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Research Article

Effect of Root and Shoot Cutting on the Seed Production of Three Varieties of Carrot

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Abstract

An investigation was carried out at the United States Department of agriculture (USDA) Allium Field Mymensingh, Bangladesh Agricultural University Horticulture Farm Laboratory during the period of January 2019 to May 2019 to supervise the effect of root and shoot cutting (steckling) on the seed generation of three different carrot kinds. Four different cutting viz 0%, 25%, 50% and 75% root and shoot cutting (steckling) treatments and three varieties of carrot viz. PA (Prima Agroflora), BA (Brasilia Agroflora) and Indian AC0075 (Germplasm PI 652410). Three replications and a Randomised Complete Block Design were used to set up the experiment. The different percent of cutting and varieties had momentous effect on growth and seed generation of carrot. Among the varieties Brasilia Agroflora developed the best performance in respect of seed generation (0.82 g/plant, 20.41 g/plot and 136.11 kg/ha) copied by Prima Agroflora (0.47 g/plant, 15.00 g/plot and 100.00 kg/ha) and the lowest seed yield (0.73 g/plant, 13.88 g/plot and 92.59 kg/Ha) was filed from the variety Indian AC0075. The treatments percent root and shoot cutting (steckling) had momentous effects on most of the parameters practised. 50% root and shoot cutting treatment significantly influenced the yield and yield subscribing roles and gave the greatest yield of seed (0.73 g/plant, 19.99 g/plot and 133.33 kg/ha) whereas, 0% root and shoot cutting treatment produced the least seed yield (0.64g/plant, 14.25 g/plot and 95.06 kg/ha). Stirring the combined effect of percent root and shoot cutting (steckling) and variety with the maximum output of seeds (0.74 g/plant, 27.77 g/plot and 185.18 kg/ha) was earned from the set of treatments used with the Brasilia Agroflora variety with 50% root and shoot cutting (steckling) and the least seed yield (0.28 g/plant, 9.44 g/plot and 62.96 kg/Ha) was noted from the fusion of diversity Prima Agroflora with 0% root and shoot cutting (steckling) treatment.

Keywords

Carrot Root and Shoot Cutting, USDA, AEZ, RCBD, Seed Production

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1. Introduction

The Apiaceae family includes the wonderful root vegetable known as the carrot (Daucus carota L.), which evolved from the wild variety Daucus carota. It is a root vegetable that is typically orange, though cultivars that are red, white, purple, and yellow also exist. In temperate region carrots can be grown in summer, autumn and spring. But winter time is accurate for sub-tropical and tropical region [1]. Quick-growing cultivars reach maturity after 90 days or three months of seed sowing, but slow maturing cultivars need longer period (120 days) for maturity. Root is the commonly eaten part of carrot. But sometimes green leaves are also eaten as vegetable.

In Bangladesh it grows better in winter season (11.7 ℃ - 28.9 ℃) [2, 21]. Bangladesh's climate is not ideal for growing exotic types of seeds with high yields. In addition, the majority of well-liked exotic cultivars are hybrids. Therefore, each year, government and private seed supply companies must import seeds from elsewhere. Bangladesh's carrot crop is largely dependent on global seeds [23].

There are two main methods for producing carrot seeds. 1. Seed-to-seed (in situ grown plants) 2. Root-to-root method (by transplanting pruned shoots and roots stacking). Researcher around the world found that proper root and shoot cut at the time of transplanting ensure better quality and higher seed yield [1, 2, 4].

In Bangladesh, the total area under carrot cultivation is 2023.43 hectare with the total producton of about 19000 tons (BBS, 2019) [5]. The average yield of carrot was 1.49 tons ha^{-1} in that cropping season. In comparison to other nations that produce carrots, such as India (15.51 t ha^{-1}), Mexico (29.03 t ha^{-1}), the USA (48.36 t ha^{-1}), Australia (49.06 t ha^{-1}), and Sweden (64.16 t ha^{-1}), Bangladesh's carrot output is relatively low [6]. This may be caused by lacking of knowledge on proper management practice, selection of good varieties and water management. Yield of carrot can be increased by proper water management and applying advanced production technologies.

Another crucial element for healthy flowering, fruiting, and maximising fertile production of seeds in plants is the heft of the stecklings. In order to prevent vertical deterioration and guarantee high-quality seed production, it is typically plucked before to the start of their period of reproduction and then replanted after a portion of their fleshy roots are chopped off. The production and quality of seed are influenced by the amount of weight of plucked plants, or stemlings. The size of seedlings affects growth and, consequently, seed quality and production [7, 8]. It is hoped that the information gathered from the result of experiment that how variety and percent cutting (steckling) affect carrot seed yield would be useful for the grower in case of carrot seed production and increasing yield. Thus, the goal of the current experiment is to investigate how root and shoot cutting, or steckling, affects seed yield and seed quality, yield performance and percent germination rate of four varieties of carrot. Ghoname AA et al. [9] reported that effect of seed production method on the productivity and quality of carrot seeds vegetables.

2. Materials and Method

2.1. Soil and Climate of the Experimental Site

The experiment was driven at the field laboratory of USDA alliums program, Horticultural farm, BAU, during the period from 14 january 2019 to 12 may 2019. The experiment was appreciated the Effect of root and Shoot cutting on the Seed Production of three varieties of Carrot. The Old Brahmaputra Flood Plain Alluvial Tract is home to the sandy loam soil type found in the pilot ground area (FAO, 1998). [10]. The analytical information of a soil sample that was taken from the experimental region was processed at the Department of Soil Science, BAU Humboldt Soil Testing Laboratory. The pilot ground was medium-high terrain, with a soil pH of 6.7 which is compatible for Carrot production.

2.2. Land Preparation and Planting Materials

In order to create a good tilth, the land is prepped with a power tiller, less cultivating, and cross mowing, then laddering.. The weeds were raised and shifted before final land preparation. For transplanting of carrot plant cutting we collected carrot plants of four varieties.

2.3. Investigational and Experimental Design Treatments

The experiment with two factors remained of 3 varieties viz. (i) varieties index 1 (V_1= Prima Agroflora (PA); (ii) varieties index 2 (V_2= Brassilia Agroflora (BA); and (iii) varieties index 3 (V_3= Indian germlasm AC0075; collected from USDA by Prof. Dr. M. A. Rahim) and four treatments percent root and shoot cutting (Steckling) viz. (i) T_1 = 0% cutting of root and shoot of carrot plant,(ii) T_2 = 25% cutting of root and shoot of carrot plant,(iii) T_3 = 50% cutting of root and shoot of carrot plant and, (iv) T_4 = 75% cutting of root and shoot of carrot plant. Three replications of the two-factor experiment were set up using the randomised complete block design (RCBD). Twelve 2.0 m × 0.75 m unit plots were created from each block. The lengths between a block and a plot were one metre and fifty centimetres, respectively. Twelve treatments were arranged at randomly in each block. Thus there were 48 (12 ×4) unit plots altogether in the experiment.

2.4. Preparation and Transplanting of Steckling

The roots were pulled at 75 days of age, when they were at the commercial stage (7.5 cm in length and 3.7 cm in diameter

on average) and given different treatments on root and shoot pruning. The meticulously uprooted plants were trimmed to the appropriate length for the course of therapy. To avoid fungal infestation at the cut surface, the chopped stemlings were immersed in a solution of Dithane M-45 (2 g per litter of water) for five minutes before to transplanting. Netting was done over the plants before flowering to protect from insect and to protect from cross pollination among the varieties (isolation).

2.5. Seed Collection

Mature seed umbels of various were picked at various times based on the umbels' ripeness in various treatments. 2019's crop year began on April 11 and ran through May 2. Following picking, the umbels underwent rigorous cleaning, drying, and weighing before being placed in polythene bags for storage.

2.6. Collection of Data

At 30 and 60 days after planting, the height of the plant was determined in centimetres using a metre scale that counted the distance between the tallest leaf's point and the surface of the earth, where the leaves link to the root.

The number of simple umbels and flower was counted by harvesting the fresh full simple umbels, and average of 9 simple umbels were considered as the mean value. The number of primary and secondary umbels was counted by harvesting umbels from primary branches in each selected plant, and average of 3 plants were considered as the mean value. The seed weight of all the plants from each unit a plot was made, the total weight was measured in grammes, and the kilogrammes (kg) per hectare were computed by converting the total seed yield per plot. Weight of 1000 seeds was taken at random from each treatment and was recorded after proper drying in sun shine by using an analytical balance in gram. A sample of 100 seeds was obtained from each treatment in order to calculate the germination percentage. The Department of Horticulture standard protocol was followed for performing the germination test in Petri dishes. The crop was harvested periodically for data collection. The harvesting was started after 85 days of transplanting [4].

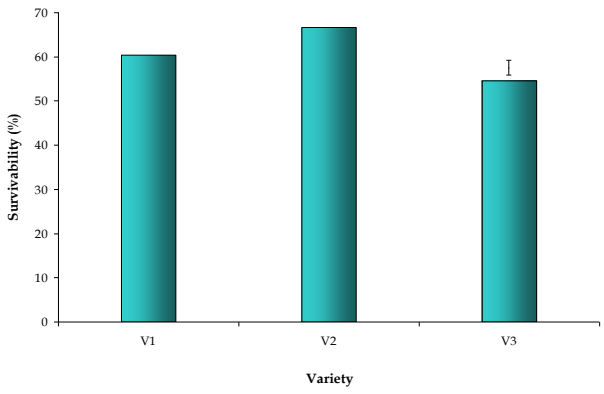
2.7. Statistical Analysis

With the aid of the computer package MSTAT, the experiment's data on development and production components were statistically examined. The "F" variance test was used to analyse the variances for every character under discussion at the 5 and 1% significance levels after the averages for every treatment were discussed. The least significant distinction (LSD) was used to assess the mean difference between two treatments (Gomez and Gomez, 1984) [11].

3. Results and Discussion

3.1. Main Effect of Variety

Prima Agroflora (PA) was identified to have taller plants than Brassilia Agroflora (BA). Sixty days after transplantation, the larger species (69.32 cm) was found from AC0075, whereas the thinner plant (67.58 cm) was detected from Brassilia Agroflora (BA). BA had the most number of primary a crown per plant (4.95) whereas PA had a tiny amount (4.25). According to Table 1, variety PA had more secondary umbels per plant (8.03), while variety BA had fewer (7.64) per plant. When it comes to diversity BA maximum number of plants (66.66%) survive, on the other hand when it comes to diversity Indian AC0075 minimum number of plants (54.58%) were survived (Figure 1). In case of variety BA highest number of plants (12.25) gave flower umbel, however, when it comes to variety Indian AC0075 (Germplasm PI 652410) lowest number of plants (8.33) gave flower umbel. The variety Indian AC0075 had the most flowers per single umbel (25.79), whereas the variety BA had the fewest flowers (23.68) (Table 2). Variety BA produced the highest seed output per plant (0.82 g), whereas variety PA produced the lowest seed yield (0.47 g) (Table 2). The variety BA gave the greatest yield (20.41 g) and the variety Indian AC0075 gave the least seed (13.88 g) yield. The higher seed yield per hectare (136.11 kg) was found in the variety BA and the lower seed yield (92.59 kg) was recorded from the variety Indian AC0075 (Table 2). The higher germination (87.42) was obtained from the variety PA and the lower germination (72.33%) was found in the variety Indian AC0075n (Figure 2). This result agrees with the study [12, 14]. He stated that different kinds had different seed yields [13]: Yield and quality of carrot varieties in organic cultivation. Impact of growing conditions and variety on carrot seed goodness and yield. Studies on seed production in carrot the sequential germination test gave sequential change in germination percentage. This result agrees with the study [15, 14, 4].



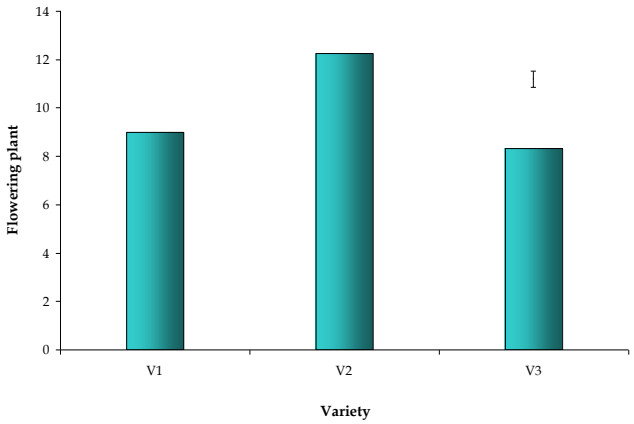


Figure 1. *Main effect of variety on survival and flowering plant of carrot. LSD is represented by vertical bars at a significance level of 1%. V_1= Prima Agroflora, V_2=Brassilia Agroflora, V_3= AC0075.*

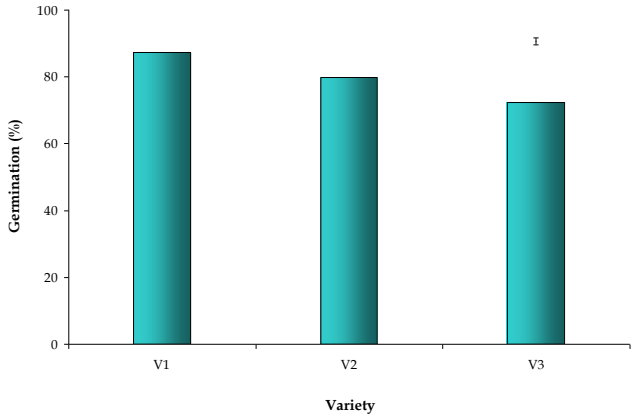


Figure 2. *Principal influence of variety on carrot germination percentage. LSD is represented by vertical bars at a significance level of 1%. V_1= Prima Agroflora, V2=Brassilia Agroflora, V3= AC0075.*

Table 1. *Main effect of variety on plant height at different days after transplanting and number of primary and secondary umbels per plant of carrot.*

Variety	Plant height (cm) on various days following transplanting		number of main umbels on a given plant	No. of secondary umbels per plant
	30 DAS	60 DAS		
V_1	32.17	68.25	4.25	8.03
V_2	34.36	67.58	4.94	8.30
V_3	34.51	69.32	4.65	7.64
$LSD_{0.05}$	0.25	0.31	0.09	0.13
$LSD_{0.01}$	0.34	0.41	0.13	0.18
Level of significance	**	**	**	**

** = noteworthy at the 1% probability level, V_1 = Prima Agroflora (PA), V_2 = Brasilia Agroflora (BA),, V_3 = Indian germlasm AC0075 (Germplasm PI 652410)

3.2. Main Effect of Root and Shoot Cutting (Steckling)

Root and shoot cutting (steckling) has a significantly substantial impact on every parameter examined for the development of carrot seeds. Plants cutting in T_2 the maximum height (69.96 cm) followed by plants having full root and full shoot (no cut) had the minimum height (66.94 cm). (Table 3). In case of T_4 treatment greatest number (65.00%) and T_1 in lowest number of plants (58.33%) were survive (Figure 3). In case of T_3 utmost number (12.00) of plants gave flower umbel, nonetheless, T1 has the fewest number of plants. (11.67) gave flower umbel (Figure 3). There were the highest number of primary umbels (5.04) in T_3 followed by lowest number of primary umbels (4.45) were formed at T_2 (Table 3). The greatest quantity of secondary umbels was present. (8.67) in T_3 followed by lowest in T_1 (7.25) were noted at T_2 (Table 3). The plants resulting from the T_4, the maximum number (25.28) flowers followed by the T_3 (24.95). The plant established from had the maximum seed output for each plant (0.87 g). T_1 and the lowest (0.43 g) was produced in T_4 (Table 4). The highest yield of seed per hectare (133.33 kg) was obtained from the plant grown from 75% root and shoot cutting treatment whereas, the lowest yield of seed (95.06 kg) was produced from the 0% root and shoot cutting treatment. The highest percent of seed germination (83.67%) was obtained in T_2 and the inferior seed germination (73.33%) was obtained from T_4 treatment. (Figure 4) This result agrees with the study [4] who reported that the root cutting on the formation of high-quality carrot seeds stecklings size and different stage and that root transplanting method the maximum [16, 22].

And Mother root size and plant spacing have an impact on the yield of carrot seeds [17]. And also Studies of seed production of carrot [3] and Carrot seed quality [18] and yield from the cultivars Carandai, Brasilia and Bragante having significance difference.

Table 2. *Main effect of variety on number of simple umbels per compound umbel and number of flowers per simple umbel of carrot and 1000 seed weight and seed yield of carrot.*

Variety	Number of basic umbels in each compound umbel	number of blooms in a basic umbel	1000 seed weight (g)	Seed yield/ plant (g)	Seed yield/ plot (g)	Seed yield (kg/ha)
V_1	42.37	24.32	1.35	0.47	15.00	100.00
V_2	44.32	23.68	1.84	0.82	20.41	136.11
V_3	47.42	25.79	1.68	0.73	13.88	92.59
$LSD_{0.05}$	1.54	0.37	0.24	0.17	0.80	1.09
$LSD_{0.01}$	2.09	0.50	0.33	0.23	5.35	7.27
Level of significance	**	**	**	**	**	**

** = Significant at 1% level of probability, (V_1 = Prima Agroflora (PA), V_2 = Brasilia Agroflora (BA), V_3 = Indian AC0075 (Germplasm PI 652410), V_1 = Prima Agroflora (PA), V_2 = Brasilia Agroflora (BA), V_3 = Indian AC0075 (Germplasm PI 652410)

Table 3. *Primary and secondary umbel count per carrot plant, as well as plant height at various days following transplanting, are the main effects of treatment (% cutting).*

Treatment	Plant height (cm) on various days adhering to transplanting		No. of primary umbels per plant	No. of secondary umbels per plant
	30	60		
T_1	31.45	66.94	4.48	7.92
T_2	33.90	69.96	4.45	7.25
T_3	35.13	67.28	5.04	8.67
T_4	34.22	69.35	4.49	8.12
$LSD_{0.05}$	0.28	0.35	0.11	0.15
$LSD_{0.01}$	0.38	0.47	0.14	0.20
Level of significance	**	**	**	**

** = Significant at 1% level of probability T_1 = 0% cutting of root and shoot of carrot plant, T_2 = 25% cutting of root and shoot of carrot plant, T_3 = 50% cutting of root and shoot of carrot plant, T_4 = 75% cutting of root and shoot of carrot plant.

Table 4. *Main outcome of the treatment (percent cutting) on number of simple umbels per compound umbel and number of flowers per simple umbel and 1000 seed weight and seed yield of carrot.*

Treatment	Number of basic umbels in each compound umbel	number of blooms in a basic umbel	1000 seed weight (g)	Seed yield/plant (g)	Seed yield/plot (g)	Seed yield (kg/ha)
T_1	42.77	24.82	1.73	0.64	14.25	95.06
T_2	43.66	23.34	1.53	0.65	15.55	103.70

Treatment	Number of basic umbels in each compound umbel	number of blooms in a basic umbel	1000 seed weight (g)	Seed yield/plant (g)	Seed yield/plot (g)	Seed yield (kg/ha)
T_3	45.61	24.95	1.63	0.73	19.99	133.33
T_4	46.78	25.28	1.60	0.43	15.92	106.17
$LSD_{0.05}$	1.75	0.42	0.28	0.19	0.91	6.08
$LSD_{0.01}$	2.35	0.57	0.37	0.26	1.23	8.19
Level of significance	**	**	NS	**	**	**

** = Significant at 1% level of probability T_1 = 0% cutting of root and shoot of carrot plant T_2 = 25% cutting of root and shoot of carrot plant, T_3 = 50% cutting of root and shoot of carrot plant, T_4 = 75% cutting of root and shoot of carrot plant

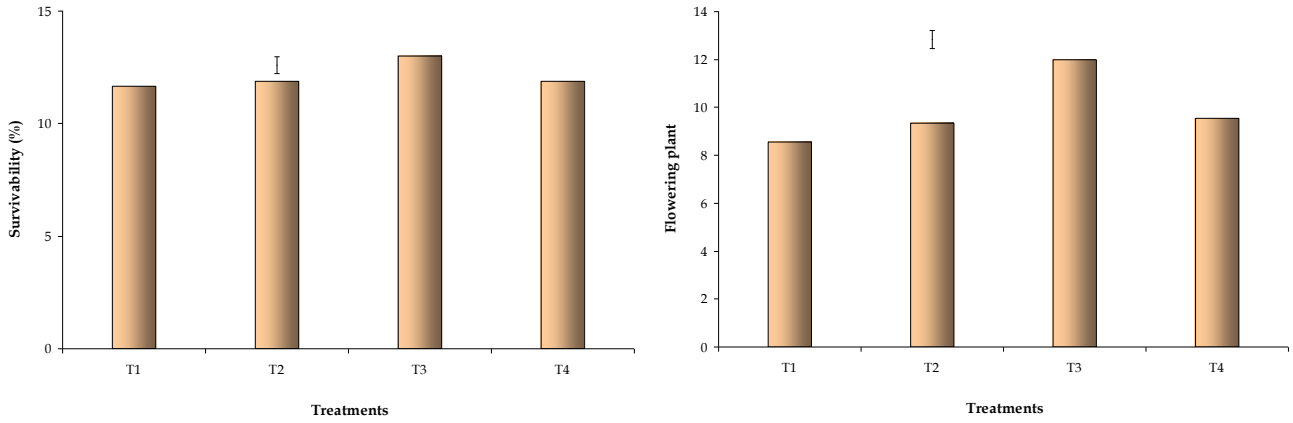


Figure 3. *Main effect of treatment (percent cutting) on survival plant and flowering plant of carrot. Vertical bar represents LSD at 1% level of Significance. T_1 = 0% cutting of root and shoot of carrot plant, T_2 = 25% cutting of root and shoot of carrot plant, T_3 = 50% cutting of root and shoot of carrot plant, T_4 = 75% cutting of root and shoot of carrot plant.*

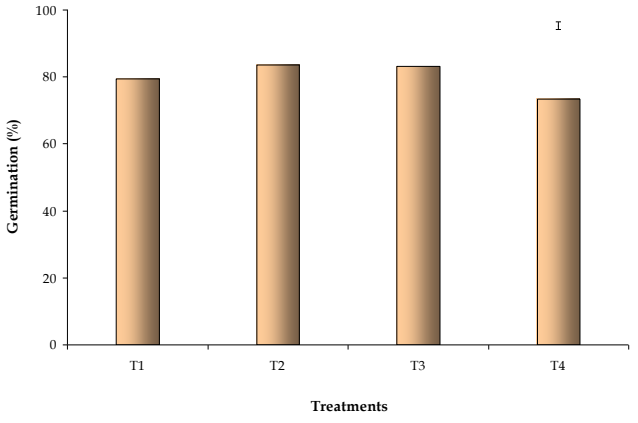


Figure 4. *Main effect of treatment (percent cutting) on percent germination of carrot. Vertical bars represents LSD at 1% level of Significance. T_1 = 0% cutting of root and shoot of carrot plant, T_2 = 25% cutting of root and shoot of carrot plant, T_3 = 50% cutting of root and shoot of carrot plant, T_4 = 75% cutting of root and shoot of carrot plant.*

3.3. Combined Effect of Variety and Root and Shoot Cutting (Steckling)

All of the parameters under investigation were significantly impacted by the combined effect of various kinds and root and shoot cutting (steckling), and the majority of the parameters, with the exception of number, exhibited considerable variation in their interaction of survival plants and 1000 seeds weight the maximum plant height at 30 days (37.11 cm) were obtained through the combination of V_2T_2 and at 60 days (71.30 cm) in V_1T_4, while the combination of V_1T_1 at 30 days (28.69 cm) and the combination of V_2T_1 at 60 days (66.14 cm) resulted the lowest plant height (Table 5). The maximum number (73.33%) of plants were survive on the combination of V_2T_1 while the combination of V_3T_1 resulted the lowest number (50.00%) of plants were survive (Figure 5). The highest number (16.67) of plants gave flower umbel on the combination of V_2T_3, while the combination of V_1T_1 resulted the lowest number (5.67) of plants gave flower umbel (Figure 5). Table 5 shows that the treatment combination of V3T2 produced the greatest number of solo umbels (49.59) per compound umbel, whereas the combination of V1T2 pro-

duced the lowest number of simple umbels (37.33) per compound umbel. The mixture of V2T4 treatment produced the most flowers (27.03) per single umbel, while the combination of V1T2 treatment produced the fewest flowers (21.19) per single umbel. (Table 5). The therapy combination of V2T1 (variety BA with 0% chopping of root and shoot) produced the largest quantity of seeds (1.25 g) per plant, whereas the V1T2 combination produced the lowest yield (0.18 g). (Table 6). The maximum seed yield (27.77 g) per plot was observed from the treatment combination of V_2T_3 and the minimum yield (9.44 g) was recorded from V_1T_1 combination (Table 6). The treatment combination of VT3 produced the best seed yield (185.18 kg) per plot, while the pair of V1T1 produced the lowest yield (62.96 kg) (Table 6). Table 6 shows that the treatment combination of V3T1 produced the largest weight of 1000 seeds (2.00 g), whereas the mixture of V1T1 produced the lowest mass of 1000 seeds (1.24 g). (Cardoso AII, 2000). The combination of treatments V1T4 produced the highest rate of germination (98.33%), while the treatment pair V3T4 produced the lowest seed weight (55.00%) (Figure 6). Seed yields differ depending on the breed. Cherry tomato seedling size and intra-row spacing were studied. This outcome is consistent with reports from this study Crop density's impact on carrot variety seed output. This result agrees with the study of [12, 19, 20]. The impact of roots size and umbels order on carrot seed output and quality was documented in the rate of germination changed sequentially according to the sequential germination test. This result agrees with the study of [15, 20, 4].

Table 5. *Combined effects of number of both primary and secondary umbels each plant, the amount of simple umbels per compound umbel, quantity of flowers per simple umbel, and variety and treatment on plant height at various days after transplanting (carrot).*

Treatment combination	Plant height (cm) on various days following transplanting		No. of primary umbels per plant	No. of secondary umbels per plant	No. of simple umbels per compound	No. of flowers per simple umbel
	30 (DAS)	60 (DAS)				
V_1T_1	28.69	65.56	4.02	7.60	40.67	26.15
V_1T_2	32.15	71.26	3.78	6.59	37.33	21.19
V_1T_3	35.39	64.87	4.54	9.25	47.01	26.15
V_1T_4	32.44	71.30	4.67	8.66	44.48	23.80
V_2T_1	31.37	66.14	4.18	8.07	38.63	21.66
V_2T_2	37.11	69.19	4.58	7.44	44.07	23.44
V_2T_3	35.36	66.64	4.42	10.23	47.14	22.69
V_2T_4	33.58	68.37	4.58	4.47	47.45	27.03
V_3T_1	34.30	69.12	5.53	8.10	49.01	26.66
V_3T_2	32.45	69.45	4.99	7.71	49.59	25.49
V_3T_3	34.63	70.33	4.15	6.53	42.67	26.01
V_3T_4	36.65	68.37	4.22	8.23	48.41	25.01
$LSD_{0.05}$	0.49	0.60	0.18	0.26	3.03	0.730.98
$LSD_{0.01}$	0.66	0.81	0.25	0.35	4.08	
Level of significance	**	**	**	**	**	**

** = Significant at 1% level of probability

Table 6. *Combined effects of variety and treatment on 1000 seed weight and seed yield of carrot.*

Treatment combination	1000 seed weight (g)	Seed yield/plant (g)	Seed yield/plot (g)	Seed yield (kg/ha)
V_1T_1	1.24	0.28	9.44	62.96

Treatment combination	1000 seed weight (g)	Seed yield/plant (g)	Seed yield/plot (g)	Seed yield (kg/ha)
V_1T_2	1.28	0.18	16.11	107.40
V_1T_3	1.57	0.81	18.33	122.22
V_1T_4	1.29	0.62	16.11	107.40
V_2T_1	1.94	1.25	20.55	137.03
V_2T_2	1.68	0.85	17.77	118.51
V_2T_3	1.77	0.74	27.77	185.18
V_2T_4	1.95	0.44	15.55	103.70
V_3T_1	2.00	1.09	12.77	85.19
V_3T_2	1.61	0.92	12.77	85.18
V_3T_3	1.54	0.65	13.88	92.59
V_3T_4	1.57	0.25	16.11	107.40
$LSD_{0.05}$	0.48	0.34	1.58	10.53
$LSD_{0.01}$	0.65	0.45	2.13	14.18
Level of significance	NS	**	**	**

** = Significant at 1% level of probability

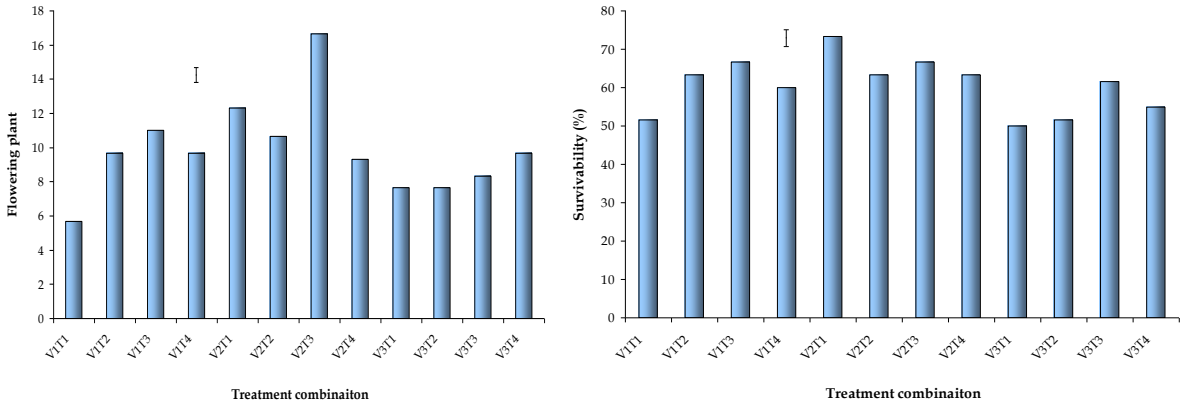


Figure 5. *Combined effects of variety and treatment on the survival and blossoming carrot plant. LSD is represented by a vertical bar at the 1% significance level.*

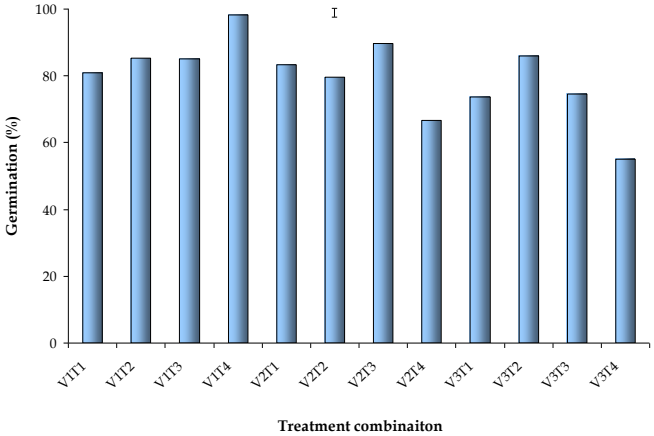


Figure 6. *Combined effects of variety and treatment on percent germination of carrot. Vertical bar represent LSD at 1% level of significance.*

4. Conclusion

Based on the conclusions of the debate above because of how diversity and treatment affect growth, it might be concluded that there was no longer any meaningful variation, seed production and germintion of carrot. The variety of Brasilia Agroflora (BA) generated the finest seed output when 50% of the roots and shoots were chopped, while Prima Agroflora supplied the lowest seed yield when 0% of the roots and shoots were crushed. The Brasilia Agroflora (BA) variety caved the finest numbers of plants that flower, surviving plants, and both primary and secondary umbels per plant. The AC0075 variety showed the highest plant height, number of flowers per alone umbel, and alone umbels per compound umbel every plant. The Prima Agroflora (PA) variety yielded the highest germination. It is possible to deduce from the current study that the highest carrot yield can be attained from (variety Brasilia Agroflora (BA) with 50% root and shoot cutting (steckling) treatment) combination treatment under BAU, Horticulture Farm conditions. However, repeated experiments in other locations are necessary to establish a recommendation for percent root and shoot cutting (steckling) and variety for successful carrot cultivation in Bangladesh.

5. Recommendations

Further studies may be suggested to repeat experiments in other locations are necessary to establish a recommendation for percent root and shoot cutting (steckling) and variety for successful carrot cultivation in Bangladesh.

Abbreviations

BBS Bangladesh Bureau of Statistics
BAU Bangladesh Agricultural University

Authors Contributions

Data collection & data analysis were done by Md. Rashed Sarker, report writing was done by Md. Imran Hossain and also helped in data collection, & data analysis. Md. Abdur Rahim was the supervisor of this research work and also provided proper guideline. Radia Rafin hasan and Anjuman Ara Tania helped in data collection, data analysis & report writing. Fakhar Uddin Talukder edited the manuscript & did submission to the journal.

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Conflicts of Interest

The author declare no conflicts of interest.

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