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Studies on Storability of Primed Seeds of Maize Hybrid COH(M5)

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Studies were initiated to evaluate the storability of maize hybrid COH (M5) seeds primed with three different combinations of liquid biocontrol agents, biofertilizers and organic humic acid (20%) + *P.fluorescens* **(10%),** *Azophos* **(15%) +** *P.fluorescens* **(10%),** *Azospirillum* **(15%) +** *Phosphobacteria* **(15%) in air tight containers for nine months along with hydro primed and control seeds. The results revealed that after nine months of storage, the seeds primed with 15%** *Azophos* **+ 10%** *P.fluorescens* **maintained germination above seed certification standard with higher seedling quality characters and lesser biochemical deteriorative observations compared to unprimed seed.**

Key words: Maize, Storability, primed seeds, biofertilizers, biocontrol agents, humic acid, seed storage, seed quality characters.

Storage is the carryover of seed from one season to next sowing. On recommendation of presowing seed management techniques for improved plant population, it also necessitates the storability of treated seeds, which could extend the usage of treated seeds over seasons. Dearman *et al.,* (1986) and Savino *et al., (*1979) also expressed that invigourated seeds could be stored well upto resowing. Seed deterioration is a irreversible deteriorative process, that expresses through physiological and biochemical manifestations (Powell and Mathews, 2000). Storage containers are one of the factors that influence the storability of seeds (Rajasekaran, 2004) since they modify the influence of external factors responsible for seed deterioration. Researchers (Sku and Tarar, 1991; Tomer *et al.,* 1993; Padma and Reddy, 2004; Kathiravan, 2008) recommended moisture impervious containers for extended storability of seeds as the deterioration rate is lesser in these containers as the seed moisture content is maintained with lesser alterations (Copeland and McDonald, 1995). Hence attempts were made to evaluate the storability of primed seeds along with physiological and biochemical changes with the newly released COH (M) 5 hybrid of maize.

Methods and Materials

Bulk seeds of maize COH (M) 5 hybrid was obtained from Agricultural Research Station of Tamil Nadu Agricultural University at Vagarai and were primed with liquid biocontrol agents, biofertilizers and humic acid in three different combinations as 15% *Azospirillum* + 15% phosphobacteria, 10% *P. fluorescens* + 20% humic acid, 15% Azophos + 10% *P. fluorescens* under ambient conditions of coimbatore (11°1′6″N, 76°58′21″E) adopting the seed to solution ratio of 1:1 and soaking duration of 8 h. The primed seeds were dried back to 8 per cent moisture and stored in air tight plastic containers under ambient conditions of Coimbatore at Department of Seed Science and Technology, Tamil Nadu Agricultural University along with unprimmed and hydroprimed seeds (water). The treated seeds were evaluated for their storability at trimonthly intervals upto nine months (the recommended validity period in seed certification). The experimental design adopted was factorial CRD with three replications. At each interval, the stored seeds were evaluated for physiological and biochemical characters. The germination (%) was evaluated as per Anon (2007). Normal seedlings of the germination test were measured for dry matter production with randomly selected 10 seedlings. Based on the germination, vigour index values as per Abdulbaki and Anderson (1973) were computed. The seeds were also measured for electrical conductivity as per Halmer and Bewley (1984) and the α-amylase activity as per Priestley (1986) to know the biochemical changes during storage with different treatments. The data were statistically scrutinized as per Panse and Sukhatme (1985) at 5 per cent probability level.

Results and Discussion

The results were highly significant for both seed treatment and storage period, (Table 1-4). The evaluated physiological seed quality characters decreased with advances in storage period irrespective of the seed treatment due to the irreversible deteriorative changes (Desai, 1976; Woodstock and Grabe, 1967) that occur with all biological organisms on aging. Seed germination was reduced by 10 per cent within the storage period, while the decrease was 27.2 and 22.09 per cent respectively with dry matter production and vigour index. The deteriorative changes observed through the biochemical variation, the electrical conductivity of seed leachate observed an increasing trend (0.079 to 0.197 dSm^{-1}) with advances in aging, while the α-amylase activity decreased from 0.320 to 0.288 (mg maltose min^{-1}) within nine months of storage.

Among the priming techniques, seeds primed with 20% humic acid + 10% *P.fluorescens* recorded higher

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Table 1. Influence of germination percentage (%) on storability of priming seeds

Containers (C) / seed treatments (T)	Germination (%) Periods of storage in months (P) 0	3	6	9	Mean
Unprimed	97 (80.03)	95 (77.08)	92(73.57)	87 (68.87)	93 (74.66)
Hydropriming	98 (81.87)	97 (80.03)	93 (74.66)	87 (68.87)	94 (75.82)
15% *Azospirillum* + 15% phosphobacteria	98 (81.87)	97 (80.03)	93 (74.66)	88 (69.73)	94 (75.82)
10% *P. fluorescens* + 20%Humic acid	100 (90)	98 (81.87)	97 (80.03)	92 (73.57)	97 (80.03)
15% *Azophos* + 10% *P. fluorescens*	100 (90)	97 (80.03)	95 (77.08)	90 (71.57)	95 (77.08)
Mean	99 (84.26)	97 (80.03)	94 (75.82)	89 (70.63)	95 (77.08)
Level of significance	P	T		P x T	
SEd	(0.76)	(0.85)		(1.70)	
CD	(1.51**)	(1.69**)		(3.39 *)	

Figures in parenthesis are arcsine transformed values, * *significant at 1%, *significant at 5%

germination of 92 per cent after nine months of storage, followed by 15% *Azophos* + 10% *P.fluorescens*, 15% *Azospirillum* + 15% *Phosphobacteria*, hydro priming and control recording the germination of 90, 88, 87 and 87 per cent respectively. In line with germination the seedling vigour measured through dry matter

Table 2. Influence of dry matter production (g) and vigour index on storability of priming seeds.

Containers (C) / seed treatments (T)	Dry matter production (g) Periods of storage in months (P) 0	3	6	9	Mean
Unprimed	1.54	1.49	1.34	1.21	1.40
Hydropriming	1.68	1.60	1.47	1.34	1.52
15% *Azospirillum* + 15% phosphobacteria	1.72	1.63	1.52	1.42	1.57
10% *Pseudomonas fluorescens* + 20% Humic acid	1.96	1.83	1.65	1.55	1.75
15% *Azophos* + 10% *Pseudomonas fluorescens*	1.82	1.81	1.58	1.45	1.67
Mean	1.74	1.67	1.51	1.39	1.58
Level of significance	P		T		P x T
SEd	0.022		0.024		0.048
CD(P=0.05)	0.042**		0.048**		0.096 *

Containers (C) / seed treatments (T)	Vigour index Periods of storage in months (P) 0	3	6	9	Mean
Unprimed	4023	3800	3613	3295	3672
Hydropriming	4207	4090	3844	3483	3906
15% *Azospirillum* + 15% phosphobacteria	4355	4119	3825	3558	3956
10% *Pseudomonas fluorescens* + 20% Humic acid	4660	4443	4235	3861	4293
15% *Azophos* + 10% *Pseudomonas fluorescens*	4520	4197	4076	3744	4131
Mean	4363	4129	3910	3579	3988
Level of significance	P		T		P x T
SEd	17.86		19.16		42.84
CD(P=0.05)	35.72*		37.85*		85.41*

* *significant at 1% , *significant at 5%

production and vigour index were also higher with 20% humic acid + 10% *P.fluorescens* by 2.5 and 16.9 per cent compared to unprimed seeds and was followed other treatments.

The biochemical manifestations of seed deterioration observed with the primed seed stored for nine months revealed that the electrical conductivity was less with seeds primed with 20% humic acid + 10% *P.fluorescens.* The α-amylase enzyme activity was at higher levels after nine months of storage in seeds primed with different combination of priming agents compared to control. The best performing priming technique for storability was found to the best was 20% humic acid + 10% *P.fluorescens*, which was followed by 15% *Azophos* + 10% *P.fluorescens*. The interaction between treatment and period revealed that at all periods of storage, humic acid 20% + 10% *P.fluorescens* expressed higher physiological expressions and lower biochemical changes focusing them as the

Table 3. Influence of electrical conductivity (dsm-1) and α-amylase (mg, maltose. min-1) on storability of priming seeds.

Electrical conductivity ds.m-1

Containers (C) / seed treatments (T)	Periods of storage in months (P) 0	3	6	9	Mean
Unprimed	0.083	0.119	0.168	0.217	0.147
Hydropriming	0.081	0.113	0.164	0.203	0.140
15% *Azospirillum* + 15% phosphobacteria	0.079	0.112	0.158	0.195	0.136
10% *P. fluorescens* + 20% Humic acid	0.075	0.104	0.154	0.185	0.130
15% *Azophos* + 10% *P. fluorescens*	0.077	0.109	0.149	0.185	0.130
Mean	0.079	0.111	0.159	0.197	0.136
Level of significance	P		T		P x T
SEd	0.005		0.005		0.011
CD	0.009**		0.011**		0.021*

α-amylase (mg maltose min-1)

Containers (C) / seed treatments (T)	Periods of storage in months (P) 0	3	6	9	Mean
Unprimed	0.314	0.295	0.288	0.280	0.294
Hydropriming	0.322	0.303	0.292	0.285	0.300
15% *Azospirillum* + 15% phosphobacteria	0.319	0.304	0.299	0.289	0.303
10% *P. fluorescens* + 20% Humic acid	0.326	0.312	0.305	0.296	0.310
15% *Azophos* + 10% *P. fluorescens*	0.321	0.309	0.306	0.291	0.307
Mean	0.320	0.305	0.298	0.288	0.303
Level of significance	P		T		P x T
SEd	0.006		0.006		0.012
CD	0.011**		0.013*		0.025*

* *significant at 1%, *significant at 5%

causes for the superior performance of primed seed storage compared to unprimed.

Thus, the study expressed that seeds primed with 20% humic acid + 10% *P.fluorescens* not only improved the initial invigourative effect, but also maintained it upto nine months with minimum certification requirement by safeguarding the seed from biochemical deteriorative changes.

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