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Short Communication

Evaluation of radish genotypes under varied environments

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Radish (*Raphanus sativus* L.) is an important root vegetable crop suitable for both tropical and temperate climate. Among the root vegetables, radish is the most popular and widely grown pungent one known for its fresh edible roots and good source of Ca, K, P and Vitamin C. The edible roots can be used as raw, as salad or cooked. Being a short duration and quick growing crop, it is highly suited for sequence cropping and as intercrop or companion crop in the wider spaced orchard crops (Mapari *et al.,* 2010). The growth and yield of radish greatly depends on soil and climatic conditions. Different varieties have different soil and climatic requirements for their optimum performance. India being a vast country with varied agro-climatic regions *viz.,* temperate, subtropical, tropical and coastal tropical humid regions, a single variety which is suitable for one region may not be suitable for all the agro-climatic regions. Hence, region specific varieties have to be identified to realize the genetic potential. In this context, there is an imperative need for the breeders to evaluate and identify the stable genotypes that could give standard performance when tested under different seasons. Season is a major environmental factor influencing the horticultural and morphological traits. Study of the extent of such influence in different seasons on these traits is required to formulate appropriate breeding strategies. Identification of high yielding and stable accession across variable environments has been a continued challenge to the plant breeders worldwide.

Radish genotypes were obtained from different sources were evaluated under three environments i.e., seasons. The seeds were grown in a randomized complete block design with three replications. The soil was a well-drained sandy loam with pH > 6. The soil was prepared and ploughed thrice to obtain a loose and friable soil. Farm yard manure (cow manure) was applied along with urea, diammonium phosphate (DAP) and muriate of potash. Each genotype was raised in beds. Each plot size was 1 m x 3 m. The seeds were sown in line. Irrigation was applied at a 3-days interval during the growing season.

Insecticide Chlorphyriphos or Dimethoate were applied at 1.5 $ml \cdot L^{-1}$. Observations were recorded on five randomly selected plants in each genotype in each replication under three different seasons for yield and its components, leaf length, leaf breadth, leaf area, number of leaves, root length, root diameter, fresh weight of leaves per plant, root/leaves ratio, dry weight of leaves per plant, dry weight of root per plant, dry weight of the plant, fresh weight of the plant and fresh root weight per plant were analyzed. The assumption of null hypothesis was tested for differences among genotypes (Panse and Sukhatme, 1967).

Different seasons *viz*., rabi season (S_1), summer season (S_2) and kharif season (S_3) were adopted. Ten radish genotypes obtained from different sources were evaluated under these three seasons at Karaikal region, the tail end of Cauvery Delta Zone. Thirteen characters *viz.,* leaf length, leaf breadth, leaf area, number of leaves, root length, root diameter, fresh weight of leaves per plant, root/leaves ratio, dry weight of leaves per plant, dry weight of root per plant, dry weight of the plant, fresh weight of the plant, and fresh root weight per plant were analyzed. The high mean performance is considered as a main criterion among the breeders while evaluating the genotype since long time. In the present study, the ten radish genotypes were evaluated for their mean performance for thirteen characters under three seasons namely rabi season (S_1), summer season (S_2) and kharif season (S_3). On the observation of the relative mean performance of the ten genotypes under different seasons, it is found that the mean performance of the

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genotypes under rabi season was relatively best for most of the characters studied when compared to other seasons *viz.,* summer season and kharif season. The relative mean performance for fresh weight of root per plant (192.96 g) recorded by Pusa Chetki under rabi season was highest and this could be attributed by the favourable environment prevailed during the crop growth period which influenced the expression of yield attributing characters *viz.,* leaf length, leaf area, root length, root / leaves ratio, dry weight of root per plant, dry weight of the plant and fresh weight of the plant, for resulting higher yield. Decreasing temperature and solar irradiation experienced during the rabi which favour the vegetative as well as root growth was observed by Akoumianakis *et al.* (2011) in radish.

From the study it is implied that the rabi season in general is found to be the most favourable environment for the cultivation of radish in obtaining highest root yield followed by kharif season. Summer season is found to be unfavourable environment for radish crop in getting consistent yield as obtained in the rabi and kharif seasons for most of the characters in all the genotypes studied. The result also closely indicated that the variety Pusa Chetki which performed well in one season (rabi season) was not performing consistently in other environments during summer and kharif seasons. However Kumbakonam local though not registered highest yield in rabi season over Pusa Chetki but significantly recorded higher yield in all the three seasons among the ten genotypes studied. Further Kumbakonam local showed significant root yield in overall mean performance also. This indicated that this genotype showed statistically significant root yield across the three environments indicating its stable performance under different environments.

Table 1. Relative mean performance of thirteen characters in three seasons

Characters	Rabi	Summer	Kharif	CD at 5%
Leaf length	17.94	26.56	23.29	0.43
Leaf breadth	6.29	8.92	7.38	0.13
Leaf area	129.48	271.33	197.06	7.09
Number of leaves	8.73	11.64	11.19	0.15
Root length	24.42	16.38	30.95	0.73
Root diameter	2.60	1.57	1.79	0.05
Fresh weight of leaves per plant	27.54	50.83	38.80	1.16
Root / leaves ratio	4.92	0.97	2.13	0.20
Dry weight of leaves per plant	6.56	8.98	8.87	0.12
Dry weight of root per plant	53.86	33.95	59.42	1.27
Dry weight of the plant	60.68	42.93	68.28	1.27
Fresh weight of the plant	163.78	98.22	118.49	3.28
Fresh root weight per plant	126.36	47.39	79.93	0.43

The influence of the different environments on the expression of the characters in radish was also observed. The characters such as leaf length, leaf breadth, leaf area, number of leaves, fresh weight of the leaves per plant and dry weight of leaves per plant were more pronounced under the environment of summer season. However, these characters are more oriented towards higher vegetative growth which affected the translocation of sources to the sink of the edible root part thereby resulted in decreased yield in summer season. In rabi season the balanced root / leaves ratio was observed which would have ultimately increased the flow of source to the economic part of the root and increased the root diameter and fresh weight of the plant which caused the increased weight of the fresh root of the plant. The favourable environmental condition prevailed in the cooler part of the rabi season influenced the greater root yield in radish compared to the other environmental conditions. In conclusion, Kumbakonam local was identified as ideal genotype performing superior under all the three environments. Pusa Chetki registered higher root yield per plant in rabi season when compared to other genotypes.

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