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EFFICACY OF PRE STORAGE TREATMENTS TO CONTROL SEED DETERIORATION IN BAJRA cv. CO 7 SEED LOTS OF DIFFERENT SEED QUALITY

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ABSTRACT

High, medium and low vigour seeds of bajra cv. CO 7 were subjected to hydration-dehydration (H-DH) and halogenation treatments to prolong storability under ambient conditions. H-DH exerted excellent effects on medium and low vigour seeds while halogenation treatments conferred best effect on medium and low vigour seeds and to a certain extent or high vigour seeds. The improvement in germination for H-DH was 3, 33 and 50 per cent for high, medium and low vigour seeds and 89, 24 and 40 per cent for halogenation treatments, respectively. The invigoration effect was significantly evident from vigour index value, dehydrogenase enzyme activity and field emergence percentage as compared to control in all seed vigour groups.

KEY WORDS: Bajra, Hydration-dehydration, Halogenation, Chlorine, Iodine.

Ageing is an inevitable phenomenon in seeds beyond physiological maturity and cannot be stopped completely once commenced. However, it can be controlled to certain extent by adoption of appropriate storage technology. Controlled storage of seeds would greatly solve the problem of rapid deterioration but it is often expensive and not feasible to our seed producers and farmers. Considering the difficulties encountered in seed storage the present investigation was aimed at evolving cost-effective storage technology to counteract seed deterioration so that the valuable seeds can be carried over under ambient condition without appreciable loss in quality.

MATERIALS AND METHODS

Fresh and processed seeds of bajra cv. CO 7 were converted into three seed vigour groups by subjecting the seeds for ageing in an accelerated ageing chamber (100% RH and 40°C) (Delouche and Baskin, 1973) for 7 and 15 days. The non-aged seeds and these aged for 7 and 15 days were considered as one portion kept without ageing high, medium and low vigour seed lots, respectively. These seeds were given the following seed treatments, packed in cloth bag and stored under ambient condition (25 1°C and 95 2% RH) for 10 months along with the control during May 1996.

T_0 = Control

T_1 = H-DH (seeds soaked in Na_2HPO_4 (10^{-4} M) solution for 3 h followed by drying back to 8% moisture content).

T_2 = Chlorine based halogen formulation (dry) @ 3 g kg^{-1}

T_3 = Iodine based halogen formulation (slurry) @ 3 g kg^{-1}

The chlorine based halogen f as prepared by mixing calcium oxychloride. dehydrated calcium carbonate and finely powdered arappu leaf powder (*Albizzia amara*) mixed at 5:4:1 ratio in a closed container and allowed to impregnate for seven days before use. The iodine based halogen formulation was prepared by impregnating 2 mg of pure iodine crystals in 30 of pure calcium carbonate taken in a glass jar tightly closed with a ground surfaced stopper and heated in a hot air oven maintained at 50-60°C for one hour with occasional stirring, allowed to impregnate for three days and then used for seed treatment.

The seeds were evaluated initially and subsequently at bimonthly interval using the following parameters.

TABLE 1. COMPARATIVE EFFICACY OF SEED TREATMENTS, SEED VIGOUR AND PERIOD OF STORAGE ON Germination (%) and Vigour Index OF BAJRA cv. CO 7

		Germination (%)		Vigour index	
		P_0	P_{10}	P_0	P_{10}
IV	T_0	85 (67.21)	67 (54.94)	2483	1347
	T_1	86 (67.61)	69 (56.16)	2544	1511
	T_2	87 (68.92)	73 (58.37)	2776	1769
	T_3	87 (68.87)	73 (58.37)	2728	1722
V	T_0	76 (60.33)	55 (47.86)	1933	1015
	T_1	86 (68.03)	73 (58.39)	2494	1813
	T_2	80 (65.07)	70 (54.65)	2218	1571
	T_3	79 (62.37)	66 (54.04)	2136	1416
LV	T_0	49 (44.14)	32 (34.44)	1116	544
	T_1	59 (50.18)	48 (43.56)	1549	1122
	T_2	56 (48.15)	47 (42.99)	1349	965
	T_3	55 (47.57)	44 (41.26)	1311	827
Mean (P)		74 (59.69)	60 (50.41)	2053	1302

CD(P=0.05)	V	P	T	VP	PT	VT
Germination	0.43	0.61	0.50	1.06	1.22	0.86
Vigour index	2.95	4.17	3.41	7.23	8.35	5.91

(Figures in parantheses are arc sine values)

T_0 - Control;

T_1 - H-DH (seeds soaked in Na_2HPO_4 (10^{-4} M) solution for 3 h followed by drying back to 8% moisture content);

T_2 - Chlorine based halogen formulation (dry) @ 3 g kg^{-1}.

T_3 - Iodine based halogen formulation (slurry) @ 3 g kg^{-1}

The germination test was carried out with 25x4 seeds adopting modified roll-towel method (Dharmalingam, 1988). The test conditions were 25 2°C and 90 5% RH maintained in a germination room. A germination period of 7 days was adopted. The vigour index was computed from germination (%) and seedling length (cm) (Abdul-Baki and Anderson, 1973). Electrical conductivity test (Presley, 1958) was conducted using 50 seeds in 50 ml of deionised water soaked for 6 hr and

TABLE 2. COMPARATIVE EFFICACY OF SEED TREATMENTS, SEED VIGOUR AND PERIOD OF STORAGE ON Electrical conductivity (dsm^{-1}) AND Dehydrogenase activity (OD VALUE) OF BAJRA cv CO 7

		Electrical conductivity		Dehydrogenase activity	
		P_0	P_{10}	P_0	
HV	T_0	0.028	0.082	0.84	0.44
	T_1	0.029	0.074	0.87	0.45
	T_2	0.016	0.064	0.92	0.58
	T_3	0.015	0.066	0.91	0.57
MV	T_0	0.121	0.183	0.74	0.4
	T_1	0.108	0.148	0.79	0.49
	T_2	0.112	0.151	0.80	0.54
	T_3	0.112	0.151	0.79	0.53
LV	T_0	0.189	0.239	0.66	0.34
	T_1	0.174	0.227	0.79	0.44
	T_2	0.185	0.223	0.72	0.43
	T_3	0.184	0.224	0.71	0.42
Mean (P)		0.106	0.153	0.79	0.47

CD(P=0.05)	V	P	T	VP	PT	VT
Electrical Conductivity	0.029	0.042	0.034	0.027	0.084	0.059
Dehydrogenase activity	0.014	0.020	0.016	0.034	0.040	0.028

T_0 - Control

T_1 - H-DH (seeds soaked in Na_2HPO_4 (10^{-4} M) solution for 3h followed by drying back to 8% moisture content);

T_2 - Chlorine based halogen formulation (dry) @ 3 g kg^{-1}.

T_3 - Iodine based halogen formulation (slurry) @ 3 g kg^{-1}

electrical conductivity values expressed as dsm^{-1}. The dehydrogenase enzyme activity (Kittock and Law 1968) was estimated on 10 seeds and expressed as OD value.

RESULTS AND DISCUSSION

The differences in germination percentage of different vigour groups were significant. The seeds tested one week after the treatment showed improvement in germination by 4-10 per cent in various treatments and vigour groups (Table 1). The overall results revealed that H-DH and halogenation treatments were significantly superior to control and among the treatments the differences were at par. However, the high vigour (HV) seeds given halogenation treatment (iodine or chlorine) showed an edge over H-DH treatment. These treatments maintained the germination above minimum seed certifiation standard (75%) up to six months against four months in untreated seeds. The medium (MV) and low vigour (LV) seeds showed the beneficial effects more with H-DH treatment than with halogenation treatment although they were significantly superior to control. Thus it highlighted that halogenation treatment as the best for high vigour seeds and H-DH and/or halogenation treatments for medium and low vigour seeds.

The computed vigour index (VI) for H-DH was significantly higher (1795) followed by chlorination (1738) and iodination (1694) treatments, accounting for 33, 29 and 25 per cent than the control (Table 1). The maximum mean value was registered for HV seeds (2077) and minimum for LV seeds (1059). The VI got reduced significantly from 2053 (P_0) to 1302 (P_{10}) upon storage in all treatments and more so in control seeds.

The differences in EC values were significant due to treatments, vigour groups, period of storage and their interactions. The H-DH treatment registered lower EC value (0.127 dSm^{-1}), followed by chlorination and iodination treatments (0.125 dSm^{-1}) the latter being on par to each other (Table 2). Maximum EC value was registered for control seeds (0.139 dSm^{-1}). Among the vigour groups, the lowest EC was recorded for high vigour seeds (0.048 dSm^{-1}) and highest for low vigour seeds (0.207 dSm^{-1}). As the storage period advanced, the EC value increased significantly.

The dehydrogenase enzyme activity was highest for H-DH seeds (0.65) followed by halogenated seeds (0.63 to 0.64) accounting for an increase of about 16 per cent for the former and 14 per cent for the latter (Table 2). The enzyme activity was reduced up to 41 per cent in the control seeds by the end of 10 months of storage period.

The primary object of giving H-DH treatment is to scavenge the free radicals formed in stored seeds (Basu, 1976) thereby, further deterioration can be controlled. The unpaired electrons in free radicals persumably damage all membrane systems leading to loss of vigour and viability. This treatment proved effective for a number of crop seeds (Basu and Dasgupta, 1978) in Jute, Basu and Pal (1979), Dharmalingam and Basu (1978) in mungbean and Dharmalingam and Basu (1990) in sunflower. Halogenation treatment was reported to be effective to control seed deterioration (Chitra, 1995; Nair, 1996 and Punitha, 1996). The beneficial effects of this treatment on HV, MV and LV seed lots in the present study and being on par with H-DH treatment has great significance for practical adoption by farmers and seed producers.

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