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CONTROL OF SEED DETERIORATION IN GREENGRAM

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ABSTRACT

Hydration accomplished by soaking the stored seeds original weight was effective in controlling deterioration of seeds stored under high humidity and high temperature conditions (100% RH and 400 C). Hydration - dehydration treatments with dilute solutions of a number of chemicals also showed significant beneficial effects with 18 months old seeds. Further, coating the seeds with kaolinite paste made with dilute solution (2 x 10-5M) of p-aminobenzoic acid and kept closed for 15 min before drying effectively controlled the physiological deterioration in greengram seeds.

The coastal belts are characterised by high temperature and humidity where maintenance of germinability of seeds is difficult. During the monsoon months, the stored seeds reabsorb from the humid air and as a result physiological deterioration starts. in greengram, seed deterioration is not a serious problem and the seeds can be carried over without appreciable loss in vigour and viability for more than one year, provided, the seeds are dried to 8 per cent moisture and protected against the devastating stored pests. In practice, it is often difficult to dry the seed lots to such a low moisture level especially in areas of high humidity and also difficult to practice sealed storage of bulk quantities to protect the seeds from moisture absorption. As a result, the carry-over seeds pose problem of physiological deterioration. Under such circumstances, some methodology in tune with the existing conditions and feasibilities would be most welcome to maintain the vigour and viability of stored seeds. The mid-storage hydration-dehydration treatment developed by Basu and co-workers gave encouraging results in a variety of crop seeds (Basu, 1976; Basu and Dasgupta, 1978; Dharmalingam and Basu, 1978; Basu and Pal, 1980). Therefore, the present investigation was aimed at standardising the hydration-dehydration methodology to control the physiological deterioration of greengram seeds.

MATERIALS AND METHODS

The stored seeds of greengram cvs. Co 3 and B 1 were given the hydration-dehydration treatments (H-D) by employing two methods (soaking the seeds in water and coating the seeds with a kaolinite paste of thick consistency) In both the cases, hydrated seeds were dried back to their original moisture content.

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Soaking-drying : (S-D) : In this, seeds stored for 8 months were soaked in double their volume of water or dilute solution of a number of chemicals such as sodium phosphate, sodium thiosulphate, urea, p-aminobenzoic acid, p-hydroxy benzoic acid and tannic acid at 2 x 10-4M to 2 x 10-5M concentrations for 5 mt at room temperature with occational stirring. (Table 2) for standardizing the soaking duration, the stored seeds were soaked in double their volume of distilled water for different durations ranging from 5 min to 24 h at room temperature. After soaking, the water was decanted off and seeds were surface-dried under a fan and subsequently dried in a current of hot air at 350C back to their original weight.

Control seeds were not hydrated but dried along with the soaked ones. After drying, the seeds were stored in a desiccator over fused calcium chloride for a week to stabilize the moisture content of seeds to a low and uniform level.

Paste coating - drying (PC-D) : Kaolinite paste of thick consistency was made by adding 10 ml. of water or chemical solution to every 100 g of kaolinite powder and mixed homogeneously on a plane glass plate with a spatula. The seeds were than coated with the paste by thorough mixing after taking them in a plastic container. The seeds thus coated were kept closed for 15 min. at room temperature before they were dried back. Then the seeds were surface-dried under the fan and subsequently in a current of hot air. The control seeds were dry-dressed with kaolinite power only and dried along with the treated ones.

The treated and untreated seeds were subjected to different ageing conditions (100% RH, 400C, 90% RH, 400C AND 73 + 7% RH, 27 + 50C).

The modified roll-towel method was followed for germination test. The test was conducted at 25 + 20C for 7 days. Eight replications of 25 seeds each were made for each treatment. Germination count was taken and expressed in percentage. For growth measurements, 10 normal seedlings from each replication were taken.

RESULTS AND DISCUSSION

The data in Table 1 showed the effects of soaking the seeds for different durations followed by drying back on the maintenance of vigour and viability of seeds stored under 100% RH and 400C for 13 days. Dipping the seeds in water for less than a min. upto 10 min. of soaking followed by drying back, showed protection against deterioration. The germination percentage, root length, shoot length, shoot length, dry matter production and vigour index values all showed the beneficial effects of 5 min. soaking-drying treatment. Soaking beyond 10 min. Showed injurious effect on the seed. Thus, a soaking duration not exceeding 5 min. may be considered optimum for greengram seeds to get the desired effect. The deleterious effect on the viability and vigour of seeds soaked for more than 5 min was presumably due to soaking injury to the seeds. In

TABLE 1 : Effect of soaking-drying treatments on germination and vigour of 8-month-old greengram seeds (Cv.Co3) subjected to accelerated ageing at 100% RH and 400C for 13 days.

Soaking duration	Germination (%)	Root length (cm)	Shoot length(cm)	Dry matter mg/seedling	Vigour Index*
Control	83 (66.15)	148	144	25	12260
Dipping drying	82 65.77)	159	150	22	12950
5 min.	95 (77.08)	165	162	23	15675
10 min.	80 (63.93)	172	161	21	13796
30 min.	63 (52.74)	153	137	16	9660
1 h	72 (58.55)	72	135	154	19
2 h	56 (49.80)	138	123	12	8006
3 h	44 (42.29)	132	86	12	6181
L.S.D.R(P=0.05)	(11.44) 23.86	23.86	12.95	4.24	3258

*Vigour index = % germination x root length in mm.

order to avoid rapid imbibition of water, as happens during soaking and to achieve required level of hydration at a steady and slower rate, kaolinite paste coating was given to seeds. Besides water, a number of chemical solutions were also used for making the paste. The treatments were compared with the counterpart seeds given the soaking-drying treatments with the corresponding chemical solutions. The treatment effects were studied after storing the seeds in different relative humidity and temperature conditions.

The data on germination percentage, root length and shoot length of seedings (Table 2 and 3) revealed a non-significant effect of the treatments in controlling the deterioration process in 12-month old CO 3 seeds. The methods of hydration also had little effect in this regard under both the ageing conditions.

In another experiment, a comparative study of the efficacy of different methods of hydration such as, soaking-drying and kaolinite paste coating-drying, was made using 18-month old seeds of greengram, B1. The results showed significant difference in physico-chemical treatments on the maintenance of germinability and vigour of seeds stored under the aforesaid conditions (Tables 4 and 5). Hydrated-dehydrated seeds (irrespective of methods of hydration) showed significant beneficial effects on the germinability and vigour of seeds after accelerated ageing at 100% RH, and 400C for 13 days. Coating the seed with kaolinite paste appeared better than the short-term (5 mt) soaking of seeds. It is also significant to note that P-aminobenzoic acid showed an added advantage over hydration by water in both the hydration methods. Evaluation of treatment effects over months of storage under ambient conditions also revealed parallel results in respect of germination and vigour potential. Thus, the study had depicted the beneficial effects of hydration-dehydration treatments on the maintenance of vigour and viability of stored seeds. The age of the seeds at which the treatments were given decides the effect critically.

The results of the present study confirm the earlier reports of Basu and Co-workers (Basu, 1967; Basu and Das Gupta, 1978; Dharmalingam and Basu, 1978; Basu and Pal, 1980; Rudrapal and Basu, 1982) on the maintenance of vigour and viability of seeds of a wide range of crop plants by mid-storage treatments. The treatments in the cultivar B1 however was more responsive than in Co 3. Significant beneficial effects due to PC-D and S-D for beneficial effects by controlling free radical chain reactions. Peroxidation of unsaturated lipid constituents of lipoprotein membranes and production of highly reactive free radical intermediates may ultimately destory the vital bio-Organelles. If the chain propagation reactions are terminated in the initial stage, much of the damage in the later stage could be prevented. That would explain why Pammenter et al. (1974) could successfully extend the viability of maize seeds through provision of free electrons.

The relationship between lipid perodixation and seed ageing is however,

Table 2 : Effect of soaking-drying treatments on the viability and vigour of stored greengram seeds Cv.Co.3 subjected to accelerated and natural ageing conditions.

Treatments	Accelerated ageing (90% RH, 40° C)		Natural ageing (73 ± 7% RH $27^{\circ} \pm 5^{\circ}$ C) 6 months 8 months			
	Germination (%)	Root length (mm)	Germination (%)	Root length (mm)	Germination (%)	Root length (mm)
Control	26	110	84	153	70	143
Water soaking	21	108	85	158	60	140
Sodium phosphate (2 x 10 - 4M) 20	88	95	155	76	147	
Sodium thiosulphate (2 x 10-4M)	24	128	87	151	74	147
Urea (2 x 10-4M)	21	102	88	141	79	162
P-amino benzoic acids (2 x 10-5M)	25	118	92	165	76	160
P-hydroxy benzonic acid (2 x 10-5M)	15	90	75	150	55	146
LSD (P=0.05)	NS		NS	NS	NS	NS

TABLE 3 : Effect of kaolinite paste treatments on the viability and vigour of stored greengram seeds Cv.Co. 3 subjected and natural ageing conditions.

Treatments	Accelerated ageing (90% RH, 40°) for 18 days		Natural ageing Months			
	Germination (%)	Root length (mm)	Germination * (%)	Root length (mm)	Germination (%)	Root length (mm)
Control	21	80	92	151	70	157
Water spaking	21	100	95	149	72	161
Sodium phosphate (2×10^{-4}M)	31	102	95	156	74	166
Sodium thiosulphate (2×10^{-4}M)	25	98	95	159	76	160
Urea (2×10^{-4}M)	20	82	88	150	68	164
P-amino benzoic acid (2×10^{-5}M)	21	92	97	176	76	167
Tanniic acid (2×10^{-5}M)	23	84	90	127	72	149
	NS	NS	NS	NS	NS	NS

*Treatments were given to 12-month-old seeds.

TABLE 4 : Effect of soaking-drying and paste treatments *on the germination of stored greengram seeds Cu.B 1 subjected to accelerated and natural ageing conditions.

Treatments	Accelerated ageing (100% RH, 40° C) for 15 days	Natural ageing Months				
		3	5	7	9	Mean
Control	43 (41.19)	81 (64.32)	82 (64.98)	80 (63.67)	72 (57.82)	79 (62.68)
Water soaking	68 (58.06)	92 (76.37)	92 (71.54)	90 (71.68)	88 (69.94)	91 (72.38)
Soaking in p-amino benzoic acid solution	71 (58.06)	93 (77.09)	94 (78.40)	88 (70.08)	90 (73.55)	91 (74.75)
Kaolinite paste with water	79 (61.86)	91 (72.83)	90 (71.79)	86 (68.96)	84 (69.27)	88 (69.96)
Kaolinite paste with P-mino benzoic acid	84 (66.41)	91 (72.50)	93 (73.44)	87 (69.25)	90 (72.91)	
Mean	69 (56.61)	90 (72.60)	90 (72.83)	87 (69.35)	84 67.36)	
L.S.D (P = 0.05)	(8.66)	Months of storage Treatments	(3.88) (4.34)			

*Treatments were given to 18 months-old seeds. Concentration of p-amino bennzoic acid (2 x 10-5M)

TABLE 5 : Effect of soaking-drying and paste treatments on the root length (mm) of seedlings from stored greengram seeds Cv.B1 subjected to accelerated and natural ageing conditions.

Treatments	Accelerated ageing (100% RH, 40° C) for 15 days	Natural ageing Months				
		3	5	7	9	Mean
Control	97	149	159	134	132	143
Water soaking	123	165	165	161	154	161
P-amino benozic acid	144	166	177	173	157	168
Kaolinite paste with water	126	164	169	173	162	166
Kaolinite paste with p-amino benzoic acid	148	173	171	171	158	168
Mean	128	163	158	162	152	
L.S.D. (P = 0.05)			Months of storage Treatments	- 5.9 - 6.6		

Treatments were given to 18-month-old seeds.
Concentration of p-amino benzoic acid (2×10^{-5}M)

a controversial one. While some workers noted the association of lipid peroxidation with seed deterioration (Harman and Mattick, 1976; Stewart and Bewley, 1980; Flood and Sinclair, 1981) others did not obtain andy such relationship (Berjak, 1978; Priestly and Leopold, 1979; Pearce and Abdul Samad, 1960). Recently, in deteriorating wheat and mustard seeds Rudrapal and Basu (1982) have noted highly significant negative correlations between lipid perioxidation and germinability. They have also shown that the H-D treatments of stored seeds, which effectively minimised physiological deterioration, exhibited significantly lower lipid peroxidation.

The radical quenching property of hydration in radiobiological experiments has been demonstrated (Conger, 1961, Ehrenberg, 1961; Hebar and Randoplh, 1967). A number of antioxidants and metal chelating agents have been shown to play a significant role in controlling agents have been shown to play a significant role in controlling free radical reactions (Ehrenberg, 1961). Compounds like simple salts and phenols have been successfully used in wheat, mustard, sunflower and several other s\seeds for extending longevity and counteraction of x-and r-irradiation damage (Basu and Dasgupta, 1978; Pathak, 1980; Rudrapal, 1981). Although some of the compounds used in the present study are not conventional free radical scavengers of radio protectors, evidence has been provided by Heckly and Bimmick (1967) that even a simple salt like sodium chloride would markedly control free radical reactions in lyophilized bacterial cells. The phosphates are widely used in food processing industries as antioxident synergists (Nickerson, 1967). Tannic acid is a known anti-oxidant. However, the involvement of lipid and free radical reactions in ageing of seeds and their possible control by physico-chemical treatments require further critical elucidation.

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MANAGEMENT OF SUGARCANE UNDER MOISTURE STRESS CONDITIONS

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ABSTRACT

A field experiment was conducted at Tamil Nadu Agricultural University Sugarcane Research Station, Sirugamani to evolve suitable agrotechnology to manage the sugarcane crop grown under moisture stress condition during 1983-84 in clay loam soil. The results of the experiment revealed that the application of Nitrogen and Potassium in three splits viz., 30, 60 and 90th days after planting was beneficial for cane yield. Net return/ha can be increased either by set treatment with ethrel 200 ppm or by foliar application of potassium at 120th and 135th day after plating under moisture stress conditions.

In the deltaic regions of the Tamil Nadu, every year irrigation canals are closed for desilting, strengthening of embankments etc., during May-July and again water is let in during the last week of July. The sugarcane crop raised in the main season suffers from moisture stress due to this closure of canals. Lift

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