



Research Article

MORPHOLOGICAL EVALUATION OF RADISH (*Raphanus sativus* L.) VARIETIES IN FOOTHILL CONDITIONS OF UTTARAKHAND

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Abstract- The present study entitled "Morphological evaluation of radish (*Raphanus sativus* L.) varieties in foothill conditions of Uttarakhand" was carried out in the experimental research area of Department of Horticulture, DCAST, Selaqui, Uttarakhand during 2015. Five different types of radish varieties were studied viz. 40 days, Green Neck, Long White (Hybrid), Snow White, Red Radish (Local) respectively. The analysis revealed highly significant differences among genotypes for all the traits. The germination per cent (66.75 %), plant height (60.05 cm), number of leaves per plant (16.50), length of leaves (25.54 cm) and fresh weight of leaves (46.72 gm) was found statistically superior in Long white (hybrid). The variety was also found outstanding for yield and its relative attributes i.e. root length (31.45 cm), root width (4.13 cm), fresh weight of root per plant (192.25 gm), yield of radish root without leaves (62.75 t/ha) and total yield of radish per plant (86.80 t/ha) as against the remaining four varieties i.e. Green Neck, Snow White, 40 days and Red Radish (Local). Thus, the variety Long White (hybrid) was found to be superior in its overall performance. Consequently, the genotype can be recommended for cultivation in the foot hill regions of Uttarakhand.

Keywords- Radish, Genotypes, Morphology, Evaluation, Long White, Uttarakhand.

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Introduction

Seasonal changes in day length or photoperiod act as an external temporal clue to Radish (*Raphanus sativus* L.) is a popular root vegetable in both tropical and temperate regions. It is mainly grown for its young tender tuberous roots, which can be eaten raw as salad or cooked as vegetable. Besides, its young leaves and pods are also consumed in cooked form. Radish is considered as a good source of vitamin C (ascorbic acid), folic acid and minerals like potassium, which are important for human nutrition and health. Basically a cool season crop, radish grows well under mild to cool climate. The temperature of 10-15°C is optimum for proper development of roots, texture and flavour. In hot weather, roots become tough and pungent before reaching the edible maturity.

Radish is cultivated in almost all states of India but on a limited scale. It occupies 17.7 million hectare area with a total production of 25.46 metric tons [2]. The major radish producing states include West Bengal, Bihar, Uttar Pradesh, Punjab, Haryana and Gujarat. In Uttarakhand, radish is grown in an area of about 432 ha with a production of about 55186 tones. The unavailability of suitable climatic conditions at lower elevations such as foot hills of Himalayas may adversely affect the crop productivity. Although, several Asiatic varieties, which are comparatively tolerant to high temperature, have been developed through hybridisation and selection procedures; however, evaluation of local as well as exotic varieties are crucial for widening the genetic base for crop improvement programmes. Hence, keeping this in view the present research study was conducted to evaluate the different radish varieties from Nepal for suitability in foot hill region of Uttarakhand.

Material and Methods

The experiment was conducted at Doon (PG) College of Agriculture Science and

Technology, Dehradun (Uttarakhand) during the period from 2014-15 to 2015-16. The site is situated at 29° 58' N to 31° 02' N latitude and 77° 34' E to 78° 18' E longitude with an altitude of 506 m above mean sea level. The climate of the experimental location is characterised by hot summers and cool winters. The temperature goes up to 35°C in April-May and cools down to about 3.3°C to 8°C and even more in November-February. Five radish cultivars, namely, 40 days, Green Neck, Long White (Hybrid) and Snow White were procured from the market of Kathmandu valley, Nepal, while, the seeds of cultivar Red Radish were brought and marketed by New Rama Seed Corporation. The radish seeds were sown on ridges at about 1.5 cm depth with 15 cm × 10 cm spacing in first week of November. Each variety was planted in randomized block design with four replications. Each plot size was 2 m × 0.09 m with row to row distance 15 cm and plant to plant distance was adjusted at 10 cm by thinning at 20 days after sowing. The plants received uniform cultural practices during experimentation. The varieties were evaluated for growth and yield contributing characters viz. germination per cent, plant height (cm), number of leaves, leaf length (cm), fresh weight of leaves (g), root length (cm), root diameter (cm), fresh weight of roots (g) and yield (ton per hectare). Five plants per replication of each cultivar were randomly taken. Observations on plant height and root length were recorded as per the standard methods and worked out to express mean value. Root diameter was recorded with the help of Vernier calliper while the fresh weight of both leaves and roots was recorded with the help of pan balance. The data was statistically analyzed according to randomized block design as suggested by [4] and the treatment effects were tested at 5 per cent level of significance.

Results and Discussion

The results in relation to germination per cent of different cultivars are mentioned in [Table-1]. The study revealed that among five varieties, the variety Long white showed maximum germination per cent (66.75%), which was significantly higher than varieties Green neck (66.23%), Snow white (65.58 %), 40 days (63.70 %) and Red radish (local) (48.95 %). Seed germination is influenced by various environmental factors such as availability of moisture, light, air and optimum temperature. But, the plant genotype also plays a critical role in germination. The characteristics such as seed vigour and dormancy are genetically inherited, which may be the reason for these variations [6]. Plant height, an indicator of vegetative

growth [3], differed significantly among all five varieties. The maximum height per plant (60.05 cm) was observed in variety Long white while, the minimum plant height was recorded in Red Radish (local) (42.62 cm). The other varieties, viz. Snow white, Green neck and 40 days (52.87) exhibited 59.27 cm, 56.70 cm and 52.87 cm height respectively. The augmentation in plant height is the result of intensive cell division and cell enlargement, which in turn is influenced by protein synthesis. Therefore, any variation in the cell metabolism can consequently affect the plant height. The genetic differences among the different genotypes can be responsible for such variations.

Table-1 Performance of different radish genotypes for germination per cent and vegetative attributes

Variety	Germination Percent (%)	Plant height (cm)	Number of Leaves per plant	Length of Leaves (cm)	Fresh weight of Leaves (gm)
40 days (T1)	63.70	52.87	15.20	22.45	34.87
Green neck (T2)	66.23	56.70	14.35	23.97	38.75
Long white (hybrid) (T3)	66.75	60.05	16.50	25.54	46.72
Snow white (T4)	65.58	59.27	13.80	23.52	40.26
Red radish (local) (T5)	48.95	42.62	10.95	20.18	30.85
Mean	62.24	54.30	14.16	23.13	38.29
SE (m)	0.71	1.09	0.50	0.61	0.91
CD	2.21	3.38	1.56	1.88	2.82
CV	2.31	4.04	7.1	5.29	4.78

Significant variations were also observed in terms of leaf number. The maximum number of leaves (16.50) was observed in Long white (hybrid). Similar findings were also reported by [1, 8]. Likewise, the genotypes also showed significant variations for leaf length. The variety Long white (hybrid) was accounted with highest leaf length (25.54 cm) while the minimum leaf length (20.18 cm) was observed in Red Radish (local). Such variations as reported by [6] could also be attributed to the genetic background of the varieties, which bears a strong influence on the growth potential of a plant. In line with this, the variety Long white (Hybrid) was also found statistically superior for leaf weight (46.72 g). Apart from genotypic features, the higher leaf weight in Long white (Hybrid) can also be attributed to phenotypic traits such as leaf size.

Perusal of the data in [Table-2], reveal that root length varied significantly among the different varieties. In radish, root is the principal storage organ and its development involves complex interactions between environmental, genetic, and physiological factors [5, 10]. The highest root length (31.45 cm) was recorded in variety Long white (hybrid), while, the lowest root length was observed in variety

Red radish (local) (20.45 cm). Long white (hybrid) F1 hybrid has superior characters and shows genetic advances compare to other four varieties. [6] also mentioned genetic gain in the difference of variance in the root length among the different radish genotypes. Similarly, the variety Long white (hybrid) (4.13 cm) was adjudged with maximum root width followed by the variety 40 days (3.30 cm), Green neck (3.30 cm) and Snow white (3.21 cm). The minimum root width was recorded in variety Red radish (local) (2.91 cm). Bolting was found to be associated with the poor performance of red radish (local). Further variations in root size, among different varieties, might be due to their varying shapes. Higher root width in Long white (hybrid) was supported by its globular shape. The data regarding root weight also indicated significant results. The variety Long white (hybrid) was found to be statistically superior for root weight (192.25 gm) as against remaining varieties. While, the minimum root weight was obtained in variety Red radish (local) (97.50 gm). The superior performance of Long white (hybrid) in terms of vegetative attributes could be responsible for its higher root weight.

Table-2 Performance of different radish genotypes for yield and relative attributes

Variety	Root Length (cm)	Root Width (cm)	Root weight per plant (gm)	Total root yield (t/ha)	Total yield of radish (tones / hectare)
40 days (T1)	27.20	3.30	136.65	40.91	55.29
Green neck (T2)	25.67	3.30	140.35	44.90	61.59
Long white (hybrid) (T3)	31.45	4.13	192.25	62.75	86.80
Snow white (T4)	24.05	3.21	122.90	41.88	54.95
Red radish (local) (T5)	20.45	2.91	97.50	24.58	30.67
Mean	25.76	3.37	137.93	43.00	57.86
SE (m)	0.91	0.33	2.92	3.17	3.21
CD	2.81	0.10	8.99	9.77	9.91
CV	7.08	1.98	4.23	14.75	11.12

The root yield is related with its length and size. The variety Long white (hybrid) being an F1 hybrid recorded highest root yield (62.75 t/ha) followed by Green neck (44.90 t/ha), Snow white (41.88 t/ha) and 40 days (40.91 t/ha). While, the variety Red radish (local) witnessed poor performance for root yield which could be due to its miniature sized roots. Similar, finding was also found by [8]. Genetic variability, heritability in superior gene characters and genetic advance play a critical role in determination of root yield. These factors may be responsible for the variations in root yield among the different genotypes under study. Furthermore, a similar trend was also observed for total yield per plant, wherein the maximum (86.80 t/ha) and minimum yield (30.67 t/ha) was recorded in variety Long white (hybrid) and Red radish (local) respectively. Strong plant growth in terms of height, number of leaves, and weight of radish per plant; plays an important role in yield contribution.

The variety Long white (hybrid) was found significantly superior for all these traits, which could be the possible reason for its highest yield. [9] have also indicated that the yield increase is mainly due to higher root weight and increase in length and diameter of the roots.

Conclusion

From the present study, it may be concluded that among the five varieties, the variety Long White (hybrid) was found to be most promising in terms of germination per cent, growth and yield attributes. Therefore, the variety can be recommended to the farmers in foot hills of Uttarakhand.

Conflict of Interest: None declared

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