen and intra row spacing under Green House Condition on total number of days attain edible size and yield

Treatments	T otal number of days attain edible size	Yield
N 50	40.09c	7.84a
N 75	38.93c	7.08ab
N 100	39.29 c	8.83a
SED	1.58	1.044
10	50.271	5.41b
15	47.76 ab	7.55a
SED	1.117	0.738
Interaction		
F x S	NS	NS

SED= Standard Error of Difference, F= Nitrogen, S= Spacing, means followed by same letter within a set of interaction are not statistically different at 5% level of significance DNMRT test.

Conclusion

In conclusion, the results of the study indicated that applications of N level 100 kg and with 15 cm intra-row spacing appeared to be optimum for good yield of radish. From the result obtained in the study, it may be recommended that the use of N level 100 kg with intra-row spacing of 15 cm will lead to better yield and quality of radish.

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