

## Effect of Pre-Sowing Invigouration Treatments on Performance of Ageing *Dendrocalamus Hamiltonii* Seeds



### Botany

**KEYWORDS :** Invigouration, seed quality, viability, fortification, osmopriming, GA<sub>3</sub>

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### ABSTRACT

*Seed quality is one of the key factors affecting successful germination of seeds but this trait declines during prolonged storage. Invigouration treatments, that include Fortification and Osmopriming with various bioactive chemicals, are known to improve the seed performance. Treated seeds were stored at controlled temperature and humidity (in desiccators at 4 °C). Fortification was done with Ascorbic acid and Potassium dihydrogen phosphate (conc. used was 2%, 5% and 10%) and GA<sub>3</sub>. Statistically all the fortification materials were effective but GA<sub>3</sub> (50 ppm) was most effective in maintaining germination percentage and vigour index. Similarly, osmopriming was done with KCl, KNO<sub>3</sub> and PEG-6000. Effective conc. of KCl for maintaining germination and vigour index for up to 18 months was found to be 10%. It was observed that the osmopriming with KCl (10%) resulted in maximum germination percentage of 83.1% and vigour index of 1272, 1282 and 1290 at 2%, 5% and 10% respectively which was more than the germination under control (80.2%). It is concluded that seeds lose viability over a period of time even under controlled conditions and in order to regain seed viability before sowing, invigouration treatments offer promising results.*

**Introduction:** Bamboos comprise the most diverse group of plant in the grass family. They are distinguished from other members of the family by having woody culms, complex branching, a complex and generally robust rhizome system, and infrequent flowering. They are intermingled with the tradition and culture of rural tribal populations from times immemorial due to which they have been variously called as the 'cradle to coffin plant', 'The poor man's Timber; Friend of the people', 'Green Gasoline', 'The Plant with Thousand Faces' and 'The Green Gold'. Bamboos can be propagated from rhizomes, Culm/branch cutting or by multiplication of nursery-raised seedlings. However, seeds serve as the best material for large-scale plantation, germplasm conservation and improvement of genotype. Seeds in general play a vital role in man's life since they serve as a source of food, fibre, spices, beverages, oil and drugs. Bamboo seeds, have very short viability of 1-3 months and are therefore useful as propagules for only a short period of time. When seeds deteriorate, they lose vigour and become more sensitive to stresses upon germination. Eventually seeds lose the ability to germinate. Non availability of viable seed is a major drawback in enhancing productivity. Seed quality can be maintained by either storing them in a controlled conditions or by invigouration treatments. Seed invigouration is a simple technique for improvements in seed performance by post harvest treatments resulting in improved germinability, greater storability and better yield performance (Ali *et al.*, 1990). It is reported that seed priming and fortification is important technique to help rapid and uniform germination and emergence of seeds and increase seed tolerance to adverse environmental condition (Heydecker, 1974; Harris *et al.*, 1999). In view of this present investigation was taken up to find out the effect of pre sowing invigouration treatments on bamboo seeds.

### Material and Methods:

Seeds of *Dendrocalamus hamiltonii* were procured from KFRI, Peechi. These were stored in two lots: one treated with invigouration chemicals whereas the second lot was untreated seeds which served as control. Control seed lot was stored at normal temperature and humidity whereas the other seeds which were used for pre sowing treatments were stored under controlled conditions (in desiccator at 4°C).

Seeds having initial germination of 80.2% were subjected to presowing invigouration treatments. Seeds were surface sterilized by soaking them in 0.5% HgCl<sub>2</sub> for two minutes followed

by thorough washing in running water. 10 randomly selected surface sterilized seeds were placed equidistantly in pre-sterilized petridishes (9.0 cm) lined with filter paper. The entire experiment was conducted in laboratory condition in seed germinator where temperature was maintained at 28 °C. Seeds were observed daily and the number of seeds germinated were recorded for 14 days. The experiment was repeated after regular intervals of 6 months for one and a half years. In pre-sowing treatments, seeds were fortified with varying concentrations of ascorbic acid, dipotassium phosphate (2%, 5%, 10% conc.), GA<sub>3</sub> (10 ppm, 20 ppm and 50 ppm conc.). Seeds were soaked in solution of equal volume for duration of 6hrs and 12 hrs to 16 hrs till it raises the moisture content of the seed to 20-25%, just enough for endogenous impregnation of chemicals by exogenous application. All the chemicals were applied in 3 different concentrations to three replicates of 10 seeds and the seeds were kept in germination chamber during these experiments. Solution to seed ratio was 1:2.5 for all the treatments. Similarly, seeds were osmoprimed with potassium chloride (KCl), potassium nitrate (KNO<sub>3</sub>), polyethylene glycol-6000. (PEG-6000) each at 2%, 5%, 10% conc. Thereafter, the seeds were rinsed with tap water three times and one time with distilled water. The treated seeds were surface dried and then dried at 25°C. Three replications of 10 seeds were germinated in 90mm Petri plates at 25±1°C under dark condition for 14 days. Vigour index values were computed using formula given by (Abdul-Baki and Anderson, 1973). VI = G% × Root length.

Seed germination was calculated by the following formula.

Germination Percentage (%) =  $\frac{\text{Total number of germinated seeds}}{\text{Total no. of seeds sown}} \times 100$

### Result:

After 6 months interval, seeds were evaluated for seed quality characteristics *i.e.* germination percentage (G%) and vigour index (VI). Vigour index values were computed using formula: VI = G% × Root Length (cms) as per Abdul-Baki and Anderson (1973). One way (ANOVA) Analysis of variance was applied to the germination parameters (G%) to find out which treatment and concentration was statistically significant in enhancing various germination parameters while LSD test (0.05) was used to compare the differences among treatment means.

**Fortification:**

Fortification with ascorbic acid resulted in maximum germination percentage of 82.1, 86.4 and 82.4 and VI 1281, 1318.2 and 1284.2 at 2%,5% and 10% concentrations respectively. After 6 months of controlled ageing ,the treatments with the same concentrations the G% was observed to be 50.1, 56.8 and 53.3 respectively. After 12 months of ageing G% recorded was 25.4, 30 and 26.1 at 2%,5% and 10% concentrations respectively. After 18 months of ageing , G% recorded was 16.7, 20 and 20.1 and VI 232.13 , 281 and 234.2 at 2%,5% and 10% concentrations respectively. Statistically , the most effective concentration of ascorbic acid for maintaining germination and vigour index for 18 months was found to be 5%

Fortification with GA<sub>3</sub> resulted in maximum germination percentage of 82.4, 83.2 and 82.8 and VI 1280, 1264 and 1285 at 2%,5% and 10% concentrations respectively. After 6 months of controlled ageing ,the treatments with the same concentrations the G% was observed to be 56.4, 60 and 60.2 respectively. After 12 months of ageing G% recorded was 30, 36.7 and 36.2 at 2%,5% and 10% concentrations respectively. After 18 months of ageing , G% recorded was 20.1, 23.3 and 23.4 and VI 280 , 328.5 and 337.4 at 2%,5% and 10% concentrations respectively. Statistically , the most effective concentration of GA<sub>3</sub> for maintaining germination and vigour index for 18 months was found to be 50 ppm.

Fortification with KH<sub>2</sub>PO<sub>4</sub> resulted in maximum germination percentage of 82.4, 88.1 and 86.2 and VI 1265, 1348 and 1332 at 2%,5% and 10% concentrations respectively. After 6 months of controlled ageing ,the treatments with the same concentrations the G% was observed to be 52.4, 56.7 and 52.4 respectively. After 12 months of ageing G% recorded was 25.4, 26.7 and 30 at 2%,5% and 10% concentrations respectively. After 18 months of ageing , G% recorded was 16.7, 20 and 20 and VI 231.4, 282 and 280.2 at 2%,5% and 10% concentrations respectively. Statistically , the most effective concentration of KH<sub>2</sub>PO<sub>4</sub> for maintaining germination and vigour index for 18 months was found to be 5%.

Among all the treatments GA<sub>3</sub> (50ppm) is the most effective in maintaining best germination and VI over control at 5% level of significance as shown in TABLE 1

**TABLE 1**  
**Effect of seed fortification (Pre-sowing) on ageing *Dendrocalamus hamiltonii* seeds**

S.No.	Treatment	Conc.	Fresh		6 Monthly		12 Monthly		18 Monthly	
			G%	VI	G%	VI	G%	VI	G%	VI
1.	Ascorbic acid	2%	82.1	1281	50.1	755	25.4	390	16.7	232.13
		5%	86.4 <sup>a</sup>	1318.2	56.8 <sup>a</sup>	848	30	441	20	281
		10%	82.4 <sup>a</sup>	1284.2	53.3	818.5	26.1	397.2	20.1 <sup>a</sup>	234.2
2.	GA3	10 ppm	82.4	1280	56.4	845.2	30	444	20.1	280
		20ppm	83.2 <sup>a</sup>	1264	60	901	36.7	556.2	23.3	328.5
		50ppm	82.8 <sup>a</sup>	1285	60.2 <sup>a</sup>	910.2	36.2	572.4	23.4 <sup>a</sup>	337.4
3.	KH <sub>2</sub> PO <sub>4</sub>	2%	82.4	1265	52.4	781.2	25.4	390.2	16.7	231.4
		5%	88.1 <sup>a</sup>	1348	56.7 <sup>a</sup>	856	26.7	392.4	20	282
		10%	86.2 <sup>a</sup>	1332	52.4	784.2	30	447	20 <sup>a</sup>	280.2
4.	Control (untreated seeds)		80.2	1014	20	108	0	0	0	0
		LSD #	Treat x 5.4	Treat x 9.56	Treat x 3.2	Treat x 6.07	Treat x 1.98	Treat x 3.38	Treat x 0.96	Treat x 1.3

LSD# represents least significant difference at 5% level of significance

\*Significant figures

**Osmopriming :**Osmopriming with KCl resulted in maximum germination percentage of 82.3, 82.3 and 83.1 and VI 1272, 1282 and 1290 at 2%,5% and 10% concentrations respectively. After 6 months of controlled ageing ,the treatments with the same concentrations the G% was observed to be 48.2, 48 and 52.1 respectively. After 12 months of ageing G% recorded was 28.2, 34.5 and 34.2 at 2%,5% and 10% concentrations respectively. After 18 months of ageing , G% recorded was 16.2, 16.2 and 18 and VI 230 , 231 and 260 at 2%,5% and 10% concentrations respectively. Statistically , the most effective concentration of KCl for maintaining germination and vigour index for 18 months was found to be 10%

Osmopriming with KNO<sub>3</sub> resulted in maximum germination percentage of 83.2, 83.1 and 85.2 and VI 1295, 1291 and 1340 at 2%,5% and 10% concentrations respectively. After 6 months of controlled ageing ,the treatments with the same concentrations the G% was observed to be 46.2, 52.1 and 52.4 respectively. After 12 months of ageing G% recorded was 26.2 , 30 and 30 at 2%,5% and 10% concentrations respectively. After 18 months of ageing , G% recorded was 14.5, 14.5 and 15.6 and VI 201 , 211 and 230 at 2%,5% and 10% concentrations respectively. Statistically , the most effective concentration of KNO<sub>3</sub> for maintaining germination and vigour index for 18 months was found to be 10%

Osmopriming with PEG-6000 resulted in maximum germination percentage of 83.2, 86.2 and 82.1 and VI 1257, 1382 and 1280 at 2%,5% and 10% concentrations respectively. After 6 months of controlled ageing ,the treatments with the same concentrations the G% was observed to be 45.7, 53.1 and 44.2 respectively. After 12 months of ageing G% recorded was 25.4, 28.5 and 28.4 at 2%,5% and 10% concentrations respectively. After 18 months of ageing , G% recorded was 12.2 , 14.2 and 13.8 and VI 150, 209 and 188.2 at 2%,5% and 10% concentrations respectively. Statistically , the most effective concentration of PEG-6000 for maintaining germination and vigour index for 18 months was found to be 5% .

Among all the treatments, priming with 10% KCl is the most effective in maintaining best germination and VI over control at 5% level of significance as shown in TABLE 2.

**TABLE 2:**  
**Effect of seed osmopriming (Pre-sowing) on ageing *Dendrocalamus hamiltonii* seeds**

S.No.	Treatment	Conc.	Fresh		6 Monthly		12 Monthly		18 Monthly	
			G%	VI	G%	VI	G%	VI	G%	VI
1.	KCl	2%	82.3	1272	48.2	720	28.2	420.1	16.2	230
		5%	82.3 <sup>a</sup>	1282	48.0	724	34.5	528	16.2	231
		10%	83.1 <sup>a</sup>	1290	52.1 <sup>a</sup>	820	34.2 <sup>a</sup>	525	18 <sup>a</sup>	260
2.	KNO <sub>3</sub>	2%	83.2	1295	46.2	709	26.2	397	14.5	201
		5%	83.1	1291	52.1	824.5	30	448	14.5	211
		10%	85.2 <sup>a</sup>	1340	52.4 <sup>a</sup>	830.1	30 <sup>a</sup>	442	15.6 <sup>a</sup>	230
3.	PEG-6000	2%	83.2	1257	45.7	702	25.4	390.1	12.2	150
		5%	86.2 <sup>a</sup>	1382	53.1 <sup>a</sup>	845	28.5	415	14.2 <sup>a</sup>	209
		10%	82.1	1280	44.2	690	28.4	412	13.8	188.2
4.	Control (untreated seeds)		80.2	1014	20	108	0	0	0	0
		LSD#	Treat x 4.35	Treat x 8.3	Treat x 3.5	Treat x 5.46	Treat x 1.78	Treat x 3.12	Treat x 0.96	Treat x 1.87

LSD\* represents least significant difference at 5% level of significance.

\*Significant figures

### Conclusions :

In fortified seeds among all the treatments GA<sub>3</sub> (50ppm) could be recommended for bamboo seeds as a pre sowing invigouration treatments and in maintaining best germination and VI over control at 5% level of significance. Seed viability can be recovered to major extent by the application of seed invigouration treatments such as osmopriming and fortification. Among all the treatments, priming with 10% KCl could be recommended most effective in maintaining best germination and VI over control at 5% level of significance. These both techniques of osmopriming and fortification can prove commercially important to increase the longevity of dendrocalamus seeds so that these could be used for longer period of time for raising plantations.

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