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Storability of polymer coated CORH 3 hybrid rice seeds

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ABSTRACT

Maintenance of seed vigour and viability during storage is a matter of prime concern in agriculture. Owing to the sub-tropical climate prevailing in major parts of the country, seeds of most crop species show rapid deterioration and hybrid rice is no exception. Freshly harvested seed of hybrid rice CORH 3 were dried to safe level moisture (<13%), graded to uniform size and coated with different polymers viz., Genius coat 171, Genius coat 172, Arcus, Myconate and Quick roots. The polymer coated seeds were stored in polyethylene bag of 700 gauge thickness and kept under ambient condition for nine months along with untreated control seeds. The seeds coated with Quick roots polymer recorded higher germination of 79 per cent at ninth month of storage compared to untreated control seeds (71 per cent). The electrical conductivity (0.129 dSm^{-1}) was low in the seeds coated with Quick roots with nil pathogen infection and insect incidence upto nine months of storage

Key words: *polymer, seed coating, hybrid rice, storage, seeds*

The success in hybrid rice in India could be visualized only if the adequate quantities of quality hybrid seeds are made available to the farming community (Ponnusamy *et al.,* 2000).

Seed senescence or deterioration is irreversible and inexorable process. The rapid deterioration of stored seed is a serious problem particularly, in India where high temperature and relative humidity prevail, and associated with accelerated ageing phenomenon. The polymer coating keeps the seeds intact, as its acts as binding material; it covers the minor cracks and aberration on the seed coat thus blocking the fungal invasion. It may also acts as a physical barrier, which reduces leaching of inhibitors from seed covering and restricts oxygen movement and thus reducing the respiration of embryo, thereby reducing the ageing in seeds (Vanangamudi *et al*., 2003). Insect infestation and infection by pathogens during storage cause a significant loss in germination and other quality parameters. Hence, the present study was taken up to study its effectiveness in preserving the viability of seeds. for protecting the seeds through polymer coating during storage.

MATERIALS AND METHODS

Genetically pure seeds of CORH 3 hybrid rice were obtained from the Tamil Nadu Agricultural University, Coimbatore and sent to the Integrated Coating Technology Pvt. Ltd., (INCOTEC), Ahmedabad, Gujarat for coating through machine with different polymers *viz*., Genius coat 171, Genius coat 172, Arcus, Myconate and Quick roots. These polymer coated seeds were used for the present investigation.

The polymer coated seeds as per treatment schedule after drying back to original moisture content were stored in polyethylene bag of 700 gauge thickness and kept under ambient condition (28 ± 1°C and 70 ± 5 % RH) for nine months along with untreated control. The seed samples drawn at monthly intervals were evaluated for various seed quality attributes in order to determine the suitable polymer for better seed storage in hybrid rice.

RESULTS AND DISCUSSION

Seed germination is an excellent indicator of growth potential and survival of seeds irrespective of factors responsible for loss of viability. The germination of 88

per cent recorded initially got reduced to 75 per cent at ninth month of storage (Table 1). The seeds coated with Quick roots recorded a minimal decrease in germination and shown , 10 per cent increase over untreated control seed at ninth month of storage. Study results were in line with Sherin (2003), who reported that seed coating with polykote did not reduce germination consistently after nine months of storage in maize. The decline in germination over the period of storage might be due to depletion of food reserves coupled with decline in synthetic activity as reported by Pal and Basu (1988) and Ravichandran and Dharmalingam (1994) in paddy. The results are in conformity with findings of Praveena (2005) in cotton; Giang and Gowda (2007) in paddy and Vijay Kumar *et al*. (2007) in cotton.

Seedling length is the best indicator of seed vigour. The relative length of root and shoot of seedlings would predict their subsequent growth and performance. Similar trend of reduction as that of seed germination was noticed with respect to seedling length. On advancement of storage period, the seedlings length was reduced. Seeds which produced longer seedlings initially showed a drastic reduction in seedling length at the end of storage period. It indicated that a progressive fail in the physiological stamina of deteriorating seed which reduces seedling length. The results are in confirmation with findings of Chauhan and Sawminathan (1984) in soybean and Krishnaveni (1997) in sunflower. The decline in root and shoot length may be attributed to age induced decline in germination. The damage caused by fungi and insects and also toxic metabolites which might have hindered the seedling growth and similar findings were also reported by Poonam Singh *et al.* (2004) in rice and Baig (2005) in soybean.

Among the various polymer coatings, the seeds coated with Quick roots proved its superiority by registering longer seedlings at the end of storage period. A progressive fall in shoot and root length was observed during storage. Initially the root length of 21.4 cm was recorded with fresh seeds which got reduced to 15.5cm with seeds at ninth month of storage. The seeds coated with Quick roots recorded a minimal decrease in root length and shown 17 per cent increase over untreated control seed at ninth month of storage (Table 2). Initially the shoot length of 12.1cm was recorded which got reduced to 9.9cm at ninth month of storage. The seeds coated with Quick roots recorded a minimal decrease in shoot length and shown 20 per cent increase over

Table 1. Performance of polymer coating and period of storage on germination (%) of CORH 3 hybrid rice seeds

Polymer coating treatments (S)	Period of storage (Months) (P)										
	0	1	2	3	4	5	6	7	8	9	Mean
Untreated control	86 (68.02)	86 (68.02)	85 (67.21)	80 (63.43)	79 (62.72)	77 (61.35)	76 (61.09)	76 (61.66)	75 (60.00)	71 (57.42)	77 (61.28)
Genius coat 171	87 (68.86)	87 (68.89)	86 (68.02)	83 (65.66)	80 (63.43)	78 (62.03)	77. (61.35)	76 (61.66)	76 (61.66)	73 (58.70)	80 (63.77)
Genius coat 172	90 (71.56)	90 (71.56)	89 (70.63)	88 (69.73)	86 (68.02)	85 (67.21)	82 (64.90)	80 (63.43)	78 (62.03)	76 (61.66)	84 (66.48)
Arcus	88 (69.73)	88 (69.73)	87 (68.86)	85 (67.21)	83 (65.66)	80 (63.43)	78 (62.03)	78 (62.03)	76 (61.66)	75 (60.00)	81 (64.43)
Myconate	88 (69.73)	87 (68.86)	87 (68.86)	86 (68.02)	85 (67.21)	84 (66.43)	82 (64.90)	80 (63.43)	79 (62.72)	77 (61.35)	83 (65.76)
Quick roots	92 (73.57)	92 (73.57)	90 (71.56)	90 (71.56)	89 (70.26)	87 (68.86)	86 (68.02)	83 (65.67)	80 (63.43)	79 (62.73)	86 (67.99)
Mean	88 (70.05)	88 (70.20)	87 (69.17)	85 (67.23)	83 (65.76)	81 (64.43)	80 (63.47)	78 (62.37)	77 (61.39)	75 (60.05)	
	S	P	S x P								
CD(P<0.05)	0.65**	0.51**	1.61**								

(Figures in parentheses are arc sine transformed values)

Table 2. Performance of polymer coating and period of storage on root length (cm) of CORH 3 hybrid rice seeds

Polymer coating treatments (S)	Period of storage (Months) (P)										
	0	1	2	3	4	5	6	7	8	9	Mean
Untreated control	21.1	20.7	20.5	19.9	19.7	19.2	18.0	16.5	15.0	14.2	18.4
Genius coat 171	21.3	21.1	20.6	20.3	19.8	19.6	18.2	16.8	15.5	15.0	18.8
Genius coat 172	21.6	21.4	21.0	20.6	20.4	20.0	18.6	17.8	16.5	14.9	19.2
Arcus	21.5	21.2	20.8	20.3	20.1	19.9	19.8	17.2	17.1	14.9	19.2
Myconate	21.7	21.5	21.1	20.7	20.6	20.3	20	18.7	17.9	16.9	19.9
Quick roots	21.7	21.5	21.2	21.0	20.8	20.5	20.1	19.0	18.0	17.1	20.0
Mean	21.4	21.2	20.8	20.4	20.2	19.9	19.1	17.6	16.6	15.5	
	S	P	S x P								
CD(P<0.05)	0.25**	0.19**	0.61**								

untreated control seed at ninth month of storage (Fig. 1). The results indicated the efficacy of different polymer coating seed treatments on slowing down the process of deterioration. Sujatha and Ramamoorthy (2009) reported that green gram and red gram seeds coated with polymer recorded higher germination and seedling growth. Similar findings were reported by Sarithadevi (2004) and in sorghum. The results proved the managing ability of the coating material against seed ageing. The results are in agreement with the findings of Selvakumari (2010) in maize hybrid and Natesan (2006) in black gram.

Seedling vigour is usually characterized by weight of the seedlings after a period of growth (Dasgupta and Austenson, 1973) and this is essentially a physiological phenomenon influenced by the reserve metabolites, enzyme activities and growth regulators. The computed vigour index, which is the totality of performance, has been regarded as a good index to measure the quality of seed lots (Abdul-Baki and Anderson, 1973). In the present investigation, the treatments differed significantly in maintenance of vigour over a period of storage. Initially the vigour index of 2980 was recorded which got significantly reduced to 1913 at ninth month of storage (Table 3). The seeds coated with Quick roots recorded a minimal decrease in vigour index with 26 per cent increase over untreated control seed at ninth month of storage. The synergestic effect of polymers might have slowed down the process of deterioration and contributed for better germination,

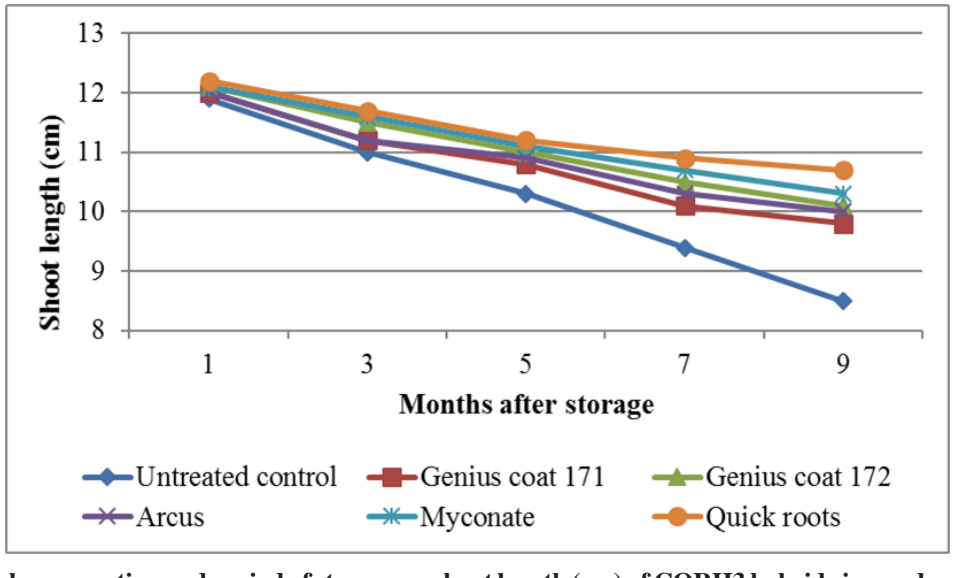

Fig.1. Effect of polymer coating and period of storage on shoot length (cm) of CORH3 hybrid rice seed

Table 3. Performance of polymer coating and period of storage on vigour index of CORH 3 hybrid rice seeds

Polymer coating	Period of storage (Months) (P)										
treatments (S)	0	1	2	3	4	5	6	7	8	9	Mean
Untreated control	2847	2804	2695	2472	2410	2272	2113	1968	1800	1612	2299
Genius coat 171	2906	2880	2761	2615	2464	2371	2225	2044	1938	1810	2401
Genius coat 172	3042	3015	2910	2825	2718	2635	2411	2264	2106	1900	2582
Arcus	2957	2922	2819	2678	2581	2464	2379	2145	2067	1868	2487
Myconate	2992	2923	2862	2778	2720	2638	2542	2352	2252	2094	2615
Quick roots	3137	3100	2988	2943	2866	2758	2675	2482	2304	2196	2744
Mean	2980	2940	2839	2718	2626	2522	2390	2209	2077	1913	
CD(P<0.05)											
S	33**										
P	26**										
S x P	82**										

vigour index. Giang and Gowda (2007) reported that the hybrid rice seed coated with littles polykote yellow, captan, thiram, gouch and super red recorded higher germination and vigour index compared to control after 10 months of storage. Similar trend of increased vigour was reported by Marimuthu (2007) in rice and Suresh vegulla (2008) in maize.

Seed during storage and this could be measured as electrical conductivity (Agarwal and Dadlani, 1995) in seed steep water, as the inner content of seed oozes out due to the loss of seed coat semipermeability (Delouche and Baskin, 1973) and dissolved in water and thereby enhances the conductivity of water used for soaking. In the present study also it has evident that initially the electrical conductivity of 0.104 dSm^{-1} was recorded which got increased to 0.134 dSm^{-1} at ninth month of storage. At ninth month of storage, the seeds coated with Quick roots recorded a minimal increase in electrical conductivity and shown 10 per cent decrease over untreated control seed (Table 4). The polymer coating may act as physical barrier, which has been reported to reduce the leaching of inhibitors from seed covering and may restrict oxygen diffusion to the embryo (Vanangamudi *etal.,* 2003). Lavanya (2009) reported that maize seed coated with polymer and imidachloprid recorded minimum increase in electrical conductivity upto the storage period of ten months. Similar findings were also reported by Basavaraj *et al*. (2008) in onion and Manjunatha *et al*. (2008) in chilli.

Table 4. Performance of polymer coating and period of storage on electrical conductivity (dSm^{-1}) of CORH 3 hybrid rice seeds

Polymer coating	Period of storage (Months) (P)										
treatments (S)	0	1	2	3	4	5	6	7	8	9	Mean
Untreated control	0.106	0.108	0.111	0.116	0.120	0.125	0.129	0.133	0.137	0.142	0.122
Genius coat 171	0.105	0.108	0.110	0.113	0.117	0.121	0.123	0.127	0.131	0.137	0.119
Genius coat 172	0.104	0.107	0.109	0.112	0.115	0.118	0.121	0.124	0.127	0.132	0.116
Arcus	0.105	0.108	0.111	0.113	0.117	0.122	0.124	0.127	0.13	0.135	0.119
Myconate	0.103	0.105	0.108	0.111	0.113	0.117	0.120	0.123	0.126	0.131	0.115
Quick roots	0.102	0.103	0.105	0.108	0.111	0.116	0.119	0.122	0.123	0.129	0.113
Mean	0.104	0.106	0.106	0.112	0.115	0.119	0.122	0.126	0.129	0.134	
CD(P<0.05)											
S	0.0015**										
P	0.0011**										
S x P	0.0037**										

Table 5. Performance of polymer coating and period of storage on insect infestation (%) of CORH 3 hybrid rice seeds

Polymer coating	Period of storage (Months) (P)										
treatments (S)	0	1	2	3	4	5	6	7	8	9	Mean
Untreated control	0.00 (0.28)	0.00 (0.28)	2.00 (8.13)	2.00 (8.13)	3.00 (9.97)	4.00 (11.53)	4.00 (11.53)	5.00 (12.92)	6.00 (14.17)	6.00 (14.17)	3.20 (10.30)
Genius coat 171	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	1.00 (5.73)	2.00 (8.13)	0.30 (3.13)
Genius coat 172	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.0 (0.28)
Arcus	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	1.00 (5.73)	0.10 (1.81)
Myconate	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)
Quick roots	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)	0.00 (0.28)
Mean	0.00 (0.28)	0.00 (0.28)	0.30 (3.13)	0.30 (3.13)	0.50 (4.05)	0.60 (4.44)	0.60 (4.44)	0.80 (5.13)	1.10 (6.02)	1.50 (7.05)	
	S	P	S x P								
SEd	0.17	0.13	0.43								
CD(P<0.05)	0.35**	0.27**	0.86**								

Seed health is a major consideration in any seed production programme next to vigour and viability of seeds. Healthy seeds must be free from both insect infestation and pathogen infection. Fungal infection increased with the advancement of storage period and it was more in untreated control seeds of rice. It might be due to increased moisture absorption by the seeds and bare seed without protection chemicals. Initially there was no pathogen infection which got increased to 2.4 per cent at ninth month of storage. The seeds coated with Quick roots recorded nil pathogen infection, whereas untreated control seed recorded 8.0 per cent at ninth month of storage. The similar trend was observed in insect infestation also. Initially there was no insect infestation which got increased to 1.5 per cent at ninth month of storage. The seeds coated with Quick roots recorded nil insect infestation where as untreated control seed recorded 6.0 per cent at ninth month of storage (Table 5). West *et al*. (1985) reported that mycelia growth was significantly less for the polymer coated soybean seeds at every observation period and the polymer coat itself provides protection from fungal invasion since polymer film coating serves as an effective dust free delivery system for fungicides and insecticides used to control diseases and pests during seed germination and seedling emergence (Robani, 1994).

The CORH 3 hybrid rice seeds coated with Quick roots maintained storage potential by recording higher germination, vigour index with nil pathogen and insect infestation after nine months of storage.

REFERENCES

Abdul-Baki AA and Anderson JD 1973. Vigour deterioration of soybean seeds by multiple criteria. *Crop Sci.,13:*630-633.

Agarwal PK and Dadlani M 1995. Principles of Seed Science and Technology .Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Baig I. 2005. Effect of grading methods, fungicides and polymer coating on storability of soybean seeds (*Glycine max* L.). M. Sc. (Agri.) Thesis, Uni. of Agril. Sci., Dharwad (India).

Basavaraj BO, Biradar Patil NK, Vyakaranahal BS, Basavaraj N, Channappagoudar B B and Ravi H. 2008. Effect of fungicide and polymer film coating on storability of onion seeds. Karnataka J. Agric. Sci., 21(2):212-218.

Chauhan KP and Sawminathan MS 1984. Cytogenetical effects of ageing in soybean seeds. Genetica.,64: 69-76.

Dasgupta PR and Austenson HM 1973. Analysis of inter relationship among seedling vigour, field emergence and yield in wheat. Agron. J.,65: 417-422.

Delouche JC and Baskin CC 1973. Accelerated ageing techniques for predicting the relative storability of seed. Seed Sci. & Technol.,1: 427-452.

Giang PL and Gowda R 2007. Influence of seed coating with synthetic polymers and chemicals on seed quality and storability of hybrid rice. Omonrice.,15:68-74.

Krishnaveni K 1997. Studies on biotic and abiotic influence on yield and quality of seed in sunflower cv. Modern (*Helianthus annuus* L.), Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore.

Lavanya L 2009. Assessment of storage potential in sequentially coated seeds of hybrid maize COH(M)5 and hybrid paddy CORH 3. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Li ZK and Xu JL 2007. Breeding for drought and salt-tolerant rice (*Oryza sativa* L.): progress and perspectives. In: Jenks MA, Hasegawa PM, Jain SM, eds. Advances in molecular breeding toward drought and salt tolerant crops. The Netherlands: Springer, 531–564.

Manjunatha SN, Ravi Hunje BS, Vyakaranahal and Kalappanavar IK 2008. Effect of seed coating with polymer, fungicide and containers on seed quality of chilli during storage. Karnataka J. Agric. Sci., 21(2): 270-273.

Marimuthu A 2007. Comprehensive seed enhancement technique for direct sown rice (*Oryza sativa* L.) cv. CO43. M.Sc., (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Natesan P 2006. Designing integrated seed treatment in black gram (*Vigna mungo* (L.) Hepper) for irrigated and rainfed ecosystem. Ph.D. Thesis. Tamil Nadu Agricultural University. Coimbatore.

Pal P and Basu RN 1988. Treatment of seed with iodine and chloride for the maintenance of vigour, viability and productivity. Indian agriculturist., 32 (1): 71-76.

Ponnusamy AS, Srinivasan MR and AyyasamyM. 2000. Hybrid rice seed technology, Tamil Nadu Agricultural University, Tamil Nadu, India.

Poonam Singh, MauryaCL, Gaura, Kumudkumar and Bajpai VP 2004. Effect of biological and chemical fungicides on longevity of rice hybrid (DRRH-1) and its parental lines seeds. Seed Res.,32(2): 177 – 179.

Praveena K 2005. Seed quality enhancement techniques in cotton (*Gossypium spp*). M.Sc., (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Ravichandran R and Dharmalingam C 1994. Halogenation of fresh paddy seeds to counteract deterioration in storage. Seed Tech. News,24 (4): 93.

Robani H 1994. Film coating horticultural seed. Hort. Technol., 4: 104-105.

Saritha Devi J 2004. Studies on film coating technique to improve field performance of sorghum cv. APK 1. M. Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Selvakumari A 2010.Standardization of seed fortification and development of a comprehensive seed treatment for enhancing seed quality, productivity and storability of pioneer maize hybrid.Ph.D. Thesis. Tamil Nadu Agricultural University, Coimbatore.

Sherin 2003. Flim coating technology using polykote for maximizing the planting value, growth and productivity of maize cv. CO 1. M. Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Sujatha K and Ramamoorthy K 2009. Seed quality enhancement in red gram and green gram by polymer coating. Int. J. Sci.,5(1): 297 -298.

Suresh Vegulla 2008. Standardization of polymer coating technology for mechanization in maize hybrid COH (M) 5 M. Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Vanangamudi K, SrimathiP, NatarajanN and Bhaskaran M 2003. Current scenario of seed coating polymer. ICAR Short Course on Seed Hardening and Pelleting Technologies for Rainfed Garden Land Ecosystem, p. 80-100.

Vijay Kumar K, Ravi Hunje, Biradar Patil, NK and Vyakaranahal BS 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.

West SH, Loftin SK, WahlM,Batich Mand Beatty CL 1985. Polymers as a moisture barrier to maintain seed quality. Crop Sci.,25: 941-944.