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EFFECT OF DIFFERENT PRIMING TREATMENTS ON QUALITY NURSERY PRODUCTION OF CHINA ASTER CVS 'POORNIMA' AND 'KAMINI'.

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ABSTRACT

The present investigation was carried out at Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan (H.P) on cvs 'Poornima' and 'Kamini' in nursery under open field conditions in randomized block design (factorial) comprising eight seed priming treatments viz., control, hydropriming with water, priming with GA_3 (50, 100 and 150 ppm) and Biopriming with Trichoderma viride @ 1×10^4 cfu/ml, 1×10^5 cfu/mland 1×10^6 cfu/ml. The findings revealed that maximum speed of germination (18.97, 21.58), germination percentage (83.17, 86.33 %), root length (2.87, 2.93 cm), shoot length (6.39, 6.59 cm), seedling length (9.26, 9.52 cm),seedling dry weight (227.67, 248.30 mg), seed vigour index-I (769.89, 822.19), seed vigour index-II (18,934.33, 21,436.62); minimum time taken to seed germination (12.72, 11.33 days) and days required to reach 4-6 leaf stage (23.70, 22.33 days) were recorded with the priming treatment GA_3 (100 ppm) in both cultivars 'Poornima' and 'Kamini', respectively. Hence, it is concluded that seeds of cv. 'Kamini' treated with GA_3 (100 ppm) for 24 hrs obtained the best results for most of the desirable for the quality nursery production of the China aster.

Keywords: Priming; quality; China aster; Poornima; Kamini; Nursery.

INTRODUCTION

China aster (*Callistephus chinensis* (L.) Nees) is an important commercial flower annual which belongs to the family Asteraceae and native to China and Europe. It was first named by Linnaeus as *Aster chinensis* and Nees changed this name to *Callistephus chinensis* (Janakiram,2006).Commercially it is being grown in different parts of the world in open conditions as cut flower, loose flower, bedding plant and potted plant. China aster is gaining fast popularity in India because of its easy cultural practices, diversity of colours and varied uses.With the development of floriculture industry in India, the area under flower crops is increasing year after year and requirement of high quality flower seeds has become the basic need of the growers for flower production to cater the market demand. Flower production of China aster is often hampered by the availability of poor quality of seeds, which is mostly connected with unfavourable weather conditions during seed development and maturation (Yu-jie *et al*., 2009). Therefore, there is an urgent need to employ some special techniques for improving the inherent seed qualities of China aster especially for improving germination attributes and production of healthy and stocky seedlings.One such method of improvising the seed quality is seed priming i.e. controlled hydration followed by redrying that helps to reduce germination time, harmonize germination, improves seed germination rate and quality of seedlings for the better crop establishment in many crops (Varier *et al*., 2010). Seed priming has presented surprise results for flower crops like pansy, marigold, gladiolus and China aster many other crop seeds like field crops, vegetables and grasses Improved seed priming techniques are used to reduce emergence time, accomplish uniform emergence, better allometric attributes and requisite stand in many horticultural and field crops. The purpose of priming in China aster is to increase germination percentage, decrease mean germination time and improving growth and vigour of seedling at very wide favourable and unfavourable environmental conditions, as some of the

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cultivars are showing poor seed germination. The present investigation were undertaken to study the influence of seed priming on quality nursery production of China aster.

MATERIALS AND METHODS

The present investigation were carried out at the research farm of the Department of Floriculture and Landscape Architecture, Dr YS Parmer, University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. To undertake the study of nursery raising, the primed seeds along with non primed seeds were sown in the raised beds in the month of Julyunder open field conditions. For nursery bed preparation, soil was dug up to a depth of 30 cm and well rotten FYM (farm yard manure) at the rate of 5 kg/m^2 was added and mixed well. Raised nursery beds about 6 inch from ground and 2 m × 3 m (Length x Breadth)were prepared. In nursery beds the treatments were arranged in a Randomized BlockedDesign (factorial) having eight treatments with three replications each containing 200 seeds. Seeds were sown in rows about 5 cm apart. After placing seeds in rows, these were covered with a fine layer of sieved farm yard manure (FYM). Irrigation of nursery bed was done with the help of wateringcan having fine rose. Nursery bed was then covered with polyethylene sheet. This polyethylene sheet was removed as soon as seeds start germinating. Seedlings of about four to six leaf stage were used for transplanting.

Seed priming treatments

The priming agents required for various seed priming treatments were obtained from the Departmental laboratory and accordingly the desired concentrations were prepared using distilled water as per the details given below:

Non-primed seeds (control) : Seeds were kept untreated.

Hydropriming of seeds: For hydro-priming 200 seeds were kept in 9 cm petri dish on filter paper and moistened with 5ml distilled water. All the petri dishes were kept at 23°C in incubator for 24 hours. Then, the seeds were taken out and spread in a thin layer on blotting paper for drying under room conditions.

Priming of seeds with GA_3 : In order to prepare 50 ppm GA_3 solution, 50 mg of GA_3 powder was weighed with the help of digital electronic balance and dissolved in small amount of distilled water and final volume was made one litre by adding distilled water. Seeds (200 seeds) were kept in 9 cm petri dish on filter paper and moistened with 5ml of GA_3 (50 ppm) solution. All the petri dishes were kept at 23°C in incubator for 24 hours. Then, the seeds were taken out and spread in a thin layer on blotting paper for drying under room conditions. Similarly GA_3 (100 ppm) and GA_3 (150 ppm) solutions were prepared using 100 mg and 150 mg GA_3 powder in one litre of distilled water, respectively. Then the seeds were also treated in the same way as that of priming with GA_3 50 ppm.

Biopriming of seeds with *Trichoderma viride:* *Trichoderma viride* culture was procured from Department of Mycology and Plant Pathology, Nauni. Solan (H.P.). The population densitythat resulted in formation of 10^4 cfu/ml of fungal isolates were usedfor preparation of liquid formulation. 200 seedswere soaked in liquid culture of *Trichoderma* formulation in sterilized petri dishes. All the petri dishes were kept at 23°C in incubator for 24 hours. Then, the seeds were taken out andspread in a thin layer on blotting paperfor drying under room conditions.The formulation of *Trichoderma viride* @ 1×10^5 andcfu/ ml (P_7) and *Trichoderma viride* @ 1×10^6 cfu/ ml (P_8) were also prepared in a similar manner and the seeds were treated in the same manner as that of biopriming with *Trichoderma viride* @ 1×10^4 cfu/ ml.Under the experiment, effect of seed priming treatments on germination and seedling vigour of China aster under nursery conditions was observed.

RESULT and DISCUSSION

The data on quality nursery production of China aster as influenced by different priming treatments are given in Table 1.

Speed of germination: The effect of seed priming on speed of germination in both the cultivars 'Poornima' and 'Kamini', between the cultivars, higher speed of germination was noticed in cv. 'Kamini' as compared to cv. 'Poornima'. It may vary from cultivar to cultivar and such differences exist and may be attributed to their genetic makeup and environment conditions. Different seed priming treatments exhibited varied responses to speed of germination. Priming of seeds with P_4 (GA_3@ 100ppm) resulted in the highest speed of germination .The possible reason for getting enhanced speed of germination with GA_3(100ppm) might be ascribed to the fact that GA_3accelerated various metabolic reactions before germination. These findings are in conformity with the work of Kumar and Singh (2013) who observed the highest speed of germination in Bitter gourd seeds when treated with GA_3(100 ppm). However, minimum speed of germination recorded in non primed seeds might be ascribed to slow metabolic reactions in non primed seeds and consequently they took more time to enhance the process of germination.

Time taken to seed germination (days): During the studies, less time to seed germination was observed in cv. 'Kamini' over cv. 'Poornima'. It is obvious that the variation might be attributed to the genetic makeup of these

cultivars. Among seed priming treatments, less time taken to seed germination was observed with GA_3(100 ppm). GA_3 might have increased the á- amylase activity for breaking starch stored in seeds to alter the physiology of embryo and activated enzymes which accelerate various developmental processes (Basra *et al.,* 2005). These results are in close proximity with the studies of Montero *et al.* (1990), who observed the lesser time taken to germination of seeds with GA_3(100 ppm) in Antirrhinum. Also, Sharma . (2012) and Kaya *et al.* (2010) were of the same opinion that GA_3(100 ppm) primed seeds took lesser time for germination in Pea and Chickpea, respectively.

Percent germination (%): Maximum germination percentage was noticed in cv. 'Kamini' over cv. 'Poornima'. As, it may vary from cultivar to cultivar and such differences exist and being attributed due to their genetic makeup and environment conditions. Among different seed priming, treatments maximum germination was noticed in the seeds primed with GA_3 @ 100 ppm. The possible reason for getting maximum germination with GA_3 treatment might be due to the fact that during germination, GA_3 activated the enzymes that digested the endosperm carbohydrates rapidly and efficiently and reduced the mechanical restraints of endosperm thus, providing energy to start and sustain embryo growth. Similar findings were reported earlier by Montero *et al.* (1990) reporting maximum germination percentage in Antirrhinum seeds treated with GA_3 (100ppm). Kumar and Singh (2013) and Sharma (2012) were of same opinion while working on Bitter gourd and Pea, respectively.

Days required to reach 4- 6 leaf stage (days): The effect of seed priming on days required to reach 4- 6 leaf stagein both the cultivars. Seedlings of cv. 'Kamini' required less time to reach 4-6 leaf stage as compared to cv. 'Poornima'. The variation might be due to their genetic makeup and environment conditions. Among different seed priming treatments, less time to reach 4-6 leaf stage was recorded in seeds primed with GA_3(100 ppm). This might be ascribed to the fact that GA_3 primed seeds exhibited an early and uniform emergence. Pre-sowing hydration might have softened the seed coat that allowed the leakage of germination inhibitors in the seed and this might have contributed to the enhancement of seed germination and early transplanting of the seedlings (Harris, 1996). Similar findings were reported by Montero *et al.* (1990) in Antirrhinum, Kaya *et al*. (2010) in Chickpea also reported that GA_3 (100 ppm) significantly increase the early seed germination and following transplanting.

Root length (cm): Seedlings of cv. 'Kamini' produced maximum root length (cm) as compared to cv. 'Poornima'. The variation might be attributed to the genetic makeup of these cultivars.Among seed priming treatments, maximum root length was recorded in the seeds primed with GA_3 (100 ppm). The increased root length following priming with GA_3 might be due to the higher rate of cell division in the root and shoot tips incited by the application and these studies are in confirmation with the work of Montero *et al.* (1990) in Antirrhinum, Kaya *et al*. (2010) in Chickpea, Sharma (2012) in Pea and Kumar and Singh (2013) in Bitter gourd who also observed increasing root lengths with GA_3 (100 ppm) priming.

Shoot length (cm): Seedlings of cv. 'Kamini' resulted maximum shoot length (cm) as compared to cv. 'Poornima'. The variation might be attributed to the genetic makeup of these cultivars. Among priming treatments, maximum shoot length was recorded in the seeds primed with GA_3 (100 ppm). The increasing shoot length following priming with GA_3 might be due to the higher rate of cell division in the root and shoot tips incited by the application of GA_3 and these studies are in conformity with the work of Montero *et al.* (1990) in Antirrhinum, Kaya *et al*. (2010) in Chickpea, Siadat *et al.* (2012) in Maize, Sharma (2010) in Pea and Kumar and Singh (2013) in Bitter gourd who observed increased shoot length with GA_3 (100 ppm) priming.

Seedling length (cm): Seedling length was noticed to be more in cv. 'Kamini' over cv. 'Poornima'. It is quite obvious that such differences between the two cultivars may exist and can be attributed to their genetic makeup and environment conditions as well.Maximum seedling length observed when seeds were treated with GA_3 (100 ppm). This might be ascribed to the fact that this increase in root and shoot length of the seedlings could be positively be correlated with respect to an increase in seedling length. Similar findings were reported by Montero *et al.* (1990) in Antirrhinum, Kaya *et al.* (2010) in Chickpea, Sharma (2012) in Pea and Kumar and Singh (2013) in Bitter gourd who observed increase in seedling length with GA_3 (100 ppm) priming.

Seedling dry weight (mg): Seedling dry weight was noticed to be more in cv. 'Kamini' over cv. 'Poornima'. Such differences between the two cultivars may be attributed to their genetic makeup and environment conditions. Maximum seedling dry weight was observed in GA_3 (100 ppm) primed seeds. This might be ascribed to the fact that GA_3 is known to enhance the water uptake of the seedlings which might have activated the enzymes with an accompanying mobilization of reserve materials in the embryo and thus strongest seedlings were obtained as a result of better embryo growth. This increases the fresh weight of the seedlings which is positively correlated further with the increase in the dry weight of the seedlings. These studies got support from the earlier findings of

Muhammad and Rha (2007) who observed the maximum dry weight in Sugar beet seeds on priming with GA_3 (100 ppm).

Seed vigour index – I: Seed vigour index- I was noticed to be more in cv. 'Kamini' over cv. 'Poornima'. Such differences between the two cultivars may be attributed to their genetic makeup and environment conditions. Among priming treatments, highest vigour index-I was observed with GA_3 (100 ppm). It might be due to production of the longer seedlings. Similar findings were reported by Kumar and Singh (2013) while working with Bitter gourd.

Seed vigour index – II: Seed vigour index- II was noticed to be more in cv. 'Kamini' as compared to cv. 'Poornima'. Such differences may exist between the two cultivars being attributed to their genetic makeup and environment conditions. The treatment with GA_3 @ 100 ppm exhibited highest seed vigour index-II. It might be due to increased á-amylase activity for breaking the starch stored in seeds by growth regulators or salt solutions (Basra *et al.,* 2005). Priming caused *de novo* synthesis of á-amylase (Lee and Kim, 2000) increasing metabolic activities in seeds, which resulted in higher seed vigour. Similar findings were in close proximity to the studies of Muhammad and Rha (2007) who observed the maximum dry weight in Sugar beet seeds on priming with GA_3 @ 100 ppm.

CONCLUSION

The response of different priming treatments on quality nursery production revealed that GA3 @ 100 ppm improved the various nursery quality parameters of China aster cvs 'Poornima' and 'Kamini'.

AUTHORS' CONTRIBUTION

Conceptualization of research work and designing of experiments (SP, PS); Execution of field/lab experiments and data collection (SP,PS,PS); Analysis of data and interpretation (SP,PS, PS,SK); Preparation of manuscript (SP,PS,SK)

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