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EFFECT OF SEED PELLETING AND CONTAINERS ON THE STORABILITY OF SESAME CV. TMV 3

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Abstract

Sesame (*Sesamum indicum* L.) is probably the most ancient oil seed known and has been used by human as food material1. This important annual oil seed crop has been cultivated for centuries, particularly in developing countries of Asia and Africa, for its high content of both excellent quality edible oil (42-54%) and protein (22-25%). Seed characteristics are usually essential elements in seedling establishment and plant development to obtain high seed yield. Good storage is a basic requirements in seed production program as the maintenance of high seed viability and vigour from the harvest to planting is of utmost important in a seed production program. The present investigations were carried out at the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University to study the Effect of seed pelleting and containers on the storability of Sesame cv. TMV 3. The sesame seeds were pelleted using following pelleting materials i.e., pelleting with Arappu (*Albizia amara*) leaf powder @ 200 g kg^{-1} of seed, pelleting with Pungam (*Pongamia pinnata*) leaf powder @ 200 g kg^{-1} of seed, pelleting with fly ash @ 200 g kg^{-1} of seed, pelleting with $MnSo_4$ @ 300 g kg^{-1} of seed, pelleting with Arappu leaf powder (100g) + fly ash (100g). The above pelleted seeds along with control were stored in two containers Gada cloth bag and 700 gauge polythene bag and kept in storage under ambient condition of Annamalai Nagar. Seed samples were drawn at bimonthly intervals and the following seed quality tests were carried out. The study revealed that the sesame seeds treated with arappu leaf powder (100 g) + fly ash (100 g) and stored with 700 gauge polythene bag registered low moisture content, electrical conductivity, high germination percentage, seedling length, dry matter production and vigour index, when compared to control. This type of seed storage in sesame maintained the minimum seed certification standard upto 10 months in sesame seeds.

Key words: Sesame, Seed Pelleting, Seed quality

Introduction

Sesame (*Sesamum indicum* L.) is an important oilseed crop in the tropics and subtropics. The majority of the wild species of the genus Sesamum are native to Africa, but its first domestication is recorded in the India sub-continent. Sesame seeds have a high nutritive value and seeds are used in baking products and oil extraction. It is considered as a drought tolerant crop. The crop is the queen of vegetable oils and the oil has high degrees of stability and resistance to rancidity. Apart from being oil yielding plant species, sesame also possesses many agronomic advantages like, capacity to set seeds under high temperature, a deep tap root system that grows well by intercropping and fits well into crop rotation. Seed security is key to the attainment of household food security among resource poor farmers in developing countries. Good quality seed play a vital role in successful seed or crop production as the end product depends on the quality of seed used for sowing. Deterioration of seed is associated with ageing phenomenon which is defined as an irreversible degradation change in the quality of a seed after it has reached stage. Its maximum quality level and the seed deterioration also starts immediately after attaining the physiological maturity on the plant itself (Abdul-Baki and Anderson, 1973). In order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are being adopted such as seed treatment and storing in safe

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containers, besides sanitation of the storage place. Hence, the study was conducted to evaluating the performance of seed pelleting treatments on the shelf life potential of sesame seeds.

Materials and Method

The present study was carried using genetically pure seeds of sesame cv. TMV 3 obtained from obtained from Regional Research Station, Thindivanam, TNAU, Tamilnadu. The experiments were conducted at the Department of Genetics and Plant Breeding, Faculty of Agriculture, 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 bulk seeds were first dried to below 12% moisture content, cleaned, then graded with suitable sieves and imposed for following priming treatments *viz.,* Pelleting with Arappu (*Albizia amara*) leaf powder @ 200 g kg^{-1} of seed, Pelleting with Pungam (*Pongamia pinnata*) leaf powder @ 200g kg^{-1} of seed, Pelleting with fly ash @ 200 g kg^{-1} of seed, pelleting with $MnSo_4$ @ 300 g kg^{-1} of seed, pelleting with Arappu leaf powder (100g) + fly ash (100g). After the treated seeds were shade and sun dried for bring back to its original moisture content. The treated seeds along with control (T_0) were stored in Gada 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 evaluated for its seed quality parameters once in two months *viz.,* moisture content (ISTA (1999), germination percentage (ISTA, 1999), shoot length (ISTA, 1999), root length (ISTA, 1999), drymatter production (ISTA, 1999), vigour index (Abdul-Baki and Anderson, 1973) and oil content (AOAC, 1960). under laboratory condition. The data were statistically analyzed as per the method of Panse and Sukhatme (1985).

Results and Discussion

Establishment of a good seedling stand in the field is an important and foremost need for higher crop yield. This depends largely on the field germination and vigour potential of the seeds used for sowing. In the normal course, the seeds start to deteriorate during post maturity period whether the seed is in the mother plant or in seed store. The rate of deterioration however, differs from one kind to another and being influenced by a number of factors that include the seed and the environmental factors such as, seed moisture content, seed maturity, initial vigour, extent of mechanical damage inflicted on seeds, the relative humidity, temperature of storage, storage pests, pathogens and so on. In addition to these factors, the cause remains to be the major reason for deterioration.

In the present study, the moisture content increased with increase in the storage period, which was found to be 7.2 to 9.6 percent irrespective of the containers and treatments (Table 1). The increase was higher in the untreated seeds of sesame stored in moisture pervious container (cloth bag) compared to those stored in moisture vapour proof container (700 gauge polythene bag). The increase was low in sesame seeds pelleted with arappu leaf powder (100g) + fly ash (100g) and stored in 700 gauge polythene bag. At the end of the storage period the above treatment recorded 8.7%. Similar results were reported by Bindu (1996) in Groundnut and Rathnavalli (1998) in sunflower. The rapid increase in the moisture content of seeds of sesame stored in moisture vapour pervious container (cloth bag) might be due to the absorption of atmospheric moisture. The porous nature of the container would have permitted the entry of moisture into the bag and the differential moisture content of the atmosphere and the seeds would have attained equilibrium that would have raised the moisture content of the seeds, as they were stored after drying to low moisture content. While the very low increase in the moisture content of the treated and untreated seed of sesame, that were stored in moisture vapour proof containers is due to the prevention of moisture entry into the containers.

The germination potential is the basic requirement for seed. The viability and vigour are the two important facts of seed quality and they go hand in hand while judging the quality of seeds. In the present study, the germination percentage decreased with increase in the storage period *viz*. 92 to 77 percent (Table 2). The study highlighted that sesame seeds pelleted with arappu leaf powder (100g) + fly ash (100g) 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 percent recorded after storage was 82 percent. In the present study, the root and shoot length of the seedling showed significant reduction over periods of storage, irrespective of the treatment, container and crops. The sesame seeds pelleted with arappu leaf powder (100g) + fly ash (100g) and stored in 700 gauge polythene bag produced lengthier seedlings compared to those stored in cloth bag. At the end of the storage period the above treatment were superior in producing lengthier seedlings than the untreated ones. It produces 8.8 cm root and 4.7 cm shoot (Table 3 and 4).

The vigour estimations based on physiological manifestations such as seedling length, dry matter accumulation and the vigour index arrived at from germination percentage with the respective seedling length had clearly brought out the importance of such estimations for determining the vigour of seeds in storage.

Table 1: Effect of seed pelleting treatments, storage containers and period of storage on Moisture content (%) of sesame cv. TMV 3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	7.4(15.78)	7.9(16.32)	8.4(16.84)	8.9(17.35)	9.8(18.24)	10.2(18.62)	8.7(17.19)
	T_1	7.2(15.56)	7.8(16.21)	8.2(16.64)	8.6(17.05)	8.8(17.25)	9.2(17.65)	8.3(16.31)
	T_2	7.4(15.78)	8.1(16.53)	8.6(17.05)	8.9(17.35)	9.2(17.75)	9.7(17.95)	8.6(17.07)
	T_3	7.3(15.67)	8.0(16.43)	8.8(17.25)	9.0(17.45)	9.3(17.75)	9.5(17.95)	8.6(17.08)
	T_4	7.4(15.78)	8.5(16.95)	8.9(17.35)	9.2(17.65)	9.7(18.14)	10.0(18.43)	8.9(17.38)
	T_5	7.1(15.45)	7.6(16.00)	7.9(16.32)	8.2(16.64)	8.7(17.15)	9.0(17.45)	8.0(16.50)
	Mean	7.3(15.67)	7.9(16.41)	8.4(16.91)	8.8(17.25)	9.2(17.71)	9.6(18.01)	8.6 (16.99)
C_2	T_0	7.3(15.67)	7.9(16.32(	8.5(16.95)	9.1(17.55)	9.7(18.14)	10.4(18.81)	8.8(17.249)
	T_1	7.0(15.34)	7.4(15.78)	7.9(16.32)	8.3(16.77)	8.7(17.15)	9.2(17.65)	8.0(16.50)
	T_2	7.1(15.45)	7.6(16.00)	8.2(16.64)	8.8(17.25)	9.2(17.65)	9.9(18.33)	8.4(16.89)
	T_3	7.2(15.56)	7.5(15.89)	8.1(16.53)	8.6(17.05)	9.1(17.55)	9.7(18.14)	8.3(16.79)
	T_4	7.3(15.67)	7.9(16.32)	8.5(16.95)	9.1(17.55)	9.7(18.14)	10.2(18.62)	8.7(17.21)
	T_5	6.9(15.22)	7.4(15.78)	7.9(16.11)	8.1(16.32)	8.4(17.15)	8.7(17.15)	7.8(16.29)
	Mean	7.1(15.49)	7.6(16.01)	8.1(16.58)	8.6(17.08)	9.1(17.63)	9.6(18.12)	8.4(16.82)
Treatment mean	T_0	7.3(15.73)	7.9(16.32)	8.4(16.89)	9.0(17.45)	9.9(18.19)	10.3(18.71)	8.8(17.22)
	T_1	7.1(15.45)	7.6(16.00)	8.0(16.48)	8.4(16.89)	9.8(17.20)	9.2(17.65)	8.1(16.61)
	T_2	7.2(15.61)	7.8(16.26)	8.4(16.84)	8.9(17.30)	8.7(17.70)	9.8(18.14)	8.5(16.98)
	T_3	7.2(15.62)	7.7(16.16)	8.4(16.89)	8.8(17.25)	9.2(17.65)	9.6(18.04)	8.5(16.94)
	T_4	7.3(15.73)	8.2(16.63)	8.7(17.15)	9.1(17.60)	9.7(18.14)	10.1(18.53)	8.9(17.03)
	T_5	7.0(15.34)	7.5(15.89)	7.9(16.21)	8.1(16.48)	8.6(17.15)	8.9(17.30)	7.9(16.39)
	Mean	7.2(15.58)	7.8(16.21)	8.3(16.74)	8.7(17.16)	9.1(17.67)	9.6(18.06)	8.5(16.91)

Figures in parenthesis are Arcsine Transformed value

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	0.027	0.048	0.051	0.068	0.118	0.068	0.167

Table 2: Effect of seed pelleting treatments, storage containers and period of storage on Germination(%) of sesame cv. TMV 3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	90(71.58)	85(67022)	80(63.44)	76(60.67)	73(58.69)	70(56.29)	79(63.06)
	T_1	93(74.68)	90(71.58)	86(68.03)	83(65.65)	82(64.90)	78(62.03)	85(67.81)
	T_2	91(72.56)	88(69.74)	84(66.43)	81(66.16)	77(61.34)	74(59.34)	82(65.59)
	T_3	92(73.59)	89(70.64)	85(67.22)	83(65.65)	79(62.73)	76(60.67)	84(66.75)
	T_4	90(71.58)	87(68.87)	83(65.65)	79(62.73)	76(60.67)	72(58.05)	81(64.59)
	T_5	94(75.85)	92(73.59)	88(69.74)	86(68.03)	83(65.65)	77(63.44)	87(69.38)
	Mean	91(73.30)	88(70.27)	84(66.75)	81(64.48)	78(62.33)	75(60.05)	83(66.20)
C_2	T_0	91(72.56)	87(68.87)	83(65.65)	79(62.73)	76(60.67)	72(58.05)	81(64.75)
	T_1	95(77.12)	92(73.59)	90(71.58)	89(70.64)	88(70.05)	78 (66.43)	89(71.57)
	T_2	93(74.68)	90(71.58)	86(68.03)	80(63.44)	78(62.03)	76(60.67)	83(66.74)
	T_3	94(75.85)	91(72.56)	89(70.64)	88(69.74)	84(66.43)	79(63.44)	87(69.77)
	T_4	92(73.59)	90(71.58)	88(69.74)	84(66.43)	78(62.03)	74(59.34)	84(67.12)
	T_5	96(78.52)	93(74.68)	91(72.56)	90(71.58)	88(69.74)	85(67.22)	90(72.38)
	Mean	93(75.39)	90(72.14)	87(69.70)	85(67.42)	82(65.16)	78(62.52)	86(68.72)
Treatment mean	T_0	90(72.07)	86(68.04)	81(64.54)	77(61.70)	74(59.68)	71(57.42)	80(63.91)
	T_1	94(75.90)	91(72.58)	88(69.80)	86(68.15)	85(67.47)	81(64.23)	87(69.69)
	T_2	92(73.62)	89(70.66)	85(67.23)	80(63.80)	77(61.69)	75(60.00)	83(66.17)
	T_3	93(74.72)	90(71.60)	87(68.93)	85(67.70)	81(64.58)	78(62.05)	86(68.26)
	T_4	91(72.58)	88(70.22)	85(67.70)	81(64.58)	77(61.35)	73(58.70)	83(65.85)
	T_5	95(77.19)	92(74.13)	89(71.15)	88(69.80)	85(67.70)	82(65.33)	88(70.88)
	Mean	92((74.34)	90(71.21)	86(68.23)	83(65.95)	80(63.74)	77(61.29)	85(67.46)

Figures in parenthesis are Arcsine Transformed value

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	0.237	0.412	0.454	0.582	1.009	0.582	1.427

In the present study, the dry matter production and vigour index decreased with increase in the storage period irrespective of treatments and containers. The decrease was low in sesame seeds pelleted with arappu leaf powder (100g) + fly ash (100g) and stored in 700 gauge polythene bag treatment. At the end of the storage period the above treatment recorded dry matter (1.874 g) and vigour index (1147) (Table 5 and 6). The oil content decreased with increased storage period i.e., 47.9% to 42.2%. The sesame seeds pelleted with arappu leaf

Table 3: Effect of seed pelleting treatments, storage containers and period of storage on Root length (cm) of sesame cv. TMV 3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	9.4	8.5	8.3	8.1	8.0	7.9	8.3
	T_1	9.8	9.3	8.9	8.7	8.5	8.4	8.9
	T_2	9.6	8.9	8.7	8.5	8.3	8.0	8.6
	T_3	9.7	9.0	8.7	8.5	8.4	8.2	8.7
	T_4	9.5	8.7	8.6	8.4	8.3	8.0	8.5
	T_5	9.9	9.4	9.0	8.8	8.6	8.5	9.0
	Mean	9.6	8.9	8.7	8.5	8.3	8.1	8.7
C_2	T_0	9.9	9.3	8.9	8.4	7.9	7.4	8.6
	T_1	10.3	9.9	9.7	9.4	9.1	8.6	9.5
	T_2	10.0	9.4	9.2	8.7	8.4	8.0	8.9
	T_3	10.2	9.6	9.3	9.0	8.6	8.3	9.1
	T_4	10.1	9.5	9.2	8.8	8.0	7.6	8.8
	T_5	10.4	10.0	9.8	9.6	9.3	8.8	9.8
	Mean	10.1	9.6	9.3	8.9	8.5	7.9	9.1
Treatment mean	T_0	9.6	8.9	8.6	8.2	7.9	7.7	8.5
	T_1	10.0	9.6	9.3	9.0	8.8	8.5	9.2
	T_2	9.8	9.1	8.9	8.6	8.3	8.0	9.0
	T_3	9.9	9.3	9.0	8.7	8.5	8.2	9.0
	T_4	9.8	9.1	8.9	8.6	8.1	7.8	8.7
	T_5	10.1	9.7	9.4	9.2	8.9	8.7	9.3
	Mean	9.9	9.2	9.0	8.7	8.4	8.1	8.9

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	0.027	0.043	0.050	0.066	0.114	0.077	0.162

Table 4: Effect of seed pelleting treatments, storage containers and period of storage on Shoot length(cm) of sesame cv. TMV3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	7.8	6.9	5.8	4.7	4.0	3.5	5.4
	T_1	8.2	7.7	6.4	5.8	4.6	4.0	5.9
	T_2	7.9	7.0	5.9	4.8	4.2	3.6	5.5
	T_3	8.1	7.5	6.3	5.5	4.4	3.8	5.9
	T_4	7.8	7.0	5.9	4.7	4.0	3.6	5.5
	T_5	8.3	7.9	6.8	6.0	4.9	4.2	6.1
	Mean	8.0	7.3	6.1	5.2	4.3	3.7	5.8
C_2	T_0	8.0	7.3	6.2	5.1	4.5	4.0	5.8
	T_1	8.4	7.6	6.7	5.7	5.0	4.5	6.3
	T_2	8.2	7.3	6.5	5.4	4.7	4.3	6.0
	T_3	8.3	7.5	6.6	5.5	4.9	4.3	6.1
	T_4	8.1	7.3	6.3	5.2	4.6	4.2	5.9
	T_5	8.5	7.8	6.9	5.9	5.2	4.7	6.5
	Mean	8.2	7.4	6.5	5.4	4.8	4.3	6.1
Treatment mean	T_0	7.9	7.1	6.0	4.9	4.2	3.8	5.7
	T_1	8.3	7.7	6.5	5.8	4.8	4.2	6.2
	T_2	8.0	7.1	6.2	5.1	4.4	3.9	5.9
	T_3	8.2	7.5	6.4	5.5	4.7	4.0	6.0
	T_4	7.9	7.1	6.1	5.0	4.3	3.9	5.8
	T_5	8.4	7.9	6.8	6.0	5.0	4.4	6.4
	Mean	8.1	7.4	6.3	5.3	4.5	4.0	6.0

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	0.041	0.086	0.96	0.126	0.310	0.136	0.420

powder (100g) + fly ash (100g) and stored in 700 gauge polythene bag recorded relatively high oil content compared to the untreated ones. At the end of the storage period the above treatment recorded high oil content (44.2 %). The results are in conformity with the findings of Vijaya geetha and Bhaskararn, 2013 in ragi, Dileepkumar *et al*., 2009 in cowpea. The arappu leaf powder contained antiageing, anti oident and biocidal properties. The arappu

Table 5: Effect of seed pelleting treatments, storage containers and period of storage on Dry matter production (mg. seedlings^{-10}) of sesame cv. TMV 3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	2.784	2.386	2.058	1.521	1.410	1.389	1.924
	T_1	2.914	2.493	2.169	1.845	1.798	1.684	2.050
	T_2	2.892	2.402	2.103	1.782	1.534	1.483	2.032
	T_3	2.864	2.444	2.102	1.684	1.599	1.523	2.036
	T_4	2.859	2.397	2.084	1.532	1.442	1.419	1.955
	T_5	2.983	2.584	2.184	1.936	1.893	1.709	2.114
	Mean	2.882	2.451	2.116	1.716	1.612	1.534	2.052
C_2	T_0	2.900	2.400	2.108	1.874	1.632	1.520	2.072
	T_1	3.028	2.783	2.256	2.021	1.876	1.754	2.286
	T_2	2.963	2.589	2.148	1.921	1.702	1.691	2.169
	T_3	2.981	2.689	2.198	1.983	1.732	1.684	2.211
	T_4	2.942	2.495	2.139	1.914	1.673	1.591	2.125
	T_5	3.121	2.830	2.372	2.098	1.942	1.874	2.372
	Mean	2.989	2.631	2.203	1.968	1.759	1.685	2.206
Treatment mean	T_0	2.842	2.393	2.083	1.697	1.521	1.454	1.998
	T_1	2.971	2.638	2.212	1.933	1.837	1.719	2.218
	T_2	2.927	2.495	2.125	1.851	1.618	1.587	2.100
	T_3	2.922	2.566	2.150	1.833	1.665	1.603	2.213
	T_4	2.900	2.446	2.111	1.723	1.557	1.505	2.040
	T_5	3.052	2.707	2.278	2.017	1.917	1.791	2.293
	Mean	2.935	2.541	2.160	1.842	1.686	1.610	2.129

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	0.027	0.047	0.047	0.066	0.115	0.066	0.162

Table 6: Effect of seed pelleting treatments, storage containers and period of storage on Vigour index of sesame cv. TMV 3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	1548	1309	1128	972	876	798	1105
	T_1	1674	1530	1315	1203	1074	967	1294
	T_2	1592	1399	1226	1077	962	858	1186
	T_3	1637	1468	1275	1162	1011	912	1244
	T_4	1557	1365	1203	1034	934	835	1155
	T_5	1710	1591	1390	1272	1120	1016	1350
	Mean	1619	1442	1255	1118	994	896	1222
C_2	T_0	1628	1444	1253	1066	942	820	1192
	T_1	1776	1610	1476	1343	1240	1100	1424
	T_2	1692	1503	1350	1128	1021	934	1271
	T_3	1739	1556	1415	1276	1134	1008	1354
	T_4	1674	1512	1364	1176	982	873	1263
	T_5	1814	1655	1519	1395	1276	1147	1468
	Mean	1720	1546	1395	1228	1096	977	1332
Treatment mean	T_0	1588	1377	1190	1019	909	809	1149
	T_1	1725	1570	1395	1273	1157	1033	1359
	T_2	1642	1451	1288	1102	991	896	1228
	T_3	1688	1512	1345	1219	1138	960	1310
	T_4	1615	1439	1283	1105	958	854	1209
	T_5	1762	1623	1454	1333	1198	1081	1408
	Mean	1670	1495	1326	1175	1058	939	1277

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	3.712	6.430	6.430	9.095	15.750	9.093	22.274

Table 7: Effect of seed pelleting treatments, storage containers and period of storage on Oil content (%) of sesame cv. TMV 3

Containers	Treatments	P_0	P_2	P_4	P_6	P_8	P_{10}	MEAN
C_1	T_0	47.3(41.23)	44.9(40.44)	43.0(39.80)	42.3(39.56)	41.9(39.43)	40.3(38.88)	43.3(39.89)
	T_1	48.3(41.57)	45.6(40.67)	44.6(40.34)	43.3(39.90)	42.7(39.70)	42.4(40.04)	44.5(40.37)
	T_2	47.8(41.40)	45.3(40.57)	43.6(40.00)	43.0(39.80)	42.6(39.66)	42.1(39.49)	44.0 (40.15)
	T_3	48.0(41.47)	45.4(40.60)	44.4(40.27)	44.0(40.13)	42.9(39.76)	42.0(39.46)	44.4(40.28)
	T_4	47.6(41.33)	45.2(40.54)	44.0(40.13)	43.6(40.00)	42.6(39.66)	41.8(39.93)	44.1(40.18)
	T_5	48.6(41.67)	46.9(41.10)	46.2(40.87)	45.7(40.70)	44.1(40.17)	43.2(39.87)	45.8(40.73)
	Mean	47.9(41.44)	45.5(40.65)	44.3(40.23)	43.6(40.02)	42.8(39.73)	41.9(39.52)	44.3(40.27)
C_2	T_0	47.2(14.20)	45.0(40.47)	42.9(39.76)	41.4(39.26)	41.0(39.12)	40.8(39.05)	43.0(39.81)
	T_1	48.4(41.60)	47.4(41.27)	45.9(42.21)	45.4(40.60)	45.0(40.47)	43.9(40.10)	46.0(40.88)
	T_2	47.8(41.40)	46.8(41.07)	44.8(40.40)	44.0(40.13)	43.9(40.10)	42.0(39.46)	44.8(40.43)
	T_3	48.1(41.50)	46.0(40.80)	45.3(40.57)	44.6(40.34)	43.2(39.87)	42.9(39.76)	45.0(40.47)
	T_4	47.6(41.33)	46.2(40.87)	45.2(40.54)	43.4(39.93)	43.0(39.78)	41.7(39.76)	44.5(40.37)
	T_5	48.7(41.70)	48.4(41.60)	47.8(41.43)	47.2(41.20)	46.4(40.94)	44.2(39.34)	47.1(41.04)
	Mean	47.9(41.46)	46.6(41.01)	45.3(40.65)	44.3(40.24)	43.7(40.04)	42.5(39.58)	45.0(40.50)
Treatment mean	T_0	47.2(41.22)	44.9(40.45)	42.9(39.78)	41.8(39.41)	41.4(39.27)	40.5(38.97)	40.5(39.89)
	T_1	48.3(41.58)	46.5(40.97)	45.2(40.77)	44.3(40.25)	43.8(40.08)	43.1(40.07)	45.2(40.62)
	T_2	47.8(41.40)	46.5(40.82)	44.2(40.20)	43.5(39.97)	43.2(39.88)	42.0(39.48)	44.4(40.29)
	T_3	48.0(41.48)	45.7(40.70)	44.9(40.42)	44.3(40.23)	43.0(39.81)	42.4(39.61)	44.7(40.38)
	T_4	47.6(41.33)	45.7(40.70)	44.6(40.34)	43.5(39.97)	42.8(39.72)	41.7(39.58)	44.3(40.27)
	T_5	48.6(41.68)	47.6(41.35)	47.0(41.15)	46.4(40.95)	45.2(40.55)	43.7(39.60)	46.4(40.88)
	Mean	47.9(41.45)	46.0(40.83)	44.8(40.44)	43.9(40.13)	43.2(39.89)	42.2(39.55)	44.7(40.38)

Figures in parenthesis are Arcsine Transformed value

	C	T	P	C x T	T x P	C x P	C x P x T
CD P = 0.05	0.237	0.526	0.593	0.752	1.711	0.842	2.361

leaf powder stimulated the production of auin and ethylene, which have positive influence on seed germination a reported by Clouse and Sasse (1998). This was due to the stimulatory effect of micronutrients and increased water holding capacity of flyash. It also provides protection against pest attack in the early stage of seedlings (Kannapiran, 1995). These micronutrients that were soluble in water might have been absorbed by the seed during the imbibition process and have promoted the various enzymatic processes leading to faster cell division and radical emergence besides improving germination (Vanangamudi and Karivaratharaju, 1986).

Flyash contains sufficient concentration of micro and macronutrients like calcium, iron, manganese, boron, nitrogen, phosphorus, zinc and potassium which can be better utilized in agriculture, as fertilizers (Carlson and Adiriano, 1991). These micronutrients would have increased rate of cell division, cell elongation and availability of these nutrients which could be responsible to increase seedling growth. The probable reason might be the activation of enzymes by the micronutrients which resulted in elongation of seedling measurements and their biomass production (Patagundi *et al.,* 1997). The micronutrients such as zinc, boron, manganese and iron present in flyash are highly essential for activation of enzyme system related to seed viability and vigour as revealed by several researchers (Patil *et al.,* 1991). The Zn and Mn present in the flyash by activating physiological and biochemical processes, would have helped to increase DMP (Dry Matter Production). It would also be due to the key role in auxin metabolism. Reports of increased DMP with Zn application was given by Sudarsan (1989) in groundnut and Jha and Chandel (1987) in soybean. The results are in conformity with the findings of Anandaraj (2009) in bhendi and black gram and Sathiya narayanan *et al.,* 2017 in black gram, Prakash *et al.,* (2014) in sesame. The study clearly revealed the sesame seeds pelleted with arappu leaf powder (100g) + fly ash (100g) and stored in 700 gauge polythene bag maintained its germination for minimum seed certification standard till the end of the storage period in sesame cv. TMV 3.

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