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Influence of Packaging on Germination of Seeds of China Aster Varieties

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ABSTRACT

The present investigation entitled "Influence of packaging on germination of seeds of China aster varieties" was carried out at Laboratory, Department of Floriculture and Landscape Architecture and Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during February 2019 to November 2019 in Completely Randomized Design with factorial concept comprising two factors and replicated thrice. Factor 1 comprises of varieties (Arka Archana and Arka Kamini) and Factor 2 included packaging treatments viz., Plastic bags at refrigerated condition, Plastic containers at refrigerated condition, Aluminium sachets at refrigerated condition, Vacuum packing in plastic bags at refrigerated condition and Plastic bags at room condition. The findings revealed that maximum seed viability percentage, speed of germination, germination percentage at 7th and 14th day, root length, shoot length, seedling length, fresh weight and dry weight of seedling, seed vigor index-I and seed vigor index-II whereas, minimum electrical conductivity, mean germination time and days required to reach the 5th leaf stage were noticed in seeds of var. Arka Archana after 6 months of storage in vacuum packed plastic bags and kept at refrigerated condition.

Keywords Aluminium sachets, China aster, Germination, Packaging materials.

INTRODUCTION

Among the wide range of commercial flower crops, China aster occupies a selective position because of its prettiness, elegens, diverse form and varied attractive color ranges. Among the annual flowers, China aster ranks next to chrysanthemum and marigold. China aster (*Callistephus chinensis* (L.) Nees) is an important commercial annual flower which belongs to the family Asteraceae and native to China and Europe.

The successful crop production also involves seed storage as the "seed saved is seed produced" the popular proverb applies in modern agriculture. Storage potential of seed is also influenced by number of other environmental factors viz., moisture content, relative humidity, temperature, storage containers, provinces. Hence, the studies on influence of storage containers on storage potential and seed quality under different storage conditions in China aster are needed.

MATERIALS AND METHODS

The present investigation was conducted at Flori-

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culture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during February-November 2020. The experiment was laid out in Completely Randomized Block Design with three repetitions consisted of China aster varieties viz., Arka Archana and Arka Kamini and five packaging materials viz., plastic bags at refrigerated condition (P_1), plastic containers at refrigerated condition (P_2), aluminium sachets at refrigerated condition (P_3), vacuum packing in plastic bags at refrigerated condition (P_4) and plastic bags at room condition (P_5) and stored for period of 6 months. Observations were recorded on seed infestation rate, seed viability and electrical conductivity using given formula

$$\text{Seed viability (\%)} = \frac{\text{Number of stained seeds}}{\text{Total number of seed used}} \times 100$$

Electrical conductivity = EC of leachate – EC of DW

After sowing of seeds, counts on germination was made by counting the seeds germinating on alternate day at fixed time and calculated by the following formula and calculate the average of speed of germination at alternate day :

$$\text{Speed of germination} = \Sigma(ni/di)$$

Where, ni - Number of germinated seeds in every counting

di - Day of counting

Moreover, other observations were recorded on germination percentage at 7th and 14th day, mean germination time (days), days required to reach 5th leaf stage, root length, shoot length, seedling length, seedling fresh weight and seedling dry weight at 45 days after seed sowing. Seed vigor index - I and II was calculated as per the given formula suggested by Abdul-Baki and Anderson (1973) as

Seed vigor index-I = G % at 30 DAS × Seedling length (cm)

Seed vigor index-II = G % at 30 DAS × Seedling dry wt

The data on various observations recorded during the course of investigation were statistically analyzed by the standard procedure given by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Effect of varieties

The results revealed that both the varieties of China aster were free from seed infestation after 6 months of storage in different packaging materials. However, among both varieties, Arka Archana (V1) recorded significantly higher seed viability (83.07 %), minimum electrical conductivity (123.03 dSm^{-1}), higher speed of germination (21.49), maximum germination at 7th and 14th day (61.59 % and 78.68 %, respectively) with minimum mean germination time (18.40 days) as compared to var Arka Kamini. Faster growth in terms of days required to reach 5th leaf stage (34.17) and strong seedling growth due to maximum root length (2.21 cm), shoot length (8.24 cm), seedling length (10.45 cm), seedling fresh weight (547.73 mg) and seedling dry weight (46.13 mg) at 45 days after seed sowing was recorded in var Arka Archana (V_1) as compared to var Arka Kamini (V_2). Moreover, significantly maximum seed vigor index- I (859.01) and seed vigor index- II (4022.07) was also noted in var. Arka Archana (V_1) over var. Arka Kamini (V_2) (Tables 1–2).

Varieties of any crop has variation due to their genetic makeup which also affect the seed production and quality that influence internal physiological activities of seed. The differences noticed in storage potential are mainly due to genetic factor besides physico-chemical properties explained by Mongali (2018). These results are in agreement with the findings of Gowda and Nanjareddy (2008) in groundnut and Murungu (2011) in wheat.

Effect of packaging

The results revealed that seed infestation in both varieties of China aster in all packaging treatments

Table 1. Effect of varieties and packaging on different attributes of China aster seeds.

Treatments	Seed viability (%)	Electrical conductivity (dS/m)	Speed of germination	Germination % at 7th day	Germination % at 14th day	Mean germination time (days)	Days required to reach 5th leaf stage
			Varieties (V)				
V_1	83.07	123.03	21.49	61.59	78.68	18.40	34.17
V_2	69.73	131.71	16.82	45.62	73.97	19.67	37.20
SEm±	1.14	2.17	0.29	0.63	1.07	0.26	0.33
CD at 5%	3.37	6.41	0.85	1.86	3.15	0.77	0.98
			Packaging (P)				
P_1	82.67	120.05	19.37	52.57	78.85	18.33	34.73
P_2	81.33	142.33	17.42	47.78	74.43	19.67	38.03
P_3	85.00	119.73	21.69	60.77	81.72	17.33	31.67
P_4	87.00	102.75	23.99	71.62	85.20	16.33	28.63
P_5	46.00	151.98	13.29	35.28	61.43	23.50	45.37
SEm±	1.81	3.43	0.46	0.99	1.69	0.42	0.52
CD at 5%	5.33	10.13	1.35	2.93	4.98	1.22	1.55
			Interaction (V × P)				
V_1P_1	89.33	110.00	22.02	62.37	81.90	17.33	33.20
V_1P_2	88.67	149.84	21.19	61.33	80.10	20.00	35.87
V_1P_3	92.00	109.63	22.95	66.10	83.00	16.33	30.27
V_1P_4	92.67	94.93	25.17	72.57	86.63	15.33	27.73
V_1P_5	52.67	150.67	16.10	45.57	61.77	23.00	43.80
V_2P_1	76.00	130.10	16.72	42.77	75.80	19.33	36.27
V_2P_2	74.00	134.73	13.66	34.23	68.77	19.33	40.20
V_2P_3	78.00	129.83	20.43	55.43	80.43	18.33	33.07
V_2P_4	81.33	110.57	22.81	70.67	83.77	17.33	29.53
V_2P_5	39.33	153.30	10.48	25.00	61.10	24.00	46.93
SEm±	2.56	4.86	0.65	1.41	2.39	0.59	0.74
CD at 5 %	NS	14.32	1.91	4.15	NS	NS	NS

was nil after 6 months of storage. Seeds packed in P_4 i.e. vacuum packaging in plastic bags and stored under refrigerated condition resulted into significantly highest seed viability (87.00 %) (Table 1). This might be due to the beneficial influence of moisture impervious containers for maintaining viability of seeds for longer period by slow deterioration of seed possibly due to lesser fluctuation of moisture content (Rashmi 2013). Similar results were reported by Rashmi (2013) in cosmos.

The results revealed that seeds packed in vacuum packaging in plastic bags stored at refrigerated condition (P_4) resulted in significantly lower electrical conductivity (102.75 dSm^{-1}) (Table 1). The minimum electrical conductivity might be due to the moisture impervious containers maintained membrane integrity of cellular structures in the seed. These results are in agreement with Rashmi (2013) in cosmos and Mongali (2018) in *Bt* and non-*Bt* cotton.

Significantly maximum germination percentage at 7th and 14th day (71.62 and 85.20 respectively) was obtained in China aster seeds stored in vacuum packed plastic bags kept under refrigerated condition (Table 1). This could be due to seeds packed in impervious packaging which were unlikely to absorb moisture and oxygen from the atmosphere due to property of film used for packaging and maintained lower moisture and oxygen (Sultana *et al.* 2016).

Table 2. Effect of varieties and packaging on different attributes of China aster seedlings.

Treatments	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Seedling fresh weight (mg)	Seedling dry weight (mg)	Seed vigor index-I	Seed vigor index-II
			Varieties (V)				
V_1	2.21	8.24	10.45	547.73	46.13	859.01	4022.07
V_2	1.89	7.61	9.50	447.73	39.33	750.35	3317.03
SEm±	0.01	0.07	0.07	8.09	0.24	6.59	25.59
CD at 5%	0.04	0.21	0.20	23.88	0.71	19.45	75.49
			Packaging (P)				
P_1	1.93	8.61	10.54	468.33	49.33	864.67	4202.16
P_2	1.66	7.29	8.95	436.00	39.00	696.53	3258.73
P_3	2.46	8.67	11.12	518.33	50.33	943.00	4451.60
P_4	2.94	8.84	11.79	758.33	59.00	1039.00	5365.01
P_5	1.28	6.22	7.49	307.67	16.00	480.20	1070.26
SEm±	0.02	0.11	0.11	12.80	0.38	10.43	40.46
CD at 5%	0.06	0.32	0.32	37.75	1.12	30.75	119.36
			Interaction (V × P)				
V_1P_1	2.19	8.98	11.17	530.00	55.33	947.93	4852.10
V_1P_2	1.95	7.58	9.53	468.67	40.00	791.95	3443.48
V_1P_3	2.67	9.05	11.71	560.00	56.67	1007.22	5020.30
V_1P_4	2.97	9.16	12.13	833.33	60.00	1052.48	5544.07
V_1P_5	1.30	6.43	7.73	346.67	18.67	495.45	1250.43
V_2P_1	1.67	8.24	9.92	406.67	43.33	781.42	3552.22
V_2P_2	1.37	7.00	8.38	403.33	38.00	601.10	3073.98
V_2P_3	2.25	8.28	10.53	476.67	44.00	878.77	3882.91
V_2P_4	2.91	8.53	11.44	683.33	58.00	1025.52	5185.95
V_2P_5	1.25	6.00	7.25	268.67	13.33	464.95	890.092
SEm±	0.03	0.16	0.15	18.10	0.54	14.74	57.22
CD at 5%	0.08	NS	NS	NS	1.59	43.49	168.80

The retention of high germination might be due to low moisture levels, which resulted reduced rate of respiration. Similar results were reported by Nataraj and Jayaramegowda (2017) in vegetable soybean.

Vacuum packed seeds in plastic bags and stored at refrigerated condition (P_4) resulted significantly highest speed of germination (23.99) with minimum mean germination time (16.33 days) and days required to reach 5th leaf stage (28.63) as compared to other treatments (Table 1). This improvement in speed of germination in less time and faster seedling growth might be because plastic bag is vapor proof which do not allow interference of outside moisture. Parallel findings were recorded by Vinayakrao (2012) in sunflower and Sultana *et al.* (2016) in *boro* rice.

With respect to growth of seedling, significantly maximum root length (2.94 cm), shoot length (8.84 cm) and seedling length (11.79 cm) were obtained from seeds packed in vacuum packaging in plastic bags at refrigerated condition (P_4) (Table 2). This improvement might be due to lesser moisture fluctuation leads to slow deterioration in the seeds stored in moisture impervious containers.

When looking to the results of seedling weight, significantly maximum fresh weight (758.33 mg), dry weight (59.00 mg) of seedling, seed vigor index-I (1039.00) and seed vigor index-II (5365.01) were obtained from seeds packed in vacuum packaging in plastic bags stored at refrigerated condition (P_4) (Table 2).

These results are dependent on germination percentage, seedling length and seedling fresh as well as dry weight which was found best in same treatment. This might be because of fresh weight and dry weight is directly influenced by growth of seedlings which are positively correlated with seedling length (Rashmi 2013). The result was in agreement with Vinayakrao (2012) in sunflower and Rashmi (2013) in cosmos.

Interaction effect

There was no seed infestation in both varieties of China aster after 6 months of storage in all packaging materials. Maximum seed viability percentage (92.67), speed of germination (25.17), germination percentage at 7th day (72.57) and 14th day (86.63), root length (2.97 cm), shoot length (9.16 cm), seedling length (12.13 cm), seedling fresh weight (833.33 mg), seedling dry weight (60.00 mg), seed vigor index - I (1052.48) and seed vigor index - II (5544.07) whereas, minimum electrical conductivity (94.93 dSm^{-1}), mean germination time (15.33 days) and days required to reach the 5th leaf stage (27.73) were noticed in seeds of Arka Archana after 6 months of storage that packed in vacuum packaging of plastic bags which kept at refrigerated condition (V_1P_4) (Tables 1– 2). These might be due to cumulative effect of differences exist among varieties because of their genetic makeup and prevailing environment conditions for seed production along with lower temperature helps to slow down metabolic process and movement of moisture is blocked due to packaging resulted into maintenance of seeds quality during storage in terms of seed viability, germination percentage, faster and strong growth of seedlings. The above findings are in close conformity with Murungu (2011) in wheat.

CONCLUSION

It can be concluded from the present study that packaging and storage are very helpful for maintaining seed quality, improve germination and vigor in both the varieties of China aster viz., Arka Archana and Arka Kamini and revealed that maximum seed viability percentage, speed of germination, germination percentage at 7th and 14th day, root length, shoot length, seedling length, fresh weight and dry weight of seedling, seed vigor index-I and seed vigor index-II whereas, minimum electrical conductivity, mean germination time and days required to reach the 5th leaf stage were noticed in seeds of var., Arka Archana after 6 months of storage in vacuum packed plastic bags and kept at refrigerated condition.

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