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Seed Packaging and Priming in Ornamental Plants

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ABSTRACT

With the development of floriculture industry in India, the area under flower crops is increasing year by year and requirement of high quality flower seeds has become the basic need of the growers for flower production to reach the market demand. Although the demand for flower seeds fluctuates very often and there may be a large surplus of seeds which need to be stored for the subsequent 2-3 sowing seasons with good quality and viability. Adequate plant population and density largely depends on better seed germination and higher seedling vigour. The seeds undergo deterioration or ageing at various stages of seed distribution. Seed deterioration targets physiological quality, vigour and viability, mainly by damaging the seed membrane. Flower production is often hampered by the availability of poor quality of seeds, which is mostly connected with unfavorable weather conditions during seed development and maturation. Seed germination and growth of seedling is also found poor in this crop. Hence, it is confirmed that an urgent need to employ some special techniques like packaging and priming for improving the inherent seed qualities of China aster especially in germination attributes and production of healthy and stocky seedling.

Keywords Seed packaging, Ornamental plants, Vigour, Viability, Physiological quality.

INTRODUCTION

Flowers are inseparable from the social fabric of human life. Flowers being adorable creation of God, befits all occasions, be it at birth, marriage or death. In the past, flowers were not of much economic importance. One would grow flowers to fulfill his or her aesthetic desire. At times, flowers were offered for sale to meet the special requirements of people. Today, flower plants are no longer meant for only window garden but play an important role in the decoration of the living houses and office establishments (Sudhagar 2013).

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 basically under genetic control and it differs with species and cultivars. It is also influenced by number of other environmental

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factors. Generally, seeds stored in sealed moisture impervious containers can be stored for longer period as compared to those stored in moisture pervious containers as they act as effective barriers against seed moisture fluctuation.

Every year mankind awaits for the miraculous transformation of seeds into plants and again into seeds. Crop growers have always faced problems associated with seeds like more time taken for germination, poor seed germination, adverse weather conditions, seed dormancy, less germination percentage which further leads to yield loss (Bose *et al.* 2018). From last two decades several seed enhancement techniques are implemented to enrich the seed quality, which includes priming, steeping, pregermination, hardening and pelleting. Among the different seed enhancement techniques seed priming is most commonly used at farmers field. The purpose of seed priming is to minimize the period of emergence and to protect seeds from environmental stresses during critical phase of seedling establishment, to synchronise emergence which leads to uniform establishment and improved yield (Sisodia *et al.* 2018). Here an attempt is made to find out the influence of storage in different packaging materials and priming on different ornamental plants in the form of review of previous research.

Seed packaging

Rashmi (2013) studied seed production and seed storage in cosmos (*Cosmos sulphureus*) and stated that seeds stored in moisture impervious containers like aluminum foil and polythene bags maintained seed viability and vigour for longer period compared to those stored in moisture pervious containers like cloth bag. It is mainly attributed to lesser moisture fluctuation in the seeds stored in moisture impervious containers.

Mattos *et al.* (2018) studied storage of chia (*Salvia hispanica* L.) seeds under different environmental conditions with various packages and found that chia seeds can be stored in a cold and dry chamber, in plastic, glass or paper containers for 12 months without hindering seeds physiological quality.

Seed priming

Seed priming is an age-old and simple but effective technique to enhanced germination percentage and speed to achieve uniform plant stand and better yield in a wide range of environmental condition. Seed priming techniques commonly include several categories based on the choice of priming substances i.e., hydropriming, hormonal priming, osmopriming, chemopriming, solid matrix priming, nutripriming, thermopriming and biopriming.

Hydropriming

Ramzan *et al.* (2010) used various concentration of KNO_3 (1, 2, 3, 4 and 5 %), distilled water and control as treatments in gladiolus seeds. The results revealed that the best germination rate, minimum time required for 50% germination, shortest mean germination rate, maximum bulb weight and diameter were obtained with distilled water primed seeds as compared to KNO_3.

Szopinska and Wojtaszek (2011) studied the germination of seven samples of naturally infected zinnia (*Zinnia elegance*) seeds with fungi. The seeds were hydroprimed and it was observed that priming treatment significantly improved germination capacity of fungi infected seeds at first and second count as well as reduction was noted in the percentage of diseased seedlings and dead seeds.

Dastanpoor *et al.* (2013) investigated the influence of hydropriming treatments on seed parameters of sage (*Salvia officinalis* L.) where seeds were treated with hydropriming at three different temperatures i.e.10, 20, 30^{o}C for 0, 12, 24 and 48 h. They reported the best result of germination was recorded in seeds hydroprimed at 30^{o}C for 24 h. and final germination percentage was increased by 25.5% as compared to control.

Mirlotfi *et al.* (2015) conducted experiment to investigate the effect of salinity and priming on seed germination and other plant traits of pot marigold (*Calendula officinalis*). They observed maximum germination by applying distilled water whereas lowest germination was recorded in seeds treated with manganese sulfate. Also, germination rate was promoted by priming treatments which resulted in better establishment with higher shoot and root dry material production in calendula seedlings.

Delac *et al.* (2018) stated that seeds of dalmatian pyrethrum treated with distilled water for 24 h. showed maximum germination (23.50 %), germination index (0.59) and mean germination rate (0.09) with minimized mean germination time (12.30 days).

Halopriming

Rauhi *et al*. (2010) suggested that application of 0.1% KNO_3 after performing stratification treatment could be the best treatment to break seed dormancy in water lilly seeds.

Mushtaq *et al.* (2012) stated that maximum germination percentage at 15 days (66.67) and 30 days (83.33) as well as germination test in growth room (80.00 %) was obtained by using lower concentrations of KNO_3 (0.25 %). While same treatment helped to reduce time taken for 50 % germination (7.08 days) and mean germination time (14.75 days) in gladiolus seeds.

Vimala and Pratap (2014) conducted experiment on China aster and reported that priming of seed with KNO_3 @ 0.5% gave best performance of the seed regarding all the physiological and biochemical parameters like germination percentage (45.50), minimum seed infestation rate (48.75 %) and electrical conductivity (1.2 dS/m) followed by hydro priming.

Ahmad *et al.* (2017) reported that seed priming with 50 mM $CaCl_2$ reduced mean germination time (8.91 days and 8.18 days) and time taken for 50 % germination (3.25 days and 1.95 days), enhanced final germination (84.00 % and 96.33 %) with maximum root length (2.00 cm and 7.76 cm), shoot length (1.53 cm and 5.67 cm), fresh weight of seedling (3.91 g and 5.56 g) and dry weight of seedling (1.15 g and 1.67 g) of gerbera and zinnia, respectively.

Osmopriming

Afzal *et al.* (2011) reported that priming with 2% mannitol gave maximum germination (94%), germination index (6.37), required minimum mean germination time (1.2 days) and time taken for 50% germination (1.60 days) with maximum shoot length (6.21 cm) and root length (6.21 cm) in African marigold. Similarly in French marigold, application of 2% mannitol was found best with respect to increased germination (91.00 %), germination index (6.28), shoot length (6.24 cm) and root length (5.91 cm) with minimum mean germination time (1.7 days) as well as time taken for 50 % germination (1.59 days). Moreover, seeds treated with 2 % Mannitol showed maximum α amylase, total sugar and reducing sugar in both species of marigold.

Dorna *et al.* (2014) studied the effect of hydropriming, osmopriming and haloprimingon germination of pansy seeds and found that osmopriming of seeds in polyethylene glycol (PEG) solution of -1.25 and -1.5 MPa osmotic potential at 15°C and in PEG solution of -1 MPa osmotic potential at 20°C gave maximum germination. Moreover, osmoprimed seeds, in all combination used, increased the percentage of germination significantly at 35°C whereas overall best result was observed when seeds were primed in PEG solution of -1.0 MPa osmotic potential at 20°C.

Among all treatments and cultivars of zinnia under study, Szopinska and Politycka (2016) observed that osmopriming (PEG at -1 MPa) was more effective method of improving germination at first count (67.8 %), germination at second count (88.0 %) and α-Amylase (54.7 µmol maltose 100 mg/h) with minimum abnormal diseased seedling (0.8), time to 50 % germination (19.00 days) and mean germination time (18.6 days) in cv Jowita.

Hormonal priming

Sedghi *et al.* (2010) studied the effect of different priming levels in *Calendula officinalis* under salinity condition. It was concluded that priming with GA_3 improved germination indices and seedling growth of *Calendula under* salinity stress. They also observed that this improvement was more at lower level of salinity while highest salinity levels adversely affected seed germination.

Sharma (2012) conducted an experiment on the effect of seed priming and planting date on growth and flowering of pansy and reported that priming with GA_3 @ 20 mg/l was most effective. However, seedlings grown from seeds primed with GA_3 @ 200 mg/l planted on 2nd November yielded maximum profits.

Zahedi *et al.* (2012) treated the seeds of sweet william (*Dianthus barbatus*) with different concentrations of GA_3 (50 and 100 ppm), KNO_3 (0.5 and 1%), KH_2PO_4 (1.0 and 2.5%) distilled water. They recorded highest length of seedling, fresh and dry weight of radicle as well as plumule with GA_3 @ 100 ppm.

Ramzan *et al.* (2014) studied that pre-planting exogenous application of gibberellic acid on sprouting, vegetative growth, flowering and subsequent bulb characteristics of 'Ad-Rem' tulip. They found that bulb treated with 100 mg/l GA_3 sprouted significantly in less number of days, exhibited higher sprouting percentage, taller plants with maximum leaf area, leaf chlorophyll, photosynthesis rate, flower stalk length, stalk diameter, fresh and dry flower stalk weight. Moreover, 100 mg/l GA_3 application also decreased overall flower emergence time, increased flower size, produced attractive, glowing and sturdy flowers with improved quality and extended vase life of 'Ad-Rem' tulip flowers up to 2.9 folds.

Karimi and Varyani (2016) revealed that treating calendula seeds with GA_3 at 100 mg/liter was found to be most effective in enhancing shoot length (4.15 cm) and root length (2.63 cm) while distilled water for 72 h. was found effective for minimal mean germination time (6.00 days). Moreover, maximum seed germination (97.00 %) and catalase activity (12 units/mg protein) were noted down in seeds treated with GA_3 at 100 ppm for 72 h., whereas highest seed vigour index (525.75) was obtained in seeds soaked in water for 24 h.

Shabnam Pangtu (2017) stated that seeds of China aster cv 'Kamini' treated with GA_3 (100 ppm) recorded maximum speed of germination (21.58), percent germination (86.33), root length (2.93 cm), shoot length (6.59 cm), seedling length (9.52 cm), seedling dry weight (248.30 mg), seed vigour index-I (822.19) and seed vigour index-II (21,436.62) with minimum days for seed germination (11.33) and days required to reach the 4-6 leaf stage (22.33).

Biopriming

Bhargava *et al.* (2015) stated that seeds treated with *T. harzianum* (1 × 105 cfu/ml) improved the germination percentage, number of leaves, shoot length and root length as compared to all pre-sowing seed treatments in snapdragon (*Antirrhinum majus*). Although, the positive effect of all priming treatments was also recorded on growth, flowering and seed attributes.

Thermopriming

James M. Garner, Allan M. Armitage (2008) reported rooted cuttings of Phlox paniculata L. 'Ice Cap' (summer phlox) forced under continuous HID lighting (400 mmols-1m-2) gives increased stem lengths (96.3 cm) and flowering stems per plant (13) as cooling (18°C night temperature) increased from zero to16 weeks than those forced under incandescent lamps.

Sysoeva *et al.* (2010) studied the effects of a pre-sowing seed treatment with a temperature drop (i.e., seed thermo-priming) on the growth and development of two popular bedding plant species, *Tagetespatula nana* L. (marigold) and *Viola Xwittrockiana* Gams. (pansy). A temperature drop from 22°C to 10 °C was applied for 2 h each day during seed germination, over the 6 days before sowing. This seed priming increased plant dry mass (734.5 mg and 113.9 mg) in both marigold and pansy respectively and increased flower numbers (19.80) in marigold, but not in pansy.

CONCLUSION

It can be concluded from above reviews that there is a huge gap between the number of seeds sown and availability of stocky seedlings in ornamental flower crops and several important tree species. Seed packaging as well as seed priming will help in reducing the risk of poor stand establishment under a wide range of environmental condition. It will also shorten the emergence time and protect the seeds from several biotic and abiotic factors during critical phase of seedling establishment leading to uniform stand and improve yield.

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