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Research Article

ROLE OF SEED TREATMENT AND STORAGE CONTAINER ON SEED LONGEVITY OF MALE PARENTAL LINE UMI 1230 IN MAIZE HYBRID COH (M)6

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Abstract: Investigations were conducted to assess the viability and vigour potential of male parental line (UMI 1230) in maize hybrid COH (M) 6 seeds obtained from the Agricultural Research Station, Bhavanisagar, Tamil Nadu Agricultural University, Coimbatore. The initial seed qualities of male parental line (UMI 1230) in maize hybrid COH (M) 6 were analysed and after, the seeds were subjected to different seed treatments viz.,Halopolymer @ 4 ml kg^{-1}, Halogenation mixture @ 3 g kg^{-1}, Carbendazim @2 g kg^{-1}. Untreated seeds served as Control. The seeds were packed in cloth bag and 700 gauge thick polythene containers and stored in ambient condition. Seed samples were tested for its physiological parameters *viz*., germination %, seedling length, vigor index and electrical conductivity at bimonthly intervals. The results revealed that male parental line (UMI 1230) in maize hybrid COH (M) 6 seeds treated with halogenation mixture @ 3 g kg^{-1} maintained the germination and vigour potential of seeds up to 10 months of storage than halopolymer @ 4 ml kg^{-1}. Moisture proof container of 700 gauge thick polythene bag performed better storer than cloth bag which reflected by the changes in electrical conductivity.

Keywords: Maize hybrid, Parental line UMI 1230, Seed treatment, Storage container, Germination, Vigour

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Introduction

Maize (*Zea mays* L.) is an important cereal crop in the world next to rice and it is grown throughout the year in India. It is valuable human food, livestock feed and raw material for several industries. The seed treatment is an important aspect in order to maintain the health and physiological qualities of seeds that are intended to the storage and sowing. Seed deterioration is loss of seed quality, viability and vigour due to the effect of adverse environmental factors [1]. During ageing, leakage of intracellular substances from seeds including cations, amino acids, phytohormones and protein ultimately causes death of the seed is closely correlated with seed vigour. Seed viability and the rate of seed deterioration have been extensively investigated [2, 3]. The rate of seed deterioration could be slowed down by certain seed treatments with fungicides, insecticides, chemicals, growth regulators, halogen compounds, low cost and non hazardous botanicals *etc*., so as to preserve the seed quality to a desired period [4]. In view of the above facts, the present research work was undertaken to evaluate the effect of different seed treatment and storage container on germination and seedling vigour of stored male parental line (UMI 1230) in maize hybrid COH (M) 6 seeds.

Materials and Methods

The research was conducted at the Department of Seed Science and Technology, Tamil Nadu Agricultural University Coimbatore, Tamil Nadu, India. Seeds of male parental line (UMI 1230) in maize hybrid COH (M) 6 were obtained from the Agricultural Research Station, Bhavanisagar, Coimbatore, Tamil Nadu. After assessing the initial quality parameters, seeds were subjected to different seed treatments *viz*., Halopolymer @ 4 ml kg^{-1}, Halogenation Mixture @ 3 g kg^{-1}, and Carbendazim @ 2 g kg^{-1} along with control(dry seeds). After the treatment the seeds were packed in cloth bags and moisture proof container of 700 gauge thick polythene bags and stored in ambient condition, maintained at room temperature. The physiological parameters were carried out with the seed samples drawn at bimonthly intervals up to 10 months of storage. To determine the moisture content of seeds, five gram of ground seed material was placed in a moisture weighing bottle and kept in a hot air oven maintained at 130 ± 2°C for 4 h for drying and cooled in a desiccator containing silica gel for 30 min. The weight of seeds along with moisture bottle before and after drying was recorded in gram. The moisture content of the seeds was calculated based on the formula prescribed in ISTA, 2011[5] and expressed in percentage. Germination test was conducted by following the procedure outlined in ISTA (2011) [5] with roll towel medium using 4 x 100 seeds in a germination room maintained at 25 ± 2°C temperature and 95 ± 3 % relative humidity. Seedlings were evaluated and based on normal seedlings, the germination was calculated and the mean expressed as percentage. Seeding vigour index was computed by adopting the method suggested by Abdul-Baki and Anderson (1973) [6]. The electrical conductivity of the seed leachate was measured in twenty five seeds from each treatment were soaked in 25 ml of distilled water for 16 h in three replicates. The seed steep water was referred as leachate in an electrical conductivity meter (Model: EUTECH PC 510) and the conductivity of the leachate was expressed in µS cm^{-1} [7].

Result

Moisture content was continuously increased depending on the storage duration and storage container after 10 months of storage. Moisture content of seed was higher in cloth bag after 4, 6, 8 and 10 months of storage. At initial stage, moisture content was 8% in both the containers. A steady increase in moisture content was notified in cloth bag container when the period of storage increases. But polyethylene bag (700 gauge) maintain the moisture content of 8% even after 10 months of storage [Fig-1]. The seed germination was significantly differed due to seed treatment, storage container, period of storage and interaction between treatment and period of storage. The interaction between treatment and container shows not significant. Irrespective of period of storage and container, after 10 month of storage seed treatment with halogenation mixture @3g kg^{-1} recorded significantly maximum seed germination of 83 % compared to untreated seeds control (72%). Between the containers, seed stored in 700gauge thick polythene bag maintain the germination (83%) when compared to cloth bag (72%).

Table-1 Effect of seed treatment, storage container and period of storage on germination (%) of male parental line (UMI 1230) in maize COH(M)6

Seed Treatment (T)	Storage Container (C)													
	Cloth Bag							Polyethylene Bag (700 Gauge)						
	Period of storage (p)													
	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean
T_0 Control	90 (71.56)	87 (68.86)	83 (65.64)	67 (54.93)	56 (48.44)	35 (36.27)	70 (56.78)	91 (72.54)	89 (70.63)	85 (67.21)	70 (56.78)	60 (50.76)	38 (70.63)	72 (58.05)
T_1 Halopolymer @ 4 ml kg^{-1}	90 (71.56)	88 (69.73)	82 (64.89)	68 (55.55)	64 (54.13)	44 (41.55)	73 (58.69)	90 (71.56)	90 (71.56)	90 (71.56)	71 (57.41)	67 (54.93)	54 (47.29)	77 (61.34)
T_2 Halogenation Mixture @ 3 g kg^{-1}	92 (73.57)	90 (71.56)	87 (68.86)	80 (63.43)	76 (60.66)	50 (45.00)	79 (62.75)	92 (73.57)	90 (71.56)	90 (7.56)	83 (65.64)	81 (64.15)	63 (52.53)	83 (65.64)
T_3 Carbendazim @ 2 g kg^{-1}	90 (71.56)	90 (71.56)	80 (63.43)	70 (56.78)	65 (53.72)	34 (35.66)	72 (58.05)	90 (71.56)	90 (71.56)	85 (67.21)	74 (59.34)	70 (56.78)	50 (45.00)	76 (60.66)
Mean	91 (72.54)	89 (70.63)	83 (65.64)	71 (57.14)	65 (53.72)	41 (39.81)	74 (59.34)	91 (72.54)	90 (71.56)	88 (69.73)	75 (60.00)	70 (56.78)	51 (45.57)	77 (61.34)

Treatment (T)	T x P Interaction Mean						Treatment (Mean)
	P_0	P_2	P_4	P_6	P_8	P_{10}	
T_0	90(71.56)	88(69.73)	84(66.42)	69(56.16)	58(49.60)	38(38.06)	71(57.42)
T_1	90(71.56)	89(70.63)	46(42.70)	70(56.78)	66(54.33)	54(47.29)	69(56.17)
T_2	92(73.57)	90(71.56)	89(70.63)	82(64.89)	79(62.72)	63(52.54)	83(65.65)
T_3	90(71.56)	90(71.56)	83(65.64)	72(58.05)	68(55.55)	50(45.00)	76(60.67)
Period of Mean	91(72.57)	89(70.63)	76(60.66)	73(58.69)	68(55.55)	51(45.57)	77(61.34)
Level of significance							
	T	C	P	T x C	C x P	T x P	T x C x P
SEd	0.562	0.397	0.688	0.795	0.973	1.377	1.947
CD (P = 0.05)	1.108	0.784	1.358	NS	1.920	2.716	3.841

Figures in parentheses indicate arcsine transformed values

Table-2 Effect of seed treatment, storage container and period of storage on electrical conductivity (µS cm-1) of male parental line (UMI 1230) in maize COH(M)6

Seed Treatment (T)	Storage Container (C)													
	Cloth Bag							Polyethylene Bag (700 Gauge)						
	Period of storage (p)													
	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean
T_0 – Control	92.9	99.3	106.9	106.3	115.2	120.1	106.8	91.7	96.2	102.0	104.0	108.1	115.2	102.9
T_1 - Halopolymer @ 4 ml kg^{-1}	90.7	95.6	84..5	104.9	110.1	108.2	99.0	90.0	93.1	98.1	100.9	103.1	108.2	98.9
T_2 - Halogenation Mixture @ 3 g kg^{-1}	90.5	92.6	97.3	100.1	105.3	103.1	98.2	89.1	92.1	96.1	98.1	100.1	103.1	96.4
T_3 - Carbendazim @ 2 g kg^{-1}	90.5	93.4	103.4	104.1	107.4	110.2	101.5	90.1	94.1	99.1	102.1	104.1	108.1	99.6
Mean	91.2	95.4	98.0	103.8	109.5	110.4	101.4	90.2	93.9	98.9	101.3	103.9	108.6	99.4

Treatment (T)	T x P Interaction Mean						Treatment (Mean)
	P_0	P_2	P_4	P_6	P_8	P_{10}	
T_0	92.3	97.7	104.5	105.1	111.1	117.7	104.8
T_1	90.3	94.4	91.3	102.9	106.6	108.2	99.0
T_2	89.8	92.5	96.7	99.1	102.7	103.1	97.3
T_3	90.3	93.9	101.1	103.1	105.7	109.1	100.5
Period of Mean	90.7	94.6	98.4	102.5	106.7	109.4	100.4
Level of significance							
	T	C	P	T x C	C x P	T x P	T x C x P
SEd	1.110	0.785	1.360	1.570	1.923	2.720	3.847
CD (P = 0.05)	2.190	1.548	2.682	NS	NS	5.365	7.588

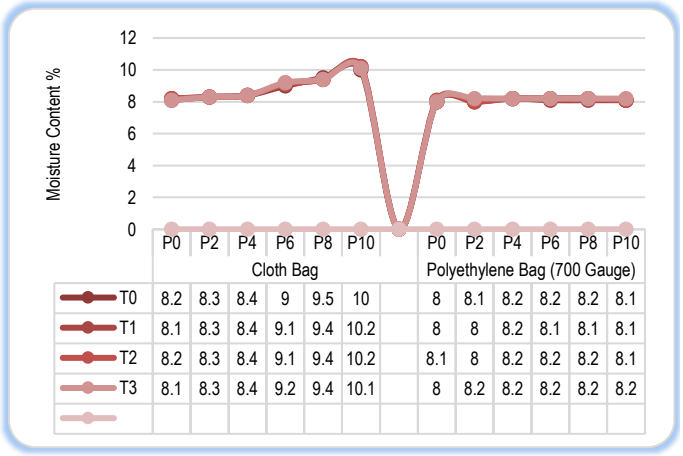


Fig-1 Effect of seed treatment, storage container and period of storage on seed

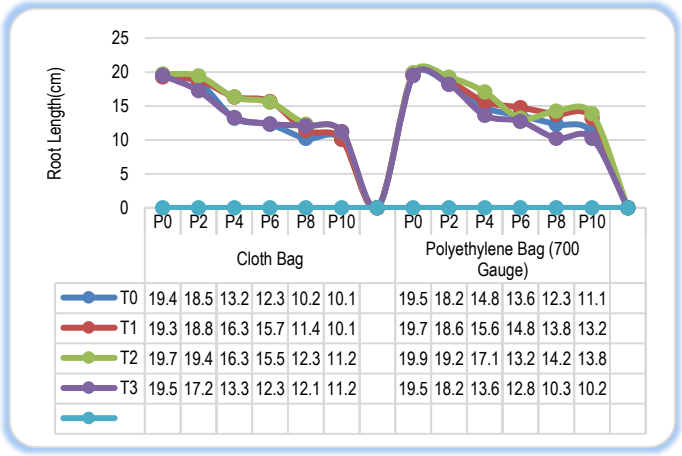
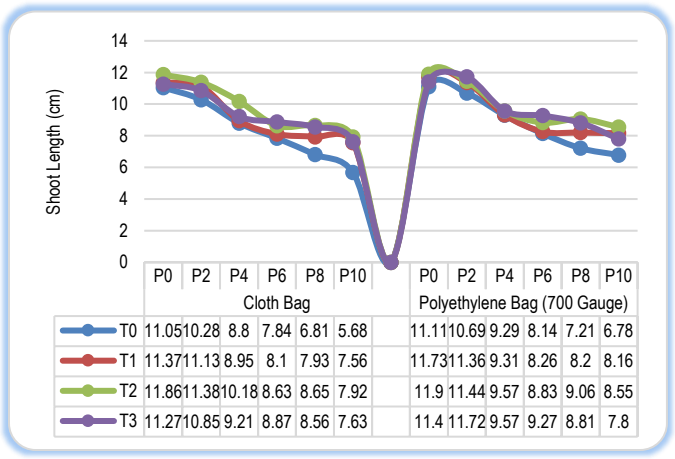
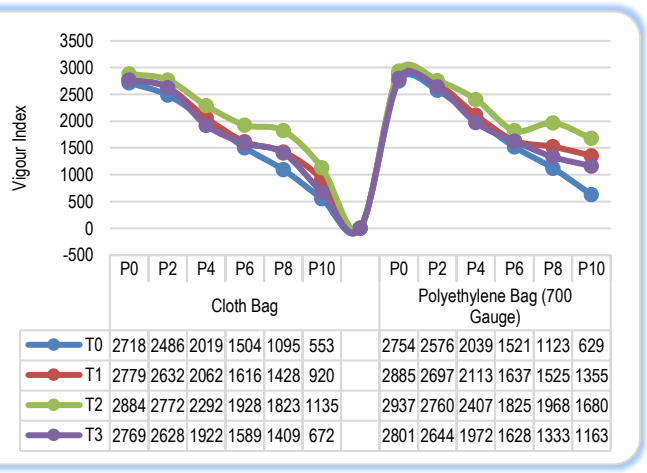


Fig-2 Effect of seed treatment, storage container and period of storage on root length (cm) of male parental line (UMI 1230) in maize COH (M)6



	Cloth Bag						Polyethylene Bag (700 Gauge)					
	P0	P2	P4	P6	P8	P10	P0	P2	P4	P6	P8	P10
T0	11.05	10.28	8.8	7.84	6.81	5.68	11.11	10.69	9.29	8.14	7.21	6.78
T1	11.37	11.13	8.95	8.1	7.93	7.56	11.73	11.36	9.31	8.26	8.2	8.16
T2	11.86	11.38	10.18	8.63	8.65	7.92	11.9	11.44	9.57	8.83	9.06	8.55
T3	11.27	10.85	9.21	8.87	8.56	7.63	11.4	11.72	9.57	9.27	8.81	7.8

Fig-3 Effect of seed treatment, storage container and period of storage on shoot length (cm) of male parental line (UMI 1230) in maize COH (M)6



	Cloth Bag						Polyethylene Bag (700 Gauge)					
	P0	P2	P4	P6	P8	P10	P0	P2	P4	P6	P8	P10
T0	2718	2486	2019	1504	1095	553	2754	2576	2039	1521	1123	629
T1	2779	2632	2062	1616	1428	920	2885	2697	2113	1637	1525	1355
T2	2884	2772	2292	1928	1823	1135	2937	2760	2407	1825	1968	1680
T3	2769	2628	1922	1589	1409	672	2801	2644	1972	1628	1333	1163

Fig-4 Effect of seed treatment, storage container and period of storage on vigour index of male parental line (UMI 1230) in maize COH (M)6

The percent germination was decreased with increase in storage periods. The germination decreased from 83 to 79 percent after 10 month of storage. The interaction between treatment and period of storage revealed that the seed treatment with halogenation mixture @ 3 g kg^{-1} registered the higher germination of 83 percent at the end of the 10 month of storage, while untreated control seeds recorded the lowest germination of 72 percent (Table 1). The root and shoot length were significantly influenced by seed treatments, storage containers, period of storage and interactions of treatment x container, container x period of storage. Irrespective of period of storage and container, the seeds in halogenation mixture @ 3 g kg^{-1} recorded longest seedling whereas, the shortest root and shoot were observed in control seeds. The interaction between container and period of storage expressed that throughout the period of storage higher root and shoot length were noticed with seeds stored in 700 gauge polyethylene bag than in cloth bag (Fig. 2 & 3). Statistically significant differences were observed in vigour index due to seed treatments, storage containers, period of storage, interaction between container and period of storage. Irrespective of period of storage and container, halogenation mixture @ 3 g kg^{-1} seeds recorded the maximum vigour index, while the minimum was noticed in untreated control seeds. The interaction between container and period of storage expressed that throughout the periods of storage, seed stored in 700 gauge polyethylene bag maintained higher vigour index than seeds stored in cloth bag (Fig 3). The container and period of storage interaction expressed that the increase in electrical conductivity was kept at minimal level in the seeds packed in 700 gauge polyethylene bag (96.4 µS cm^{-1}) when the periods of storage increases while, the cloth bag registered the maximum level of electrical conductivity (98.2 µS cm^{-1}). The interaction between treatment and period of storage, halogenation mixture @ 3 g kg^{-1} recorded the lowest electrical conductivity even at 10 months of storage when compared to control seeds (Table 2).

Discussion

The present investigation was conducted to study the effect of various dry treatments on the germinability of male parental line (UMI 1230) in maize hybrid COH (M) 6. As seed is highly hygroscopic in nature it absorbs moisture from air if it is stored in an environment where relative humidity is higher than seed moisture content [8]. The rate of absorbance was higher in cloth bag because of its moisture pervious nature whereas polythene bags are moisture impervious. Similarly, values of standard germination gradually declined with increase in storage period under both cloth bag and polythene bag. Identification of various seed treatment and packaging container could be used for proper storage of maize seeds with a minimum loss in vigor and viability. The polyethylene bag maintained higher germination (83percent), maximum root length, shoot length, vigour index and of minimum seed electrical conductivity (96.4 µS cm^{-1}) the end of storage period. Irrespective of the treatments, seeds stored in polyethylene bag maintained germination of 83 percent up to 10 months compared to seeds stored in cloth bag which lost viability below 79 percent after 10 months of storage period. Since, the minimum germination prescribed for certification is 90%, the data recorded in the investigations maintained the germination of 90 percent at the end of 9 months of storage period. This finding is in agreement with results of Kumar and Rai (2007) [9] in maize seeds. The reduction in germination was higher in cloth bag than polythene bag. The seeds of cloth bag absorbed moisture from the surrounding atmosphere during storage. Due to increase in moisture content of seeds, respiratory activity and other physiological activities of the stored seeds could be increased and due to the rate of deterioration, the formation of abnormal seedling and dead seeds were also significantly increased. These results agree with Monira *et al.* (2012) [10] in soybean. The shoot length, root length of seedling and seedling vigour were lowest at the end of storage in cloth bag. Rahman and Rahman, (1997) [11] supported that the highest germination and lowest vigour index of the seeds stored in polythene bag and cloth bag, respectively. The electrical conductivity was significantly lower in seeds stored in polythene bag (96.4 µS cm^{-1}) and was higher in cloth bag at (98.2 µS cm^{-1}) at the end of 10 months of storage. Higher EC values were recorded in seeds stored in cloth, that may be due to higher level of seed deterioration on account of age induced membrane damage of various cell and cell organelles [12-16].

Conclusion

Among the seed treatments, seeds treated with halogenation mixture @ 3 g kg^{-1} recorded higher seed quality parameters throughout the storage period. Seeds treated with Halogenation Mixture @ 3 g kg^{-1} maintained higher germination (83%) at the end of 10 month of storage with higher root and shoot length, vigour index, with lower electrical conductivity. Cloth bag is not safe for seed storage for longer time because the rate of moisture migration was higher in cloth bag than polythene bag of male parental line (UMI 1230) in maize hybrid COH (M) 6 seeds.

Application of research:

The findings of the research will be useful for the seed's men, traders and researchers who are involved in seed preservation.

Research Category: Seed Science and Technology

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Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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