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QUALITY OF CORIANDER SEEDS STORED IN DIFFERENT PACKING MATERIALS AT AMBIENT CONDITION

Ahmed S[1], Hossain MM[2], Sirajul Karim AJM[3], Ruhul Quddus AFM[4] and Sarker Rumpa[5]

[1] Senior Scientific Officer, On Farm Research Division, BARI, Faridpur, Bangladesh

[2]Dept. Hort, [3]Dept. Soil Science, BSMRAU, Gazipur, Bangladesh, [4]OFRD, BARI, Faridpur and [5] SRSC, BARI, Faridpur

ABSTRACT

A lab experiment was conducted at Gazipur during April to November, 2011 with the objective to find out the suitability of seeds (harvested on 102 and 110 days after sowing) for storing and the efficiency of the storage containers on retention of seed quality. The experiment was tested in completely randomized design and consisted of five storage containers viz. earthen pot, cloth bag, plastic can, polyethylene bag and aluminum foil packet. The coriander variety was BARI dhania 1. For every two months (60 days) intervals observations were conducted to evaluate the results. The vapor proof containers maintained germination above minimum seed certification standard up to eight months and plastic can and polyethylene up to 6 months where as cloth bag up to 4 months. Seed moisture content of seed was lower in aluminum foil and plastic container. The electrical conductivity values were significantly lower in vapor proof packing materials compared to vapor pervious containers. Seeds packed in aluminum foil pack exhibited higher vigor index compared to cloth bag and earthen pot. The brown colored seed showed the best performance in all seed quality aspect than yellow colored seed.

INTRODUCTION

Coriander (*Coriandrum sativum*) is an important spice crop grown during the *rabi* season in Bangladesh. It is cultivated mainly for seed. Ripening of coriander takes place gradually and hence it may harvest when approximately half of the total fruits formed on plants have turned grey or rust brown or chestnut color (Shanmugavelu *et al.,* 2002). It was suggested that the crop will be ready for harvest in about 90 to 110 days depending upon the varieties and growing season (Kumar *et al.* 1997). Ripening time is a factor for coriander seed without deterioration of quality of seed as well as seed yield. Maturity of crop is an important factor for maintaining seed quality. Early harvests lead to considerable loss of immature seed and deteriorate the quality of seeds in storage condition due to fungal infection. Harvesting at later stage also risks in excessive shattering of mature seeds and inferior the quality of seed (Shanmugavelu *et al.*, 2002). So an experimental finding is necessary to determine the optimum maturity stage of crop for storing.

The seed is said to be in storage at all the stages between harvests to sowing. These stages are considered actually part of storage process. The extent of storability is influenced by type of packing materials. In general seed stored in moisture impervious sealed containers provide suitable environment for storage, offer protection against contamination and also acts as a barrier against the escape of seed treatment chemicals than in moisture pervious containers. Generally low cost and easily available materials like earthen pot, biscuit tin, gunny bag, dole etc are used as storage containers (Hossain, 1978). Seeds of coriander packed in poly bag recorded higher germination, seedling dry weight, vigor index, lower moisture content and EC (70.47%, 17.17 mg, 1005, 5.89% and 0.529dsm^{-1}, respectively) compared to seeds stored in cloth bag (55.1%, 8.88 mg, 921, 12.9% and 0.564 dsm^{-1}, respectively) and was followed by aluminum foil at the end of 10 months of storage(Nagaveni, 2005). The seed of coriander could be stored for only 6 months in polyethylene or cotton bags, while aluminum foil bags were superior for ground seed reported by Sanjeeva and Sharma (1999). The farmers have different types of storage containers over the year in order to protect the seed from moisture absorption and insect infestation. Generally low cost and easily available materials like earthen pot, biscuit tin, gunny bag, dole etc are used as storage containers (Hossain, 1978).Bangladesh Agricultural Research Institute (BARI) developed only one variety of coriander named BARI dhania 1. The limited research has been done on coriander seeds storage at ambient condition in Bangladesh. Considering the above points, the present investigation was undertaken to know which seeds (harvest on 102 and 110 days after sowing) are suitable for storing and to find out a suitable packing materials to attain quality seed of coriander

MATERIALS AND METHODS

The storage experiment was conducted at the Seed Science and Technology laboratory, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur during the period of April to November, 2011. Tests were conducted at every two

months (60 days) interval starting from 1 April, 2011 and were continued up to 30 November, 2011.

During the investigation period, the mean maximum temperature was 31.59^{0}C and the mean minimum was 26.93^{0}C. The relative humidity varied from 80.0 percent to 88.68 percent (Figure 1).

The using seeds of coriander cv. BARI dhania 1 were harvested in two different times of last growing season. First harvested was at 102 days after sowing (DAS) designated as yellow colored seeds and second was at 110 DAS designated as brown colored seeds. Both of the seeds were harvested after obtaining physiologically matured stages. The experiment consisted of 5 treatments involving different packing materials (earthen pot, cloth bag, plastic can, polyethylene bag (0.04 mm) and aluminum foil pack) and two different colored (brown and straw) of seeds.

The seeds of 100.0 g per bag were packed in earthen pot, cloth bag, plastic can and polyethylene bag, 50.0 g per bag in aluminum foil pack. All the seeds stored at ambient condition in the laboratory of Seed Science and Technology for a period of 8 months (April 2011 to November 2011). The laboratory experiment was conducted in complete randomized design with replicated four times.

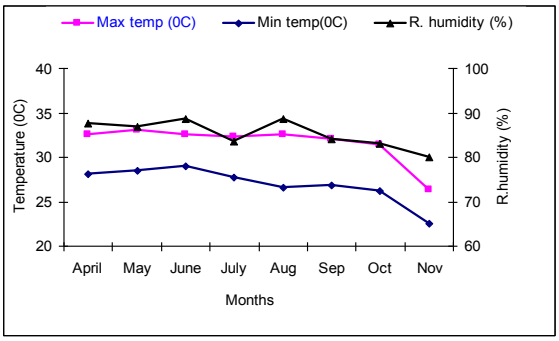

Fig 1: Average temperature and relative humidity during the experimental period

The seed moisture content was determined following high temperature constant oven dry method where seeds were dried in the electric oven at 130^{0}C for 1 hour. It was expressed as a percentage of the weight of the original sample. Percentage of moisture content was recorded to one decimal place (ISTA, 2006) by means of the following formula.

Moisture content (%) *= (M_2-M_3) x 100/M_2-M_1*

Where, M_1- is the weight in grams of the container and its cover,M_2 – is the weight in grams of the container, its cover & its contents before drying and M_3- is the weight in grams of the container, cover and contents after drying

Germination capacity

Germination test was carried out at 20^{0}C in the germinator. Four hundred seeds were sown in four plastic trays in between paper where each replicates contain 100 seeds. After emergence of seeds results are recorded as percentage by number of seeds germinated on trays. Germination percentage was computed using the following formula:

Germination (%) *= Number of seeds germinated/ number of seeds tested x 100*

Seed vigor (Electrical conductivity test)

For electrical conductivity test, 2.0 g of seeds of each sample were taken in a conical flask containing 50 ml de-ionized water and incubated at 20^{0}C for 24 hours. After then, water of the beaker containing seeds was decanted in order to separate the seeds. The electrical conductivity meter was used. Four replications of measurements were made for each sample of seed and expressed on a ms cm^{-1}

Seedling vigor index

The seed lot showing higher vigor index was considered to be more vigorous (Gupta, 1993). The vigor index of seedling was calculated by adopting the method suggested by Baki and Anderson (1973) and expressed as whole number for each treatment by using the formula:

Seedling vigor index (VI) *= Germination (%) x Seedling length (cm)*

The recorded data on different parameters were statistically analyzed by using MSTATC software to find out the significance of variation resulting from the experimental treatments. The difference between the treatments means were judged by Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Moisture content (%)

The moisture content 9.3 and 9.10 percent was recorded in yellow, and brown colored seed at storing period. Moisture content was differed significantly due to packing materials during storage period (Figure 2). Impervious container viz. polyethylene bag, plastic container and aluminum foil bag have recorded lower moisture content in yellow and brown colored seed through the storage period compared pervious container viz. earthen

and cloth bag. At yellow colored seed, cloth bag and earthen pot showed fluctuation in moisture content due to the surrounding relative humidity was the highest (Above 88%) in the month of June and August (Fig. 1) and range of moisture content was 13.29 to 10.13 and 12.48 to 10.40 percent, respectively at the end of storing period while moisture content was intact 9.30 percent in aluminum foil bag. At brown colored seed, it was 14.14 to 9.32 in cloth bag and 9.10 %in aluminum foil bag at the end of storing period. The moisture content in aluminum foil, plastic can and polyethylene bag statistically identical throughout the storing period. The brown colored seed showed the lower moisture content then followed by yellow colored seed during storing period. The present results confirms the findings of Huda (2001) who reported that seeds packed in plastic can and aluminum foil recorded lower moisture content followed by poly bag which indicate the impervious nature of this containers.

Germination percentage

Packing materials produced significant effect on the germination percentage in all the eight months of storage period (Fig. 3). The germination was 97.5 and 99.0 percent at storing period of yellow and brown colored seed, respectively. Among the packing materials seeds stored in aluminum foil pack recorded significantly higher germination (94.55%) compared to cloth bag (76.25%) and followed by plastic can (88.34%) at the end of two months (60 DAS) of storage at brown colored seed. Similar trend was observed at yellow colored seed. Seeds stored in aluminum foil recorded higher germination (75.00%) and above minimum certification standard (70%) up to 8 months (240 DAS) followed by plastic can and polyethylene bag (above 70.00%) up to 6 months (180 days) and cloth bag and earthen pot maintained above 70 % only 2 months (60 DAS) during storage. Seeds packed in cloth bag or earthen pot showed lower germination because it was not air tight conditions. The brown colored seed showed the higher germination percentage than yellow colored seed. This is in accordance with the findings of Nagaveni (2005),who have reported germination above seventy percent obtained in aluminum and polyethylene up to 9 months storage of onion seed in ambient condition while cloth bag only 4 months. Similar findings have been reported by Sanjeeva and Sharma (1999) in coriander, Shelar and Patil (1993) in brinjal and tomato.

Electrical conductivity (mscm^{-1})

Packing materials produced significant effect on electrical conductivity throughout the storage period of 8 months. The electrical conductivity (EC) values were 0.193 and 0.110 mscm^{-1} at storing period of yellow and brown colored seed, respectively. The EC values were significantly lower in vapour proof packing materials (polyethylene, plastic can and aluminum foil) compared to vapor pervious containers (earthen pot and cloth bag). At yellow colored seed, the lower electrical conductivity of 0.194 ms cm^{-1} in aluminum foil at 60 days after storing and it was increased up to 0.223 at 240 days after storing while the electrical conductivity was 0.349 and 0.364 at earthen pot and cloth bag, respectively. Similar trend was observed in the case of brown colored seed. The lowest electrical conductivity was 0.114 mscm^{-1} at aluminum foil and the highest was found in cloth bag (0.378 mscm^{-1}) at 240 days after storing. The yellow colored seed showed higher electrical values during storing period and lower was observed in brown colored seed. Nagaveni (2005) who have observed electrical conductivity increased with advancement of storage period and EC values were significantly lower in vapor proof container compared to vapor pervious container.

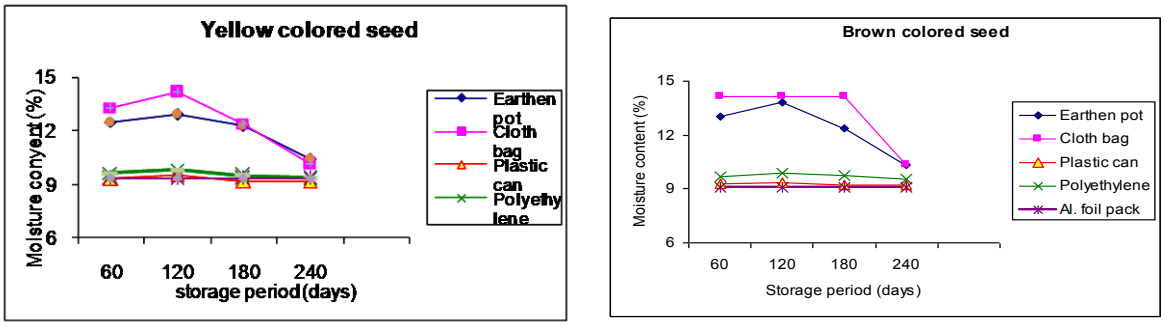

Fig 2. Effect of packing materials on moisture (%) of coriander seed during storage

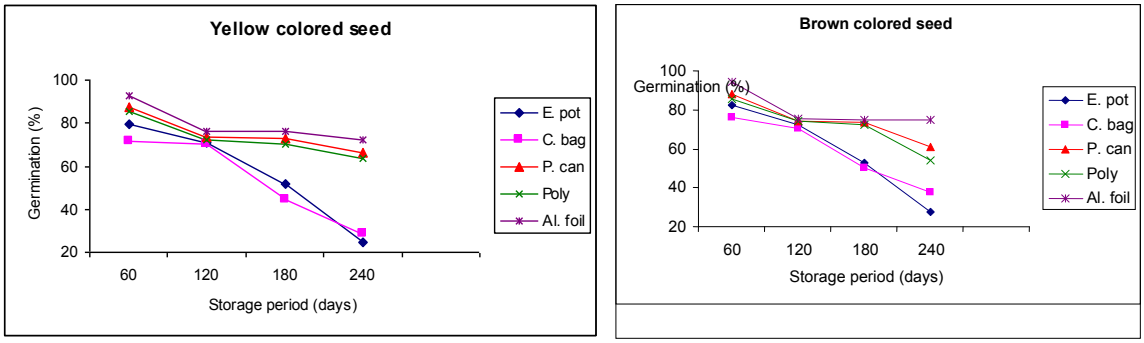

Fig 3. Effect of packing materials on germination (%) of seed during storage

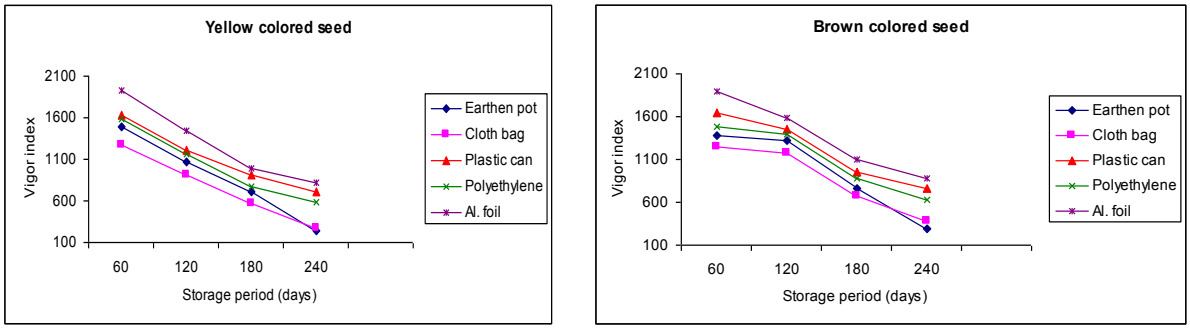

Fig 4. Effect of packing materials on vigor index of coriander seed during storage

Table 1: Effect of packing materials on EC (ms cm^{-1}) of coriander seed during storage

		60 days	120 days	180 days	240 days
Yellow colored seed	Earthen pot	0.260a	0.271a	0.316ab	0.349ab
	Cloth bag	0.242ab	0.251 a	0.323a	0.364a
	Plastic can	0.239ab	0.245ab	0.268bc	0.303b
	Polyethylene	0.253a	0.254a	0.264c	0.304b
	Al. foil	0.194b	0.198b	0.205d	0.223c
CV (%)		7.56	4.89	6.40	12.45
Brown colored seed	Earthen pot	0.221a	0.259a	0.279ab	0.355a
	Cloth bag	0.224a	0.259a	0.316a	0.378 a
	Plastic can	0.214a	0.225a	0.258b	0.273b
	Polyethylene	0.216a	0.226a	0.252b	0.272b
	Al. foil	0.119b	0.123b	0.144c	0.157c
CV (%)		5.13	7.13	13.03	8.55

Means with common letter in column are not different significantly at 0.05% by DMRT

Table 2: Effect of storage containers on root dry weight(mg) of coriander seed during storage

		60 days	**120 days**	**180 days**	**240 days**
Yellow colored seed	Earthen pot	9.40b	8.60b	7.40b	3.70b
	Cloth bag	8.50c	8.00c	7.40b	3.90b
	Plastic can	10.40a	9.20a	7.40b	6.40a
	Polyethylene	9.50b	8.40bc	7.50b	6.30a
	Al. foil	10.50a	9.50a	8.40a	6.70a
CV (%)		4.00	3.90	2.32	8.16
Brown colored seed	Earthen pot	9.40bc	8.40b	7.30c	3.80b
	Cloth bag	9.20c	8.10c	7.30c	2.40c
	Plastic can	9.70bc	9.10a	8.10b	6.70a
	Polyethylene	9.80b	9.10a	8.40c	6.90a
	Al. foil	10.60a	9.20a	8.50a	7.10a
CV (%)		3.66	1.88	1.16	7.96

Means with common letter in column are not different significantly at 0.05% by DMRT

Table 3: Effect of packing materials on shoot dry weight (mg) of coriander seed during storage

		60 days	120 days	180 days	240 days
Yellow colored seed	Earthen pot	16.90d	16.10d	15.50c	11.80b
	Cloth bag	16.60d	16.00d	16.10c	11.70b
	Plastic can	20.00b	18.60b	17.10b	12.10b
	Polyethylene	19.30c	17.40c	17.70ab	11.90b
	Al. foil	21.00a	19.70a	17.90a	15.00a
CV (%)		2.51	3.47	2.48	2.22
Brown colored seed	Earthen pot	19.00d	17.60d	16.00c	12.10c
	Cloth bag	19.00d	16.40e	14.00d	12.10c
	Plastic can	21.50b	19.80b	17.90b	14.50b
	Polyethylene	20.70c	19.00c	18.80a	14.10b
	Al. foil	22.00a	20.80a	18.80a	15.30a
CV (%)		3.45	2.51	5.13	2.60

Means with common letter in column are not different significantly at 0.05% by DMRT

Root dry weight (mg)

Significant differences in root dry weight (Table 2) were observed due to packing material during the storage period. The initially root dry weight were 10.95 and 11.20 mg at storing period of yellow, and brown colored seed, respectively. The root dry weight was gradually decreased with increasing of storing period. Seeds packed in aluminum foil pack recorded higher rate of root dry weight (10.50 mg) which was at par with plastic and polyethylene bag in yellow colored seed at 60 DAS compared to cloth bag and earthen pot and the lowest values were recorded from cloth bag (8.50 mg) and earthen pot (9.40 mg). At 240 DAS, the lowest value (2.40 mg) founded from cloth bag and highest (7.10 mg) observed in aluminum foil pack from brown colored seed which was statistically similar to yellow colored seed.

Shoot dry weight (mg)

Shoot dry weight in coriander seed varied significantly due to packaging materials during the storing period (Table 3). The initially shoot dry weight were 21.25 and 22.30 mg at storing period of yellow and brown colored seed, respectively. There was an appreciable variation among the packing materials over storing time. The shoot dry weight in aluminum foil after 60days storing was recorded in 21.0 and 22.0 mg in yellow and brown colored seed bag, respectively. The brown colored seed showed best performance compared to yellow colored seed throughout the storing period. Doijode (1995) who have observed higher seedling dry weight when onion seeds dried to 6.5 percent moisture content and preserved in aluminum foil stored for seven years.

Seedling vigor index

Effect of storage containers on seedling vigour of coriander is shown in Figure 4. Seeds packed in aluminum foil pack exhibited higher vigour index compared to cloth bag and earthen pot. The seedling vigor index was 2070 and 2142 at storing period of yellow and brown colored seed, respectively. At yellow seeded, the highest seedling vigor was noted in aluminum foil (1928) followed by plastic can (1627) and polyethylene bag (1589). The lowest value (1269) was obtained in cloth bag after 60 days after storage (DAS). The values were deteriorated with over time. Similar trend was recorded at brown colored seed. The seedling vigour values were higher in brown colored seed between the two colored seed even 240 days after storage. Kaur *et al.* (1990) who have observed that germination and seedling vigor decreased with increasing storage period and was highest in seeds with initial moisture contents of 10% stored in polyethylene bag.

CONCLUSION

The result concludes that coriander seed that harvested was 110 days showed best performance than yellow colored seed (harvested at 110 days after sowing) in all seed quality aspect. The vapor proof containers (aluminum foil pack) maintained germination above minimum seed certification standard up to ending of storage period (eight months) and plastic can and polyethylene up to 6 months where as cloth bag and earthen pot up to 4 months. The seedling vigor was highest in aluminum foil bag and plastic can up to eight month of storing.

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