FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-9496
Vol. 8 No. 1, June 2022: Pp.83-86

https://doi.org/10.33003/jaat.2022.0801.078

THE EFFECT OF DIFFERENT STORAGE MEDIA AND DURATION ON SEED EMERGENCE AND GROWTH OF MORINGA (*Moringa oleifera* LAM) IN DELTA STATE, NIGERIA

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ABSTRACT

A study was conducted to investigate the viability of Moringa (*Moringa oleifera* Lam) seed stored in various storage media, which include, earthen container, plastic container, tin container, gunny bag and some spread on the ground under a shade without a storage medium (control) as levels treatments in the first factor, while the second factor was duration of seed in the storage media before sowing, which include; 0, 2, 4, 6 and 8 weeks. The total of five hundred 500) seeds were sown. Every two weeks interval, twenty seeds were taken from storage medium and planted on seed beds. The seedling emergence count was collected at every fourth week after sowing. The result showed that 80 % of seeds sown emerged from seeds stored for four weeks. With exception of control, there was no significant difference on seedling emergence percentage of seeds stored for 2, 6 and 8 weeks. Plant height, number of leaves and girth of plant followed the same trends as seeds emergence count. The result of storage media revealed that earthen container was better than others in all the perimeters measured. This study has shown that Moringa seeds need to be stored for four weeks after harvest in an earthen container for better seedling emergence and growth. It is therefore, recommended that seeds of Moringa should be stored for four weeks in earthen container before sowing.

KEYWORDS: Moringa**,** storage duration, seed emergence, storage media, seed viability

INTRODUCTION

Many plants have gone into extinction due to inability of mankind to preserve their seeds. Some were unconventionally stored in storage media were they were destroyed by pests or disease causing organisms or were harvested used by man or eaten by animals in their natural habitat without replacement. Most of these plants were medicinal plants. Man unconventionally harvest them in the wild, use them for medicinal purposes some time eat them as wild seeds, nuts or fruits just like the wild birds, rodents or other herbivorous animals (Okafor 2010). The population of organisms that depend on these produce of these plants are high and this had tremendously reduced these plants population, therefore, make them go into extinction.

Moringa (*Moringa oleifera* Lam) is one of the most important perennial plant that is used in both local delicacies and for medicinal purpose. It is a native of India, but today is a common plant grown as one of the hedge plants across West Africa (Makinde, 2019). Just like other vegetables, the leaves, seeds and bark of the shoot and root of moringa are succulent and therefore used to prepare soup with meat or fish in some part of Nigeria (Ifeanyi, 2020). The leaves are air dried at room temperature and grind which can be steeped in cold or warm water and taken as a tea, or sprinkled into soup. The fresh leaves are sliced and used for salad. It is also stir in warm water either mixed with little honey or steep it and taken as green tea. The essential oil in moringa plant is known to have a great medicinal value and have the tendency of curing more than 200 diseases (Amaglo, Timpo, Ellis and Bennett, 2006). This essential oil contains a healthy monounsaturated fat that is high in protein and other compounds. It has the benefits for moisturizing and cleansing the skin as well as acne and a moisturizing hair treatment. It is used as lubricant for massaging of the body and confectionary (Adeoye, 2020). The extract of the plant can be used for the treatment of certain ailments such as sore throat, constipation, gastritis diarrhea, intestinal ulcer, heart problem, high blood pressure, kidney stones, symptoms of menopause and thyroid (Josiah, 2018).

Storage of seed is a common practice in agriculture. Seed storage is the art and science of preserving seeds in a medium for future use. However, as beneficiary as the seeds of moringa are, the storage of its germplasm is vital. The purpose of its seed storage is to maintain the seed in good physical and physiological condition from the time they are harvested until the time they are sown (Nwaokoro, 2020). Gilbert (2020) reported that seeds begin the process of losing their viability at harvest, but with proper conditioning, some species can last for many years in storage medium. The duration of storage is one of the most important factors which affect germination of seeds. Most vegetable seeds are recalcitrant in nature, when stored for a longer period of

time in the storage medium, they lost viability. It is advisable not to store seeds for a longer period than necessary in order to prevent loss of viability. Seeds that have lost their viability should not be sown as higher percentage of them will not germinate. Many farmers suffer missing stands or having less vigorous seedlings in their respective farms as a result of the seeds that were stored for a long duration of time in the storage medium (Molade, 2019).

This study was conducted to investigate the seedling emergence rates and growth of *Moringa oleifera* seeds stored in different storage media and duration. The specific objectives of the research were to determine the storage medium and duration of time that is more appropriate for storage of seeds which enhance the growth of *Moringa oleifera.*

MATERIALS AND METHODS

Experimental Site

The field work was conducted in the Agbor. Agbor is in Ika South local Government Area, Delta state, Nigeria.

Vegetation and Climate

Agbor lies in the tropical rainforest zone and it is one of the towns in the dissected upland physiographic areas. The upland physiographic nature of the land is the most important hydrographic center in Delta State. Agbor river called Orogodo river is one of the sources of the major rivers in Delta state. Agbor lies on latitude $6^{o}26'$ North, longitude $6^{o}18'$ East of the equator at 153 m elevation above the sea level. It is characterized rainfall ranging from 1300 mm to 1649 mm. (Okafor, 2010). The high humidity over 80 % and the long wet season 8 to 10 months ensures adequate supply of water and the continuous presence of moisture in the air. The mean daily temperature for northeastern zone of Delta State where Agbor is located ranges from 26^{o}C to 35^{o}C with an average of 26^{o}C in August when skies are heavily overcast and cloudy.

SeedsCollection: Fresh, healthy, and matured pods were harvested from the plant in the wild.

Experimental Design and Data Analysis

This experiment was laid out as 5 x 5 factorial in Randomized Complete Block Design (RCBD) and replicated three times. There were a total of 25 plots. The factors A were storage media which include ;under a shade without any storage media (control), tin container, earthen container, plastic container and gunny bag and durations of stored seeds (0, 2, 4, 6 and 8 weeks). A total of five hundred (500) seeds were sown. The variables measured were seedlings emergence, germination percentage at 4 weeks after sowing (WAS) and tther variables include; plant height, number of leaves and stem girth of plants. Plant height was measured with meter rule taken from the base of the plant to the tip of the plant. 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 seed emergence was determined by the number of seedling emerged over number of seedssown multiply by 100.Every two weeks interval, twenty seeds were collected from the storage medium and planted on 8 m x 8 m beds. These were allowed to grow under good agronomic maintenance for another eight weeks, independent of the storage media. Weeds were rouged and watering carried out at regular intervals. Insect pests were handpicked.

The data were subjected to analysis of variance (ANOVA) and the means obtained among the treatments were separated using Duncan Multiple Range Test (DMRT) (Duncan, 1955)

RESULTS AND DISCUSSION

The seeds stored for four weeks had the highest mean value of 16.5 (82.5%), this was followed by those of 2, 6 and 8 weeks which were not significantly different from each other, while those seeds that were not stored before planting, which is the control, had the least seedling emergence, with mean value of 12.3 (61.5%). The highest seedling emergence count in the 4^{th} week could be as a result of rapid reduction of moisture content in the initial time of seed harvest due to physiological processes taking place in the seeds, which as well prevented the growth of mold and retains their viability. This is in line with Chidiebele (2020) who reported that when seeds are stored, there is rapid reduction in the moisture content at harvest to few weeks in storage due to physiological processes taking place in the seeds this will gradually reduced to a level. This helps to eliminate the moisture that would have led to deterioration of the seeds as a result of growth of mold on them and this would affects viability. The result of the storage media indicated that there was significant difference ($P>0.05$) among emergence count/percentage of seeds stored in the various storage media. The earthen container exercised superiority over others with mean value of emergence 16.2 (81%). This was followed by those stored in Tin container and Gunny sack with mean values of 14.0 (70%) and 14.8 (74%) respectively and were not significantly different ($P>0.05$) from each other, while plastic bag had the least mean value. This could be as a result of the ability of earthen container to maintain specific relative humidity which prevents the growth of fungus. This is in line with Magus (2020) who reported that when seeds are stored in earthen container, it has the ability of providing a congenial environment for the seeds which will enable the seeds viability to be retained.

The result of the seed duration on plant height followed the same trend with seedling emergence count. More also, with exception of seedlings grown from earthen container that significantly outgrown others, there was no significant difference on the other storage media (Table 2). The reason for this could be that when seeds of plants attained specific moisture content it facilitates seedling growth. This is in line with Udume (2020) who stated that seed moisture content determines the vigour of seedlings and their growth. Hence, care should be taken to avoid total dryness of the moisture content of seeds when in the storage medium.

The result of number of leaves indicated that with exception of seeds stored for 4 weeks which had the highest number of leaves, there was no significant difference ($P<0.05$) from 0, 2, 6 and 8 weeks duration in the storage media (Table 3). The result of the storage media followed the same trend as it was in plant height.

The results of effect of storage media and duration on stem girth showed that the same trend was followed as it was in plant height.

CONCLUSION

The result of evaluation of viability of seeds of Moringa (*Moringa oleifera* Lam)**,** under different durations in the storage showed that seeds that were stored for four weeks had significant higher number of seedling emergence than those with shorter and longer storage durations. Plants grown from earthen container showed superiority over others in plant height, while those grown at four weeks had more number of leaves than others. Based on the findings in this study, there is need to store Moringa (*Moringa oleifera* Lam) seeds for 4 weeks pro to planting since the viability of the seeds and vigour are affected by the duration of seed in the storage. With respect to storage media used, the earthen container had advantage over others. This therefore, suggests that the seed of Moringa (*Moringa oleifera* Lam)**,** having being harvested after physiological maturity, should be stored for four weeks in earthen container. I suggest that these phases should be confirmed in future studies. This study has elucidated information on how to retain viability of the Moringa seeds. This research study has revealed that duration of storage from the first to third week and from the fifth to eighth week in storage media have significant effect on seed emergence.

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Table 1: Seedling Emergence Percentage (%) of Moringa taken at 4 weeks after Sowing for seeds stored in various storage media and duration of seed storage

	Duration (weeks) of seed in storage media					
Storage Media	0	2	4	6	8	mean
Control	10.2	15.2	14.4	13.3	15.2	13.6[a]
Earthen container	19.4	15.4	14.5	14.0	12.0	16.2
Plastic container	11.4	12.4	17.3	11.3	12.3	12.9[a]
Tin container	12.4	12.2	17.2	14.0	14.3	14.0[b]
Gunny sack	12.4	12.0	19.2	16.3	14.3	14.8[b]
Mean	12.3_a	13.4_b	16.5_c	13.7_b	13.6_b	

Mean values within the same column or row followed by the same letter are not significantly different at P>0.05 using DMRT.

Table 2: Plant height (cm) of Moringa taken at 8 weeks after sowing for seeds stored in various storage media and duration of seed storage

	Duration (weeks) of seed in storage media					
Storage Media	0	2	4	6	8	mean
Control	36.3	39.4	47.9	46.4	43.8	42.2[a]
Earthen container	45.0	49.3	58.2	46.5	55.2	50.0[b]
Plastic container	38.5	39.1	47.6	46.7	43.9	43.0[a]
Tin container	32.5	40.1	58.8	47.3	54.9	46.5[c]
Gunny sack	33.7	37.4	47.4	46.5	43.7	41.4[a]
Mean	37.0_a	41.1_b	51.2_c	46.2_d	48.2_d	

Mean values within the same column or row followed by the same letterare not significantly different at P>0.05 using DMRT.

Table 3: Number of leaves of Moringa taken at 8 weeks after sowing for seeds stored in various storage media and duration of seed storage

	Duration (weeks) of seed in storage media					
Storage Media	0	2	4	6	8	mean
Control	52.0	52.0	77.1	55.7	43.1	56.0[a]
Earthen container	43.8	69.1	87.0	65.9	63.4	65.2[b]
Plastic container	54.5	48.3	67.6	56.1	53.7	56.3[a]
Tin container	54.4	59.3	66.8	55.6	52.5	57.0[a]
Gunny sack	54.4	48.5	56.2	55.0	52.0	53.1[d]
Mean	51.0_a	55.0_b	71.0_c	57.2_b	52.3_a	

Mean values within the same column or row followed by the same letter are not significantly different at P>0.05 using DMRT.

Table 4: Girth (cm) of Moringa taken at 8 weeks after sowing for seeds stored in various storage media and duration of seed storage

	Duration (weeks) of seed in storage media					
Storage Media	0	2	4	6	8	Mean
Control	5.0	7.9	9.8	5.7	5.4	6.7[a]
Earthen container	7.0	7.8	9.8	7.7	7.6	7.9[b]
Plastic container	5.3	5.0	6.9	6.9	5.8	6.3[a]
Tin container	5.2	6.9	7.8	6.8	5.7	6.4[a]
Gunny sack	5.9	6.8	8.7	5.6	6.5	6.7[a]
Mean	5.6_a	6.9_b	8.6_b	6.5_b	6.2_a	

Mean values within the same column or row followed by the same letterare not significantly different at P>0.05 using DMRT.