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Effect of Invigoration Treatments on Biochemical Changes on Stored China Aster Seed (*Callistephus chinensis* L. Nees)

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ABSTRACT

The invigoration experiment was conducted on different aged seeds of china aster (*Callistephus chinensis* L. Nees) with water, PEG, KNO_3 and stored for a period of six months. During the storage, some biochemical changes i.e, electrical conductivity, dehydrogenase activity and lipid peroxidase activity occured due to these reactions the quality of the seed decreased. Among the treatments KNO_3 invigorated seed performed better over other treatments on six months old seed stored for six months. EC and Lipid peroxidase activity increased with ageing, where as a decline in trend was observed in dehydrogenase activity.

Key words : China aster, EC, Dehydrogenase activity, Invigoration, Lipid peroxidase activity.

China aster is an important commercial flowering annual ranks next to chrysanthemum and marigold. Commercially grown in many parts of the world in open conditions as cut flower, loose flower, bedding plant, herbaceous borders and potted plant. Seeds of china aster should never be saved from one season to the next, because the seeds loose viability within months and they lose weight and deteriorate during the storage. Seed being a living entity, deterioration in its quality occur with the advancement in ageing which are natural, inevitable, irreversible and continuous processes. In most of the flowers, we have limited knowledge on the effect of biochemical changes on quality of china aster

MATERIAL AND METHODS

Electrical conductivity

To study membrane permeability 50 seeds were soaked in 25 ml of distilled water at 25±1^0 C for 24 hrs. The amount of electrolyte leakage was assessed by measuring the electrical conductivity of the seed soaked water with a conductivity meter.

Dehydrogenase activity

The dehydrogenase activity of seeds was determined after 24 h of imbibition by taking 10 embryonic axes in glass tube containing 50ml of 1% tetrazolium salt and incubated for 3 hours at 25^0 C in dark. The embryonic axis were then thoroughly washed with distilled water and placed in test tubes containing 6 ml of methoxy ethanol for the extraction of red coloured formazon and absorbance was recorded on colorimeter at 470 nm.

Lipid peroxidase activity

Lipid peroxidase activity was estimated by the colorimetric method (Heath and Packer) 100mg of powdered seed soaked in distilled water, after 24 hrs the water was decanted and to this 0.5% TBA prepared in 20% TCA was added. The mixture was boiled at 95^0 C and cooled in ice bath and then centrifuged at 16000 rpm for 15 mins. The absorbance was measured at 532nm.

RESULTS AND DISCUSSION

Electrical conductivity:

Electrical conductivity of seed leachate has negative effect on seed quality. This parameter was studied for different seed priming treatments throughout the storage period. One year old seed recorded highest electrical conductivity, it was recorded lowest in the first month in half year old seed.

At initial month of storage lowest electrical conductivity was recorded in KNO_3 primed seed and highest was recorded in unprimed seed. The differential EC values recorded among the seed treatments indicate the nature and extent of

Table1. Effect of priming treatments on electrical conductivity of china aster seed (dS m^{-1}).

Treatments	Electrical conductivity					Lipid peroxidase activity						
	October	November	December	January	February	March	October	November	December	January	February	March
Age of the seed (S)												
S_1	1.48	1.58	1.59	1.74	1.75	1.82	0.38	0.44	0.46	0.50	0.54	0.63
S_2	1.18	1.18	1.23	1.29	1.31	1.34	0.17	0.18	0.19	0.20	0.20	0.28
SEm ±	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.00	0.01	0.00	0.01	0.04
CD (0.05)	0.03	0.03	0.03	0.05	0.05	0.06	0.03	0.01	0.02	0.01	0.01	0.13
Priming treatments (T)												
T_1	1.41	1.41	1.42	1.43	1.40	1.48	0.27	0.25	0.26	0.28	0.31	0.38
T_2	1.23	1.24	1.42	1.51	1.54	1.60	0.28	0.31	0.33	0.34	0.36	0.41
T_3	1.20	1.20	1.26	1.32	1.34	1.40	0.28	0.25	0.27	0.29	0.30	0.36
T_4	1.47	1.47	1.58	1.79	1.83	1.90	0.40	0.44	0.46	0.49	0.51	0.53
SEm ±	0.01	0.01	0.01	0.03	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01
CD (0.05)	0.04	0.04	0.04	0.08	0.07	0.08	0.04	0.20	0.02	0.02	0.02	0.03
Interactions (S×T)												
S_1T_1	1.57	1.58	1.59	1.56	1.48	1.60	0.38	0.35	0.36	0.40	0.45	0.58
S_1T_2	1.35	1.35	1.64	1.72	1.75	1.81	0.40	0.46	0.48	0.50	0.55	0.64
S_1T_3	1.31	1.31	1.36	1.47	1.50	1.56	0.41	0.35	0.38	0.42	0.45	0.55
S_1T_4	1.67	1.67	1.85	2.20	2.25	2.32	0.60	0.62	0.64	0.68	0.72	0.74
S_2T_1	1.25	1.23	1.24	1.30	1.32	1.36	0.16	0.16	0.16	0.17	0.17	0.18
S_2T_2	1.11	1.12	1.20	1.29	1.33	1.38	0.16	0.16	0.17	0.18	0.18	0.19
S_2T_3	1.09	1.09	1.15	1.18	1.20	1.21	0.16	0.15	0.16	0.16	0.16	0.17
S_2T_4	1.27	1.28	1.31	1.38	1.40	1.43	0.20	0.25	0.28	0.29	0.30	0.32
SEm ±	0.02	0.02	0.03	0.04	0.33	0.40	0.02	0.10	0.01	0.01	0.01	0.01
CD (0.05)	0.05	0.06	0.05	0.11	0.10	0.12	0.05	0.03	0.03	0.02	0.03	N.S

S_1: One year old seed
S_2: six months old seed

T_1: Seed primed with distilled water
T_2: Seed primed with polyethylene glycol (PEG)
T_3: Seed primed with potassium nitrate (KNO_3)
T_4: Unprimed half year old seed (Control)

Table 2. Effect of priming treatments on dehydrogenase activity of china aster seed (OD value).

Treatments	Storage months					
	October	November	December	January	February	March
Age of the seed (S)						
S_1	0.03	0.03	0.03	0.03	0.02	0.02
S_2	0.20	0.20	0.19	0.19	0.11	0.10
SEm ±	0.00	0.00	0.00	0.00	0.00	0.00
CD (0.05)	0.00	0.00	0.00	0.00	0.00	0.01
T_1	0.13	0.14	0.13	0.13	0.13	0.12
T_2	0.14	0.13	0.13	0.13	0.13	0.12
T_3	0.14	0.14	0.14	0.13	0.13	0.13
T_4	0.05	0.05	0.05	0.04	0.04	0.04
SEm ±	0.00	0.00	0.00	0.00	0.00	0.00
CD (0.05)	0.00	0.00	0.00	0.00	0.01	0.01
Priming treatments (T)						
S_1T_1	0.03	0.04	0.03	0.03	0.02	0.02
S_1T_2	0.03	0.04	0.03	0.03	0.03	0.02
S_1T_3	0.04	0.04	0.03	0.03	0.04	0.03
S_1T_4	0.02	0.03	0.02	0.02	0.02	0.01
S_2T_1	0.24	0.24	0.23	0.23	0.23	0.22
S_2T_2	0.24	0.23	0.23	0.23	0.23	0.22
S_2T_3	0.24	0.24	0.24	0.24	0.23	0.23
S_2T_4	0.08	0.07	0.07	0.07	0.06	0.06
Interactions (S×T)						
SEm ±	0.00	0.00	0.00	0.00	0.00	0.00
CD (0.05)	0.00	0.01	0.01	0.00	0.01	0.01

S_1: One year old seed
S_2: six months old seed
T_1: Seed primed with distilled water
T_2: Seed primed with polyethylene glycol (PEG)
T_3: Seed primed with potassium nitrate (KNO_3)
T_4: Unprimed half year old seed (Control)

membrane protection offered may not be the same for all seed priming treatments, thus resulting in difference in EC values as stated in cotton. Electrical conductivity of seed leachate increased with the increase in storage period due to the leakage of electrolytes from the seed and loss of membrane integrity due to ageing (Ghosh *et al.*, 1958). Generally, the electrical conductivity of seed leachate is inversely related to seed quality, higher the EC lower the seed quality and vice versa. In aged seeds or partly deteriorated seed, the EC will be higher owing to decrease in membrane integrity caused by detrimental changes occurring in seeds (Koostra and Harrington 1969). Seed deterioration is associated with enhanced permeability of seed membranes, which leads to higher leakage of electrolytes during imbibition (Parrish and Leopold, 1978; Ray and Gupta, 1979), similar results by sung, 1996 in soybean.

Dehydogenase activity:

The dehydrogenase activity was high for aged seeds in initial months of storage, however with increase in storage period there was a decline in dehydrogenase activity. Greater dehydrogenase activity was reported in seeds subjected to KNO_3 (T_3) followed by hydro priming (T_1). Similar observations were made by Dey and Mukherjee (1986) in mustard, soybean and maize. A sharpfall in dehydrogenase activity with ageing and found that direct correlation exists between germinability and dehydrogenase activity of seeds in sunflower

Table 3. Effect of priming treatments on lipid peroxidase activity of china aster seed.

Treatments	Storage months					
	October	November	December	January	February	March
Age of the seed (S)						
S_1	0.38	0.44	0.46	0.50	0.54	0.63
S_2	0.17	0.18	0.19	0.20	0.20	0.28
SEm ±	0.01	0.00	0.01	0.00	0.01	0.04
CD (0.05)	0.03	0.01	0.02	0.01	0.01	0.13
T_1	0.27	0.25	0.26	0.28	0.31	0.38
T_2	0.28	0.31	0.33	0.34	0.36	0.41
T_3	0.28	0.25	0.27	0.29	0.30	0.36
T_4	0.40	0.44	0.46	0.49	0.51	0.53
SEm ±	0.01	0.01	0.01	0.01	0.01	0.01
CD (0.05)	0.04	0.20	0.02	0.02	0.02	0.03
Priming treatments (T)						
S_1T_1	0.38	0.35	0.36	0.40	0.45	0.58
S_1T_2	0.40	0.46	0.48	0.50	0.55	0.64
S_1T_3	0.41	0.35	0.38	0.42	0.45	0.55
S_1T_4	0.60	0.62	0.64	0.68	0.72	0.74
S_2T_1	0.16	0.16	0.16	0.17	0.17	0.18
S_2T_2	0.16	0.16	0.17	0.18	0.18	0.19
S_2T_3	0.16	0.15	0.16	0.16	0.16	0.17
S_2T_4	0.20	0.25	0.28	0.29	0.30	0.32
Interactions (S×T)						
SEm ±	0.02	0.10	0.01	0.01	0.01	0.01
CD (0.05)	0.05	0.03	0.03	0.02	0.03	N.S

S_1: One year old seed
S_2: six months old seed
T_1: Seed primed with distilled water
T_2: Seed primed with polyethylene glycol (PEG)
T_3: Seed primed with potassium nitrate (KNO_3)
T_4: Unprimed half year old seed (Control)

reported by Dey and Basu (1982). Damage to membrane system could be repaired and protected against such changes by invigoration treatments particularly KNO_3 as indicated by low electrical conductivity of seed leachates, which presumably have extended the viability of seeds (Dias *et al.,* 2004).

Lipid peroxidase activity:

The lipid peroxidase activity was low with six months old seed after one month of storage (0.17) and subsequent months of storage the activity shoot up and finally it was 0.28 after six months of storage. In contrary, the lipid peroxidase activity was recorded higher values for one year old seed (S_2). The enhanced lipid peroxidation was indirectly supported by increased peroxide accumulation in connection with reduced germinability might explain the loss of vigor and viability as reported in cotton (Goel and Sheoran, 2003). KNO_3 primed seed recorded less lipid peroxide activity value, which gradually increased from first to six months of storage ranging between 0.283 to 0.357 respectively, closely followed by hydro priming (T_1). Unprimed seed (T_4) showed a linear trend of increase in lipid peroxidation activity from first to six months of storage and the data ranged between 0.396 to 0.508. The level of lipid peroxidation decreased in seeds primed with KNO_3 might be malonaldehyde and its secondary by products, decrease the activity of enzymes and membrane potrubations leading to electrolyte leakage and exudation of simple sugars (Wilson and Mc Donald, 1986).

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