ENHANCING THE STORAGE LIFE AND QUALITY OF SUNFLOWER (*HELIANTHUS ANNUS* L) SEED USING DESICCANT (ZEOLITE) BEADS

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Abstract: The present study was conducted on storage of sunflower seed using desiccant (Zeolite) beads made of aluminum silicate to study the effect of the beads on seed longevity and quality of sunflower hybrid (NDSH-1) from August, 2012 to October, 2013 at Seed Research and Technology Centre, Rajendranagar. The treatments included storing the seed in air tight container; storing the seed in air tight container with silica gel (1:0.17); storing the seed in air tight container with zeolite beads (1:0.35); seed in cloth bag and seed stored in gunny bag (Control) under ambient storage conditions. The experiment was laid out in completely randomized design with three replications.Data were collected on seed quality parameters at alternate months during the storage period and statistically analyzed. The study revealed that sunflower seed lots stored in air tight container along with zeolite beads was significantly superior compared to other treatments with respect to germination per cent (81.3), field emergence (83%), seedling vigour index (23.31) based on seedling dry weight and seedling vigour index (1768.4) based on seedling length after a period of 14 months storage followed by seed lots stored in airtight containers along with silica gel. However, the seed lots stored in gunny bag was inferior as it recorded a lower germination per cent of 35, field emergence (53%), seedling vigour index (SVI I) based on seedling dry weight (8.42) and seedling vigour index (SVI II) based on seedling length (9678.8) at the end of storage period of 14 months.

Introduction: High quality seeds of improved varieties are essential to enhance the productivity of crops. Seeds are hygroscopic in nature and the moisture content of the seed changes in accordance to the relative humidity of the surrounding environment in which they are stored. In tropical climate, high temperature and humidity cause rapid deteoration of seed in open storage resulting in loss of viability, poor stand establishment, lower productivity and disincentive to invest in improved seeds. In general, seed longevity is reduced by approximately half for every one per cent increase in seed moisture content or five degrees increase in temperature and effects are additive (Miller and Lawrence, 1998). Thus, combination of temperature and moisture content result in rapid loss of viability.

Generally, the moisture content of the seeds harvested at physiological maturity is high (15-18 %). For safe seed storage the moisture content need to be brought down to 6-13 %. However, if seeds are dried to low moisture content, these are much better able to survive in storage even at high temperatures (Sastry *et al*, 2007). Majority of crop seeds in India are locally produced, stored and utilized. Improved varieties can enhance productivity and quality and expand the market opportunities. Therefore, there is need to develop low cost drying methods as alternative to expensive seed drying equipments in order to lower the moisture content and to maintain safe moisture level for longer storage life. Drying beads are modified ceramic materials (Aluminum silicates or Zeolites) that absorb and hold water molecules very tightly in their microscopic pores. The beads will continue to absorb water until all their pores are filled up to 20 per cent of their initial weight (Nasaari *et al*., 2014). Seeds placed in to a container with beads will lose water due to low air humidity and will continue to do so until they come to equilibrium. Thus, it has been proposed that in lieu of humidity controlled and air conditioned storage facilities, which require expensive and reliable energy sources to run and maintain. Seeds can be dried to low moisture levels and sealed in hermetic containers without temperature control. Zeolite beads are used in the present study due to their micro pores and strong affinity to absorb and hold water very tightly. Thus, seeds can be used for longer period without loosing viability and vigour. The current investigation was carried out to study the effect of zeolite beads on storability and seed viability.

Materials and Methods:

Freshly harvested seed material of Sunflower hybrid (NDSH-1) was obtained from Regional Agricultural Research Station, Nandyal. The seed material was measured for moisture content and reduced to eight per cent by spreading in a thin layer on ground at a temperature ranging from 29°C to 34 °C for 30 hours with a duration of five hours a day. Then the treatments were imposed *viz*., seed stored in air tight container; seed stored in air tight container with silica gel (1:0.17); seed stored in air tight container with zeolite beads (1:0.35); seed stored in cloth bag and seed stored in gunny bag under ambient conditions. Seeds with 10 per cent moisture content were utilized for testing the longevity during storage. The experiment was laid out in CRD replicated thrice. The containers were kept under ambient storage conditions. Bimonthly observations on germination per cent (ISTA, 2004), moisture percent (ISTA 2004), field emergence and seedling vigour index (SVI)

(Abdul-Baki and Anderson, 1973) were recorded. The data were statistically analyzed using Anova technique (Panse and Sukhatme. 1985). Standard error of difference was calculated at 5 per cent probability level to compare the mean difference among the treatments.

Results and Discussion: Mean initial germination per cent of seed lots stored in different containers was 95.3 and there was no significant difference among the treatments. After a storage period of 14 months, the germination per cent was reduced drastically in all the treatments. However, germination per cent in the seed lot stored in air tight container along with drying beads (81.3%) was significantly superior followed by seed lot stored in air tight container along with silica gel (76.0%) (Table 1 and 2). The seed lots stored in gunny bag recorded the lowest germination per cent of 35.0% at the end of storage period. Similar findings were reported by Kong and Zhang (1998) by storing the asparagus beans along with silica gel with a ratio of 4:1. Further, Eklou *et al* 2006 also found that rice seed stored with silica gel at the ratio of 1:1 could reduce the moisture content to five per cent and improved the seed longevity.

The fluctuations in moisture content were more in seed stored in gunny bag and the moisture content was higher at the end of storage period (9.13%). The seed lot stored in air tight container along with drying beads recorded significantly lower moisture content (4.71%) followed by seed lot stored in air tight container along with silica gel (7.1%). The moisture trend showed that sunflower seed (1kg) stored with 350 g of zeolite beads had reduced the moisture to 3.97 per cent at the end of few hours of mixing with beads and this was maintained during the entire storage period (Table 1 and 2). The current findings are in accordance with the work of Ejeromedoghene (2010) who reported that seeds stored with desiccant beads had significantly reduced the moisture content throughout the storage period and also had their viability and vigour better maintained than those stored with other means like silica gel. Therefore, the storage life of the seeds stored under moisture controlled environment usually longer than seeds stored under ambient storage conditions and seed deteoration is faster than the later (Oyekale, 2010). Sastry *et al*. (2007) stated that groundnut seed survived for 20 weeks when seed moisture content decreased from 10.1% to 3.4 %. Seed stored at moisture content of 10.1% deteorated faster and lost viability with in a short period. Significant and lower qualitative seed quality parameters were observed in gunny bag during entire storing period may be due to its permeable nature which might have favored the longer fluctuations in moisture content leading to metabolic and respiratory activity of the seeds compared to airtight containers, where in seed quality parameters were comparatively superior with slow rate of seed deteoration. Similar beneficial effects were documented by Venkatasalam (2001) in Tomato and Veena (2007) in Onion.

The superiority of seed lot stored in air tight container along with drying beads also continued for seedling vigour index (Based on seedling length) at the end of the storage period (1768) followed by seed lot stored in air tight container along with silica gel (1438) (Table 1 and 2). Similarly, seedling vigour index based on seedling dry weight and field emergence were also higher for seed lot stored with zeolite beads (23.31 and 83.0%) while the seed lot stored in gunny bag recorded the lowest (654) seedling vigour index based on seedling length and 5.44 based on dry weight. However, field emergence recorded by the seed lot stored in gunny bag was 51 per cent after 14 months of storage. The results are in line with the reports of Gupta *et al* (1989). The seed lot stored in air tight container along with drying beads was found to be superior during storage with respect to all seed quality parameters. Singh and Dadlani (2003) and Usha *et al* (1990) also reported significantly superior performance for seed quality parameters for Sesame and Soybean seeds stored along with charcoal.

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Table 1 : Effect of drying beads in air tight containers on seed quality parameters of sunflower after 2 months of storage

Treatment	Germination (%)	Moisture (%)	Seedling length (cm)	Seedling dry weight (mg)	VI-I	VI-II	FE (%)
T1 (Seed stored in polythene 700 guage bag)	89	4.97	31.61	0.218	2806.1	19.45	83
T2 (Seed stored in air tight container)	92.3	4.73	29.82	0.225	2752.6	20.78	89.6
T3 (Seed stored in polythene bag + silica gel)	94	4.50	34.34	0.231	3228.7	21.76	91.3
T4 (Seed stored in air tight container + drying beads)	90.3	3.97	33.56	0.218	3041.3	19.46	88.3
T5(Seed stored in gunny bag)	88.3	5.93	32.72	0.212	2911.4	18.43	86.6
T6 (Seed stored in cloth bag)	82.0	5.93	31.09	0.216	2277.8	17.82	79.0
Mean	89.3	5.00	32.19	0.22	2836.32	19.62	86.3
S.Em±	**10.53**	**1.31**	**1.16**	**0.01**	**1.35**	**1.01**	**3.11**
CD at 5%	**N.S**	**4.14**	**3.65**	**N.S**	**427.46**	**3.19**	**9.81**

Table 2 : Effect of drying beads in air tight containers on seed quality parameters of sunflower after 14 months of storage							
Treatment	**Germination (%)**	**Moisture (%)**	**Seedling length (cm)**	**Seedling dry weight (mg)**	**VI-I**	**VI-II**	**FE (%)**
T2 (Seed stored in air tight container)	73.0	8.63	16.6	0.150	10.92	1212	63.0
T3 (Seed stored in polythene bag + silica gel)	76.0	7.1	19.0	0.170	12.69	1438	73.0
T4 (Seed stored in air tight container + drying beads)	81.3	4.71	21.7	0.286	23.31	1768	83.0
T5(Seed stored in gunny bag)	35.0	9.13	18.7	0.160	5.44	654	51.0
T6 (Seed stored in cloth bag)	55.7	8.10	15.8	0.152	8.52	678	53.0
Mean	64.5	7.73	17.53	0.180	11.95	1105	63.8
S.Em±	**2.82**	**0.25**	**0.59**	**0.01**	**0.79**	**58.7**	**2.77**
CD at 5%	**8.88**	**0.81**	**1.88**	**0.22**	**2.50**	**184.9**	**8.75**

VI-I: Seedling vigour index based on dry weight;
VI-II: Seedling vigour index based on seedling length
E.E: Field emergence

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