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Mid –Storage Treatment and Its Effect on Bamboo (*Bambusa bambos* L.) Voss) Seeds

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A B S T R A C T

Bamboo set seeds once in life time, and the seeds are poor storer, necessitates the preservation of seeds until net availability. Experiments were conducted with one year refrigerated stored medium vigour (78% germination and vigour index of 1522) seeds of *Bambusa bambos* to extend the storage life. The seeds were soaked in 0.25 and 0.5% of Para Amino Benzoic Acid, 0.5 and 0.75% of Para Hydro Benzoic Acid, 0.1 and 0.2% of KH2PO4, 500, 600 ppm of α – tocopherol solutions and water for a duration of 30 min, 1, 2, 4, 6, and 12h as a mid-storage seed treatment to maintain the viability and vigour. The experiment results revealed that mere water soaking for 4h and drying could able to improve the germination (91%) and vigour (1738) immediately after treatment when compared to chemical and vitamin solutions. From the observations, water soaking for 4h and drying can be recommended as NO COST mid storage seed treatment for better performance of *B. bambos* seeds.

Introduction

Irrespective of agricultural or forestry, all seeds suffer a degree of deterioration after attainment of maturity. Particularly in forestry species, the deterioration may incur during delays between collection and processing, if seeds are held under inappropriate conditions, either during processing or in storage. Even under dry state, slow and normal metabolism essential to keep the seeds alive also may lead to some damage. Up to certain level of damage, repair will be possible through rehydration. On rehydration, metabolic activity are reactivated and cellular integrity is restored by the synthesis of Macromolecules and repair of cellular lesions and DNA (Cheah and Osborne, 1978; Elder and Osborne, 1993 and Onelli *et al.,* 2000). The critical moisture content for reactivation of repair mechanisms varies between species and ranged from 15% (*Lactuca sativa*) to 30% (*Triticum durum*) (Ibrahim *et al.*, 1983; Petruzelli, 1986), seed longevity also increases under this range (Roberts and Ellis, 1989), the repair processes are start to function when the seeds are rehydrated sufficient for the metabolic activities until then the processes are not fully functional (Butler *et al.,* 2009). The repair mechanism of hydrated seed were reported in lettuce (Villiers and Edgcumbe, 1975); Maize, oat and rye (Zlatanova *et al.*, 1987; Elder and Osborne, 1993 and Boubriak *et al.*, 1997).

The hydration treatments either with water or dilute salt solutions or PEG may be given prior to storage or during storage (mid storage) or after storage as pre sowing (Basu, 1994) seed treatment. However number of conflicts on performance of seeds after hydration also exists. Differences in the effect of treatment between seed lots with differential vigour and maturity have been described (Powell *et al.*, 2000; Demir, 2003, Butler *et al.*, 2009). The treatment effect was more apparent in the medium viogur seeds than high and low vigour (Powell *et al.*, 2000).

The magnitude of hydration is most effective on subsequent drying (Gurusinghe and Bradford, 2001). Gurusinghe *et al.*, 2002, reported that slow drying of hydrated seeds may induce the LEA protein synthesis. Hydration-dehydration (H-DH) treatments of stored orthodox seeds of wheat, soybean and sesamum have been found to be very effective for the maintenance of vigour, viability and productivity (Mandal *et al.*, 1989; Mandal *et al.*, 2000 and De *et al.*, 2003). H-DH is able to control the generation of free radical and damage already occurred due to free radicals (De *et al.*, 2003).

Dilute solutions of chemicals such as sodium or potassium phosphate (di and mono basic), sodium chloride, p-hydroxy benzoic acid, p-amino benzoic acid, oxalic acid, potassium lodide, etc are effective against the age related problems in number of crops (Kundagrami *et al.*, 2008 and Mandal *et al.*, 2010). An investigation on potential of hydration and dehydration on seed performance of one year refrigerated stored seeds of *B. bambus* carried out and findings were presented.

Materials and Methods

One year refrigerated stored seeds of B.bambus were soaked in 0.25 and 0.5% of Para Amino Benzoic Acid, 0.5 and 0.75% of Para Hydro Benzoic Acid, 0.1 and 0.2% of KH_2PO_4, 500, 600 ppm of α – tocopherol solutions and water for a duration of 30 min, 1, 2, 4, 6, and 12h. After soaking, the seeds were dried back to original moisture content of 8%.

The performance of the treatments was evaluated through germination test (ISTA, 2010) in an inclined paper method along with control and observed for seedling length in cm (root and shoot) by measuring all normal seedlings after 21 days of test, vigour index (Abdul Baki and Anderson, 1973) and dry matter production in mg-seedling by drying all normal seedlings. Moisture content was estimated by sieving the grounded seeds in 0.5mm sieve and placed in an oven maintained high constant (130ºC±1) for 2h.

Results and Discussion

Both duration of soaking and the chemicals influenced the germination, seedling length, dry weight and vigour index. Among the four chemicals, the seeds soaked in KH_2PO_4 performed better with germination of 84% in both the concentrations (0.1and 02%) followed by water and 0.25% of Para Amino Benzoic Acid (83%), both the values were statistically different from each other. The poorest performer was α – tocopherol at all two concentrations. It produces only 9 and 11% of normal seedlings at 500 and 600ppm respectively (Plate 1).

The highest germination percentage varied with chemicals and duration of soaking. Germination percentage increased along with duration of soaking in water. It reached a maximum of 91% in water soaking for 4h, thereafter started to decline, at the end of 12h the germination % was 82. However 0.2% KH_2PO_4 soaked seeds registered higher germination 89% at short period of 2h of soaking. The long durations were not beneficial. The potential of chemicals on influencing germination varied with duration of soaking (Table 1). Length of seedlings measured in root and shoot were not much influenced by the treatments. The seeds of KH_2PO_4 and water soaking produced longer seedlings with mean root and shoot length of 9.2 and 8.6cm followed by water soaking (8.8 and 8.2) respectively (Table 2). Vigour index computed using germination % and seedling length registered higher mean value for KH_2PO_4 soaked seeds (1485) followed by water soaking (1430). Irrespective of chemical and duration, water soaking for 4h and 0.2% KH_2PO_4 for 2 h produced vigorous seedlings with vigour index of 1738 and 1647 respectively (Table 3).

Short hydration of stored seeds are effective immediately after drying, in the present study a 12% increase in germination was observed, confirms the earlier findings by Basu (1976) and Rudrapal and Basu (1982).

Plate.1 Effect of mid storage correction treatment on seedling performance

4h water soaking **2h 500 ppm of α- tocopherol**

Table.1 Effect of mid-storage H-DH seed treatments on seed germination %

Chemicals (T)/ Duration of soaking (D)	**Germination**						**Mean**
	30 min	**1h**	**2h**	**4h**	**6h**	**12h**	
Control	71(57.42)						
Water	79 (62.73)	79 (62.73)	80 (63.44)	91 (72.54)	88 (69.73)	82 (64.90)	**83** (65.65)
0.25% Para Amino Benzoic Acid	78 (62.03)	88 (69.73)	87 (68.87)	84 (66.42)	82 (64.90)	80 (63.44)	**83** (65.65)
0.5% Para Amino Benzoic Acid	78 (62.03)	82 (64.90)	84 (66.42)	83 (65.65)	79 (62.73)	72 (58.05)	**80** (63.44)
0.5% Para Hydro Benzoic Acid	77 (61.34)	80 (63.44)	82 (64.90)	84 (66.42)	84 (66.42)	68 (20.27)	**76** (56.79)
0.75% Para Hydro Benzoic Acid	78 (62.03)	85 (67.21)	83 (65.65)	75 (60.00)	71 (57.42)	71 (57.42)	**77** (61.34)
0.1% KH_2PO_4	79 (62.73)	80 (63.44)	83 (65.65)	84 (66.42)	88 (69.73)	87 (68.87)	**84** (66.42)
0.2% KH_2PO_4	79 (62.73)	80 (63.44)	89 (70.63)	86 (68.03)	84 (66.42)	83 (65.65)	**84** (66.42)
500ppm α – tocopherol	45 (42.13)	6 (14.18)	2 (8.13)	0 (0.29)	0 (0.29)	0 (0.29)	**9** (17.46)
600ppm α – tocopherol	53 (46.72)	11 (19.37)	3 (9.97)	0 (0.29)	0 (0.29)	0 (0.29)	**11** (19.37)
Mean	**72** (58.05)	**66** (54.33)	**66** (54.33)	**65** (53.73)	**64** (53.13)	**54** (47.29)	**64** (53.13)
	D		**T**		**DxT**		
SEd	0.424		0.548		1.342		
CD (P=0.05)	0.849**		1.096**		2.684**		

** Significant at 1% level (Figures in parenthesis are arc sine values)

Table.2 Effect of mid-storage H-DH seed treatments on root and shoot length (cm)

Ch%)emicals (T)/ Duration of soaking (D)	**Root length (cm)**						**Mean**	**Shoot length (cm)**						**Mean**
	30 min	**1h**	**2h**	**4h**	**6h**	**12h**		**30 min**	**1h**	**2h**	**4h**	**6h**	**12 h**	
Control	8.2							8.7						
Water	8.2	8.6	9.0	**9.6**	9.1	8.4	**8.8**	8.0	8.3	8.4	**9.5**	7.9	7.9	**8.2**
0.25% Para Amino Benzoic Acid	8.6	8.6	8.4	8.3	8.0	8.0	**8.3**	7.9	7.6	7.6	7.4	7.2	7.1	**7.5**
0.5% Para Amino Benzoic Acid	8.0	8.4	8.5	7.8	7.8	7.7	**8.0**	7.6	7.9	8.0	7.9	7.4	7.4	**7.7**
0.5% Para Hydro Benzoic Acid	8.7	8.8	8.9	8.9	9.0	9.3	**8.9**	7.7	7.7	7.3	7.3	7.2	7.0	**7.4**
0.75% Para Hydro Benzoic Acid	8.6	8.8	9.1	9.0	8.9	8.8	**8.9**	7.3	8.1	7.7	7.4	7.3	7.3	**7.5**
0.1% KH_2PO_4	8.6	8.4	8.4	8.5	7.7	7.3	**8.2**	8.1	8.4	8.5	8.5	8.6	8.2	**8.4**
0.2% KH_2PO_4	10.3	9.3	9.6	9.0	8.6	8.4	**9.2**	8.5	8.5	8.9	8.6	8.5	8.5	**8.6**
500ppm α – tocopherol	9.0	8.7	8.7	0.0	0.0	0.0	**4.4**	8.6	8.5	8.1	0.0	0.0	0.0	**4.2**
600ppm α – tocopherol	9.2	8.3	8.3	0.0	0.0	0.0	**4.3**	8.8	8.3	8.3	0.0	0.0	0.0	**4.2**
Mean	**8.8**	**8.7**	**8.8**	**6.8**	**6.6**	**6.4**	**7.7**	**8.1**	**8.1**	**8.1**	**6.2**	**6.0**	**5.9**	**7.1**
	D		**T**		**DxT**			**D**		**T**		**DxT**		
SEd	0.042		0.055		0.134			0.042		0.055		0.134		
CD (P=0.05)	0.085**		0.110**		0.268**			0.085**		0.110**		0.268**		

Table.3 Effect of mid-storage H-DH seed treatments on dry-matter production (mg/seedling) and vigour index

Chemicals (T)/ Duration of soaking (D)	**Dry-matter production (mg/seedling)**						**Mean**	**Vigour index**						**Mean**
	30 min	**1h**	**2h**	**4h**	**6h**	**12 h**		**30 min**	**1h**	**2h**	**4h**	**6h**	**12h**	
Control	8.5							1278						
Water	8.5	8.8	8.9	**9.5**	9.0	8.9	**8.9**	1280	1335	1392	**1738**	1496	1337	**1430**
0.25% Para Amino Benzoic Acid	9.0	8.9	9.0	9.0	8.9	8.6	**8.9**	1287	1426	1392	1319	1246	1208	**1313**
0.5% Para Amino Benzoic Acid	9.2	9.5	10.2	10.0	9.4	9.2	**9.6**	1217	1337	1386	1303	1201	1087	**1255**
0.5% Para Hydro Benzoic Acid	9.1	9.1	8.9	8.7	7.9	7.9	**8.6**	1263	1320	1328	1361	1361	1196	**1304**
0.75% Para Hydro Benzoic Acid	8.0	10.3	8.8	8.8	8.6	8.5	**8.8**	1240	1437	1394	1230	1150	1143	**1266**
0.1% KH_2PO_4	8.5	8.8	8.8	9.2	9.7	8.8	**9.0**	1319	1344	1403	1428	1434	1349	**1380**
0.2% KH_2PO_4	8.7	8.8	8.8	8.7	8.8	8.8	**8.8**	1485	1424	**1647**	1514	1436	1403	**1485**
500ppm α – tocopherol	8.9	8.0	7.8	0.0	0.0	0.0	**4.1**	792	103	34	0	0	0	**155**
600ppm α – tocopherol	8.5	7.9	7.5	0.0	0.0	0.0	**4.0**	954	183	50	0	0	0	**198**
Mean	**8.7**	**8.9**	**8.7**	**7.1**	**6.9**	**6.7**	**7.9**	**1204**	**1101**	**1114**	**1099**	**1036**	**858**	**1069**
	D		**T**		**DxT**			**D**		**T**		**DxT**		
SEd	0.042		0.055		0.134			0.849		1.096		2.683		
CD (P=0.05)	0.085**		0.110**		0.268**			1.698**		2.191**		5.367**		

Hydration-dehydration removes the age accumulated toxic substances (Powell *et al.*, 2000) and drying allows the seed to exclude the free radicals generated during storage (Gurusinghe and Bradford, 2001) thus improved the performance of seed. Proper drying is much essential to keep the respiration at lower rates. The activation of enzymes like superoxide dismutase (SOD) might have involved in removal of free radicals (Wilson and McDonald, 1986). However, the extent of damage due to free radical needs to be considered for a decision on strength of chemicals required or the soaking duration.

In the present study, the seeds were stored under refrigerated condition and were able to produce 71% normal seedlings after one year of storage. By the experience it is suggested that the seeds were occurred with a minimum loss in vigour, sufficient repair during rehydration might have resulted in increased germination and vigour. The chemicals except KH_2PO_4 at all concentrations and duration failed to produce the effect of water but improvement over control might be due to shallow depth of damage due to free radicals, which can be removed by mere water soaking, upon further damage, the seeds may require chemical solutions to rectify the damage occurred due to storage. Though KH_2PO_4 equally performing with water, economic point water soaking serves as best one with nil expense.

However, the storability of hydrated dehydrated seeds needs to be investigated.

From the study it can be concluded that the performance of *B. bambus* seeds with medium vigour and viability can be improved by water soaking for 4h, as a NO COST treatment it can be recommended.

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References

Abdul-Baki, A. S. and Anderson. J. D., 1973, Vigour determination in soybean by multiple criteria. Crop Sci., 13, 630-633.

Basu, RN.1976. Physico-chemical control of seed deterioration. Seed Research 4, 15-23

Basu RN. 1994. An appraisal of research on wet and dry seed treatments and their applicability with special reference to tropical and sub-tropical countries. Seed Science and Technology. 22:107-126

Boubriak I, Kargiolaki H, L.Lyne and D.J.Osborne 1997, the requirement for DNA repair in desiccation tolerance of germinating embryos. Seed Science Research. 7:97–105.

Butler L.H., F.R.Hay, R.H. Ellis and R.D.Smith 2009, Post-abscission, pre-dispersal seeds of *Digitalis purpurea* L. remain in a developmental state that is not terminated by desiccation *ex planta*. Annals of Botany.103:785–794.

Cheah, K.S.G. and D.J. Osborne 1978, DNA lesions occur with loss of viability in embryos of ageing rye seeds. Nature, 272: 593-599.

De, B.K., A.K.Mandal, and R.N.Basu 2003, Seed invigoration treatments on different seedsizes of wheat (*Triticum aestivum* L.) for improved storability and field performance. Seed Sci. &Technol., 31, 379-388.

Demir I. 2003, Effect of controlled hydration treatment on quality of aubergine seeds following storage. Phyton Annales Rei Botanicae.43:307–317.

Elder, R.H., and D.J. Osborne 1993, Function of DNA synthesis and DNA repair in the survival of embryos during early germination and in dormancy. Seed Science Research. 3:43–53.

Gurusinghe S, K.J.Bradford 2001, Galactosyl-sucrose oligosaccharides and potential longevity of primed seeds. Seed Science Research. 11:121–133.

Gurusinghe S, A.L.T. Powell and K.J. Bradford 2002, Enhanced expression of BiP is associated with treatments that extend storage longevity of primed tomato seeds. Journal of the American Society for Horticultural Science. 127:528–534.

Ibrahim, A.E., E.H.Roberts and A.J. Mordche 1983, Viability of lettuce seeds II. Survival and osmotically controlled storage. Journal of Experimental Boatny, 34:631-640

ISTA,, 2010, International rules for seed testing, Rules Draper (ed) Switzerland, The International Seed Testing Association, 2003, 1- 47.

Kundagrami, S., B.K.De, B.K. and A. K. Mandal. 2008, Post-harvest seed invigoration

Treatments for improved storability and field performance of rice (*Oryza sativa* L.). Crop Res., 35, 317 – 322.

Mandal, A.K., B.K. De and R.N.Basu, 1999, Dry-seed treatment for improved germinability and productivity of wheat (*Triticum aestivum* L.). Indian J. of Agril. Sci., 69, 627-630.

Mandal, A.K., B.K.De, R. Saha and R.N.Basu 2000, Seed invigoration treatments for improved storability, field emergence and productivity of Soybean (*Glycine max* Merrrill). Seed Sci. &Technol., 28, 201-207.

Mandal, A. K., B.K.De, and M.K.Pradhan 2010, Seed treatment for the maintenance of vigour, viability and field performance of Sunflower (*Helianthus annuus* L.). Indian Agric., 54, 7-12.

Onelli E., S.Citterio, M. Labra, A.Ghiani and S.Sgorbati 2000, Presence of a p53-like protein during pea seed maturation and germination. Plant Biosystems. 134:153–165.

Petruzelli, L. 1986, Wheat viability at high moisture content under hermetic and aerobic storage. Annals of Botany 58: 258-265

Powell, A.A., L.J.Yule, H.Jing, S.P.C.Groot, R.J.Bino and H.W. Pritchard 2000, The influence of aerated hydration seed treatment on seed longevity as assessed by the viability equations. Journal of Experimental Botany.51:2031–2043.

Roberts E.H.and R.H.Ellis 1989, Water and seed survival. Annals of Botany.63:39–52.

Rudrapal, A.B. and R.N. Basu, 1982, Lipid peroxidation and membrane damage in deteriorating wheat and mustard seeds. Indian Journal of Experimental Biology 20, 465-470

Villiers T.A., and D.J.Edgcumbe 1975, on the cause of seed deterioration in dry storage. Seed Science and Technology.1975; 3:761–774.

Wilson D.O. and M.B.McDonald 1986, the lipid peroxidation model of seed ageing. Seed Science Technology.14:269–300.

Zlatanova J.S., P.V.Ivanov, L.M.Stoilov, K.V. Chimshirova and B.S.Stanchev 1987, DNA repair precedes replicative synthesis during early germination in maize. Plant Molecular Biology. 10:139–144.

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