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SEED QUALITY DETERIORATION DUE TO TEMPORAL VARIATION OF BIOTIC AND ABIOTIC FACTORS IN CUCUMBER

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Abstract

Cucumber seeds were taken to assess the effect of temporal variation on the seed quality. Seeds were stored in three types of containers, such as metal (tin), polythene bag, and cloth bag. The containers were stored at room temperature and ambient relative humidity around three months. Seed quality factors viz., moisture content, germination percentage, vigor index, percentage of abnormal seedling, fresh seed, dead seed, hard seed, root-shoot ratio and amount of dry matter were recorded every 15 days interval. The initial moisture content of seed in tin, poly bag, and cloth bag were 10.66%, 10.13%, and 9.89%, respectively, but it was increased with increasing storage time after 60 days (11.08%, 10.67%, and 10.98%). The germination percentage was higher at 15 days after observation (DAO) for different containers like tin (90%), poly bag (86%), and cloth bag (85%) than after 60 DAO (86%, 84%, and 80%), respectively, on blotting paper substrate. The percentage of dead seed was increased from 2 to 10%, 5 to 12%, and 6 to 12% in tin container, poly bag, and cloth bag, respectively, from 15 DAO to 60 DAO. The vigor indexes of seedling were 14.58, 12.85, and 10.92 at 15 DAO in tin, poly bag, and cloth bag, respectively, which attained at 10.39, 10.26, and 10.08 at 60 DAO, respectively. The length of seedling was 25.85 cm, 25.15 cm, and 24.30 cm at 60 DAO in tin, poly bag, and cloth bag, respectively. Shoot-root ratio was found highest in tin container at 15 DAO (0.95) and lowest in cloth bag (0.70) at 60 DAO.

Key Words: Seed quality, cucumber, temporal variation, biotic and abiotic factors.

Introduction

Cucumber *(Cucumis sativus* L.) belongs to the family cucurbitaceae. There are 30 *Cucumis* species found in Asia and Africa. Cucumber is a native to the tropics and is one of the oldest cultivated vegetable crops. It is known in the history for over 3,000 years (Yawalkar, 1985).

Two distinct fruit morphotypes are found in Bangladesh, one is round fruited type called Khira grown in winter season and the other is long type called Shosha mostly in summer season (Ali *et al.,* 1993).

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In our native climate, three factors: bad weather, insect, and disease are prevailing. Considering the deleterious effect of these three factors, it is generally said that the seeds in Bangladesh are in adverse condition of storage; therefore, quality deterioration is quite likely. But there is lack of scientific data about the quality status of the seed used for crop production.

Seed quality and longevity of seeds during preservation period mainly depends on two major factors: biotic factors like insects, fungi, bacteria, virus, rodents, etc. and abiotic factors like temperature, relative humidity, moisture content, rainfall, day length, and sunshine, etc.

The factors like moisture, temperature, relative humidity and activity of pests are related to the retention of seed viability in storage. High temperature, relative humidity and moisture in the storage environment appear to be principal factors involved in deterioration of seed quality. Loss of germination capacity is the final manifestation of seed deterioration. Seed kept in metal container has the lowest moisture content followed by polythene bag, earthen pot, jute bag, and bamboo bin. The metal container can restrict movement of moisture from ambient atmosphere into the seed better than other container (Huda, 2001). The declination of germinability with high moisture content is related to the hygroscopic nature of seeds, especially under worm temperatures, which in turn is associated with the relative humidity of the surrounding air (Delouche *et al.,* 1973). Cucumber seed *(Cucumis sativus)* with 12 % initial moisture content were stored at 70 % RH and 20°C for upto 12 months and germination percentage remained high throughout the storage period, while vigor decreased and electrolyte leakage increased from 6 months of storage (Lin, 1999). Doijode (1997) reported that the polythene bags are effective in maintaining high viability at 50^0 C and could be used for seed storage, while aluminium soil pouches are suitable for the long-term storage of seeds (germplasm), especially at sub-zero temperatures. Storage temperature played a significant role in the development of seed mycoflora during storage, the minimum fungal development occurring at 40°C and 15^0C and the maximum at 20-30°C (Pratima, 1998). Lower germination of farmer's seed may be due to higher infestation of pathogen, which has negative relationship between pathogen percent and the germination of seeds (Hossain *et al.,* 1994). Fungi and bacteria which commonly occur on and in seeds can easily and seriously affect their viability in several different ways. Their respiration for instance produces energy which may raise the seeds' temperature and cause their death. Thus the present study has been undertaken with the following objectives:

i. to identify the best storage container for maintaining quality of cucumber seed.

ii. to know the effect of moisture on the germination percentage and weight of Cucumber seed.

iii. to asses the vigority of cucumber seeds obtained from different containers.

Materials and Method

The present investigation was carried out at the outreach center of Bangabandhu Sheik Mujibur Rahman Agricultural University, Salna, Gazipur. Experimental material was the cucumber *(Cucumis sativus)* seeds stored in three different containers. The containers were, Tin made unsealed container, Polythene bag and Cloth bag. The seeds were purchased from Siddique Bazar Seed Market, Dhaka.

Seeds were stored at room temperature (RT) and relative humidity (RH) for 60 days. Initial moisture content of seeds was recorded as 10.66% (tin container), 10.13% (polythene bag), and 9.89% (cloth bag). For moisture content determination test, high constant temperature method was followed according to ISTA rules. The cucumber seeds of about 4-5 g was taken in metal container with lid which diameter was less than 8 cm and was placed in oven under temperature of 133 ± 3°C for 1 hour to dry.

One hundred seeds were placed in the moist blotting paper on each plastic tray and replicated four times in each trial of each treatment. The germinated seeds were taken as seedling where it was attained at 4 mm shoot length. The germination test was done according to the prescribed rules (ISTA, 1993). For the cucumber seed, 4^{th} day after sowing was considered as the first counting day and 8^{th} day was the final counting day though data were taken every day to assess the seedling evaluation like normal seedling, abnormal seedling, dead seed, fresh seed, hard seed, and vigority. The seeds were set in every 15 days. Vigor index was assessed by counting the first seedling count divided by the respective day and liking onward upto final counting day.

Seedling length was calculated from combining the shoot and root length. After germination test, 10 seedlings were selected randomly and were measured by a centimeter scale from root tip to shoot apex. Then seedling dry matter was determined by using oven dry method following ISTA rules. Seedlings were kept maintaining a temperature of *72°C* for three days. Then the shoot length was divided by root length to get the root-shoot ratio.

Seedlings obtained from standard germination test were used to determine seedling evaluation. Normal and abnormal seedling, dead seeds, fresh seeds, and hard seeds were classified (ISTA, 1993).

Data was collected regularly of insects attack and diseased one to assess the effect of temperature and relative humidity on infection and infestation. One thousand seeds from each treatment were counted by seed counter

machine. Ten seeds were weighed with electrical balance of four decimal counters.

Results and Discussion

Results of the experiment are shown in Table 1-6 and discussed under the following heads. Moisture content of seed: Three containers i.e., tin, poly bag, and cloth bags were used to preserve the seed. Seeds kept in these containers have different moisture contents which affect the seed quality. Moisture content of cucumber seed with interaction of relative humidity and temperature is presented in Table 1.

Table 1. Moisture content of cucumber seeds with average temperature and relative humidity (RH) of room during storage period.

	Moisture Percentage*			
Treatment	15 DAO	30DAO	45 DAO	60 DAO
Tin pot	10.66	*10.95*	11.03	11.08
Poly bag	10.13	*10.25*	10.42	10.67
Cloth bag	9.89	10.02	10.42	10.98

DAO = Days after Observation, *Mean value of 3 replications

The first observation (15 DAO) of storage seed in tin, poly bag, and cloth were 10.66%, 10.13 %, and 9.89%, respectively, and lastly in 60 DAO, it was 11.08%, 10.67%, and 10.98%, respectively. The seeds of cloth bag come to the contact with air and their moisture content was increased sharply from initial moisture content. But moisture contents of seeds of tin and poly bag remain approximately constant during the experimental period. Gradual increase tendency of moisture was found in the seeds of tin pot and poly bag. It was found increased from 10.66 to 11.08, and l0.13 to 10.67 in the seeds of tin and poiy bag, respectively. In every container, the moisture content slowly increases due to time of storage period.

Germination test on paper substrate: Seeds preserved in three containers had different moisture restricting capability. Germination test provides to the ability of seeds to germinate and produce seedlings that emerge from blotting paper. The rate of germination showed decrease as the time passes. Table 2 shows the germination rate as 88%, 86%, and 83% in tin container, poly bag, and cloth bag, respectively, after 60 days where initially was 90%, 86%, and 85%, respectively.

Table 2. Mean percentage of germination of cucumber seeds.

Treatments	Germination rate (%)				
	15 DAO	30 DAO	45 DAO	60 DAO	Mean
Tin	90	90	88	86	88
Poly bag	86	85	89	84	86
Cloth bag	85	83	84	80	83

Table 3 showed the relationship between moisture content (%) and germination. In tin container, the maximum germination parentage (90%) was observed when moisture contents was 10.66 and 10.95 but slightly decreased (88% and 86%) when the moisture content attained at 11.03 and 11.08, respectively. In poly bag,

Table 3. Interrelationships between moisture content (%) and germination (%) during storage period.

Treatments	15 DAO		30 DAO		45 DAO		60 DAP	
	MC (%)	Germinati-on (%)	MC (%)	Germinati-on (%)	MC (%)	Germinati-on (%)	MC (%)	Germinati-on (%)
Tin	10.66	90	10.95	90	11.03	88	11.08	86
Polybag	10.13	86	*10.25*	85	10.42	89	10.67	84
Cloth bag	9.89	85	10.02	83	10.42	84	10.98	80

MC = Moisture Content

the germination (%) was highest at 10.42% moisture content, which is 89% but lowest at 10.67% moisture content, which is 84% maximum (85%) germination was found at 9.89% moisture content in cloth bag which decreased (80%) as moisture content increased at 10.98%.

Table 4. Mean percentage of distinct components (seedling evaluation) of germination test after rounded the values.

Treatments	15 DAO				30 DAO				45 DAO				60 DAO			
	NS	AB	DS	FS	NS	AB	DS	FS	NS	AB	DS	FS	NS	AB	DS	FS
Tin	84	6	2	8	82	8	5	5	80	8	6	6	78	8	10	4
Polybag	76	10	5	9	80	5	9	6	80	9	*5*	6	76	8	12	4
Cloth bag	80	*5*	6	9	78	*5*	7	10	75	5	10	10	72	12	12	4

NS = Normal Seedling, AB = Abnormal Seedling, DS = Dead seed and FS = Fresh Seed.

The mean percentages of distinct components, such as normal seedling, abnormal seedling, and dead and fresh seeds were evaluated three times (Table 4). The variation was found with time. Initially the percentage of normal seedling was high in each container (84 in tin, 76 in poly bag, and 80 in cloth bag) and which gradually decreased. But abnormal seedling percentage was increased in

tin and sharply in cloth bag and like-wise the percentage of dead seed was increased with the time duration.

Vigor test of cucumber seeds: In case of vigor index, the highest vigority (14.58) was found in Tin container at 15 DAO (Table 5) and the lowest was observed in cloth bag at 60 DAO (10.08). The tendency of vigority loss was slow which reflected in the germination percentage.

Table 5. Different parameters closely related to vigor test of cucumber seed.

Treatments	Vigor index				Shoot length (cm)				Root-shoot ratio			
	15 DAO	30 DAO	45 DAO	60 DAO	15 DAO	30 DAO	45 DAO	60 DAO	15 DAO	30 DAO	45 DAO	60 DAO
Tin	14.58	14.02	11.39	10.49	26.24	26.23	25.9	25.85	.95	.85	.84	.73
Poly bag	12.85	11.20	11.02	10.26	27.08	26.10	25.6	25.15	.93	.86	.80	.76
Cloth bag	10.92	10.88	10.24	10.08	26.25	26.02	25.45	24.3	.86	.77	.73	.70

In case of shoot length, highest length was observed in poiy bag (27.08 cm) at 15 DAO and the lowest length was 24.3 cm in cloth bag at 60 DAO. But there is no significant difference in shoot length among the containers. Any way, in the long run, tin container showed slightly better performance (25.85 cm). In case of root-shoot ratio, it is clear that in each container, higher length of roots was noticed than shoots. The highest ratio was found in Tin container at 15 DAO (0.95) and the lowest ratio at 60 DAO in cloth bag was 0.70 (Table 4). This result confirmed that the root length of cucumber seedling is higher than the length of shoot.

Thousand seed weight and dry matter weight: From the Table 6, it is clear that seed of each container have absorbed moisture in storage period. The increasing tendency of seed weight was higher in cloth bag (21.46 g to 22.46 g) than the two containers which might be due to the air exchange between inside and outside of cloth bag and absorption of moisture by the seed.

Table 6. Thousand seed weight and seedling dry matter weight.

Treatments	1000-seed weight (g)				Seedling DM weight (g)			
	15 DAO	30 DAO	45 DAO	60 DAO	15 DAO	30 DAO	45 DAO	60 DAO
Tin	21.36	21.65	21.95	22.22	.048	.047	.045	.046
Poly bag	22.41	22.50	22.85	23.06	.047	.047	.046	.045
Cloth bag	21.46	21.93	22.21	22.46	.039	.038	.036	.037

DM= Dry matter

The highest seedling dry matter weight was obtained from tin container (0.48g) at 15 DAO and lowest from (.037g) cloth bag at 60 DAO which indicated the lower vigority obtained from cloth bag (Table 6).

So, finally it can be concluded that the metal (Tin) container as a storage of seed performed better than other two containers.

Summary and conclusion

The present study assesses the effects of biotic and abiotic factors on storage quality of cucumber seed. Effects of these factors on quality of cucumber seeds was observed after storing in tin container, poiy bag, and cloth bag. Tin container is the best means for cucumber seed storage. The conventional practices of seed storage by farmers in gunny bags are not suitable because there is a chance for moisture gain and insect and disease attack which may enhance the viability loss as seed is a highly hygroscopic in nature.

References

Ali, M., A. K. Mian and E. A. Mamun. 1993. Improvement of some cucurbits: In: Breeding high female bitterless cucumber. Proc. Workshop Res. Div. Veg. crops. 9-10 March, 1993. IPSA, Gazipur.

Delouche, J.C., R.K. Mathes, G.M. Dougherty and A. H. Boyde. 1973. Storage of seeds in subtropical and tropical regions. *Seed Science and Technology* **1:** 671-700.

Doijode S.D. 1997. Effect of packaging and temperatures on seed longevity in Okra. Indian Inst. of Hort. Res., Bangalore 560089, India. *Vegetable Science* **24:** (1): 67-69; 7 ref.

Hossain, M.A., S.A. Mannan, M.K. Sultana and A.L. Khandakar. 1994. Survey of the constraints of quality jute seed farm, level. Ministry of Agriculture, support service project. GOB/ World BanlcIODA seed technology research team, BJRI, Dhaka. p.25.

Huda, M.N. 2001. Why quality seed? Reality and Vision, Bangladesh context. Bangladesh German Seed Development Project, Dhaka, Bangladesh. p. 90.

ISTA. 1993. Proceedings. International Seed Testing Association. **31:** 1-5.

Lin, S.S. 1999. Effect of duration of storage under controlled conditions on mungbean seed quality. *Revista-do-setorde-ciencies- Agrareis* **18:** (1-20,7-16).

Pratima- Ray and P, Ray. 1998. Effect of storage temperature, period and moisture content of seed health of rice. Department of Micre-biology, college of Basic Science and Humanities, O.U.A.T., Bhubaneswar -751003, India. *Oryza* 1998, **35:** 1, 53-56; 7 ref.

Yawalkar, K.S. 1985. Cucurbitaceous or vine crops. In: Vegetable crops of India Agric. Horticultural Publishing House, Nagpur, India. pp. 150-158.