

## Effects of variety and weight of stecklings on yield and quality of carrot seed

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**Abstract:** The study was carried out to investigate the effects of variety and weight of stecklings on quality seed production of carrot. Using three varieties viz. Brasilia Agroflora, Prima Agroflora, New Kuroda and three different weight of stecklings viz. 40, 80, 120g weight stecklings were used. The two-factor experiment was laid out in RCBD with three replications. Different variety and weight of stecklings showed highly significant influence all most all the parameters studied. The highest seed yield (1450.30 kg/ha) was recorded from Brasilia Agroflora and the quality of seed (germination 86.23% and seed vigour index 12.69) was produced from the same variety, on the other hand, the lowest seed yield (1124.38 kg/ha) and germination (76.60%) obtained from New Kuroda. The 80g weight stecklings was recorded the highest seed yield (1434.29 kg/ha) and the quality of seed (germination 85.14% and seed vigour index 12.54) produced from the same weight, while the lowest seed yield (1206.99 kg/ha) and germination (79.03%) were recorded from 40g weight stecklings. In case of combined effect, the highest seed yield (1578.73 kg/ha) was obtained from Brasilia Agroflora with 80g weight stecklings and that of the lowest (1044.57 kg/ha) from New Kuroda with 40g weight stecklings.

**Key words:** Carrot, variety, stecklings weight, yield, quality seed

### Introduction

Carrot is an important root vegetable crop from nutritional point of view. It plays a vital role to protect the blindness of children providing vitamin A. In Bangladesh, there is no recommended variety of carrot for seed production. Many countries have developed good quality high yielding varieties through introduction. For the development of suitable varieties, it is essential to evaluate the characters of the available germplasm properly and conserve the collected materials for future use. Almost entire production of carrot in Bangladesh depends on imported seeds. These are relatively expensive which are not always available in time for sowing. So, cultivation of good quality carrot falls in an uncertainty. This situation also restricts its production. To save the foreign currency and increase carrot production, timely supply of quality seed in desired quantity should be ensured. This is possible through the improvement of seed production. Hence, the genetic information of different varieties on yield, yield contributing characters and quality of carrot seed producing species are to be assessed for its improvement. Again, weight of stecklings are considered as another important factor in proper flowering, fruiting and maximizing viable seed production in plant. It is generally uprooted before on-set of their reproductive phase and then replanted after cutting a part of their fleshy roots to avoid vertical degeneration and to ensure quality seed production. Weight of uprooted plants (stecklings) has influence on the yield and quality of seed. Stecklings size also influences the growth and thus on seed yield and quality (Kanwar, 1984; Singh *et al.*, 1981). This information needs thorough study to standardize the size of stecklings for quality carrot seed production. So, it is essential to know the optimum weight of stecklings for maximizing the quality seed yield of carrot. Therefore, the present study was designed to establish the suitable variety and optimum weight of stecklings for maximizing the yield and quality of carrot seed.

### Materials and Methods

The experiment was conducted at Horticulture Farm, Bangladesh Agricultural University, Mymensingh during September, 2011 to June, 2012. Three varieties of carrot viz. Brasilia Agroflora, Prima Agroflora and New Kuroda,

and three different weight viz. 40, 80 and 120g weight of stecklings were used in this study. The unit plot size was 1 m×1 m. Seeds were sown uniformly in rows in 15 September'11 and 75 days old stecklings were transplanted in 2 December'11. The selected land was medium high and the texture of soil was clay loam. The two-factor experiment was laid out in RCBD with three replications. The experimental plot was prepared by good tilth and fertilized with recommended doses of manures and fertilizers. The seeds of carrot varieties were collected from USDA-Alliums' project, Department of Horticulture, BAU, Mymensingh. All intercultural operations were done as and when needed. The matured umbels were harvested in several phases, when the umbel turned into grayish in colour. Seeds were then collected by hand rubbing, cleaned and dried until they reached in safe moisture (7-9%) level.

After 30 days of storage, the seeds of each treatment were placed for germination test and measure vigour index in petridishes methods, taking 100 seeds for each treatment with blotting papers in the laboratory. The seed vigour was measured through its speed of germination. The germinated seeds were counted every day until germination was completed. An index of the speed of germination was then calculated by adding the quotients of the daily counts divided by the number of days of germination using the formula (Agrawal, 1996) as below: Seed vigour index = (No. of seed germinated at first count/No. of days required to first count) + ..... + (No. of seed germinated at last count/No. of days to last count). Thus, the seeds with higher index has faster germination rate and would be considered to be higher in vigour. Data were recorded on vegetative growth and flowering behavior, yield components, yield and quality contributing characteristics of carrot from five randomly selected plants of each plot and were analyzed statistically by Mstatc computer programme. The difference between the treatment means was adjudging by least significant difference (LSD) test.

### Results and Discussion

**Effect of variety:** It is evident from the Table 1 that variety significantly influenced all most all of the parameters under study. The tallest plant height (149.63

cm) was measured in Brasilia Agroflora, while the most dwarf (105.31 cm) from New Kuroda. This might be due to genetical phenomena of these varieties. The results are in agreement with Sharma *et al.* (1990). Minimum days required for 50% flowering (57.51 days) was noted in variety Brasilia Agroflora whereas, New Kuroda took 63.99 days. Maximum time required (14.88 days) from 50% flower to fruit set was found in New Kuroda and minimum time (12.78 days) in Brasilia Agroflora. The

highest number of primary umbels/plant (10.08) was recorded in Brasilia Agroflora and the lowest (8.67) was found in New Kuroda. The highest seed yield in primary umbel (5.19g) was recorded in Brasilia Agroflora but New Kuroda demonstrated the lowest (4.20g). A similar report was revealed by Cardoso (2000), who stated that seeds in the primary umbels were of better seed yield and quality than the seeds of secondary umbel.

**Table 1.** Main effect of variety and weight of stecklings on growth, yield contributing characters, yield and quality of carrot seed

Treatments	Plant height (cm)	Days to 50% flowering	Days to 50% fruit set	Days required for fruit set	Primary umbels/plant	Secondary umbel/plant	Yield of primary umbel (g)	Yield of secondary umbel (g)	Seed yield/plant (g)	1000-seed weight (g)	Germination % of seed	Seed vigour index
<b>Variety</b>												
Brasilia Agroflora	149.63	57.51	69.89	12.78	10.08	15.39	5.19	3.75	9.09	1.29	86.23	12.69
Prima Agroflora	139.41	58.02	71.12	13.75	10.04	13.78	5.01	3.65	8.80	1.22	83.76	12.51
New Kuroda	105.31	63.99	77.98	14.88	8.67	12.59	4.20	3.01	7.10	0.99	76.60	10.64
LSD at 5%	4.363	2.519	2.401	1.156	0.925	0.929	0.466	0.144	0.165	0.061	2.471	0.522
LSD at 1%	5.898	3.405	3.246	1.563	1.251	1.256	0.629	0.194	0.223	0.083	3.341	0.705
Level of significance	**	**	**	**	**	**	**	**	**	**	**	**
<b>Stecklings weight</b>												
40g weight stecklings	113.74	58.79	72.22	14.31	7.66	13.28	4.35	3.21	7.64	1.06	79.03	11.37
80g weight stecklings	149.51	60.32	73.81	13.96	10.72	14.95	5.20	3.73	9.01	1.31	85.14	12.54
120g weight stecklings	131.09	60.41	72.86	13.15	10.40	13.54	4.85	3.47	8.34	1.13	82.42	11.93
LSD at 5%	4.363	-	-	-	0.925	0.929	0.466	0.144	0.165	0.061	2.471	0.522
LSD at 1%	5.898	-	-	-	1.251	1.256	0.629	0.194	0.223	0.083	3.341	0.705
Level of significance	**	NS	NS	NS	**	**	**	**	**	**	**	**

\*\* = Significance at 1% level, NS = Not Significant

**Table 2.** Combined effect of variety and weight of stecklings on growth, yield contributing characters, yield and quality of carrot seed

Treatments (Variety x Stecklings weight)	Plant height (cm)	Days to 50% flowering	Days to 50% fruit set	Days required for fruit set	Primary umbels/plant	Secondary umbel/plant	Yield of primary umbel (g)	Yield of secondary umbel (g)	Seed yield/plant (g)	1000-seed weight (g)	Germination % of seed	Seed vigour index
Brasilia Agroflora x 40g wt. stecklings	124.48	58.85	71.66	13.30	7.45	13.21	4.93	3.44	8.31	1.14	82.34	12.30
Brasilia Agroflora x 80g wt. stecklings	175.16	59.64	71.34	12.32	11.40	16.84	5.44	4.09	9.91	1.51	89.93	12.95
Brasilia Agroflora x 120g wt. stecklings	149.23	54.05	66.65	12.73	11.39	16.12	5.19	3.73	9.05	1.21	86.42	12.81
Prima Agroflora x 40g wt. stecklings	115.96	55.31	69.07	14.62	8.67	15.46	4.49	3.32	7.99	1.07	79.22	11.74
Prima Agroflora x 80g wt. stecklings	164.71	57.04	71.99	15.08	11.17	13.56	5.41	3.97	9.60	1.42	88.04	13.29
Prima Agroflora x 120g wt. stecklings	137.55	61.70	71.98	11.56	10.27	12.34	5.13	3.66	8.80	1.18	84.02	12.50
New Kuroda x 40g wt. stecklings	100.77	62.23	75.93	15.01	6.88	11.16	3.63	2.88	6.62	0.96	75.55	10.05
New Kuroda x 80g wt. stecklings	108.67	64.29	78.09	14.48	9.57	14.46	4.75	3.14	7.52	1.01	77.43	11.38
New Kuroda x 120g wt. stecklings	106.48	65.47	79.93	15.16	9.55	12.17	4.22	3.02	7.16	1.00	76.83	10.49
LSD at 5%	7.556	4.363	4.159	-	1.603	1.61	-	0.249	0.286	0.106	4.280	0.904
LSD at 1%	10.21	5.898	-	-	2.167	2.176	-	0.337	0.386	0.144	5.786	1.222
Level of significance	**	**	*	NS	**	**	NS	**	**	**	**	**

\* = Significance at 5% level \*\* = Significance at 1% level, NS = Not Significant

Brasilia Agroflora gave the highest seed yield/ha (1450.30 kg) followed by Prima Agroflora (1395.31 kg) whereas, it was the lowest (1124.38 kg) in New Kuroda (Fig. 1). This might be due to the fact that the variety Brasilia Agroflora had a good genetic potential which enhanced more cell division and cell elongation resulting best performance. This result agrees with Mohanty (1998). Mohanty and Prusti (2001) reported that seed yields vary with the cultivars. This might be due to higher umbel size, number of seeds/ umbel and 1000-seed weight. Maximum 1000-seed weight (1.29g) was recorded in Brasilia Agroflora and New Kuroda gave minimum (0.99g). Malik *et al.* (1993) found 1000-seed weight of carrot 0.96g. This result is in agreement with this finding. The highest quality of seed (germination 86.23% and vigour index 12.69) was exhibited in Brasilia Agroflora followed by Prima Agroflora (83.76% & 12.51). The lowest quality of seed (germination 76.60% and vigour index 10.64) was observed in New Kuroda variety. This might be due to higher thousand seed weight which enhanced the speed of germination. This result is in agreement with the findings of Shantha *et al.* (1998). They found 80.2 % seed germination in carrot seed from primary umbel.

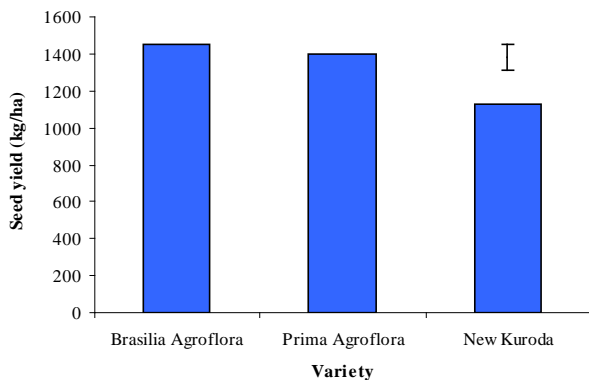


Fig. 1. Main effect of variety on seed yield of carrot. Vertical bar represents LSD at 1%

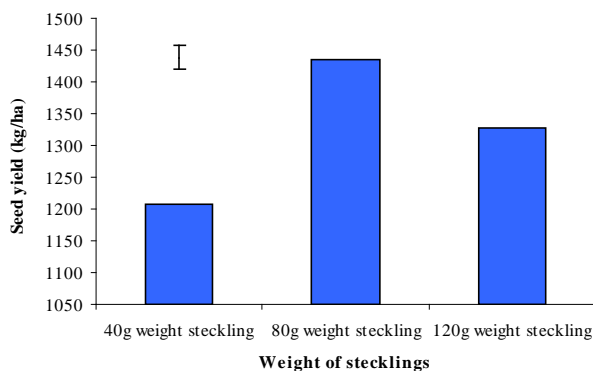


Fig. 2 Main effect of weight of stecklings on seed yield of carrot. Vertical bar represents LSD at 1%

**Effect of weight of stecklings:** Significant variation was observed most of all of the parameters under study (Table 1). The tallest plant height (149.51 cm) was measured in 80g weight stecklings, while 40g weight stecklings showed the most dwarf (113.74 cm). The results are agreement with Sharma *et al.* (1990). Minimum days

required for 50% flowering (58.02 days) was noted in 40g weight stecklings and 120g weight took 60.41 days. Maximum days required (73.81 days) from 50% flower to fruit set was found in 80g weight stecklings and minimum time (72.22 days) from 40g weight stecklings. The highest number of primary umbels/plant (10.72) was recorded in 80g weight stecklings, while the lowest (7.66) in 40g. The highest seed yield in primary umbel (5.20g) was observed in 80g weight stecklings followed by 120g weight stecklings (4.85g), while 40g weight stecklings demonstrated the lowest (4.35g) seed yield.

The 80g weight steckling gave the highest seed yield/ha (1434.29 kg) followed by 120g weight stecklings (1328.71 kg) and it was the lowest (1206.99 kg) in 40g weight (Fig. 2). This might be due to higher umbel size, number of seeds/umbel and 1000-seed weight. The highest 1000-seed weight (1.31g) was recorded in 80g weight stecklings, while 40g weight occurred the lowest (1.06g). The highest quality of seed (germination 85.14% and vigour index 12.54) was exhibited in 80g weight stecklings and the lowest (79.03% & 11.37) was observed in 40g weight (Table 1). This might be due to higher thousand seed weight which enhanced the speed of germination.

**Combined effect of variety and weight of stecklings:**

Highly significant variations were observed most of all the parameters under study due to combined effects of variety and weight of stecklings (Table 2). The tallest plant height (175.16 cm) was recorded in treatment combination of Brasilia Agroflora with 80g weight stecklings treatment, while the lowest (100.77 cm) in New Kuroda with 40g weight. The longest days to 50% flowering (65.47 days) were required in the treatment combination of New Kuroda with 120g weight stecklings and the shortest period (54.05 days) from Brasilia Agroflora with 120g weight. The highest time required (15.16 days) from flower to fruit set was found in New Kuroda with 120g weight stecklings and the lowest time (11.56 days) in the variety of Prima Agroflora with 120g weight stecklings. The highest number of primary umbels/plant (11.40) was recorded in Brasilia Agroflora with 80g weight stecklings, while the lowest (7.45) in Brasilia Agroflora with 40g (Table 2).

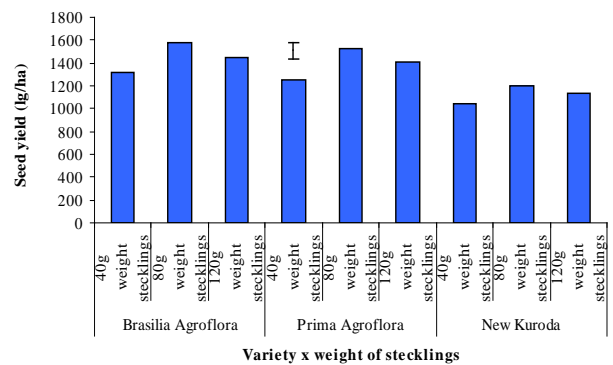


Fig. 3. Combined effect of variety and weight of stecklings on seed yield of carrot. Vertical bar represents LSD at 1%

Maximum seed yield in primary umbel (5.44g) was observed in Brasilia Agroflora with 80g weight stecklings, while New Kuroda with 40g weight demonstrated the lowest seed yield (3.63g). Brasilia Agroflora with 80g

weight stecklings obtained the highest seed yield/ha (1578.73 kg) whereas, it was the lowest (1044.57 kg) in New Kuroda with 40g weight (Fig. 3). This might be due to higher umbel size, number of seeds/umbel and 1000-seed weight. Maximum 1000-seed weight (1.51g) was recorded in Brasilia Agroflora with 80g weight stecklings, while New Kuroda with 40g weight stecklings gave minimum (0.96g). The highest quality of seed (germination 89.93% and vigour index 12.95) was exhibited in Brasilia Agroflora with 80g weight stecklings and the lowest (75.55% & 10.05) was observed in New Kuroda with 40g weight stecklings (Table 2). This might be due to higher 1000-seed weight which enhanced the speed of germination.

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