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IMPACT OF SEED TREATMENT CHEMICALS ON SEED STORABILITY IN PIGEONPEA (*CAJANUS CAJAN* (L.) MILLSP.)

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ABSTRACT

The storage experiment on influence of seed treatment chemicals on seed quality in pigeonpea Cv. BRG-1. From the present investigation it could be concluded that thiram @ 3 gm/kg of seed + spinosad @ 0.04 ml/kg of seed which were stored in superbag recorded significantly higher germination (83.50%), seedling length (30.43 cm), seedling dry weight (28.90mg), seedling vigour index-I (2555) and II (2427), seed moisture is lowest recorded 8.45% at the end of sixth months of storage period compared to control.

INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is cultivated throughout the tropics, especially in the arid regions. One of the major constraints in production of pulses are the insect pests which inflict severe losses both in the field and storage. Agrawal *et al*. (1988) reported that about 8.5 % of total annual pulse seed production mainly pigeonpea is lost during storage at ambient condition. Number of pathogens and insects [bruchids, (*Callosobruchus chinensis*)] have been reported on infesting of seeds during storage.

Seed treatment chemical thiram acts as protective agent against seed deterioration due to fungal invasion and physiological ageing as a result of which the seed viability was maintained for comparatively longer period of time (Savitri *et al*., 1998). Seed treated with chemicals also found effective for controlling of seed infection from diseases and pests (Laxman and Singh, 2013). New types of insecticides, Spinosad is one of the biologically derived insecticides. It is comprised primarily of two macrocyclic lactones, spinosyn A and D, which are secondary metabolites having toxicological profiles, and cross-sensitivity spectra (Thompson *et al*., 1997). Fungicides and insecticides provide protection from the stress imposed by natural ageing of seeds. Rate of seed deterioration could be slowed down either by keeping the seed in effective containers and by imposing certain pre-storage treatments like seed treatment with fungicide and insecticide, with this background the present investigation was carried out with objective of impact of seed treatment chemicals on seed storability in pigeonpea.

MATERIALS AND METHODS

An experiment on influence of seed treatment with chemicals and containers on storability of pigeonpea seeds has been studied at the UAS, Bangalore, under ambient conditions. After recording the initial seed quality parameters, two kilo gram of cleaned seeds were treated with chemicals and packed in different packaging materials as detailed below.*viz*., T_1: Control, T_2: Bavistin @ 2g/kg + Spinosad @ 0.04ml/kg of seed, T_3: Bavistin @ 2g/kg +Nimbicidine @ 5ml/kg of seed, T_4: Thiram @ 3g/kg +Spinosad @ 0.04ml/kg of seed, T_5: Thiram @ 3g/kg + Nimbicidine @ 5ml/kg of seed and T_6: Sprint @ 3g/kg of seed. The treated seeds were air dried under shade for 24h to bring back to its original moisture content. Seeds were packed in cloth bag and super bag and stored under ambient condition. Samplings were done to study the seed quality attributes up to six months of storage and The seed quality parameters were evaluated as per ISTA (2011) procedures.

RESULTS AND DISCUSSION

The initial seed quality parameters *viz*., seed moisture (9.03%), germination (86.33 %), seedling length (31.62 cm), seedling dry weight (33.62 mg), seedling vigour index-I (2592), seedling vigour index-II (2762) were recorded. They are presented

Table 1: Influence of seed treatment chemicals and packaging on seed moisture content (%) in pigeonpea cv.BRG-1 during storage

Treatments	Storage period		
	2	4	6
T_1	8.59(17.02)	8.65(17.10)	8.88(17.35)
T_2	8.45(16.89)	8.55(16.99)	8.85(17.30)
T_3	8.48(16.97)	8.58(17.02)	8.83(17.28)
T_4	8.54(16.98)	8.60(17.04)	8.70(17.14)
T_5	8.46(16.94)	8.61(17.06)	8.78(17.22)
T_6	8.35(16.88)	8.61(17.06)	8.70(17.14)
Mean	8.48(17.95)	8.60(17.04)	8.73(17.24)
S.Em. ±	0.03	0.03	0.03
CD(P=0.05)	0.10	0.08	0.09
C_1	8.70(17.15)	8.82(17.27)	9.04(17.49)
C_2	8.26(16.74)	8.38(16.82)	8.54(16.98)
Mean	8.48(17.95)	8.60(17.04)	8.73(17.24)
S.Em. ±	0.02	0.01	0.02
CD(P=0.05)	0.05	0.04	0.05
T_1C_1	8.83(17.28)	8.89(17.34)	9.12(17.57)
T_1C_2	8.36(16.75)	8.42(16.86)	8.66(17.15)
T_2C_1	8.67(17.12)	8.76(17.21)	9.10(17.55)
T_2C_2	8.22(16.66)	8.33(16.77)	8.58(17.03)
T_3C_1	8.73(17.18)	8.82(17.27)	9.10(17.55)
T_3C_2	8.22(16.76)	8.33(16.77)	8.60(17.04)
T_4C_1	8.74(17.19)	8.79(17.24)	8.95(17.40)
T_4C_2	8.35(16.77)	8.40(16.84)	8.45(16.89)
T_5C_1	8.69(17.14)	8.85(17.30)	9.04(17.49)
T_5C_2	8.22(16.74)	8.38(16.82)	8.51(16.950
T_6C_1	8.53(16.97)	8.82(17.27)	8.96(17.41)
T_6C_2	8.17(16.79)	8.41(16.85)	8.43(16.87)
Mean	8.48(17.95)	8.60(17.04)	8.73(17.24)
S.Em. ±	0.05	0.04	0.05
CD(P=0.05)	0.13	0.12	0.13

Initial Seed moisture content (%): 9.03

below the respective tables.

Significantly lower (8.35% and 8.70%) seed moisture content was observed in treatments *viz.*, Sprint @ 3gm/kg (T_6) and the higher seed moisture (8.59% and 8.88%) content was observed in control (T_1) during second and end of the storage period, respectively. Among the packaging materials, significantly lowest (8.26% and 8.54%) seed moisture content was noticed in super bag compared to cloth bag (8.70% and 9.04%) in second and end of the storage period, respectively. There were significant differences in the interaction between treatments and packaging materials. However, (T_6C_2) recorded lowest (8.17% and 8.43%) seed moisture content whereas higher moisture found in T_1C_1 (8.83 % and 9.12 %) at second and end of month of storage period (Table 1).

The lower seed moisture present in the sprint treat seeds it helps for covering the pores in the seed coat and prevents the entry of both water and fungal mycelia and provide protection from physical damage similar results were recorded by (Rathinavel and Raja, 2007) in cotton. However the seed moisture fluctuation was more in cloth bag compared to super bag due to less exchange of moisture and gases in superbag compared to cloth bag hence it cause slower deterioration under natural ageing condition. The results are in agreement with the findings of (Shanmugavelu *et al.*,1995) in soybean, (Meena *et al.*,1998) and (Shivayogi Ryavalad *et al.*, 2009) in cotton seeds.

Germination (%)

During second and end of the storage period Thiram @ 3gm/kg + Spinosad @ 0.04ml/kg recorded significantly highest (85.88% and 83.25%) germination and lowest (79.88% and 73.50%) germination was noticed in control (T_1) respectively.

Among the packaging material, super bag recorded significantly highest germination (83.69% and 81.36%) compared to cloth bag (82.10% and 78.10) during second and end of the storage period, respectively. Significantly higher seed germination noticed in super bag compared to cloth bag. It may be attributed to low rate of respiration of seeds resulted in rapid deterioration and decreased germination percent in cloth bag. The present findings are similar with Meena *et al.*,1998 in cotton.

Interaction between treatments and packaging materials were significantly differing, significantly higher (86.75% and 83.50%) germination was recorded in T_4C_2 and lowest (79.50% and 73.25%) germination noticed in T_1C_1 during second and end of the storage period, respectively (Table 2).

Irrespective of treatment and packaging materials, decline in germination percentage may be attributed to ageing effect leading to depletion of food reserves and decline in synthetic activity of embryo apart from death of seed because of fungal invasion, fluctuating temperature, relative humidity and storage container in which seeds are stored. Increased accumulation of total peroxide and leakage of electrolytes was due to ageing of seeds. These findings are in agreement with the results obtained by (Shekhar Gouda *et al.*, 1998) in

Table 2: Influence of seed treatment chemicals and packaging on seed germination (%) in pigeonpea during storage

Treatments	Germination (%) Storage period		
	2	4	6
T_1	79.88(63.32)	77.13(61.42)	73.50(58.99)
T_2	81.75(64.69)	81.13(64.24)	80.00(63.41)
T_3	79.88(63.32)	79.00(62.71)	78.00(62.01)
T_4	85.25(68.21)	84.25(66.60)	83.25(65.82)
T_5	83.75(66.21)	82.50(65.25)	80.50(63.77)
T_6	85.88(67.90)	83.38(65.92)	83.13(65.72)
Mean	82.90(65.61)	81.23(64.36)	79.73(63.29)
S.Em. ±	0.22	0.30	0.15
CD(P=0.05)	0.73	0.87	0.42
C_1	82.10(63.51)	80.15(63.99)	78.10(62.97)
C_2	83.69(65.91)	82.31(64.73)	81.36(63.61)
Mean	82.90(65.61)	81.23(64.36)	79.73(63.29)
S.Em. ±	0.15	0.17	0.08
CD(P=0.05))	0.42	0.50	0.24
T_1C_1	79.50(63.05)	75.50(60.31)	73.25(58.83)
T_1C_2	80.25(63.59)	78.75(62.53)	73.75(59.16)
T_2C_1	81.25(64.32)	80.00(63.41)	79.50(63.05)
T_2C_2	82.25(65.06)	82.25(65.06)	80.50(63.77)
T_3C_1	79.50(63.05)	78.75(62.53)	77.50(61.66)
T_3C_2	80.25(63.59)	79.25(62.90)	78.50(62.35)
T_4C_1	85.75(67.80)	84.25(66.60)	82.50(65.25)
T_4C_2	86.75(68.63)	84.25(66.60)	83.50(66.40)
T_5C_1	83.50(66.01)	82.50(65.25)	80.25(63.59)
T_5C_2	84.00(66.40)	82.50(65.26)	80.75(63.95)
T_6C_1	85.50(67.59)	83.25(65.82)	82.75(65.44)
T_6C_2	86.25(68.21)	83.50(66.02)	83.00(66.01)
Mean	82.90(65.61)	81.23(64.36)	79.73(63.29)
S.Em. ±	0.40	0.43	0.38
CD(P=0.05)	1.20	1.22	0.60

Initial Germination (%):86.33

sunflower, (Gurung *et al.,* 2014) in Passion fruit and (Gupta and Aneja., 2004) in soybean.

Seedling length (cm)

Seed treatment with Thiram @ 3gm/kg + Spinosad @ 0.04ml/kg (T_4) noticed higher (32.61cm and 29.86 cm) seedling length and lower seedling length (28.43 cm and 23.76 cm) in control (T_1) during second and end of the storage period, respectively.

During second and end of the storage period, seed stored in super bag recorded significantly highest seedling length (31.41cm and 29.31cm) compared to cloth bag (28.98 cm and 26.34 cm) respectively.

There were significant differences with respect to interaction between treatments and packaging materials. However, maximum (33.64 cm and 30.43 cm) seedling length was recorded in T_4C_2, and lowest seedling length (27.21cm and 22.55 cm) noticed in T_1C_1 during second and end of the storage period, respectively (Table.3).

Decline in seedling length may be due to age induced decline in germination, the damage caused by fungal infection and also production of toxic metabolites which hindered the seedling growth over a storage period. These findings are in agreement with results obtained by (Paul *et al.,*1996) in mungbean.

Seedling dry weight (mg)

There were significant differences with respect to treatments, highest (32.36 mg and 28.67 mg) seedling dry weight was recorded in Thiram @ 3gm/kg + Spinosad @ 0.04ml/kg (T_4) and that differed significantly with all other treatments, whereas least in control (T_1) (30.17 mg and 25.53 mg) in second and end of the storage period, respectively.

Super bag recorded significantly highest seedling dry weight (32.29 mg and 28.49 mg) compared to cloth bag (30.05 mg and 26.15 mg) during second and end of the storage period, respectively.

Among the interaction combination, the highest Seedling dry weight was recorded in T_4C_2 (32.56 mg and 28.90 mg) and whereas lowest (29.55 mg and 25.41 mg) was in T_1C_1 during second and end of the storage period, respectively (Table 3).

Dry weight of seedling decreased with increase in storage period with irrespective of treatments and packaging materials. This may be due to ageing, which resulted in deterioration of seed, decrease in the germination percentage and seedling length. The present results are simillar findings of (Mahendrapal and Grewel,, 1985) in pigeonpea, (Paul *et al.,* 1996) in mung bean.

Seedling vigour index-I and II

However, Highest (2812 and 2790 and 2486 and 2386) seedling vigour index-I and II were recorded in Thiram @ 3gm/kg + Spinosad @ 0.04mL/kg that differed significantly with all other treatments and least (2271 and 2409 and 1746

Table 3: Influence of seed treatment chemicals and packaging on seedling length (cm) and seedling dry weight (mg) in pigeonpea during storage

Treatments	Seedling length (cm) Storage Period			Seedling dry weight (mg) Storage Period		
	2	4	6	2	4	6
T_1	28.43	26.26	23.76	30.17	27.63	25.53
T_2	29.51	28.83	27.41	32.43	30.38	28.1
T_3	29.42	29.29	28.26	30.93	28.35	26.3
T_4	32.61	31.52	29.86	32.36	30.96	28.67
T_5	30.17	29.9	28.4	31.94	29.16	26.96
T_6	31.05	30.02	28.97	32.21	30.65	28.37
Mean	30.2	29.3	27.78	31.67	29.52	27.32
S.Em. ±	0.2	0.19	0.13	0.16	0.14	0.18
CD(P = 0.05)	0.58	0.55	0.22	0.45	0.4	0.52
C_1	28.98	28.04	26.34	30.05	28.41	26.15
C_2	31.41	30.57	29.31	32.29	30.63	28.49
Mean	30.2	29.3	27.78	31.67	29.52	27.32
S.Em. ±	0.12	0.11	0.08	0.09	0.08	0.1
CD(P = 0.05)	0.34	0.32	0.22	0.26	0.23	0.3
T_1C_1	27.21	25.43	22.55	29.55	27.02	25.41
T_1C_2	29.65	27.09	24.97	30.78	28.24	25.66
T_2C_1	28.06	27.11	26.35	32.36	30.11	27.86
T_2C_2	30.95	30.55	28.47	32.5	30.65	28.34
T_3C_1	28.67	28.47	27.18	30.8	28.08	26.09
T_3C_2	30.17	30.12	29.34	31.07	28.62	26.51
T_4C_1	31.57	30.45	29.3	32.16	31.06	28.43
T_4C_2	33.64	32.59	30.43	32.56	30.87	28.9
T_5C_1	29.02	28.61	27.58	31.78	28.83	26.33
T_5C_2	31.32	31.2	29.23	32.1	29.5	27.59
T_6C_1	29.34	28.16	27.75	32.08	30.36	28.11
T_6C_2	32.76	31.89	30.20	32.34	30.94	28.63
Mean	30.2	29.3	27.78	31.67	29.52	27.32
S.Em. ±	0.29	27	0.18	0.23	0.2	28
CD(P = 0.05)	0.82	0.78	0.53	0.66	0.57	0.8

Initial Mean Seedling length (cm): 31.62; Initial Seedling dry weight (mg): 33.62

Table 4: Influence of seed treatment chemicals and packaging on seedling vigour index–I and II in pigeonpea during storage

Treatments	Vigour Index-I Storage Period			Vigour Index-II Storage Period		
	2	4	6	2	4	6
T_1	2271	2026	1746	2409	2131	1876
T_2	2412	2340	2193	2650	2464	2248
T_3	2349	2314	2204	2470	2240	2051
T_4	2812	2655	2486	2790	2608	2386
T_5	2526	2466	2286	2674	2405	2169
T_6	2667	2504	2408	2584	2399	2179
Mean	2506	2384	2216	2627	2401	2179
S.Em. ±	16.53	21.23	10.95	15.88	16.68	13.87
CD(P = 0.05)	47.40	60.91	31.41	45.76	47.84	39.89
C_1	2393	2266	2049	2467	2277	2042
C_2	2620	2502	2386	2702	2521	2317
Mean	2506	2384	2216	2584	2399	2179
S.Em. ±	9.54	12.26	6.32	7.94	9.63	7.43
CD(P = 0.05)	27.37	35.16	18.14	22.88	27.62	21.42
T_1C_1	2163	1919	1651	2349	2039	1861
T_1C_2	2378	2133	1841	2470	2223	1891
T_2C_1	2279	2169	2094	2628	2408	2214
T_2C_2	2546	2512	2291	2672	2521	2281
T_3C_1	2278	2241	2106	2448	2211	2021
T_3C_2	2420	2386	2303	2493	2269	2081
T_4C_1	2706	2565	2416	2757	2616	2345
T_4C_2	2918	2745	2555	2824	2600	2427
T_5C_1	2422	2360	2213	2653	2377	2112
T_5C_2	2630	2572	2360	2696	2433	2227
T_6C_1	2508	2344	2296	2742	2526	2325
T_6C_2	2825	2664.	2521	2789	2583	2390
Mean	2506	2384	2216	2584	2399	2179
S.Em. ±	23.37	30.03	15.49	22.46	23.59	21.03
CD(P = 0.05)	67.04	86.13	44.42	64.71	67.65	60.58

Initial Seedling vigour index –I : 2592; Initial Seedling vigour index –II: 2762 and 1876) was in control in second and end of the storage period respectively. The seeds stored in super bag recorded highest seedling vigour index-I and II (2620 and 2702 and 2386 and 2317) as compared to cloth bag (2393 and 2467 and 2049 and 2042) during second and end of the storage period respectively. Significantly, highest seedling VI-I and II (2918 and 2824 and 2555 and 2427) was recorded in T_4C_2 and lowest VI- I and II (2163 and 2349 and 1651 and 1861) in T_1C_1 during second and end of the storage period respectively (Table 4).

The significant difference in the treatments was noticed in vigour index throughout the storage period. Vigour index was also decreased as progress in storage period increases. This decrease in seed quality parameters during storage may be attributed to ageing effects, leading to depletion of stored food reserves and decline in synthetic activity of the embryo apart from death of the seeds due to fungal invasions. The rate of reduction in vigour index in super bag was lower than that of cloth bag.

Similarly the decline in seedling vigour may be attributed to decrease in germination per cent, seedling length and dry matter accumulation in seedling simillar findings with the results obtained by (Meena *et al*., 1998), (Freitas *et al*., 2002) in cotton.

The study could be concluded that pigeonpea seeds treated with Thiram @ 3 gm/kg + Spinosad @ 0.04ml/kg stored in super bag maintained the seed viability, seed vigour and other seed quality parameters up to six months of storage.

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