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Effect of Treatment, Container and Storage Period on Longevity of Lentil (*Lens culinaris* medic) Seed

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ABSTRACT Highly significant effect and difference were observed for treatment; container and storage period for germination percentage, seedling dry weight, seedling vigour index, electric conductivity and moisture content of stored seed. All the treatments were found significantly superior over control for germination percentage, seedling vigour index, electric conductivity and moisture content. Deltamethrin showed best performance among the treatments followed by Thiram for all the characters during entire ten months of storage. Sealed in container was found significantly better than jute bag for all the parameters due to its impervious nature.

Key words: Treatment, container, storage period, deltamethrin

Seed deterioration starts after physiological maturity and continue during storage period. The rate of deterioration can only be slowed down by providing optimal storage conditions. Besides good storage conditions, several other factors like moisture content of seed at the time of storage and packaging material also affect longevity [1]. Treatment of seeds with chemicals [2, 3, 4] reported to offer certain amount of protection to seed from microorganisms and maintains longevity during storage. The present investigation was designed to depict the effect of different chemical treatments, containers and storage period on longevity of lentil seed stored for ten months.

MATERIALS AND METHODS

Freshly harvested seeds of lentil variety K-75 were treated with 4 insecticide (T_1-T_4) (Malathion @ 0.06 ml/kg, Deltamethrin @ 0.04 ml/kg, Nimbicide @ 0.02 ml/kg) and two fungicides (T_5, T_6 - Thiram @ 2.0g/kg Bavistin @ 1.2 g/kg) and packed in sealed tin container (C_1) and jute bag (C_2) on 1st July, 99 and stored in ambient conditions for ten months. Initial germination of seed (95%), dry weight of seedling (0.188 g), seedling vigour index (2007.35), electric conductivity (1.17 mm mhos/cm/g) and moisture content (9.25%) were recorded. Bimonthly observations were recorded from September 1999 (P_2) to May 2000 (P_{10}) on germination, dry weight, seedling vigour index [5], seed moisture content and electric conductivity. Meteorological data on temperature and relative humidity was recorded which ranged from 20.38 to 34.87°C and 42.20 to 78.17 per cent respectively during July 1999 to May 2000. Maximum temperature 34.87°C, was observed in the month of May 2000 while relative humidity 78.17 per cent in the month of September 1999.

RESULTS AND DISCUSSION

1. *Treatment*: The effect of treatment was found significant for germination, dry weight, seedling vigour index and electric conductivity but was not significant for moisture content. Maximum germination (90.75%), dry weight (0.167g), seedling vigour index (1691.23) was recorded in seed treatment with Deltamethrin followed by Thiram in all the characters (Table 1). Similar findings have been reported by Narayan *et al.* [6] in green gram.

2. *Container*: Significant differences were observed over ten months of storage (Table 1). Sealed tin container (C_1) was better than jute bag (C_2). In jute bag germination was reduced by

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Table 1. Effect of treatment, container and their interaction on germination and vigour of lentil seed

Treatment (t)	Germination (%)			Dry weight (g)			Seedling vigour index			Electric conductivity (mμ mhos/cm/g)		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
Control (T_0)	79.85	77.03	78.40	0.147	0.140	0.143	1351.66	1258.83	1305.24	1.50	1.67	1.58
Malathion (T_1)	82.23	79.45	80.84	0.152	0.149	0.151	1405.44	1288.62	1347.03	1.41	1.52	1.46
Deltamethrin (T_2)	92.05	89.46	90.75	0.170	0.164	0.167	1746.30	1636.16	1691.46	1.30	1.38	1.34
Nimbicides (T_3)	84.65	82.85	83.75	0.155	0.147	0.151	1538.92	1447.66	1493.29	1.40	1.49	1.44
Cypermethrin (T_4)	84.65	82.12	83.38	0.156	0.150	0.153	1547.35	1431.40	1489.75	1.42	1.53	1.47
Thiram (T_5)	89.20	87.44	88.32	0.167	0.161	0.164	1656.92	1543.39	1600.15	1.33	1.41	1.37
Bavistin (T_6)	87.25	86.47	86.86	0.166	0.161	0.163	1633.47	1529.33	1581.50	1.34	1.43	1.39
Mean	85.66	83.56	-	0.159	0.153	-	1554.29	1497.94	-	1.38	1.49	-
CD (P = 0.5)												
T			0.56			0.002			12.20			0.02
C			0.30			0.001			6.52			0.01
TxC			NS			NS			NS			0.02

14.16 per cent, dry weight by 26.06 per cent, seedling vigour index by 36.94 per cent after ten months of storage. In case of electric conductivity sealed tin container was found significantly better than jute bag. Seed stored in tin container showed lesser value of electric conductivity (1.38 mm mhos/cm/g) than stored in jute bag (1.49mm mhos/cm/g). Minimum fluctuations in moisture was observed in sealed tin container. Similar findings were observed by Vanangamudi and Ramaswamy [7] and Narayan *et al.* [8].

3. *Storage period* : Effect of storage period was found significant for all the characters (Table 2). Germination, dry weight, seedling vigour index showed gradual sgnificant reduction as storage period advanced. Highest value of electric conductivity (1.56 mμ mhos/cm/g) was found in tenth months of storage and lowest 1.33 mμ mhos/cm/g) with second month of storage. Maximum moisture was observed in month of January (10.35%) which was at par to September. Minimum moisture (9.04%) was in May (P_{10}).

Treatment x *Container (T x C)* : In respect to interaction effect between T x C was non-significant except electric conductivity. T_2 x C_1 interaction showed better performance than other combinations for all parameters.

Treatment x Storage period (T x P) : The interaction effect of treatment x storage period was non-significant for germination, dry weight and moisture content while it was significant for seedling vigour index and electric conductivity. At the end of storage period better results were observed in seeds treated with Deltamethrin (T_2). In case of electric conductivity interaction of untreated seeds with all storage period (P_2 to P_6) showed significant inferior performance than other interactions. Lowest value (1.23 mμ mhos/cm/g) was recorded in T_2 x P_2 highest in T_4 x P_{10} (1.61 mμ mhos/cm/g) among treated seeds.

Container x *storage period (C x P)* : Seed vigour index showed highly significant interaction of container x storage period while it was non-significant for germination, dry weight and electric conductivity. All interactions of tin container, (C_1) and storage period were found superior over interaction of jute container (C_2) x storage period.

Table 2. Effect of storage period and its interaction with container on germination and vigour of lentil seed

Period (p)	Germination (%)			Dry weight (g)			Seedling vigour index			Electric conductivity (mμ mhos/cm/g)		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
Sep. 99 (P_2)	88.47	86.15	87.31	0.169	0.166	0.167	1684.63	1612.25	1648.44	1.32	1.38	1.33
Nov. 99 (P_4)	87.10	85.02	86.06	0.166	0.162	0.164	1654.93	1550.45	1602.69	1.32	1.41	1.37
Jan. 2000 (P_6)	85.28	83.12	84.20	0.160	0.152	0.156	1556.80	1442.60	1499.70	1.39	1.49	1.44
Mar 2000 (P_8)	84.34	82.42	83.38	0.153	0.148	0.151	1472.88	1368.75	1420.81	1.43	1.54	1.49
May 2000 (P_{10})	83.14	81.12	82.13	0.146	0.139	0.142	1402.24	1265.64	1333.94	1.50	1.61	1.56
Mean	85.66	83.56		0.159	0.153		1554.29	1447.94		1.38	1.49	
CD(P = 0.5)												
P			0.47			0.002			10.31			0.01
PxC			NS			NS			14.58			NS

Table 3. Interaction effect of treatment and storage period on germination and vigour of lentil seed

(a) T x P	Germination (%)						Dry weight (g)					
Factor	P_2	P_4	P_6	P_8	P_{10}	Mean	P_2	P_4	P_6	P_8	P_{10}	Mean
T_0	81.57	80.00	78.00	77.21	75.49	78.40	0.159	0.155	0.143	0.135	0.129	0.144
T_1	83.52	82.18	81.00	79.49	78.03	80.84	0.161	0.187	0.151	0.147	0.138	0.151
T_2	93.00	91.57	90.60	90.02	88.56	90.75	0.180	0.176	0.167	0.161	0.151	0.167
T_3	86.42	85.10	83.40	82.50	81.35	83.75	0.163	0.160	0.152	0.144	0.137	0.151
T_4	86.02	84.50	83.40	82.00	81.00	83.38	0.165	0.163	0.154	0.147	0.136	0.153
T_5	91.24	90.15	87.00	87.00	86.21	88.32	0.174	0.170	0.163	0.161	0.152	0.164
T_6	89.50	89.00	86.00	85.50	84.32	86.86	0.171	0.168	0.165	0.161	0.153	0.163
Mean	87.31	86.06	84.20	83.38	82.13		0.167	0.164	0.156	0.151	0.142	
CD (P =0.05)												
TxP						NS						NS

Contd....

(a) T x P	Vigour index						Electric conductivity (mμ mhos/cm/g)					
Factor	P_2	P_4	P_6	P_8	P_{10}	Mean	P_2	P_4	P_6	P_8	P_{10}	Mean
T_0	1485.81	1498.24	1278.09	1168.85	1094.74	1305.24	1.57	1.48	1.57	1.62	1.67	1.58
T_1	1518.54	1464.64	1313.09	1266.62	1172.28	1347.03	1.33	1.40	1.46	1.52	1.60	1.46
T_2	1820.51	1760.17	1698.06	1639.64	1537.78	1691.23	1.23	1.29	1.34	1.39	1.44	1.34
T_3	1609.46	1575.76	1502.35	1435.97	1342.91	1443.29	1.32	1.38	1.45	1.51	1.58	1.44
T_4	1612.11	1531.46	1518.44	1452.64	1332.22	1489.37	1.34	1.40	1.47	1.54	1.61	1.47
T_5	1768.58	1704.88	1592.94	1493.17	1441.98	1600.15	1.25	1.31	1.38	1.43	1.50	1.37
T_6	1724.08	1683.98	1594.93	1488.82	1415.68	1581.50	1.26	1.32	1.40	1.43	1.53	1.39
Mean	1648.44	1602.69	1499.70	1420.81	1333.94		1.33	1.37	1.44	1.49	1.56	
CD (P=0.05)												
TxP						27.28						0.04

Table 4 : Interaction effect of treatment, container and storage period on germination and vigour of lentili seed

Treatment (T)	Sealed tin container (C_1)																			
	Germination (%)					Dry weight (g)					Seedling vigour index					Electric conductivity (mμ mhos/cm/g)				
	Storage period (months)					Storage period (months)					Storage period (months)					Storage period (months)				
	P_2	P_4	P_6	P_8	P_{10}	P_2	P_4	P_6	P_8	P_{10}	P_2	P_4	P_6	P_8	P_{10}	P_2	P_4	P_6	P_8	P_{10}
Control (T_0)	83.0	82.0	79.0	78.0	77.0	0.160	0.158	0.146	0.139	0.137	1526.0	1492.4	1360.3	1216.3	1162.6	1.38	1.43	1.52	1.57	1.57
Malathion (T_1)	85.0	83.0	82.0	81.0	80.0	0.162	0.159	0.154	0.148	0.141	1557.5	1526.3	1375.1	1328.1	1240.0	1.31	1.36	1.41	1.42	1.53
Deltamethrin (T_2)	93.9	93.0	92.0	91.0	90.0	0.182	0.179	0.170	0.162	0.157	1841.5	1822.6	1754.9	1695.9	1616.4	1.20	1.26	1.30	1.35	1.40
Nimbicide (T_3)	88.0	86.0	84.0	83.0	83.0	0.165	0.162	0.159	0.150	0.142	1632.8	1631.4	1543.9	1477.1	1409.0	1.30	1.34	1.40	1.44	1.53
Cypermethrin (T_4)	88.0	86. 0	84.0	83.0	82.0	0.168	0.165	0.157	0.152	0.142	1656.7	1630.5	1551.5	1501.4	1396.4	1.31	1 35	1.42	1.48	1.54
Thiram (T_5)	92.0	91.0	87.8	87.9	87.0	0.176	0.172	0.170	0.163	0.154	1815.4	1767.2	1643.9	1544.2	1513.7	1.22	1.27	1.35	1.39	1.46
Bavistin (T_6)	90.0	89.0	87.8	86.0	85.0	0.173	0.170	0.169	0.163	0.156	1762.2	1713.8	1667.7	1546.2	1477.3	1.24	1.29	1.35	1.38	1.48

Treatment (T)	Jute bag (C_2)																			
	Germination (%)					Dry weight (g)					Seedling vigour index					Electric conductivity (mμ mhos/cm/g)				
	Storage period (months)					Storage period (months)					Storage period (months)					Storage period (months)				
	P_2	P_4	P_6	P_8	P_{10}	P_2	P_4	P_6	P_8	P_{10}	P_2	P_4	P_6	P_8	P_{10}	P_2	P_4	P_6	P_8	P_{10}
Control (T_0)	80.0	78.0	77.0	76.0	74.0	0.157	0.153	0.140	0.147	0.133	1445.5	1505.0	1195.8	1120.9	1026.8	1.47	1.54	1.63	1.68	1.73
Malathion (T_1)	82.0	81.0	80.0	78.0	76.0	0.161	0.156	0.149	0.147	0.136	1479.5	1402.9	1251.0	1205.1	1104.5	1.36	1.45	1.52	1.59	1 68
Deltamethrin (T_3)	92.0	90.0	89.0	89.0	87.0	0.178	0.173	0.164	0.160	0.146	1799.5	1697.6	1641.1	1583.3	1459.1	1.27	1.32	1.39	1.43	149
Nimbicide (T_3)	85.0	84.0	83.0	82.0	80.0	0.162	0.158	0.146	0.138	0.137	1586.0	1520.1	1460.8	1394.5	1276.8	1.34	1.42	1.51	1.58	1.63
Cypermetbrin (T_4)	84.0	83.0	83.0	81.0	80.0	0.163	0.161	0.152	0.143	0.138	1567.4	1432.3	1485.3	1403.8	1267.9	1.58	1.46	1.53	1.60	1.67
Thiram (T_5)	90.0	89.0	86.0	86.0	85.0	0.172	0.169	0.157	0.157	0.150	1721.7	1640.9	1541.9	1442.1	1370.2	1.28	1.35	1.41	1.47	1.54
Bavistin (T_6)	89.0	89.0	86.0	85.0	84.0	0.170	0.167	0.161	0.159	0.151	1685.9	1654.1	1522.0	1431.4	1354.0	1.29	136	1.46	1.49	1.58
CD (P = 0.05)																				
TxCxP	1.79					NS					38.58					0.06				

In case of moisture, the effect of C x P was found significant. Non-significant fluctuation was recorded in tin container upto six months while in jute bag it was only upto four months of storage. Highest moisture was recorded in C_2 x P_6 and lowest in C_1 x P_{10}.

Treatment x containers x storage period (T x C x P) interaction

Interaction effect of T x C x P was found significant for germination, seedling vigour index and electric conductivity while it was non significant for dry weight (Table 3) and moisture content. For germination all the treatments in tin container were significantly superior over control except Malathion (T_1) in fourth month of storage. Regarding tin container Deltamethrin (T_2) was best for ten months of storage. At the end of storage, highest seedling vigour index (1616.4) was exhibited in T_2 x C_1. Maximum increase (47.86%) in electric conductivity was found when untreated seeds (To) were stored in jute bag from July to May (P_0 to P_{10}) in ambient condition. Minimum enhancement in electric conductivity was observed in T_2 with sealed tin container over ten months of storage period.

Thus, it is concluded that Deltamethrin treatment was best among the treatments. Sealed tin container was found better as compared to jute bag. No moisture fluctuation was observed upto six month of storage in sealed tin container.

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