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Influence of seed pelleting with different botanical leaf powder on seed quality attribute in carrot (*Daucus carota* L.)

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Abstract
The present investigation was carried out in the laboratory of Department of Seed Science and Technology, Dr. Y S parmar University of Horticuture and Forestry, Nauni, Solan (HP) during the year 2017 to determine the effect of seed pelleting with botanical leaf powder on seed quality attribute in carrot. Seed pelleting showed significant effect on seed quality in carrot. Among all the treatment Seed pelleted with *Melia azaderach* leaf powder + Clay (T_3) enhanced germination (88.00%), seedling length (17.78cm), Seedling dry weight (1.76 mg), Vigour index-length (1564.76) and Vigour index-mass (154.88). Also there was positive correlation between all the seed quality attributes. It is therefore suggested that *Melia azaderach* leaf powder pelleted seed can be used to enhance seed quality in carrot.

Keywords: Seed pelleting, seed quality, carrot, botanicals

Introduction
Carrot (*Daucus carota* L.) is an important root vegetable grown in India during winter season. It belongs to the family Umbelliferae. Carrots are thought to have originated from the Afghanistan region of Asia (Rubashevskaya, 1931) [12]. However, the secondary centre extends to Asia, Europe and North Africa around the Mediterranean sea. There are two distinct group of carrot *viz,* tropical or Asiatic and temperate or European. The European type form roots both under temperate and tropical climate but sets seed only under temperate conditions since they need thermal induction in the form of verbalization to enter into reproductive phase, hence often termed as temperate carrot. European carrot is one of the important root vegetables rich in bioactive compounds like carotenoids. It is good source of vitamin A, thiamin, protein, calcium, riboflavin and vitamin C. Its root is valued as food mainly for high carotene content, Beta carotene, having high vitamin A activity (Biesalski, 1997) [6] which constitute 60 to 90 per cent of carrot carotenoids (Simon and Wolff, 1987) [15]. Being a member of Umbelliferae, carrot bears seed in compound umbel resulting non uniform seed size and quality. Furthermore, the presence of beard on the seed make them unfit for precision placement in the field by manual as well as machine sowing. Emergence and stand establishment of carrot seeds are often slow and erratic. These inherent problems related to seed lot of carrot leads to uneven crop stand and plant growth.

Seed pelleting provides the solution to these seed quality related issues by singulating the seed, randering it globular unit of required uniform size and smothering the surface. Likewise, the additives such as botanical leaf powder, nutrients, biofertilizer etc used in filler material improve seed quality Seed pelleting is a technique by which different materials are applied to the seed that can improve seed quality with regard to physiological, physical and health attributes. Precision sowing with additional benefits of improved establishment and increased productivity is the prime purpose of seed pelleting.

Seed pelleting with botanical leaf powder not only improve physiological quality of seeds but also protect the seeds from fungal infection and insect damage and improving seed and soil relationships through enriching the rhizosphere region of seed. The pellet can also serve as a delivery system for other materials required at the time of sowing. The biochemical substances present in leaf powders also enhance the germination and vigour. The leaf powders possess antioxidant, fungicidal and insecticidal properties besides being source of nutrition to the germinating seed. The treated seed produce uniform seedling stand as these can be placed precisely in field and helps to attain maximum yield. Keeping in view the above perspectives, the present study have been planned to assess the influence of seed pelleting with different botanical leaf powder on seed quality in carrot seed.

Materials & Methods

The laboratory experiment was carried out in the laboratory of department of seed science and technology during the year 2017. The experimental material used for the present investigations was Early Nantes variety of carrot. Seven treatments viz. *Lantana camara* leaf powder + clay (T_1), *Eucalyptus* species leaf powder + clay (T_2), *Melia azedarach* leaf powder + clay (T_3), *Vitex negundu* leaf powder + clay (T_4), Clay (T_5), Gum Arabica (T_6) and Control (unpelleted) (T_7). Gum Arabica was used as adhesive in all treatments except control.

Seed pelleting procedure

Fresh leaves of different botanicals were collected from university and nearby area. Leaves were sun dried and powdered with the help of grinder. After grinding a fine leaf powder was obtained by sieving through 0.10 mm wire mesh. The filler materials clay were mixed with botanicals powder in definite proportion 1:4 by volume and gum arabica (5%) used as adhesive. SATEC equipment was used for seed pelleting. Carrot seeds were then subjected to seven different pelleting treatments. 50 g seeds were put in the rotating drum and the combination of filler materials and botanicals powder as a inert matter are sprinkled on the seeds and are rolled for effective and uniform coating. The thickness of the pelleted seed is depend on the amount of adhesive in relation to the amount of seed. So that pelleting mixture was coated on to the seed uniformly in required proportion. After pelleting pelleted seeds were air dried under the shade for two days. These pelleted seeds were further used for conducting a laboratory experiment and were evaluated for seed quality. The observations were recorded under laboratory condition on five quality parameters *viz*; germination, seedling length, seedling dry weight and vigour index -length and Vigour index -mass. The pelleted seeds of carrot as 4 x 100 were germinated in between paper (B.P.) media as per the recommendations of ISTA (2010) [8]. Then the samples were placed at 20 ºC and 90% humidity in BOD germinator. The germination test was evaluated as normal seedlings, abnormal seedlings and dead seed and the germination was reported in percentage adopting the following formula as per the standard procedure (ISTA, 2010) [8]. Among the normal seedlings ten seedlings were randomly selected on 14th day of germination test from each replication of each treatment and measured with the help of measuring scale. The value was obtained by calculating mean of 10 seedlings for each replication in centimeter. For dry weight seedlings were dried in oven at 80 ºC for 48 hrs. The dried seedling were weighed on an electronic balance and expressed as gram. Based on the results obtained, the vigour index values were computed The seedling vigour index I was calculated as per the following formula: Standard germination (%) x Seedling length (cm) and the seedling vigour index II was calculated as per the following formula: Standard germination (%) x Seedling dry weight (g) (Abdul-Baki and Anderson, 1973) [1] and the values were reported as whole number without unit. The critical difference at 5 per cent level of significance was calculated to compare the mean different treatment by using OPSTAT and SPSS 20.0.

Result and Discussion

In this study, different botanical seed pelleting had a significant effect on seed quality attributes in carrot. The highest germination 88.00% was recorded in seed pelleted with *Melia azedarach* leaf powder + clay (T_3) followed by over control (66.00%). Among the different pelleting treatment the highest seedling length (17.78 cm) was recorded in seed pelleted with *Melia azedarach* leaf powder + clay (T_3). While the lowest (11.13 cm) was recorded in T_7 (control). Also the maximum dry weight (1.76 mg) was obtained in seed pelleted with Melia azadirach leaf powder with clay over control (1.52 mg). Seed pelleting also improved vigour significantly over unpelleted seed. The highest vigour index length and Mass (1564.76 and 154.88) was recorded in T3 over contol (736.16 and 100.33), respectively.

The correlations between germination and seed quality attributes was worked out and results have been presented in Table 2. The results revealed that there was positive correlation between all the seed quality attributes. Highly positive correlation was found between germination and vigour index-L (0.911), germination and vigour index-M (0.977), seedling length and vigour index-L (0.958), seedling length and vigour index II (0.805), dry weight and vigor index-M (0.807) and vigour index- L and vigour index-M (0.922). Further, germination and seedling length (0.761), germination and dry weight (0.664), seedling length and dry weight (0.720) and dry weight and vigour index-L (0.712) were moderately positively correlated. This positive correlation indicated that increase or decrease in one attribute will increase or decrease the other simultaneously.

Increased germination of seed pelleted with botanical leaf powder might be due to high colloid hydration and higher protoplasm and cell membrane viscosity that allow the early entry of moisture that enables the early hydrolysis of reserve food materials in the seed over unpelleted seeds. Lu *et al.* (1983) [9] opined that the biocontents present in botanical leaf powder may synergistically interact with aminoacids especially tryptophan (precursor of auxin) to form the indole acetic acid (IAA) in germinating seeds that enhances seedling growth. Sasthri and Srimathi (2010) [13] also reported that botanicals may contain micronutrients that likely to lead seed invigoration. The possible reason for the increased seedling length of pelleted seed may be due to the extension of cell wall and increased metabolic activities (Afzal *et al*., 2002) [2]. Napar *et al.* (2012) [10] stated that in pelleted seeds seedling length and dry matter may increase due to growth promoting substances activation and secondary metabolites translocations to the growing seedling. Rathinavel and Dharmalingam (1999) [11] Due to the presence of bioactive substances such as auxin in botanical leaf extract, the rise in dry weight was supposed to be due to increased lipid utilization and enzymatic activity. Physiologically active substances may have activated the embryo and other associated structures which results in absorption of more water due to cell wall elasticity and development of stronger and efficient root system which leads to the increase of higher vigour index (Basra *et al.*, 2005) [5]. Similar reports of enhanced seed quality attributes were also reported through various botanical leaf powder pelleted seeds in tomato (Shashibhasker *et al.*, 2011) [14], red gram (Anbarsan *et al.*, 2016), Cenchrus (Geetha and Krishnasamy, 2011) [7] and French bean (Babu *et al.*, 2005) [4].

Table 1: Effect of seed pelleting with different botanical leaf powder on seed quality characteristic in carrot cv. Early Nantes

Treatment	Germination (%)	Seedling length (cm)	Seedling dry weight (mg)	Vigour index- length	Vigour index -mass
T_1	78.00	16.90	1.70	1318.19	132.61
T_2	84.50	15.34	1.72	1296.20	145.34
T_3	88.00	17.78	1.76	1564.76	154.88
T_4	76.50	14.42	1.70	1103.05	130.10
T_5	66.50	13.94	1.72	926.95	114.42
T_6	77.50	12.72	1.72	985.81	133.33
T_7	66.00	11.13	1.52	736.16	100.33
C.D.	2.44	1.24	0.06	96.94	7.05
SE(m)	0.82	0.42	0.02	32.74	2.38
SE(d)	1.17	0.59	0.03	46.30	3.37
C.V.	2.15	5.75	2.41	5.78	3.66

Table 2: Correlation between germination and other seed quality attributes of carrot cv. Early Nantes

	Seedling Length	Dry Weight	Vigour Index-L	Vigour Index-M
Germination	.761*	.664	.911**	.977**
Seedling Length		.720*	.958**	.805*
Dry Weight			.712*	.807*
Vigour Index-L				.922**

* Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level

Conclusion

Based on the present study it was concluded that *Melia azaderach* leaf powder pelleted seed can be used to enhance seed quality in carrot.

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