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Impact of synthetic polymer coating and seed treatment chemicals on seed longevity of cotton seed (*Gossypium hirsutum* L.)

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ABSTRACT : An experiment was carried out to know the influence of polymers and seed treatment chemicals on longevity of cotton seeds. The results revealed that in all treatments germination decreased as storage period progressed. The seed coated with synthetic polymer and chemical treatment polykote @ 3 ml/kg + vitavax 200 @ 2ml/kg of seeds and stored in the polythene bag (400 gauge) maintained higher seed quality attributes such as germination (73.67%), vigour index –I (2038), vigour index –II (2156), and lower electrical conductivity (0.259 ms/ppt), after ten months of storage compared to control in cloth bag germination (60.00%), vigour index –I (1108), vigour index –II (1220), and higher electrical conductivity (0.430 mS/ppt). Hence, cotton seed coating with polykote @ 3 ml/kg + vitavax 200 @ 2ml/kg of seeds and stored in the polythene bag (400 gauge) is better to maintain germination and other seed quality parameters for ten months of storage.

Key **W**ords : Polykote, Synthetic polymer, Longevity, Germination

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Cotton is one of the important fibre crop, known as king of fibre and in recent times it is called as white gold. It is one of the most important fibre crop playing a key role in economic and social affairs of the world. It is the oldest among the commercial crops of the world. Cotton seed looses its viability and vigour rapidly in storage as being poor storer. The linted cotton seed hosts many pathogens and insect pests during storage and reduce the seed quality (Delouche, 1973). The rapid loss of viability and vigour in storage leads to poor stand establishment of the crop and low productivity. Hence, storage of seeds after harvest till next sowing season is of prime importance for successful seed production programme and also an essential segment of seed industry. The seed has to be stored safely to maintain viability and vigour intact. The polymer coat provides protection from the stress imposed by ageing, which includes fungal invasion also. The polymer coat is thin simple to apply, diffuses rapidly and nontoxic to the seedlings during germination. It improves plantability and emergence of the seeds, accurate application of chemicals reduces chemical wastage, helps to hold all ingredients, protectants, nutrients and growth promoters. By encasing the seed within a thin film of biodegradable polymer, the adherence of seed treated chemicals to the seed, which will ensures dust free handling, making treated seeds both useful and environmental friendly. The polymer film may act as physical barrier, which has been reported to reduce the leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo (Vamangamudi *et al.,* 2003). The information on polymer seed coating is scanty and hence, the study was under taken.

RESEARCH PROCEDURE

The seeds of cotton cv. NHH- 44 produced during *Kharif* 2008 were collected from NSP, University of Agricultural Sciences, Dharwad. The seeds were cleaned and dried to < 8 per cent of moisture and used for the study. The experiment consisted of treatments *viz*., Control (T_0), Polykote @ 3 ml/kg (T_1), Polykote @ 3 ml/kg + flowable thiram @ 2.5 ml/kg (T_2), Polykote @ 3 ml/kg + imidacloprid @ 6 ml/kg (T_3), Polykote @ 3 ml/kg + flowable thiram @ 2.5 ml/kg + imidacloprid @ 6 ml/kg

(T_4), Polykote @ 3 ml/kg + vitavax 200 (T_5), Hydroprimed seed (T_6), Hydroprimed+ polykote @ 3 ml/kg + flowable thiram @ 2.5 ml/kg + imidacloprid @ 6 ml/kg (T_7). Seeds were air dried under shade for 24h to bring back to its original moisture content. Only from each treatment seeds were packed in cloth bag (C_1) and polythene bag (C_2) and stored under room conditions at NSP, Bangalore for ten months. Observations were taken to know seed quality attributes *viz*., germination, vigour index –I, vigour index –II, and electrical conductivity.

RESEARCH ANALYSIS AND REASONING

The polymer coated seeds coupled with chemical treatment stored in polythene bag (400 gauge) exhibited superiority in maintaining the seed quality through out the storage period. Irrespective of the treatments all the seed quality parameters decreased as the storage period advanced. There was significant differerence in germination during storage (Table 1). Seed germination in cloth bag was 84.25 per cent and

Table 1 : Influence of synthetic polymers, chemical treatments and packaging on germination (%) in cotton hybrid NHH-44 during storage

Storage period (months) (Sep-09 to Jun-10)					
Treatments	2	4	6	8	10
T_0	85.67(67.74)	78.17(62.13)	74.83(59.88)	69.50(56.46)	61.00(51.34)
T_1	86.33(68.30)	79.83(63.31)	77.33(61.56)	72.50(58.35)	67.00(54.93)
T_2	85.67(67.82)	79.67(63.19)	77.83(61.90)	73.33(58.89)	68.00(55.53)
T_3	85.00(67.21)	80.33(63.66)	77.67(61.78)	73.00(58.67)	68.67(55.96)
T_4	85.33(67.49)	81.33(64.42)	78.67(62.49)	75.83(60.56)	70.67(57.19)
T_5	88.33(70.04)	84.17(66.54)	81.17(64.28)	77.50(61.68)	72.33(58.25)
T_6	83.67(66.16)	78.50(62.37)	74.17(59.43)	69.50(56.46)	62.83(52.43)
T_7	84.50(66.84)	79.33(62.94)	76.83(61.22)	73.67(59.11)	67.50(55.23)
Mean	85.56(67.70)	80.17(63.57)	77.31(61.57)	73.10(58.77)	67.25(55.11)
S.E. ±	0.44	0.41	0.33	0.37	0.41
C.D.(P=0.05)	1.27	1.17	0.94	1.07	1.19
C_1	84.25(66.63)	79.13(62.82)	76.21(60.81)	72.13(58.13)	65.83(54.24)
C_2	86.88(68.77)	81.21(64.32)	78.42(62.33)	74.08(59.42)	68.67(55.98)
Mean	85.56(67.70)	80.17(63.57)	77.31(61.57)	73.10(58.77)	67.25(55.11)
S.E. ±	0.28	0.20	0.16	0.19	0.21
C.D.(P=0.05)	0.64	0.59	0.47	0.53	0.59
T_0C_1	85.00(67.19)	77.00(61.33)	73.00(58.67)	68.67(55.94)	60.00(50.75)
T_0C_2	86.33(68.29)	79.33(62.94)	76.67(61.09)	70.33(56.99)	62.00(51.92)
T_1C_1	86.00(68.03)	79.00(62.73)	76.00(60.64)	72.00(58.03)	65.00(53.72)
T_1C_2	86.67(68.56)	80.67(63.89)	78.67(62.48)	73.00(58.67)	69.00(56.15)
T_2C_1	83.00(65.64)	78.00(62.01)	76.67(61.09)	72.67(58.46)	66.67(54.72)
T_2C_2	88.33(70.00)	81.33(64.38)	79.00(62.70)	74.00(59.32)	69.33(56.35)
T_3C_1	83.67(66.14)	80.33(63.68)	77.67(61.78)	72.67(58.46)	66.00(54.31)
T_3C_2	86.33(68.28)	80.33(63.65)	77.67(61.78)	73.33(58.89)	71.33(57.61)
T_4C_1	84.00(66.42)	79.00(62.70)	76.67(61.09)	73.67(59.11)	69.67(56.56)
T_4C_2	86.67(68.57)	83.67(66.14)	80.67(63.89)	78.00(62.01)	71.67(57.82)
T_5C_1	87.00(68.85)	83.33(65.89)	79.67(63.18)	75.67(60.43)	71.00(57.40)
T_5C_2	89.67(71.22)	85.00(67.19)	82.67(65.38)	79.33(62.94)	73.67(59.11)
T_6C_1	82.33(65.13)	78.00(62.01)	74.00(59.32)	69.00(56.16)	62.00(51.94)
T_6C_2	85.00(67.19)	79.00(62.73)	74.33(59.54)	70.00(56.77)	63.67(52.92)
T_7C_1	83.00(65.66)	78.33(62.24)	76.00(60.65)	72.67(58.46)	66.33(54.51)
T_7C_2	86.00(68.01)	80.33(63.65)	77.67(61.78)	74.67(59.76)	68.67(55.94)
Mean	85.56(67.70)	80.17(63.57)	77.31(61.57)	73.10(58.77)	67.25(55.11)
S.E. ±	0.62	0.58	0.46	0.52	0.58
C.D.(P=0.05)	NS	NS	1.33	NS	NS

*Initial germination: 93% before treatment, Figures in parentheses are Arc sine values, NS=Non–significant

T_0–Control, T_1 – Polykote @ 3 ml/kg of seed, T_2 – Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg of seed, T_3 – Polykote @ 3 ml/kg + Imidacloprid @ 6 ml/kg of seed, T_4–Polykote @3 ml/kg+Flowable thiram @ 2.5 ml/kg+Imidacloprid @ 6 ml/kg of seed, T_5 –Polykote @ 3 ml/kg + Vitavax 200 @ 2g/kg of seed, T_6 –Hydroprimed, T_7 –Hydroprimed+ Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg + Imidacloprid @ 6 ml/kg of seed

C_1 – Cloth bag , C_2 –Polythene bag

polythene bag was 86.88 per cent at second month of storage and it was declined to 65.83 per cent in cloth bag and 68.67 per cent in polythene bag at the end of ten month of storage. Among the treatments seeds coated with polykote @ 3 ml/kg + vitavax 200 @ 2g/kg treatment which were stored in polythene bag maintained better germination through out the storage period which noticed (73.67 %). There is significant difference among the treatments, seeds coated with polykote @ 3 ml/kg + vitavax 200 @ 2g/kg treatment recorded higher germination 72.33 per cent at the end of storage as compared to control 61 per cent (without polymer and chemical). Polymer and seed treatment chemicals cover 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 and Chachalis and Smith (2001) and Kumar *et al*. (2007) in soybean. Which

Table 2 : Influence of synthetic polymer, chemical treatments and packaging on seedling vigour index-I and vigour index-II in cotton hybrid NHH-44 during storage

Treatments	Storage period (months) (Sep-09 to Jun-10)									
	Vigour index-I					Vigour index-II				
	2	4	6	8	10	2	4	6	8	10
T_0	2612	2162	1853	1560	1256	3111	2448	2044	1652	1296
T_1	2622	2259	1983	1764	1500	3235	2601	2274	1932	1631
T_2	2600	2205	2018	1794	1594	3227	2691	2326	2020	1722
T_3	2621	2291	2073	1846	1642	3176	2728	2347	1973	1739
T_4	2630	2389	2176	2013	1793	3212	2815	2419	2121	1889
T_5	2771	2474	2273	2112	1882	3399	2880	2616	2320	2038
T_6	2515	2163	1897	1640	1332	3071	2517	2076	1804	1466
T_7	2609	2311	2117	1911	1686	3174	2725	2379	2096	1832
Mean	2623	2282	2049	1830	1586	3200	2676	2310	1990	1702
S.E. ±	20.21	15.88	14.27	14.87	15.31	19.92	25.10	18.82	18.80	20.34
C.D. (P=0.05)	58.21	45.76	41.11	42.83	44.11	57.37	72.29	54.21	54.17	58.58
C_1	2462	2110	1881	1666	1426	3105	2564	2229	1905	1611
C_2	2783	2454	2217	1994	1745	3296	2787	2391	2075	1792
Mean	2623	2282	2049	1830	1586	3200	2676	2310	1990	1702
S.E. ±	10.10	7.94	7.13	7.43	7.66	9.96	12.55	9.41	9.40	10.17
C.D. (P=0.05)	29.10	22.88	20.55	21.42	22.05	28.69	36.15	27.11	27.08	29.29
T_0C_1	2476	1989	1684	1380	1108	3093	2343	1925	1586	1220
T_0C_2	2748	2335	2022	1740	1403	3128	2554	2163	1719	1372
T_1C_1	2488	2059	1761	1572	1301	3161	2561	2183	1836	1535
T_1C_2	2756	2458	2205	1956	1700	3308	2640	2364	2028	1727
T_2C_1	2393	2033	1861	1654	1454	3064	2586	2318	1984	1660
T_2C_2	2806	2378	2175	1934	1733	3390	2795	2334	2057	1784
T_3C_1	2477	2161	1929	1722	1434	3043	2628	2272	1856	1586
T_3C_2	2766	2421	2218	1970	1850	3308	2828	2421	2090	1891
T_4C_1	2495	2196	1978	1829	1655	3099	2602	2326	2003	1822
T_4C_2	2765	2582	2374	2197	1931	3325	3028	2512	2239	1955
T_5C_1	2614	2333	2122	1939	1726	3317	2768	2486	2199	1920
T_5C_2	2929	2614	2425	2285	2038	3481	2992	2746	2441	2156
T_6C_1	2322	1942	1739	1486	1197	2980	2423	2072	1809	1412
T_6C_2	2709	2383	2054	1794	1466	3162	2612	2080	1799	1520
T_7C_1	2432	2162	1973	1747	1534	3084	2599	2250	1965	1736
T_7C_2	2787	2461	2260	2076	1838	3264	2850	2508	2227	1929
Mean	2623	2282	2049	1830	1586	3200	2676	2310	1990	1702
S.E. ±	28.58	22.46	20.18	21.03	21.65	28.17	35.49	26.61	26.59	28.76
C.D. (P=0.05)	NS	64.71	58.13	60.58	62.38	81.14	102.24	76.67	76.60	82.84

*Initial vigour index-I: 2941 and vigour index-II : 3648 (before treatment), NS= Non–significant

T_0–Control, T_1–Polykote @ 3 ml/kg of seed, T_2–Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg of seed, T_3–Polykote @ 3 ml/kg + Imidacloprid @ 6 ml/kg of seed, T_4–Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg + Imidacloprid @ 6 ml/kg of seed, T_5–Polykote @ 3 ml/kg + Vitavax 200 @ 2g/kg of seed, T_6–Hydroprimed, T_7–Hydroprimed+ Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg + Imidacloprid @ 6 ml/kg of seed

C_1–Cloth bag , C_2– Polythene bag

results in higher respiration of seed germ resulted in rapid deterioration of seeds and decreased germination per cent in cloth bag (Meena *et al.*, 1999 and Kunkur, 2007 in cotton).

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 polythene bag was lower than that of cloth bag. Vigour index-I and II initially it was 2941 and 3648, respectively before conducting storage, where as vigour index I and II was lower 2462 and 3105 in cloth bag as compared to in polythene bag stored seeds 2783 and 3296, respectively at second month after storage and it was declined to 1426 and 1611 in cloth bag and in polythene bag 1745 and 1792 at end of storage period, respectively (Table 2). Seedling vigour index I and II was highest in polykote @ 3 ml/kg + vitavax 200 @ 2ml/kg (1882 and 2038, respectively) compared to control (1256 and

Table 3 : Influence of synthetic polymer, chemical treatments and packaging on electrical conductivity (ms/ppt) in cotton hybrid NHH-44 during storage

	Electrical conductivity storage period (months)				
Treatments	2	4	6	8	10
T_0	0.139	0.201	0.249	0.337	0.418
T_1	0.128	0.187	0.236	0.317	0.394
T_2	0.124	0.177	0.220	0.271	0.336
T_3	0.127	0.171	0.224	0.283	0.347
T_4	0.138	0.169	0.210	0.245	0.288
T_5	0.127	0.165	0.199	0.238	0.275
T_6	0.135	0.197	0.238	0.325	0.397
T_7	0.126	0.173	0.207	0.253	0.285
Mean	0.130	0.180	0.223	0.284	0.342
S.E. ±	0.001	0.001	0.002	0.003	0.002
C.D. (P=0.05)	0.004	0.004	0.005	0.009	0.007
C_1	0.138	0.193	0.238	0.298	0.354
C_2	0.122	0.167	0.208	0.270	0.331
Mean	0.130	0.180	0.223	0.284	0.342
S.E. ±	0.001	0.001	0.001	0.002	0.001
C.D. (P=0.05)	0.002	0.002	0.002	0.004	0.003
T_0C_1	0.150	0.210	0.262	0.355	0.430
T_0C_2	0.127	0.192	0.235	0.318	0.407
T_1C_1	0.135	0.199	0.243	0.320	0.404
T_1C_2	0.120	0.175	0.230	0.314	0.384
T_2C_1	0.128	0.189	0.229	0.284	0.341
T_2C_2	0.119	0.165	0.211	0.259	0.331
T_3C_1	0.133	0.181	0.242	0.295	0.353
T_3C_2	0.121	0.161	0.206	0.271	0.342
T_4C_1	0.147	0.190	0.233	0.269	0.306
T_4C_2	0.128	0.149	0.186	0.221	0.269
T_5C_1	0.137	0.178	0.216	0.250	0.291
T_5C_2	0.117	0.152	0.182	0.225	0.259
T_6C_1	0.142	0.210	0.253	0.346	0.409
T_6C_2	0.128	0.184	0.222	0.303	0.385
T_7C_1	0.134	0.185	0.225	0.261	0.298
T_7C_2	0.118	0.160	0.189	0.245	0.273
Mean	0.130	0.180	0.223	0.284	0.342
S.E. ±	0.002	0.002	0.002	0.004	0.003
C.D. (P=0.05)	NS	0.006	0.007	0.013	0.010
C.V. (%)	2.36	1.915	1.905	2.662	1.672

*Initial electrical conductivity:0.105ms/ppt (before treatment), NS=Non–significant

T_0–Control, T_1–Polykote @ 3 ml/kg of seed, T_2–Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg of seed, T_3–Polykote @ 3 ml/kg + Imidacloprid @ 6 ml/kg of seed, T_4–Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg + Imidacloprid @ 6 ml/kg of seed , T_5–Polykote @ 3 ml/kg + Vitavax 200 @ 2g/kg of seed , T_6–Hydroprimed , T_7–Hydroprimed+ Polykote @ 3 ml/kg + Flowable thiram @ 2.5 ml/kg + Imidacloprid @ 6 ml/kg of seed

C_1–Cloth bag , C_2– Polythene bag

1296, respectively) at the end of ten month of storage. Among the treatment combination seeds treated with polykote @ 3 ml/kg + vitavax 200 @ 2ml/kg stored in polythene bag recorded higher vigour index I and II at the end of storage period (2038 and 2156, respectively). However, the lowest vigour index I and II was noticed seed stored in cloth bag which was 1108 and 1220, respectively. The higher vigour index in polykote @ 3 ml/kg + vitavax 200 @ 2ml/kg treated seeds stored in polythene bag was due to chemicals and containers effect, which will prevent the deterioration of seed over other treatments. The polymer coating and chemical treatments keep the seed intact, as it acts as binding material. It covers the minor cracks and aberration on the seed coat, thus blocking the fungal invasion. It may also act as a physical barrier which reduces leaching of inhibitors from the seed covering and restrict oxygen movement and thus reducing the respiration of embryo thereby reducing the ageing effect on the seed (Vamangamudi, 2003).

The present study also evidently implicates a progressive but rapid increase in EC (Electrical conductivity) of the seed leachate during storage period. The EC was recorded initially 0.105 ms/ppt before storage, The seeds packed in cloth bag recorded higher EC (0.354 ms/ppt) compared to polythene bag stored seeds (0.331 ms/ppt) at the end of storage, but at the second month of storage was 0.138 ms/ppt and 0.122 ms/ppt, respectively (Table 3). The seeds which were coated with Polykote @ 3 ml/kg + Vitavax 200 treated recorded lower EC (0.275 ms/ppt) compared to other treatments and higher EC was recorded control (0.418 ms/ppt). Among the treatment combination T_5C_2 recorded lowest electric conductivity (0.259 ms/ppt) compared to T_0C_1 (0.430 ms/ppt) at the end of ten months after storage. This might be due to the incidence of fungi, which causes to loss of membrane integrity in seeds stored without chemical treatment. The observations recorded on the increased leakage from the seeds of natural ageing (Struve and Hopper, 1996 in cotton) are some of the strong evidences to support the hypothesis that membrane damage is found to be the first stage of ageing.

The study could be concluded that seed coating with polykote @ 3 ml/kg + vitavax 200 @ 2ml/kg of seed with storage in polythene bag (400 gauge) is better to maintain seed viability and longevity during cotton seed storage up to ten months. Similar work related to the present topic was also done by Manjunatha *et al*. (2008) on chilli, Giang and Gowda (2007) on rice, Shakuntala *et al*. (2010) on sunflower; Vanangamudi *et al*. (2003) and West *et al*. (1985).

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