



# Comparative Techniques of Raising Seedlings of *Acacia seyal* in the Arid Zone of Borno State, North - Eastern Nigeria

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**Abstract:** This study was conducted on the techniques of raising seedlings of *Acacia seyal* in the arid zone of Borno state, north - eastern Nigeria. Techniques were carried out to investigate the effect of mixed potting system (MPS) and open potting system (OPS) on seed germination and seedlings growth. Seeds sample was obtained commercially at Gamboru market, Maiduguri, Nigeria. Experiments were carried in 2 different sites, 4 replications, 16 boiled seeds sown in each of the 2 PSs, rows containing 4 seeds (R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> and R<sub>4</sub>) each, 64 seeds were used. The total mean numbers of seeds germinated in MPS and OPS was 117 (58.5 ± 7.8); 53 and 64. Total mean number of seedlings were; 247 (61.7 ± 26.6) and 282.6 (70.6 ± 26.3). Total mean stem diameters were; 20.8 (5.2 ± 2.2) and 19.6 (4.9 ± 2.3). Total mean height were; 295 (73.6 ± 29.9) and 352 (88 ± 47) were recorded each weekly for 4 weeks. The number of seeds germinated in to seedlings and stem diameters were found to be higher in the OPS than the MPS. There was no significant difference between the 2 PSs in terms of germination, despite the difference in numbers of germinated seeds OPS had the highest, highest diameter in R<sub>2</sub> and R<sub>4</sub>, and MPS had higher in diameter in R<sub>1</sub> and R<sub>3</sub>. The mean number of leaves in the first day was 0, on day 13<sup>th</sup> the average number of leaves was approximately 1, it increased with days to 19<sup>th</sup> to the last day of the experiment that is (30<sup>th</sup> day). It has been noticed that, at 1<sup>st</sup> week, the number of leaves was higher in MPS, while the OPS was lower with difference of 6 leaves, and at the last 3 weeks OPS had higher numbers leaves than the MPS. To this, in raising seedlings in the arid zone environment, the MPS treatment technique is preferable from the findings obtained in this research work.

**Keywords:** *Acacia seyal*, Arid Zone, Germination, Mixed Potting, Open Potting, Technique, Seed, Seedling

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## 1. Introduction

The success or failure of any Afforestation programme depends largely on the procurement of adequate quantities of good quality seeds of the desired species and provenances [1]. Seed do not only influence the amount and quality of palatable stock but also affect other tree planting processes as well characteristics inherent in the seed or acquired during the harvesting, processing and storage of the seed govern several aspects of the nursery practice [2]. Although the seeds of the desired species for arid zone are rapidly available, and preferences for nursery production be given to seeds of those species for which the local inhabitants have shown the greatest demand [3, 4]. Seeds of some trees species are said to be dormant and will remain in this state until they are given some sort of pre-treatment. The delayed germination of seeds posses' serious problems for the nursery man and will have adverse consequences on the success of nursery operations and field planting [5, 6].

Seeds of most leguminous species like *Acacia spp*, etc, are noted for their hard seed coats and pretreatment of the seeds causes them to germinate faster [7]. The pretreatment usually involves soaking the seeds in water overnight or soaking in boiling water and allowing the seed to soak in the gradual cooling water for a period of time or in concentrated sulphuric acid for a specific period [3, 8]. Soaking overnight in cold water has yield very satisfactory result for seeds of most species used in arid zone Afforestation reduced the period required for germination of such horticultural plants [2, 9].

Planting of nursery - raised seedlings is a major component of Afforestation and reforestation programmes, especially in arid and semi arid areas where potential of Afforestation by natural regeneration and direct sowing is limited [10, 11]. Essentially two types of nurseries are in use in Nigeria forestry practices; permanent and temporary. The permanent nurseries are established at centralized location within the areas they serve, and produce trees on continuous basis for a variety of needs, such as forest plantings, shade trees, woodlot or small conservation project. They are usually large and very intensively managed, and contain permanent and durable structures like offices; stores shed, etc. Temporary nurseries on the other hand, are established to provide stock for project that will be completed within a relatively short period of time [12, 13, 14, 15].

Having determined the soil mixture, kind and size of container, one would proceed to sow the seeds also the depth of sowing seeds are sown at a depth of 1 to 3 times their diameter. When seeds are sown at this depth adequate moisture and optimum temperature will hasten their germination. Excessively deep sowing will impair seedling emergence. Small seeds like those of Eucalyptus are mixed with fine soil before sowing to facilitate uniform distribution of seeds and to avoid seed waste by dense sowing [15, 16]. After sowing, seed beds should be watered using a fine nozzle spray, producing almost a mist. Hand watering frequently until seeds germinate, whether by a container or

with a hose, is the best method of watering. When raising seedlings in pots it is normal to use polythene tubes that are around 10 cm in diameter and 20 cm deep, though the size of pots will depend on the species in question and the time that seedlings will be in the nursery. It is better to use open-bottomed than closed containers, since this allows healthier root development and possible root pruning [17, 18]. The sowing period should normally begins in October to November the previous year and end in March of the planting season. Beside the fact that during this period the relative humidity is low, discourage the development of damping off, the plant are allowed sufficient time to grow and develop good root system before, they are taken to the field for planting in June to July the same year in the tropical region [19].

The regular supply of clean water is essential to plant growth. Plants are made out of more than 90% water [20]. Water is the commonly one of the factors limiting the sitting of nurseries and growth of seedlings in the arid areas. It is therefore necessary that dependable sources of water are assured before a nursery is sited in any locality to facilitate regular watering of seedlings [21]. The plant should be watered every day morning and evening daily by hand or irrigation system [2, 7, 8].

Construct a shade to protect the seedlings from direct sunlight for two to three weeks after pricking out. Use locally available materials such as grass, mats, or banana fibers for shade construction [2, 22]. The use of light shade particularly during the germination phase is a very common feature of most forest nurseries in Nigeria. It is easier to maintain moisture conditions for germination under such shade, transporting seedbeds are most lightly shaded at least during the first few weeks of transplanting [2, 13, 24].

The provision of windbreak, belt of trees, etc. (which reduce the adverse effects of the prevailing winds and climate change) of shelter to the seedlings from the impact of wind is perhaps more important than shading for the successful establishment of nursery stock in the arid areas and the invariably result in damage to the seedlings, leading to a drastic reduction in growth [2].

Weeds compete for water, soil nutrients and light, block the circulation of air, harbor insects and disease organisms which cause seedlings to be of poor quality and must be eliminated. Weeds constitute a nuisance to efficient nursery management and threat to healthy seedlings development. Whenever weeds and any rubbish around the beds are observed, remove all manually, unless you are sure that this can be converted to compost. Growing medium containing fresh animal manure, compost and topsoil tends to exacerbate weed growth [1, 2, 9].

Seedlings are delicate and susceptible to attack by various pests and diseases as well as weather conditions are the commonest problems that are likely to be encounter in arid zone nurseries work, particularly termites (Pre - emergence and post emergence damping off) [2]. Such damages can seriously weaken or kill the seedlings, such can be prevented immediately [4]. Tropical trees are increasingly seen as a

valuable renewable natural resource [10]. They maintain and improve soil fertility, and provide protection from sun, wind and heavy raindrops; Trees also yield a great range of important products, play a crucial role in many farming systems, and form the base of the food-chain for the survival of people and numerous animals in the tropics [1, 10].

Noticeable symptom of disease is a discolored stem of the young seedlings which lapses and dies, caused by a number of fungi, and can be prevented to a certain extent by sterilization of the potting mix with 5% of formalin before picking out of the seedlings or direct seedlings and adoption of good hygiene in the nursery. Soil with high pH of 6.0 and above, are less susceptible to infection [2, 3, 7].

Successfully established, the seedlings are ready for planting in the field during the planting season of the same year, as soon as the soil is wet to a specified depth, with local knowledge of patterns of rainfall within appropriate period [1]. Prior to lifting, the seedlings should be watered thoroughly. It would be so regulated that not too many plants are left in the field unplanted for too long which may result in drying out before planting [7].

Generally, all *Acacia* variety have large genus of (800 – 900 spp.) of shrubs and trees, native to large areas of the tropics and subtropics arid areas of Africa and Australia are important centers of diversity. Numerous species of value for many purposes e.g. timber, gum forage, tannin, perfume, etc. are cultivated [3]. *Acacia seyal* belongs to the group of wattle to the family leguminosae. *Acacia seyal* Delile (family; Leguminosae, subfamily; Mimosoideae) is one of over 60 African *Acacias* referred to the Uniseriae group of subgenus *Acacia*. The species usually reaches 9 to 10 metre in height at maturity and in well formed individuals a flat topped crown develops [11]. The seed is oval shaped, brownish - whitish in colour, rather like a tiny egg, about 8 mm long., *A. seyal's* seeding time is highly variable in its range, normally being ready about three months after the rains [12]. *Acacia seyal* species yield gum, forage and timber i.e. (Shittim wood) from which the ark of covenant was fashioned. It is cultivated to a limited extent to supplement natural population in part of tropical Africa [3]. But in part of Borno State of Nigeria, some part of the *Acacia seyal* body is very important in the culture of native of Shuwa Arabs were using the part as perfumes.

Furthermore, the important of these species *Acacia seyal* is widely spread around the world many different plant sources have been employed for tanager. These are so widespread and abundant that different cultures have their own materials and techniques for leather production, it is also used in confectionery manufacture of chewing gum and it is also important as a binder in legumes, tablets, pills and cough drops [2]. Countries like South Africa, East Africa and Australia, many *Acacia* (especially *Acacia seyal* are successfully grown on a plantation scale to provide tanning materials). *Acacia seyal* seem to have potential for competing successfully with the other plant species in terms of Agri – horticulture products, pharmaceutical products, bee / honey plants, insect plants, fibre, gum products, religion,

superstitions, magic, etc.

Hence the present study aimed at suggesting ways of probes propagation of *Acacia seyal*, right from seed procurement to seedlings establishment, while the objectives were to determine the growth effect and investigate the growing interval to compare between the two potting system either the mixed or the open system has the higher or lower growth rate.

## 2. Methodology

### 2.1. Study Area

The study on the techniques of raising Seedlings of *Acacia seyal* in the arid zone of Borno state, north - eastern Nigeria was conducted at the nursery premises of the forestry division, department of agriculture and natural resources, Maiduguri, Borno state of Nigeria.

### 2.2. Materials

The following standard materials were required and used in the cause of this scientific research study and standard operation procedures (SOP) are absolutely been observed.

#### 2.2.1. Reagents

Clear river sand, mixed soil, decomposed cow dung, water and 0.5% formalin.

#### 2.2.2. Apparatus

Mini sterilizer of 0.5 curve capacity, Bowl container, Bunsen burner, Beaker of various sizes, Head pan, Hand trowel, Hoe and Shovel, Polythene pots (black gazette type 150 gauge, 15.24 cm × 6.35 cm), Filling funnel, Record book, fine nozzle Spray, Vanier caliper, Metre rule and Spraying can.

### 2.3. Methods

#### 2.3.1. Soil Sampling and Soil Sample

The sampling of the soil is that to have a good quality, clear and healthy river sandy soil in order have an aerated environment for appropriate germination of the seeds. Sample of soil, clear river sand was collected from the forestry division, department of agriculture and natural resources, Maiduguri.

#### 2.3.2. Soil Sterilization

Sterilization of the soil was not to effect in quick germination or increase the growth rate of the viable seeds of *Acacia seyal*, but, to kill any pathogen or insects that might infect or eat up seedlings from the soil.

*Procedure:* - The collected soil sample was sterilized in a mini sterilizer of 0.5 curve capacity, and whole system was then connected to a current sources. The sampled soil was the sterilized by steaming for 45 minutes. Finally, the sterilized soil sample was allowed to cool at room temperature.

#### 2.3.3. Sampling of Seeds of *Acacia Seyal*

The sampling was carried in such way that good quality

and healthy sample of *Acacia seyal* variety could be obtained commercially in the market.

#### 2.3.4. Sample Collection

The seeds sample of *Acacia seyal* was obtained commercially at the Gamboru market Maiduguri, Borno state, Nigeria. About 500 grams of the sample was chosen and obtained and packed in polythene bag, brought to the forestry laboratory and sorted.

#### 2.3.5. Identification and Authentification of the Seed Sample

The seed sampled was identified and authenticated as the seed of *Acacia seyal* by Shettima, M. L. and Kyari, S. U. of the Department of Forestry Technology, Mohamet Lawan College of Agriculture, Maiduguri, Borno state of Nigeria. The age of the *Acacia seyal*'s seed was estimated to be about 2 years old been harvested and authenticated with reference to the herbarium sheets with the voucher number 014, kept at the herbarium of the forestry department of the same college.

#### 2.3.6. Seed Viability Test

Food and Agriculture Organization [9] stated that some seeds lose their viability in a short time. Therefore, it is important to test seeds which are stored in order to determine their germination percentage and it is useless to store any seeds that fall below 40% of germination unless they are very rare or very expensive.

To the above statement made by FAO [9], the viability test becomes paramount and necessary in this study to determine and check for viable ones from the non viable as follow;

##### Pouring Techniques

Procedure: - Two hundred and fifty (250) seeds of *Acacia seyal* were poured in to large mouth container containing water. The poured seeds were washed thoroughly until the viable seeds remain in the bottom of the container and the non viable seeds float at the top of the water. Then gently, the floated non viable seeds were poured off and removed. Gentle with care, the viable seeds at the bottom of the container were collected and dried under good conducive atmospheric air and temperature (room temperature). Then the viable and non viable seeds were counted; the viable seeds were found to be two hundred forty one (241 viable seeds) and the non viable seeds were found to be nine (9 non viable seeds) respectively. The percentage viability was measured by dividing the number of viable seeds with the number of the total number of the seeds used and multiplies by 100 percent (100%).

Thus mathematically expressed;

$$\text{Percentage Viability} = \frac{\text{Number of Viable Seeds}}{\text{Total number of Seed Used}} \times 100$$

Where,

Number of viable seeds = 241

Total number of seeds used = 250

Then substitute the variables obtained,

$$\% \text{ Viability} = \frac{241 \times 100}{250} = 96.4\%$$

This implies that the percentage of viable seeds was 96.4%.

#### 2.3.7. Pretreatment of Seeds Sampled

Food and Agriculture Organization [9] stated that some seeds and shrub seeds are ready for sowing as soon as they are collected, while others pass through a dormant stage, during which the time embryo completes its development. Often, a pretreatment is used to hasten germination or to obtain a more evenly germination. The methods of pretreatment vary with the different types of dormancy of tree and shrub seeds.

With this reasons, to this research study, after the viability test was conducted, it becomes paramount and necessary to perform the pretreatment of the seeds of *Acacia seyal* in order to ensure quick and healthy germination of stated seeds and the technique is perform as follows;

##### Pretreatment Techniques

Procedure: - Water was boiled to 100°C contained in a 1 litre beaker. The viable seeds were soaked in to the boiled water (100°C) for 30 minutes. Then the seeds were removed, allowed to cool in cold water. Now is ready for sowing in the mixed potting system and open potting system.

#### 2.3.8. Soil for Mixed Potting and Open Potting System Operation

In this, the experiments were carried out in two phases, the mixed sterilized soil with well decomposed cow dung and non mixed soil (sterilized clear river sand) only.

a. Procedure: - For the mixed potting system, the soil mixture for potting was made by adding one (1) pan of well decomposed cow dung to three (3) pan of clear sand and mixed very well by using hoe and shovel for the mixing. With the aid of filling funnel and trowel, the polythene pots were filled to the brim with the potting mixture. The pots were then tightly held at the middle, then raised and allowed to drop on their base with a thud for several times in order to allow the soil mixture to sink down very well. The space left at the top of the pots was further filled with the potting mixture. It was then (the pots) put away in a stalk and arranged orderly and followed by pre – watering of the filled pots. It was well watered before planting finally.

b. Procedure: - For the open potting system, the sterilized clear river sand was turned and mixed very well using hoe and shovel for the mixing as well. With the aid of filling funnel and trowel, the polythene pots were filled to the brim with the sterilized clear river sand. The pots were then tightly held at the middle, then raised and allowed to drop on their base with a thud for several times in order to allow the clear river sand soil to sink down very well. The space left at the top of the pots was further filled the pot with the clear river sand soil. It was then (the pots) put away in a stalk and arranged orderly and followed by pre – watering of the filled pots. Finally, it was well watered before planting.

### 2.3.9. Sowing and Nursery Planting

#### i. Viable and Pretreated Seeds

In this experiment of the study, one hundred and twenty eight (128) viable and pretreated seeds of *Acacia seyal* were sown at a depth of 5 cm, one (1) seeds per each polythene pot of the potting system, i.e. the mixed potting system and the open potting system. The seed beds were hand watered by using fine nozzle spray in order to produce almost a mist. This will guard against removing and washing away fine seeds and sand.

#### ii. Nursery Tending

The nursery tending, like watering and weeding was necessary. The watering was done daily twice, morning and evening. Observation and monitoring was made in order to note the time of germination. The germination of seeds was observed daily and the number of seeds that had germinated each day was recorded, seedling height by using metre rule, the stem diameter using Vanier caliper and number of leave were taken and record weekly for four weeks (28 days) respectively.

### 2.4. Data Analysis

The data obtained from this research study were subjected to statistical tools of analysis using percentage, mean for the measurement of central tendency, and standard deviations for measurement of dispersion and or discrepancy within the variables, variance to determine statistical difference between means being obtained and its' significance, and MTB > ANOVA as described by Stroud and Booth [25].

## 3. Results

The results obtained from this research work was that the experiments were carried in two different sites, 4 replications where 16 seeds in each system were further made and sown in to the mixed potting system and the open potting system. The mixed potting system rows containing 4 seeds ( $R_1$ ,  $R_2$ ,  $R_3$  and  $R_4$ ) each sown in polythene pots, likewise, the open potting system also containing 4 seeds ( $R_1$ ,  $R_2$ ,  $R_3$  and  $R_4$ ) each sown in polythene pots respectively. Seven days after planting, there was no germination in all the replicates. From day 8<sup>th</sup> – 11<sup>th</sup> germination was observed in replicate 4 ( $R_4$ ), seed germinated in replicates 1 ( $R_1$ ) – 3 ( $R_3$ ) on day 14<sup>th</sup>, that is, 2 weeks after planting the germination and was completed as from day 27<sup>th</sup> – 30<sup>th</sup>. In the open soil treatment, germination was much more delayed which commenced averagely on the 12<sup>th</sup> days after planting. In facts, in first week of planting there was no leaves as the plant did not germinated, leaves started developing from day 11<sup>th</sup> – 13<sup>th</sup> and the total number of leaves began to increase progressively with days as shown in the tables below as follow: -

Table 1 showed the germination of the seeds of *Acacia seyal* in mixed and open potting system.

The total number of seeds that germinated in both potting system were 117; the mixed pot had 53 and open pot soil

treatment was 64. There was no significant difference between the two potting systems in terms of germination, despite the difference in numbers of germinated seeds; the open potting system had the highest number the seeds germinated.

Table 2 showed the height of *Acacia seyal* seedlings over weeks in mixed and open potting system. The height of the plants averagely for first (1<sup>st</sup>) week was 39.6 cm for the mixed potting system, while, that of the open potting system was 48.6 cm, for second (2<sup>nd</sup>) week the mixed potting was 41.1 cm and 49.5 cm for the open potting system, for the third (3<sup>rd</sup>) 71.1 cm was for mixed potting system and 81.9 cm was for the open potting system, lastly the fourth (4<sup>th</sup>), 95.2 cm was for mixed potting system and the open potting system had 102.6. In all of the height of the seedlings in between the two potting systems treatments, open potting system had the highest height in all respects.

Table 3 showed the diameter of the stem of *Acacia seyal* over weeks in mixed and open potting system. The total diameter of the plant in mixed potting system had 2.46 cm, 4.45 cm, 6.4 cm and 7.47 cm for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> week, while the open potting system had 2.09 cm, 4.48 cm, 5.27 cm and 7.71 cm for the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> week respectively. Among the two potting system treatments, the open potting system had the highest diameter in replicates  $R_2$  and  $R_4$  (treatments 2 and 4), while the mixed potting system had higher in diameter in replicates  $R_1$  and  $R_3$  (treatments 1 and 3).

Table 4 showed the number of leaves of Seedling of *Acacia seyal* over weeks in mixed and potting system. The mixed potting system had number of leaves; 40 leaves, 60 leaves, 87 leaves and 108 leaves for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> week were recorded. While the open potting had 34 leaves, 64 leaves, 120 leaves and 134 leaves for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> week respectively. The mean number of leaves in the first day was 0. On day 13<sup>th</sup> the average number of leaves was approximately 1 where it increased with days to 19<sup>th</sup> to the last day of the experiment that is (30<sup>th</sup> day). It has been noticed that, at 1<sup>st</sup> week, the number of leaves was higher in mixed potting system, while the open potting system was lower with difference of 6 leaves, but, at the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> week the open potting system had higher numbers leaves than the mixed potting system.

Figure 1 and 2 showed the nursery experiments of the 2 potting systems; the mixed potting system and the open potting system rows containing four seeds each in polythene pots.

Figure 3 showed the Photograph of the mixed Polythene Pot filled with the mixture of river sand and cow decomposed cow dung shown at the left hand side and the right hand was the sand filled Poly Pot arranged systematically before sowing the seeds of *Acacia seyal* up to germination period.

Figure 4 showed the photograph of the seedlings from the 2 potting systems. The seedlings from the open potting system treatment had more leaves, thicker in diameter of stem and taller than the seedlings from the mixed potting system among the treatments.

Figure 5 showed the photograph of a growing plant of *Acacia seyal* raised from open potting system Treatment.

Figure 6 showed the photograph of grown tree of *Acacia seyal* in the College Poultry Farm premises raised from open potting system. The age of the tree is 8 years old (2009).

**Table 1.** The Number of Seeds of *Acacia seyal* Germinated in Mixed and Open Potting System.

Type of Potting System	Number of Seeds Germinated
Mixed Pot	53
Open Pot	64
Total (Mean $\pm$ Standard deviation)	118 (58.5 $\pm$ 7.8)

**Table 2.** Seedlings of *Acacia seyal* Height (cm) Per Weeks in Mixed and Potting System.

Period in Weeks	Type of Potting System (cm)	
	Mixed Pot	Open Pot
1 <sup>st</sup> Week	39.6	48.6
2 <sup>nd</sup> Week	41.1 cm	49.5 cm
3 <sup>rd</sup> Week	71.1	81.9
4 <sup>th</sup> Week	95.2	102.6
Total (Mean $\pm$ Standard Deviation)	247 (61.7 $\pm$ 26.6)	282.6 (70.6 $\pm$ 26.3)

**Table 3.** Stem Diameter of *Acacia seyal* Per Weeks in Mixed and Open Potting System.

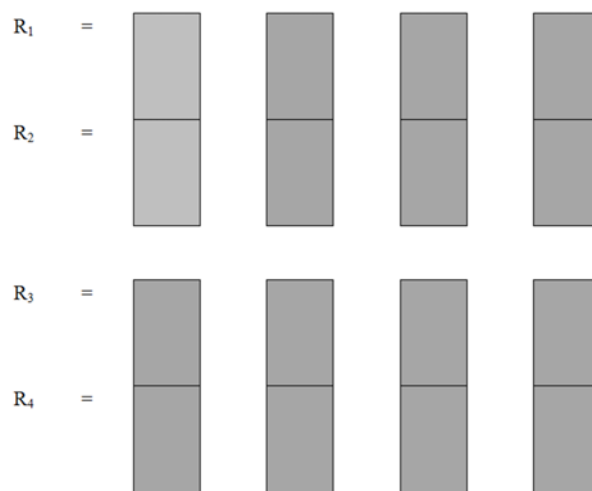
Period in Weeks	Type of Potting System (cm)	
	Mixed Pot	Open Pot
1 <sup>st</sup> Week	2.46	2.09
2 <sup>nd</sup> Week	4.45	4.48
3 <sup>rd</sup> Week	6.41	5.29
4 <sup>th</sup> Week	7.47	7.71
Total (Mean $\pm$ Standard Deviation)	20.8 (5.2 $\pm$ 2.2)	19.6 (4.9 $\pm$ 2.3)

**Table 4.** Number of Leaves of Seedling of *Acacia seyal* Per Weeks in Mixed and Potting System.

Period in Weeks	Type of Potting System (cm)	
	Mixed Pot	Open Pot
1 <sup>st</sup> Week	40	34
2 <sup>nd</sup> Week	60	64
3 <sup>rd</sup> Week	87	120
4 <sup>th</sup> Week	108	134
Total (Mean $\pm$ Standard Deviation)	295 (73.6 $\pm$ 29.9)	352 (88 $\pm$ 47)



**Figure 1.** The mixed potting system rows containing 4 seeds each in polythene pots, was made by adding 1 pan of well decomposed cow dung to 3 pan of clear sand and mixed, the polythene pots were filled to the brim with the potting mixture, tightly held at the middle, then raised and dropped on their base several times to sink down very well, and followed by pre – watering of the filled pots and was well watered before planting finally.



**Figure 2.** The opening potting counting four seeds each in polythene pots, the sterilized clear river sand was turned and mixed well, the polythene pots were filled to the brim with the sterilized clear river sand, tightly held at the middle, then raised and allowed to drop several times to sink down well, were pre – watering of the filled pots, was well watered before planting.



**Figure 3.** Photograph of the mixed Polythene Pot filled with the mixture of river sand and decomposed cow dung shown at the left hand side and the right hand side was the open Poly Pot filled with sand only, arranged systematically before sowing the seeds of *Acacia seyal* up to germination period.



**Figure 4.** Photograph of the seedlings from the 2 potting systems. The seedlings from the open potting system treatment at the right hand side had more leaves, thicker in diameter of stem and taller than the seedlings from the mixed potting system which was shown at the left hand side, among the treatments.





**Figure 5.** This is a photograph of a growing young plant of *Acacia seyal* raised from open potting system Treatment.



**Figure 6.** This is a photograph of grown tree of *Acacia seyal* in the College Poultry Farm premises raised from open potting system. The age of the tree is 8 years old (2009).

## 4. Discussions

The success of plantation projects mostly depends on the established nursery, time period, demand, adequate funding, observations and monitoring, quite conducive environment and the type of the seedlings availability. The establishment of plantation in the arid zone, e.g. Nigeria, in order to meet the growing demands for shelter, fuel wood, fodder for livestock, food security, pharmaceuticals and manufacturing industries demand, to arrest desertification and to provide most simple, easiest, and cheap measures of control has been a top priority of this present administration of Federal Government of Nigeria, clarion call for a change. Yes, call for positive change for all sustainable development goals and the clarion call for Zero Hunger Initiative; ending hunger by the year 2030 by UN / FAO. In the arid zone of some states in the Northern Nigeria, plantations depend largely on the acquisitions of skill techniques and the knowledge of forestry technology, draught resistant plants and their varieties, adequate number of viable and sterilized seeds and seedlings indigenous one that could adopt to the environment, climate condition of the area concern and grow well within a short period. In order to attain and provide the solutions to these problems mentioned, knowledge in various fields of local, traditional, indigenous and modern knowledge becomes compulsory and necessary to acquire in quantum and speedily.

The research findings revealed that in the first one week, the reason for no germination in both treatments (open and mixed potting system) was not because of dormancy, but due to its natural time interval for germination. The dormancy of the seed was broken using hot water treatment (been sterilized). This is conformed to Anonymous [6] who reported that pre-treatment of seed for faster germination involve soaking the seeds in water accompanied by a quick withdrawal of the source of heat and allowing the seed to soak in the gradual cooling water for a period of time.

In another finding, the results of the research revealed that,

*Acacia seyal* been a leguminous plant with epigeal germination pattern, i.e. early young seedlings with cotyledon above the ground, after 4 weeks of observation of seed germination, it was observed that number of seeds that had germinated was higher in the open potting system than the mixed potting system. The mean seedlings height was also observed to be higher in the open potting system than mixed potting system in each week. This is in line with the work of Nwoboshi [2] who reported that germinating seeds are sensitive to the physical as well as the chemical environment in which they are growing, hence the addition of fertilizer and fresh cow dung to the growing medium or use of medium rich in nutrient can be harmful to the germinating seed either partially or directly.

It also revealed that after 21 days of planting the average number of seed that germinated was 3.4 with an average number leave produce being 7.4. There was significant difference. This is because the roots have started establishing and absorbing water, therefore the number of leaves produced becomes higher, likely enough the *Acacia* varieties of plants are leguminous plant, they fixes nitrogen to the environment, hence they required not much manure or fertilizer for their growths. This is in conformity with the work of FAO [3]. According to Mohammed *et al*, [26] who stated that Afforestation plays a vital role in the sustainability and development of a semi – arid or arid land and vegetation is very important to human and animal as primary source of; building materials, pharmaceutical and manufacturing industries, as fuel, etc. These, when they alter the natural vegetation to grassland, then it is deforested. Deforestation is not only affects the immediate rainforest and ecosystem, but it may also have some consequences on semi – arid and arid zones. It is a complex environmental problem such as erosion, drought, microclimate changes, fuel wood scarcity, reduced stream flow, etc.

Changes in climate have caused some impacts on human, its environment and the natural ecosystem in the recent years causes some problems across agriculture, forestry, food security, shelter, etc. The ecological system and ecology is the interaction between organisms and their environment as an integrated system. The ecosystem approach is fundamental in order to managing earths' resources, addresses the interactions that link between abiotic and biotic system. According to Gwana *et al*. [27] who stated that climate change is occurring as a results of the global warming of the earth's atmosphere due to human activities, generating excessive amount of greenhouse gasses which have an enormous effect human health generally.

Knowledge is said to be the central key to success, factors in this modern world. Gwana *et al*, [28] stated that it becomes very necessary, imperative and impressive to acquired knowledge and experience in agricultural farming practice, forestry, etc. for the purpose excellent, quality living in respect of food security and bio-security within the biodiversity. This necessitates the acquisition of knowledge of forestry nursery and horticulture amongst others. Also Gwana *et al*, [27] reiterated that the

acquisition of knowledge in various fields of local, traditional, indigenous and modern knowledge becomes compulsory and necessary, especially when been acquired in quantum and speedily.

The knowledge of Afforestation, forestry science and technology as whole is vital to human and any environment; it encompassed the ecosystem ecology and biodiversity aspects. Therefore, Afforestation plays a vital role in the sustainability the development and protection earths' environment of semi – arid land or zone. Trees (Vegetations) serve various purposes (tangible and intangible benefits), they help in protecting the land from wind and water erosion. For these reasons, this scientific research work, provide an important information on the knowledge on the techniques of raising seedlings of *Acacia seyal* (been an indigenous plant in the area, known as “*Bishiyar Farar Kaya*” in Hausa language and “*Kiska Karamga*” in Kanuri language, all these terms signified the tree of *Acacia seyal*) in the arid zone of North – Eastern Nigeria. Simple procedures for seed procurement, nursery development and seedlings production in the arid zone of Nigeria are described to individuals, Institutions, communities, and private organizations who may wish to establish their nurseries for seedlings productions for various purposes, including landscaping, establish for fruit orchard, village woodlot, farm forestry, shelter belt establishment, etc. Although, emphasis is been laid on the arid zone, but the information that is been given contained herein will also be applicable to other situation outside the region. In addition, the agencies responsible for seeds procurement should provides enough viable and sterilized, good quality seeds of various indigenous variety (species) of economic trees to the local indigenous communities, so that to support, hasten and encourage the Afforestation programs by communities.

It is important to notice that climate change is occurring in the semi arid or the arid zone of Nigeria, especially, in the upper northern part of Nigeria, more occurring in the part of north – eastern Nigeria, especially around Lake Chad Basin axis where the Boko Haram Terrorists and some Armed Bandits harbored and are terrorizing the habitats of the area. The activities of the Boko Haram insurgency and armed Bandits took cover under the Boko Haram are putting those human populaces, the vegetations and wildlife that are occupying the area in to chaos, causing a lot of environmental impact to these habitats. Also the biodiversity is been affected; the ecosystem - ecological aspect of the environment are affecting the human society, plants and animals as well as they are reduced to certain numbers. As a result of their activities in the area, it is causing more serious and severe environmental impact of which need to be assess later or in future. Most plants and animals are been destroyed and deserted as a result of bombardments and the use of arsenal materials by the Boko Haram terrorists and their allied.

Plants such as the *Acacia species* which are in abundant in these areas of semi arid zone of the Lake Chad Basin axis were made to be deserted, been an indigenous, resistant to harsh to adopt the environmental weather and it is economic tree which generate a lot of income to the local communities,



and its bye-products are export commodity used for various purposes in the building materials, pharmaceutical and food industries internationally. It contributes it quarter by enriching the local communities when its products been harvested, thus, reduce hunger of local community by increasing their purchasing capability and power.

Therefore, the planting of such trees like *Acacia* varieties, e.g. the specie of *Acacia seyal*, *Acacia senegal*, etc, in this area or related area will help in generating funds, contributing to the Gross Domestic Product (GDP) of the country concerned and support the clarion call for Zero Hunger Initiative; ending hunger by the year 2030 by United Nations and Food and Agriculture Organizations (UN / FAO) and present administration of the Federal Government of Nigeria as well. Tree planting practice in African Savanna, observed that the regular watering of plants under appropriate conducive atmosphere will therefore greatly affect the successful growth determination. In comparing the two techniques it was observed that the open potting system has more favorable to seed germination and seedling growth than the mixed potting system.

## 5. Conclusion

The establishment of plantation in the arid zone, e.g. Nigeria, to meet the growing demands for shelter belt, fuel wood, fodder for livestock, food security, pharmaceuticals and industries demand and to arrest the desertification and to provide most simple, easiest, and cheap measures of monitoring and control has been the top priority of the present administration of Federal Government of Nigeria (Federal Republic of Nigeria), the clarion call for positive change and the clarion call for Zero Hunger Initiative; ending hunger by the year 2030 by UN / FAO (2017). In the arid zone of the Northern Nigeria, the raising of plantations depend largely on the acquisitions of skill techniques and the knowledge of forestry technology, drought resistant plants and their varieties that could adapt the environment harsh weather, adequate numbers of viable and sterilized seeds and seedlings that are indigenous one that could adopt to the environmental ecosystem, climate condition of the area concern and ability to grow well within a short period. In order to attain and provide the solutions to these problems mentioned, knowledge in various fields of local, traditional, indigenous and modern knowledge becomes compulsory and necessary to acquire in quantum and speedily. In summary, comparing the two germinating techniques the open potting system has a very high germinated seeds of *Acacia seyal* and number of leaves produced. Therefore it can be concluded that in raising seedlings in the arid zone environment, the open potting system treatment techniques is preferable from the findings obtained in this research work.

## Recommendation

We recommend the open potting system techniques treatment for raising of seedlings to agro foresters, who intent

to raised seedlings for Afforestation Programmes in the arid zone, especially in Borno State Nigeria and more especially in the Lake Chad axis of the North – Eastern Nigeria at large.

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