International Journal of Plant & Soil Science

15(6): 1-8, 2017; Article no.IJPSS.32722
ISSN: 2320-7035

Evaluation of Seed Quality in Naturally Aged Seed Lots of Coriander

Vinod Kumar[1*], T. P. Malik[1], S. K. Tehlan[1] and Amit Kumar[1]

[1]*Department of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004, India.*

Authors' contributions

This work was carried out in collaboration between all authors. Authors VK, TPM and AK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author SKT managed the analyses of the study. Authors VK and AK managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2017/32722
Editor(s):
(1) Scd Victoria Anatolyivna Tsygankova, Department for Chemistry of Bioactive Nitrogen-Containing Heterocyclic Compounds, Institute of Bio-organic Chemistry and Petrochemistry, Plant Physiology, NAS, Ukraine.
Reviewers:
(1) Nazmul Haque, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh.
(2) Adel Mohamed Ghoneim, King Saud University, Saudi Arabia.
(3) Rupnarayan Sett, Tropical Forest Research Institute, India.
(4) S. Sathish, Tamil Nadu Agricultural University, India.
(5) Cecilia M. Onyango, University of Nairobi, Kenya.
Complete Peer review History: http://www.sciencedomain.org/review-history/18999

Original Research Article

Received 11th March 2017
Accepted 2nd May 2017
Published 10th May 2017

ABSTRACT

Three seed lots of fifteen genotypes of coriander were subjected to study the effect of natural ageing on different seed quality parameters. Results revealed that all the genotypes showed the germination percentage above the Minimum Seed Certification Standards (65%) in Lot-1 (freshly harvested seed) and Lot-2 (1 year old seed). Standard germination (%), seedling length (cm), seedling dry weight (mg), seedling vigor index-I & II and accelerated ageing test (%) revealed that quality of seeds declined with faster rate inLot-3 (2 years old seed). Among all the genotypes, maximum germination was retained by genotype DH-339 (75.5%) followed by Hisar Surbhi (74.5%) and maximum loss of germination was observed in genotype DH 352-1 (61.2%). Hence, the genotypes DH-339 and Hisar Surbhi were found superior in terms of viability, vigor and storability whereas genotype DH 352-1 was found poor under ambient conditions.

Keywords: Ageing; coriander; germination (%); seed lots; seed quality.

**Corresponding author: E-mail: vinoddudhyan68@gmail.com;*

1. INTRODUCTION

Coriander (*Coriandrum sativum* L.) is an annual herb belonging to the family umbelliferae (Apiaceae) and is native of Mediterranean region. It is an important seed spice crop, which occupies a prime position in flavoring substances. All parts of this herb are in use as flavoring agent and/or as traditional remedies for the treatment of different disorders in the folk medicine systems of different civilizations [1]. Coriander has been reported to posses many pharmacological activities like antioxidant [2], anti-diabetic [3] and anti-mutagenic [4].

Quality seed is the basic unit for releasing higher yield per unit area. The quality seed not only enables the farmers to take economic decisions regarding cost of seed but also helps them to have idea about the quality of seed to plant, uniformity of plant stand and consequently the net returns. Therefore, the availability of genetically pure and vigorous seed at planting time is important for achieving target of agriculture production. Use of quality seeds increased productivity of crop by 15-20% [5].

Seed is considered as one of the important basic agricultural inputs for obtaining higher yield. After harvesting several field crops seeds keep in storage conditions for some days, weeks, months or years. Seed storage conditions can determine germination characteristics and vigor potential of seeds [6] storage time and relative humidity of store can affect vigor of seeds [7].

Among the seed spices, coriander is very susceptible to loss in quality in terms of seed viability and vigor during seed storage. One of the approaches adopted in this direction is to identify the physiological and biochemical changes accompanying seed deterioration during seed storage, as its seed deteriorates during prolonged storage. Since the viability of carryover seed lots deteriorates rapidly; therefore, the prior assessment of seed quality is important to plant only the viable seed in the coming season. Therefore, the present study was aimed at to assess the seed quality parameters of seeds of different genotypes of coriander stored under ambient conditions.

2. MATERIALS AND METHODS

The present investigation was carried out on coriander seeds of fifteen genotypes *viz*., DH-333-1, DH-336, DH-337, DH-338,DH-339, DH-340, DH-341, DH-343, DH-344, DH-345, DH-352-1, Hisar Anand, Hisar Sugandh, Hisar Bhoomit and Hisar Surbhi with three lots of seed *viz*., freshly harvested seed (Lot-1), one year old seed (Lot-2) and two year old seed (Lot-3) collected from Department of Vegetable Science, CCS H.A.U, Hisar during 2014-15. All the 3 seed lots stored under ambient condition (uncontrolled storage) were subjected to test weight, standard germination test (%), seedling length (cm), seedling dry weight (mg), seedling vigor index-I, seedling vigor index-II and accelerated ageing test (%) in seed testing laboratory, Department of Seed Science and Technology, CCS Haryana Agricultural University. The statistical analysis will be done by using Completely Randomized Design (CRD) in laboratory parameters [8].

2.1 Test Weight (g)

A random sample of seeds was drawn from each lot of naturally aged seeds of coriander and 1000 seeds were selected without discrimination for their size and appearance and weight of these 1000 seeds denotes the test weight of that seed lot.

2.2 Standard Germination (%)

Hundred seeds were picked from each seed lot for 15 genotypes and placed in between sufficient moistened rolled towel papers in four replicates and kept at 25ºC in seed germinator. The final count was taken on 21st day and only normal seedlings were considered for percent germination as per rules of International Seed Testing Association [9].

2.3 Seedling Length (cm)

Seedling length was measured on ten randomly selected normal seedlings taken from four replications of standard germination test and recorded in centimeter. At last, average of ten seedlings was recorded in centimeters for final calculations.

2.4 Seedling Dry Weight (mg)

Seedling dry weight was assessed after the final count in the standard germination test (21 days). The 10 seedlings of each genotype replicated four times and dried at 80℃ for 48 h and the seedling dry weight was recorded in milligram.

2.5 Seedling Vigor Indices

Seedling vigor indices were calculated according to the method suggested [10]:

Vigor index-I (on seedling length basis):

Vigor index-I = Standard germination (%) x seedling length (cm)

Vigor index-II (on seedling dry weight basis):

Vigor index-II = Standard germination (%) x seedling dry weight (mg)

2.6 Accelerated Ageing Test (%)

For accelerated ageing test (%) sufficient number of seeds in a single layer from each genotype was taken on wire mesh tray fitted in plastic boxes having 40 ml of distilled water. The boxes were placed in ageing chamber after closing their lids. The seeds were aged at 40±1℃ temperature and about 100% RH for 120 hours. Aged seed will be subjected to germination test as mentioned earlier.

3. RESULTS AND DISCUSSION

Significant differences were found among all the genotypes and ageing periods for test weight (Fig. 1). In freshly harvested seed lot maximum test weight was recorded in Hisar Surbhi (18.18 g) which was followed by DH-339 (18.10 g) and minimum test weight was recorded for DH-341 (13.98 g). High test weight of freshly harvested seed may be due to the commencement of rainy season at time of harvesting and storage which increased the moisture content of seed.

Test weight decreased due to deterioration of seed tissues with advancement of ageing period in all the fifteen genotypes. The results indicated that the genotype Hisar Surbhi (17.40 g) recorded highest mean test weight whereas DH-341 recorded lowest (12.96 g). Maximum (3.54 g) decrease in test weight was recorded for DH-345 and minimum (1.44 g) in DH-344 from fresh seed lot to two year old seed lot. Similar finding was reported in coriander (*Coriandrum sativum* L.) [11] and in fenugreek [12].

In freshly harvested seed lots and one year aged seed lots, all the genotypes showed germination percentage above Minimum Seed Certification Standards (65.0%). Among all genotypes and seed lots Hisar Surbhi (90.2%) recorded highest germination followed by DH-339 (90.0%) whereas the genotype DH-352-1 recorded lowest germination (74.7%) in freshly harvested seed lot. Thereafter standard germination decreased gradually with the advancement of storage period among all the genotypes (Table 1). Standard germination declined with a faster rate in two year aged seed lot as compared to one year aged seed lot. The maximum standard germination was recorded in DH-339 (60.7%) followed by Hisar Surbhi (58.7%) and lowest in DH-352-1 (43.5%) in two year aged seed lot. The change in the seed viability under ambient storage conditions is a function of a complex interaction of genetic constitution and environmental conditions. The present results are also in corroborate with the findings of Kumar et al. [13] where loss of seed viability and vigor increased with increase in period of storage in coriander. Above results are in close agreement with various workers in different crops such as okra [14], Indian mustard [15], fenugreek [16], carrot [17], turnip [18] and in four seed vegetables i.e. carrot, cucumber, onion and tomato [19].

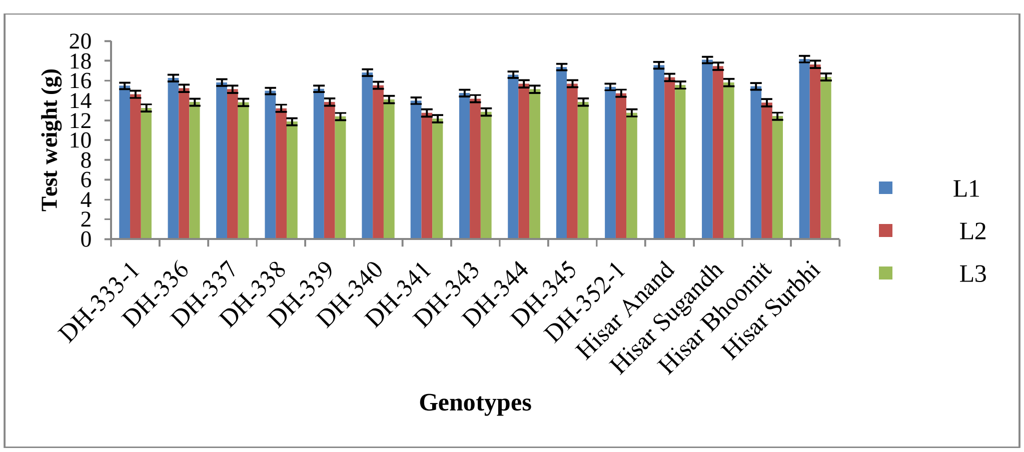

Fig. 1. Effect of natural ageing on test weight (g) of coriander genotypes

Table 1. Effect of natural ageing on standard germination (%) of coriander genotypes

Genotypes	Seed lots			Mean
	L_1	L_2	L_3	
DH-333-1	75.7 (60.4)	67.0 (54.9)	54.5 (47.5)	65.7 (54.3)
DH-336	84.7 (67.0)	73.0 (58.6)	50.2 (45.1)	69.3 (56.9)
DH-337	80.2 (63.6)	65.2 (53.8)	50.7 (45.4)	65.4 (54.2)
DH-338	77.5 (61.6)	67.2 (55.0)	46.0 (42.6)	63.5 (53.1)
DH-339	90.0 (71.6)	76.0 (60.6)	60.7 (51.1)	75.5 (61.1)
DH-340	76.5 (61.0)	66.7 (54.7)	45.0 (42.1)	62.7 (52.6)
DH-341	80.2 (63.6)	69.7 (56.6)	45.0 (42.1)	65.0 (54.1)
DH-343	79.7 (63.2)	72.2 (58.2)	46.5 (42.9)	66.1 (54.8)
DH-344	83.2 (65.8)	68.2 (55.7)	47.0 (43.2)	66.1 (54.9)
DH-345	80.7 (63.9)	69.7 (56.6)	47.2 (43.4)	65.9 (54.6)
DH-352-1	74.7 (59.8)	65.5 (54.0)	43.5 (41.2)	61.2 (51.6)
Hisar Anand	80.5 (63.7)	68.2 (55.6)	52.7 (46.5)	67.1 (55.3)
Hisar Sugandh	82.2 (65.0)	70.5 (57.0)	44.2 (41.6)	65.6 (54.6)
Hisar Bhoomit	76.5 (61.0)	68.5 (55.8)	45.7 (42.5)	62.9 (53.1)
Hisar Surbhi	90.2 (71.8)	74.5 (59.6)	58.7 (50.0)	74.5 (60.5)
Mean	80.8 (64.2)	69.5 (56.4)	49.2 (44.5)	

C.D. (p = .05) for genotypes = 1.059, lots = 0.474, Genotypes x lots = 1.835
Figures in parenthesis are arcsine value

All the genotypes recorded maximum seedling length (Fig. 2) at the commencement of storage and thereafter, it declined as the period of ambient storage advanced. Seedling length in all the fifteen genotypes decreased significantly with the advancement of ageing period. Seedling length showed a variation in freshly harvested seed of different genotypes from 27.45 to 33.09 cm with a general mean of 30.35cm. The maximum average value for seedling length was recorded for genotype DH-339 (28.67 cm) followed by Hisar Surbhi (28.27 cm) and minimum (21.85 cm) for DH-352-1. The maximum decrease (13.45 cm) in seedling length was recorded for DH-338 and minimum (6.10 cm) for DH-333-1 from fresh seed lot to two year old seed lot. The reduction in the physical and physiological manifestation of vigor during storage could be attributed to the irreversible deteriorative changes occurring in them as a result of ageing [20]. Similar findings were also reported in fenugreek [12,16], in coriander [11,21] and in turnip [18].

Among all the genotypes, DH-340 recorded highest value of seedling dry weight (35.40 mg) and followed by DH-339 having dry weight (33.63 mg) whereas genotype DH-352-1 recorded lowest dry weight (22.20 mg) in freshly harvested seed lot (Fig. 3). Highest mean seedling

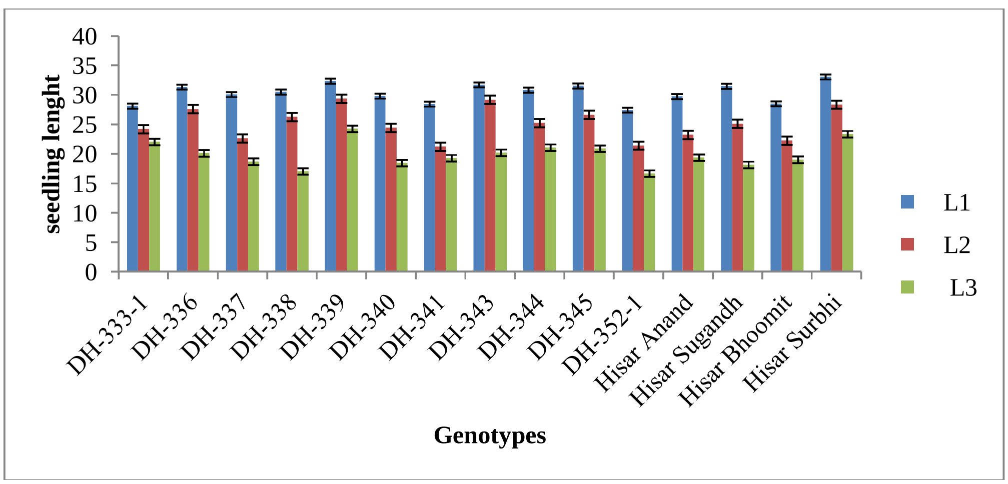

Fig. 2. Effect of natural ageing on seedling length (cm) of coriander genotypes

dry weight was observed in DH-340 (32.09 mg) followed by Hisar Surbhi (31.14 mg) and lowest in DH-352-1 (19.76 mg). These observations were similar to those already reported by various workers in different crops such as in urd bean, mung bean [22] and in fenugreek [12].

The standard germination test fails to account for the progressive nature of seed deterioration and the seeds are merely classified as either viable or non-viable with no distinction between strong or weak seedlings. These weaknesses have encouraged the interest in vigor testing to provide information about the vigor and viability of seed, which has not been realized by standard germination test. Results indicated that seedling vigor indices declined significantly in all the varieties/genotypes with the passage of seed storage time, vigor index-I ranged from 725.24 (two year aged seed) to 2986.33 (freshly harvested seed). The genotype Hisar Surbhi showed maximum value (2986.33) followed by DH-339 (2910.96) and minimum in DH-352-1 (2051.48) in freshly harvested seed lot as shown in Fig. 4. Highest mean vigor index–I was observed in DH-339 (2206.74) followed by Hisar Surbhi (2157.21) and lowest in DH-352-1 (1393.18). Therefore, among all the genotypes, DH-339 was found more vigorous than other genotypes. Vigor index –II ranged from 1660.20 (DH-352-1) to 3022.65 (DH-339) among genotypes for fresh seed lot. In freshly harvested seed lot, the maximum value of seed vigor index-II was recorded in DH-339 (3022.65) followed by Hisar Surbhi (3019.22), which were statistically at par and lowest in DH-352-1 (1660.22) However in two year old seed lot, the maximum value of seed vigor index-II was recorded in Hisar Surbhi (1724.97) and minimum was recorded in DH-352-1 (728.65) as shown in Fig. 5. The maximum average value for seed vigor index (2341.81) was observed for genotype Hisar Surbhi followed

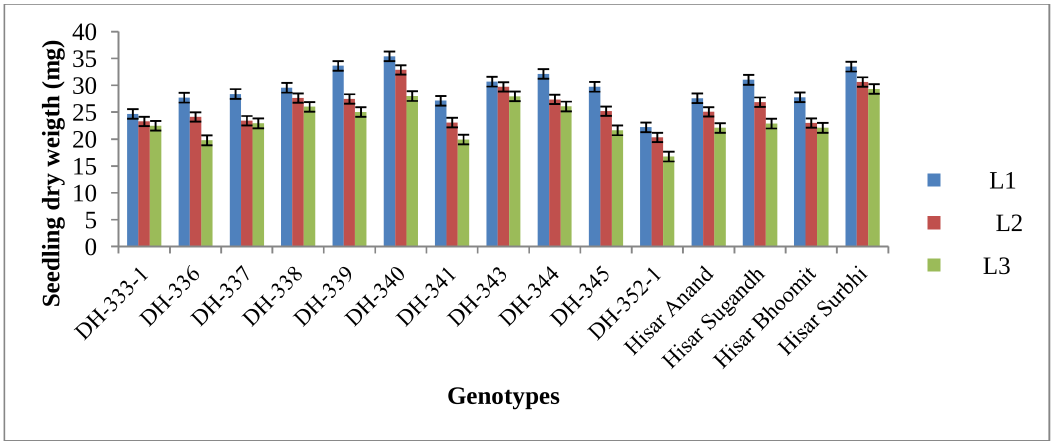

Fig. 3. Effect of natural ageing on seedling dry weight (mg) of coriander genotypes

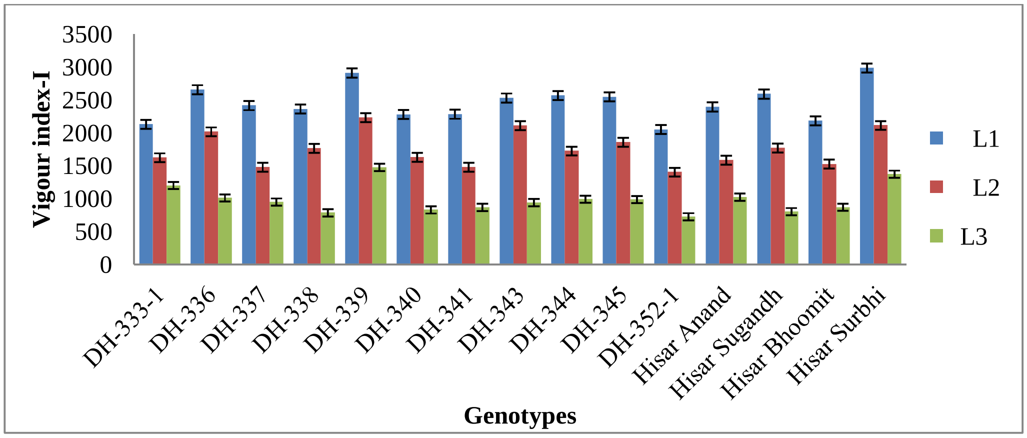

Fig. 4. Effect of natural ageing on Vigor index –I of coriander genotypes

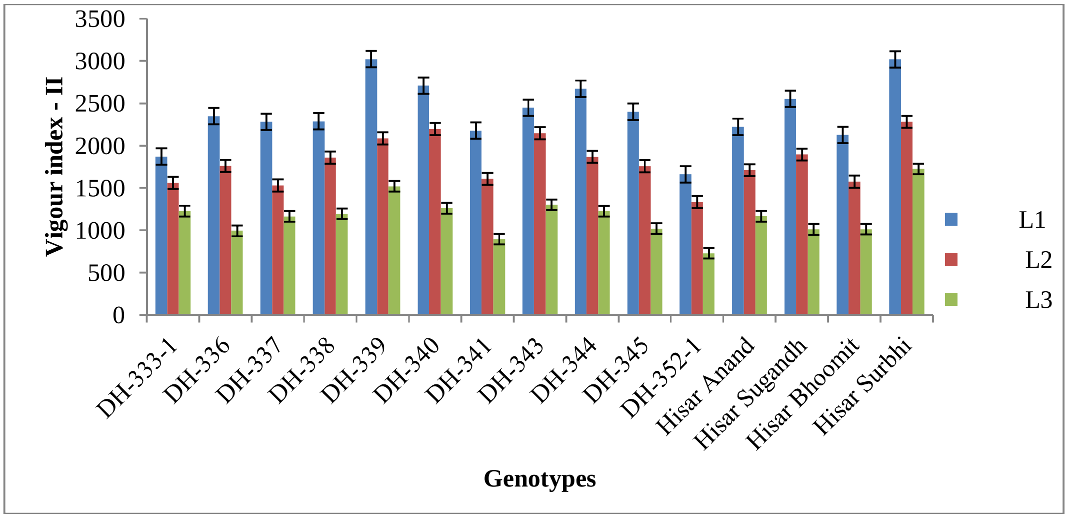

Fig. 5. Effect of natural ageing on Vigor index –II of coriander genotypes

Table 2. Effect of accelerated ageing on germination (%) of seeds of coriander genotypes

Genotypes	Seed lots			Mean
	L_1	L_2	L_3	
DH-333-1	52.0 (46.1)	33.7 (35.4)	21.2 (27.4)	35.6 (36.3)
DH-336	64.7 (53.5)	44.7 (41.9)	19.5 (26.1)	43.0 (40.5)
DH-337	56.7 (48.8)	36.2 (36.9)	16.5 (23.8)	36.5 (36.5)
DH-338	56.2 (48.5)	39.2 (38.7)	18.0 (25.0)	37.8 (37.4)
DH-339	67.2 (55.0)	41.0 (39.7)	21.5 (27.5)	43.2 (40.8)
DH-340	52.2 (46.2)	34.5 (35.9)	17.0 (24.3)	34.5 (35.5)
DH-341	57.2 (49.1)	37.5 (37.7)	17.0 (24.3)	37.2 (37.0)
DH-343	64.7 (53.5)	36.5 (37.1)	19.2 (25.9)	40.1 (38.9)
DH-344	61.2 (51.4)	48.0 (43.8)	14.7 (22.5)	41.3 (39.2)
DH-345	68.2 (55.6)	50.5 (45.2)	25.0 (29.9)	47.9 (43.6)
DH-352-1	50.2 (45.1)	28.7 (32.4)	9.2 (17.6)	29.4 (31.7)
Hisar Anand	60.0 (50.7)	40.2 (39.3)	19.5 (26.1)	39.9 (38.7)
Hisar Sugandh	62.2 (52.0)	39.2 (38.7)	16.7 (24.1)	39.4 (38.3)
Hisar Bhoomit	53.7 (47.1)	33.2 (35.1)	18.2 (25.2)	35.0 (35.8)
Hisar Surbhi	70.0 (56.7)	47.0 (43.2)	22.0 (27.9)	46.3 (42.6)
Mean	59.8 (50.6)	39.3 (38.7)	18.3 (25.2)	

C.D. (p = .05) for genotypes =1.191, lots =0.533, Genotypes x lots = 2.064
Figures in parenthesis are arcsine values

by DH-339 (2209.39) and minimum for DH-352-1 (1240.47). The present results substantiate with the findings of Kumar et al. [13] in coriander and Rajkumar et al. [23] in pea where loss of vigor increased with increase in period of storage.

Different seed lots of different genotypes of coriander were subjected to accelerated ageing treatment and the percentage germination of normal seedlings are presented in Table 2 above. The range of percentage germination for different genotypes varied from 70.0% (Hisar Surbhi) to 50.2% (DH-352-1) in freshly harvested seed, 50.5% (DH-345) to 28.7% (DH-352-1) in one year old seed lot, 25.0% (DH-345) to 9.2% (DH-352-1) in two year old seed lot. The genotype DH-345 (47.9%) and Hisar Surbhi (46.3%) recorded significantly high mean percentage of normal seedlings because these genotypes strongly resisted the accelerated ageing up to certain period, hence could be classified as more vigorous and viable. The decline in seed germination and vigor during accelerated ageing as well as storage treatments were influenced by chronological age of seed rather than initial germination percentage [24]. The possible reason of this reduction might be the lowering of biochemical activities in seeds.

Ageing have damaging effect on enzymes that are necessary to convert reserve food in the embryo to usable form and ultimately production of normal seedling [25]. The similar results were also reported in coriander [13] and in fenugreek [26].

4. CONCLUSION

From the present investigation, it was observed that the viability and vigor of coriander seeds decreased as the age of the seeds increased and it can be concluded that the seeds more than one year old should not be used for sowing purpose by the farmers as the quality of the seeds of all the genotypes declined with fast rate in two year old seed under natural storage conditions and if they have their leftover seed it should be used after increasing the seed rate so that optimum plant population can be maintained. Among the genotypes, the genotype DH-339 and Hisar Surbhi were found most promising in respect of vigor, viability and storability and these genotypes may be used for further breeding program whereas genotypes DH 333-1 and DH 352-1 were found poor under naturally stored condition.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sahib NG, Anwar F, Gilani AH, Hamid AA, Saari A, Alkharfy KM. Coriander (*Coriandrum sativum* L.): A potential source of high-value components for functional foods and nutraceuticals- A Review. J. Phytother. Res. 2012;27(10): 1439-56.
2. Darughe F, Barzegar M, Sahari MA. Antioxidant and antifungal activity of Coriander (*Coriandrum sativum* L.) essential oil in cake. Int. Food Res. J. 2012;19(3):1253-1260.
3. Eidi M, Eidi A, Saeidi A, Molanaei S, Sadeghipour A, Bahar M, Bahar K. Effect of coriander seed (*Coriandrum sativum* L) ethanol extract on insulin release from pancreatic beta cells in streptozotocin induced diabetic rats. J. Phytother. Res. 2012;23(3):404-406.
4. Cortes-Eslava J, Gomez-Arroyo S, Villalobos-Pietrini R. Antimutagenicity of coriander (*Coriandrum sativum* L.) juice on the mutagenesis produced by plant metabolites of aromatic amines. J. Toxicol. Lett. 2004;153:283-292.
5. Sidhawani SK. Use of certified seeds and its contribution towards productivity. In: seminar seed industry in Haryana, present at September 12-13, CCS HAU, Hisar; 1991.
6. Mc Donald MB. Seed deterioration: Physiology, repair and assessment. Jou. Seed .Sci. Technol. 1999;27:177-273.
7. Marshal AH, Levis DN. Influence of seed storage conditions on seedling emergence, seedling growth and dry matter production of temperate forage grasses. Jou. Seed. Sci. Technol. 2004;32:493-501.
8. Panse VG, Sukhatme PV. Stastical methods for agricultural workers, 4th Ed., ICAR, New Delhi; 1985.
9. ISTA. Rules amendments. Seed Sci. Technol. 2001;29 (supplement):13-33.
10. Abdul-Baki AA, Anderson JD. Vigor determination in soybean seed by multiple criteria. Crop Sci. 1973;13:630-633.
11. Kumar A. Seed quality assessment in naturally aged seeds of coriander (*Coriandrum sativum* L.). M. Sc. Thesis, submitted to CCS HAU, Hisar.; 2007.
12. Singh Bahader, Bhuker Axay, Mor VS, Dahiya OS, Punia RC. Seed quality assessment in naturally aged seed of fenugreek (*Trigonella foenum-graecum* L). Int. J. Sci. Res. Sci. Technol. 2015;1(4): 243-248.
13. Kumar V, Verma SS, Verma U, Kumar A. Seed viability and vigor in naturally aged seeds of coriander (*Coriandrum sativum* L.). Indian J. Agric. Sci. 2015;85(4):561–565.
14. Narwal AK. Studies on seeds viability of okra (*Abelmaschus esculentus* L. Moench.). Ph. D. Thesis submitted to CCS Haryana Agricultural University, Hisar; 1995.
15. Verma SS, Verma U, Tomer, RPS. Studies on seed quality parameters in deteriorating seeds in brassica (*Brassica campestris*). Seed Sci. Technol. 2003;31:389-396.
16. Kumari S, Kumar A, Tehlan SK. Studies on physiological parameters in fenugreek under ambient conditions. Annals of biology. 2014;30(4):691-695.
17. Maskri AI, Khan, AY, Khan IA, Habri, K. Effect of accelerated ageing on viability,

vigor (RGR) lipid peroxidation and linkage in carrot (*Daucus carota* L.) seeds. Int. J. Agric Biol. 2003;5(4):580-584.

18. Khan MM, Iqbal MJ, Abbas M. Loss of viability correlates with membrane damage in aged turnip (*Brassica rapa*) seeds. Seed Sci. Technol. 2005;33(2):517-520.
19. Alhamdan AM, Alsadon AA, Khalil SO, Wahb-Allah MA, Nagar Mel., Ibrahim AA. Influence of storage conditions on seed quality and longevity of four vegetable crops. Am Eurasian J. Agric. Environ. Sci. 2011;11(3):353-359.
20. Palanisamy V, Ramaswamy KR. Effect of seed size and weight on seedling vigor in bhindi. Seed Res. 1985;13(1):82-85.
21. Deshraj. Studies on viability and vigor in coriander (*Coriandrum sativum* L.). M. Sc. Thesis, submitted to CCS HAU, Hisar; 2002.
22. Singh B, Singh CB, Gupta PC. Influence of seed ageing in *Vigna* species. J. Farm Sci. 2003;12(1): 4-7.
23. Rajkumar, Nagarajan S, Rana SC. Effect of natural ageing under controlled storage on seed quality and yield performance of field pea cv. DMR-7. Seed Res. 2004; 32(1):96-97.
24. Agarwal PK, Sinha SK. Response of okra seed (*Abelmoschus esculentus* L.) of different chronological ages during accelerated ageing and storage. Seed Res. 1980;8(1):64-70.
25. Iqbal, N A, Shahzad M, Basra, Khalil Ur Rehman. Evaluation of vigor and oil quality in cottonseed during accelerated aging. Int. J. Agri. Biol. 2002; 4(3):318-322.
26. Kumar S, Verma SS. Studies on viability and vigor in fenugreek seeds stored under ambient conditions. Haryana J Hort. Sci. 2008;37(3&4):349-352.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/18999