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Effect of varietal performance on growth and yield parameter at different day stage in radish (*Raphanus sativus* L.) crop

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Abstract

The present experiment was conducted to find out the character association in radish genotypes during the year 2014-15 at research farm, Udai Pratap Autonomous College, Varanasi. Observations *viz.*, plant height, no. of leaves per plant, leaves length, leaves width, leaf weight, root length, root thickness, fresh weight of root, leaf: root length ratio, leaf: root weight ratio, and root yield, recorded at 15, 30 and 45 DAS. The silent findings of the experimentation are as Using 9 genotype namely, Suneha, Pusa hillqueen, Panjob Pasand, Hongkong-11, Snow white, Pusa Reshmi, White icicle, Pusa Himani, Japanese White of radish the early stages Pusa Himani, Pusa hill queen and Pusa Reshmi a rapid increase in plant height was noted during early stages of growth up to 30 DAS. There was a significant variation regarding the plant height between the nine varieties. The lowest leaf weight was recorded in Hong kong-11 (T-4, 10.4 g) and maximum in Pusa Himani (T-3, 17.56 g) at 15 DAS. At the harvesting stage maximum number of leaves per plant was recorded in Pusa Himani (T-3, 13.66) variety and was found significantly superior to other varieties. Data on the leaf length were recorded maximum leaf length in Pusa Reshmi (T-2, 18.80 cm) and minimum leaf length was recorded in Suneha (T-1, 11.63 cm). At 30 DAS maximum leaf width recorded in Pusa Reshmi (T-2, 7.43 cm) and minimum leaf width in Suneha (T-1, 5.26 cm) at harvesting stage maximum root length was recorded in variety Pusa Himani (T-3, 24.40 cm) and minimum root length recorded in Suneha (T-1, 19.00 cm). Maximum root thickness recorded in Pusa Himani (T-3, 5.26 cm) at harvesting stage. Variety White icicle (T-9, 1.62) reported maximum leaf: root ratio and was significantly superior other varieties and minimum in variety Snow white (T-5, 0.60) at 15 DAS. However, leaf: root weight ratio in the variety Pusa hill queen (T-7, 0.82) was found maximum and minimum in the variety Pusa Reshmi (T-2, 0.62) at 45 DAS. The maximum fresh root weight was recorded in the variety Pusa Himani (T-3, 85.53 g) and minimum in the variety Suneha (T-1, 63.80 g) at 30 DAS. The maximum yield at harvest time was recorded in the variety Pusa Himani (T-3, 33.14 t/ha) which was followed by Pusa Reshmi (T-2, 32.65 t/ha) and Japanese white (T-8, 32.28 t/ha).

Keywords: Varietal performance, growth, yield parameter, day stage, radish (*Raphanus sativus* L.) crop

Introduction

Radish is grown for its young tender tuberous roots which are eaten raw as salad or cooked as vegetable. Radish is one of the important root vegetable extensively grown in almost all parts of the country. Radish plays a vital role in the health and nutritional security of human beings in addition to improve the economy of the people of the country. In recent years, due to increased urbanization and change in food habits, the demand for salad vegetables is increasing very fast. The botanical name of radish is *Raphanus sativus* L. It belongs to the family *Brassicaceae* and chromosome number $2n=18$. Radish originated probably in China. Radish was domesticated in the eastern Mediterranean area and subsequently spread to China and Japan (Kitamura 1958) [5]. The word “*raphanus*” comes from a Greek word meaning “quick-appearing” or “easily grown.” It is one of the most ancient vegetables. It was cultivated in about 2700 BC and was spread to China in 500 BC and to Japan in 700 AD. Radish is a widely used root vegetable, tender leaves and shoots are also used as greens (Alam *et al.*, 2010) [1]. The consumers as well as growers are demanding for the varieties having good qualities. As radish is an important salad vegetable, it is in demand throughout the year in big cities. It is relished for its pungent flavor and is considered as an appetizer. The young leaves are also cooked as vegetable and eaten. Radish has refreshing and depurative properties. It is a good source of vitamin-c and minerals like calcium, potassium and phosphorus. One hundred gram fresh root of radish contain 93.7 gram water, 1.1 gram protein, 4.2 gram carbohydrate, 24 mg vitamin c and 20 mg potassium, whereas 100 gram fresh leaves of radish contain 89.1%

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water 3.9% protein 4.1% carbohydrate, 21 mg vitamin c and 20 mg vitamin B (Watt. and Merrill 1964). In India, it seems to have been cultivated from ancient times. Leaves are arranged in a rosette. They have a lyrate shape, meaning they are divided pinnately with an enlarged terminal lobe and smaller lateral lobes. The white flowers are borne a racemose inflorescence. The root axis of radish is composed of two anatomically distinct parts. The upper part originates from the hypocotyls, and lateral roots are not present on this part. The lower part consists of true root tissue, and lateral roots are developed in this part. These two parts of the radish root can thicken and form succulent tissue, which is used as a vegetable (Tsuro *et al.* 2008).

The swollen fleshy axis of the radish (*Raphanus sativus* L.) is derived from hypocotyl and upper radicle tissues. Soon after plant emergence, tissues within the axis core begin to divide and expand, resulting in rupture of the cortex at opposite poles. This is followed by cell division and expansion for at least 40 days after sowing (Weaver and Bruner, 1927; Hayward, 1938; Paliwal and Kavatheker, 1971). The mature fleshy axis consists of large parenchyma cells arranged in irregular rays surrounded by a relatively thin band of pericycle tissue. A ring of cambial tissue divides the pericycle from the inner parenchymatous region which contains the xylem elements and a large portion of the phloem tissue; areas of secondary cambium develop during the later stages of growth to maturity. The Radish is two distinct genetical groups in radish. The Asiatic varieties, which are primarily for tropical climates, produce edible roots in the first season and seed in the second season as a biennial crop. On the other hand, the exotic or European varieties produce roots in the plains of tropical and subtropical climate and seeds in the hills of temperate climate. It attains best flavour, texture and size at 10 to 15°C. Long days as well as high temperature lead to bolting without adequate root formation. Radishes grow best in full sun in light, sandy loams with a soil pH 6.5 to 7.0, but for late season crops, a clayey-loam is ideal. The growth and yield of radish depends on soil and climatic condition. Different varieties have different soil and climatic requirements for their growth and yield. Keeping the above facts in view the present investigation using 9 genotype of radish was designed. Hence the aim this research is helped to farmer as well as researcher in selection of suitable variety in different point of view.

Review and Literature

Deotale *et al.* (1994) ^[3] reported that Pusa Reshmi was the best cultivar with aspect to the root length at 45 days after sowing which was 23.0 cm compared with 3.01 to 3.50 cm weight per plant of 299.12 g compared with 216.1 to 278.12 g and yield 27.14 t per ha for other cultivars. Baramasi produced the highest root weight per plant of 219.14 g compared with 108.11 to 142.33 g for other cultivars. Pusa Himani produced the highest leaf weight per plant of 136.56 g compared with 106.34 to 135.20 g for the other cultivars.

Kumar *et al.* (1995) ^[6] reported that Pusa Himani recorded significantly highest plant height, number of leaves per plant, root length, root diameter, root weight and yield compared to the white Icickle. Pusa Himani was recommended for sowing during spring season.

Anjanappa *et al.* (1998) ^[2] reported that the performance of 5 cultivars namely local, Chinese Pink, Japanese White, Pusa Himani and Arka Nishant at hebbal. Plant height was greatest for the cultivar local and Arka Nishant and list of Pusa Himani leaf number did not differ significantly between

cultivars. The highest root: leaf ratio was observed. For Arka nishant and lowest for Chinese pink .highest total dry matter was seen in Chinese pink and lowest was Japanese White. Root yield was highest in Arka Nishant and lowest in Local. Arka Nishant considered the most promising cultivar tested for Karnataka region.

Singh *et al.* (1998) reported that plants height, number of primary branches, seed germination were greatest for plants transplanted earlier but the value of these parameter decrease with delay in transplanting.

Nomura *et al.* (1999) In an experimental found that plants from the earlier sowing exhibited flower growth rates (leaf number, leaf area and plants height) than later sowing and it was concluded that in order to obtain a longer number of flower, sowing time should be standardized so that a temperature of >5°C <10°C is maintained for long period of time. Alam *et al.* (2010) ^[1] to study the effect of date of sowing on growth and yield of three varieties of radish. Seeds of three cultivars of radish namely Tasakistan, SAU line-1 and Red Bombay were sown on three different dates viz. November 1, November 5 and December 1. Sowing time showed significant effects on the growth and yield of radish. Maximum number of leaves and leaf length were produced by plant sown on November 1. Similarly root width, root fresh weight; yield per plot and yield per hectare were obtained from November 1 sowing. All parameters showed decreasing trend as sowing date was delayed. In the experiment, November 1 sowing gave the highest yield of (81.8 t/ha) compared to the lowest yield of 68.7 t/ha by December 1 sowing V2 (SAU line-1). Combined effect of sowing date and varieties showed that early sowing on November 1, all cultivars performed well in respect of yield and yield components. SAU line-1 was found to be the best in respect of quality judged followed by Red Bombay and Tasakistan.

Tanaka *et al.* (2012) reported that the root shape, as well as the very big root, of Japanese radish 'Sakurajima daikon' is an important trait different from those of other cultivars. We clarified the mode of inheritance of the root shape in 'Sakurajima daikon' for effective breeding. We conducted a half-diallel analysis using 8x8 half-diallel crosses among its inbred lines with different root shapes. We measured the root length and root diameter as factors which represent the root.

Preeti and Gupta., (2013) ^[8] reported that a particular variety of *Raphanus sativus* L. named jaunpuri or newar grown in certain belt of Jaunpur city showed better growth in terms of length, girth and biomass at certain place and period of its growth cycle. However, this was not conspicuous in another cultivar of radish i.e. Pusa Himani growing at the same site. Thorat *et al.* (2013) ^[12] reported the Radish varieties Indem Sweta, Ankur Naveen, Ganesh Synthetic and Pusa Reshmi had shown the significantly superior performance with respect to most of the growth and yield quality attributes. Among local varieties, the variety Pune local had performed better. Hence this genotype can be involved in further breeding programme for improving the yield and quality of radish.

Material and Method

The present investigation entitled "Effect of Varietal performance on growth and yield parameter at different days stage in radish (*Raphanus sativus* L.) crop." was carried out of the research farm Horticulture Department, faculty of agriculture Udai Pratap Autonomous College, Varanasi, U.P. during the rabi season of 2014-2015. Observation were recorded on ten competitive plants in each genotypes for each treatment in each replication selected at randomly for 27

economic trials Data were statistically analyzed as suggested by Panse and Sukhatma. Observation regarding the growth and yields attributing characters was recorded from the 3 randomly selected plants in each plot.

Growth attribute

Plant height (cm) The plant height included the root length and leaf length was measured by meter scale from leaves tips to end of root and the plant height was noted in centimetre.

Number of leaves per plant

The leaves were counted from samples plant and in number.

Length of leaves (cm)

Length of leaves was measured by meter scale from leaves tip to leaves arises and the length of leaves was noted in centimetre.

Width of leaves (cm)

Width of leaves was measured by meter scale from the middle leaves at horizontal and width of leaves was noted in centimetre.

Leaves weight per plants (g)

Fresh weight of leaves was recorded per plant wise with the help of physical balance and data presented in gram.

Yields attribute

Root length per plant (cm)

Length of main root was measured by meter scale from leaves arises to end point of root and the length was noted in centimetre.

Root thickness per plant (cm)

Thickness of main root was measured at the middle of root in term of diameter with help of vernier-calipers and data presented in centimetre.

Fresh weight of root (g)

Fresh weight root measured per plant wise with help of physical balance and fresh weight of root was noted in gram.

Leaf: root length ratio

Leaf: root length ratio was leaf length divided from root length.

Leaf: root weight ratio (g)

Leaf: root weight ratio was leaf weight divided from root weight.

Yield per hectare

The weight of root was recorded treatment-wise from each net plot and each replication. Radish crop utilized only 80 % of land and the remaining 20 % of the land was used for irrigation channels and bund. Keeping this in mind, the total yield per hectare in tones was calculated using the formula-

$$\text{Yield per ha (t)} = \frac{\text{Yield per net plot (kg)}}{\text{Net plot area sq. m.}} \times 10$$

Result

Growth Parameters

Plant height (cm)

Plant height was at 15, 30 and 45 DAS from the point of attachment of the leaves with the root (ground level) to the tip

of the longest leaf. In recording plant height, lengths of the well-developed leaves were considered. Data on plant height as affected by different varieties were recorded at different stage are presented in Table- 1. Revealed that shoot elongation continued to increase with the advancement in age of the plants and a rapid increase in plant height was noted during early stages of growth up to 30 DAS. Subsequent elongation was slower between 30 DAS and at harvest. The maximum plant height at 15 DAS was significantly higher in Pusa Himani (T-3, 17.06 cm) as compared to other varieties and Suneha (T-1, 10.93 cm) recorded the statically lowest plant height. Pusa Himani (T-3, 35.90 cm) was highest plant height at 30 DAS and had significant large plant height as compared to other varieties and Suneha (T-1, 24.26 cm) was recorded lowest plant height. However, at harvest stage Pusa Himani (T-3, 51.03 cm) was significantly superior to other varieties and the lowest plant height was recorded in Suneha (T-1, 38.50 cm) at harvest stage.

Number of leaves per plants

Number of leaves/plant was counted at 15, 30 and 45 days after sowing (DAS). All the leaves of each sample plant were counted separately. Only the smallest young leaves at the growing point of the plant were excluded from the counting. The analysis of the table-1 revealed that there was significant variation in functional leaves per plant in different varieties with different stages.

Leaves length per plant (cm)

The length of leaf was measured from the base of the petiole to the tip of the leaf and was expressed in centimetre (cm). Data on the leaf length were recorded at an interval of 15 days and was continued up to 45 days. The maximum leaf length was recorded in Japanese white (T-8, 8.70 cm) had significant higher leaves length per plant at 15 DAS as compared to other varieties and minimum leaf length Snow White (T-4, 4.46 cm). At 30 DAS data was recorded maximum leaf length in Pusa Reshmi (T-2, 18.8 cm) and minimum leaf length was recorded in Suneha (T-1, 11.63 cm). However, after at harvesting stage Pusa Himani (T-3, 26.63 cm) significantly maximum leaf length over the other varieties. Significant variation was found in case of production of number of leaves/plant due to the effect varieties of radish. The significant number of maximum leaves was recorded at 15 DAS in Pusa Himani (T-3, 7.66) over other varieties. After 30 DAS Pusa Himani (T-3, 11.33) were recorded maximum leaves over the other varieties and White- icicle (T-9, 8.66) the minimum number of leaves per plant. At the harvesting stage maximum number of leaves per plant was recorded in Pusa Himani (T-3, 13.66) variety and was found significantly superior to other varieties.

Leaves width per plant (cm)

The functional leaf width per plant increased with the advancement of crop growth up to at harvest and maximum rate of increase was observed during all the growth stages of crop period. The maximum leaf width was recorded in the variety Pusa Himani (T-3, 4.40 cm) and minimum leaf width in Suneha (T-1, 2.56 cm) was recorded at 15 DAS. At 30 DAS maximum leaf width recorded in Pusa Reshmi (T-2, 7.43 cm) and minimum leaf width in Suneha (T-1, 5.26 cm). The maximum leaf width was recorded in the variety Pusa Himani (T-3, 8.96 cm) at 45 DAS.

Leave weight per plant (g)

The weight of leaves of different varieties at different interval after sowing are presented in Table-1. The lowest leaf weight was recorded in Hong kong-11 (T-4, 10.4 g) and maximum in Pusa Himani (T-3, 17.56 g) at 15 DAS. At 30 DAS maximum leaf weight was recorded in Pusa Himani (T-3, 66.70 g) and minimum leaf weight in Hong kong-11 (T-4, 52.60 g). However, the response of Pusa Himani (T-3, 78.60 g) was highly significant over other varieties.

Yield parameters**Root length per plant (cm)**

Length of the main root was recorded at 15, 30 and 45 days or harvest stages in all the varieties show in table-2. Data in respect of length of root indicated that, at 15 DAS the highest root length was recorded in Pusa Himani (T-3, 9.63 cm) varieties and minimum root length in Suneha (T-1, 4.43 cm). At 30 DAS root length was obtained highest in variety Pusa Himani (T-3, 18.3 cm) that provide statistically significant over other varieties. However, at harvesting stage maximum root length was recorded in variety Pusa Himani (T-3, 24.40 cm) and minimum root length recorded in Suneha (T-1, 19.00 cm).

Root thickness (cm)

It is evident from Table-2 that root thickness per plant increased with the advancement of root growth and maximum rate of increase was observed during 30 DAS and harvest of all the treatment. Maximum thickness of root in Pusa Himani (T-3, 0.76 cm) and minimum in the variety White icicle (T-9, 0.33 cm) at 15 DAS. At 30 DAS maximum thickness of root was recorded in Pusa Reshmi (T-2, 3.50 cm) and minimum thickness in Suneha (T-1, 2.33 cm). At harvesting stage maximum root thickness recorded in Pusa Himani (T-3, 5.26 cm). However, the Pusa Himani was highly significant over other varieties.

Fresh weight of root (g)

The fresh weight of root per plant significantly affected by the effect of variety. The root weight of plants is presented in table -2. The maximum root weight in variety Japanese white (T-8, 8.60 g) and minimum in the variety Hong kong-11(T-4, 3.76 g) recorded at 15 DAS. At 30 DAS the maximum root weight was recorded in the variety Pusa Himani (T-3, 85.53 g) and minimum in the variety Suneha (T-1, 63.80 g). At harvesting stage maximum root weight was recorded in the variety Pusa Himani (T-3, 99.43 g) and minimum in the variety Suneha (T-1, 78.83g).

Leaf: root length ratio (cm)

At 15 DAS, variety White icecle (T-9, 1.62) reported maximum leaf: root ratio and was significantly superior other varieties and minimum in variety Snow white (T-5, 0.60). At 30 DAS maximum leaf: root ratio was reported in variety Hong kong-11(T-4, 1.51) was found statically significant over other varieties and minimum in the variety Suneha (T-1, 0.91). However, at harvest maximum leaf: ratio was fund in variety Pusa Reshmi (T-2, 1.19) and minimum in Japanese white (T-8, 0.92).

Leaf: root weight ratio (g)

Data present in Table -2 revealed that maximum leaf: root weight ratio was recorded in variety Pusa hill queen (T-7, 3.03) and minimum in the variety Pusa Reshmi (T-2, 1.54) at

15 DAS. After 30 DAS, maximum leaf: root weight ratio was found in variety Pusa hill queen (T-7, 0.79) and minimum in the Pusa Reshmi (T-2, 0.55). However, at harvesting stage maximum leaf: root weight ratio in the variety Pusa hill queen (T-7, 0.82) and minimum in the variety Pusa Reshmi (T-2, 0.62).

Yield of Radish (root) ton/ha

The yield of radish varieties basis of their growth performance and weight of per plant at 45 DAS. The maximum yield at harvest time was recorded in the variety Pusa Himani (T-3, 33.14 t/ha) which was followed by Pusa Reshmi (T-2, 32.65 t/ha) and Japanese white (T-8, 32.28 t/ha). The minimum yield was recorded in Suneha (T-1, 26.27 t/ha). It is oblivious that the varieties which performed better in a unit area are likely to perform better on large scale as the yield per hectare was calculated by multiplying yield per plot with hectare factor. The yield is the result of interaction of the genotype to a given agro climatic and management factors.

Discussion

The growth and development of crop plants are directly related to their genetic constitutes. Beside this, environmental factors, cultural practices and crop sowing time also influence growth and development of plant through their direct or indirect roles in different metabolic processes. The finding shall be discussed after brief remark on the weather situation during the crop period. The finding of earlier works on the subject has also been taken in to consideration while discussing the results of present investigation. The discussions have been presented under heads.

Growth Parameters

The present investigation was carried out to assess the variability among the 9 genotypes of radish with 11 characters comprising of leaf, root and yield attributes at 15 DAS, 30 DAS and 45 DAS (at harvesting stage). Significant variations were observed for all the 12 characters at different stages. The plant height was recorded at different stages of growth i.e. 15, 30 and 45 days after sowing (DAS). There was a significant variation regarding the plant height between the nine varieties. The highest plant height (51.03 cm) was recorded in Pusa Himani which was on par with Pusa Reshmi (47.06 cm) and lowest was in Suneha (38.50 cm) 45 DAS at harvesting stage (Table: 1). Similar results were also reported by Anjanappa *et al.*, 1998. The plant height relatively slower growth in later stage between 30 DAS and 45 DAS (at harvesting stage) than the early stage. Seyama and Takai (1982) also observed that during the early stage the relative growth rate and net assimilation rate affected by air temperature and root weight increased due to cumulative interaction of the air temperature and solar radiation. Significant variation was found in case of production of number of leaves per plant due to the effect of varieties of radish. The maximum number of leaves (13.66) was found in Pusa Himani followed by Jpanese White and White icecle (10.33) showed the minimum number of leaves (Table: 1). A significant variation was found due to the individual effect of variety. The maximum leaf length of 26.63 cm was recorded in Pusa Himani. Minimum (19.50 cm) was in Suneha 45 DAS (at harvesting stage) (Table: 1). Among the varieties maximum leaf width was recorded in Pusa Himani (8.96 cm) followed by Pusa Reshmi and Japanese White (8.43 cm) and minimum leaf width was recorded in White Icecle (6.33 cm). Leaf weight per plant data was significantly affected by the

varieties of radish. The highest leaf weight (78.60 g) was in Pusa Himani and lowest in Hong kong-11(54.60 g). Data in respect of length of root indicated that, maximum root length was recorded in variety Pusa Himani (24.40 cm). The minimum length of root (19.00 cm) was recorded in variety Suneha (Table-1). The root length of a cultivar is the factor which is of main concern to the research. Long root is an important character regarding root quality and it is useful to classify the varieties for consumer acceptability which might be due to genetical diversity in different varieties and ecological condition. Pujari *et al.* (1977) ^[9], Rajagopal *et al.* (1979) and Chapagain *et al.* (2010), which supports the results of the present investigation. The maximum root thickness of 5.26 cm was observed in Pusa Himani followed by Pusa Reshmi (4.43 cm) and minimum of 3.30 cm observed in Snow-White. The maximum root size was recorded in Pusa Himani (128.50 cm) followed by Japanese white (97.34 cm) and minimum root size in Suneha (67.23 cm). The maximum leaf: root length ratio was recorded in variety Pusa Reshmi (1.19) and minimum in Japanese White (0.92). The maximum leaf: root weight ratio was observed in Pusa hill queen (0.82) and minimum in the variety Pusa Reshmi (0.62). The weight of roots was influenced significantly among the different varieties. It was observed maximum (99.43 g) in variety Pusa Himani which was statistically at par with Pusa Reshmi (97.96 g), while the minimum weight of root (78.83 g) was recorded in variety Suneha. The variation in the weight of root might be due to the genetic variation. The present findings are in conformity with the work of Dixit *et al.* (1980) ^[4], Bhatti *et al.* (1983) and Deotale *et al.* (1994) ^[3]. They reported variations in root weight ranging from 24.38 g to

279.50 g among the different cultivars of radish under different agroclimatic conditions. The root weight obtained in the present investigation is well within the range of the results obtained by these.

Yield parameters

Root yield per plant was highly significant different among the varieties. A perusal of data on yield of radish indicated that, the maximum (33.14 t/ha) yield was recorded in variety Pusa Himani which was followed by Pusa Reshmi (32.65 t/ha) and Japanese White (32.28 t/ha). The minimum (26.27 t/ha) was recorded in Suneha (Table-1). It is obvious that the varieties which performed better in a unit area are likely to perform better on large scale as the yield per hectare was calculated by multiplying yield per plot with hectare factor. The yield is the result of interaction of the genotype to a given agro climatic and management factors. Further, yield is supposed to be the reflections of the yield components. The yield variations among these nine varieties may be considered as varietal difference, as all these varieties are tested under same soil, management and similar agro climatic conditions. Deotale *et al.* (1994) ^[3] reported that, the variety Pusa Reshmi had performed best under Nagpur condition, but in present study it was found second best. The variations in yield among the radish varieties were also reported by several workers (Rajagopal, *et al.* 1979) (Singh *et al.* 1979) (Dixit *et al.* 1980) ^[4] (Bhatti *et al.* 1983; Khokar *et al.* 1987) (Singh and Taj 2005 and Kumar *et al.* 2012) ^[7] from different parts of the country. Hence, the results of the present investigation are on parallel line with the findings of earlier workers.

Table 1: Varietal performance on growth at different day stage in radish (*Raphanus sativus* L.) crop.

Treatment	Plant height (cm)			Number of leaves per plant			Leaves length per plant (cm)			Leaves width per plant (cm)			Leaf weight per plant (g)		
	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS
T ₁ Suneha	10.93	24.26	38.50	5.66	9.33	12.33	6.50	11.63	19.50	2.56	5.26	7.56	10.50	47.30	63.13
T ₂ Pusa Reshmi	12.73	34.33	47.06	6.66	10.66	12.66	6.23	18.80	25.60	4.10	7.43	8.43	10.73	45.30	61.90
T ₃ Pusa Himani	17.06	35.90	51.03	7.66	11.33	13.66	7.43	17.73	26.63	4.40	7.03	8.96	17.56	66.70	78.60
T ₄ Hong kong-11	10.96	28.33	44.13	6.00	9.33	11.33	5.50	16.86	23.46	3.46	5.73	6.50	10.40	40.86	54.60
T ₅ Snow white	11.86	27.26	42.73	6.33	9.66	12.66	4.46	13.86	21.26	3.73	6.30	7.20	10.70	48.20	59.43
T ₆ Panjob Pasand	15.00	31.70	43.60	6.33	9.66	2.33	7.50	17.30	22.43	4.33	6.33	7.26	11.66	55.56	68.83
T ₇ Pusahill queen	16.13	33.93	42.93	6.33	9.33	12.66	7.70	16.56	21.53	3.66	6.46	7.56	13.43	59.70	71.70
T ₈ Japanese white	15.06	34.33	44.90	6.66	10.33	13.00	8.70	18.66	21.10	4.33	7.40	8.43	16.33	62.50	72.63
T ₉ White icicle	12.00	26.93	41.10	5.66	8.66	10.33	7.43	15.36	20.70	3.40	5.46	6.33	11.53	49.60	58.70
SEM±	0.22	0.23	0.31	0.38	0.42	0.36	0.16	0.19	0.24	0.13	0.19	0.23	0.24	0.22	0.38
CD at 5%	0.82	0.84	1.15	0.140	1.54	1.34	0.62	0.70	0.90	0.50	0.70	0.86	0.82	0.82	1.42

Table 2: Varietal performance on Yield parameters at different day stage in radish (*Raphanus sativus* L.) crop.

Treatment	Root length per plant (cm)			Root thickness (cm)			Fresh weight of root (g)			Leaf: root length ratio			Leaf: root weight ratio			Yield of Radish (root) (ton/ha)
	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	
T ₁ Suneha	4.43	12.63	19.00	0.36	2.33	3.66	5.60	63.80	78.83	1.46	0.91	1.06	1.87	0.74	0.79	26.27
T ₂ Pusa Reshmi	6.50	15.53	21.46	0.53	3.50	4.43	6.93	81.83	97.96	0.95	1.20	1.19	1.54	0.55	0.62	32.65
T ₃ Pusa Himani	9.63	18.30	24.40	0.76	3.40	5.26	6.50	85.53	99.43	0.76	0.96	1.08	2.69	0.77	0.76	33.14
T ₄ Hong kong-11	5.46	11.46	20.46	0.36	2.46	3.66	3.76	65.16	81.40	1.003	1.47	1.14	2.76	0.62	0.67	27.13
T ₅ Snow white	7.40	13.40	21.46	0.36	2.56	3.40	4.63	78.96	91.26	0.60	1.02	0.99	2.30	0.60	0.64	30.42
T ₆ Panjob Pasand	7.50	14.33	21.50	0.56	2.80	4.16	5.60	78.56	93.26	0.99	1.20	1.04	2.07	0.70	0.73	31.08
T ₇ Pusahill queen	8.43	17.36	21.53	0.50	3.33	4.40	4.43	74.63	86.26	0.91	0.93	1.00	3.03	0.79	0.82	28.75
T ₈ Japanese white	6.40	15.66	22.46	0.66	2.76	4.33	8.60	83.93	96.86	1.35	1.20	0.92	1.89	0.74	0.72	32.28
T ₉ White icicle	4.56	11.56	20.40	0.33	2.60	3.66	4.60	78.86	91.26	1.62	1.32	1.01	2.51	0.62	0.63	30.42
SEM±	0.13	0.17	0.23	0.03	0.11	0.09	0.13	0.49	0.61	0.03	0.01	0.01	0.07	0.007	0.005	0.08
CD at 5%	0.49	0.62	0.87	0.11	0.42	0.34	0.49	1.82	2.24	0.13	0.07	0.04	0.28	0.02	0.02	0.31

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