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Short Communication

EFFECTS OF DIFFERENT GROWTH REGULATORS ON SEED GERMINATION AND VIGOR OF POT MARIGOLD (*Calendula Officinalis*. L)

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ABSTRACT

Flowers are valued to mankind from the dawn of civilization. Flowers are used for various purposes in our day to day life like worshipping, religious and social functions, wedding, interior decoration, natural colours, dyes, scents and self adornment. *Calendula officinalis* is used as sudorific, blood refiner, blood sugar reducer and also use as anti-inflammatory skin. Seed testing is an essential step for evaluation of planting value of seeds, to minimize the risk of failure in planting low quality seeds. The importance of seed testing in agricultural crops has long been realized. Seed testing is also necessary to determine the need for drying and processing, to determine the quality standards under seed certification and seed law enforcement program, to identify seed quality problems and their probable causes and to provide basis for price fixation and consumer discrimination of seed lots etc.the 200ppm concentration of GA_3 shows the significant and positive effect on the various germination and seedling parameters under study shows that GA_3 is the best priming substance for the healthy and better germination in pot marigold.

Keywords: Germination, Vigour, Pot marigold, Growth hormone, GA_3

NTRODUCTION

Flowers are associated with mankind from the dawn of civilization. It is said that in India, man is born with flowers, lives with flowers and finally dies with flowers. Flowers are used for various purposes in our day to day life like worshipping, religious and social functions, wedding, interior decoration, natural colours, dyes, essential oils and self-adornment (Aroras, 2003). There is a great increase in demand of floriculture product with increasing income and globalization of economy.

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Production of flowers depends on the propagating material such as “Seed”. Good seed is, therefore, a basic requirement in seed production. The successful production of any crop depends on the quality of seeds sown. *Calendula officinalis*, known as “pot marigold”, is a plant of Asteraceae family. Pot Marigold is decorative and medicinal plant. It is used for many purposes such as Calendula tea, turkey calendula roll-ups, egg salad, with calendula and chive, morning sunshine muffins, calendula corn bread, flower salad, calendula rice, marigold custard, coconut calendula cake, calendula vinegar etc. Medicinally is used as sudorific, blood refiner, blood sugar reducer and also use as anti-inflammatory skin. Seed testing is an essential step for evaluation of planting value of seeds, to minimize the risk of failure in planting low quality seeds. The importance of seed testing in agricultural crops has long been realized. In Aromatic and medicinal plant species, seed testing is also necessary to determine the need for drying and processing, to determine the quality standards under seed certification and seed law enforcement program.

MATERIAL AND METHODS

The experiment was conducted in laboratory in the department of Seed Science and Technology, Chauras Campus HNB Garhwal University, Srinagar, Uttarakhand. The seeds were collected from Department of Horticulture H.N.B. Garhwal University, Srinagar (Garhwal). The experiment was lay out in a Randomized block design (RBD) and four replication with Thirteen treatment. The treatment concisted of T_1-Absolute control, T_2-GA_3-50 ppm, T_3-GA_3-100 ppm, T_4-GA_3-200 ppm, T_5-NAA-50 ppm, T_6-NAA-100 ppm, T_7- NAA-200 ppm, T_8- IAA-50 ppm, T_9- IAA-100 ppm. T_{10}- IAA-200 ppm. T_{11}- 6BAP-50 ppm. T_{12}- 6BAP-100 ppm. T_{13}- 6BAP-200 ppm. The required quantity of gibberellins GA_3, NAA, IAA, 6BAP was dissolved in little absolute ethyl alcohol solution and then diluted with distilled water to give a stock solution of 1000 ppm. From the stock solution, further dilutions were made according to the treatment requirement by using distilled water. Formulation of the selected hormones was used for seed treatment. Twenty five treated seeds were planted on the moist blotter paper in four replicate and plates were covered with a lid lined with moist blotter paper. The plates were incubated for 16 days at 25^{o}C, and observations with respect to seedling growth parameter were recorded at the end of the experiment (as per rule of ISTA 1985). For seed treatment seed were dipped in the solution of growth regulator for 24 hours.Seed germination &seedling development characters were observed daily basis for 30 days. The collected data for various parameters were statistically analyzed by using ANOVA. The Means values were analyzed at 5% probability of error (P=0.05). Wherever the variance ratio (F value) was found significance, critical difference (CD) values were computed for the comparison among the treatment means.

RESULTS AND DISCUSSION

There was significant difference in the germination and other growth parameters in comparison to control and different growth regulators. Germination percent, mean daily germination, accumulated speed of germination and vigor index II were found significantly higher in T4 (200 ppm GA_3) whereas, shoot length seedling length and vigor index I was found highest in T2 (50 ppm GA_3) and root length was found highest in T8 (IAA 50 ppm) (Table-1 and Table-2). Seedling fresh weight and dry weight was found highest in T3 (100ppm GA_3) (Table-2) GA_3 increases the germination percent in various crops by breaking dormancy and helps in increasing the seedling length. Increase in seedling vigor index is due to the cumulative increase in the seedling dry weight and seedling length by application of growth regulators (Hossain et al., 2005; Orr et al., 2005; Rangaswamy et al., 1993; Kandari et al., 2008). Speed of germination and germination value were found highest in T13 (200 ppm 6 BAP) and T9 (100 ppm IAA) respectively, (Table1). In earlier studies application of growth regulators also had significant positive effect on germination and seedling quality of flower crops (Yasamin, 2013).

Table 1. Effect of plant growth hormones on germination parameters of pot marigold

Treatment	Germination percent	Mean Daily Germination	Speed of Germination	Accumulated Speed of Germination	Germination Value	Seedling Length
Control	29.20±0.200	1.54±0.270	10.24±0.030	20.14±0.030	17.60±0.006	4.75±0.032
GA_3 50 ppm	43.23±0.233	2.72±0.040	13.10±0.005	24.00±0.000	11.43±0.033	7.51±0.082
GA_3 100 ppm	41.26±0.267	2.57±0.013	13.14±0.028	24.28±0.210	12.62±0.023	7.15±0.043
GA_3 200 ppm	52.30±0.300	3.33±0.083	15.17±0.062	29.86±0.033	8.86±0.033	7.15±0.078
NAA50 ppm	23.06±0.067	1.40±0.003	6.21±0.094	13.26±0.267	18.73±0.033	3.76±0.015
NAA100 ppm	16.03±0.033	1.07±0.007	3.54±0.074	7.17±0.027	23.31±0.012	3.18±0.026
NAA200 ppm	24.13±0.133	1.51±0.010	5.68±0.047	9.60±0.100	16.36±0.067	2.03±0.009
IAA50 ppm	10.10±0.100	0.61±0.007	1.69±0.224	13.10±0.003	30.73±0.067	7.07±0.047
IAA100 ppm	8.16±0.167	0.50±0.000	1.25±0.054	7.20±0.052	31.16±0.120	5.96±0.020
IAA200 pp	12.20±0.200	0.73±0.017	2.59±0.154	9.43±0.033	27.49±0.210	5.27±0.026
6BAP50 ppm	43.23±0.233	2.65±0.027	13.10±0.005	24.22±0.095	11.24±0.091	2.74±0.065
6BAP100 ppm	41.26±0.267	2.54±0.020	13.11±0.003	24.28±0.210	12.58±0.033	1.84±0.027
6BAP200 ppm	52.06±0.067	3.23±0.017	15.19±0.031	29.76±0.094	8.70±0.132	2.53±0.012
C.D.	0.524	0.240	0.267	0.362	0.260	0.125
SE(m)	0.178	0.082	0.091	0.123	0.089	0.043
SE(d)	0.252	0.116	0.129	0.174	0.125	0.060
C.V.	1.014	7.566	1.795	1.175	0.864	1.569

Table 2. Effect of plant growth hormones on growth parameters of pot marigold

Treatment	Root Length	Shoot Length	Fresh Weight	Dry Weight	Vigor Index-I	Vigor Index-II
Control	1.19±0.003	3.56±0.030	0.31±0.000	0.032±0.002	138.80±1.668	0.94±0.077
GA_3 50 ppm	1.77±0.087	5.73±0.019	0.43±0.022	0.046±0.000	324.64±1.877	1.98±0.010
GA_3 100 ppm	1.60±0.050	5.55±0.027	0.69±0.002	0.058±0.000	295.17±1.024	2.39±0.014
GA_3 200 ppm	1.54±0.077	5.60±0.003	0.68±0.002	0.057±0.000	374.16±6.269	2.98±0.019
NAA50 ppm	0.92±0.013	2.83±0.018	0.23±0.004	0.031±0.000	86.73±0.602	0.71±0.003
NAA100 ppm	0.92±0.013	2.25±0.029	0.25±0.193	0.016±0.000	51.04±0.514	0.25±0.001
NAA200 ppm	0.32±0.010	1.71±0.007	0.22±0.175	0.012±0.000	49.07±0.478	0.29±0.001
IAA50 ppm	2.23±0.033	4.84±0.020	0.30±0.229	0.021±0.000	71.44±0.789	0.21±0.002
IAA100 ppm	1.42±0.010	4.54±0.024	0.22±0.001	0.035±0.000	48.73±1.137	0.28±0.006
IAA200 ppm	1.85±0.027	3.42±0.012	0.15±0.051	0.036±0.000	64.38±1.335	0.43±0.008
6BAP50 ppm	0.40±0.050	2.34±0.024	0.32±0.004	0.019±0.000	118.74±2.732	0.82±0.003
6BAP100ppm	0.14±0.027	1.70±0.000	0.44±0.086	0.014±0.000	76.20±0.949	0.57±0.005
6BAP200ppm	0.21±0.007	2.32±0.013	0.54±0.165	0.013±0.000	132.07±0.791	0.68±0.000
C.D.	0.124	0.029	0.277	0.002	5.927	0.064
SE(m)	0.042	0.010	0.094	0.001	2.019	0.022
SE(d)	0.060	0.014	0.133	0.001	2.855	0.031
C.V.	6.546	0.476	43.797	3.735	2.482	3.927

CONCLUSION

Among various concentration of Growth regulators GA_3, 100 ppm, and 200 ppm are found highly significant and shows the best performance in terms germination %, mean daily germination, speed of germination, accumulated speed of germination, germination value, root length (cm), shoot length (cm), seedling length (cm), fresh weight (g), dry weight (g), seedling vigor I, seedling vigor II. On other hand, IAA, NAA and 6 BAP are not so useful in the germination and vigor of *Calendula officinalis* but they can be used for specific purposes. Further study should be conduct in field condition to evaluate the effect on seed quality, plant growth, pre and postharvest quality of flower in *Calendula officinalis.*

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