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RESEARCH ARTICLE

Effect of seed pelleting chemicals and storage containers on storability of brinjal (*Solanum melongena* L.)

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SUMMARY

The storage experiment was carried out for a period of 12 months under ambient conditions in the laboratory of Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Dharwad from August 2004 to July 2005 The seed pelleting treatments and storage containers differed significantly with regard to seed quality parameters through out the storage period under ambient condition over control. Among the seed pelleting treatments, bavistin (1%) recorded significantly higher germination percentage (85.70) and seedling vigour index (887) than the other treatments ($ZnSO_4$, $MnSO_4$, DAP and control) followed by arappu leaf powder (250g/kg) at the end of12months of storage period. Among the containers polythene bag 700gauge recorded significantly higher germination (82.50%), vigour index (790) than the paper bag at the end of 12months of storage period.

Key Words : Pelleting chemicals, Storage containers, Polythene bag, Brinjal, Germination

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Brinjal (*Solanum melongena* L.) commonly know as egg plant, belongs to the family Solanaceae and referred by different names, *viz*., egg plant, aubergine, garden egg (French), baigan (Hindi), badanekai (Kannada), vangi (Marathi) and vankaya (Telugu). Brinjal is an important vegetable crop grown in India throughout the year. India is regarded as the center of origin of brinjal (Vavilov, 1931). Contrary to the common belief, it is quite high in nutritive value and can be well compared with tomato. Brinjal fruit contains high amount of carbohydrates (6.4%), protein (1.3%), fat (0.3%), calcium (0.02%), phosphorus (0.02%), iron (0.0013%) and other mineral matters. Apart from this, it also contains β-carotene (34 mg), riboflavin (0.05 mg), thiamine (0.05 mg), niacine (0.5 mg) and ascorbic acid (0.9 mg) per 100 g fruit (Choudhary, 1976). The brinjal plant contains an alkaloid called "solanine" found in roots and leaves. Some medicinal use of egg plant tissues and extract include treatment of diabetes, asthma, cholera, bronchitis and diarrhea, its fruits and leaves are reported to lower blood cholesterol levels. Since the loss of viability impairs the biological and planting value of seed, it is of special concern to breeders, businessmen and farmers. Several factors *viz*., inherent genetic potential, initial seed quality, environment during seed production, seed moisture content, mechanical damage, seed borne mycoflora, storage insects, seed dressing chemicals and seed treatments influence the seed longevity and affect subsequent field performance. Hence, storage of seeds after harvest till next planting time assumes prime importance for successful seed production programme. In agriculture, to achieve a desired plant population and a high probability of successful establishment of each seed planted, precision planting is advocated. The most essential phase of precision planting is the singling of seeds for exact placement at a predetermined depth and spacing in the soil with a uniform coverage and at reasonable planting speed. Singling is difficult for small seeds

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which are low in density and irregular in shape. To overcome these difficulties, seed pelleting is advocated (Barathi *et al.*, 2003). Seed pelleting is the process of enclosing a small and irregular seeds with a small quantity of inert material just large enough to produce a globular unit of standard size to facilitate precision planting. It is also a mechanism of applying needed materials in such a way that they affect the seed or soil at the seed-soil interface. Thus, seed pelleting provides an opportunity to package, effective quantities of materials such that they can influence the micro-environment of each seed (Krishnasamy, 2003).

MATERIAL AND METHODS

The storage experiment was carried out for a period of 12 months under ambient conditions in the laboratory of Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Dharwad from August 2004 to July 2005. The four month old hybrid seed of brinjal cv. ARKA NAVNEET, processed and cleaned were obtained from the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The experiment consisted of 12 treatment combinations involving five chemicals (Bavistin, $ZnSO_4$, $MnSO_4$, DAP, Arappu leaf powder and without chemical) as one factor and two containers (Paper bag, polythene bag 700 gauge) as another factor with four replications and laid out in Complete Randomized Design with two factorial concept. The details of the treatments are furnished below.

Factor I : Seed pelleting (P)
P_1 : Bavistin (1%)
P_2 : $ZnSO_4$ (300 mg/kg)
P_3 : $MnSO_4$ (2%)
P_4 : DAP (60 g/kg)
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)
P_0 : Control (without pelleting
Factor II : Containers (C)
C_1 : Paper bag
C_2 : Polythene bag (700 gauge)
Treatment combinations : 6 x 2 = 12

1. P_1C_1	5. P_5C_1	9. P_3C_2
2. P_2C_1	6. P_0C_1	10. P_4C_2
3. P_3C_1	7. P_1C_2	11. P_5C_2
4. P_4C_1	8. P_2C_2	12. P_0C_2

Adhesive material : Gum @ 30 ml per kg of seed
Filler material : Ash @ 35 g per kg of seed.

Procedure of seed pelleting:

Before imposing seed treatments, the seeds were manually cleaned and subjected for processing. The three basic steps involved in seed pelleting are stated as stamping, coating and rolling. The materials needed for pelleting were seed, adhesive and filler materials. The seeds were uniformly coated with adhesive and chemicals mentioned in correct quantity initially. Then the filler materials (Ash) were sprinkled on the coated seeds and were rolled on the filler material for effective and uniform coating The seeds after pelleting as per treatment were dried back to their original moisture content and stored in paper bags and polythene bag (700 gauge) in the laboratory of the Department of Seed Science and Technology, College of Agriculture, Dharwad (Zone-8) under ambient conditions for 12 months (Aug. 2004 to July 2005).The design of the experiment adopted was Completely Randomized Design with two factors including four replications. The seeds were drawn at random from the bag as bimonthly interval for analysing the seed quality characters' on germination (%), speed of germination, root length (cm) shoot length (cm), seedling vigour index, seedling dry weight (mg), field emergence (%). The mean experimental data were analysed by Fisher's method of analysis of variance (Sundararaj *et al.*, 1972). All the observations recorded were subjected to 'F' test, wherever, 'F' test found significant 't' test was carried out and level of significance used for 't' test was P = 0.05. The data on percentage germination and field emergence were transformed into arc sine root percentage and transformed data were used for the statistical analysis.

RESULTS AND DISCUSSION

Different data have been presented in Table 1-8.

During storage, viability and vigour are lost due to many biotic factors like storage pest and other microflora. The insect pest and fungi cause considerable damage and are responsible for deterioration and reduction in storage potential of seed. So, seed treatment with suitable chemicals and botanicals will reduce the quantitative and qualitative loss besides maintaining quality of the seed for longer period.

In the present study, seed pelleting with fungicide, chemical and botanical had a significant effect on germination. Seeds treated with bavistin gave significantly higher germination throughout the storage period followed by seeds treated with arappu leaf powder, $MnSO_4$, $ZnSO_4$, DAP over control. The probable reasons for the differences in storability of seeds treated with different chemicals and botanicals may be due to the variation in effectiveness of these chemicals and botanicals in combating the seed borne pathogens and also may be due to the persistence of these chemicals on seed in storage for longer time and might have reduced the germination. The seed pelleting with bavistin was found to preserve the quality of seed by its antifungal effect. Bavistin also protect the seed from fungal and insect attack finally contributing to seed quality parameters (Taylor and Eckenrode, 1993). Similar findings were reported by Jayaraj *et al.* (1988) in capsicum, Gupta and Singh (1990) in vegetable, mung and cowpea seeds for bavistin and thiram. Gutpa *et al.* (1994) in chilli for thiram and bavistin, Raju and Sivaprakasam (1994) in cabbage and Ramanathan and Sivaprakasam (1994) in chilli

for bavistin and thiram. Beneficial effects for arappu leaf powder may be due to the presence of certain bioactive principles which might synergistically interact with amino acids especially tryptophan to form the indole acetic acid (IAA) in germinating seeds to bring about enhancement in seedling growth (Krishnasamy and Basaria Begam, 2003). Increased seed quality parameters may be due to the physiologically active substances present in the arappu leaf powder which might have activated the embryo and other associated structure leading to development of stronger and efficient root system and higher vigour index Ahmed Raza, 1997). Similar results upholding the beneficial effects of botanicals were reported by Vasantha (1995) in redgram, Nargis *et al.* (1992) in tomato, Renugadevi and Jaculine (1995) in ash gourd, Ahmed Raza (1997) in onion. However, a decline in per cent germination was observed in all the treatments with advance in storage period, which may be attributed to phenomenon of ageing, depletion of food reserves, decline in synthetic activity and degradation of seed coat which resulted in leaching of its constituents as reported by Chandrasenan (1996) in chilli and Joeraj (2000) in sunflower.

Among the seed pelleting treatments, bavistin followed by arappu leaf powder recorded significantly higher root length, shoot length, seedling vigour index and seedling dry weight during the storage period. This may be due to the control of physiological deterioration of seeds by their antifungal and antioxidant effects, increased enzymatic activity, efficient translocation of the nutrients from the seed into the initially heterotropic seedling. Similar findings were also reported by Vijayakumar *et al*. (1991) in onion and Sharanamma (2002) in chilli. With respect to storage periods, the germination, root length, shoot length, seedling vigour index, seedling dry weight decreased as the storage period increased. This may be due to damage to membranal enzyme, proteins and nucleic acids and such degenerative changes resulted in the complete disorganization of membranes and

Table 1 : Effect of seed pelleting on initial seed quality parameters of brinjal hybrid seeds cv. ARKA NAVNEET

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	SVI	SDW (mg/10 seedlings)	Speed of germination	Field emergence (%)
P_0 : Control	94.20 (76.06)*	6.00	5.00	992	460	12.88	85.10 (67.24)*
P_1 : Bavistin (1%)	98.10 (82.00)	8.00	6.00	1373	494	13.99	90.00(71.57)
P_2 : $ZnSO_4$ (300 mg/kg)	95.70 (78.08)	7.18	5.60	1223	489	13.64	88.20 (69.84)
P_3 : $MnSO_4$ (2%)	95.10 (77.23)	7.05	5.50	1194	481	13.56	88.00 (69.73)
P_4 : DAP 60 g/kg	94.80 (76.36)	6.69	5.30	1132	475	13.42	86.10 (68.05)
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	97.10 (78.65)	7.80	5.85	1325	491	13.71	89.10 (70.68)
Mean	95.20 (77.35)	7.07	5.53	1197	482	13.54	87.80 (69.52)
S.E.±	1.65	0.14	0.13	24.10	6.7	0.16	0.91
C.D. (P=0.05)	NS	0.40	0.38	71.60	20	0.36	2.70

* Figures in the parentheses indicate arc sine transformed values NS=Non-significant
SVI : Seedling vigour index SDW : Seedling dry weight

Table 2 : Effect of seed pelleting and containers on germination (%) during storage of brinjal hybrid cv. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	87.50 (69.30)*	85.10 (67.24)	82.60 (65.31)	80.10 (63.52)	76.60 (61.08)	72.00 (58.40)
P_1 : Bavistin (1%)	96.70 (79.56)	95.20 (77.32)	93.70 (75.45)	92.20 (73.76)	89.70 (71.25)	85.70 (67.74)
P_2 : $ZnSO_4$ (300 mg/kg)	93.20 (74.80)	91.60 (73.13)	90.20 (71.69)	88.70 (70.31)	86.30 68.21)	82.20 (65.03)
P_3 : $MnSO_4$ (2%)	92.60 (74.20)	89.50 (71.60)	87.60 (69.37)	85.20 (67.38)	81.90 (64.88)	77.70 (61.77)
P_4 : DAP 60 g/kg	91.60 (73.10)	88.60 (70.21)	85.90 (67.96)	83.60 (66.12)	80.10 (63.46)	75.70 (60.44)
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	95.70 (76.68)	94.20 (76.06)	92.60 (74.21)	91.10 (73.64)	88.10 (69.82)	84.70 (66.97)
S.E.±	0.73	0.25	0.60	0.54	0.50	0.50
C.D. (P=0.05)	2.08	1.73	1.64	1.64	1.38	1.38
Containers (C)						
C_1 : Paper bag	92.30 (73.98)	89.70 (71.27)	87.10 (68.94)	84.60 (66.89)	80.90 (64.11)	76.70 (61.27)
C_2 : Polythene bag	93.60 (75.38)	92.00 (73.58)	90.50 (73.04)	89.10 (70.68)	86.80 (68.65)	82.50 (65.23)
S.E.±	0.30	0.61	0.23	0.22	0.20	0.20
C.D. (P=0.05)	0.85	0.70	0.67	0.63	0.56	056

* Figures in the parentheses indicate arc sine transformed values

Table 3 : Effect of seed pelleting and containers on speed of germination during storage of brinjal hybrid cv. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	12.58	12.13	11.78	11.42	10.92	10.35
P_1 : Bavistin (1%)	13.78	13.57	13.35	13.14	12.78	12.21
P_2 : $ZnSO_4$ (300 mg/kg)	13.28	13.07	12.85	12.64	12.28	11.71
P_3 : $MnSO_4$ (2%)	13.21	12.85	12.50	12.14	11.73	11.07
P_4 : DAP 60 g/kg	13.06	12.64	12.26	11.92	11.36	10.78
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	13.49	13.28	13.07	12.85	12.58	11.97
S.E.±	0.09	0.08	0.08	0.09	0.09	0.09
C.D. (P=0.05)	0.24	0.24	0.24	0.25	0.25	0.25
Containers (C)						
C_1 : Paper bag	13.14	12.76	12.40	12.04	11.52	10.95
C_2 : Polythene bag	13.31	13.09	12.87	12.66	12.33	11.73
S.E.±	0.03	0.03	0.03	0.04	0.04	0.04
C.D. (P=0.05)	0.09	0.09	0.09	0.10	0.10	0.10

Table 4 : Effect of seed pelleting and containers on root length (cm) during storage of brinjal hybrid cv. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	5.71	5.42	5.13	4.84	4.55	4.25
P_1 : Bavistin (1%)	7.69	7.42	7.18	6.92	6.65	6.06
P_2 : $ZnSO_4$ (300 mg/kg)	6.95	6.73	6.50	6.27	6.05	5.78
P^3 : $MnSO_4$ (2%)	6.83	6.61	6.40	6.18	5.97	5.65
P_4 : DAP 60 g/kg	6.38	6.11	5.84	5.57	5.30	4.80
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	7.64	7.35	7.15	6.89	6.60	5.95
S.E.±	0.03	0.03	0.02	0.02	0.04	0.05
C.D. (P=0.05)	0.09	0.09	0.06	0.06	0.11	0.16
Containers (C)						
C_1 : Paper bag	6.77	6.48	6.18	5.88	5.59	5.25
C_2 : Polythene bag	6.82	6.62	6.42	6.21	6.01	5.57
S.E.±	0.01	0.01	0.01	0.01	0.02	0.02
C.D. (P=0.05)	0.03	0.03	0.03	0.03	0.06	0.06

Table 5 : Effect of seed pelleting and containers on shoot length (cm) during storage of brinjal hybrid cv. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	4.73	4.45	4.18	3.90	3.63	3.35
P_1 : Bavistin (1%)	5.72	5.46	5.20	4.95	4.75	4.30
P_2 : $ZnSO_4$ (300 mg/kg)	5.31	5.11	4.91	4.71	4.44	3.95
P_3 : $MnSO_4$ (2%)	5.23	4.98	4.73	4.48	4.23	3.88
P_4 : DAP 60 g/kg	5.14	4.75	4.48	4.20	3.93	3.66
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	5.60	5.37	5.16	4.85	4.70	4.20
S.E.±	0.07	0.04	0.03	0.04	0.04	0.05
C.D. (P=0.05)	0.20	0.11	0.08	0.11	0.11	0.16
Containers (C)						
C_1 : Paper bag	5.23	4.94	4.66	4.73	4.12	3.75
C_2 : Polythene bag	5.32	5.06	4.85	4.63	4.41	3.99
S.E.±	0.03	0.02	0.01	0.02	0.02	0.02
C.D. (P=0.05)	0.09	0.06	0.03	0.06	0.06	0.06

Table 6 : Effect of seed pelleting and containers on seedling vigour index during storage of brinjal hybrid CV. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	913	839	768	699	626	552
P_1 : Bavistin (1%)	1293	1224	1160	1092	1021	887
P_2 : $ZnSO_4$ (300 mg/kg)	1139	1082	1026	971	903	798
P_3 : $MnSO_4$ (2%)	1115	1050	973	906	832	739
P_4 : DAP 60 g/kg	1054	961	886	817	735	640
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	1267	1198	1140	1070	996	835
S.E.±	11.11	10.50	7.81	9.16	9.80	9.60
C.D. (P=0.05)	31.70	29.90	22.30	26.24	27.90	27.30
Containers (C)						
C_1 : Paper bag	1106	1023	945	869	787	694
C_2 : Polythene bag	1133	1072	1091	965	902	790
S.E.±	4.53	4.30	3.20	3.74	3.98	5.52
C.D. (P=0.05)	12.90	12.22	9.09	10.70	11.40	15.80

Table 7 : Effect of seed pelleting and containers on seedling dry weight (mg) during storage of brinjal hybrid CV. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	438	415	393	370	348	325
P_1 : Bavistin (1%)	477	460	444	428	412	395
P_2 : $ZnSO_4$ (300 mg/kg)	470	453	436	419	402	380
P_3 : $MnSO_4$ (2%)	463	446	428	411	393	375
P_4 : DAP 60 g/kg	454	433	412	392	371	350
P_5 : Arappu leaf powder (*Albizzia amara*) (250 g/kg)	473	459	442	427	411	392
S.E.±	0.84	061	0.71	0.70	0.61	1.11
C.D. (P=0.05)	2.41	11.74	2.03	1.95	1.75	3.25
Containers (C)						
C_1 : Paper bag	461	441	422	402	383	362
C_2 : Polythene bag	464	446	430	412	395	377
S.E.±	0.34	0.25	0.30	0.30	0.30	0.50
C.D. (P=0.05)	0.98	0.71	0.80	0.88	0.81	1.38

Table 8 : Effect of seed pelleting and containers on field emergence per cent during storage of brinjal hybrid CV. ARKA NAVNEET

Seed pelleting Treatments (P)	Storage period (months)					
	2	4	6	8	10	12
P_0 : Control	83.40 (65.96)*	80.10 (63.50)	81.40 (64.41)	74.60 (59.71)	71.40 (57.67)	62.60 (52.25)
P_1 : Bavistin (1%)	88.60 (70.19)	87.60 (69.37)	86.60 (68.45)	85.60 (67.65)	83.30 (65.84)	76.60 (61.02)
P_2 : $ZnSO_4$ (300 mg/kg)	86.60 (68.45)	85.70 (67.74)	84.60 (66.85)	83.60 (66.10)	80.70 (63.90)	72.10 (58.08)
P_3 : $MnSO_4$ (2%)	86.60 (68.45)	84.60 (66.85)	82.70 (65.37)	80.60 (63.85)	76.20 (60.78)	69.50 (56.49)
P_4 : DAP 60 g/kg	83.60 (66.06)	81.20 (64.26)	78.60 (62.44)	76.30 (60.82)	73.60 (59.04)	66.50 (54.65)
P_5 : Arappu leaf powder (*Albizzia amara*) (250g/kg)	87.50 (69.27)	86.60 (68.54)	85.60 (67.65)	84.60 (66.85)	82.40 (65.14)	75.60 (60.40)
S.E.±	0.58	0.50	0.50	0.50	0.50	0.40
C.D. (P=0.05)	1.41	1.40	1.34	1.37	1.38	1.15
Containers (C)						
C_1 : Paper bag	85.50 (67.55)	83.70 (66.16)	81.83 (64.68)	80.10 (63.44)	76.60 (61.05)	68.80 (56.03)
C_2 : Polythene bag	86.70 (68.58)	84.90 (67.18)	83.60 (66.04)	81.90 (64.89)	79.50 (63.05)	72.00 (58.03)
S.E.±	0.20	0.20	0.20	0.20	0.20	0.20
C.D. (P=0.05)	0.58	0.65	0.55	0.53	0.53	0.55

* Figures in the parentheses indicate arc sine transformed values

cell organelles (Roberts, 1972).

The seed pelleting treatments had significant effect on vigour during all the months of storage period. The seeds treated with bavistin gave higher vigour followed by arappu leaf powder due to their contact and specific nature of action against a wide variety of fungi infecting brinjal during storage. Loss of vigour index in terms of germination, root length, shoot length, seedling dry weight in okra was observed by Doijode (1986) during storage.

In this study, micronutrients ($ZnSO_4$, $MnSO_4$, DAP) were found effective against control (without seed pelleting) but ineffective against bavistin, arappu leaf powder because micronutrients do not have antifungal action, use of higher dose of micronutrients causes toxic effect on the seed quality. Micronutrients are not helpful in enhancing storage life of the seed, but helpful in plant establishment in the field (Krishnasamy and Basaria Begam, 2003).

Among the different months of storage, initial months recorded higher vigour index compared to the last months of storage. Doijode (1993) reported that seed storability and seedling vigour are related to storage period in onion. In the present study, germination percentage, root length, shoot length, vigour index, seedling dry weight, field emergence and speed of germination were declined progressively with increase in the storage period in the seeds stored in both the containers (paper bag and polythene bag). Significantly higher values for germination, root length, shoot length, vigour index and seedling dry weight were recorded in the seeds stored in polythene bag while, the seeds stored in paper bag recorded lower values which may be attributed to a larger fluctuation in moisture content leading to a faster rate of deterioration in the seeds stored in paper bag. These results are in conformity with the reports of Karivaratharaju *et al*. (1987) in brinjal, Elizabeth and Warham (1986) in onion, Palanisamy and Vanagamudi (1987) in okra and Doijode (1997a) and (1997c) in okra and tomato.

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