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EFFECT OF SEED STORAGE MEDIA AND DURATIONS ON SEEDLING EMERGENCE AND GROWTH OF FEVER PLANT (*Ocimum gratissimum)*

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ABSTRACT

A greenhouse study was conducted to determine seed viability of *Ocimum gratissimum* stored in various storage media, namely ambient condition, bottle, polyethylene bag, aluminium foil and paper envelope as levels in the first factor, while the second factor was duration of seed in the storage media before planting that ranged from 1-8 weeks. On each week, fifty seeds were taken from each of the storage medium and planted in polyethylene bag for a period of eight weeks. The result showed that less than 33.8% of seeds sown emerged from seeds stored for a week. Seedling emergence declined with longer duration in storage, with seedling emergence resulting to less than 6% at eighth weeks of seed storage, irrespective of the storage medium. Similarly, plant height, number of leaves, leaf area and girth of plant were equally affected. All the storage media had similar trend in their capacity to store the seeds of *O.gratissimum.* This study has shown that *O.gratissimum* seed is recalcitrant and would need to be planted immediately after seed harvest or would need unconventional seed storage methods or media. The low percentage of seed emergence even at the first week of storage suggests that the seed would need to be harvested and planted immediately after the physiological maturity of the seeds.

Keywords: *Ocimum gratissimum;* Seed storage; Seedling growth

INTRODUCTION

There are no firm rules for determining when seeds of selected plants are matured and ready for collection. Changes in inflorescence colur from fresh green to dry dark brown serve as usual guide to seed maturation (Sowswell *et al.*, 2000). Physiologically, a seed is said to be mature when it has the capacity to germinate (Matti *et al.,* 2000). Therefore, seeds should be collected during this stage and seed viability test should be carried out before seed storage and at planting. The seeds of *Ocimum gratissimum (*fever plant or scent leaf*)* produced during the early rains, usually mature for collection from August to January (Etutudo and Banjo, 2000). *O. gratissimum* produces seeds during growing seasons, but the regeneration from these seeds as seedlings in the subsequent season is very sparse. Bando *et al.* (2000) and Grieve (2000) reported that *O. gratissimum* seed is a recalcitrant because it loses viability rapidly after harvest. This is probably because it would not survive complete drying or the seeds are sensitive to desiccation. Any seed which exhibits seed recalcitrance is usually difficult to store for a long period and propagated during a

favourable period (Fredrick and Michael, 1999). The recalcitrant seed nature of *O. gratissimum* affects its viability in storage and consequently in the subsequent growing season, leaving only few for volunteer crops to germinate. As a result of this, the plant is perceived to be neglected by commercial farmers. *Myrianthus arboreous* has also been reported to exhibit recalcitrance. Nwaebichi (2008) reported that only the seeds of *Myrianthus arboreous* stored in the fruit pulp germinated after six weeks in pre-storage condition, while others stored in other storage media, stopped germinating after four or five weeks in storage. Similarly, the vigour of the pulp-stored seedlings were significantly better than those stored in other storage media. Recalcitrant seeds have been described as short-lived, which retain viability for as little as few days, months, or at most, a year, and added that with proper handling and storage, seed longevity may be maintained for longer periods (Copeland, 1976; Hartmann *et al*.,1990).

The dearth of seed propagules for the propagation of *O. gratissimum* has limited its cultivation in Nigeria. Although, a measure of success has been achieved in its domestication, the apparent institutional neglect of its conservation has led to a limited impact at the local level. This study will elucidate information on the possibility of storing the seeds of *O. gratissimum* for propagation for the subsequent season, to make the seed available all-year-round. If the plant is cultivated commercially, it could generate income for the farmers. It could also be exported to other countries as a source of foreign exchange to the country and used medicinally as a raw material for herbal drugs. The objective of this study is therefore to assess the viability and vigour of *O. gratissimum* seeds stored in different storage media over various periods of time.

MATERIALS AND METHODS

Study Location

This experiment was conducted in the College of Education farm Agbor, South Western Nigeria in May 2006. Agbor is in the tropical rain forest zone, which lies between latitude 5^0 15'S and 8^0 20'N and longitude 5^0 13'W and 7^0 15'E of the equator. It is characterized by a dry period between November and March, rainy season between April and October. There is usually about 2-3 weeks dry spell in August usually referred to as August break. The average annual rainfall of the location ranges from 1905 to 2665 mm. The temperature ranges from 29 to 34^0C, with an average of about 30^0C (Nmosi, 2000).

Experimental Seed and Set-up

Fresh, healthy, and matured seeds were harvested at the basal part of the inflorescences of *O. gratissimum* plants which is commonly grown in homestead gardens as a volunteer crop. These seeds were stored in five different storage media for eight weeks. The storage media were ambient condition, bottle, polyethylene bags, aluminium foil and paper envelope. On each week, fifty seed samples were collected from each storage media and planted into a polyethylene bag filled with top soil. These were allowed to grow under good nursery maintenance for another eight weeks independent of the storage media. Weeds were rogued fortnightly and watering carried out every other day. Insect pests were hand picked.

The experimental design was a completely randomized design with three replicates in a 5 x 8 simple factorial layout

Data Collection and Analysis

. The parameters measured were seedlings emergence percentage at 2 weeks after planting. Other parameters included plant height, number of leaves, girth of plants, while leaf area was taken at 8 weeks after planting. Plant height, leaf length and width were measured with meter rule. The stem diameter also presented as plant girth was measured using veneer caliper. The number of leaves and seedling emergence were obtained by direct counting of seedlings. The percentage of sprout was determined from the ratio of number sprouted plant to number of plants sown.

The collected data were subjected to analysis of variance (ANOVA) and Duncan Multiple Range Test was used to separate the treatment means, where 'F' test showed significant difference between the treatments (Duncan, 1955; Gomez and Gomez, 1984)

RESULTS AND DISCUSSION

Seedling emergence count declined with longer duration of seed storage, irrespective of the storage medium. The emergence count from seeds stored for one week produced 33.8% seedlings, while the seeds stored for eight weeks produced average of five seedlings (Table 1). For the storage media, there was no significant difference ($P > 0.05$) between emergence count of seeds stored in polyethylene bag, aluminium foil, ambient condition and bottle. The reason for the decline in seedling emergence count could be due to decrease in moisture content of the seeds over time the seeds spent in storage media which equally affected their viability, irrespective of the storage medium. This is in line with the findings of Fredrick and Michael (1999) who reported that any seed which has the characteristic of seed recalcitrance in it, is always difficult to be stored for a long period of time.

Table 1. Seedlings emergence percentage (%) of *O. gratissimum* taken at 2 weeks after sowing for seeds stored in various storage media and durations of seed storage.

Storage media	Durations (weeks) of seed storage								
	1	2	3	4	5	6	7	8	Mean*
Ambient condition	34.3	30.2	30.2	24.4	20.3	18.2	16.1	3.1	22.1[a]
Bottle	33.3	29.4	27.4	24.5	20.0	17.0	13.0	5.0	22.2[a]
Polyethylene bag	36.4	31.4	28.4	24.3	21.3	19.3	16.2	7.0	23.0[a]
Aluminum foil	34.6	31.3	27.2	24.2	21.0	18.3	15.3	6.0	22.2[a]
Paper envelope	30.4	26.4	22.0	19.2	16.3	14.3	13.0	5.1	18.3[b]
Mean*	33.8a	29.7b	27.0b	23.3c	19.7d	17.4e	12.3e	5.2f	

*Means followed by same letter (s) across a row for duration and column for storage media are not significantly different (P>0.05).

The seedling height of *O. gratissimum* declined drastically with longer duration of seed storage. The seeds stored for a week had average seedling height of 15.4cm per plant, while seeds stored for eight weeks had seedling height of 4cm (Table 2). The seeds stored in aluminium foil produced seedlings that were significantly different ($P < 0.05$) from others, followed by seedlings stored in ambient condition, bottle and polyethylene bag that were not significantly different from one another, but significantly different from seedlings produced by seeds stored in paper envelope except seedlings from polyethylene bag.

Table 2: Seedling height (cm) of *O. gratissimum t*aken at 8 weeks after sowing for seeds stored in various storage media and durations of seed storage

Storage media	Durations (weeks) of seed storage								
	1	2	3	4	5	6	7	8	Mean*
Ambient condition	15.9	14.3	11.3	9.4	7.9	6.4	4.9	3.8	9.2[b]
Bottle	15.3	13.7	11.0	9.3	8.2	6.5	5.2	3.9	9.1[b]
Polyethylene bag	15.3	13.4	10.5	9.1	7.6	6.7	5.6	3.9	9.0[b]
Aluminum foil	15.6	13.8	11.5	10.1	8.8	7.3	6.1	4.9	9.8[a]
Paper envelope	14.9	13.1	9.7	8.4	7.4	6.5	5.0	3.7	8.6
Mean*	15.4a	13.7b	10.9c	9.3d	8.0e	6.7f	5.4g	4.0h	

*Means followed by same letter (s) across a row for duration and column for storage media are not significantly different (P>0.05).

Number of leaves varied with duration of time seeds spent in the storage medium with seeds stored for a week having an average of 13.8 leaves, which was significantly different from seeds stored for eight weeks with an average of 3.3 leaves (Table 3). The seedlings from various storage media were not significantly different from one another in the number of leaves produced except the seedlings from paper envelope.

The result followed the same trend with plant height, seedling emergence percentage and number of leaves. The seedlings from seeds stored for eight week had the least girth. The girth of seedlings produced by seedlings from seeds stored in polyethylene bag was significantly different from others followed by aluminium foil, and ambient condition that were not significantly different from each other, but were significantly different from seedlings grown from seeds in bottle and paper envelope (Table 4).

The results presented in Table 5 showed that there was decline in the leaf area of *O. gratissimum* with the duration of seed storage for all the storage media. This was similar to those of plant height, seedling emergence, girth and number of leaves. This results supports the result obtained by Roux and Martins (1990) that a dried seed is characterized by a gradual decline in vigour. The result of the storage media showed that seeds stored in polyethylene bag, bottle, ambient condition and aluminum foil did not differ significantly from each other and were superior to those of paper envelope.

Table 3: Number of leaves of *O. gratissimum* taken at 8 weeks after sowing for seeds stored in various storage media and durations of seed storage

Storage media	Durations (weeks) of seed storage								
	1	2	3	4	5	6	7	8	Mean*
Ambient condition	14.0	11.6	10.0	7.9	7.1	5.7	4.6	3.1	8.0[a]
Bottle	13.8	10.6	9.1	7.8	7.0	5.9	4.7	3.4	7.8[a]
Polyethylene bag	14.5	11.7	10.3	9.1	7.6	6.1	4.8	3.7	8.5[a]
Aluminum foil	14.4	11.2	9.3	8.3	6.8	5.6	4.4	3.5	8.0[a]
Paper envelope	12.4	10.0	8.5	7.4	6.2	5.0	3.9	3.0	7.1[b]
Mean*	33.8a	11.0b	9.5c	8.1d	7.0e	5.7f	4.5g	3.3h	

*Means followed by same letter (s) across a row for duration and column for storage media are not significantly different (P>0.05).

Table 4: Girth (cm) of *O. gratissimum* taken at 8 weeks after sowing for seeds stored in various storage media and durations of seed storage

Storage media	Durations (weeks) of seed storage								
	1	2	3	4	5	6	7	8	Mean*
Ambient condition	1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.3	0.7[b]
Bottle	1.0	0.9	0.8	0.7	0.6	0.5	0.5	0.3	0.7[b]
Polyethylene bag	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.8[a]
Aluminum foil	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.7[b]
Paper envelope	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.3	0.6[c]
Mean*	1.0a	0.9b	0.8c	0.7d	0.6e	0.5f	0.46f	0.3g	

*Means followed by same letter (s) across a row for duration and column for storage media are not significantly different (P>0.05).

Evidence from the experimental work showed that seeds stored longer had lower seed emergence percentage than those with short storage duration. The result here is similar to the findings of Bando *et al.* (2000) that *O. gratissimum* seed is recalcitrant because it looses viability rapidly during storage. The result of the plant height, leaf area, plant girth and number of leaves followed the same trend. All the storage media used in this study had similar trend in their capability to store the seeds of *O. gratissimum* resulting in general emergence of about 5% at the eight weeks of seed storage. Future studies should consider the inclusion of seed storage because the seed do not tolerate complete drying.

Table 5: Leaf area (cm^2) of *O. gratissimum* taken at 8 weeks after sowing for seeds stored in various storage media and durations of seed storage

	Durations (weeks) of seed storage								
Storage	1	2	3	4	5	6	7	8	Mean*
Ambient condition	8.3	7.7	6.9	6.3	5.5	4.7	4.1	3.5	5.9[b]
Bottle	8.3	7.7	7.2	6.7	6.1	5.3	4.4	3.8	6.2[a]
Polyethylene bag	8.3	7.8	7.3	6.8	6.0	5.3	4.8	4.1	6.3[a]
Aluminum foil	8.2	7.7	7.4	6.3	6.1	5.4	4.9	4.4	6.4[a]
Paper envelope	8.0	7.4	6.7	6.2	5.6	5.1	4.5	3.9	5.9[b]
Mean*	8.3a	7.7b	7.1c	6.6d	5.9e	5.2f	4.6g	3.9h	

*Means followed by same letter (s) across a row for duration and column for storage media are not significantly different (P>0.05).

CONCLUSION

The study on the viability of *O. gratissimum* seeds in various storage media and durations, showed that seedling emergence count declined with duration of storage, irrespective of storage medium. Those stored under shorter duration had significantly higher number of seedling emergence percentage than those with longer storage duration. Other variables measured also followed the same trend.

Based on the findings in this study, there is need to plant the seeds of *O. gratissimum* immediately after harvest since the viability of the seeds and vigour were affected by the duration of seed in the storage, irrespective of the storage medium. This study has elucidated information on seed recalcitrance of the *O. gratissimum* which generally declined from one to the eight weeks in storage. This therefore, suggests that the seed of *O. gratissimum* should be planted as soon as they are harvested after physiological maturity. With respect to storage media, no storage media used had an advantage over each other in their ability to store the seeds of *O. gratissimum.*

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