RESEARCH ARTICLE

EFFECT OF STECKLING SIZE AND PRUNING OF TERTIARY BRANCHES ON YIELD AND QUALITY OF CARROT SEED CROP CV. HISAR GAIRIC

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Abstract: An experiment was conducted during rabi season 2018-19 to evaluate the performance of carrot under different steckling size and pruning treatments. Medium size stecklings (4-5 cm in diameter) produced good quality and higher seed yield per plant (26.01 g) and per hectare (15.63 q/ha) as compared to large and small size stecklings. Significantly higher test weight, germination, and seed vigor were recorded with medium size stecklings as compared to small size stecklings. However, the medium and large size stecklings were comparable for germination of seed obtained from secondary and tertiary umbels. Pruning of tertiary branches did not affect seed yield per plant and per hectare significantly. However, test weight, germination percentage, and seed vigor were found higher under pruning treatment as compared to unpruned (control).

Keywords: Carrot, Germination, Steckling, Pruning, Test weight, Seed vigor

INTRODUCTION

The vegetables being more remunerative, the area under vegetable crops is increasing every year and the demand for quality seed of improved varieties is also increasing fast. Carrot (*Daucus carota* L.) is a popular cool-season root vegetable of the Umbelliferae family. In India carrot was grown over an area of 97 thousand hectares with an annual production of 1648 thousand metric tons. The seed is the basic, most important, and cheapest input and has a profound influence on the ultimate yield of the crop. There are two distinct methods of producing carrot seed, root to seed and seed to seed method. Root to seed method is the standard procedure adopted for carrot seed production in India. Since the commercial seed production in carrot is done by root to seed method in northern plains where true to type roots are selected for replanting, but the seed producers face the problem of non-availability of a sufficient number of uniform size roots. Moreover, investigations have not been taken up to improve the quality of seed. Since the contribution of tertiary umbels towards total seed is very meager and the quality of seed of these umbels is also poor. Removal of tertiary umbels may be an alternative to improve the quality of the seed. Therefore, the present study was carried out to investigate the effect of steckling size and pruning of tertiary branches.

MATERIALS AND METHODS

The field experiment was conducted during the rabi season 2018-19 at Vegetable Research Farm and Laboratory of Department of Vegetable Science, HAU, Hisar. The soil of the experimental field was sandy loam having medium organic carbon and phosphorus, low in nitrogen, and rich in potash with slightly alkaline in reaction. The experiment was laid out in randomized block design with three replications in a plot size of 3.6m x 3.6m during both years. Six treatment combinations were comprising of three-steckling sizes in diameter (up to 4, 4 - 5, and above 5 cm) and two pruning treatments [unpruned (control) and pruning of tertiary branches]. The root crop was shown on 23rd September during both the years. Recommended package of practices regarding seed rate, sowing time, fertilizer doses, and plant protection were adopted for root production. Proper aftercare was given to the crop to produce healthy roots. Roots of 115 days old were lifted and stecklings were prepared from the selected true-to-type roots. These stecklings were then planted as per treatments in respective plots. Tertiary branches were removed as and when appear on the plant. The observations recorded on growth and yield parameters were analyzed as per the design of the experiment.

RESULTS AND DISCUSSION

The data shown in Table 1 revealed that the seed yield of primary, secondary and tertiary umbels, seed yield per plant, and per hectare was observed to be highest with medium size stecklings. Higher seed yield with increased steckling size and highest seed yield per unit area with the use of medium and large size stecklings has also been reported by earlier researchers (Arya and Saini, 1977; Verma *et al.*, 1993; Muhammad and Anjum, 2001).

Seed yield increased with the increase in steckling size. The increase in seed yield depicted in the results might be due to the difference in the size of stecklings. Large steckling size has more accumulated food as compared to small steckling size which affects morphological characteristics of carrot-like the number of leaves, size of leaves, production of branches, etc which ultimately leads to

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more seed yield. Similar findings were reported by Kumar *et al*. (2017), Hamid *et al*. (2002) in radish, Hemayati *et al*. (2008) in sugar beet, Dev (2009) in radish.

Table 1. Effect of steckling size and pruning of tertiary branches on yield of carrot seed crop cv. Hisar Gairic

Treatments	Seed yield of primary umbel (g)	Seed yield of secondary umbels (g)	Seed yield of tertiary umbels (g)	Seed yield/plant (g)	Seed yield /hectare (q)
Steckling size (Diameter in cm)					
Up to 4	5.38	12.74	3.24	21.35	14.28
4 – 5	6.67	15.37	3.96	26.01	15.63
Above 5	5.94	13.72	3.48	23.14	14.67
C.D. at 5% level	0.45	1.01	0.50	1.76	0.62
Pruning of tertiary branches					
Unpruned (control)	5.77	15.00	3.56	24.40	15.09
Pruning of tertiary branches	6.21	16.33	---	22.53	14.65
C.D. at 5% level	0.37	1.09	---	N.S.	N.S.

Table 2. Effect of steckling size and pruning of tertiary branches on quality of carrot seed cv. Hisar Gairic

Treatments	Test wt. of primary umbels	Test wt. of secondary umbels	Test wt. of tertiary umbels	Germination of primary umbels seed (%)	Germination of secondary umbels seed (%)	Germination of tertiary umbels seed (%)	Seed vigor of primary umbels seed	Seed vigor of secondary umbels seed	Seed vigor of tertiary umbels seed
Steckling size (Dia. in cm)									
Up to 4	2.39	1.93	1.37	80.16	75.77	54.44	1312.44	12.33.77	1016.72
4 – 5	2.58	2.07	1.46	85.50	79.38	59.21	1384.77	1273.99	1093.55
Above 5	2.45	1.97	1.41	81.94	77.38	56.88	1340.27	1254.72	1056.99
C.D. at 5% level	0.04	0.04	0.05	2.20	2.50	2.55	8.98	8.09	13.29
Pruning of tertiary branches									
Unpruned (control)	2.43	1.95	1.41	78.88	73.92	56.66	1304.11	1213.96	1055.75
Pruning of tertiary branches	2.51	2.04	---	86.22	80.10	---	1387.55	1294.37	---
C.D. at 5% level	0.03	0.03	---	1.78	2.72	---	7.33	6.60	---

The superiority of medium size stecklings may be explained based on healthy plant growth. The better growth performance of individual plants appeared to have been due to sufficient reserve food material in stecklings resulted in good growth of secondary roots and root hairs, in which cells are still totipotent, so good initial growth of plants leading to availability of more photosynthates hence the higher yield. The low yield in large and small size stecklings as compared to medium size steckling might be due to poor initial growth of root hairs and secondary roots due to less totipotency of cells in large size stecklings and in the case of small size stecklings low reserve food material available at the initial growth stage, which has a direct effect on the growth of the plant and ultimately leads to the poor yield of end product i.e. seed. Similar findings were also observed by Ilyas *et al*. (2013) in carrot.

Removal of tertiary umbels by pruning of tertiary branches did not affect the seed yield in comparison to unpruned (control). The slight loss in seed yield by removal of tertiary umbels was compensated by the plants by various means like diverting the flow of nutrients towards the remaining umbels which resulted in increased assimilation of food material like carbohydrates and proteins which ultimately lead to bold seed having higher test weight as compared to unpruned (control). These observations are in concurrence with those reported by Cebula and Kalisz (2001), and Parveen *et al*. (2002). The quality of seed as determined by its boldness (test weight), germination, and seed vigor was also influenced by steckling size and pruning treatments (Table 2).

The medium size stecklings have higher test weight as compared to small and large size stecklings; it may be due to better growth and availability of more photosynthates at the time of maturity. While in the case of small size stecklings the growth was poor due to less availability of reserve food material and in large size stecklings, slow initial growth may be the most probable reason for the low test weight. The seed vigor also behaved in the same fashion and was recorded highest under medium size stecklings.

However, as far as the germination was concerned the medium and large size stecklings were comparable for germination of secondary and tertiary umbels. These results are also in concurrence with the findings of Arya and Saini (1977) and Pandita and Nagarajan (2001). Pruning of tertiary branches also significantly influenced the test weight of a seed of primary and secondary umbels and was observed higher under pruning treatment as compared to

unpruned (control). Germination and seed vigor was also higher under pruning treatment as compared to seed obtained from unpruned plants because in pruned plants the seed was bold and better developed as a result of the availability of more photosynthates. The results are in agreement with Parveen *et al*. (2002) in radish.

CONCLUSION

From the present investigation, it could be concluded that for raising a successful seed crop of carrot cv. Hisar Gairic, stecklings of 4–5 cm size (in diameter) may be planted and tertiary branches may be pruned to further improve the seed quality.

Future Research

In future effect of pruning, spacing, growth regulators etc. could be observed on size of umbel, yield, vigor and viability of seed.

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