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Storability of bhendi seeds in different agro-ecological conditions

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Abstract : In bhendi var. Parbhani kranti an experiment was carried out to study the influence of agro-ecological conditions, seed treatments and containers on storability of seeds. The results revealed that among the place of storage, seeds stored at Coimbatore, Yercaud, Kodaikanal and Paiyur maintained higher viability and vigour for 24 months. The seeds treated with thiram @ 2 g kg^{-1} of seed stored in polyethylene bag remained viable for longer period as compared to those seeds stored in cloth bag in all the places of storage. The seeds remain viable for 21 and 15 months when stored in polythene and cloth bags, respectively irrespective of treatments, locations and periods of storage. *(Key words: Agro-ecology, Viability, Vigour, Storability).*

One of the major problems with seed industry is the behaviour of stored seeds at various regions differing in environmental conditions. Many a time,due to failure of timely supply of seeds, cropping programmes have been modified. Inadequate supply of quality seed to the extent of 30-40 per cent is one of the major constraints in limiting the vegetable cultivation. It may be helpful, if the seeds can be stored in bulk quantities in favourable places and moved to the desired destinations at the time of sowing. Therefore, generation of information on storability of seeds in different regions may be highly useful for stocking the seeds in adequate quantities well in advance.

Ageing involves a series of irreversible degnerative changes leading to loss of viability (Mathews and Powell, 1981). Differential viability of species over storage (Agarwal, 1976), varieties (Agarwal, 1978), place of storage (Krishnasamy, 1982) and places of production and their deterioration pattern (Banumurthy and Gupta, 1981) had been well documented by many workers.

The most important factors of the storage environment affecting the maintenance of seed quality during storage are relative humidity and temperature. Between the two, RH has a greater influence on longevity of seed in storage because seed moisture content is directly related to the RH of the atmosphere (Delouche *et al.*,1973).

Materials and Methods

The graded seeds of bhendi var. Parbhani kranti were packed in cloth polythene (700 gauge) (C_1) and cloth (C_2) bags with (thiram @ 4g/kg; T_1) and without seed treatment (control: T_2) in the following 11 locations representing seven agro-ecological zones.

The seed samples were collected once in three months in moisture vapour proff containers from the above locations to V.R.S., Palur and evaluated for the follwing seed quality attributes

S.No	Place of storage	Agro-ecological zone
01.	Vegetable Research Station, Palur	(L1) North Eastern Zone
02.	Regional Research Station, Paiyur	(L2) North Western Zone
03.	Agricultural College and Research Institute, Coimbatore	(L3) Western Zone
04.	Horticultural College and Research Institute, Periyakulam	(L4) Western Zone
05.	Tamil Nadu Rice Research Institute, Aduthurai	(L5) Cauvery Delta Zone
06.	Agricultural College and Research Institute, Trichy	(L6) Cauvery Delta Zone
07.	Agricultural College and Research Institute, Madurai	(L7) Southern Zone
08.	Agricultural College and Research Institute, Killikulam	(L8) Southern Zone
09.	Horticultural Research Station, Petchiparai	(L9) High Rainfall Zone
10.	Horticultural Research Station, Kodaikanal	(L10) Hilly and Tribal Zone
11.	Horticultural Research Station, Yercaud	(L11) Hilly and Tribal Zone

Table 1. Influence of places of storage, seed treatments, containers and period on germination (%)

Location	Periods								Mean	Treatments		Conditions	
	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8		T_1	T_2	C_1	C_2
L1	86.8 (68.71)	80.5 (63.84)	72.3 (58.25)	94.3 (53.30)	52.3 (46.29)	39.3 (38.71)	21.3 (24.05)	9.3 (12.71)	53.2 (45.73)	55.4 (47.54)	51.1 (43.93)	57.3 (49.57)	49.3 (41.90)
L2	90.0 (71.63)	87.5 (69.36)	85.5 (67.67)	81.6 (64.68)	78.5 (62.39)	75.0 (60.03)	72.8 (58.56)	69.4 (56.43)	80.0 (63.84)	80.4 (64.13)	79.7 (63.56)	81.2 (64.65)	78.9 (63.04)
L3	90.5 (72.10)	89.3 (70.92)	87.6 (69.42)	85.5 (67.67)	83.0 (65.70)	79.5 (63.12)	76.3 (60.86)	72.0 (58.09)	82.9 (65.99)	83.4 (66.35)	82.5 (65.62)	84.3 (67.05)	81.6 (64.96)
L4	90.0 (71.62)	87.5 (69.34)	84.3 (66.66)	81.8 (64.77)	77.8 (61.90)	74.3 (59.55)	70.1 (56.87)	66.5 (54.66)	79.0 (63.17)	79.8 (63.74)	78.2 (62.60)	80.7 (64.37)	77.8 (61.97)
L5	89.8 (71.40)	85.3 (67.49)	79.5 (63.20)	74.0 (59.48)	67.0 (55.07)	58.5 (49.98)	48.8 (44.25)	37.5 (37.44)	67.5 (56.04)	70.1 (57.64)	65.0 (54.44)	73.5 (59.71)	61.6 (52.36)
L6	89.8 (71.39)	88.5 (70.27)	86.3 (68.30)	83.5 (66.11)	79.5 (63.14)	75.3 (60.23)	70.5 (57.15)	63.8 (53.01)	79.6 (63.70)	80.8 (64.50)	78.5 (62.91)	81.4 (64.96)	77.3 (62.44)
L7	90.0 (71.62)	87.0 (68.92)	82.8 (65.50)	80.5 (63.84)	77.3 (61.55)	74.5 (59.71)	71.5 (57.76)	66.0 (54.37)	78.7 (62.91)	79.4 (63.41)	77.9 (62.40)	79.9 (63.70)	77.5 (62.12)
L8	90.3 (71.85)	87.4 (69.26)	83.5 (66.11)	79.8 (63.33)	77.6 (61.81)	73.0 (58.77)	67.8 (55.47)	61.0 (51.40)	77.5 (62.25)	79.1 (63.29)	76.0 (61.21)	80.2 (64.04)	74.9 (60.46)
L9	84.3 (66.81)	79.8 (63.35)	72.8 (58.58)	65.8 (54.20)	56.0 (48.47)	44.3 (41.61)	29.0 (31.72)	16.3 (17.37)	56.0 (47.76)	58.4 (49.38)	53.6 (46.15)	62.7 (52.91)	49.3 (42.62)
L10	91.0 (72.60)	89.3 (70.90)	86.8 (68.71)	84.0 (66.48)	80.3 (63.73)	76.5 (61.10)	73.0 (58.81)	68.8 (56.13)	81.2 (64.81)	81.9 (65.32)	80.4 (64.30)	84.0 (66.75)	78.4 (62.87)
L11	91.0 (73.63)	89.0 (70.75)	87.3 (69.17)	84.3 (66.69)	81.8 (64.78)	78.01 (62.18)	75.9 (60.64)	71.5 (57.78)	82.3 (65.58)	83.4 (66.39)	81.3 (64.76)	84.3 (67.05)	80.4 (64.10)
Mean	89.4 (71.12)	86.4 (68.58)	82.6 (65.60)	78.6 (62.78)	73.7 (59.53)	68.0 (55.91)	61.5 (51.47)	54.7 (46.31)	-				
Containers									Mean				
C1	90.0 (71.66)	87.5 (69.50)	84.1 (66.75)	80.5 (64.08)	76.5 (61.33)	71.8 (58.26)	66.8 (55.14)	60.6 (51.24)	77.2				
C2	88.8 (70.58)	85.3 (67.66)	81.1 (64.44)	76.8 (61.47)	71.0 (57.73)	64.3 (53.55)	56.2 (47.79)	48.8 (41.37)	71.5				
Treatments													
T1	89.9 (71.57)	87.2 (69.18)	83.5 (66.24)	79.7 (63.49)	75.1 (60.46)	69.9 (57.11)	63.7 (53.17)	56.3 (47.27)	75.7				
T2	88.9 (70.67)	85.7 (67.99)	81.7 (64.95)	77.6 (62.07)	72.3 (58.60)	66.1 (54.70)	59.4 (49.77)	53.2 (45.34)	73.1				
CD (P=0.05)		L 0.8430	P 0.7191	T 0.3597	C 0.3597	P x L 2.3847	P x T 1.0166	P X C 1.0166	T x L 1.1921	C x L 1.1921	T x C 0.5086		

Table 2. Influence of places of storage, seed treatments, containers and period on drymatter production

Location	Periods								Mean	Treatments		Conditions	
	P1	P2	P3	P4	P5	P6	P7	P8		T1	T2	C1	C2
L1	395.3	386.2	376.5	365.9	355.4	346.2	254.8	156.7	329.6	342.5	316.7	367.8	291.5
L2	400.2	398.8	396.4	395.4	393.2	391.2	388.9	384.4	393.6	394.7	392.4	395.4	391.7
L3	400.6	399.3	397.9	396.4	394.2	392.9	391.0	387.9	395.0	395.6	394.4	396.2	393.9
L4	399.6	397.8	395.4	392.9	390.4	388.1	385.1	378.6	391.0	392.7	389.3	393.7	388.3
L5	396.9	392.3	387.4	382.2	376.9	371.3	345.4	353.4	378.2	381.2	375.3	383.6	372.9
L6	398.6	395.7	392.6	390.0	386.8	383.7	380.4	370.9	387.3	389.1	385.6	390.4	384.2
L7	399.6	397.3	394.9	392.4	389.6	386.5	383.2	375.1	381.8	391.0	388.6	392.4	387.2
L8	398.4	395.2	391.6	387.9	383.9	379.8	375.4	365.2	384.7	386.5	382.9	388.2	381.1
L9	396.3	389.3	382.2	374.9	366.8	358.6	349.8	177.3	349.4	352.6	346.2	378.8	319.9
L10	400.9	400.3	399.2	397.8	396.1	394.5	392.6	390.4	396.5	396.9	396.0	397.7	395.3
L11	400.8	399.9	398.5	398.1	395.1	393.4	391.6	388.3	395.7	396.3	395.1	396.8	394.6
Mean	**398.8**	**395.6**	**392.1**	**388.5**	**384.4**	**380.6**	**368.9**	**338.9**	-				
								Mean					
Containers													
C1	399.5	397.2	394.5	392.0	388.6	385.6	382.2	373.7	**389.2**				
C2	398.1	394.0	389.6	385.0	380.2	375.5	355.7	304.1	**372.8**				
Treatments													
T1	399.2	396.4	393.3	390.2	386.4	382.9	378.5	341.6	**383.5**				
T2	398.4	394.8	390.8	386.8	382.4	378.3	359.4	336.3	**378.4**				
		L	P	T	C	PxL	PxT	PxC	TxL	CxL	TxC		
CD (P=0.05)		1.6328	1.3924	0.6962	0.6962	4.6181	1.9692	1.9692	2.3091	2.3091	0.9846		

Table 3. Influence of places of storage, seed treatments, containers and period on vigour index

Location	Periods								Mean	Treatments		Conditions	
	P1	P2	P3	P4	P5	P6	P7	P8		T1	T2	C1	C2
L1	3192.6	2849.1	2416.9	2028.4	1523.1	1035.9	513.4	194.9	1719.3	1800.5	1638.1	1865.1	1573.5
L2	3407.1	3273.4	3151.1	2971.4	2773.1	2595.7	2461.9	2249.6	2861.0	2893.6	2828.5	2928.4	2793.7
L3	3433.1	3354.6	3258.9	3136.3	2984.9	2795.1	2618.3	2385.9	2995.9	3026.7	2965.0	3072.3	2919.5
L4	3408.9	3263.2	3077.7	2917.6	2693.4	2497.3	2316.8	2092.3	2783.4	2824.5	2742.2	2867.8	2699.0
L5	3338.9	3073.4	2723.6	2443.9	2104.3	1747.2	1359.1	964.4	2219.3	2322.4	2116.3	2451.4	1987.3
L6	3399.4	3307.9	3168.2	2986.2	2748.3	2508.4	2273.4	1959.6	2793.9	2853.7	2734.2	2894.7	2693.1
L7	3410.1	3243.9	3018.0	2866.4	2668.1	2504.4	2318.6	2036.4	2758.2	2804.0	2712.5	2828.3	2688.2
L8	3398.1	3220.0	3002.4	2822.3	2661.4	2423.5	2157.9	1860.4	2693.3	2766.7	2619.8	2823.7	2562.8
L9	3101.3	2805.5	2432.4	2056.6	1623.3	1181.3	699.0	362.3	1782.7	1879.9	1685.5	2006.1	1559.3
L10	3463.8	3374.8	3237.9	3080.4	2882.4	2695.9	2523.6	2313.9	2946.6	2291.8	2901.3	3082.4	2810.8
L11	3459.1	3339.9	3224.9	3046.2	294.9	2707.6	2567.9	2349.1	2950.2	3005.5	2894.9	3045.3	2855.1
Mean	3364.8	3191.4	2973.8	2760.3	2506.3	2244.5	1982.7	1706.3	-				
								Mean					
Containers													
C1	3401.5	3254.1	3057.6	2861.2	2644.0	2410.5	2178.6	1912.9	2715.0				
C2	3328.1	3128.7	2890.1	2659.5	2368.6	2078.4	1786.8	1499.6	2467.5				
Treatments													
T1	3393.7	3231.9	3022.9	2816.1	2577.5	2328.1	2063.7	1780.1	2651.7				
T2	3335.9	3150.9	2924.7	2704.6	2435.1	2160.9	1901.7	1632.4	2530.8				
		L	P	T	C	PxL	PxT	PxC	TxL	CxL	TxC		
CD (P=0.05)		44.7878	38.1951	19.0976	19.0976	126.6789	54.0161	54.0161	63.3395	63.3395	27.0080		

Table 4. Influence of places of storage, seed treatments, containers and period on electrical conductivity (dSm^{-1})

Location	Periods								Mean	Treatments		Conditions	
	P1	P2	P3	P4	P5	P6	P7	P8		T1	T2	C1	C2
L1	0.310	0.342	0.379	0.424	0.479	0.549	0.643	0.785	0.489	0.475	0.503	0.446	0.531
L2	0.292	0.303	0.317	0.335	0.357	0.382	0.410	0.444	0.355	0.353	0.357	0.336	0.364
L3	0.289	0.300	0.313	0.329	0.348	0.370	0.395	0.433	0.347	0.343	0.351	0.338	0.356
L4	0.297	0.310	0.325	0.344	0.366	0.392	0.422	0.465	0.365	0.601	0.369	0.358	0.373
L5	0.305	0.329	0.355	0.385	0.421	0.465	0.516	0.606	0.423	0.415	0.431	0.405	0.441
L6	0.300	0.316	0.335	0.357	0.383	0.410	0.442	0.490	0.379	0.373	0.385	0.368	0.390
L7	0.300	0.314	0.331	0.345	0.375	0.400	0.435	0.474	0.371	0.367	0.376	0.460	0.382
L8	0.303	0.320	0.340	0.369	0.389	0.418	0.443	0.500	0.384	0.376	0.393	0.369	0.400
L9	0.308	0.340	0.378	0.423	0.476	0.542	0.629	0.764	0.482	0.468	0.497	0.437	0.527
L10	0.286	0.295	0.306	0.321	0.340	0.362	0.386	0.417	0.339	0.333	0.345	0.328	0.350
L11	0.291	0.300	0.313	0.329	0.349	0.372	0.397	0.431	0.348	0.344	0.352	0.339	0.357
Mean	0.298	0.315	0.336	0.359	0.389	0.424	0.465	0.528	-				
								Mean					
Containers													
C1	0.293	0.308	0.326	0.346	0.373	0.403	0.437	0.493	0.372				
C2	0.304	0.323	0.346	0.373	0.406	0.444	0.493	0.564	0.406				
Treatments													
T1	0.295	0.312	0.331	0.354	0.382	0.415	0.454	0.515	0.382				
T2	0.301	0.319	0.340	0.365	0.396	0.432	0.476	0.541	0.396				
		L	P	T	C	PxL	PxT	PxC	TxL	CxL	TxC		
CD (P=0.05)		44.7878	38.1951	19.0976	19.0976	126.6789	54.0161	54.0161	63.3395	63.3395	27.0080		

viz. germination Anon (1985), drymatter production, vigour index (Abdul-Baki and Anderson, 1973) and electrical conductivity (Presley, 1958).

Results and Discussion

It was evident that the variability in percentage of germination was greater at the end of storage period than at the initital period among the seeds stored at different places. The seeds stored at Palur, Petchiparai and Aduthurai lost their viability (52.3, 56 and 58.5%, respectively) after 15,15 and 18th month of storage, respectively, while the seeds stored at Killikulam and Trichy lost their viability (63.8 and 61%, respectively) after 22 months of storage (Table.1). In the other locations seeds maintained higher germination above the certification standard. Similar results were reported by Pushpamma and Reddy (1979), Krishnasamy (1982) in sorghum and Jayaraj *et al.* (1987) in tomato, chilli, brinjal and bhendi.

The per cent reduction in germination of the treated seeds over periods of storage was less in all the locations compared to untreated seeds. The deterioration rate of seeds stored in cloth bags in different zones was higher than those stored in polythene bags. This is in conformity with the findings of Palanisamy and Vanagamudi (1987) in bhendi, Jeyaraj *et al.* (1987) in tomato, chilli, brinjal and bhendi and Singh and Singh (1990) in onion. The poor germination noticed in Palur, Petchiparai and Aduthurai were due to the high RH and temperature.

The variation in drymatter production of the seeds stored at different locations was noticed, irrespective of the containers and treatments (Table. 2). The results are in conformity with the findings of Krishnasamy (1982) and Jeyaraj *et al.* (1990) in sorghum and vegetable seeds, respectively. The rate of reduction of seedling drymatter in the treated seed was less. Between the containers, the seeds stored in polythene bag produced higher drymatter than those stored in cloth bag irrespective of locations. Such results were reported by Doijode (1988) in french bean.

The vigour index of the stored seeds at different locations decreased with increase in the period of storage irrespective of containers and treatments. The reduction in seed vigour was more pronounced after 15 months at Palur and Pechiparai and after 18 months at Aduthurai (Table 3). The rate of reduction of vigour in the treated seed was less. Between the containers, the seeds stroed in polythene bag maintained higher vigour than those stored in cloth bag (Table. 3). Similar results were reported by Doijode (1986) and Jayaraj *et al.* (1990). The increase in electrical condictivity was more pronounced in the seeds stored at Palur, Petchipari and Aduthurai (Table 4). The seeds stored in cloth bag and untreated seeds showed increased values compared to polythene bag stored and treated seeds, respectively. Such increase in EC value has already been reported by Dharmalingam *et al.* (1976) and Saxena and Gita Singh (1987).

The reduction in germination, drymatter production and vigour index and increase in EC value of the seeds at different places of storage varied and this might be due to the differences in weather factors, especially RH and temperature (Delouche *et al.* 1973). The poor storability of the seeds stored in cloth bag might be due to increase in the moisture content of the seed due to the pervious nature of the container as reproted by Thomas (1979). Bhendi seeds could be stored better in Kodaikanal, Coimbatore, Yercaud and Paiyur without loss of viability for more than 24 months.

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Consumers preference and perceptions to fresh and processed spices in Coimbatore and Palakkad

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Abstract : A study was conducted in Coimbatore and Palkkad with 200 sample respondents to analyse the consumers preference to fresh and processed spices in 1998. The results revealed that consumers distinguish fresh and processed spices as different products. Consumers preference was more for fresh spices than for processed one. *(Key words: Spices, Consumer, Preference, Fresh, Processed; Perceptions).*

The history of Indian spices dates back to the begining of human civilization. India is the largest producer, consumer and exporter of spices in the world. Though India is the leading producer of spices, it consumes 93 per cent of its production. It is estimated that the global import demand in 2000 AD for pepper was 1.85 lakh tonnes, for chillies 0.37 lakh tonnes, turmeric 0.38 lakh tonnes, ginger 0.23 lakh tonnes and small cardamom 0.12 lakh tonnes (Source: Indian Agriculture, 1996).

Change in food habits and practices could be attributed to changing attitudes of housewives towards cooking task, reduced dependence on servants, increased usage of appliances, non-traditional foods or easy to prepare snacks entering the menu, change initiated by children and status factor (Cherian, 1995). Environmental factors which add impetus to the above factors are liberalisation of economy, globalization of business and special concessions to food industry.

Ying Chein and Potty (1996) reported that in traditional foods and medicinal preparations in India, China and many countries with ancient civilisations spices especially of herbal origin form an important ingredient in various food