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Seed viability tests of different varieties of Celosia using GA_3

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Abstract
The present investigation was carried out to know the seed viability and germination percentage of celosia genotypes. Twenty genotypes of celosia were used for the study and GA_3@10 ppm was used as a growth regulator to stimulate the germination process. The experiment was conducted in Floriculture and Landscape Architecture department of Kittur Rani Chennamma College of Horticulture, Arabhavi. The experiment was laid out in Completely Randomized Design (CRD) and each treatment was replicated twice. The experiment was conducted in laboratory condition and the seeds were soaked in GA_3 @10 ppm in a transparent beaker and the seeds were sown in petridish along with germination paper. Highest germination speed was recorded in Celosia cristata var. Armor Red (64.5) this was followed by Armor Purple (58.5). Maximum seed test weight was recorded in T_2, T_3 and T_6 (8.5 g) and maximum germination percentage was recorded in T_2 (83%), shoot length was recorded in the genotype T_{11} and T_{17} (4.0 cm), root length was recorded in the genotype T_{20} (3.1 cm), seedling length found highest in the genotype T_5 (6.9 cm) as well as seedling vigor was found highest in Celosia cristata var. Chief Carmine (448.6).

Keywords: Speed of germination, Seedling vigor, GA_3, test weight, seed priming, seed enhancement

Introduction
Seed is a fertilized matured ovule together covered with seed coat. Quality seed is said to be structural and functional unit of agriculture. The old scripture, Manusmriti says "Subeejam Sukshetre Jayate Sampadyate" which means good quality seed in good soil yields abundantly. Proper seed management practices can improve the seed performance and quality. Pre-sowing seed priming treatments with various chemicals and growth regulators is being practiced for improving the physiological stamina.

Among different strategies, seed priming is an easy, low cost and low risk technique also we can say it as one of the seed enhancement technique. *i.e.*, seed enhancement techniques are the pre germination treatments that improve the germination rate, time and seedling growth.

Seed priming is a process of regulating the germination process by managing the temperature and seed moisture content and it is a controlled hydration technique in which seeds are soaked in water to a particular point where germination related metabolic activities takes place in seeds, but radical emergence does not occur. The main purpose of seed priming is to increase the rate of germination, decrease the time of germination, improve growth and vigour of seedlings and improve seed performace even under stress conditions.

The present investigation was undertaken to study the effect of GA_3 for improving the seed germination and viability of celosia seeds. Here twenty genotypes of celosia were taken for the study.

Materials and Methods
The experiment was conducted at Kittur Rani Channamma college of Horticulture during 2022 under laboratory conditions in a completely randomized design with twenty treatments and two replications. Concentration of GA_3 was fixed in all twenty treatments. *i.e.*, 10 ppm.

Results and Discussion

Speed of germination

Here, up to 8 days germination speed was recorded and presented in Table 1. At first day, highest germination speed was recorded in *Celosia cristata* var. Armor Red (64.5) this was followed by Armor Purple (58.5) and lowest speed was recorded in *Celosia plumosa* var. Century Apricot Brandy (2.0). However, in second day also same pattern has followed and maximum speed of germination was recorded in *Celosia cristata* var. Armor Red (34.5), this was followed by Armor Purple (31.5) and lowest speed of germination was noticed in T_{14} (1.0). After that, speed of germination keep on decreasing. From third day to eighth day it was found that

maximum was recorded in the *Celosia cristata* var. Armor Purple (27.2, 20.8, 16.6, 13.8, 11.9, and 10.4) and followed by Armor Red (23.7, 18.0, 14.4, 12.0, 10.3 and 9.0). While minimum was recorded in the genotype. *i.e.*, *Celosia plumosa* var. Century Apricot Brandy (0.7, 0.5, 0.4, 0.3, 0.3 and 0.3).

The results revealed that, among the cultivars, speed of germination was noticed to be more in cv. '*Celosia cristata* var. Armor Red and Purple over nineteen genotypes. It may vary from cultivar to cultivar and such differences may be attributed to their genetic makeup and environment conditions. Priming of seeds with GA_3 @ 10 ppm resulted in the maximum speed of germination, the main reason for getting increased speed of germination with GA_3 (10 ppm) might be due to the fact that presence of GA_3 accelerates the various metabolic activities before germination. The same results are reported by Kumar and Singh (2013) [15] who observed the highest speed of germination in bitter gourd seeds when treated with GA_3 (100 ppm). The same results were reported by Sedghi *et al*. (2010) [12] in medicinal plants, he also mentioned that, increase in speed of germination may be due to the fact that GA_3 might cause the speeding up of various metabolic reactions before the germination.

In the present experiment it was found that, maximum speed of germination was attained within one day (using GA_3) in all the genotypes. The same results were reported by Bruggink *et al*. (1999) [3] that soaking of seeds reduce time to germination often leading to improved emergence.

Seed test weight (g)

Maximum seed test weight was recorded in T_2, T_3 and T_6 (8.5 g), this was on par with T_9 (8.3 g), T_4, T_{15} (8.0 g) and T_{18} (7.5 g), it was followed by T_1, T_7, T_8, T_{12} and T_{16} (7.0 g). Whereas, minimum test weight was recorded in T_{10} and T_{13} (5.5 g).

GA_3 soaked seeds showed the increased seed weight. This may be due to GA_3 (10 ppm) was attributed to enlarged embryos. These results are similar with findings of Pawar (2006) [11], Narayanreddy *et al*. (2007) [9] in sunflower.

Germination percentage (%)

Celosia genotype was found that, maximum germination percentage was recorded in T_2 (83%). This was followed by T_{20} (76.5%) and lowest germination percentage was recorded in T_{14} (2%).Such differences exist and being it may be due to their genetic makeup and environment conditions.

GA_3 also play important role in increasing the germination percentage, this may be due to the gibberellic acid helped to stimulate cell elongation and increased enzyme activities and better for supply of nutrients (Selvakumari *et al*., 2007, Pangtu *et al*, 2017 and Dilip *et al*., 2017 in China aster) [13, 10, 5]. The same finding was reported in *Anemone coronaria* by Bullowa *et al*., 1975 [4] *i.e.*, they reported that, gibberellins stimulate germination by inducing hydrolytic enzymes that weaken the barrier tissues such as the endosperm or seed coat which induce the mobilization of seed storage reserves and thereby this will stimulate the expansion of the embryo.

Shoot length (cm)

In present investigation the results regarding shoot length as influenced by seed testing. Here maximum shoot length was recorded in the genotype T_{11} and T_{17} (4.0 cm). This was followed by T_5 (3.9 cm), T_4, T_{16} and T_{18} (3.4 cm), T_{15} (3.7 cm) and minimum shoot length was recorded in T_1 (1.7 cm).

The increased shoot length by GA_3 priming might be due to the fact that, increased rate of cell division in the shoot and root tips incited by the application of GA_3 and these studies are in agreement with the work of Montero *et al*. (1990) [8] in Antirrhinum, Kaya *et al*. (2010) [6] in Chickpea

Root length (cm)

Maximum root length was recorded in the genotype T_{20} (3.1 cm). This was on par with the other genotypes, *i.e.*, T_5 (3.00 cm), T_7 (2.7 cm), T_4, T_{12} and T_{17} (2.5 cm). Whereas, minimum root length was recorded in T_{10} (0.9 cm).

The increased root length by using GA_3 might be due to application of GA_3stimulates increased rate of cell division in the shoot and root tips, the similar results were reported by Montero *et al*. (1990) [8] in Antirrhinum, Kaya *et al*. (2010) [6] in Chickpea, Sharma (2012) [14] in Pea and Kumar and Singh (2013) [15] in Bitter gourd who observed increased root lengths with GA_3 (100 ppm) priming

Seedling length (cm)

It was found that maximum seedling length was recorded in the genotype T_5 (6.9 cm), this was on par with the genotype T_{17} (6.5 cm), which was followed by T_{11} (6.0 cm) and lowest seedling length were recorded in T_3 (3.3 cm) and the GA_3 soaked seeds showed maximum results. The reason might be due to, application of GA_3 stimulates the cell division in the shoot and root tips, these studies are in agreement with the results of Amooaghaie and Valivand (2011) [1] who worked with *Russia odoratissima* and recorded increased shoot and root length with GA_3 priming and minimum recorded under control.

Seedling vigour

Seedling vigour is the other important character, because it is the sum total of those properties of the seed which determine the level of activity and performance of the seed during germination and seedling emergence.

Here, maximum seedling vigour was recorded in the genotype of *Celosia cristata* var. Chief Carmine (448.6). This was on par with the genotype *Celosia plumosa* var. Glorious Yellow (428.2) and *Celosia cristata* var Armor Purple (427.30), which was followed by *Celosia plumosa* var. Kimono Cream (354.8), *Celosia cristata* var. Kimono Rose (325.00) and Glorious Orange (321.4). While, minimum vigour was recorded in T_{14} (11.30) by using GA_3.This might be due to increased α-amylase activity for breaking the starch stored in seeds by growth regulators, the same results were reported by Basra *et al*. 2005 [2] and Lee and Kim, 2000 [7] in rice. They also reported that, GA_3 accelerates the metabolic activities in seeds, which resulted in higher seedling vigour.

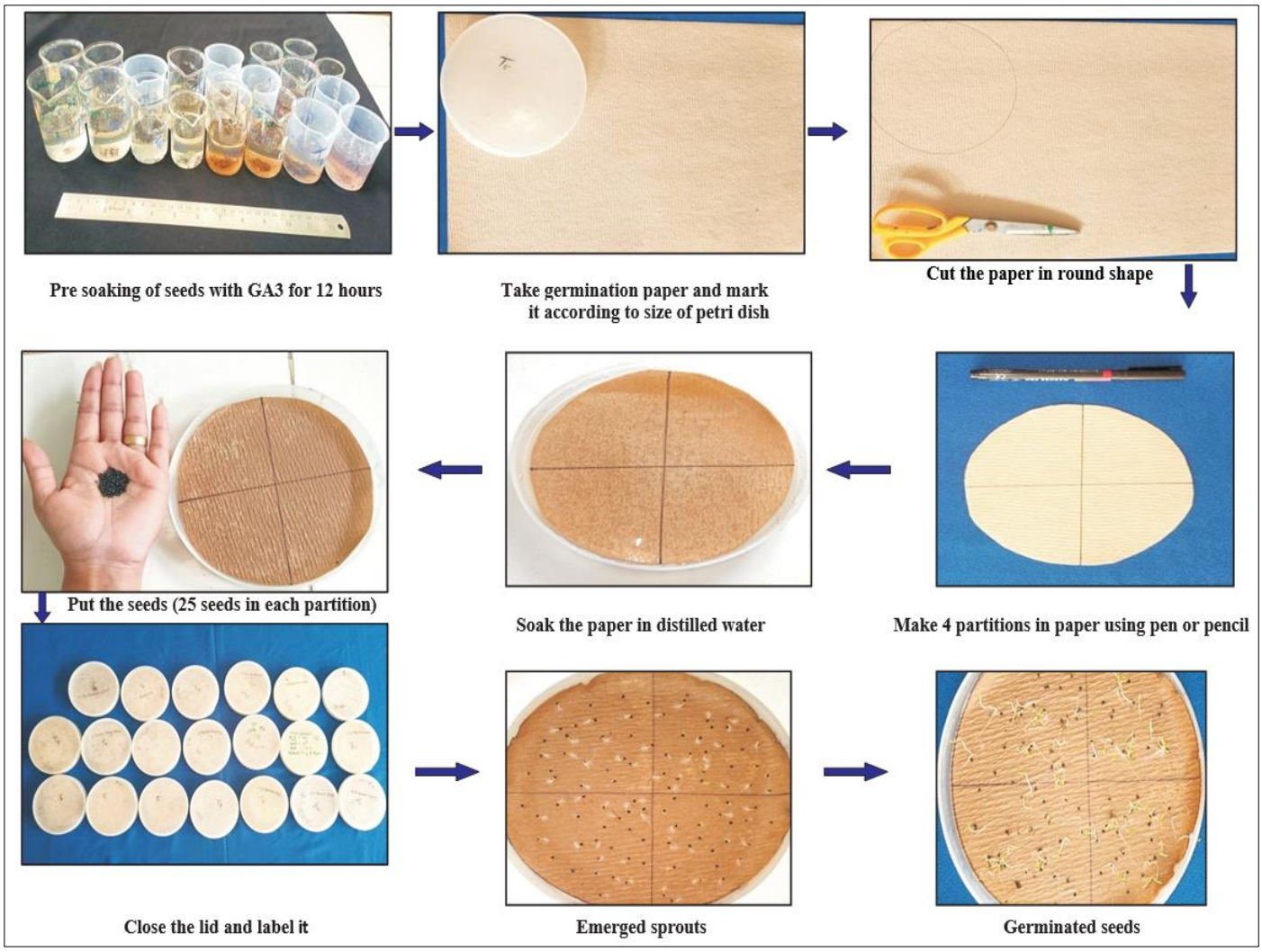

Plate 1: Steps followed in seed germination test

Plate 2: Germinated seeds presoaked with GA3

Table 1: Speed of germination of different celosia varieties by using GA_3 @ 10 ppm

Treatment		Speed of germination							
		1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
T_1	*Celosia cristata* var. Armor Orange	11.0	7.3	21.3	17.0	13.6	11.3	9.7	8.5
T_2	*Celosia cristata* var. Armor Purple	58.5	31.5	27.2	20.8	16.6	13.8	11.9	10.4
T_3	*Celosia cristata* var. Armor Red	64.5	34.5	23.7	18.0	14.4	12.0	10.3	9.0
T_4	*Celosia cristata* var. Armor Yellow	36.0	20.8	14.7	11.4	9.1	7.6	6.5	5.7
T_5	*Celosia cristata* var. Chief Carmine	45.0	26.0	22.0	16.4	13.1	10.9	9.4	8.2
T_6	*Celosia cristata* var. Chief Fire	42.5	11.0	10.2	7.6	6.1	5.1	4.4	3.8
T_7	*Celosia cristata* var. Chief Gold	35.0	19.5	13.8	11.4	9.1	7.6	6.5	5.7
T_8	*Celosia cristata* var. Chief Persimmon	5.0	2.5	1.7	1.3	1.0	0.8	0.7	0.6
T_9	*Celosia plumosa* var. Century Red	33.5	18.3	13.3	11.5	9.2	7.7	6.6	5.8
T_{10}	*Celosia plumosa* var. Century Pink	10.0	5.3	3.5	2.8	2.2	1.8	1.6	1.4
T_{11}	*Celosia plumosa* var. Century Rose	15.5	9.0	6.2	4.9	3.9	3.3	2.8	2.4
T_{12}	*Celosia plumosa* var. Century Salmon Pink	5.0	4.0	2.7	2.3	1.8	1.5	1.3	1.1
T_{13}	*Celosia plumosa* var. Century Yellow	4.0	4.0	3.3	2.5	2.0	1.7	1.4	1.3
T_{14}	*Celosia plumosa* var. Century Apricot Brandy	2.0	1.0	0.7	0.5	0.4	0.3	0.3	0.3
T_{15}	*Celosia plumosa* var. Kimono Rose	36.5	20.8	21.5	16.3	13.0	10.8	9.3	8.1
T_{16}	*Celosia plumosa* var. Kimono Red	32.0	18.3	12.8	11.1	8.9	7.4	6.4	5.6
T_{17}	*Celosia plumosa* var. Kimono Cream	38.5	20.5	18.2	13.8	11.0	9.2	7.9	6.9
T_{18}	*Celosia plumosa* var. Glorious Orange	42.5	24.3	17.7	14.9	11.9	9.9	8.5	7.4
T_{19}	*Celosia plumosa* var. Glorious Pink	16.0	10.3	7.3	5.5	4.4	3.7	3.1	2.8
T_{20}	*Celosia plumosa* var. Glorious Yellow	43.0	24.0	23.7	19.1	15.3	12.8	10.9	9.6
	S.Em±	1.3	0.6	0.3	0.3	0.2	0.2	0.1	0.1
	C.D.@ 1%	3.7	1.7	0.8	0.7	0.6	0.5	0.4	0.4

Table 2: Seed test weight, germination percentage and seedling quality parameters of different celosia varieties using GA_3 @ 10 ppm.

Treatment		Seed test weight (g)	Germination percentage (%)	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Seedling vigour
T_1	*Celosia cristata* var. Armor Orange	7.0	68.0	1.7	2.3	4.0	270.2
T_2	*Celosia cristata* var. Armor Purple	8.5	83.0	3.0	2.2	5.2	427.3
T_3	*Celosia cristata* var. Armor Red	8.5	72.0	2.4	1.0	3.3	237.6
T_4	*Celosia cristata* var. Armor Yellow	8.0	45.5	3.4	2.5	5.9	269.6
T_5	*Celosia cristata* var. Chief Carmine	6.5	65.5	3.9	3.0	6.9	448.6
T_6	*Celosia cristata* var. Chief Fire	8.5	30.5	3.0	2.3	5.3	161.8
T_7	*Celosia cristata* var. Chief Gold	7.0	45.5	3.1	2.7	5.8	262.9
T_8	*Celosia cristata* var. Chief Persimmon	7.0	5.0	2.9	1.2	4.1	20.5
T_9	*Celosia plumosa* var. Century Red	8.3	46.0	2.9	1.9	4.8	222.1
T_{10}	*Celosia plumosa* var. Century Pink	5.5	11.0	3.0	0.9	3.9	42.4
T_{11}	*Celosia plumosa* var. Century Rose	6.0	19.5	4.0	2.0	6.0	116.6
T_{12}	*Celosia plumosa* var. Century Salmon Pink	7.0	9.0	3.3	2.5	5.8	51.8
T_{13}	*Celosia plumosa* var. Century Yellow	5.5	10.0	3.3	1.0	4.3	42.5
T_{14}	*Celosia plumosa* var. Century Apricot Brandy	6.5	2.0	3.3	2.3	5.6	11.3
T_{15}	*Celosia plumosa* var. Kimono Rose	8.0	65.0	3.7	1.3	5.0	325.0
T_{16}	*Celosia plumosa* var. Kimono Red	7.0	44.5	3.4	1.7	5.1	227.5
T_{17}	*Celosia plumosa* var. Kimono Cream	6.0	55.0	4.0	2.5	6.5	354.8
T_{18}	*Celosia plumosa* var. Glorious Orange	7.5	59.5	3.4	2.1	5.4	321.4
T_{19}	*Celosia plumosa* var. Glorious Pink	6.5	22.0	2.9	1.6	4.4	98.0
T_{20}	*Celosia plumosa* var. Glorious Yellow	6.5	76.5	2.5	3.1	5.6	428.2
	S.Em±	0.4	1.0	0.2	0.2	0.2	10.0
	C.D.@ 1%	1.2	2.9	0.7	0.6	0.7	29.5

Conclusion

From the above data, it may be concluded that, GA_3 gave the best response for seed germination, viability and all other seed quality parameters. Among different genotypes studied T_2, T_3, T_5, T_{11} and T_{20} showed best results with respect to various seed quality parameters, due to its genetic makeup and various environmental factors.

References

1. Amooaghaie R, Valivand M. Combined effect of gibberellic acid and longtime Osmopriming on seed germination and subsequent seedling growth of *Kelussia odoratissima* Mozaff. Afr. J Biotechnol. 2011;10(66):14873-14880.
2. Basra SM, Farooq M, Tavassum R. Physiological and biochemical aspect of seeds vigour enhancement treatments in fine rice. Seed Sci. Technol. 2005;33:623-28.
3. Bruggink GT, Ooms JJ, Toorn PV. Induction of longevity in primed seeds. Seed Sci. Res. 1999;9:49-53.
4. Bullowa S, Negbi M, Ozeri Y. Role of temperature, light and growth regulators in germination in *Anemone coronaria* L. Aust. J Plant Physiol. 1975;1:91-100.
5. Dilip WS, Singh D, Moharana D, Rout S, Patra SS. Effect of Gibbrelic acid (GA) different concentration at different time intervals on seed germination and seedling

growth of Rangpur lime. J Agroecol. Nat. Resour. Manag. 2017;4(2):157-165.
6. Kaya M, Sanil A, Tonguc M. Effect of sowing dates and seed treatments on yield, some yield parameters and protein content of chickpea (*Cicer arietinum* L.). Afr. J Biotechnol. 2010;9:3833-3839.
7. Lee SS, Kim JH. Total sugars alpha-amylase activity and germination after priming of normal and aged rice seeds. Korean J Crop Sci. 2000;45:10-11.
8. Montero F, Herrera J, Alizago R. Effect of gibberellic acid and pre-chilling on dormancy breaking in snapdragon (*Antirrhinum majus*) seeds. Agronomia Costarricense. 1990;14:55-60.
9. Narayanareddy AB, Biradarpatil NK, Gowda. Effect of pre-sowing invigoration seed treatments on seed quality and field performance in both fresh and revalidated seed lots of sunflower hybrid KBSH-1. M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad (India); c2007.
10. Pangtu S, Sharma BP, Dilta BS, Chaudhary SV. Effect of seed priming on seed parameters of China aster, *Callistephus chinensis* (L.) Nees. Int. J Agric. Sci. 2017;5(1):43-48.
11. Pawar. Effect of seed invigoration on synchrony and storage potentiality of parental lines of sunflower hybrid RSFH-1. *M.Sc. thesis*, Univ. Agric. Sci., Dharwad; c2006.
12. Sedghi M, Ali N, Behrooz E. Effect of seed priming on germination and seedling growth of two medicinal plants under salinity. Emir. J Food Agric. 2010;22(2):130-139.
13. Selvakumari A, Vijaykumar A, Geetha R. Seed fortification with botanicals on vigour and viability of China aster (*Callistephus chinensis*) cv. Poornima. Plant Arch. 2007;7(1):195-196.
14. Sharma RK. Effect of salicylic acid and gibberellic acid on seed germination and growth of pea. Int. J Plant Sci. 2012;7:322-324.
15. Kumar R, Singh R. Effect of seed priming on emergence and vigour of bitter gourd (*Momordica charantia* L.). J Res. Punjab Agr. Univ. 2013;50:114-118.