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Original Research Article

Studies on Germination and Seedling Vigour of Summer Groundnut Seeds Stored Under Ambient Storage Condition

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Seed storage, vacuum pack, germination, Groundnut

A B S T R A C T

Present investigation was undertaken in order to know the effect of provenance, storage containers and seed forms on seedling vigour of summer groundnut under ambient condition. Among the production and storage locations, seeds produced at Bagalkot recorded significantly higher seed quality parameters than Dharwad and Kumta. Among seed forms pod storage recorded significantly higher seed quality parameters than that of kernel storage. Among the storage containers, seeds stored under vacuum pack recorded significantly higher seed quality parameters than polylined gunny bag and HDPE. The pods of Bagalkot stored in vacuum pack showed higher germination per cent (68.00 %) and seedling vigour index (2179) compared to Dharwad and Kumta at 12th month of storage.

Introduction

Groundnut (*Arachis hypogaea* L.) is one of the principal oilseed crops of the world, mostly produced in semi-arid regions and is one of the poor storer. Low seedling vigour is largely due to deterioration of seeds during storage.

The rapid loss of seed viability is observed in summer harvested groundnut and about 50 per cent viability could be lost within four to five months of storage (Nautiyal and Ravindra, 1991). The seed longevity is influenced by production location, storage environment and packaging material. In this direction a study was taken up with the objective of assessing the effect of provenance, storage containers and seed forms on seedling vigour of summer groundnut under ambient condition.

Materials and Methods

Seed materials (GPBD-4) required for storage experiments were produced during summer season of 2015-16 and stored in their respective places *viz.*, Dharwad, Bagalkot and Kumata under ambient conditions. It consists of three factors *viz.*, Factor-I: Production locations (L) (L_1-Dharwad, L_2-Bagalkot, L_3-Kumata), Factor-II: Seed forms (S) (F_1-Pod, F_2-Kernel) and Factor-III: Storage containers (B) (B_1-

Polylined gunny bag, B_2-HDPE bag, B_3-Vacuum pack container). Seed materials were collected bimonthly to assess the seed quality parameters in laboratory of National Seed Project, University of Agricultural Sciences, Dharwad.

Results and Discussion

The present study on storability of seeds produced in three different agro-climatic conditions of Karnataka revealed that, there was a significant influence of production locations on initial seed quality and storability. The seeds produced and stored at Bagalkot (L_1) location maintained higher seed germination (71.68 %), followed by Dharwad (L_2) (70.00 % germination) which was above prescribed minimum standard of seed certification for germination (70.00 %) up to 6^{th} month of storage. Whereas, the seeds produced at Kumta (L_3) location recorded low seed germination (65.52 %) at 6^{th} month of storage which was below prescribed standard (Table 1). The seeds produced and stored at Bagalkot (L_1) recorded significantly higher seedling vigour index (2179) at the end of 12 months of storage compared to Dharwad and Kumta (Table 1).

Between Kernel and pod storage, pod storage was able to maintain higher germination and seedling vigour index (50.88 % & 842) compared to kernels (44.05 % & 770) at the end of twelve months of storage. These results are in accordance with Mahantesh (2002). In the present study, the seed germination was decreased with the progress in the storage period. Significantly higher germination, values were recorded in the vacuum packed seeds-B_3 (70.28 %), which was above the prescribed seed certification standard (70 %) up to eight months of storage, as compared to polylined gunny bag-B_1 (60.22 %).

The seeds stored in vacuum pack recorded significantly higher seedling vigour index (1072 respectively) at the end of 12 months of storage compared to polylined gunny bag and HDPE bag (B_2) which recorded lowest germination of 45.83 %. The interaction among L x F x B were found significant for seed germination, seedling length and seedling vigour index. The seeds produced at Bagalkot and stored as pod in vacuum pack were significantly superior and germination maintained upto eight months (73.70 %), followed by Dharwad (72.95 %) and Kumta (69.56 %). Kumta seeds stored in HDPE bag found to be poor (44.30 %). They also maintained significantly higher seedling vigour index (2179) compared to Dharwad and Kumta at 12^{th} month of storage. The place of seed production is one of the most important factor influencing seed quality since the weather condition such as temperature, relative humidity and soil type etc vary from location to location. The difference in storage potential of seeds produced at different locations may be due to difference in initial seed quality under different environmental conditions. The reduction in germination was more in Kumta region compare to Bagalkot and Dharwad. Because in coastal areas relative humidity and temperature will be high which favours both physiological and microbial deterioration of seeds. The changes in seedling vigour index also closely followed the changes in viability, since vigour index is directly dependent on germination per cent and seedling vigour. The effect of high relative humidity was very drastic on seedling vigour index.

At physiological maturity Kumta recorded higher temperature and relative humidity (40.2^0 C and 71 %), where Bagalkot and Dharwad recorded lower temperature (37 & 36.1^0 C respectively) and relative humidity (37 & 41 %) in the month of May-2016.

Table.1 Effect of provenance, storage containers and seed forms on germination (%) and seedling vigour index in summer groundnut under ambient condition

Treatments		Germination (%)			Seedling vigour index		
		Initial	6th month	12th month	Initial	6th month	12th month
Locations (L)	Dharwad (L_1)	90.33(71.93)	70.00(56.98)	49.34(45.14)	2063	1434	803
	Bagalkot (L_2)	91.30(72.90)	71.68(58.03)	52.14(46.67)	2179	1485	890
	Kumta (L_3)	90.46(72.06)	65.52(54.20)	40.91(39.58)	2122	1277	606
	Mean	90.70(72.30)	69.06(56.40)	47.46(43.80)	2121	1399	766
	S. Em±	0.61	0.41	0.46	16.18	12.34	9.12
	C. D (0.01)	NS	1.53	1.70	NS	46.06	34.03
Forms of storage (F)	Pod (F_1)	90.70(72.30)	71.37(57.84)	50.88(45.96)	2121	1464	842
	Kernel (F_2)	90.70(72.30)	66.75(54.96)	44.05(41.64)	2121	1334	690
	Mean	90.70(72.30)	69.06(56.40)	47.46(43.80)	2121	1399	766
	S. Em±	0.49	0.33	0.37	13.21	10.08	7.45
	C. D (0.01)	NS	1.25	1.39	NS	37.61	27.79
Bags for storage (B)	HDPE bag (B_1)	90.70(72.30)	59.77(50.68)	33.42(35.23)	2121	1131	466
	Polylined gunnybag (B_2)	90.70(72.30)	70.69(57.30)	46.46(43.86)	2121	1410	760
	Vacuum packing (B_3)	90.70(72.30)	76.74(61.22)	62.51(52.30)	2121	1655	1072
	Mean	90.70(72.30)	69.06(56.40)	47.46(43.80)	2121	1399	766
	S. Em±	0.61	0.41	0.46	16.18	12.34	9.12
	C. D (0.01)	NS	1.53	1.70	NS	46.06	34.03
Interaction (LxF)	L_1F_1	90.33(71.93)	72.27(58.40)	52.61(47.25)	2063	1495	877
	L_1F_2	90.33(71.93)	67.72(55.55)	46.07(43.04)	2063	1373	729
	L_2F_1	91.30(72.90)	73.83(59.41)	55.02(48.53)	2179	1549	965
	L_2F_2	91.30(72.90)	69.53(56.65)	49.27(44.80)	2179	1421	815
	L_3F_1	90.46(72.06)	68.02(55.73)	45.02(42.09)	2122	1347	685
	L_3F_2	90.46(72.06)	63.01(52.67)	36.80(37.08)	2122	1207	527
	Mean	90.70(72.30)	69.06(56.40)	47.46(43.80)	2121	1399	766
	S. Em±	0.86	0.58	0.64	22.88	17.46	12.90
	C. D (0.01)	NS	2.16	2.40	NS	65.14	48.13
Interaction (LxB)	L_1B_1	90.33(71.93)	60.23(50.94)	35.23(36.40)	2063	1159	497
	L_1B_2	90.33(71.93)	72.50(58.43)	49.05(46.00)	2063	1460	817
	L_1B_3	90.33(71.93)	77.26(61.56)	63.75(53.02)	2063	1682	1094
	L_2B_1	91.30(72.90)	63.00(52.57)	38.71(38.48)	2179	1217	570
	L_2B_2	91.30(72.90)	73.72(59.21)	51.67(47.12)	2179	1511	906
	L_2B_3	91.30(72.90)	78.31(62.33)	66.10(54.40)	2179	1726	1193

	L_3B_1	90.46(72.06)	56.16(48.53)	26.35(30.81)	2122	1017	331
	L_3B_2	90.46(72.06)	65.82(54.27)	38.76(38.45)	2122	1260	557
	L_3B_3	90.46(72.06)	74.63(59.80)	57.72(49.48)	2122	1555	930
	Mean	90.70(72.30)	69.06(56.40)	47.46(43.80)	2121	1399	766
	S. Em±	1.05	0.71	0.79	28.03	21.38	15.79
	C. D (0.01)	NS	2.65	2.94	NS	79.78	58.94
Interaction (FxB)	F_1B_1	90.70(72.30)	62.65(52.36)	37.18(37.55)	2121	1214	538
	F_1B_2	90.70(72.30)	72.98(58.76)	50.14(46.35)	2121	1477	846
	F_1B_3	90.70(72.30)	78.49(62.41)	65.32(53.97)	2121	1700	1143
	F_2B_1	90.70(72.30)	56.89(48.99)	29.66(32.91)	2121	1048	394
	F_2B_2	90.70(72.30)	68.39(55.85)	42.78(41.37)	2121	1344	674
	F_2B_3	90.70(72.30)	74.98(60.04)	59.70(50.64)	2121	1609	1002
	Mean	90.70(72.30)	69.06(56.40)	47.46(43.80)	2121	1399	766
	S. Em±	0.86	0.58	0.64	22.88	17.46	12.90
	C. D (0.01)	NS	2.16	2.40	NS	65.14	48.13
Interaction (LxFxB)	$L_1F_1B_1$	90.33(71.93)	63.10(52.62)	38.80(38.55)	2063	1243	569
	$L_1F_1B_2$	90.33(71.93)	75.00(60.03)	52.43(48.47)	2063	1527	902
	$L_1F_1B_3$	90.33(71.93)	78.70(62.55)	66.60(54.72)	2063	1714	1161
	$L_1F_2B_1$	90.33(71.93)	57.35(49.25)	31.65(34.25)	2063	1075	426
	$L_1F_2B_2$	90.33(71.93)	70.00(56.82)	45.66(43.54)	2063	1394	733
	$L_1F_2B_3$	90.33(71.93)	75.82(60.58)	60.89(51.32)	2063	1651	1027
	$L_2F_1B_1$	91.30(72.90)	65.55(54.09)	41.95(40.39)	2179	1297	642
	$L_2F_1B_2$	91.30(72.90)	76.05(60.73)	55.10(49.63)	2179	1585	1003
	$L_2F_1B_3$	91.30(72.90)	79.90(63.40)	68.00(55.58)	2179	1765	1248
	$L_2F_2B_1$	91.30(72.90)	60.45(51.06)	35.46(36.57)	2179	1138	499
	$L_2F_2B_2$	91.30(72.90)	71.39(57.69)	48.23(44.61)	2179	1437	808
	$L_2F_2B_3$	91.30(72.90)	76.75(61.20)	64.12(53.23)	2179	1688	1137
	$L_3F_1B_1$	90.46(72.06)	59.30(50.39)	30.80(33.73)	2122	1102	403
	$L_3F_1B_2$	90.46(72.06)	67.90(55.52)	42.90(40.94)	2122	1319	633
	$L_3F_1B_3$	90.46(72.06)	76.86(61.28)	61.36(51.59)	2122	1621	1019
	$L_3F_2B_1$	90.46(72.06)	52.87(46.67)	21.88(27.90)	2122	932	258
	$L_3F_2B_2$	90.46(72.06)	63.78(53.03)	34.45(35.96)	2122	1201	481
	$L_3F_2B_3$	90.46(72.06)	72.38(58.33)	54.08(47.36)	2122	1490	841
	Mean	90.70(72.30)	69.06(56.400	47.46(43.80)	2121	1399	766
	S. Em±	1.48	1.00	1.12	39.63	30.23	22.34
	C. D (0.01)	NS	3.75	4.16	NS	112.82	83.36

Figures in parenthesis indicate arcsine transformed values.

The adverse environmental conditions of high temperature and humidity in coastal areas make it difficult to produce quality seeds and maintain their viability during storage Likewise, such differences in seed storability were noticed by Mahantesh (2002), Rashmireddy *et al.*, (2006) and in Reddy *et al.*, (2012) in groundnut.

The seeds stored as pods (F_1) recorded significantly higher seed germination throughout the storage period over kernel storage (F_2) under ambient condition. The seeds stored as pods retained germination per cent (70.00 %) above minimum seed certification standards up to 6^{th} month of storage. This may be attributed to the reason that the pods will provide certain protection to the seeds against fungal attack which is very common under high humidity and kernels may get damaged during shelling that hasten the seed deterioration and also makes kernels susceptible to micoflora and insect attack. This is in agreement with the earlier studies of Mahantesh (2002) in groundnut.

Seeds stored in HDPE bag followed by poly lined gunny bag showed rapid reduction in germination compared to vacuum packed bags, which may be due to higher seed moisture content in these bags because of pervious nature of these containers. The higher values in vacuum packing is due to the reason that vacuum packed bags are less permeable to air moisture and humidity. Similar results were reported by Vasudevan *et al.*, (2014) in groundnut. HDPE bag-B_2 recorded lowest germination values which may be attributed to the fluctuation of moisture content, leading to a faster rate of deterioration in the seeds stored in HDPE bag. These results are in conformity with the reports of Basavegowda and Ravikumar (2001) in groundnut.

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