Journal of Applied Horticulture, 23(2): 115-119, 2021
https://doi.org/10.37855/jah.2021.v23i02.22
Journal of Applied Horticulture
ISSN: 0972-1045

Effect of specific gravity separation on seed quality improvement of coriander var. CO3

R. Chandraprakash, P. Masilamani*, P. Rajkumar, R. Geetha, V. Alex Albert and T. Eevera

*Anbil Dharmalingam Agricultural College and Research Institute, Tamil Nadu Agricultural University, Navalur Kuttappattu, Tiruchirappalli District, Tamil Nadu-620027, India. *E-mail: masil_mahesh@yahoo.com*

Abstract

An attempt was made to study the effect of specific gravity separation on seed germination and biochemical properties of coriander var. CO3 seed. The seeds were graded in a specific gravity separator *viz.,* horizontal height (0.0, 0.5, 3.0 cm), vertical height (0.5, 1.0 3.5cm) and air blow rate (3.0, 3.5, 4.0 m^3/hr) adjustments at 485 rpm. Coriander seeds were classified into five grades and labeled A, B, C, D, and E (grade A represents lightest weight seeds and grade E represents heaviest weight seeds). Graded seeds were tested for seed recovery percentage, 100 seed weight, seed filling percentage, germination percentage, speed of germination, seedling length (cm), dry matter production (g/10 seedlings), vigour index, field emergence (%), and biochemical analysis. The results revealed that higher germination per cent was recorded in the E grade (74 per cent) than A, B, C and D grades as well as F-ungraded bulk seeds. Estimation of storage reserves revealed that variation existed among the grades separated by the specific gravity separator. E grade seeds recorded higher protein, oil and carbohydrate contents, which would have substantiated the higher germination, vigour and field emergence.

Key words: Coriander, specific gravity separator, germination, seedling vigour, field emergence

Introduction

Coriander (*Coriandrum sativum* L.) which belongs to family Apiaceae (Umbelliferae) is an important spice and condiment used as common flavouring substance in Indian curries. It is quite popular for its peculiar sweet fragrance in leaves and fruits and is recognized well as good source of vitamins and minerals (Hnamte *et al.*, 2013). Coriander crop is widely cultivated in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Rajasthan, Karnataka and Uttar Pradesh, almost in every season. It is popularly grown in hilly regions of south India during rainy season and mostly in winter season in Odisha. All parts of coriander plant are edible; however, its fresh leaves and dried seeds are most frequently used. The seeds contain essential oil, rich in varying components, which provides typical flavour, when added to the food products and acts as preservative (Kalemba and Kunicka, 2003).

Quality seed plays a vital role in sustainable agricultural production. It is estimated that quality of seed accounts for 20-25 % of productivity (Ebert and Chou, 2014). Seed is a key component amongst all inputs for sustainable crop production. Indian population is increasing abruptly, to meet the demands for ever increasing population we have to increase the production and productivity of agricultural and horticultural crop which can be achieved by use of good quality seed for crop production (Dhillon *et al.*, 2018). The genetic purity, physical purity, viability, vigour and uniformity in seed size are important parameters to determine the quality of seed. The harvested seed lot contains impurities, immature and damaged seeds. Seed size and weight are also positively correlated to seed vigour. Uniformity in size and constituents of seed lot were emphasized for precision sowing as well as better crop establishment. Through mechanical seed processing, heterogeneity of harvested seed lots are reduced by segregation of seeds based on its morphological/physical properties. Machine aided seed processing certainty improve the physical purity, test weight, germination and vigour potential of harvested seed lots. The present study investigated the coriander seed quality improvement by using different adjustments in specific gravity separator.

Materials and methods

Coriander seeds of variety CO3, collected from Agricultural Research Station, Paramakudi, Tamil Nadu, were used for this study during year 2018-19. Collected heterogeneous material was graded in a specific gravity separator by adjusting the machine settings combination *viz.*, horizontal height, vertical height, air blow rate and deck oscillation rate. Machine setting combination was: C1 (0.0, 0.5, 3.0), C2 (0.5, 1.0, 3.5), C3 (1.0, 1.5, 4.0) with standard deck oscillation rate of 485 rpm. After machine setting adjustments, seed grading was performed and all the machine run seeds were collected in the five outlets namely A, B, C, D, and E. All the collected grade wise seed samples were subjected to physical (seed recovery, 100 seed weight and seed filling), physiological (germination, speed of germination, seedling length, vigour index and field emergence) and biochemical (oil, protein and carbohydrate) parameters analysis.

Results and discussion

Grade E seeds with C2 combination recorded significantly higher value for seed recovery percentage, 100 seed weight (g) and seed filling percentage when compared to other grades and bulk. Regarding seed filling, grade E with C2 combination recorded the highest filling percentage (82 %), whereas the seeds of grade A recorded the lowest value of 41 % (Table 1). The percentage of

germination recorded by grade E seeds was 74 per cent. This value was 20, 18, 12, 6 and 7 percent higher than the seeds of grade A, B, C, D and ungraded bulk, respectively. The shoot length, root length, dry matter production, vigour index I and vigour index II and field emergence percentage also followed the same trend as that of germination value recorded in all the five grades of seeds (Table 2, 3 & 4 and Fig. 1).

Among the biochemical parameters, the oil content was less in grade A, B, C, D and bulk seeds when compared to grade E seeds with C2 machine setting. The percentage decreased for A, B, C, D grades and bulk seeds compared with grade E (24.0, 19.0, 11.8, 4.3 and 12.3 %, respectively). Similarly, the decreasing trend was recorded with reference to protein content of grade A, B, C, E and bulk seeds compared with grade D seeds *viz.*, 21.6, 13.0, 6.6, 3.8 and 7.0 %, respectively. The carbohydrate content also followed the same trend as that of oil and protein content (Table 5).

The present study showed that the protein, carbohydrate and oil content decreased as the quality of seeds decreased. The observation on the filling percentages showed that, as the seed filling percentage decreased, the seed quality also decreased. The superiority of the E grade seeds obtained in C2 machine setting combination with reference to seed filling, hundred seed weight, protein and oil contents, positively influenced germination and seedling vigour of coriander seeds. Several authors have recorded the positive influence of upgrading the seed quality on the subsequent seed germination and seedling vigour. Seed upgrading

Table 1. Effect of specific gravity separation of seeds on seed recovery (%), 100 seed weight (g) and seed filling (%) of coriander var CO3

Specific gravity grades	Seed recovery (%)				100 seed weight (g)				Seed filling (%)			
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
A	3 (9.89)	3 (9.90)	5 (12.76)	3.67 (10.85)	0.96	0.83	1.12	0.97	45 (42.13)	41 (39.81)	43 (40.98)	43.00 (40.97)
B	10 (18.38)	5 (12.76)	10 (18.38)	8.33 (16.51)	1.02	1.09	1.19	1.10	55 (47.87)	53 (46.72)	63 (52.54)	57.00 (49.04)
C	33 (35.06)	19 (25.79)	38 (38.05)	30.00 (32.96)	1.12	1.25	1.25	1.21	63 (52.54)	62 (51.95)	65 (53.74)	63.33 (52.74)
D	29 (32.57)	28 (31.94)	30 (33.20)	29.00 (32.57)	1.16	1.38	1.26	1.27	67 (54.95)	76 (60.67)	73 (58.71)	72.00 (58.11)
E	25 (29.99)	45 (42.13)	17 (24.33)	29.00 (32.57)	1.25	1.83	1.27	1.45	74 (59.35)	82 (64.92)	79 (62.75)	78.33 (62.34)
F	-	-	-	-	1.24	1.24	1.24	1.24	70 (56.80)	70 (56.80)	70 (56.80)	70.00 (56.80)
Mean	20 (25.17)	20 (24.50)	20 (25.34)	20 (25.34)	1.13	1.27	1.22	1.21	62.33 (52.27)	65.5 (54.25)	64 (53.48)	63.94 (53.33)
	G	C	GxC		G	C	GxC		G	C	GxC	
SEd	0.100	0.078	0.174		0.010	0.007	0.017		0.301	0.213	0.522	
CD (*P*=0.05)	0.202	0.157	0.350		0.020	0.014	0.033		0.604	0.427	1.046	

Combination	Machine setting adjustments			Seed grades			
	Horizontal height (cm)	Vertical height (cm)	Air blow rate (m3/hr)				
C1	0	0.5	3.0	A	Lighter weight	D	Heavy weight
C2	0.5	1.0	3.5	B	Light weight	E	Heavier weight
C3	1.0	1.5	4.0	C	Medium weight	F	Bulk

C – Combination of machine setting G – Germination (%). (value in parentheses indicate arc sine transformed values)

Table 2 Effect of specific gravity separation of seed germination (%) and speed of germinationof coriander var CO3

Specific gravity grades	Germination (%)				Speed of germination			
	C1	C2	C3	Mean	C1	C2	C3	Mean
A	55 (47.87)	54 (47.30)	57 (49.03)	55.33 (48.06)	5.89	6.03	5.81	5.91
B	58 (49.61)	56 (48.59)	59 (50.19)	57.67 (49.46)	6.09	6.24	6.02	6.12
C	60 (50.77)	62 (51.95)	61 (51.36)	61.00 (51.36)	6.13	6.67	6.29	6.36
D	65 (53.74)	68 (55.56)	63 (52.54)	65.33 (53.94)	6.45	6.91	6.37	6.58
E	69 (56.18)	74 (59.19)	68 (55.56)	70.33 (56.97)	6.91	7.78	6.85	7.18
F	67 (54.79)	67 (54.79)	67 (54.79)	67.00 (54.79)	6.82	6.82	6.82	6.82
Mean	62 (52.18)	63 (52.91)	62.46 (52.26)	55.33 (52.43)	6.38	6.74	6.36	6.49
	G	C	GxC		G	C	GxC	
SEd	0.258	0.182	0.446		0.053	0.038	0.092	
CD (*P*=0.05)	0.517	0.365	0.895		0.107	0.076	0.185	

(Fvalue in parentheses indicate arc sine transformed values). C – Combination of machine setting G – Germination (%). Details of machine setting adjustments and seed grades are the same as given below Table 1.

Table 3. Effect of specific gravity separation of seeds on root length, shoot length (cm) and dry matter production (g/10 seedlings) of coriander var CO3

Specific gravity grades	Root length (cm)				Shoot length (cm)				Dry matter production (g/10 seedlings)			
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
A	5.47	5.31	5.63	5.47	5.30	5.35	5.52	5.39	0.032	0.030	0.034	0.032
B	5.43	5.40	6.00	5.61	5.65	5.55	5.70	5.63	0.032	0.033	0.035	0.033
C	5.88	6.55	6.18	6.20	6.23	6.13	6.10	6.15	0.033	0.035	0.037	0.035
D	6.25	6.65	6.53	6.48	6.35	7.49	7.31	7.05	0.035	0.037	0.038	0.037
E	7.13	7.78	7.14	7.35	7.92	8.52	7.97	8.14	0.040	0.041	0.043	0.041
F	6.75	6.75	6.75	6.75	7.53	7.53	7.53	7.53	0.039	0.039	0.039	0.039
Mean	6.15	6.41	6.37	6.31	6.50	6.76	6.69	6.65	0.035	0.04	0.037	0.036
	G	C	GxC		G	C	GxC		G	C	GxC	
SEd	0.061	0.043	0.106		0.054	0.038	0.094		0.0003	0.0002	0.0006	
CD (*P*=0.05)	0.122	0.086	0.212		0.108	0.077	0.188		0.0006	0.0005	0.0011	

C – Combination of machine setting G – Germination (%). Details of machine setting adjustments and seed grades are the same as given below Table 1.

Table 4. Effect of gravity separation of seeds on vigour Index I, vigour Index II and field emergence (%) of coriander var CO3

Specific gravity grades	Vigour Index I				Vigour Index II				Field emergence (%)			
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
A	592	576	636	601.18	1.63	1.82	1.80	1.75	47 (43.28)	45 (42.13)	47 (43.28)	45.33 (42.32)
B	643	613	690	648.71	1.87	1.94	1.93	1.91	50 (45.03)	47 (43.28)	50 (45.03)	48.00 (43.86)
C	727	786	749	753.95	2.00	2.31	2.10	2.14	52 (46.15)	53 (46.72)	52 (46.15)	51.33 (45.77)
D	819	962	872	884.15	2.26	2.57	2.35	2.39	54 (47.30)	60 (50.97)	54 (47.30)	56.33 (48.71)
E	1038	1206	1027	1090.71	2.74	3.15	2.81	2.90	59 (49.90)	67 (54.95)	59 (49.90)	61.67 (51.68)
F	957	957	957	956.76	2.57	2.57	2.57	2.57	57 (49.03)	57 (49.95)	57 (49.03)	57.00 (49.34)
Mean	784.20	829.61	815.73	809.84	2.18	2.39	2.26	2.28	53 (46.78)	55 (47.85)	53 (46.78)	53.28 (46.90)
	G	C	GxC		G	C	GxC		G	C	GxC	
SEd	6.384	4.514	11.058		0.016	0.011	0.027		0.228	0.161	0.395	
CD (*P*=0.05)	12.800	9.051	22.170		0.032	0.022	0.055		0.458	0.324	0.793	

(Value in parentheses indicate arc sine transformed values) C – Combination of machine setting G – Germination (%)

Table 5. Effect of gravity separation of seeds on oil content (%), protein content (%) and carbohydrates (%) of coriander var CO3

Specific gravity grades	Oil content (%)				Protein content (%)				Carbohydrates (%)			
	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
A	23.78 (29.19)	23.04 (28.69)	23.34 (28.89)	23.39 (28.92)	21.04 (27.30)	20.12 (26.65)	21.34 (27.51)	20.83 (27.16)	16.49 (23.96)	15.45 (23.15)	16.32 (23.83)	16.09 (23.64)
B	24.98 (29.99)	25.56 (30.37)	24.16 (29.44)	24.90 (29.93)	21.43 (27.58)	21.42 (27.57)	22.18 (28.10)	21.68 (27.75)	16.54 (24.00)	16.16 (23.70)	16.41 (23.90)	16.37 (23.87)
C	25.38 (30.25)	27.43 (31.58)	25.45 (30.30)	26.09 (30.71)	22.16 (28.08)	23.45 (28.96)	22.27 (28.16)	22.63 (28.40)	16.81 (24.21)	17.36 (24.62)	16.75 (24.16)	16.97 (24.33)
D	26.61 (31.06)	28.27 (32.12)	26.84 (31.20)	27.24 (31.46)	22.62 (28.40)	25.37 (30.25)	23.16 (28.77)	23.72 (29.14)	17.51 (24.74)	18.42 (25.42)	17.38 (24.64)	17.77 (24.93)
E	27.56 (31.67)	29.39 (32.83)	27.82 (31.83)	28.26 (32.11)	23.42 (28.94)	26.51 (30.99)	24.13 (29.42)	24.69 (29.79)	17.63 (24.83)	19.17 (25.97)	17.91 (25.04)	18.24 (25.28)
F	27.26 (31.47)	27.26 (31.47)	27.26 (31.47)	27.26 (31.47)	23.24 (28.82)	23.24 (28.82)	23.24 (28.82)	23.24 (28.82)	17.64 (24.40)	17.64 (24.40)	17.64 (24.40)	17.64 (24.40)
Mean	25.93 (30.60)	26.83 (31.18)	25.81 (30.52)	26.19 (30.77)	22.32 (28.19)	23.35 (28.87)	22.72 (28.46)	22.80 (28.51)	17.10 (24.36)	17.37 (24.58)	17.07 (24.33)	17.18 (24.42)
	G	C	GxC		G	C	GxC		G	C	GxC	
SEd	0.145	0.102	0.251		0.127	0.090	0.220		0.109	0.077	0.189	
CD (*P*=0.05)	0.290	0.205	0.502		0.255	0.180	0.441		0.219	0.155	0.380	

(value in parentheses indicate arc sine transformed values). C – Combination of machine setting G – Germination (%)

usually entails removal of empty, immature, broken or insect damaged seeds. After extraction and cleaning, seed lots should be further conditioned to upgrade the quality of the lots. Bonner and Switzer (1971) reported significance of upgrading the seed quality of *Platanus occidentalis* by removal of empty seeds. Eucalyptus seeds were upgraded based on specific gravity by using water floatation or gravity separator significantly increased the seed weight and germination (Dharmalingam *et al.,* 1973; Khan, 1976). Density grading of depulped neem drupes using water has produced better seedling production (Ponnuswamy, 1993). Upgrading of *Casuarina equisetifolia* seeds with specific gravity separator significantly increased the seed weight, germination and bio chemical constituents (Umarani and Vanangamudi, 2002). Upgrading of okra (Yogesha *et al.*, 2013), Aggregatum Onion (Geetharani *et al.,* 2008), amaranths (Manikandan and Srimathi, 2014), lentil (Sinha *et al.,* 2009), sunflower (Balamurugan, 1993)

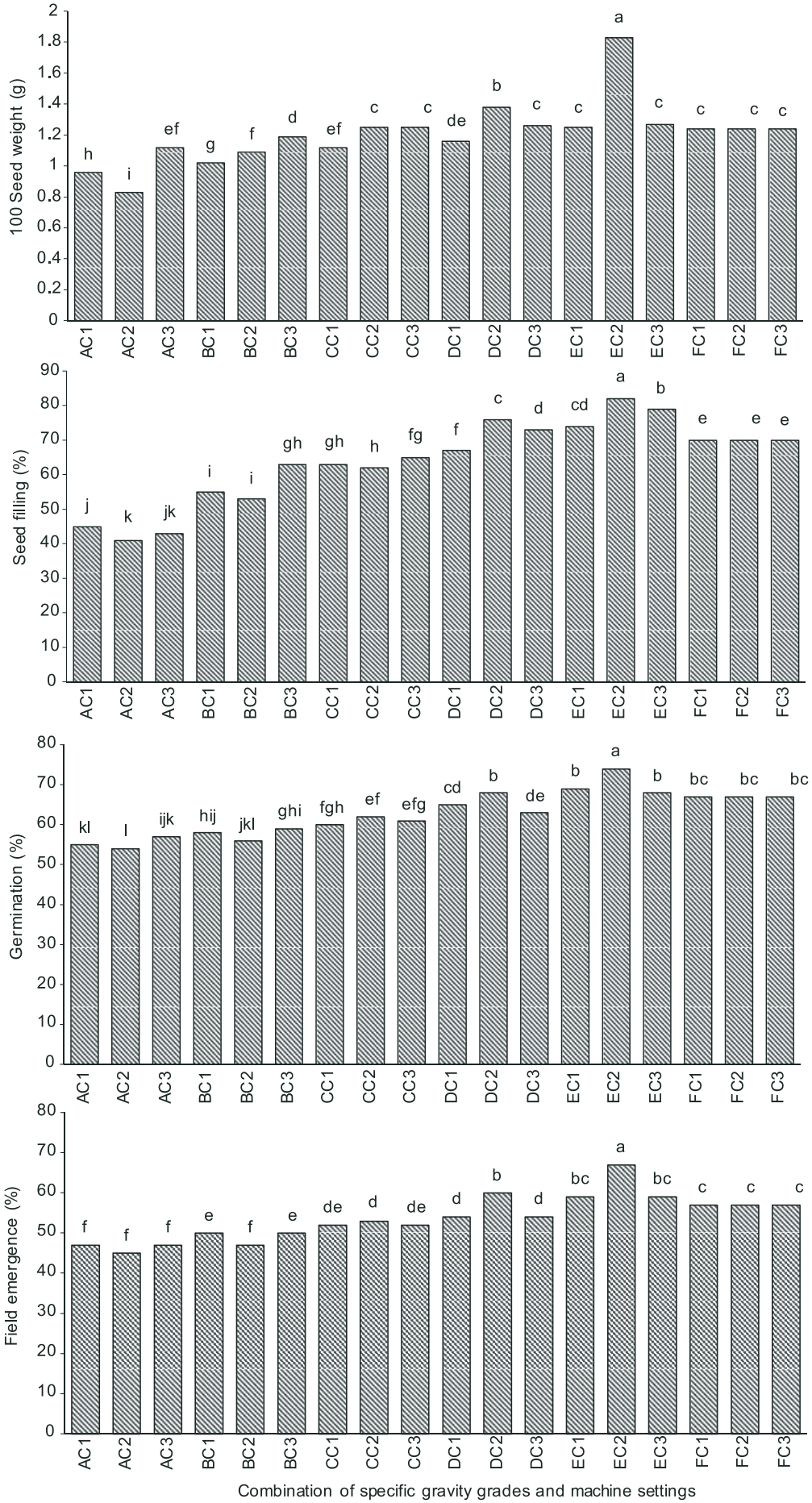

Fig. 1. Effect of combination of different grades and machine settings on 100 seed weight, seed filling, germination and field

and soybean (Vishwanath *et al.,* 2019) seeds on specific gravity separator (Pawankumar *et al.*, 2018) significantly enhanced the physical, physiological and biochemical parameters of coriander seeds.

From this study, it is concluded that coriander var. CO3 seed quality can be upgraded by using specific gravity separator with the machine setting *viz.*, horizontal height -0.5 cm, vertical height-1.0 cm, air blow rate -3.5 m^3/hr and deck speed at 485rpm. As per the Indian Minimum Seed Certification Standard, the coriander seed germination standard is 65 per cent. Hence, that E grade (74 per cent) and D grade (68 per cent) seeds can be used for seed purpose to achieve uniform and maximum field emergence.

References

Balamurugan, P. 1993. Seed production techniques in BSH 1 and quality assessment in parental lines and hybrid of sunflower (*Helianthus annuus* L.). Tamil Nadu Agricultural University, Coimbatore, India.

Bonner, F. and G.L. Switzer 1971. Upgrading yellow-poplar seeds. Research Note SFES-RN-SO-129. New Orleans, LA: USDA-Forest Service, Southern Forest Experiment Station. 129: 1-4.

Dharmalingam, C., S. Daniel, V. Ramakrishnan, T. Karivaratharaju and M. Thangaraj, 1973. Influence of seed separation and upgrading on germination in Eucalyptus hybrid seeds. *Madras Agriculture Journal*., 60(9): 1714-1718.

Dhillon, T.S., D. Singh, R. Singh and P.K. Singh, 2018. Vegetable seed production: A remunerative opportunity. *Seed Research*., 46: 1-7.

Ebert, A. and Y.Y. Chou 2014. The tomato collection maintained by AVRDC–The World Vegetable Center: composition, germplasm dissemination and use in breeding. XXIX International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014): IV 1101.

Geetharani, P., A. Ponnuswamy, M.I. Manivannan, J. Rajangam and S. Natarajan, 2008. Enhancing the sowing quality of seed by grading in onion (*Allium cepa* var. aggregatum). *Asian J. Hort*., 3(2): 439-441.

Hnamte, V., R. Chatterjee and C. Tania, 2013. Growth, flowering, fruit setting and maturity behaviour of coriander (*Coriandrum sativum* L.) with organics including biofertilizers and inorganics. *The bioscan*., 8(3): 791-793.

Kalemba, D. and A. Kunicka 2003. Antibacterial and antifungal properties of essential oils. *Current Medicinal Chemistry*., 10(10): 813-829.

Khan, A.M. 1976. Report.FAO/DANIDA Training Course on Forest Seed Collection and Handling. FAO/DANIDA Training Course on Forest Seed Collection and Handling, Chiang Mai (Thailand), 17 Feb 1975.

Manikandan, S. and P. Srimathi 2014. Studies on post-harvest seed handling techniques on grain amaranth (g.) cv. Suvarna. *Current Biotica*., 8(2): 132-141.

Pawankumar, P., T. Goswami, L. Priti and P. Nitesh, 2018. Performance enhancement of pre-cleaner and gravity separator. *Int. J. Pure App. Biosci*., 6(6): 838-852.

Ponnuswamy, A.S. 1993. Seed technological studies in neem (*Azadirachta indica* A. Juss). Ph.D, Thesis, Seed Science and Technology, Tamil Nadu Agricultural University, Inda.

Sinha, J., M. Vishwakarma and S. Sinha, 2009. Quality improvement in lentil (*Lens culinaris* Medic) seed through mechanical seed processing. *J. Res.*., 8: 7-17.

Umarani, R. and K. Vanangamudi 2002. The effect of specific gravity separation on germination and biochemical potential of *Casuarina equisetifolia* seeds. *J. Tropical Forest Sci*., 14(2): 207-212.

Vishwanath, R.H., R. Gurumurthy and M. Manjunatha, 2019. Influence of seed grading and specific gravity separator on seed quality parameters of soybean var. Dsb-21. *Int. J. Curr. Microbiol. App. Sci*., 8(1): 1707-1713.

Yogeesha, H., B. Kashinath, K. Bhanuprakash and L. Naik, 2013. Seed quality improvement in okra through specific gravity separation. *J. Hort. Sci*., 8(1): 70-73.

Received: October, 2020; Revised: December, 2020; Accepted: December, 2020