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Growth assessment of endangered *Aframomum sceptrum* (Braun) under different planting regime for sustainable utilization

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The study investigated the growth assessment and germination study of endangered *Aframomum sceptrum* (Braun) under different planting regime for sustainable utilization. The result of various planting regime showed that shoot height was highest in seeds planted 5 days after extraction (35.36 cm) closely followed by 3 days after extraction (31.36 cm) and the least value was found in 14 days after extraction. In the same vain, base diameter was highest in seeds planted 5 days after extraction, while the least was recorded in seeds sown after 3 days of extraction. Number of leaves was highest for seeds planted 3 days after extraction (11 cm) and the least value was recorded for the ones planted 14 days after extraction (8 leaves). Differences in all the growth parameters assessed were significant at $p < 0.05$. There were positive effects in growth performance of this specie in the entire planting regime. Therefore, this study shows a positive domestication and multiplication of this species.

Key words: *Aframomum sceptrum*, planting regime, sustainable utilization, dormancy, germination.

INTRODUCTION

Aframomum sceptrum (Braun) is an herbaceous, perennial and aromatic species classified in the monocotyledonous family of Zingiberaceae, native to Ethiopia where it is called Korarima. In Nigeria, it is commonly found in derived savanna area. In Benue State, the Idoma people called it Ugbenya. The plant consists of an underground rhizome, a pseudostem, and several broad leaves and resembles *Elettaria* species morphologically (Eyob et al., 2008). Mature plant can reach a height of 1 to 2 m. It sets seed after 3 to 5 years of planting depending on the planting materials used and it continue to bear seeds for a number of decades. It occurs as a cultivated crop only in Ethiopia. The seed of *A. sceptrum* is mainly used as sources of spices in traditional Ethiopian dishes and in Nigeria. It is a source of income for growers as its seeds fetches high prices in local and export markets. *A. sceptrum* parts are used in traditional medicine for humans and cattle. Also, it is an important plant for soil conservation as the rhizomes and leaves spread on the ground covering and protecting the soil from erosion in hilly areas (Eyob et al., 2008). Recent attempts in Ethiopia to encourage farmers to cultivate the *A. sceptrum* plant have not been successful due to several production constraints. In Nigeria, it is neglected and underutilized. Among all production constraints, farmers emphasized that lack of improved varieties with improved agronomic practices like propagation techniques had contributed to decrease in production (Eyob et al., 2009). The slow seed germination and growth of the subsequent seedlings were concerns of *A. sceptrum* growers. The germination of *A. sceptrum* seeds faces certain problems. There might be some kind of

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Table 1. Analysis of variance of planting regime and weeks on height.

SV	DF	SS	MS	F
Planting regime	4	411.64	102.90906	194.17**
Weeks	2	557.52	278.76161	525.96**
Error	38	20.32	0.53	
Total	44	989.48		

** = Significant at $p < 0.05$.

dormancy, possibly associated with the hard seed coat. Dormancy as a result of impermeable seed coat was reported from seeds of *Elettaria* species (Sulikeri and Kololgi, 1977). Low food reserve in the seed endosperm might be a reason for the very slow growth of the seedlings. Enhancement of korarima seed germination is important in propagation and breeding program as well as for testing and using germplasms (Bhattacharya and Khuspe, 2001). Although, *A. sceptrum* is mainly propagated by vegetative method using 1 year old rhizomes, the need for bulk of rhizome as planting materials and slow multiplication rate of the rhizomes became another critical problem (Polat, 1997). Also, the destructive harvestings and malhandling of the rhizomes for vegetative propagation seems not to be feasible because there is always the possibility of losing the mother plant during this process. Despite the fact that *A. sceptrum* is a useful crop with a high potential as income source and other purposes, only limited efforts have been made to improve this crop using traditional and modern biotechnological approaches (Echeverrigaray et al., 2003). To achieve such an improvement, proper agronomic and tissue culture procedures, which assure successful and efficient propagation, need to be developed. To date, only two tissue culture studies have been reported (Tefera and Wannakrairoj, 2004), but have no reports on agronomic practices such as seed germination procedures. Therefore, the overall goal of the present study was to investigate the effects of different seed treatment methods, to evaluate *in vitro* performances of different cultivars and *in vitro* growth response of ex-plant sources of *A. sceptrum*.

MATERIALS AND METHODS

Matured seeds of *A. sceptrum* were collected from Akinsola village in Ido-Local Government Area of Oyo State between the months of September to October, 2009. The plant was collected by Lawal Ibraheem, and was further identified by Mr P. O Daramola of Forestry Research Institute of Nigeria, while the herbarium specimen was kept in Forest Herbarium Ibadan. The seeds were extracted from its outer layer coat. Washed and sterilized river sand was filled into perforated plastic trays and later transferred to black polythene pot for growth evaluation/assessment and to assess best sowing or planting regime. These were investigated under mist propagated chamber. The 20 seedlings of *A. sceptrum* were sown according to their planting regime at both germination and seedling stages. Watering was carried out once daily. The study set up consisted of freshly sown immediately after extraction, sown after 3, 5, 7 and 14 days, respectively.

Growth variables

Plant height (cm), base diameter and number of leaves were respectively assessed for 3 weeks. Analysis of variance was carried out to ascertain the relationship between the germination and growth pattern and the treatment used (planting regime) for the species over time (weeks).

RESULTS AND DISCUSSION

Effect of planting regime on plant height

The result of the plant height assessed was significantly influenced by the planting regime and time (weeks) at $P < 0.05$ (Table 1). This could be due to the juvenility of the seedlings, which are in their initial period of active growth and have high levels of auxins to enhance rooting as reported by Oni et al. (2005). Plant height improved with increased period of planting. It was observed that seeds sown after 5 days of extraction (45.32 cm) performed better than others (Figure 1). The least of 21.02 cm was obtained from seeds planted after 14 days of extraction. This revealed that the seed dormancies are broken after 5 days of extraction and the height growth is also improved

Effect of planting regime on number of leaves

The significant effects of planting regime and time of planting (weeks) reflected on leaves number (Table 2). Mean leaf numbers did not follow similar trends for the various planting regime with the seedlings having the maximum leaf numbers (14 leaves) in seeds sown after 3 days of extraction at the 3rd week (Figure 2). This was followed by seeds freshly sown (10 leaves) and the least number of leaves was observed in seeds sown after 14 days (8 leaves). This revealed that the delay in sowing of the seed affect the leaves production of the plant. This needs to be noted, if the purpose of production is meant for leaves harvesting.

Effect of planting regime on base diameter

Base diameter is a vital parameter needed in growth and

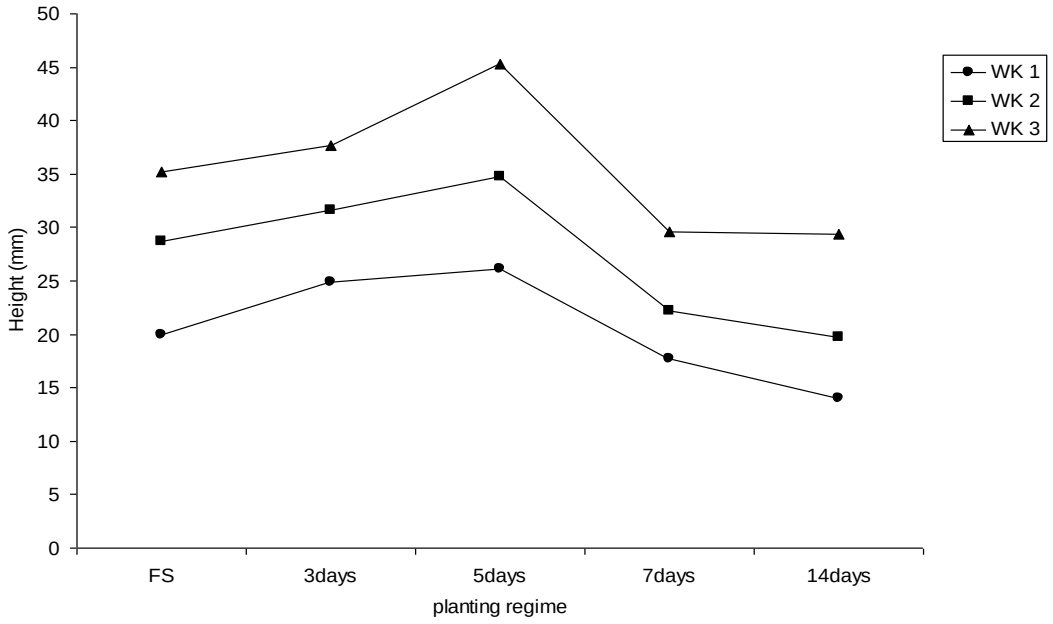

Figure 1. Chart of the plant height after 3 weeks of assessment. FS, Freshly sown; DF, Degree of freedom; SV, source of variation; SS, sum of squares; MS, mean of sum of squares; F, F-values.

Table 2. Analysis of variance of planting regime and weeks on number of leaves**.**

SV	DF	SS	MS	F
Planting regime	4	20.10	5.02	35.86**
Weeks	2	17.52	8.76	62.57**
Error	38	5.17	0.14	
Total	44	42.79		

** = Significant at $p < 0.05$.

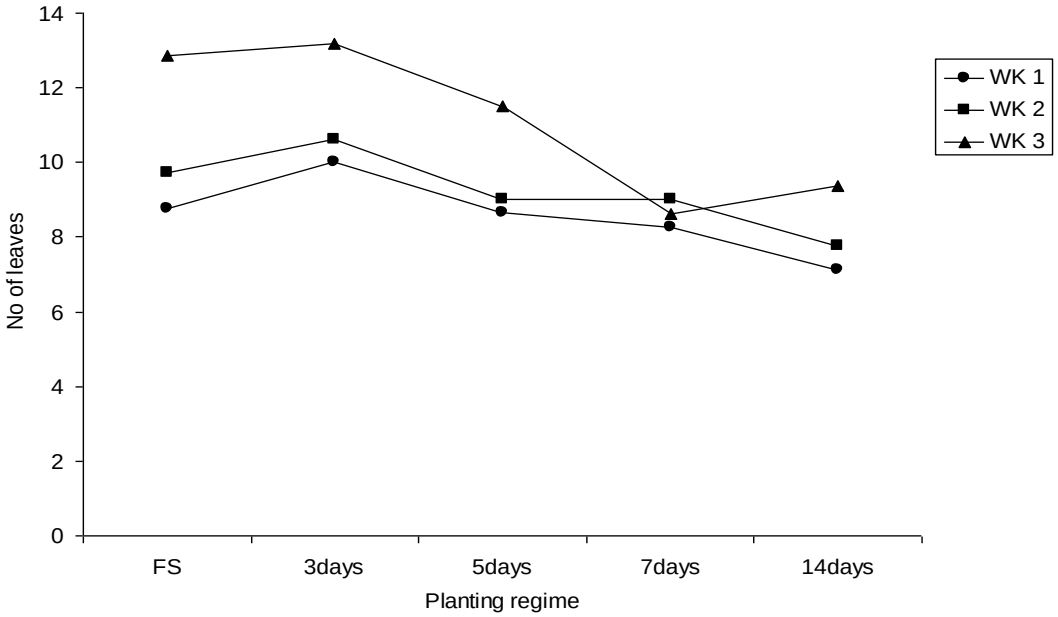

Figure 2. Chart of number of leaves produced after 3 weeks of assessment. **FS,** Freshly sown.

Table 3. Analysis of variance of planting regime and weeks on base diameter.

SV	DF	SS	MS	F
Planting regime	4	1.36	0.34075	17.00**
Weeks	2	0.11	0.06	3.00**
Error	38	0.75	0.02	
Total	44	2.22		

** = Significant at $p < 0.05$.

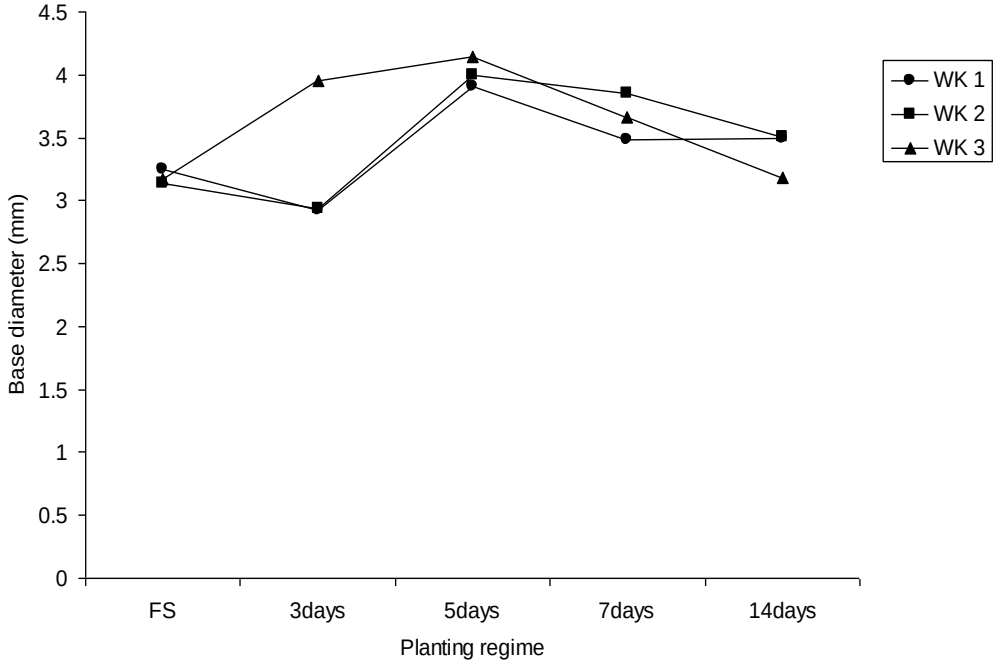

Figure 3. Chart of the plant base diameter after 3 weeks of assessment. FS, Freshly sown.

yield assessment of a plant. Volume of tree/plant is a function of its base diameter and height (Avery and Burkhart, 2002). The effect of the planting regime and weeks on the base diameter was also significant (Table 3). It was also observed that the base diameter was highest for seeds left for 5 days after extraction before sowing and the least was observed in seeds sown after 3 days of extraction (Figure 3).

Conclusion

From this study, optimum growth of *A. sceptrum* can be obtained in the seeds sown after 5 days which shows that the seed does not required mechanical or chemical method breaking its dormancy. Planting regime indicated a contributory effect on early seedlings growth revealed a positive effect in the growth performance of *A. sceptrum* in the entire study. This study has therefore showed a possible domestication and multiplication of this species to avoid its extinction and to make it available for sustainable utilization in any capacity.

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