

Comparison of Commercial and Local Varieties of Radish at Different Levels of Manures and Fertilizers

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Abstract

Five commercial (Any sesion, Tikimashi, Mino Early, Forty Days and Chetki) and a local (Bhedetar Local) varieties of radish were tested at the Agricultural Research Station (ARS), Pakhribas, Dhankuta, during the autumn season of 2008 and 2009 for their performance at different levels of manures and fertilizers. Two trials, varietal and fertilizer were conducted in randomized complete block design with four replications. The highest root yield (65.1 t ha⁻¹) was obtained from Mino Early which was at par with Bhedetar Local (62.85 t ha⁻¹) in varietal trial. In fertilizer trial, the highest mean root yield of Bhedetar Local was obtained from 100:80:40 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹ which was at par with 75:50:50 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹, however, differed statistically with other treatments. The root yield obtained from the exiting farmers practice was statistically at par with 75:50:50 N₂:P₂O₅:K₂O kg ha⁻¹. Root yield (t ha⁻¹) was positively and significantly (≥ 0.01) correlated with root length, plant height, root diameter and number of leaves per plant.

Key words: Bhedetar Local, fertilizers, radish,

Introduction

Radish (*Raphanus sativus* L.), one of the most popular root vegetable crops, can successfully be grown throughout the year in the hills of Nepal (Poon *et al.* 2004). Its popularity could be due to its wider climatic adaptation, easy cultivation methods and wider ranges of uses (Shrestha & Shakya 2004). Area under radish was about 16,570 ha and total production was 2,19,230 tons with an average productivity of 13.23 t ha⁻¹ in Nepal (VDD 2009). Likewise, the area coverage, production and productivity of radish in Dhankuta were 530 ha, 9,545 t and 18.01 t ha⁻¹ respectively (DADO 2009). Farmers are growing very few recommended varieties of radish, however, many potential local radish cultivars are available in Nepal (Jha 2003). Mino Early, White Neck, Forty Days and Pyuthane Red are released varieties of radish in Nepal. Although neither registered nor released variety, Bhedetar Local is one of the highly productive, heat and moisture tolerant cultivar of radish from local

farmers' collection (Gautam & Khatiwada 1997). Besides these noble characteristics, the cultivar has not been found suitable for recommendation due to its large phenotypic variation in root yield and size (Gautam *et al.* 1990). Therefore, purification work on this variety with bud pollination was started at Pakhribas Agricultural Centre (PAC) since 1996 (Gautam & Khatiwada 1997) and its purification is still continued under cage through hand pollination. Now it is largely purified and ready for release (ARSP 2009). In order to prepare this variety for release, it was necessary to compare Bhedetar Local with other commercial varieties.

Appropriate variety selection and optimum nutrient supply is crucial for obtaining optimum yield from radish. Radish being a short duration and quick growing crop, the root growth should be rapid and uninterrupted. Hence, for the production of good

quality roots and high yields, optimum fertilization with nitrogen and potassium is very important (Kale & Massalkar 1993). Moreover, the reason for low production of radish in farmers' field is insufficient nutrient supply and lack of knowledge on suitable varieties (Gautam & Khatiwada 1997). The same level of fertilizer may not be appropriate to all varieties. Hence, the fertilizer requirement of Bhedetar Local may vary with other commercial varieties. Therefore, this study was conducted to evaluate the performance of Bhedetar Local radish at different doses of fertilizers.

Methodology

Varietal trial

A field experiment was carried out during two consecutive autumn seasons of 2008 and 2009 at ARS, Pakhribas to compare cv. Bhedetar Local with other established commercial varieties of radish. Six varieties of radish namely: Any Season, Bhedetar Local, Tokinashi, Mino Early, Forty Days and Chetki Long were planted in randomized complete block design and replicated four times. Individual plot size was 2.7 m² where 30 cm row to row and 15 cm plant to plant

spacings were maintained by thinning after seedling establishment. Seed sowing was done during 2nd week of September in both the years. Fertilizers @ 75:50:50 N₂:P₂O₅:K₂O kg ha⁻¹ and FYM @ 20 t ha⁻¹ were applied in the soil.

Manure and fertilizer trial

A field experiment was carried out to find out the response of local radish cv. Bhedetar Local to different levels of organic and inorganic fertilizers at ARS, Pakhribas in two consecutive autumn seasons of 2008 and 2009. Seven different organic and inorganic sources of nutrient combinations were verified in randomized complete block design with four replications (Table 1). Plot size was 2.7 m² where 30 cm row to row and 15 cm plant to plant spacings were maintained by thinning after seedling establishment. Seeds were sown during 2nd week of September in both the years. Soil of the experiment site was analyzed before experiment where organic matter and nitrogen were found 1.61% and 0.1% respectively. Likewise phosphorus and potash were 23.80 and 52 kg ha⁻¹ respectively. P^h of the experiment site was 6.16.

Table 1. Treatment details of the fertilizer experiment

S.N.	Treatments
1.	Control
2.	FYM 10 t ha ⁻¹
3.	FYM 20 t ha ⁻¹
4.	50:50:50 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹
5.	Farmers' practice (60:50:00 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹)
6.	75:50:50 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹
7.	100:80:50 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹

Statistical Analysis

Plant, root and yield characteristics were recorded during experimentation. Data were analyzed by analysis of variance. Microsoft Excel and MSTAT-C were used for the analysis. Mean separation was done by Duncan's multiple range test (DMRT).

Results and Discussion

Plant and root characteristics

Varieties differed significantly (p<0.01) for plant height and biomass yield, however, they were statistically similar for root length and diameter (Table 2). Chetki Long was the tallest (48.84 cm) and Mino Early was the most dwarf (39.35 cm) variety. Chetki

Long and Forty Days were statistically at par while all other varieties were also statistically similar for height. The similar findings in Mino Early at PAC was reported by Khanal *et al.* (1990). The highest biomass yield was obtained from Mino Early and the lowest from Tokinashi. Root length and diameter did not vary among the radish varieties, however, the largest and longest roots were observed in Forty Days and Bhedetar Local, respectively. Similar observation in Bhedetar Local was also made by Gautam & Khatiwada (1997). Plant height was significantly and positively correlated with root length and diameter, however, the tallest variety Chetki Long did not produce the longest root.

Table 2. Fdiage and root characteristics of radish varieties

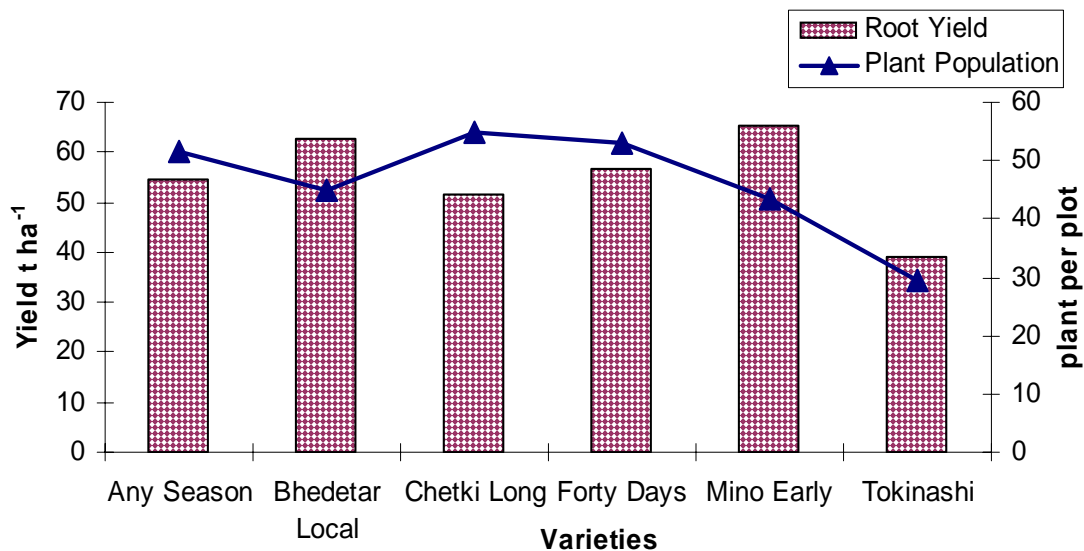
Varieties	Plant height (cm)	Biomass (kg/plot)	Root Diameter(cm)	Root length (cm)
Any Season	41.7bc ↑	20.62ab	3.91	28.60
Bhedetar Local	43.4bc	21.90ab	4.42	35.40
Chetki Long	48.84a	19.04b	4.14	25.04
Forty Days	45.90ab	20.28ab	4.73	24.26
Mino Early	39.35c	23.75a	4.34	33.70
Tokinashi	39.92c	14.00c	4.03	30.47
F-test	<.001	<.001	NS	NS
LSD(p<0.05)	4.57	3.87	-	-
CV%	10.4	19.1	10.1	16.7

†Mean of 4 replications. In the columns means followed by the same letter are not significantly different ($p < 0.05$) by DMRT. NS = Not significantly different.

Root yield of radish varieties

Radish varieties differed significantly ($p < 0.01$) for marketable root yield ($t\ ha^{-1}$). The highest root yield ($65.1\ t\ ha^{-1}$) was obtained from Mino Early which was at par with Bhedetar Local ($62.85\ t\ ha^{-1}$) (Fig. 1). The similarity in root yield might be due to similar root length and diameter. Pandey and Pun (2004) reported maximum $59.53\ t\ ha^{-1}$ root yield from Mino Early and $50.64\ t\ ha^{-1}$ from Forty Days at Bhakimli (1600-2300m) in Myagdi. The lowest root yield from Tokinashi was due to relatively short and small root size. Chapagain *et al.* (2000) reported $27.15\ t\ ha^{-1}$ root yield from Tokinashi in farmers field at Fikkal, Ilam. Similarly 28.2

to $39.3\ t\ ha^{-1}$ root yield of Tokinashi was recorded from organic kitchen garden at Pakhribas Agriculture Centre (PAC 1995). The root yield ($65.1\ t\ ha^{-1}$) was recorded from Bhedetar Local during rainy season at ARS, Pakhribas (ARS 2005). Number of plants per plot varied significantly due to poor germination of seeds of Tokinashi, however, plant population in other varieties was statistically at par. Number of plants per plot also affected the root yield of radish varieties. Covariate analysis of plant per plot showed significant effect of plant population on root yield.

**Fig. 1.** Root yield ($t\ ha^{-1}$) and plant population of radish varieties

Effect of fertilizers on plant and root characteristics of Bhedetar Local

The plant height was increased according to increased doses of fertilizers. The highest plant height (47.72 cm) was recorded in the plots treated with 100:80:50 N₂:P₂O₅:K₂O kg/ha + FYM 20 ton t ha⁻¹ and the lowest plant height (26.52 cm) from the control plot (Table 3). The stunted growth at lower fertility level clearly indicated that Bhedetar Local requires higher dose of

fertilizer for normal growth. Number of leaves per plant and root diameter were also increased significantly with increased dose of fertilizers up to 75:50:50 N₂:P₂O₅:K₂O kg/ha + FYM 20 ton t ha⁻¹ and declined marginally at 100:80:50 N₂:P₂O₅:K₂O kg/ha + FYM 20 ton t ha⁻¹. Fertilizer doses did not affect the root length of Bhedetar Local nor showed any clear growth pattern, however, significantly higher than those treatments without fertilizer use.

Table 3. Fdiage and root characteristics of Bhedetar Local

Treatments	Plant height (cm)	No. of Leaves per plant	Root diameter (cm)	Root length (cm)
Control	26.52b [†]	16.23c	3.81b	30.63
FYM 10 t ha ⁻¹	30.37b	16.67bc	3.83b	34.03
FYM 20 t ha ⁻¹	29.02b	18.30abc	4.02b	34.40
50:50:50 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹	44.90a	18.65abc	4.61a	37.65
Farmers' practice	41.92a	19.67ab	4.71a	33.75
75:50:50 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹	47.71a	20.48a	4.7a	38.20
100:80:50 N ₂ :P ₂ O ₅ :K ₂ O kg ha ⁻¹ + FYM 20 t ha ⁻¹	47.72a	20.40a	4.6 ^a	36.88
F-test	<.001	0.04	<.001	NS
LSD(p<0.05)	6.73	3.08	0.54	-
CV%	17.4	16.4	12.5	17.2

[†]Mean of 4 replications. In the columns means followed by the same letter are not significantly different (pd"0.05) by DMRT. NS = Not significantly different.

Root yield of Bhedetar Local at different doses of fertilizers

Fertilizer doses significantly affected the root yield of Bhedetar Local radish. The highest mean root yield was obtained from 100:80:50 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹ which was at par with 75:50:50 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹, however, differed statistically with the other treatments (Fig. 2). The lowest root yield was obtained from control, however, it was at par with 10 t ha⁻¹ FYM. This condition might be due to the residual nutrients available in the soil. However, organic matter, phosphorus and potash were low and nitrogen was in medium condition in the experiment site before experiment. The root yield obtained from the exiting farmers practice (60:50:00 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹) was statistically at par with 75:50:50 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹. The similarity in root yield between 10 and 20 t ha⁻¹ FYM could be due to under utilization of FYM by radish in short period of time. Adhikari and Pathak (1999) recorded

the highest root yield (63.64 t ha⁻¹) from Mino Early with application of 60:30:60 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹ and 20 kg/ha borax in Pokhara condition. The highest plant population per plot was recorded in the plots treated with 50:50:50 N₂:P₂O₅:K₂O kg ha⁻¹ + FYM 20 t ha⁻¹. However, covariate analysis of plant population per plot showed non significant effect of plant population on root yield.

Correlation study

Root yield (t ha⁻¹) was positively and significantly (<0.01) correlated with root length, plant height, root diameter and number of leaves/plant (Table 4). The correlation study revealed that the value of these factors/characters increased, the root yield can be increased. Similar findings have been reported by Verman and Singh (1989). Plant height was also significantly and positively correlated with root length and diameter.

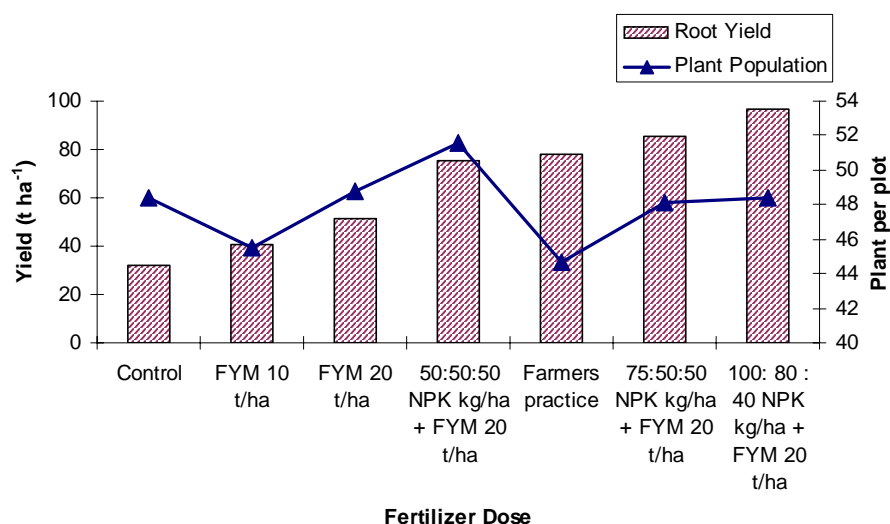


Fig. 2. Root yield and plant population at different doses of fertilizers

Table 4. Correlation between major plant characters and root yield (t ha⁻¹)

Plant characters	Correlation	Coefficient Probability
Plant height	0.816	d"0.01
Root length	0.640	<.001
Root diameter	0.663	<.001
No. of leaves	0.621	<.001

Bhedetar Local is one of the suitable radish varieties for commercial cultivation and it is also appropriate for release. To increase the overall productivity of radish, farmers have to increase the level of nutrient they currently applying.

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