ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 7, July 2014

Seed Quality of Maize with Polymer Film Coating in Storage

Shushant Kumar Kaushik[1], Anuj Kumar Rai[2*], Vishal Singh[3]

[1]Research Scholar (Ph.D.), Department of Seed Science & Technology, F/Ag., Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (W.B.), India

[2*]Assistant Professor, Department of Seed Technology, School of Agriculture Science, Centurion University of Technology and Management, Gajapati- 761211, Odisha, India

[3]Assistant Professor, Department of Agricultural Engineering, School of Engineering and Technology, Centurion University of Technology and Management, Gajapati- 761211, Odisha, India

ABSTRACT: Seeds of maize (variety MH-7) were obtained from the Department of Genetics and Plant Breeding, SHIATS, India. After through cleaning and grading the maize seeds were well dried before storage and treated with polymer @ 3, 6 and 9 ml per kg of seed, fungicides and their combinations (i.e. polymer 3ml + thiram 2 g and polymer 6 ml + thiram 2 g etc.). Seeds were stored for 2, 4 and 6 months respectively under ambient condition. The results revealed that, the seed treatment with polymer @ 9 ml + thiram 2 g per kg of seed observed significant shoot length, root length, seedling length, viability, fresh weight and higher vigor index and high germination rate was observed for seed coated with polymer @6 ml+ thiram 2 g per kg of seed after 6 month of storage. Seeds stored in plastic box recorded significantly maximum seed quality parameters compared to cotton bag.

KEY WORDS: Maize (Zea mays L.), cereal crop, Coating, Storability, seed quality and Polymer

I. INTRODUCTION

Maize (*Zea mays* L.) is the third most important cereal crop in the world economy. It has world wide significance as human food, animal feed and as good source of starch, protein, fat, oil and sucrose in addition to some of the important vitamins and minerals. Maize (*Zea mays* L.) is one of the most important cereals of the world and provides more human food than any other cereal. Maize grains are rich in vitamins A, C and E, carbohydrates and essential minerals and contain 9-10% protein. It is high yielding, easy to process, readily digested, and costs less than other cereals. The polymer coating with the negligible thickness of 84µ over the seed coat provides protection from the imposed accelerated ageing, which include fungal invasion. It reduces chemical wastage, helps to make room for including all required ingredients, protect the nutrients, oxygen suppliers and protect seed from fungal invasion and insects attack. By encasing the seed with thin film of biodegradable polymer, the adherence of seed treatment to the seed is improves, ensures dust free handling, making treated seed both useful and environment friendly [1]. Seed coating technology has developed rapidly during the past two decades and provides an economical approach to seed enhancement. An advantage of seed coating is that the seed enhancement material (fungicide and insecticide) is placed directly on the seed without obscuring the seed shape [2]. Seed coatings with natural or synthetic polymers have gained rapid acceptance by the seed industry as a much safer coating material. The storability of poly coated seeds has also to be investigated in order to determine the viability of seeds for long term. Polycoated seeds can be stored for long term, if adequate storage conditions are provided [3].

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 7, July 2014

II. MATERIALS AND METHODS

Maize seeds (variety MH-7) were obtained from the Department of Seed Science & Technology, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad. After through cleaning and grading the seeds were well dried before storage. The experiment adopted was Randomized Block Design (Factorial) with three replications. Maize seeds were treated with polymer (@ 3ml, 6ml and 9 ml per kg of seed), fungicide + thiram @ 2 g per kg of seed) and their combinations treatment (@ polymer 3 ml + thiram 2 g, polymer 6 ml + thiram 2 g and polymer 9 ml + thiram 2 g of seed) and these seeds were stored for 2, 4 and 6 months respectively. It was packed in plastic box or cotton bag and stored under ambient condition in the Seed Testing Laboratory. The seeds of maize were treated with synthetic polymer then poly-coated seeds were being shade dried and further treated with fungicide thiram at recommended dose.

III. RESULTS AND DISCUSSION

The present study for used in fungicides, polymer dye treatment on storability help with about in the quality characters recorded on maize (MH-7) and all conditions and characters show in Table 1 and 2. The germination percentage due to seed treatments were observed throughout storage period. The polymer coating alone or in combination with fungicide recorded significantly higher germination percentage compared to untreated seeds. Higher germination was recorded of coated seeds with polymer @ 6 ml + thiram @ 2 g per kg of seed with treatment, T_6 at the end of storage period (85.50 %) and minimum seed germination was recorded throughout the storage period with control treatment, T_1 which recorded 79.50 % germination at the end of 6th month of storage. The shoot length due to seed coating with polymer alone or along with fungicide treatment was observed throughout storage period. Higher shoot length was recorded 7.80 cm with the polymer @ 9 ml + thiram 2 g per kg of seeds treatment ,T_7 at the end of storage period and lower shoot length was recorded 5.24 cm throughout the storage period with untreated seeds treatment, T_1 at the end of 6^{th} month of storage. The higher root length due to seed coating with polymer alone or along with fungicide treatment with the polymer @ 9 ml + thiram @ 2 g per kg of seed treatment, T_7 was noticed 13.90 cm and root length for untreated seeds T_1, observed 9.82 cm at the end of 6^{th} month of storage. Viability of seeds coated with polymer @ 9 ml + thiram @ 2 g per kg of seed were recorded 90% and 77.59% for treated (T_7) and untreated seed (T_1) respectively at the end of 6^{th} month storage period (Table 2).

After 6^{th} month of storage period, fresh weight of seedlings of polymer coated @ 9 ml + thiram @ 2 g per kg were observed 5.58 g and 4.26 g for treated (T_7) and untreated (T_1) seeds respectively then dry weight of seedlings with polymer coated @ 6 ml + thiram @ 2 g per kg of seed also observed 1.66 g and 1.40 g for treated (T_6) and untreated seeds (T_1) respectively at the end of 6^{th} month of storage period. Vigour index due to polymer coating alone or along with fungicide were observed throughout the storage period and higher vigour index (1840.70) was recorded with polymer coating @ 9 ml + thiram @ 2 g per kg of seeds for treatment (T_7) as well as lower seed vigour index was recorded (1199.39) for untreated seeds (T_1) at the end of 6^{th} month of storage**.** Research findings reveals that seed quality parameters declined progressively with the increase in storage period and other related conditions and characters has been shown in Table 1 and 2. Seed ageing and deterioration of seed are irreversible, inexorable and inevitable process, but the rate of seed deterioration could be slowed either by storing the seeds under controlled condition or by imposing seed treatment with polymer coating along with seed treatment chemicals [4]. As the controlled condition involves the huge cost, the seed treatment remains the best alternative approach to maintain the seed quality. Similar were finding [5, 6]**.** The average germination, shoot length, root length, seedling length, viability, fresh weight, dry weight and vigour index of maize seed at the beginning of the storage were noticed 88.82 %, 6.82 cm, 13.17 cm, 20.00 cm, 86.54 %, 4.50 g, 1.67 g and 1783.72 respectively and after 6 month of storage observed values are 82.64 %, 6.29 cm, 11.83 cm, 18.12 cm, 84.51%, 4.86 g, 1.54 g and 1502.52 respectively. This decrease in seed quality during storage may be attributed to ageing effects, leading to depletion of food reserves and decline in synthetic activity of the embryo apart from death of seeds because of fungal invasion [7]. However, the average germination was above the minimum seed certification standards (70.0%) even after 6^{th} months of storage.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 7, July 2014

Seeds treated with fungicides coupled with polymer coating exhibited superiority in maintaining the seed quality throughout the storage period. The seeds treated with polymer @ 9 ml per kg of seed + thiram @ 2 g per kg of seed (T_7) shown significantly higher seed quality parameters than the seeds treated with polymer 6 ml + thiram @ 2 g per kg of seed. The polymer treatment @ 9 ml + thiram @ 2 g per kg of seed (T_7) recorded significantly higher values for shoot length, root length, seedling length, viability, fresh weight and vigor index indicating the superiority, while polymer treatment @ 6 ml + thiram 2 g per kg of seed (T_6) recorded significantly higher values for germination percentage and dry weight over control in maintaining the seed quality in storage. The rate of reduction in germination percentage from the beginning of the storage period till the end of 6^{th} month of storage was observed lesser in seeds treated with polymer or polymer with fungicide, compared to untreated seeds. The rate of reduction in germination percentage during storage varies between 79.50% to 85.50%. The polymer keeps the seed intact, as it acts as binding material and covers the minor cracks and aberrations on the seed coat and blocking the fungal invasion as well act as a physical barrier which reduces leaching of inhibitors from seed coverings and restrict oxygen movement and thus reducing the respiration of embryo there by reducing the ageing effect on seeds [4]. The polymer also prevents moisture content fluctuations during storage [8]. Some containers are moisture pervious and some are impervious. In the present study, two containers namely plastic box and cotton bag were used and plastic box was observed significantly superior in maintaining higher seed quality throughout the storage compared to cotton bag. Experimental observation reveals that the seeds stored in plastic box recorded higher germination (86.0%), shoot length (8.60 cm), root length (15.0 cm), seedling length (23.60 cm), viability (90.0%), fresh weight (6.0 g), dry weight (1.48) and vigour index (1958.80) compared to cotton bag(87.0%, 7.0 cm, 12.80 cm, 19.80 cm, 90%, 5.15 g, 1.72 g and 1722.60 respectively). The superiority of plastic box in maintaining the higher seed quality parameters has been reported earlier in maize seeds. Interaction effect between seed treatments and containers was found to be significant throughout storage period. Higher germination, shoot length, root length, seedling length, viability, fresh weight, dry weight and vigour index of seedling was recorded in T_7 C_2 (87%, 8.60 cm, 15 cm, 23.60 cm, 90%, 6.0 g, 1.79 g and 1958.80 respectively) and lower in T_1 C_1 (79%, 4.98 cm, 7.85 cm, 12.83 cm, 69%, 3.66 g, 1.34 g and 1015.57 respectively), at the end of storage [9]**.** The selective influence of containers for polymer coating and polymer + fungicide coating might have resulted in the significant interaction effects and [10]. The seeds treated with combination of polymer and fungicide *i.e.* T_7 (9ml polymer + 2gm thiram) showed significant superiority on seed quality parameters during storage, concluded that the combined treatment of polymer dye and fungicide stored in air tight plastic box for 6 months showed significantly maximum percentages of vigour index, dry weight, root length, shoot length, seedling length and viability as compared to the other in best result on this experiments. It is concluded that the combined treatment of polymer dye and fungicide, stored in plastic box (air tight) for 6 months showed significantly higher quality of seed in compared with stored seed in cotton bag.

Table 1: Effect of two and four month's storage on different parameters of (*Zea mays* L.) (MH-7)

Storage Months	Treatments	Germination (%) Mean	SLM, (cm)	Root length (cm) Mean	SL (cm) Mean	Viability (%)Mean	Fresh weight(gm) Mean	Dry weight (gm) Mean	Vigour index Mean
	T_1	84.00	5.73	10.00	15.73	76.75	3.95	1.50	1322.30
	T_2	88.08	6.20	11.98	18.18	85.50	4.21	1.58	1604.63
2 month	T_3	89.50	6.40	12.33	18.73	87.00	4.30	1.60	1679.30
	T_4	90.36	7.03	13.25	20.28	87.50	4.54	1.68	1834.19
	T_5	86.50	7.23	14.20	21.43	88.50	4.58	1.76	1853.94

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 7, July 2014

	T_6	91.35	7.50	14.90	22.40	89.55	4.90	1.80	2047.70
	T_7	92.00	7.69	15.60	23.29	91.00	5.09	1.82	2144.01
	T_8	84.00	5.73	10.00	15.73	73.75	3.65	1.20	1322.30
C.D. at %	**T**	0.24	0.78	0.88	1.33	0.32	0.45	0.07	114.14
	C	0.13	0.42	0.47	0.71	0.17	0.24	0.04	61.01
Mean	**T×C**	0.34	1.11	1.24	1.87	0.45	0.64	0.10	161.42
	T_1	81.56	5.80	9.85	15.65	74.75	4.33	1.45	1276.27
	T_2	82.50	6.90	11.63	18.52	81.50	4.37	1.57	1528.42
	T_3	86.05	7.25	12.07	19.32	86.00	4.69	1.66	1664.01
4 month	T_4	86.15	7.55	12.21	19.76	85.50	4.74	1.61	1703.67
	T_5	86.85	7.60	12.55	20.15	87.30	4.98	1.73	1752.27
	T_6	89.00	7.70	13.55	21.25	89.50	5.17	1.75	1895.35
	T_7	89.15	8.25	14.15	22.40	85.25	5.35	1.78	2000.24
	T_8	81.10	5.59	11.31	16.90	80.00	4.00	1.13	1370.03
C.D. at 5 %	**T**	0.16	1.12	1.02	1.92	0.49	0.44	0.061	157.53
	C	0.08	0.60	0.54	1.02	0.26	0.24	0.033	84.20
	T×C	0.22	1.59	1.44	2.71	0.69	0.63	0.086	222.79

Legends -T_1- Control, T_2- Polymer (3ml), T_3- Polymer (6ml), T_4- Polymer (9ml), T_5- Polymer(3ml) + thiram (2gm) , T_6- Polymer(6ml) + thiram (2gm),T_7- Polymer(9ml) + thiram (2gm), T_8.Only fungicide, T- treatment , C- Containers (plastic and cotton), SL=Seedling length, SLM=Shoot length mean.

Table 2: Effect of six months storage on different parameters of (*Zea mays* L.) (MH-7)

Storage Months	Treatments	Germination (%) Mean	SLM(cm)	Root length (cm) Mean	SL (cm) Mean	Viability (%)Mean	Fresh weight(gm) Mean	Dry weight (gm) Mean	Vigour index Mean
	T_1	79.50	5.24	9.82	15.06	77.59	4.33	1.40	1199.39
	T_2	80.85	5.37	10.90	16.27	81.84	4.37	1.46	1316.21
6	T_3	81.10	5.59	11.31	16.90	85.50	4.69	1.53	1370.03
	T_4	82.15	5.97	11.55	17.51	86.25	4.74	1.58	1439.82
	T_5	84.40	6.95	12.20	19.15	85.55	4.98	1.61	1614.97
	T_6	85.50	7.15	13.15	20.30	84.85	5.17	1.66	1736.55
	T_7	85.00	7.80	13.90	21.70	90.00	5.35	1.60	1840.70

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 7, July 2014

C.D. at 5%	T_8	81.10	5.59	11.31	16.90	80.00	4.00	1.13	1370.03
	T	0.45	0.74	0.86	1.21	0.63	0.97	0.077	101.80
	C	0.24	0.40	0.46	0.64	0.34	0.52	0.041	54.41
	T×C	0.64	1.05	1.21	1.71	0.89	1.37	0.109	143.97

Legends -T_1- Control, T_2- Polymer (3ml), T_3- Polymer (6ml), T_4- Polymer (9ml), T_5- Polymer(3ml) + thiram (2gm) , T_6- Polymer(6ml) + thiram (2gm),T_7- Polymer(9ml) + thiram (2gm), T_8-Only fungicide, T- treatment , C- Containers (plastic and cotton), SL=Seedling length, SLM=Shoot length mean

V. CONCLUSION

Vigour index either with single polymer coating or combine with fungicide were observed within the duration of storage and vigour index was recorded 1840.70 with polymer coating @ 9 ml + thiram @ 2 g per kg of seeds for treatment (T_7) as well as recorded 1199.39 for untreated seeds (T_1) after 6 month storage**.** Higher germination, shoot length, root length, seedling length, viability, fresh weight, dry weight and vigour index of seedling has been observed higher in the case of T_7 C_2 (87%, 8.60 cm, 15 cm, 23.60 cm, 90%, 6.0 g, 1.79 g and 1958.80 respectively) and lower for T_1 C_1 (79%, 4.98 cm, 7.85 cm, 12.83 cm, 69%, 3.66 g, 1.34 g and 1015.57 respectively) at the end of storage **as well as** selective influence of containers for polymer coating and polymer + fungicide coating also has been studied which reveals that the seeds stored in plastic box recorded higher germination (86.0%), shoot length (8.60 cm), root length (15.0 cm), seedling length (23.60 cm), viability (90.0%), fresh weight (6.0 g), dry weight (1.48) and vigour index (1958.80) compared to cotton bag(87.0%, 7.0 cm, 12.80 cm, 19.80 cm, 90%, 5.15 g, 1.72 g and 1722.60 respectively). Plastic box is proven superior to cotton bag for maintaining the higher seed quality parameters of the stored maize seeds.

ACKNOWLEDGEMENTS

We are sincerely thankful to all generous persons associate with Department of Genetics and Plant Breeding, SHIATS, Prof. P. Chakraborty (Associate Professor, Department of Seed Science and Technology, BCKV, West-Bengal), Dr. Prem Prakash Srivastav (Assistant professor, Department of Agricultural and Food Engineering, I.I.T Kharagpur), Prof. Vijay Kumar Jena (Dean, School of Agriculture Science, Centurion university, Odisha) for providing us scientific and research related suggestions.

REFERENCES

[1] Kaushik, S.K and P. K. Rai (2012). Effect of polymer film coating, fungicide and storage on vigour and viability of Wheat seeds. M. Sc. (Ag.) Thesis, Department of GPB and SST.AAI (DU), Allahabad, (U.P.) India.
[2] Kumar, V. (2007). Effect of seed coating with polymer, fungicide and insecticide on seed quality in cotton during storage. *Karnataka J. Agric. sci.,* 20(1): 137-139.
[3] Giang, P. L ., Gowda, R. (2007). Influence of seed coating with synthetic polymers and chemicals on seed quality and storability of hybrid rice. *Omonrice.,* 15: 68-74.
[4] Duan, X., Burris, J. S. (1997). Film coating impairs leaching of germination inhibitors in sugar beet seeds. *Crop Sci.,* 37: 515 - 520.
[5] Varghese, K. and Rai, P. K. (2005). Variation in growth and performance of maize inbreeds stored under ambient condition. M. Sc.(Ag.) Thesis, Department of GPB and SST.AAI (DU), Allahabad, (U.P.) India.
[6] Krishnaveni, K. (1984). Studies on certain aspect of production, processing and storage maize, M.Sc. Thesis , Deptt. of seed tech, TNAU, Coimbatore.
[7] Gupta, A., Singh, D. (1993). Effect of Fungicidal treatment on seed viability and mycoflora of stored vegetable seeds. *Seed Res.,* 1: 270 - 276.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 7, July 2014

[8] West, S. H., Loftin, S. K., M. Wahl, Batich, C.D., Beatty, C.L. (1985).Polymer as moisture basis to maintain seed quality. *Crop sci*.25: 941-944.
[9] Sushil, K., Singhal, N. C., Surendra, P. (1997). Intervarietal variability for seed longevity in Pea (Pisum sativum), The Indian journal of Genetics and plant breeding. 57(2).
[10] Nutil, G. E. (1964). Effect of desiccation on viability of seeds. *Crop Science* 4:325-328.