Biological Forum – An International Journal **15(7): 83-88(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Studies on Storability of primed Seeds of Traditional Rice Variety Navara

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(Received: 17 April 2023; Revised: 27 April 2023; Accepted: 28 May 2023; Published: 05 July 2023)
(Published by Research Trend)

ABSTRACT: Storage without pesticide is a challengeable aspect. The deterioration of physiological quality of seeds during storage was strongly attributed to containers. Storage is the carryover of seed from one season to next sowing. On recommendation of presowing 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 with expected in vigourative effect up to resowing. Traditional rice variety Navara with three different combinations of liquid biofertilizers *Azospirillum* (15%), Phosphobacteria (15%), *Azospirillum* (15%) Phospho bacteria (15%), in cloth bag, polythene bag and plastic containers for eight months along with hydro primed and control seeds. The results revealed that after eight months of storage, the seeds primed with *Azospirillum* (15%) Phospho bacteria (15%) maintained the germination above the seed certification standard with higher seedling quality characters compared to unprimed seed.

Keywords: Navara, Traditional rice varieties, Seed storage, Storage containers.

INTRODUCTION

Seed deterioration is air reversible deteriorative process that expresses through physiological and biochemical manifestations (Powell and Mathews 2000). Storage containers are one of the factor that influences the storability of seeds (Rajasekaran, 2004) since they modify the influence of external factors responsible for seed deterioration. Researchers (Padma and Reddy 2004; Kathiravan, 2008) recommend 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).

In any crop production programme, rapid and uniform field emergence is the essential pre requisite to increase the yield, quality and the ultimate profit. Pre-sowing seed treatment is one such technological highlight, focused on invigouration, protection and production (Sundaralingam *et al.*, 2005), claiming its contribution to a tune of 10-15 per cent (Selvi and Jerlin 2008) on end product, the yield irrespective of eco system in total productivity of crops. Biopriming is priming the seed with biological living organism that would adhere or primed into seed and multiply at favorable edaphic conditions to have invigourative expression on crop growth by improving the stamina of the crop and through protection. Seeds are commonly recommended (Anon, 2005) for physical coating with biofertilizer in different doses as 10g, 50g/kg of seed etc for enrichment of rhizosphere region of crops with microbes that would help in fixing the natural nitrogen (Ramos *et al.*, 2002) mobilizing the phosphorus fertilizer. In maize, Gomathy *et al.* (2009), in wheat, Zorita and Canigia (2009), in sorghum, Suma (2005) expressed that seed coating with biofertilizer as physical treatment improved the seed quality characters. However, Hegde (2002) opined that biofertilizers manufactured in India are carrier based and they suffer from short shelf life, poor quality, high contamination and unpredictable field performances. So, as an alternate, Singleton *et al*., (2002) opined that liquid inoculant formulation with a better field performance low cost that are easily available to small producers could restrict problems associated with carrier based biofertilizer.

Hence attempts were made to evaluate the storability of primed seeds along with physiological changes with the traditional rice variety Navara.

METHODS AND MATERIALS

Bulk seeds of traditional rice variety navara was primed with liquid, biofertilizers under ambient conditions of coimbatore (11°1′6″N, 76°58′21″E) adopting the seed to solution ratio of 1:1 and the soaking duration of 8 h. The primed seeds were dried back to 8 per cent moisture and stored in cloth bag, polythene bag, plastic containers under ambient conditions of Coimbatore at Department of Agriculture, Karunya Institute of Technology and Science along with un primmed and hydro primed seeds as above using water as priming agent. The treated seeds were evaluated for their storability at monthly intervals up to eight months the recommended validity period in seed certification. The experimental design adopted was factorial CRD with three replications. A teach interval, the stored seeds were evaluated for physiological characters. The germination (%) was evaluated as per Anon (2007).

The normal seedlings of the germination test were measured for dry matter production with all seedlings. Based on the germination and vigour index values as per Abdul-baki and Anderson (1973) were computed. The data gathered were statistically scrutinized as per Panse and Sukhatme (1985) at 5 percent probability level.

RESULTS AND DISCUSSION

The results obtained were highly significant for both seed treatment and storage period, (Table 1-6). 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) that occur with all biological organisms on aging. These germination reduced by 11 percent within the storage period while the decrease was 30.4 and 36.9 percent respectively with dry matter production and vigour index.

Among the priming techniques, seeds primed with 15% *Azospirillum* + 15% Phosphobacteria recorded the higher germination of 88 per cent after 8 months of storage and was followed by 15% *Azospirillum*, 15% Phospho bacteria 15%, hydro priming and control recording the germination of 87, 85, 84 and 83 per cent respectively. In line with germination the seedling vigour measured through dry matter production and vigour index were also higher with 15% *Azospirillum* + 15% phosphobacteria by 17.9, 9.7 per cent compared to unprimed seeds and was followed other treatments as that germination. Even the extracts of carrier based bio fertilizer were viewed beneficial in Rice cv. ASD 18 where Ramamoorthy *et al.* (2000) evaluated the influence on both high (stored for three weeks) and low vigour (stored for 56 weeks under ambient conditions) seeds treated with mixed cultures of *Azospirillum lipoferum* and *Azospirillum brasilense*, and found that *Azospirillum* seed treatment improved the initial vigour of the seed and could be recommended as a pre-sowing treatment for paddy nursery. The performance of liquid formulations of *Azospirillum* and phosphobacteria found to increase the rhizosphere population, plant biometric observations and yield of maize and tomato under field conditions (Kanimoli *et al.*, 2004).

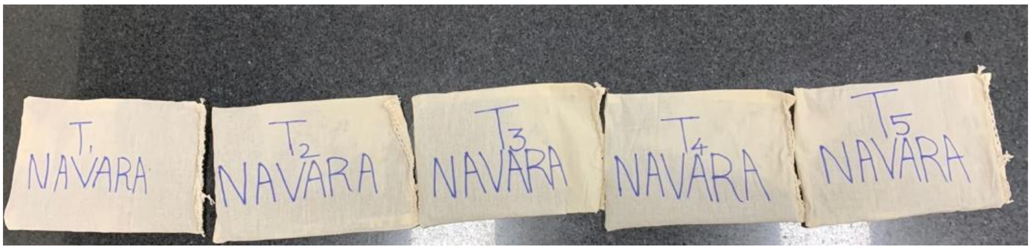


Fig. 1. Cloth bag storage containers.

Fig. 2. Polybag storage containers.

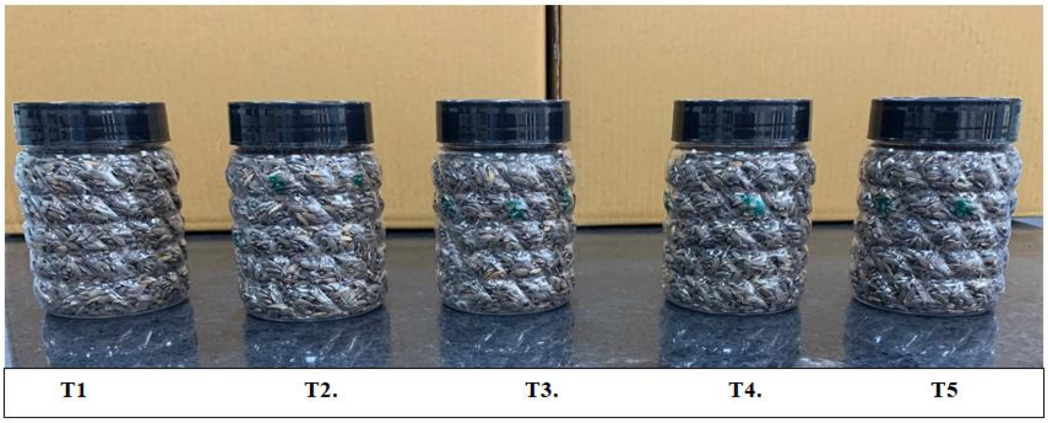
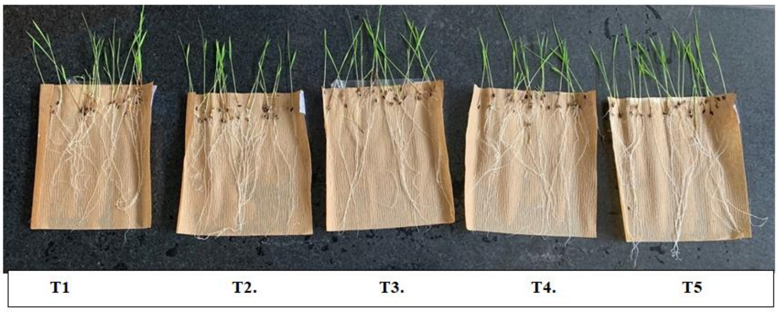


Fig. 3. Plastic storage containers.



T1 – Unprimed, T2 – Hydropriming, T3 – 15% *Azospirillum*
T4 – 15% Phosphobacteria, T5 - 15% *Azospirillum* + 15% Phosphobacteria

Fig. 4. Different seed treatment influence in Navara seeds.

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

Germination percentage (%)										
Seed treatments (T)	**Periods of storage in months (P)**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
Unprimed	95 (77.08)	94 (75.82)	89 (70.63)	84 (66.42)	80 (63.44)	77 (61.35)	77 (61.35)	75 (60.00)	74 (59.35)	83 (65.65)
Hydropriming	96 (78.46)	95 (77.08)	90 (71.57)	84 (66.42)	81 (64.16)	79 (62.73)	78 (62.01)	78 (62.01)	76 (60.67)	84 (66.42)
15% *Azospirillum*	98 (81.87)	96 (78.46)	91 (72.34)	89 (70.63)	87 (68.87)	84 (66.42)	83 (65.65)	81 (64.16)	80 (63.44)	87 (68.87)
15% Phosphobacteria	97 (88.02)	94 (75.82)	90 (71.57)	85 (67.21)	83 (65.65)	81 (64.16)	82 (64.90)	79 (62.73)	77 (61.35)	85 (67.21)
15% *Azospirillum* + 15% Phosphobacteria	99 (87.81)	98 (81.87)	92 (73.57)	87 (68.87)	85 (67.21)	85 (67.21)	84 (66.42)	83 (65.65)	83 (65.65)	88 (69.73)
Mean	97 (88.02)	95 (77.08)	91 (72.34)	86 (68.03)	83 (65.65)	81 (64.16)	81 (64.16)	79 (62.73)	78 (62.01)	86 (68.03)
Level of significance	P			T				P x T		
SEd	0.593			0.335				1.092		
CD	1.012**			0.772**				2.121**		

Figures in parenthesis are arcs in e transformed values,**significantat1%level,*significant at 5% level

Table 2: Influence Shoot length(cm) on storability of priming seeds.

Shoot length (cm)										
Containers (C) /seed treatments(T)	**Periods of storage in months (P)**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
Unprimed	13.1	12.9	12.6	12.4	12.2	12	11.8	11.5	11.1	12.1
Hydropriming	13.3	13.1	12.9	12.8	12.7	12.6	12.3	12.1	11.8	12.6
15% *Azospirillum*	13.5	13.2	13	12.9	12.8	12.6	12.4	12.2	12.3	12.8
15%phosphobacteria	13.4	13.3	13.3	12.9	12.7	12.5	12.3	12.1	12	12.7
15% *Azospirillum*+15%phosphobacteria	13.7	13.5	13.4	13.2	13.3	13.1	12.9	12.7	12.6	13.2
Mean	13.4	13.2	13	12.9	12.7	12.6	12.3	12.1	12	12.7
Level of significance	P			T				P x T		
SEd	0.039			0.027				0.089		
CD	0.078**			0.054**				0.178**		

Figures in parenthesis are arcs in e- transformed values,**significantat1%level,*significant at 5% level

Table 3: Influence of root length (cm) on storability of priming seeds.

Root length (cm)										
Containers (C) / Seed treatments(T)	**Periods of storage in months (P)**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Mean**
Unprimed	17.8	17.6	17.4	17.2	17	16.8	16.6	16.4	15.7	16.9
Hydropriming	18.4	18.2	18	17.9	17.8	17.7	17.4	17.3	17.1	17.6
15% *Azospirillum*	19.9	19.7	19.5	19.3	19.2	19.1	18.8	18.6	18.4	19.2
15%phosphobacteria	19.2	19	18.9	18.7	18.5	18.4	18.5	18.3	18.2	18.6
15% *Azospirillum* + 15% phosphobacteria	21.1	20.8	20.6	20.3	20.1	19.8	19.5	19.3	19.1	20.1
Mean	19.3	19.1	18.9	18.7	18.5	18.4	18.2	18	17.7	18.5
Level of significance	P			T				P x T		
SEd	0.052			0.042				0.112		
CD	1.004**			0.081**				0.224**		

Figures in parenthesis are arcs in e-transformed values,**significant at 1% level,*significant at 5% level

Table 4: Influence vigour index on storability of priming seeds.

Containers (C) / Seed treatments(T)	Vigour Index									
	Periods of storage in months (P)									
	0	1	2	3	4	5	6	7	8	Mean
Unprimed	2936	2867	2670	2486	2336	2218	2187	2093	1983	2407
Hydropriming	3043	2974	2781	2579	2471	2394	2317	2293	2196	2537
15% *Azospirillum*	3273	3158	3055	2866	2784	2663	2590	2495	2456	2816
15% phosphobacteria	3162	3036	2898	2686	2590	2503	2526	2402	2325	2661
15% *Azospirillum* + 15% phosphobacteria	3445	3361	3128	2915	2839	2797	2722	2656	2631	2930
Mean	3172	3069	2901	2718	2590	2511	2471	2378	2317	2683
Level of significance	P			T			P x T			
SEd	9.03			5.86			20.45			
CD	18.22*			12.02*			40.88*			

Figures in parenthesis are arcs in e transformed values,**significantat1%level,*significant at5% level

Table 5: Influence of Dry matter production(g) on storability of priming seeds.

Containers (C) /seed treatments(T)	Dry matter production(g)									
	Periods of storage in months (P)									
	0	1	2	3	4	5	6	7	8	Mean
Unprimed	1.23	1.20	1.17	1.15	1.13	1.10	1.08	1.06	0.96	1.12
Hydropriming	1.30	1.27	1.24	1.21	1.18	1.16	1.06	1.09	0.98	1.17
15% *Azospirillum*	1.37	1.34	1.31	1.27	1.23	1.21	1.14	1.09	1.06	1.22
15%phosphobacteria	1.34	1.30	1.27	1.25	1.21	1.18	1.08	1.02	1.00	1.18
15% *Azospirillum* + 15% phosphobacteria	1.40	1.36	1.30	1.27	1.24	1.21	1.18	1.14	1.10	1.24
Mean	1.33	1.29	1.26	1.23	1.2	1.17	1.11	1.08	1.02	1.19
Level of significance	P			T			P x T			
SEd	0.03			0.026			0.041			
CD	0.06 **			0.052 **			0.084 *			

Figures in parenthesis are arcsine transformed values, **significantat1% level,*significant at 5% level

Table 6: Influence of vigour index on storability of priming seeds.

Containers (C) /seed treatments(T)	Vigour index									
	Periods of storage in months (P)									
	0	1	2	3	4	5	6	7	8	Mean
Unprimed	117	113	104	97	90	85	83	80	71	93
Hydropriming	125	121	112	102	96	92	83	85	74	98
15% *Azospirillum*	134	129	123	113	107	102	95	88	85	107
15%phosphobacteria	130	122	114	106	100	96	89	81	77	100
15% *Azospirillum* + 15% phosphobacteria	139	133	120	110	105	103	99	95	91	109
Mean	129	123	115	106	100	95	90	85	80	102
Level of significance	P			T			P × T			
SEd	0.617			0.393			1.282			
CD	1.063**			0.904**			2.476**			

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

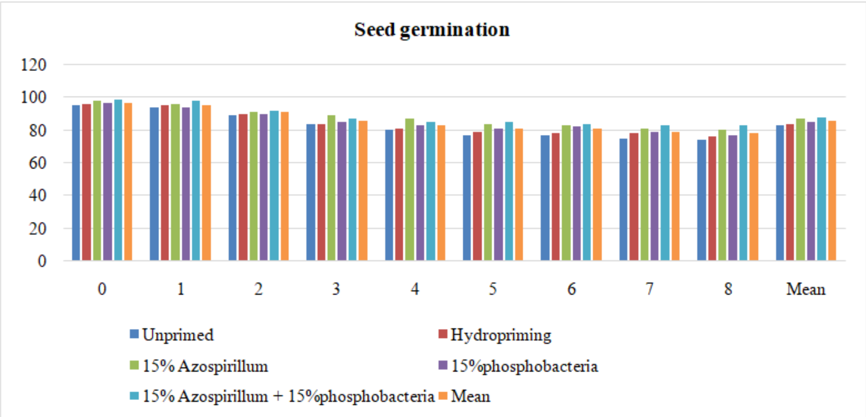


Fig. 5. Influence of germination percentage (%) on storability of priming seeds.

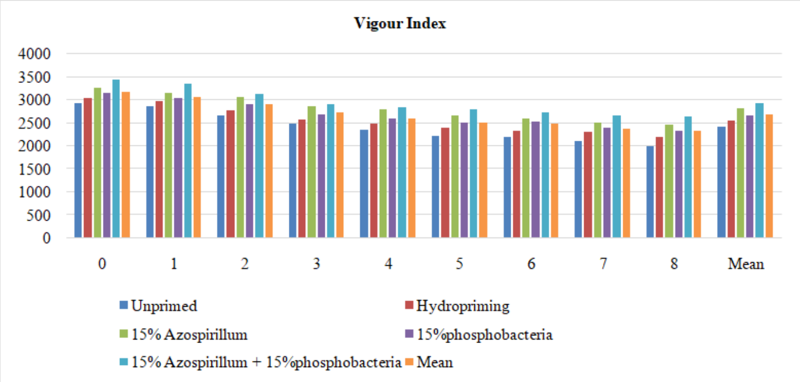


Fig. 6. Influence vigour index on storability of priming seeds.

Seeds primed with 15% *Azospirillum* + 15%Phospho bacteria, exposed the maximum shoot length (13.2 cm) while the lowest values were with control shoot length (12.1 cm), Among the root length seeds primed with 15% *Azospirillum* + 15% Phospho bacteria record the maximum root length (20.1) while the lowest values were with control root length (16.9 cm). Between the dry matter production Seeds primed with 15% *Azospirillum* + 15% Phosphobacteria record the maximum dry matter production (1.24 g) while the lowest values were with control dry matter production (1.12 g). Among the vigour index seeds primed with 15% *Azospirillum* + 15% Phosphobacteria record the maximum vigour index (2930) while the lowest values were with control vigour index (2407). Between the vigour index based on dry matter production seeds primed with 15% *Azospirillum* + 15% Phosphobacteria record the maximum vigour index (109) while the lowest values were with control vigour index (93). Gomathy *et al.* (2007) inoculated maize seeds with liquid formulation of phosphobacteria and found improvement in cob length, cob weight, grain recovery and the nutrient content. Gomathy *et al.* (2009) reported that 1 per cent inoculum showed better results followed by 1.5 per cent inoculums in maize. Zorita and Canigia (2009) inoculated wheat seeds with liquid formulation of *Azospirillum brasilense* and found that the crop exhibited more vigorous vegetative growth, greater shoot and root growth and dry matter accumulation. The inoculation also increased the number of harvested grains and grain yield. On tracing the cause for seed invigouration by these biofertilizers, Vasyuk *et al.* (1990) opined that seed treatment with *Azospirilum brasilense* and *Azospirilum lipoferum* improved the level of aminoacid, lysine and pectinase enzyme activity and IAA content in seed and invigourated the seed and influences the fixation of atmospheric nutrients.

Thus the study expressed that seeds primed 15% *Azospirillum*+ 15% Phosphobacteria not only improved the initial invigourative effect, but also maintained it upto eight months with minimum certification requirement by safe guarding the seed from deteriorative changes.

CONCLUSIONS

The seeds primed with combinations of bio products evaluated for seed quality characters were (15 per cent *Azospirillum* + 15 per cent Phosphobacteria, 15 per cent *Azospirillum*, 15 per cent Phosphobacteria) evaluated for storability along with unprimmed and hydroprimed seeds under ambient conditions of coimbatore for 8 months where the primed seeds were dried back to original moisture content and stored in air tight plastic containers under ambient condition. The results revealed that 15 per cent *Azospirillum* + 15 per cent Phosphobacteria by 15 *Azospirillum*, 15 per cent Phosphobacteria, performed best compared to unprimed seeds at the end of 8 months of storage, measuring the higher order level of seed vigour characters in terms of germination, seedling length, vigour index and dry matter production.

Acknowledgement. The authors are thankful to Dr. D. Wilson (Karunya Institute of Technology and Science, Coimbatore) for his attempts in conduction of laboratory assays and scientific assistance in terms of study.

Conflict of Interest. None.

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How to cite this article: J. Srinivasan and K. Indira Petchiammal (2023). Studies on Storability of primed Seeds of Traditional Rice Variety Navara. *Biological Forum – An International Journal, 15*(7): 83-88.