

Seed quality deterioration of some winter flowers during storage

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ABSTRACT

India has immense potential for generating gainful employment among small and marginal farmer. In the recent years it has emerged as a profitable agri-business in India and worldwide as improved standards of living and growing consciousness among the citizens across the globe to live in environment friendly atmosphere has led to an increase in the demand of floriculture products in the developed as well as in the developing countries worldwide. Production of flower seeds is one type of preservation of germplasm. Seed propagated genotypes are maintained by keeping selected amount of seeds for next season or next year. Flowering annuals have become very popular because they can be grown conveniently from seeds. With the above consideration, the present investigation has been undertaken to evaluate of ten flower crops such as Candytuft, Flox, Dimorphotheca, Saponaria, Dianthus, Cornflower, Annual chrysanthemum, Scorodinum, Lupin and Poppy and document their storability during 2014-2015 at Seed testing laboratory, BCKV, West Bengal, India. Immediately after harvesting among the winter annuals Cornflower was highest germination percentage (90%) and no germination was found in annual Chrysanthemum and poppy. After viability test it can be confirmed that Chrysanthemum and poppy have the dormancy. Both Annual Chrysanthemum and Poppy dormancy period is two months, confirmed it after TZ test. Five months after harvesting highest germination percentage was found in cornflower (72.667), lowest was found in Saponaria and Lupin (64.667). The significant variation among the flower crops for the trait germination percentage. Highest pool germination percentage over season was found in cornflower (81.883) and lowest was found in annual chrysanthemum (46.722). Highest pooled vigour index over season was recorded in acroclonium (659.046) and lowest was found in poppy (222.558). According to seed standard of flower crops the minimum germination percentage is 60%. From the experiment it has been observed that all the ten winter annuals have germination percentage maintained 60% up to five months of storing (i.e next sowing season) in desiccators.

Keywords : Germination, storability, vigour and winter flower

India has a long tradition of floriculture and flowers are associated with mankind from dawn of civilization. References to flowers are found in most of our ancient classic literature, like the Vedas, Ramayana, Mahabharata, etc. depiction of flowers in ancient painting, murals coins, etc was common. All this gives idea of the close association of floriculture with our life and culture. Flowers are used for various purposes in our day to day life like worshipping, religious and social function, wedding, interior decoration. In spite of this long close association of floriculture records of commercial activity related to this area is limited. In India, Floriculture industry comprises flower trade, production of nursery plants and potted plants, seed and bulb production, micro propagation and extraction of essential oils. Though the annual domestic demand for the flowers is growing at a rate of over 25% and international demand at around Rs 90,000 crore, India's share in international market of flowers is negligible Chawla, K. S. (2004). However, India is having a better scope in the future as there is a shift in trend towards tropical flowers and this can be gainfully exploited by country like India with high amount of diversity in indigenous flora. Most of winter annuals have been introduced by British in India. These annuals are able to tolerate comparatively low temperature and hence,

are comfortably grown in winter season and bloom best during this season. Flowering annuals are much in demand all over the world for beautifying our landscape.

Finally, in the context of the flower seed production, there is a great scope to produce in Indian condition Kumari *et. al.* (2016). Most of the flower seeds come from outside India. So the flower seeds are very costly and it is not easy access to the farmers. They would not get all the flower seeds from his near market. Even the farmer does not know the preservation procedure of flower seed. Keeping the above view, the present investigation was undertaken with ten winter flower and observed their storability.

MATERIALS AND METHODS

The experiment was carried out to elucidate the effect of germination and vigour of ten winter annuals such as Candytuft, Flox, Dimorphotheca, Saponaria, Dianthus, Cornflower, Annual Chrysanthemum, Scorodinum, Lupin and Poppy at Seed testing laboratory, BCKV, West Bengal during 2014-2015. Seeds of all the winter annuals were kept in brown paper at desiccator and the seed were tested at one month interval. Observations were recorded on germination%, root length (cm), shoot length (cm), seedling length (cm) and vigour (by Abdul-Baki and Anderson, 1973) of ten

flowers at just after storage and one month after interval and it continue upto five month storage.

RESULTS AND DISCUSSION

Performances of ten winter annuals for various characters are presented in Table-1 to 7. Significant variation in vigour index as well as other characters was noticed among the crops. With respect to germination, there was significance variation among the crops. However immediately after harvest the maximum germination was noted in annuals Cornflower (90%) but minimum germination were noted in Annual Chrysanthemum and poppy(0%). After viability test it can be confirmed that Chrysanthemum and poppy have the dormancy. The flower crops showed highly significant variation for this trait.

In case of root length (cm) highest value was found in Cornflower (6.133 cm) followed by Acroclonium and lowest in Chrysanthemum as well as poppy as they were dormant. The highest shoot length (4.633 cm), seedling length (10.623) and vigour index (871.227) was found in Acroclonium. Lowest value of shoot length (0), seedling length (0) and vigour index (0) was recorded in Annual Chrysanthemum and poppy as both flower crops remain dormant. Significant differences among the flower crops exists for the shoot length, seedling length and vigour index.

After one month of harvesting, of all the parameters i.e., germination percentage (88), root length (7.163 cm), shoot length (4.483 cm), seedling length (11.643 cm) and Vigour index (1015.383) was highest in Cornflower. Germination percentage (0), root length (0), shoot length (0), seedling length (0) and vigour index (0) was recorded in Annual Chrysanthemum as well as Poppy. This was due to the fact that Annual Chrysanthemum and Poppy were still dormant after one month of harvesting. The significant variation was recorded between the flower crops of all the parameters i.e., germination percentage, root length, shoot length, seedling length and vigour index.

After two months of harvesting germination percentage was highest in Poppy (82.667) and lowest in Saponaria (67). The significant variation among the flower crops for the trait germination percentage. Root length was highest in Annual Chrysanthemum (7.233 cm) lowest in Candytuft (2.013 cm). The significant variation among the flower crops for the trait root length. Shoot length was highest in Candytuft (4.077 cm) and lowest in Poppy (1.083 cm). The flower crops showed significant variation for shoot length. Seedling length was recorded highest in Annual Chrysanthemum (10.053 cm) and lowest in Lupin (3.473 cm). In case of seedling length significant variation was recorded among the

flower crops. Vigour index was recorded highest in Annual Chrysanthemum (750.18) and lowest in Lupin (256.72). Here also significant variation was found between flower crops.

After three months of harvesting highest germination percentage was found in poppy (80) lowest in Saponaria (65.667). The significant variation among the flower crops for the trait germination percentage. Highest root length was found in Annual Chrysanthemum (6.96 cm) lowest in Dimorphotheca (1.95 cm). The significant variation among the flower crops for the trait root length. Highest shoot length was recorded in Acroclonium (3.34 cm) whereas lowest shoot length was recorded in Lupin (1.05 cm). The flower crops showed significant variation for shoot length. Highest seedling length was recorded in Annual Chrysanthemum (9.653 cm) lowest seedling length was recorded in Lupin (3.183 cm). In case of seedling length significant variation was recorded among the flower crops. Highest vigour (724.35) was recorded in Annual Chrysanthemum lowest was found in Dimorphotheca (216.423). Significant variation was recorded in vigour index among the flower crops.

Fourth month after harvesting highest germination percentage was found in Cornflower (76.667), lowest was found in Saponaria (65). The significant variation among the flower crops for the trait germination percentage. Highest root length was found in Annual Chrysanthemum (6.52 cm) and lowest in Dimorphotheca (1.82 cm). The significant variation among the flower crops for the trait root length. Highest shoot length was recorded in candytuft (3.77 cm), whereas lowest shoot length was recorded in Lupin (0.86 cm). The flower crops showed significant variation for shoot length. Highest seedling length was recorded in Annual Chrysanthemum (9.047 cm) lowest seedling length was recorded in Dimorphotheca (2.873 cm). In case of seedling length significant variation was recorded among the flower crops. Highest vigour index was recorded in Annual Chrysanthemum (611.5) lowest was found in Dimorphotheca (191.957). Significant variation was recorded in vigour index among the flower crops.

Five month after harvesting highest germination percentage was found in Cornflower (72.667), lowest was found in Saponaria and Lupin (64.667). The significant variation among the flower crops for the trait germination percentage. Highest root length (6.35 cm) was found in Annual Chrysanthemum lowest in Dimorphotheca (1.783 cm). The significant variation among the flower crops for the trait root length. Highest shoot length was recorded in Candytuft (3.687 cm), whereas lowest shoot length was recorded in Lupin (0.823). The flower crops showed significant variation for shoot length. Highest seedling length was recorded

Table 1: Mean values of germination, root length, shoot length, seedling length and vigour index of winter annuals at immediately after harvesting.

Sl no.	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	76.333	2.393	3.710	6.097	465.300
2	Phlox	79.333	3.793	2.250	6.040	481.600
3	Dimorphotheca	71.667	4.300	3.277	7.577	542.683
4	Saponaria	71.333	3.787	3.500	7.287	519.553
5	Dianthus	85.000	4.730	3.710	8.437	717.097
6	Cornflower	90.000	6.133	3.833	9.967	865.490
7	Annual chrysanthemum	0.000	0.000	0.000	0.000	0.000
8	Acroclonium	82.000	5.990	4.633	10.623	871.227
9	Lupin	77.667	3.220	1.960	5.177	424.063
10	Poppy	0.000	0.000	0.000	0.000	0.000
SEm (±)		0.89	0.890	0.220	0.210	0.370
LSD (0.05)		2.63**	2.63**	0.66**	0.61**	1.10**

Note: **means significant at 1% level

Table 2: Mean values of germination, root length, shoot length, seedling length and vigour index of winter annuals at 1 month after harvesting.

Sl no.	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	74.333	2.400	4.353	6.753	500.050
2	Phlox	77.667	4.240	2.527	6.770	533.943
3	Dimorphotheca	69.000	3.137	2.903	6.040	406.753
4	Saponaria	69.000	3.213	2.900	6.147	424.190
5	Dianthus	81.333	3.613	2.773	6.387	510.667
6	Cornflower	88.000	7.163	4.483	11.643	1015.383
7	Annual chrysanthemum	0.000	0.000	0.000	0.000	0.000
8	Acroclonium	80.667	5.660	4.067	9.727	784.293
9	Lupin	76.000	2.307	1.367	3.670	295.747
10	Poppy	0.000	0.000	0.000	0.000	0.000
SEm (±)		1.04	1.040	0.310	0.240	0.520
LSD (0.05)		3.08**	3.08**	0.92**	0.71**	1.54**

Note: **means significant at 1% level

Table 3: Mean values of germination, root length, shoot length, seedling length and vigour index of winter annuals at 2 months after harvesting.

Sl no.	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	72.000	2.013	4.077	6.090	424.793
2	Phlox	73.333	3.517	2.110	5.630	401.187
3	Dimorphotheca	68.333	2.320	1.743	4.063	276.530
4	Saponaria	67.000	2.720	2.567	5.287	354.193
5	Dianthus	79.333	4.067	3.017	7.083	560.683
6	Cornflower	84.000	3.577	3.087	6.660	743.687
7	Annual chrysanthemum	74.667	7.233	2.823	10.053	750.180
8	Acroclonium	79.000	4.687	3.833	8.520	672.240
9	Lupin	74.000	2.253	1.220	3.473	256.720
10	Poppy	82.667	3.310	1.083	4.400	363.613
SEm (±)		1.21	1.210	0.270	0.230	0.450
LSD (0.05)		3.60**	3.60**	0.80**	0.69**	1.34**

Note: **means significant at 1% level

Table 4: Mean values of germination, root length, shoot length, seedling length and vigour index of winter annuals at 3 months after harvesting.

Sl no	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	69.000	2.743	3.123	5.867	405.860
2	Phlox	70.667	4.150	2.147	6.297	448.870
3	Dimorphotheca	67.667	1.950	1.277	3.230	216.420
4	Saponaria	65.667	2.260	1.680	3.940	258.590
5	Dianthus	75.000	3.753	2.707	6.460	487.380
6	Cornflower	79.667	3.133	2.147	5.277	417.480
7	Annual chrysanthemum	71.000	6.960	2.700	9.653	724.350
8	Acroclonium	76.667	4.153	3.340	7.493	574.410
9	Lupin	70.667	2.133	1.050	3.183	224.850
10	Poppy	80.000	2.907	1.533	4.440	354.500
	SEm (\pm)	1.03	1.030	0.440	0.330	0.540
	LSD (0.05)	3.05**	3.05**	1.29**	0.97**	1.62**

Note: **means significant at 1% level

Table 5: Mean values of germination, root length, shoot length, seedling length and vigour index of winter annuals at 4 months after harvesting.

Sl no	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	67.000	1.947	3.770	5.717	383.500
2	Phlox	67.670	3.560	2.160	5.720	390.000
3	Dimorphotheca	67.000	1.820	1.050	2.870	191.957
4	Saponaria	65.000	2.100	1.690	3.797	246.923
5	Dianthus	70.330	3.367	2.570	5.943	417.467
6	Cornflower	76.670	2.943	2.020	4.967	378.550
7	Annual chrysanthemum	68.000	6.520	2.527	9.047	611.500
8	Acroclonium	74.000	4.000	3.200	7.200	533.467
9	Lupin	66.000	2.030	0.860	2.897	212.577
10	Poppy	76.000	2.803	1.413	4.217	320.167
	SEm (\pm)	0.92	0.920	0.310	0.240	0.460
	LSD (0.05)	2.74**	2.74**	0.91**	0.70**	1.37**

Note: **means significant at 1% level

Table 6: Mean values of germination, root length, shoot length, seedling length and vigour index of winter annuals at 5 months after harvesting.

Sl no	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	66.000	1.797	3.687	5.483	362.527
2	Phlox	65.333	3.963	2.220	6.183	403.933
3	Dimorphotheca	65.333	1.783	0.977	2.760	179.050
4	Saponaria	64.667	1.787	0.953	2.653	177.350
5	Dianthus	66.667	3.123	2.517	5.640	376.000
6	Cornflower	72.667	2.817	2.047	4.867	350.877
7	Annual chrysanthemum	66.667	6.350	2.487	8.837	585.793
8	Acroclonium	71.667	3.867	3.097	7.230	518.633
9	Lupin	64.667	2.070	0.823	2.897	187.283
10	Poppy	72.000	2.680	1.477	4.157	297.067
	SEm (\pm)	0.95	0.950	0.230	0.280	0.410
	LSD (0.05)	2.81**	2.81**	0.69**	0.82**	1.23**

Note: **means significant at 1% level

Table 7: Pooled values of germination, root length, shoot length, seedling length and vigour index of winter annuals at 5 months after harvesting.

Sl no	Name of winter annuals	Germination (%)	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Vigour Index
1	Candytuft	70.778	2.216	3.787	6.001	423.673
2	Phlox	72.333	3.871	2.236	6.107	443.256
3	Dimorphotheca	68.167	2.552	1.872	4.424	302.233
4	Saponaria	67.111	2.644	2.216	4.852	330.134
5	Dianthus	76.278	3.776	2.883	6.658	511.550
6	Cornflower	81.833	4.294	2.936	7.230	628.578
7	Annual chrysanthemum	46.722	4.511	1.756	6.265	445.304
8	Acroclonium	77.333	4.726	3.695	8.466	659.046
9	Lupin	71.500	2.336	1.213	3.549	266.873
10	Poppy	51.778	1.950	0.918	2.869	222.558
SEm (±) A		1.410	0.480	0.420	0.630	42.230
SEm (±) LA		1.980	0.760	0.680	0.960	76.720
LSD (0.05) L		0.41**	0.12**	0.10**	0.19**	17.09**
LSD (0.05) LA		1.01**	0.30**	0.26**	0.46**	41.87**

Note: **means significant at 1% level

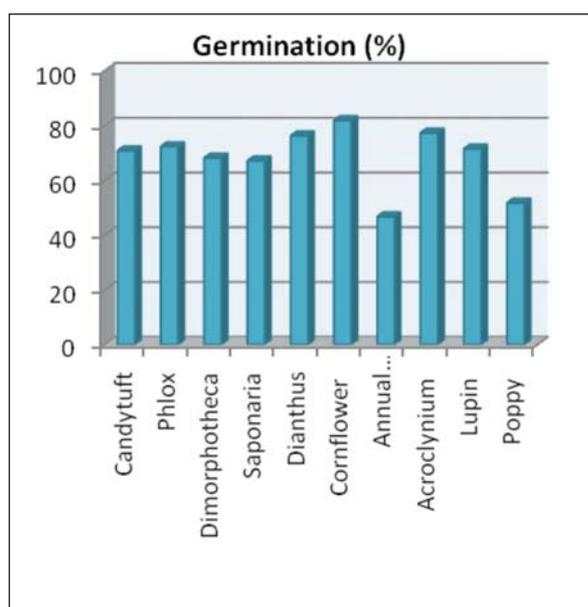


Fig.1: Graphical representation of Pooled values of germination% at one month interval of germination with progress in storage

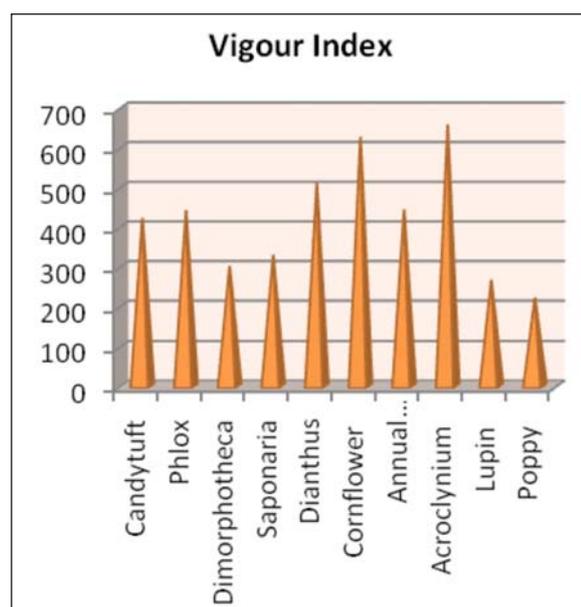


Fig.2: Graphical representation of Pooled values of vigour index at one month interval of vigour index with progress in storage

in Annual Chrysanthemum (8.837 cm) lowest seedling length was recorded in Saponaria (2.653 cm). In case of seedling length significant variation was recorded among the flower crops. Highest vigour index was recorded in Annual Chrysanthemum (585.793) lowest was found in Saponaria(177.35). Significant variation was recorded in vigour index among the flower crops.

Highest pool germination percentage over season was found in Cornflower (81.883) and lowest was found in annual Chrysanthemum (46.722). The significant variation among the flower crops for the trait pool germination percentage over season. Highest pooled root length over season (4.726 cm) was found in Acroclonium

lowest in poppy (1.95). The significant variation among the flower crops for the trait pooled root length over season. Highest pooled shoot length over season was recorded in Candytuft (3.787 cm), whereas lowest shoot length was recorded in Poppy (0.918 cm). The flower crops showed significant variation for pooled shoot length over season. Highest pooled seedling length over season was recorded in Acroclonium (8.466 cm) and lowest in poppy (2.869 cm). In case of pooled shoot length over season significant variation was recorded among the flower crops. Highest pooled vigour index over season was recorded in Acroclonium (659.046) and lowest was found in Poppy (222.558). Significant variation was recorded in pooled vigour index over season among the flower crops.

Among the ten winter annuals, most of them had the better performance for most of the phenotypic traits. Regarding germination highest pooled germination percentage over season was found in Cornflower (81.883) and lowest was found in Annual Chrysanthemum (46.722). Annual Chrysanthemum showed low pooled germination percentage due to the dormancy. Highest pooled vigour index over season was

recorded in Acroclonium (659.046) lowest was found in poppy (222.558). Significant variation was recorded in pooled vigour index over season among the flower crops.

According to seed standard of flower crops the minimum germination percentage is 60%. From the experiment it has been observed that all the ten winter flowers have germination percentage maintained 60% up to five months of storing (i.e next sowing season) in desiccators. Hence it can be concluded that flower seed can be store at desiccators in Gangetic Alluvial zone.

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