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Effect of Polymer Coating, Plant Biocides and Insecticide on Seed Quality of Fodder Cowpea during Storage

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A B S T R A C T

The laboratory experiment was conducted at the Seed Quality Research Laboratory of National Seed Project, Seed Unit. University of Agricultural Sciences, Dharwad during 2016-2017 to evaluate effect of polymer coating, plant biocides and insecticide on seed quality of fodder cowpea during storage. The experiment consisted of totally 16 treatment combinations involving two factors *viz.*, first factor consists of two containers (C_1:Cloth bag and C_2:HDPE bag) and second factor consists of 8 seed treatments *viz.*,[T_1 : Control, T_2 : Polymer seed coating @ 5 $mlkg^{-1}$ of seed, T_3 : Vitavax(Carboxin 37.5 % @ 2 gkg^{-1} of seeds + Thiram @ 2 gkg^{-1} of seed),T_4 : Aluminium phosphide @ 1 tablet/250 cuft, T_5 :Methomyl @ 0.6 gkg^{-1} of seed, T_6 : Neem oil @ 5 $mlkg^{-1}$ of seed, T_7: Castor oil @ 5 $mlkg^{-1}$ of seed ,T_8: Sweet flag @ 5 gkg^{-1} of seed. Among all the treatments T_3 (Vitavax (Carboxin 37.5 % @ 2 gkg^{-1} of seeds + Thiram @ 2gkg^{-1} of seed) showed maximum seed quality parameters like germination (89.83 %), Root length (18.76 cm), shoot length(15.60 cm),seedling vigour index (3230).Where as the lowest germination (80.00 %), root length(14.40 cm), shoot length(11.26 cm), seedling vigour index (2125) were recorded in control at the end of nine months of storage period.

Introduction

Cowpea (*Vigna unguiculata* (L.) is one of the most important pulse legume. It is native to central Africa, belongs to the family *Fabaceae*. Pulses are excellent sources of proteins (20-40 %), carbohydrates (50 - 60 %) and are fairly good sources of thiamin, niacin, calcium and iron. Hence, they form an integral part of our diet and also they occupy major portion of agricultural land and are the second most important group of crops worldwide (Arora, 1989). Apart from its protein content, pulses due to their nitrogen fixing ability, enrich soil fertility. One of the major constraints in storing the cowpea seeds from harvest to next sowing is storage insect pests which inflict severe losses. Pulse beetle is a

major pest that causes serious damage and is a cosmopolitan. The pulse seed suffer a great damage during storage due to insect attack. Several bruchid species attack cereals and pulses in the store and causes a loss of 10-15% with a germination loss ranging from 50-92.

Cowpea is no exception because of its high protein content, cowpea seed is highly affected by storage pests and other microflora. The pulse beetle (*Callosobruchus chinensis*) in storage causes considerable losses and affects the quality of seed. The taking care of seeds during storage, therefore is of supreme importance for India‘s economic well-being and self-sufficiency.

Information on seed treatment of fodder cowpea with different organic and in-organic source is quite meagre and scanty. Hence, studies on seed storability of fodder cowpea using different organic and inorganic sources of seed treatment was conducted to assess the storability of fodder cowpea seeds using cloth bag and high density polythene bag (HDPE) under ambient conditions of Dharwad.

Materials and Methods

The experiment was conducted in the Seed Quality Research Laboratory of National Seed Project, Seed unit, University of Agricultural Sciences, Dharwad on influence of polymer coating, plant biocides and insecticide on seed quality of fodder cowpea during storage during 2016 and 2017. Cowpea (Cv.MFC 9-1) Seeds were obtained from Indian Grassland and Fodder Research Institute, Southern Regional Research Station, Dharwad.

The experiment consisted of two factors, factor on is containers *viz*. Cloth bag(C_1) and HDPE bag (C_2). The second factor deals with seed treatments *viz*., T_1: Control, T_2: Polymer seed coating @ 5 ml/kg of seed, T_3: Vitavax (Carboxin 37.5 %) @ 2 g/kg of seeds + Thiram @ 2 g/kg of seed), T_4: Aluminium phosphide @ 1 tablet/250 cuft, T_5: Methomyl @ 0.6 g/kg of seed, T_6: Neem oil @ 5 ml/kg of seed, T_7: Castor oil @ 5 ml/kg of seed, T_8: Sweet flag @ 5 g/kg of seed.

Observations on seed quality parameters were recorded monthly. The mean data obtained from the experiment was statistically analysed and subjected to the Analysis of variance by adopting appropriate statistical methods as outlined by Panse and Sukhatme (1967). The critical differences were calculated at one per cent level of significance. The percentage data of germination were transformed into arcsine root transformation before analysis.

Results and Discussion

Germination (%)

The results of germination percentage as influenced by effect of polymer coating, plant biocides and insecticide on seed quality of fodder cowpea during storage are presented in (Table 1). Significant differences in germination percentage due to seed treatments were recorded from fifth month onwards till the end of the storage period.

Significantly highest germination (94.0 %) was recorded at 5^{th} month in T_3 (Carboxin 37.5 % @ 2 gkg^{-1} of seeds + Thiram @ 2 gkg^{-1} of seeds) which was on par with T_7 (Castor oil @ 5 $mlkg^{-1}$ of seed) of 93.3 per cent and T_8 (Sweet flag @ 5 gkg^{-1} of seed) 92.8 per cent, while significantly lowest germination per cent was recorded in T_1 - control (89.2 %).

The germination percentage does not differ significantly due to containers. Higher germination was recorded in C_2 (HDPE bag) (84.7 %) and lower germination was recorded in C_1 (cloth bag) (84.0 %) at the end of nine months of storage period.

Table.1 Effect of polymer coating, plant biocides and insecticide on germination (%) and root length (cm) during storage period

Treatments		Germination (%)					Root length (cm)				
		Months after storage					Months after storage				
		Initial month	3rd month	5th month	7th month	9th month	Initial month	3rd month	5th month	7th month	9th month
Containers (C)	(C_1)	95.6 (78.0)	94.3 (76.3)	91.1 (72.8)	88.3 (70.5)	84.0 (66.0)	21.00	19.47	18.42	16.81	15.44
	(C_2)	95.9 (78.2)	94.7 (76.8)	92.0 (73.6)	88.8 (70.6)	84.7 (67.1)	21.05	19.49	18.57	16.96	15.66
	Mean	**95.8 (78.2)**	**94.5 (76.5)**	**91.5 (73.2)**	**88.6 (70.3)**	**84.3 (66.8)**	**21.02**	**19.48**	**18.49**	**16.89**	**15.55**
	SEm±	0.24	0.35	0.28	0.14	0.21	0.14	0.14	0.07	0.06	0.09
	CD (0.01)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Treatments (T)	T_1	94.8 (76.9)	93.3 (75.4)	89.2 (71.0)	85.3 (67.5)	80.0 (63.5)	20.86	19.16	17.22	15.98	14.04
	T_2	95.7 (78.0)	94.3 (76.2)	91.0 (72.6)	86.5 (68.4)	82.2 (65.0)	21.03	19.51	18.62	16.73	15.29
	T_3	96.7 (79.5)	96.0 (78.6)	94.0 (75.8)	92.0 (73.6)	89.8 (71.4)	21.09	19.58	18.76	17.34	16.19
	T_4	95.7 (78.0)	94.0 (75.8)	89.5 (71.1)	86.0 (68.0)	81.0 (64.2)	21.02	19.50	18.61	16.65	15.24
	T_5	95.2 (77.3)	93.8 (75.6)	89.8 (71.4)	85.8 (67.9)	80.7 (63.9)	21.01	19.48	18.60	16.63	15.18
	T_6	95.8 (78.3)	94.5 (76.4)	92.5 (74.1)	90.5 (72.0)	86.3 (68.3)	21.05	19.53	18.69	17.23	16.13
	T_7	96.2 (78.7)	95.3 (77.5)	93.3 (75.0)	91.3 (72.9)	88.0 (69.7)	21.08	19.56	18.73	17.29	16.18
	T_8	96.2 (78.7)	94.8 (76.9)	92.8 (74.5)	91.0 (72.5)	86.8 (68.7)	21.07	19.54	18.71	17.25	16.15
	SE m±	0.48	0.70	0.56	0.28	0.43	0.05	0.13	0.14	0.11	0.18
	CD(0.01)	NS	NS	2.17	1.08	1.65	NS	NS	0.54	0.43	0.70
Interaction (CX T)	**C_1T_1**	94.7 (76.7)	93.3 (75.7)	89.0 (71.0)	85.3 (67.5)	80.0 (63.5)	20.83	19.13	16.70	15.45	13.22
	C_1T_2	95.7 (78.0)	94.0 (75.8)	90.0 (71.6)	86.3 (68.3)	82.0 (65.0)	21.01	19.50	18.60	16.72	15.28
	C_1T_3	96.33 (79.0)	95.67 (78.0)	93.67 (75.4)	91.67 (73.2)	89.67 (71.2)	21.06	19.57	18.76	17.33	16.19

	C_1T_4	95.67 (78.0)	93.67 (75.4)	89.00 (70.6)	85.67 (67.8)	80.67 (63.9)	21.00	19.48	18.58	16.63	15.21
	C_1T_5	95.00 (77.1)	93.67 (75.4)	89.67 (71.2)	85.67 (67.8)	80.33 (63.7)	21.00	19.47	18.57	16.62	15.16
	C_1T_6	95.67 (78.0)	94.33 (76.2)	92.00 (73.6)	90.33 (71.9)	85.67 (67.8)	21.02	19.52	18.68	17.22	16.13
	C_1T_7	96.00 (78.5)	95.00 (77.1)	93.00 (74.7)	91.00 (72.5)	87.67 (69.4)	21.05	19.55	18.73	17.28	16.17
	C_1T_8	96.00 (78.5)	94.67 (76.7)	92.33 (73.9)	90.67 (72.2)	86.33 (68.3)	21.05	19.53	18.71	17.24	16.15
	C_2T_1	95.00 (77.2)	93.33 (75.0)	89.33 (70.9)	85.33 (67.5)	80.00 (63.4)	20.89	19.20	17.74	16.51	14.86
	C_2T_2	95.67 (78.0)	94.67 (76.7)	92.00 (73.6)	86.67 (68.6)	82.33 (65.1)	21.05	19.52	18.63	16.74	15.30
	C_2T_3	97.00 (80.1)	96.33 (79.2)	94.33 (76.2)	92.33 (73.9)	90.00 (71.6)	21.11	19.58	18.77	17.35	16.20
	C_2T_4	95.67 (78.0)	94.33 (76.2)	90.00 (71.6)	86.33 (68.3)	81.33 (64.4)	21.03	19.51	18.63	16.66	15.26
	C_2T_5	95.33 (77.5)	94.00 (75.8)	90.00 (71.6)	86.00 (68.0)	81.00 (64.2)	21.01	19.49	18.62	16.64	15.20
	C_2T_6	96.00 (78.5)	94.67 (76.7)	93.00 (74.7)	90.67 (72.2)	87.00 (68.9)	21.07	19.53	18.70	17.23	16.14
	C_2T_7	96.33 (79.0)	95.67 (78.0)	93.67 (75.4)	91.67 (73.2)	88.33 (70.0)	21.10	19.56	18.74	17.30	16.18
	C_2T_8	96.33 (79.0)	95.00 (77.1)	93.33 (75.0)	91.33 (72.9)	87.33 (69.1)	21.09	19.54	18.72	17.26	16.15
	Mean	**95.77 (78.2)**	**94.52 (76.5)**	**91.52 (73.2)**	**88.56 (70.3)**	**84.35 (66.8)**	**21.02**	**19.48**	**18.49**	**16.89**	**15.55**
	SE m±	0.67	0.99	0.79	0.39	0.60	0.06	0.18	0.20	0.16	0.26
	CD (0.01)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table.2 Effect of polymer coating, plant biocides and insecticide and shoot length (cm) and seedling vigour index during storage period

Treatments		Shoot length (cm)					Seedling Vigour Index				
		Months after storage					Months after storage				
		Initial month	3rd month	5th month	7th month	9th month	Initial month	3rd month	5th month	7th month	9th month
Containers (C)	(C_1)	16.50	16.06	15.07	14.08	12.48	3586	3349	3072	2731	2399
	(C_2)	16.55	16.11	15.18	14.19	12.56	3607	3373	3130	2768	2451
	Mean	**16.53**	**16.08**	**15.12**	**14.13**	**12.52**	**3596**	**3361**	**3101**	**2750**	**2425**
	SE m±	0.05	0.03	0.06	0.06	0.07	26	22	20	18	16
	CD (0.01)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Treatments (T)	T_1	16.33	15.87	13.97	12.56	11.26	3527	3265	2796	2436	2125
	T_2	16.48	16.08	14.95	14.02	12.36	3588	3358	3093	2660	2373
	T_3	16.83	16.20	15.60	14.67	13.01	3665	3434	3230	2945	2623
	T_4	16.45	16.06	14.94	14.01	12.35	3584	3342	3075	2636	2345
	T_5	16.43	16.04	14.89	13.96	12.30	3563	3333	3064	2625	2331
	T_6	16.50	16.11	15.52	14.59	12.93	3598	3367	3165	2880	2509
	T_7	16.69	16.17	15.57	14.64	12.98	3632	3406	3202	2916	2566
	T_8	16.51	16.15	15.55	14.62	12.96	3614	3384	3181	2900	2528
	SE m±	0.09	0.07	0.12	0.12	0.13	52	43	40	35	32
	CD(0.01)	NS	NS	0.48	0.46	0.51	NS	NS	157	136	125
Interaction (CX T)	**C_1T_1**	16.20	15.75	13.03	12.19	11.02	3505	3245	2704	2358	2026
	C_1T_2	16.47	16.07	14.45	14.00	12.34	3586	3343	3073	2652	2356
	C_1T_3	16.82	16.19	15.12	14.67	13.01	3649	3421	3218	2933	2618
	C_1T_4	16.44	16.04	14.44	13.99	12.33	3581	3328	3048	2623	2323
	C_1T_5	16.42	16.03	14.39	13.94	12.28	3555	3325	3032	2618	2314
	C_1T_6	16.49	16.10	15.03	14.58	12.92	3588	3360	3146	2873	2489
	C_1T_7	16.68	16.17	15.09	14.64	12.98	3622	3393	3189	2904	2555
	C_1T_8	16.50	16.14	15.06	14.61	12.95	3605	3377	3163	2888	2513
	C_2T_1	16.46	15.98	13.72	12.94	11.51	3549	3284	2887	2513	2223
	C_2T_2	16.48	16.09	14.49	14.04	12.38	3590	3372	3113	2667	2390
	C_2T_3	16.84	16.21	15.13	14.68	13.02	3682	3448	3243	2957	2629
	C_2T_4	16.46	16.07	14.48	14.03	12.37	3587	3357	3102	2650	2367
	C_2T_5	16.45	16.05	14.43	13.98	12.32	3571	3341	3096	2633	2348
	C_2T_6	16.51	16.11	15.05	14.60	12.94	3608	3375	3184	2886	2530
	C_2T_7	16.70	16.18	15.10	14.65	12.99	3642	3419	3214	2928	2577
	C_2T_8	16.52	16.15	15.08	14.63	12.97	3624	3391	3199	2912	2543
	Mean	**16.53**	**16.08**	**15.12**	**14.13**	**12.52**	**3596**	**3361**	**3101**	**2750**	**2425**
	SE m±	0.13	0.09	0.18	0.17	0.19	74	61	57	50	46
	CD (0.01)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Interaction effects due to containers and seed treatments recorded non-significant difference throughout the storage period however, the seed treatment C_2T_3 recorded higher germination percentage of 90.0, which was on par with C_1T_3 (89.7 %) and C_2T_8 (88.3 %) and the lowest germination was recorded in C_1T_1 (80.0 %) at the end of nine month of storage period.

Vitavax power minimizes the impact of ageing enzymes; it also acts as a protective agent against seed deterioration due to fungal invasion and physiological ageing as a result of which the seed viability was maintained comparatively for longer period of time by acting as anti-ageing agent and there by maintained the germination percentage throughout the storage period. These results are in agreement with the findings Sushma (2003) in chickpea; Vinod Kumar *et al.,* (2012) in pigeon pea.

Root length, shoot length and Seedling vigour index

Significant differences due to seed treatments on root length shoot length and vigour index recorded. Significantly highest root length, shoot length and vigour index was observed 18.76cm, 15.60cm and 3230, respectively was recorded at 5th month in T_3 (Carboxin 37.5 % @ 2 gkg^{-1} of seeds + Thiram @ 2 gkg^{-1} of seeds). While the lowest root length (14.04 cm), shoot length (11.26 cm) and vigour index (2936) was recorded in T_8 control (Without treatment).

The root length shoot length and vigour index do not differed significantly due to containers during storage period. At the end of nine months of storage period numerically higher root length (15.66 cm), shoot length (12.56 cm) and vigour index (2451) was recorded in C_2 (HDPE bag).

Interaction effects due to containers and seed treatments recorded non-significant difference throughout the storage period however the treatment combination of C_2T_3 recorded higher root length, shoot length and vigour index of 16.20 cm 13.02 cm and 2629, respectively and lowest root length, shoot length and vigour index was recorded in C_1T_1 13.22 cm, 11.02 cm and 2026, respectively at the end of nine month of storage period.

Different seed treatments showed significant variations in seed qualitative and quantitative parameters throughout the nine months of storage period. The germination percentage (%), root length (cm), shoot length (cm) and seedling vigour index of cowpea seeds decreased gradually with increase in the period of storage in all the treatment combinations, which might be attributed to the phenomenon of physiological deterioration, natural ageing and depletion of food reserves and might be due to damage caused by fungi and insects and also toxic metabolites which might have hindered the seedling growth, gradual decline in seed vigour index was noticed due to age induced decline in germination, decrease in dry matter accumulation in seedling and decrease in seedling length at the end of nine months of storage. Similar findings are in conformity with findings of Vinodkumar *et al.,* (2010) in cowpea and Omvati and Verma (2014) in soybean.

Based on the above discussion it is clear that from the results obtained, is concluded that irrespective of seed treatments seed quality parameters decreased with the advancement of storage period. Among all the seed treatments, T_3 (Carboxin 37.5 % @ of seeds + Thiram @ 2 gkg^{-1} of seeds) gave significantly highest germination percentage root length, shoot length and seedling vigour index at the end of nine month of storage period and

which was on par withT_7 (Castor oil @ 5 $mlkg^{-1}$ of seed). While significantly lowest germination percentage was recorded in T_1 control (Without treatment). However, the minimum germination of 75 % as per the IMSCS (Indian Minimum Seed Certification Standard) was maintained in vitavax power even after nine months of storage period.

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