J. Phytol. Res. 16(1) : 77-80, 2003

IMPROVEMENT OF GERMRINATION AND VIGOUR OF DIFFERENTIALLY AGED SEEDS IN RICE VARIETIES

P. SELVARAJU*, V. KRISHNASAMY and K. RAJA**

Department of Seed Science and Technology, Tamil Nadu Agricultural University - Coimbatore - 641 003, India.

* Department of Seed Science and Technology, Anbil Dharmalingam Agricultural College and Research Institute, Tiruchy - 9, India.

**Central Institute of Cotton Research, Coimbatore-3, India.

An experiment was conducted at the Department of Seed Science and Technology, Tamilnadu Agricultural University, Coimbatore to find out the effects of different pre-sowing seed treatments of differentially aged seeds in three rice varieties *viz.*, ADT 38, CO 43 and CO 46. The results revealed that thiourea at 0.1 per cent enhanced the germination, seedling growth and vigour of fresh and aged seeds. Next to thiourea, *Prosopis* leaf extract at one per cent and potassium chloride at 100 ppm also improved germination as compared to the untreated seeds. Among varieties, improvement in germination was more in ADT 38 than CO 43 and CO 46.

Keywords : Paddy; aged seeds; treatments, germination; vigour.

Introduction

The differential performance of stored seed lot on seedling establishment may be due to the variation in seed vigour. One or more germination processes are considered as limiting factors for field emergence in low vigour seeds. For example, in rice aleurone layer is the site of production of hydrolase enzymes, which are responsible for the initial breakdown of stored reserve material to simple sugars[1], and in less vigourous seeds, this process may be delayed. So, sowing of low vigour seeds may affect synchrony in emergence and the production performance of the resultant plant could always be lower under field conditons, because of reduced capacity to mobilize the seed reserves[2].

Hence, pre-treatment of seeds with nutrient chemicals initiates the physiological and biochemical effects in seed which ultimately enhances the vigour status. The treated seeds respond due to increased hydrophilicity associated with high osmotic pressure of bound water, increased phosphorylative activity of the mitochondria, higher DNA in growing point, less ribonucliase activity and well preserved cellular ultra structure[3].

Materials and Methods

Differentially aged seeds of paddy varieties were soaked overnight in water, leaf extract and chemical solutions as described below. The unsoaked seeds were treated as control.

Varieties :

V_1 - ADT 38
V_2 - CO 43
V_3 - CO 46

Age of seeds :

Y_1 - Fresh
Y_2 - One year old
Y_3 - Two year old

Treatments :

T_0 - Control
T_1 - Water soaking
T_2 - Thiourea 0.1%
T_3 - *Prosopis* leaf extract 1.0%
T_4 - Succinic acid 20 ppm
T_5 - Potassium chloride 100 ppm
T_6 - Sodium molybdate 100 ppm
T_7 - Zinc sulphate 100 ppm

After soaking, the seeds were washed with water thoroughly and shade dried. A total number of 400 seeds were taken in four replicates of 100 seeds each in all the treatments and placed in paper roll towel medium. They were then allowed to germinate at 25± 2°C and 90 ± 2 per cent relative humidity. After 14 days, the seedlings were evaluated and the normal seedlings produced were counted and expressed as germination per cent[4]. After germination test evaluation was over, ten

Table 1. Effect of pre-sowing seed treatments on germination (%) in differentially aged seeds of rice varieties.

Treatments	Y_1				Y_2				Y_3				Grand Mean
	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	
T_0	84 (66.5)	89 (70.7)	86 (68.1)	86 (68.4)	71 (57.4)	78 (62.0)	80 (63.5)	76 (61.0)	43 (41.0)	45 (42.1)	40 (39.2)	43 (40.8)	68 (56.7)
T_1	85 (67.3)	80 (71.7)	86 (68.1)	87 (69.0)	73 (58.7)	79 (62.7)	80 (63.5)	77 (61.6)	60 (51.0)	50 (45.0)	49 (44.4)	53 (46.8)	72 (59.1)
T_2	92 (73.6)	94 (76.0)	91 (72.6)	92 (74.1)	80 (63.5)	88 (69.8)	85 (67.3)	84 (66.8)	61 (51.4)	64 (53.1)	61 (51.4)	62 (51.9)	79 (64.3)
T_3	87 (68.9)	92 (73.7)	88 (69.8)	89 (70.8)	78 (61.7)	82 (64.9)	83 (65.7)	81 (64.1)	51 (45.3)	55 (47.9)	52 (46.1)	53 (46.4)	74 (60.4)
T_4	84 (66.5)	90 (71.7)	87 (68.9)	87 (69.1)	72 (58.1)	79 (62.7)	81 (64.2)	77 (61.7)	45 (42.1)	46 (42.7)	47 (43.3)	46 (42.7)	70 (57.8)
T_5	86 (68.1)	91 (72.6)	89 (70.7)	89 (70.5)	74 (59.3)	80 (63.5)	82 (64.9)	79 (62.6)	47 (43.3)	50 (45.0)	50 (45.0)	49 (44.4)	72 (59.2)
T_6	85 (67.3)	87 (68.9)	87 (68.4)	86 (59.3)	74 (64.2)	81 (64.2)	81 (62.6)	79 (62.6)	45 (42.1)	47 (43.3)	47 (43.3)	46 (42.9)	70 (58.0)
T_7	86 (68.1)	86 (68.1)	86 (68.1)	86 (68.1)	73 (58.7)	80 (63.5)	80 (63.5)	78 (61.9)	36 (36.9)	47 (43.3)	47 (43.3)	43 (41.1)	69 (57.0)
Mean	86 (68.3)	90 (71.7)	88 (69.4)	88 (69.8)	74 (59.6)	81 (64.2)	82 (64.6)	79 (62.8)	48 (44.1)	51 (45.3)	49 (44.5)	49 (44.6)	

	T	V	Y	TV	VY	TY	TVY
SEd	0.74	0.45	0.45		0.79	1.28	
CD (P=0.05)	1.48	0.91	0.91	NS	1.57	2.56	NS

Table 2. Effect of pre-sowing seed treatments on root length (cm) in differentially aged seeds of rice varieties.

Treatments	Y_1				Y_2				Y_3				Grand Mean
	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	
T_0	21.0	17.4	19.3	19.2	20.3	17.2	18.0	18.5	18.5	15.0	17.0	16.8	18.2
T_1	21.2	17.8	19.5	19.5	20.4	17.4	18.0	18.6	18.6	15.4	17.2	17.1	18.4
T_2	21.5	19.6	20.0	20.4	20.5	18.6	18.5	19.2	19.6	16.0	17.8	17.8	19.1
T_3	21.2	19.3	19.8	20.1	20.8	18.5	18.3	19.2	19.2	15.8	17.7	17.6	19.0
T_4	21.3	19.0	19.5	19.9	20.6	17.8	18.1	18.8	19.5	15.5	17.3	17.4	18.7
T_5	21.2	19.2	19.6	20.0	20.3	18.0	18.3	18.9	19.1	15.6	17.5	17.4	18.8
T_6	22.0	20.6	21.1	21.2	21.6	19.7	19.0	20.1	19.8	17.0	18.3	18.4	19.9
T_7	21.8	20.1	20.1	20.7	21.5	19.5	18.7	19.9	19.6	16.0	18.5	18.0	19.5
Mean	21.4	19.1	19.9	20.1	20.8	18.3	18.4	19.2	19.2	15.8	17.7	17.6	

	T	V	Y	TV	VY	TY	TVY
SEd	0.15	0.09	0.09	0.26	0.16	0.26	0.45
CD (P=0.05)	0.30	0.18	0.18	0.52	0.32	NS	NS

Table 3. Effect of pre-sowing seed treatments on shoot length (cm) in differentially aged seeds of rice varieties.

Treatments	Y_1				Y_2				Y_3				Grand Mean
	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	
T_0	12.3	11.0	13.0	12.1	11.3	10.3	12.5	11.4	10.7	8.6	11.2	10.2	11.2
T_1	12.5	11.2	13.2	12.3	11.7	10.4	12.6	11.6	11.0	9.1	11.5	10.5	11.5
T_2	13.3	12.6	14.6	13.5	12.9	11.7	13.7	12.8	12.0	10.1	12.6	11.6	12.6
T_3	12.7	12.3	14.3	13.1	12.3	11.6	13.5	12.5	11.5	10.0	12.4	11.3	12.3
T_4	12.5	11.5	13.5	12.5	11.9	10.6	12.8	11.8	11.0	9.3	11.7	10.7	11.7
T_5	13.0	12.0	14.1	13.0	12.6	11.4	13.5	12.5	11.8	10.0	12.3	11.4	12.3
T_6	12.7	11.9	14.0	12.9	12.1	11.0	13.3	12.1	11.4	9.7	12.0	11.0	12.0
T_7	12.6	11.6	13.7	12.6	12.0	10.8	14.0	12.3	11.2	9.4	12.0	10.9	11.9
Mean	12.7	11.8	13.8	12.8	12.1	11.0	13.2	12.1	11.3	9.5	12.0	10.9	

	T	V	Y	TV	VY	TY	TVY
SEd	0.13	0.08	0.08	0.23	0.14	0.23	0.39
CD (P=0.05)	0.26	0.16	0.16	NS	0.28	NS	NS

Table 4. Effect of pre-sowing seed treatments on shoot length (cm) in differentially aged seeds of rice varieties.

Treatments	Y_1				Y_2				Y_3				Grand Mean
	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	Y_1	Y_2	Y_3	Mean	
T_0	2799	2528	2779	2702	2244	2146	2441	2277	1255	1062	1128	1148	2042
T_1	2867	2610	2813	2763	2343	2196	2461	2333	1282	1226	1407	1305	2134
T_2	3202	3029	3150	3127	2673	2665	2707	2682	1928	1671	1848	1815	2541
T_3	2949	2909	3019	2959	2566	2468	2623	2552	1550	1419	1540	1503	2338
T_4	2840	2749	2871	2820	2339	2244	2503	2362	1322	1141	1363	1275	2152
T_5	2942	2840	3000	2927	2436	2352	2607	2465	1452	1281	1491	1408	2267
T_6	2950	2827	3054	2944	2493	2479	2615	2529	1404	1256	1425	1361	2278
T_7	2959	2727	2906	2864	2445	2425	2536	2468	1110	1194	1434	1246	2193
Mean	2938	2777	2949	2888	2442	2371	2561	2458	1413	1281	1454	1383	

	T	V	Y	TV	VY	TY	TVY
SEd	30.98	18.97	18.97	53.67	32.86	53.67	92.95
	61.77	37.82	37.82	NS	NS	106.98	NS

normal seedlings from each replication were removed at random and length of root and shoot was measured. These seedlings were then transferred to hot air oven maintained at 85+1°C. After drying was over, the seedlings were removed from the hot air oven; cooled in a desiccator over silicagel and dry weight of the seedlings was recorded.

Vigour index values were computed as per the formula suggested by Abdul-Baki and Anderson[5] in which the germination percentge was multiplied with seedling length.

Results and Discussion

The results showed that pre-sowing seed treatments enhanced the germrination percentage of fresh and aged seeds. Among the treatments, thiourea at 0.1 per cent registered the maximum germination in all the three varieties. The effect was more pronounced in two year old seeds than fresh and one year old seeds. similar reports of enhanced germination due to thiourea have been reported by many workers in the crops like prosomillet[6-8] and ber[9]. Among the varieties, percentge increase in germination was more in ADT 38 (Table 1).

Utheib *et al.*[10] have described that the thiourea may cause an increase in gibberellin-like substances in the plant tissues which might be the reason for increased germination in the present investigation.

Root length, shoot length and vigour index (Table2, 3 &4) also increased due to thiourea and the increased growth due to pre-sowing treatment has been reported by several authors[11-13]. It is possible that increase in seedling growth after presowing teatment of seeds obviously depends on the activation of the germination process of the seeds during the pretretment[14].

Next to thiourea, *Prosopis* leaf extract at one per cent also improved the germination than the untreated control. Similar findings were reported in rice[15] and in sorghum[16]. Use of plant products as manures and pesticides are very much looked upon to avoid health hazards and environmental pollution. The present approach is also organic based with easily accessible materials to the farmer at negligible cost. The factor responsible for the promotion of germination might be due to the saponins present in the *Prosopis* leaves and these *vis-a-vis-* could bring about similar action as that of gibberellins. Further studies to deciphor the chemical nature of the substances would be very much rewarding.

References

1. Palmiano E and Juliano B O 1972, *Plant Physiol.*, **49** 751.
2. Anderson JD 1970, *Crop Scin.*, **10** 36
3. Henckel P A 1964, *Ann. Rev. Pl. Physiol.*, **15** 363.
4. ISTA 1999, *Seed Sci. and Technol.* **27** 30.
5. Abdul Baki and Anderson J D 1973, *Seed Sci. and Technol.*, **1** 401.
6. Anderson M 1962, *Compt. Rend. Assoc. Int. Essais Semences,* **27**(3) 730.
7. Bruece M L, Zwar S A and Kafford N P 1965, *Life Sci.*, *4* 461.
8. Selvaraju P 1986, *Studies on certain aspects of production, grading, treating and storage of seed in marigold (Tagetes erecta L.)* M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.
9. Srimathi P 1997, *Research focus on seed collection, processing and storage of amla (Emblica officinalis), Garten, Jamun (Syzygium cuminii Skeels) and ber (Zizyphus mauritiana Lamk.)*, Ph. D. Thesis, Tamil Nadu Agricultural University, Coimbatore.
10. Utheib N A, Abbas M F and Al-Ammara A S 1981. *J. Indian Potato Assoc.*, **8**(3) 134.
11. Mandal A K, Basu R N 1987, *Fld. Crops Res.*, **15** 259.
12. Hofmann P, 1992, *Seed Sci. and Technol.* **20** 441.
13. Suksoon L, Jae Hyeun, Seungbeom H and Anghee Y 1998, *Korean J. Crop Sci.* **43**(3) 157.
14. Lush W M, Groves R H and Kaye P E 1981, *Australian J. Pl. Physiol.* **8** 409.
15. Nagarajan S 1996, *Seed hardening and coating studies in upland rice (Oryaza sativa L.)* M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.
16. Jagathambal 1996, *Pre-sowing seed treatment to augment productivity of sorghum Co 26 under rainfed agriculture.* Ph. D. Thesis, Tamil Nadu Agricultural University, Coimbatore.