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Improving Vigour and Viability of TNAU Blackgram cv.CO 6 (*Vigna mungo* (L) Hepper) through Iodination

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An investigation was undertaken to standardize the iodination treatment, its dosage and duration of exposure to improve seed vigour and viability in blackgram using halogen with two different doses *viz*., 500 and 1000 mg of iodine; at three different durations (12, 24, 36h); with (2 g. kg^{-1} of seeds) and without carrier using fresh, aged treated and treated aged seeds. About 500 mg of iodine for 12 to 24h duration with carrier @ 2 g kg^{-1} of seeds could bring the desired advantages in all the three lots and performed better in terms of germination and seedling vigour. Germination improvement was 10, 14, and 14 per cent in fresh seeds, aged treated seeds and treated aged seeds, respectively.

Key words: Blackgram, fresh seeds, aged seeds, treated aged seeds, iodination, carrier.

Seed is a biological entity with inevitable deterioration after harvest. Consequences of poor quality seeds are poor germination, slow emergence, weak growth and inadequate field stand. Rapid loss of vigour and viability of blackgram seeds during storage is one of the major constraints faced by the Indian seed industry with consequent financial implications.

One of the most notable characteristics blackgram seed is that they lose their viability very easily. Although seed treatment is proved to be beneficial, the efficacy is inconsistent (Basu and Sur 1988 and Sengupta *et al*.,2005) and mainly, aimed towards protection against deterioration during storage. Soaking and drying treatments of high seeds would reduce storability particularly, in legumes (Basu and Pal,1980; Ramamoorthy and Basu, 1984). Soaking treatment was found to be injurious in soybean (Powell and Matthews 1979; Ramamoorthy *et al*., 1992).

It could be more convenient if the treatment is given for seeds before bagging and storage. Halogenation is one such treatment to control the deterioration process. It involves iodine, an antioxidant of immense potential in controlling deterioration process. Dry dressing of fresh seeds with halogen formulations (chlorine or iodine) has conferred beneficial effects by lowering lipid peroxidation and there by extension of vigour and viability of seeds would be increased (Mandal and Basu, 1986). Hence, the present experiment was carried out to standardize the suitable concentration and duration of exposure of iodine treatment to improve vigour and viability in fresh seeds, 3 days accelerated aged seeds and treated aged seeds in prolonging the shelf life of blackgram seeds.

Materials and Methods

The experiments were conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore using freshly harvested (7/64" R) seeds of TNAU blackgram cv. CO6 that were graded for uniformity.

The samples were divided into three lots *viz*.,fresh seeds immediate to harvest; seeds aged for three days under accelerated ageing conditions and treated with iodine (aged treated seeds); fresh seeds treated with iodine and aged artificially for three days (treated aged seeds). The seed lots were exposed to iodine at various concentrations and durations with and without $CaCO_3$ as carrier @ 2g kg^{-1} of seed as detailed below and evaluated for seed quality characters *viz*., germination, shoot length, root length and dry matter production along with untreated control. The treatment given for freshly harvested seeds, aged treated and treated aged seeds can be considered as pre sowing, mid storage and pre storage treatments, respectively.

Halogen	Carrier ($CaCO_3$)	Dosage	Duration (hours)
Iodine	Without carrier With carrier 2g kg^{-1} of seeds	500 mg & 1000mg kg^{-1} of seeds	12, 24 & 36

The data collected from above experiments were analyzed statistically adopting the procedure described by Panse and Sukhatme (1985).

Results and Discussion

Fresh, aged and treated aged seeds exhibited significant differences for iodination, duration and their interaction in germination parameters. Among all the three seed lots, treatment with iodine @ 500 mg kg^{-1} with carrier exposed for 12 h or 24 h registered higher germination. In case of fresh seeds, exposure for 12 h in iodine @ 500 mg kg^{-1} with carrier registered higher germination of 95% as compared

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Table 1. Effect of iodination on seed germination percentage of TNAU Blackgram cv. CO6.

a) Fresh seeds

Treatment	12 hrs			24 hrs			36 hrs			C x T		Mean
	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	500	1000	
T_1	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)	85 (67.21)
T_2	88 (69.73)	87 (68.86)	88 (69.73)	89 (70.63)	85 (67.21)	87 (68.86)	85 (67.21)	85 (67.21)	85 (67.21)	87 (68.86)	86 (68.02)	87 (68.86)
T_3	95 (77.08)	93 (75.82)	94 (77.08)	91 (72.54)	90 (71.56)	91 (72.54)	88 (69.73)	85 (67.21)	87 (68.86)	91 (72.54)	89 (70.63)	90 (71.56)
Mean	89 (70.63)	88 (69.73)	88 (69.73)	88 (69.73)	87 (68.86)	88 (69.73)	86 (68.02)	85 (67.21)	86 (68.02)	88 (69.73)	87 (68.86)	88 (69.73)
	T		C		D	T × C		C × D	T × D	T × C × D		
SE(d)	0.818		0.667		0.818	1.156		1.156	1.416	2.003		
CD (0.05%)	1.659**		NS		NS	NS		NS	NS	4.064*		
CD (0.01%)	2.224**		NS		NS	NS		NS	NS	5.449*		

(Figures in parenthesis indicates arcsine values)

b) Aged treated seeds

Treatment	12 hrs			24 hrs			36 hrs			C x T		Mean
	C_1 500	C_2 000	Mean	C_1 500	C_2 000	Mean	C_1 500	C_2 000	Mean	500	1000	
T_1	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	7 (60.00)	5 7 (60.00)	5 7 (60.00)	5
T_2	89 (70.63)	88 (69.73)	89 (70.63)	81 (64.15)	80 (63.43)	81 (64.15)	85 (67.21)	85 (67.21)	85 (67.21)	8 (67.21)	5 8 (66.42)	4 8 (66.42)	4
T_3	89 (70.63)	86 (68.02)	88 (69.73)	90 (71.56)	87 (68.86)	89 (70.63)	86 (68.02)	85 (67.21)	86 (68.02)	8 (69.73)	8 8 (68.02)	6 8 (68.02)	6
Mean	84 (66.42)	83 (65.65)	84 (66.42)	82 (64.89)	81 (64.15)	81 (64.15)	82 (64.89)	82 (64.89)	82 (64.89)	8 (65.65)	3 8 (64.89)	2 8 (64.89)	2
	T		C		D	T × C		C × D	T × D	T × C × D			
SE(d)	0.391		0.319		0.391	0.554		0.554	0.678	0.959			
CD (0.05%)	0.794**		NS		0.648*	NS		NS	1.376**	NS			
CD (0.01%)	1.065**		NS		0.870*	NS		NS	1.846**	NS			

(Figures in parenthesis indicates arcsine values)

c) Treated aged seeds

Treatment	12 hrs			24 hrs			36hrs			C x T		Mean
	C_1 500	$C_2$1000	Mean	C_1 500	$C_2$1000	Mean	C_1 500	$C_2$1000	Mean	500	1000	
T_1	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)	75 (60.00)
T_2	88 (69.73)	85 (67.21)	87 (68.86)	88 (69.73)	85 (67.21)	87 (68.86)	88 (69.73)	84 (66.42)	86 (68.02)	88 (69.73)	85 (67.21)	86 (68.02)
T_3	89 (70.63)	86 (68.02)	88 (69.73)	89 (70.63)	87 (68.86)	88 (69.73)	85 (67.21)	86 (68.02)	86 (68.02)	88 (69.73)	86 (68.02)	87 (68.86)
Mean	84 (66.42)	82 (64.89)	83 (65.65)	84 (66.42)	82 (64.89)	83 (65.65)	83 (65.65)	82 (64.89)	82 (64.89)	84 (66.42)	82 (64.89)	83 (65.65)
	T		C		D	T × C		C × D	T × D	T × C × D		
SE (d)	0.411		0.336		0.411	0.582		0.582	0.713	1.008		
CD (0.05%)	0.834**		NS		0.834*	NS		NS	1.446**	NS		
CD (0.01%)	1.119**		NS		1.119*	NS		NS	1.939**	NS		

(Figures in parenthesis indicates arcsine values)

T1 – Control (untreated), T2 – Iodine without carrier, T3 – Iodine with carrier

T- Iodine C - Concentration D - duration

* at 5% significant level ** at 1% significant level NS – Non Significant

to treatment without carrier (88%) and control (85%) Iodine @ 500 mg kg^{-1} with carrier exposed for 12 h or 24 h registered higher germination of 89 and 90%, respectively for aged treated seeds. In treated aged seeds, higher germination (89 %) was evident and the improvement was 14 per cent over control (Table 1a, b and c). Any post harvest treatment given for improved germinability, greater storability and better field performance can be referred as an index of seed vigour (Basu, 1994).

The physiological seed treatments, depending on the kind of seed and initial seed vigour status, would significantly extend storability and improve subsequent crop performance. Dry treatments

Table 2. Effect of iodination on shoot length of TNAU Blackgram cv. CO6

a) Fresh seeds

Treatment	12 hrs			24 hrs			36hrs			C x T		Mean
	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	500	1000	
T_1	13.95	13.95	13.95	13.95	13.95	13.95	13.95	13.95	13.95	13.95	13.95	13.95
T_2	15.65	14.90	15.28	14.95	14.70	14.83	14.90	14.50	14.70	15.17	14.70	14.94
T_3	15.65	15.30	15.48	15.60	15.10	15.35	15.00	14.65	14.83	15.42	15.02	15.22
Mean	15.08	14.72	14.90	14.83	14.58	14.71	14.65	14.68	14.66	14.96	14.65	14.81
	T		C		D		T × C		C × D	T × D		T× C × D
SE (d)	0.190		0.155		0.190		0.268		0.268	0.329		0.465
CD (0.05%)	0.385**		NS		NS		NS		NS	NS		NS
CD (0.01%)	0.516**		NS		NS		NS		NS	NS		NS

b) Aged treated seeds

Treatment	12 hrs			24 hrs			36hrs			C x T		Mean
	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	500	1000	
T_1	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75
T_2	15.39	14.61	15.00	14.71	14.00	14.36	14.41	14.38	14.40	14.84	14.33	14.58
T_3	15.94	15.42	15.68	15.01	14.96	14.99	13.50	13.00	13.25	14.82	14.46	14.64
Mean	14.69	14.26	14.48	14.16	13.90	14.03	13.55	13.38	13.47	14.13	13.85	13.99
	T		C		D		T × C		C × D	T × D		T × C × D
SE (d)	0.652		0.533		0.652		0.923		0.923	1.130		1.599
CD (0.05%)	1.324**		NS		NS		NS		NS	NS		NS
CD (0.01%)	1.775**		NS		NS		NS		NS	NS		NS

c) Treated aged seeds

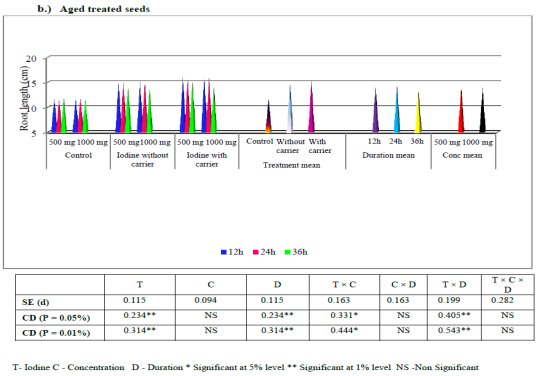
Treatment	12 hrs			24 hrs			36hrs			C x T		Mean
	C_1 500	$C_2$1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	$c_1$500	$c_2$1000	
T_1	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75
T_2	15.29	14.50	14.90	14.98	14.11	14.55	14.49	13.76	14.13	14.92	14.12	14.52
T_3	15.76	14.62	15.19	15.53	15.20	15.37	14.75	14.66	14.71	15.35	14.83	15.09
Mean	14.60	13.96	14.28	14.42	14.02	14.22	14.00	13.72	13.86	14.34	13.90	14.12
	T		C		D		T × C		C × D	T × D		T × C × D
SE (d)	0.327		0.267		0.327		0.463		0.463	0.567		0.802
CD (0.05%)	0.6648**		NS		NS		NS		NS	NS		NS
CD (0.01%)	0.891**		NS		NS		NS		NS	NS		NS

T1 – Control (untreated), T2 – Iodine without carrier, T3 – Iodine with carrier T- Iodine
C - Concentration D - duration * at 5% significant level ** at 1% significant level NS – Non Significant

are only effective only when employed to freshly harvested high vigour seeds. Shoot length was not altered due to concentration, durations of exposure and their interaction effects except carrier for fresh seeds and treated aged seeds. Root length and drymatter production were positively enhanced in both the seed lots (fresh and aged treated seeds) while, shoot length remained unaltered. Between the lots, pronounced improvement was observed in aged treated seeds than fresh seeds (Fig. 1a, b and c).

The beneficial effects of halogen on viability maintenance have been reported in bajra (Malarkodi and Dharmalingam, 1999); cotton (Rathinavel and Dharmalingam, 2002); chilli (Ravi Hunje *et al*.,2007) and sunflower (Sathiya Narayanan and Prakash, 2007).

In the present study, the improvement was evident for viability alone rather than vigour parameters *viz*., seedling growth and dry matter production. It is



	T	C	D	T × C	C × D	T × D	T × C × D
SE (d)	0.115	0.094	0.115	0.163	0.163	0.199	0.282
CD (P = 0.05%)	0.234**	NS	0.234**	0.331*	NS	0.405**	NS
CD (P = 0.01%)	0.314**	NS	0.314**	0.444*	NS	0.543**	NS

T- Iodine C - Concentration D - Duration * Significant at 5% level ** Significant at 1% level NS -Non Significant

possible that the carrier retains part of the halogen vapour and the residual vapour may add advantage during storage.The halogen also offers protection against storage pathogens as observed through fungus free seeds during ageing. Iodine used in the formulation may act on the unsaturated fatty acid and stabilize membrane lipids, thereby control the

Table 3. Effect of iodination on dry matter production (g 10 seedlings $^{-1}$) in seeds of TNAU Blackgram cv. CO6.

a) Fresh seeds

Treatment	12 hrs			24 hrs			36hrs			Concentration		Mean
	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	
T_1	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171
T_2	0.293	0.282	0.288	0.281	0.280	0.281	0.280	0.268	0.274	0.285	0.277	0.281
T_3	0.301	0.298	0.300	0.287	0.283	0.285	0.287	0.259	0.273	0.292	0.280	0.286
Mean	0.255	0.250	0.253	0.246	0.245	0.246	0.246	0.233	0.239	0.249	0.243	0.246
	T		C	D		T × C		C × D		T × D		T × C × D
SE (d)	0.005		0.004	0.005		0.008		0.008		0.014		0.014
CD (0.05%)	0.011**		NS	NS		NS		NS		NS		NS
CD (0.01%)	0.015**		NS	NS		NS		NS		NS		NS

b) Aged treated seeds

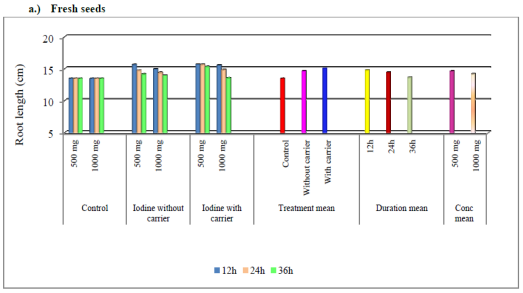
Treatment	12 hrs			24 hrs			36hrs			Concentration		Mean
	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	
T_1	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154
T_2	0.200	0.214	0.207	0.168	0.203	0.186	0.146	0.191	0.169	0.171	0.206	0.189
T_3	0.236	0.213	0.225	0.216	0.192	0.204	0.191	0.224	0.208	0.206	0.217	0.212
Mean	0.196	0.193	0.195	0.179	0.183	0.181	0.164	0.190	0.177	0.177	0.192	0.185
	T		C	D		T × C		C × D		T × D		T× C × D
SE (d)	0.004		0.004	0.004		0.007		0.007		0.008		0.012
CD (0.05%)	0.010**		0008**	0.010**		0.014**		NS		0.017*		0.024*
CD (0.01%)	0.013**		0.011**	0.013**		0.019**		NS		0.023*		0.033*

c) Treated aged seeds

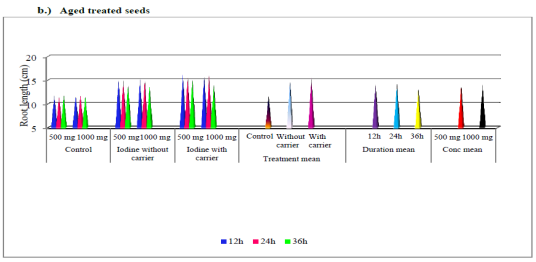
Treatment	12 hrs			24 hrs			36hrs			C x T		Mean
	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	Mean	C_1 500	C_2 1000	
T_1	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154
T_2	0.213	0.260	0.237	0.198	0.215	0.207	0.209	0.200	0.205	0.207	0.225	0.216
T_3	0.260	0.212	0.236	0.210	0.231	0.221	0.203	0.192	0.198	0.219	0.212	0.216
Mean	0.209	0.209	0.209	0.187	0.200	0.194	0.189	0.182	0.186	0.193	0.197	0.195
	T		C	D		T × C		C × D		T × D		T × C× D
SE (d)	0.012		0.104	0.012		0.018		0.018		0.022		0.031
CD (0.05%)	0.026**		NS	NS		NS		NS		NS		NS
CD (0.01%)	0.034**		NS	NS		NS		NS		NS		NS

T1 – Control (untreated), T2 – Iodine without carrier, T3 – Iodine with carrier T-Iodine
C - Concentration D - duration * at 5% significant level ** at 1% significant level
NS – Non Significant

Fig. 1. Effect of iodination on root length (cm) of TNAU Blackgram cv. CO6.



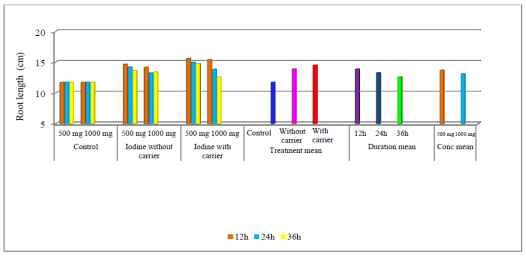
	T	C	D	T × C	C × D	T × D	T × C × D
SE (d)	0.165	0.135	0.165	0.234	0.234	0.286	0.405
CD (P = 0.05%)	0.335**	0.274**	0.335**	0.475**	NS	0.581*	NS
CD (P = 0.01%)	0.450**	0.367**	0.450**	0.637**	NS	0.780*	NS



	T	C	D	T × C	C × D	T × D	T × C × D
SE (d)	0.115	0.094	0.115	0.163	0.163	0.199	0.282
CD (P = 0.05%)	0.234**	NS	0.234**	0.331*	NS	0.405**	NS
CD (P = 0.01%)	0.314**	NS	0.314**	0.444*	NS	0.543**	NS

T- Iodine C - Concentration D - Duration * Significant at 5% level ** Significant at 1% level NS -Non Significant

c.) Treated aged seeds



	T	C	D	T × C	C × D	T × D	T × C × D
SE (d)	0.312	0.254	0.254	0.312	0.441	0.441	0.540
CD (P = 0.05%)	0.633**	NS	NS	NS	NS	NS	NS
CD (P = 0.01%)	0.849**	NS	NS	NS	NS	NS	NS

T- Iodine C - Concentration D - Duration * Significant at 5% level ** Significant at 1% level NS - Non Significant

production of free radicals. The halogens act as free radical quenchers or scavengers (Pryor and Lass Well, 1975). It has been reported that halogens stabilize carbon to carbon double bond and render them less susceptible to peroxidative and free radical reactions. The beneficial effect of halogenation towards the stabilization of the unsaturated fatty acid moiety of lipoprotein membrane was reported by other research workers (Basu and Rudrapal, 1980; Mandal and Basu, 1986 and Pal and Basu, 1988). The halogenation stabilizes the C=C bond in poly unsaturated fatty acids, which are the primary sites of free radical attack (Wilson and McDonald, 1986). Besides, halogen may also account party for its antimicrobial action particularly on storage fungi.

Conclusion

Irrespective of the mechanism of action, dry seed treatment of blackgram cv.CO 6 with iodine @ 500 mg for 12 to 24h duration, with carrier @ 2 g kg^{-1} of seeds has been found to be ideal prior to bagging for long term storage.

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