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INFLUENCE OF PHYSICAL SEED ENHANCEMENT TECHNIQUES ON STORABILITY OF SESAME (*SESAMUM INDICUM* L.) cv. VRI 1

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Abstract

Sesame (*Sesamum indicum* L.) is one of the most ancient oilseed crop grown in India. Seed being the basic input in agriculture, production and supply of quality seeds to the farmers will go a long way to achieve the goal of self sufficiency in this crop. Sesame seed storage study was undertaken in the Department of Genetics and Plant Breeding, Annamalai University, Annamalai Nagar (Tamilnadu), India. Genetically pure seeds of sesame cv. VRI 1 were obtained from the Oilseed Research Station, Virudhachalam. The bulk seeds were graded for uniformity using appropriate round perforated metal sieves of sizes of 5/64" size sieve and were imposed with various physical seed enhancement techniques. The treated seeds along with control were stored in cloth bag and 700 gauge polythene bag under ambient condition of Annamalai nagar for a period of 10 months and were evaluated for seed quality characters *viz.*, moisture content, germination per cent, oil content and electrical conductivity at bimonthly intervals. The study revealed that the seeds treated with halogen slurry treatment and stored in 700 gauge polythene bag registered low electrical conductivity (0.097 d sm^{-1}), high germination percentage (84%), and oil content (44.8%) when compared to control. It was also noted that they maintained the minimum seed certification standard upto 10 months of storage.

Key words : Sesame, seed enhancement, storage, germination percentage.

Introduction

India is a paradise for oilseed crops. No other country has its range of perennial and annual oilseeds. In terms of area, India ranks first in groundnut, sesame, linseed, safflower, niger and castor. Although, India has 20.8 per cent of the world's area under oilseeds, it accounts for less than 10 per cent of world's production. Sesame (*Sesamum indicum* L.) is one of the most ancient oilseed crop grown in the country. Sesame is the third main oilseed crop in India.

Seed being a living entity, deterioration beyond physiological maturity is inevitable and will be pronounced when seeds are stored under hostile conditions. Although, ageing of seeds cannot be arrested completely, when they are stored under ambient condition, it can however, be controlled to an appreciable extent by adoption of suitable storage technologies. The physiological ageing in seed is accelerated by the hostile environment like increased temperature and relative humidity. Developing controlled storage condition might solve this problem, but it is often not feasible for storing bulk quantity of seeds at least for the present.

For this purpose, various physical enhancement techniques are followed in the seed industry such as fungicidal treatments, halogenation and pelleting treatments. With these in background, studies have been undertaken in sesame cv. VRI 1 to study the influence of physical seed enhancement techniques on storability.

Materials and Methods

Genetically pure seeds of sesame cv. VRI 1 from the Oilseed Research Station, Virudhachalam formed the base material for the study. The bulk seeds were graded for uniformity using appropriate round perforated metal sieves of sizes *viz*., 5/64'' for sesame. The storage experiment was conducted at the Department of Genetics and Plant Breeding, Annamalai University, Annamalai Nagar (11°24'N latitude and 79°44'E longitude with an altitude of +5.79 mts above mean sea level). The seeds were imposed with the following physical seed enhancement techniques

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Table 1: Influence of physical seed enhancement techniques on storability of sesame *cv* VRI 1- Germination percentage

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean
C_1	T_0	92 (74.12)	85 (68.21)	78 (62.20)	71 (58.06)	62 (52.03)	57 (49.32)	74 (60.32)
	T_1	92 (73.32)	85 (67.01)	77 (62.02)	70 (57.06)	64 (53.06)	62 (52.32)	74 (60.21)
	T_2	93 (74.52)	86 (68.14)	80 (63.03)	74 (60.06)	69 (56.31)	65 (54.32)	77 (62.31)
	T_3	94 (76.25)	88 (70.03)	84 (67.21)	81 (64.06)	79 (62.32)	75 (60.00)	83 (66.10)
	T_4	95 (77.21)	91 (72.11)	87 (69.25)	85 (67.06)	83 (66.31)	81 (64.26)	86 (69.26)
	T_5	94 (76.12)	89 (70.31)	84 (66.32)	80 (63.06)	75 (60.14)	72 (58.11)	82 (65.26)
	T_6	92 (73.21)	86 (68.21)	80 (63.25)	76 (60.06)	72 (58.21)	68 (56 14)	78 (62.25)
	T_7	92 (74.21)	86 (68.62)	81 (64.31)	79 (62.03)	76 (61.45)	72 (58.32)	80 (64.11)
	T_8	93 (75.52)	89 (70.62)	84 (66.02)	80 (63.15)	77 (61.26)	75 (60.26)	82 (65.51)
	Mean	93 (75.26)	87 (69.21)	82 (65.36)	77 (62.02)	73 (59.03)	70 (57.32)	80 (64.31)
C_2	T_0	93 (74.62)	88 (70.21)	81 (64.32)	76 (60.03)	72 (58.21)	67 (55.25)	79 (63.00)
	T_1	94 (76.12)	88 (70.62)	84 (66.36)	80 (64.15)	76 (61.32)	72 (58.23)	82 (65.25)
	T_2	93 (75.26)	89 (71.26)	84 (67.25)	81 (64.10)	78 (62.03)	75 (60.26)	83 (66.62)
	T_3	94 (76.32)	91 (72.26)	88 (70.26)	85 (68.25)	84 (66.31)	83 (65.30)	87 (69.31)
	T_4	95 (78.12)	92 (74.26)	90 (72.03)	87 (69.26)	88 (70.13)	87 (69.20)	90 (71.12)
	T_5	93 (75)	89 (70.26)	84 (67.31)	81 (64.32)	78 (62.32)	77 (61.25)	83 (66.15)
C_2	T_6	93 (75.32)	89 (71.26)	85 (67.26)	80 (64.20)	76 (61.31)	72 (58.26)	82 (65.62)
	T_7	92 (74.26)	88 (70.26)	84 (66.32)	81 (64.15)	79 (63.32)	76 (61.32)	83 (66.15)
	T_8	94 (76.26)	90 (72.26)	87 (69.12)	84 (66.22)	81 (64.62)	79 (62.25)	85 (68.26)
	Mean	94 (75.62)	89 (71.26)	85 (67.23)	82 (65.25)	79 (63.26)	76 (61.62)	84 (67.16)
Treatment mean	T_0	92 (74.26)	87 (69.26)	80 (63.62)	74 (59.62)	67 (55.26)	62 (52.62)	76 (61.26)
	T_1	93 (75.62)	87 (69.26)	81 (64.32)	75 (60.10)	70 (57.13)	67 (55.32)	78 (63.13)
	T_2	93 (75.26)	88 (69.26)	82 (65.06)	78 (62.30)	74 (59.12)	70 (57.35)	80 (64.25)
	T_3	94 (76.26)	90 (71.26)	86 (68.25)	83 (66.26)	81 (64.62)	79 (63.23)	85 (67.62)
	T_4	95 (77.26)	92 (73.26)	89 (70.03)	86 (68.32)	86 (68.12)	84 (67.00)	88 (70.25)
	T_5	94 (75.26)	89 (70.15)	84 (67.03)	81 (64.21)	77 (61.36)	74 (59.12)	82 (65.30)
	T_6	92 (74.26)	88 (70.26)	82 (65.03)	78 (62.65)	74 (59.25)	70 (57.26)	80 (64.11)
	T_7	92 (74.26)	87 (69.56)	83 (65.03)	80 (63.36)	77 (62.03)	74 (60.32)	82 (65.20)
	T_8	94 (76.26)	90 (71.26)	85 (67.45)	82 (65.25)	79 (63.06)	77 (61.23)	84 (66.13)
	Mean	93 (75.26)	88 (70.26)	83 (66.03)	79 (63.21)	76 (61.26)	73 (58.25)	82 (66.32)

Figures in parenthesis are Arcsine Transformed value.

	C	T	P	C × T	T × P	C × P	C × P × T
CD P = 0.05	0.192	0.408	0.451	0.577	1.355	0.638	1.916

Note: C_1- Cloth bag; C_2- 700 gauge polythene bag.

T_1 - Dry dressing with Thiram @ 2 g kg^{-1} of seed.

T_2 - Slurry treatment with Thiram @ 2 g kg^{-1} of seed.

T_3 - Dry dressing with Halogen mixture @ 4 g kg^{-1}.

T_4 - Slurry treatment with Halogen mixture @ 4 g kg^{-1} as slurry.

T_5 - Pelleting with Arappu leaf powder @ 200 g kg^{-1} of seed.

T_6 - Pelleting with neem leaf powder @ 200 g kg^{-1} of seed.

T_7 - Pelleting with Pungam leaf powder @ 200 g kg^{-1} of seed.

T_8 - Pelleting with Vasambu rhizome powder @ 200 g kg^{-1} of seed.

Table 2 : Influence of physical seed enhancement techniques on storability of sesame cv VRI 1- Electrical conductivity (dSm^{-1}).

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean
C_1	T_0	0.086	0.100	0.118	0.132	0.140	0.146	0.121
	T_1	0.084	0.106	0.119	0.124	0.129	0.133	0.117
	T_2	0.085	0.104	0.118	0.128	0.133	0.138	0.118
	T_3	0.081	0.093	0.096	0.101	0.106	0.112	0.098
	T_4	0.080	0.085	0.090	0.094	0.100	0.106	0.093
	T_5	0.078	0.088	0.102	0.113	0.123	0.129	0.106
	T_6	0.083	0.096	0.115	0.125	0.131	0.135	0.115
	T_7	0.084	0.098	0.115	0.125	0.129	0.530	0.151
	T_8	0.082	0.100	0.114	0.124	0.129	0.131	0.114
	Mean	0.083	0.097	0.110	0.119	0.125	0.173	0.115
C_2	T_0	0.084	0.095	0.109	0.121	0.127	0.132	0.112
	T_1	0.081	0.092	0.102	0.109	0.115	0.121	0.104
	T_2	0.082	0.094	0.102	0.108	0.116	0.122	0.105
	T_3	0.076	0.085	0.090	0.095	0.098	0.103	0.091
	T_4	0.072	0.078	0.082	0.088	0.093	0.097	0.085
	T_5	0.079	0.087	0.094	0.102	0.112	0.119	0.099
	T_6	0.079	0.088	0.098	0.110	0.117	0.128	0.103
	T_7	0.085	0.095	0.107	0.114	0.118	0.121	0.107
	T_8	0.079	0.092	0.104	0.116	0.120	0.125	0.107
	Mean	0.080	0.090	0.099	0.107	0.113	0.119	0.101
Treatment mean	T_0	0.084	0.097	0.111	0.120	0.124	0.326	0.129
	T_1	0.083	0.099	0.110	0.117	0.122	0.127	0.110
	T_2	0.083	0.099	0.110	0.118	0.125	0.130	0.111
	T_3	0.079	0.089	0.093	0.098	0.102	0.107	0.095
	T_4	0.076	0.082	0.086	0.091	0.097	0.102	0.089
	T_5	0.079	0.088	0.098	0.107	0.118	0.124	0.102
	T_6	0.081	0.092	0.107	0.118	0.124	0.132	0.109
	T_7	0.085	0.097	0.114	0.127	0.134	0.139	0.117
	T_8	0.081	0.096	0.109	0.120	0.125	0.128	0.110
	Mean	0.081	0.093	0.104	0.113	0.119	0.146	0.108

	C	T	P	C × T	T × P	C × P	C × P × T
CD P = 0.05	0.007	0.016	0.018	0.023	0.056	0.026	0.079

Note: C_1-Cloth bag; C_2- 700 gauge polythene bag.

The treated seeds along with control (**T_0**) were stored in cloth bag (C_1) and 700 gauge polythene bag (C_2) under ambient condition at Annamalai Nagar for a period of 10 months. The experiment was formulated adopting FCRD with three replications and were evaluated for seed and seedling quality characters such as germination percentage (ISTA, 1999), dry matter production, electrical conductivity (Priestley and Leopold, 1983) and oil estimation (AOAC, 1960) immediately after treatment and at bimonthly intervals.

Results and Discussion

The results of physical seed enhancement techniques on storability of groundnut kernels revealed that the germination percentage decreased with increase in the storage period for 93 to 73 per cent to sesame of

Table 3: Influence of physical seed enhancement techniques on storability of sesame *cv.* VRI 1 - Oil content (%)

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	Mean
C_1	T_0	48.8 (44.32)	47.1 (43.31)	45.3 (42.32)	42.8 (40.90)	40.2 (39.30)	36.9 (37.42)	43.5 (41.33)
	T_1	49.3 (44.61)	47.5 (43.65)	44.8 (42.05)	43.1 (41.02)	40.6 (39.63)	38.1 (38.16)	42.6 (40.32)
	T_2	48.8 (44.32)	46.5 (43.02)	44.0 (41.54)	42.2 (40.52)	40.4 (39.50)	39.5 (38.91)	43.5 (41.20)
	T_3	49.3 (44.63)	47.3 (43.53)	45.3 (42.34)	43.8 (41.52)	42.7 (40.82)	41.5 (40.11)	45.0 (42.11)
	T_4	49.4 (44.63)	48.0 (43.92)	46.6 (43.13)	45.5 (42.42)	44.3 (41.72)	43.2 (41.12)	46.1 (42.82)
	T_5	48.6 (44.20)	46.5 (43.01)	45.0 (42.13)	43.8 (41.42)	42.5 (40.70)	40.0 (39.30)	44.4 (41.71)
	T_6	48.9 (44.44)	47.2 (43.42)	45.5 (42.46)	43.8 (41.44)	41.8 (40.30)	39.2 (38.81)	44.3 (41.72)
	T_7	48.8 (44.32)	46.9 (43.23)	44.8 (42.02)	43.6 (41.35)	41.9 (40.33)	39.8 (39.12)	44.2 (41.60)
	T_8	48.8 (44.33)	46.5 (43.01)	44.8 (42.01)	42.9 (40.91)	41.5 (40.11)	40.2 (39.42)	44.0 (41.63)
	Mean	49.0 (44.40)	47.1 (43.32)	45.1 (42.21)	43.5 (41.33)	41.8 (40.33)	39.8 (39.16)	44.2 (41.60)
C_2	T_0	48.3 (44.03)	46.6 (43.02)	45.0 (42.11)	43.2 (41.15)	41.1 (39.92)	39.3 (38.83)	43.9 (41.52)
	T_1	48.4 (44.11)	46.8 (43.22)	44.8 (42.05)	43.1 (41.06)	41.3 (40.03)	39.9 (39.22)	43.9 (41.53)
	T_2	48.6 (44.23)	46.9 (43.22)	45.2 (42.23)	43.3 (41.20)	41.9 (40.31)	40.7 (39.63)	44.3 (41.72)
	T_3	49.0 (44.40)	47.4 (43.53)	45.7 (42.51)	44.1 (41.63)	43.0 (41.00)	42.5 (40.72)	45.2 (42.23)
	T_4	49.2 (44.51)	47.9 (43.08)	47.1 (43.32)	46.0 (42.73)	45.2 (42.20)	44.8 (42.01)	46.6 (43.12)
	T_5	48.6 (44.23)	47.0 (43.31)	45.2 (42.22)	43.7 (41.40)	42.3 (40.62)	41.2 (40.03)	44.6 (41.80)
C_2	T_6	48.4 (44.13)	46.5 (43.03)	44.8 (42.02)	43.0 (41.02)	41.9 (40.31)	40.3 (39.44)	44.1 (41.61)
	T_7	49.1 (44.51)	47.2 (43.46)	44.9 (42.13)	43.1 (41.02)	42.0 (40.43)	41.7 (40.22)	44.5 (41.80)
	T_8	49.1 (44.53)	47.0 (43.32)	44.9 (42.15)	43.4 (41.22)	42.5 (40.70)	41.1 (39.91)	44.6 (41.82)
	Mean	48.7 (44.30)	47.0 (43.33)	45.3 (42.32)	43.7 (41.40)	42.3 (40.66)	41.3 (40.03)	44.6 (41.90)
Treatment mean	T_0	48.5 (44.23)	46.8 (43.21)	45.1 (42.22)	43.0 (41.02)	40.6 (39.65)	38.1 (38.16)	43.2 (40.92)
	T_1	48.9 (44.40)	47.2 (43.40)	44.8 (42.03)	43.1 (41.02)	41.0 (39.81)	39.0 (38.70)	43.7 (41.46)
	T_2	48.7 (44.23)	46.7 (43.11)	44.6 (41.95)	42.8 (40.92)	41.2 (39.91)	40.1 (39.36)	43.9 (41.51)
	T_3	49.2 (44.53)	47.4 (43.56)	45.5 (42.41)	44.0 (41.53)	42.8 (40.90)	42.0 (40.42)	45.1 (42.11)
	T_4	49.3 (44.63)	48.0 (43.85)	46.9 (43.20)	45.8 (42.61)	44.7 (42.03)	44.0 (41.66)	46.4 (42.90)
	T_5	48.6 (44.20)	46.8 (43.13)	45.1 (42.20)	43.8 (41.42)	42.4 (40.61)	40.6 (39.66)	44.5 (41.83)
	T_6	48.7 (44.20)	46.9 (43.21)	45.2 (42.23)	43.4 (41.26)	41.8 (40.31)	39.7 (39.14)	44.2 (41.06)
	T_7	49.0 (44.41)	47.0 (43.31)	44.9 (42.11)	43.3 (41.20)	41.9 (40.40)	40.8 (39.73)	44.4 (41.71)
	T_8	49.0 (44.43)	46.7 (43.13)	44.8 (42.02)	43.2 (41.13)	42.0 (40.42)	40.7 (39.60)	44.3 (41.73)
	Mean	48.8 (44.30)	47.0 (43.30)	45.2 (42.20)	43.5 (41.30)	42.0 (40.41)	40.5 (39.53)	44.4 (41.70)

Figures in parenthesis are Arcsine Transformed value.

	C	T	P	C × T	T × P	C × P	C × P × T
CD P = 0.05	0.257	0.546	0.603	0.772	1.811	0.853	2.561

Note: C_1-Cloth bag; C_2- 700 gauge polythene bag.

irrespective of treatments (table 1). The study highlighted that sesame seeds treated with halogen slurry and stored in 700 gauge polythene bag, maintained their germination for minimum seed certification purpose till the end of the storage period. Where the actual germination per cent recorded after storage was 87 per cent in sesame. Rathinavel and Dharmalingam (2002, 2001) also recorded the same trend in cotton and Kavitha (2007) in chilli. The decline in germination over periods of storage is due to depletion of food reserves, decline in synthetic activity as reported by Heydecker (1973) and Roberts (1972).

Electrical conductivity was increased with increase in the storage period. The increase was from 0.081 to 0.146 dS m^{-1} in sesame. The seeds of sesame treated with halogen slurry recorded relatively low electrical conductivity compared to the untreated ones. It was 0.089

in sesame respectively (table 2). The same trend was recorded by Senthilkumar and Muguntha Devi (2012) in various vegetables, Ramamoorthy *et al.* (2009) in black gram and Sathiya Narayanan and Prakash (2014) in Groundnut. The increase in the electrical conductivity might be due to the alteration in the membrane permeability during ageing (Berjak and Villers, 1972), loss of integrity of plasmalemma and tonoplast and concomitant increase for molecules that leach out of seeds (Hibbard and Miller, 1928). The formation of free radicals have the potential to damage the biomembranes (Bewley and Black, 1982) resulting in increased leaching of electrolytes and sugars during storage. Stabilization of membrane integrity and free radical quenching or scavenging effect of halogens are the reasons for the relatively low electrical conductivity of the halogen slurry treated seeds groundnut kernel.

The oil content decreased with increase in storage period, irrespective of containers and treatment. The decrease was from 48.8 to 40.5% in sesame. In the seeds treated with halogen slurry recorded less reduction of oil content of 46.5% in sesame (table 3). The same trend was recorded by Sathiya Narayanan *et al.* (2011) in sesame and sunflower and Sathiya Narayanan and Prakash (2014) in groundnut. The oxidative process taking place during storage of seeds convert the triglycerides into free fatty acids and accumulation of free fatty acid would lead to loss of viability in seeds (Harrington, 1972). It might be due to halogens stabilization of unsaturated fatty acid compound of lipo-protein membranes and rendering them less susceptible to peroxidase change. In fact, Basu and Rudrapal (1980) have suggested that it may react with C=C double bond of polyunsaturated fatty acid making them less susceptible to further oxidation. In the present investigation at the end of the storage period, the halogenation dry treatment reduced pathogenicity and offered good protection against pathogen infections of 5.0 percentage in groundnut kernel respectively. The study clearly revealed in sunflower the halogen slurry treatment imparted best effects on vigour and viability.

Conclusion

Hence, the present study revealed that the sesame seeds treated with halogen slurry and stored in 700 gauge polythene bag registered low electrical conductivity, high germination percentage, dry matter production and oil content when compared to control. It was also noted that they maintained the minimum seed certification standard up to 10 months of storage.

References

AOAC (1960). *Oils, fats and waxes*. Official method of analysis, Washington, pp.358-378.

Berjak, P. and T. A. Villers (1972). Ageing in plant embryos. II. Age induced damage and its repair during early germination. *New Phytol.,* **71** : 135-144.

Bewley, J. D. and M. Black (1982). *Physiology and Biochemistry of seeds*. **In** : Relation to germination. Vol. 2. Springer- Verlag, New York, p. 375.

Harrington, J. F. (1972). Seed storage and longevity, seed biology (Ed) T.T. Kozlowski Academic Press. New York and London, pp. 145-245.

Heydecker (1973). *Glossery of terms in 'Seed Ecology'* (ed. H. Heydecker), Butterworths, London, pp. 553-557.

Hibbard, R. P. and E. V. Miller (1928). Biochemical studies on seed viability. I. Measurements of conductance. *Pl. Physiol.,* **3** : 335-352.

ISTA (1999). International Rules for Seed Testing. *Seed Sci. & Technol.,* **27** : Supplement Rules, 1-84.

Justice, O. L. and L. N. Bass (1978). *Principles and practices of storage*. Agricultural Hand book Number 506. USDA. Washingten, D.C. Pp. 289.

Kavitha, M. (2007). Seed quality enhancement and storability studies in chilli (*Capsicum annuum L.*), *M.Sc.(Agri) Thesis*, University of Agricultural Sciences, Dharwad.

Priestley, D. A. and A. C. Leopold (1983). Lipid changes during natural ageing of soybean seeds. *Pl. Physiol*., **59**:467-470.

Qualls, M. and C. S. Cooper (1968). Germination, growth and respiration rates of foxtail millet at three temperatures during the early non-photosynthetic stage of development. *Crop Sci.,* **9** : 758-760.

Ramamoorthy, K., N. Natarajan and K. Raja (2009). Effect of seed invigoration treatments on vigour and viability in black gram [*Vigna mungo* (L.) Hepper]. *International Journal of Plant Sciences*, **4(1)** : 188-190.

Rathinavel, K. and C. Dharmalingam (2001). Efficacy of seed treatment on storability of cotton seeds and seedling vigour. *Journal of Tropical Agriculture*, **39** : 128-133.

Rathinavel, K. and C. Dharmalingam (2002). Effect of chlorination treatment on the control of seed deterioration in cotton (*Gossypium* sp). *Indian J. Agric. Res*., **36(1)**:17-23.

Roberts, E. H. (1972). *Loss of viability and crop yields*. In: "Viability of Seeds". (ed.) E.H. Roberts, Chapman and Hall Ltd, London, p. 313.

Sathiya Narayanan, G., M. Prakash and B. Sunil Kumar (2011). Seed Enhancement Techniques to Improve Productivity of Certain Oilseed Crops. *Global Journal of Plant Ecophysiology*, **1(1)** : 1-13.

Sathiya Narayanan, G. and M. Prakash (2014). Influence of physical seed enhancement techniques on storability of Groundnut Kernals (*Arachis hypogaea* L). *Legume Res*., **37(5)** : 460-466.

Senthilkumar, N. and S. Muguntha Devi (2012). Studies on halogenation in storability of vegetable seeds. *Plant Archives*, **12(2)** : 849-852.