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M Ananthi
Dept. of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

G Sasthri
Dept. of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

P Srimathi
Dept. of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

K Malarkodi
Dept. of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Correspondence
M Ananthi
Dept. of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Evaluation of storage potential of pre-sowing seed treatment in greengram

M Ananthi, G Sasthri, P Srimathi and K Malarkodi

Abstract

Experiments were carried out to evaluate the pre sowing seed storage potential of green gram cv. CO 6. The seeds were imposed with hardening treatment with $MgSO_4$ 100 ppm (soaking in 1/3 volume of seed to solution ratio for 3h) and integrated seed management technique (Designer seed treatment (Hardening with $MgSO_4$ 100 ppm + Polymer 3ml/kg + Carbendazim 2g/kg + Imidacloprid 1ml/kg)) along with untreated seeds were packed in cloth bag and polythene bag and stored in nine months under ambient condition. The results revealed that, designer seed stored in polythene bag container maintained the seed quality parameters without seed deterioration upto nine months of storage.

Keywords: Greengram seed, $MgSO_4$, Polymer, Carbendazim and Imidachloprid.

Introduction

Seed storage is an important post-harvest operation that decides the success of seeds in next generation. One of the most important basic needs for higher productivity is quality seed characterized by higher viability and vigour (Yaklich *et al*., 1979) [38]. Pulses are mesobiotic in storage behaviour, which can only be stored upto a storage period of three years (Ewart, 1908) [9] and their higher lipoprotein content which gain moisture on storage undergo rapid lipid peroxidation (Agrawal and Dadlani, 1995) [1] that leads to degradation of seed quality characters and finally ends with death of seed. Seed, like any other biological materials deteriorate with ageing and the rate of which depended on many factors such as dormancy (Parameshwari,1999) [20], chemical composition (Maranville and Clegg, 1977) [17], storage temperature, microflora (Chacko and Singh,1971) [5], seed moisture and relative humidity (Justice and Basu, 1978) [12], seed coat characters (Srimathi *et al*., 1991) [30] and the genotype (James *et al*., 1967) [11]. At times it is also decided by the pre-sowing seed treatment given to the seed (Punithavathi, 1997) [21], where the storability of treated seed is warranted for use in future course of time which may be either short or medium term. On recommendation of pre-sowing seed management techniques for betterment of plant population, necessitates the storability of treated seeds with expected benefits for longer period of usage. Researchers also expressed that seeds after imposing management techniques could be stored (Dearman *et al.*, 1986) [6] with expected invigourative effect up to resowing (Savino *et al.*, 1979) [26]. Keeping these in view, the present study was made in greengram cv. CO 6 to determine the storage potential of pre sowing seed treatment.

Material and Methods

Genetically pure, freshly harvested breeder seeds of greengram (*Vigna radiata* L. Wilczek) cv. CO 6 obtained from Agricultural Research Station, Bhavanisagar served as the base material for the study of storage experiments and laboratory evaluations were conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2010-2011. The bulk seeds were imposed with hardening treatment with $MgSO_4$ 100 ppm (soaking in 1/3 volume of seed to solution ratio for 3h) as per CPG and the integrated seed management technique (Designer seed treatment (Hardening with $MgSO_4$ 100 ppm + Polymer 3ml/kg + Carbendazim 2g/kg + Imidacloprid 1ml/kg)) along with untreated seeds were packed in cloth bag and polythene bag and stored nine months under ambient condition and evaluated the seed quality parameters, biochemical parameters and seed health. The data obtained from different experiments were analysed for ‘F’ test of significance following the methods described by Panse and Sukhatme (1985) [19].

Results and Discussion

Important factors that determine the viability of seeds in storage is seed moisture content. In the present investigation, moisture content of seed increased very slightly with advances in storage period and attained the maximum of 9.2 per cent. Seeds stored in cloth bag might have be an exposed to increased frequency of moisture equilibration with atmosphere that resulted in the increased rate of absorption which accelerated the rate of deterioration. But in polythene bag container, the increase was less due to their lesser amenability to variations in atmospheric moisture (Roberts, 1986) [24] as reported by Sumathi (2010) [32] in karpokkarasi. West *et al*. (1985) [36] reported that adsorption of moisture from the storage environment has been reduced by coating the seeds with polymer in soybean and sugarbeet, respectively. In the present study, among the treatments, seeds coated with polymer + imidachloprid + carbendazim registered 0.4 per cent lower moisture content than untreated seeds in polythene bag container. The moisture content was comparatively lower compared to control due to the preventive mechanism operated in seed coated with fungicide and insecticide (Manjunatha *et al*., 2008) [16].

The germinability of seeds observed through the standard germination test indicated that the seed germination was in decreasing order from the initial period to nine months storage periods. The decline in germinability during storage could be attributed to the irrevessible ageing characteristics of all living biological organism causing deteriorative changes in the physical, physiological and biochemical characters of seed (Roberts, 1972) [25]. Designer seed recorded (85 and 81 per cent) higher germination at nine months storage period of cloth bag and polythene bag container when compare to control (75 and 64 per cent) (Table 1). The beneficial effect of coating the seeds with polykote was reported by many researchers (Sherin, 2003; Giang and Rame Gowda, 2007; Sureshvegulla, 2008) [29, 10, 34]. According to Taylor and Harman (1990) [35], the coating process is worthy to be applied for many species of seeds with consequent improvement on the seed quality and maintenance of properties after storage.

Table 1: Influence of seed treatment, storage container and periods of storage on germination (%) of greengram seeds

Treatments (T)	**Periods of storage (P)**										
	Cloth Bag (C)										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Mean**
T_1	95 (77.08)	93 (74.66)	90 (71.56)	88 (69.73)	85 (67.21)	82 (64.89)	79 (62.72)	75 (60.00)	70 (56.69)	64 (53.13)	82 (64.89)
T_2	96 (78.46)	94 (75.82)	94 (75.82)	93 (74.66)	92 (73.57)	90 (71.56)	89 (70.63)	86 (68.02)	83 (65.65)	78 (62.02)	90 (71.56)
T_3	98 (81.87)	95 (77.08)	95 (77.08)	94 (75.82)	93 (74.66)	91 (72.54)	90 (71.56)	88 (69.73)	85 (67.21)	81 (64.15)	91 (72.54)
Mean	96 (78.46)	94 (75.82)	94 (75.82)	93 (74.66)	91 (72.54)	89 (70.63)	88 (69.73)	85 (67.21)	82 (64.89)	77 (61.34)	89 (70.63)
Polythene bag (C)											
T_1	95 (77.08)	94 (75.82)	92 (73.57)	91 (72.54)	90 (71.56)	88 (69.73)	87 (68.86)	84 (66.42)	81 (64.15)	75 (60.00)	88 (69.73)
T_2	96 (78.46)	95 (77.08)	95 (77.08)	93 (74.66)	93 (74.66)	91 (72.54)	90 (71.56)	88 (69.73)	84 (66.42)	80 (63.43)	91 (72.54)
T_3	98 (81.87)	98 (81.87)	97 (80.03)	96 (78.46)	96 (78.46)	94 (75.82)	93 (74.66)	91 (72.54)	89 (70.63)	85 (67.21)	94 (75.82)
Mean	96 (78.46)	96 (78.46)	95 (77.08)	94 (75.82)	94 (75.82)	93 (74.66)	92 (73.57)	90 (71.56)	87 (68.86)	83 (65.65)	92 (73.57)
P mean	96 (78.46)	95 (77.08)	95 (77.08)	94 (75.82)	93 (74.66)	91 (72.54)	90 (71.56)	88 (69.73)	85 (67.21)	80 (63.43)	91 (72.54)

	P	C	T	PxC	CxT	PxT	PxCxT
SEd	0.24	0.15	0.20	0.35	0.26	0.57	0.85
CD(P=0.05)	0.49	0.28	0.40	0.71	0.45	1.12	1.62

(Figures in parenthesis indicates are arcsine values)
T_1 – Control seeds; T_2 – Hardened seeds; T_3 – Designer seeds

Maintenance of vigour is highly preferable in line with germinability to coin any management practice as a best technique for adoption. In the present study, seed designed with hardened +polymer coating at 3ml kg^{-1}, imidacloprid at 1ml kg^{-1} and carbendazim at 2g kg^{-1} recorded the highest root length (17.8 and 18.2 cm), shoot length (21.0 and 21.6 cm), drymatter production (228 and 252 mg/10 seedling) and vigour index (3264 and 3054) in cloth bag and polythene bag, respectively (Table 2). The vigour parameters of the stored seeds, in terms of shoot length, root length, drymatter production and vigour index were also in decreasing order with increase in storage period which was in conformity with findings of Evera (2000) [8] and Raja (2000) [22] in blackgram and greengram respectively. The enhanced vigour parameters in designer seed were due to increase in the rate of imbibition where the fine particle in the coating acts as a "wick" or moisture attracting material or perhaps to improve germination. The higher vigour characters maintained by designer seed could be due to reduced seed deterioration (Selvakumari, 2010) [28] of the fungicidal property of carbendazim and insecticidal property of imidacloprid.

Table 2: Influence of seed treatment, storage container and periods of storage on vigour index of greengram seeds

Treatments (T)	**Periods of storage (P)**										
	Cloth Bag (C)										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Mean**
T_1	3952	3794	3600	3441	3239	3050	2876	2670	2429	2170	3122
T_2	4051	3901	3845	3748	3643	3510	3418	3259	3096	2847	3532
T_3	4214	4057	4000	3901	3804	3658	3573	3423	3247	3054	3693

Mean	4072	3918	3815	3698	3563	3408	3291	3120	2927	2693	3450
Polythene bag (C)											
T_1	3952	3863	3717	3622	3537	3406	3297	3116	2940	2663	3411
T_2	4051	3962	3924	3794	3729	3604	3519	3388	3184	2976	3613
T_3	4214	4185	4113	4022	3974	3835	3739	3613	3480	3264	3844
Mean	4072	4004	3918	3814	3748	3616	3520	3375	3204	2971	3624
P mean	4072	3961	3867	3756	3656	3512	3406	3247	3065	2832	3537

	P	C	T	PxC	CxT	PxT	PxCxT
SEd	15.42	7.58	12.25	20.58	15.48	33.56	46.75
CD(P=0.05)	32.56	13.25	25.42	42.56	32.65	65.89	NS

T_1 – Control seeds; T_2 – Hardened seeds; T_3 – Designer seeds

Electrical conductivity of seed leachate is normally recorded as an important biochemical manifestation and this measurement in the present study increased gradually over periods of storage from 0.134 dSm^{-1} to 0.171 dSm^{-1}, irrespective of the treatments. The causes for increase in the electrical conductivity of seeds could have been focused to loss of cell membrane integrity with the advancement in storage period (Koostra and Harrington, 1969) [14]. The electrical conductivity of coated seed (designer seed) stored in polythene bag recorded very low (0.158 dSm^{-1}) whereas it was high in untreated seed (0.165 dSm^{-1}), indirecting the leaching of lesser quantum of protoplasmic substances into seed steep water due to maintanence of semi permeability.

During storage, protein becomes less soluble and degraded into free amino acids (Anderson, 1973) [4]. Hence, the denaturation of protein could also be one of the reason for loss of physiological vigour of seeds during storage. In the present study, the protein content highly preserved in designer seed stored in polythene bag when compared to cloth bag at nine months period of storage. The degradation of protein could be preserved to some extent by treating the seeds either with polymer / fungicide / insecticide / their combination compared to untreated seed (Dharmalingam *et al*., 1976 in blackgram, and Eevera 2000) [7, 8] in blackgram). However decrease in protein content was observed with increase in storage period. The reduction in protein content during storage might be attributed to conversion of protein into free amino acids and increased fungal activity.

Dehydrogenase enzyme activity is also considered as seed quality factor that influences the storability of seed in storage. The observations of the present study was also in line with Menaka (2000) [18] in amaranthus who expressed that the activity of the enzyme responsible for respiration of the seed reduced with age of the seed, with additive response with the factors. Similar decrease of enzyme activity was also observed by Stewart and Bewtey (1980) [31] in soybean and Anandi (2001) [2] in cowpea with advance in storage period or entrance of seed into senescence phase. In the present study, the seeds obtained from seed treatment composed of polymer + carbendazim + imidacloprid recorded higher activity of dehydrogenase that reduced with increase in storage period highlighting the biochemical protection given to this molecular enzymes for prolonged shelf life of resultant seed managed against seed quality character. The decrease in the enzyme activity due to storage is in agreement with the findings of Kittock and Law (1968) [13] and Woodstock (1973) [37] and Sung (1996) [33].

Seed mycoflora is important biotic factor that influences the storability of seed adversely. Pathogens either field carry over or occur in storage are found to activate deterioration rate of seed in storage (Ananthi, 1994) [3]. The observations on pathogen infection and insect infestation revealed that in none of the treatments stored in polythene bag container recorded insect infestation upto nine months. In cloth bag, the bruchids infestation was evident from fourth month in control and by eighth month in hardened seed, which might be due to secondary infestation for which the control seeds were highly amenable than that of seeds imposed with presowing treatment (Malarkodi, 2003) [15].

Conclusion

The present study on effect of presowing treatments on storability of seed explained that designer seeds formulated with hardening and treating with polymer at 3ml kg^{-1} and applied with Carbendazim 2g/kg + Imidacloprid 1ml/kg of seed maintained the vigour and viability of seed upto nine months without pathogen and pest infestation while storing at polythene bag container.

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