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Effect of Sowing Intervals on the Performance of Grain Components of African Yam Bean (*Sphenostylis stenocarpa* L.) in Northern Guinea Savanna, Nigeria

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Abstract

Field experiment was carried out during 2021 rainy season at Teaching and Research Farm, Department of Crop Science, Adamawa State University, Mubi, and Teaching and Research Farm, Department of Crop Production and Horticulture, Modibbo Adama Univesity, Yola both located in Northern Guinea savanna of Nigeria. This was to study the performance of grain components of African yam bean (*Sphenostylis stenocarpa* L.) under varying sowing intervals. The treatments were early July, mid July and late July, fitted in a randomized complete block design (RCBD) and replicated three times. Data were collected on important pod determining parameters (number of secondary branches per plant and days to 50 % flowering). Days to first podding, pod dry weight, number of pods per plant, pod length were also collected as grain determining parameters and as well as other grain yield components were also collected and subjected to analysis of variance using the Statistical Package, Statistix "10.0". From the results of the analysis, number of secondary branches

were higher with early and mid sowing. Similarly, early and mid sowing influenced earliness to 50 % flowering and 50 % podding in terms of number of days. Average pod dry weight was higher at early sowing as mid sowing influenced higher performance of number of grains per plant (31.5), pod length (15.5 cm), number of grain per pod (8.5); and also a hundred grain weight (26.4 g) which was at par with later sowing time (25.6 g). Grain yield per hectare for both the location and mean of the locations (2.42 t/h) were influenced with the mid sowing period, which could conclusively stand as the recommended sowing time for the agro-ecological area under study.

Introduction

Nigeria is one of the African Countries that are endowed with varieties of leguminous plants that are required for sustainable food security (Saka *et al*., 2004). Unfortunately, one major causes of food shortage in many African countries and Nigeria in particular is the under-utilization of some potential food endowing crops in the continent (Saka *et al*., 2007). Amongst the under-utilized crops with promising potentials in Nigeria is African yam bean (*Sphenostylis stenocarpa* L.).

The crop forms small tuberous roots that contain more protein than sweet potatoes. The leaves are also utilized as spinach/cooked vegetable (Tindall, 1983). The protein content of African yam bean is up to 19 % of the tubers and 29 % of the grains and the crop has medicinal importance (Potter, 1992). Assefa and Kleiner (1997) remarked that African yam bean has very high nitrogen-fixing ability. It has remarkably low susceptibility to most fields and storage leguminous pests (Omitogun *et al*., 1999). Both its seed and tubers are edible (Potter and Doyle, 1992). According to Uguru and Madukarfe (2001), African yam bean is well balanced in essential amino acid and has higher amino acid content than pigeon pea, cowpea and bambara nut. The grain is a good source of proteins, fibre and carbohydrate and rich in

minerals such as phosphorus, iron and potassium. Despite these importance however, the under-exploitation of the crops potential has subjected it to be classified in Africa as minor grain legumes (Saka *et al*., 2004).

Modern cropping system demands that plants be cultivated at the right time in order to meet up with the ideal environmental requirements to maximize yield. It is an effective strategy to reducing yield loss to harsh environmental conditions, incidences of pest and diseases of grains and tubers which are prevalent in the tropics and often promoted by unpredictable onset and cessation of rainfall due to the present climate change narrative.

Sowing intervals of crops have therefore been reported to offer effective control measures to crops in order to avoid the aforementioned field prevalences and increase grain yield in African yam beans. Besides, information from previous studies were not clear on the ideal sowing time of African yam bean in Northern Guinea savanna of Nigeria as at present. This study was therefore aimed at finding the ideal sowing time of African yam bean with the objective of increasing grain yield in the study area.

MATERIALS AND METHODS

Field experiment was carried out at the Teaching and Research Farm, Department of Crop Science, Adamawa State University, Mubi (10° 10′N, 13° 10′E, and Altitude 599 m above sea level) and Teaching and Research Farm, Deparment of Crop Production and Horticulture, Modibbo Adama University, Yola (09° 10′N, 11° 14′E, and Altitude 582 m above sea level) during 2021 rainy season. This was aimed at studying the effects of staggering sowing time on the performance of the grain parameters of African yam bean accession in the agro ecological area of study.

The treatments were three sowing intervals (early July, mid July, and late July) fitted in Randomized Complete Block Design (RCBD) and replicated three times. Land was manually cleared and harrowed; and marked out into beds measuring 3.0 m x 3.0 m (9.0 m^2). The net area consisted of two central rows in each bed. An alley of 2.0 m was maintained between the replicates and 1.0 m between the beds to allow movement.

Seeds were sourced from IITA and soaked in water for 24 hours before sowing in order to terminate dormancy, a phenomenon common among African yam bean seeds. The seeds were sown at 60 cm x 60 cm in July according to the staggering treatment intervals and staked using vertical and horizontal poles at 6 WAS to stake the creeping vines. Beds were weeded twice at 3 and 6 WAS and data on number of secondary vines were recorded at 12 WAS. Days to 50 % flowering and first podding from the sowing dates were also counted to assess the period of maturity among the treatments, and pod dry weight, number of pods per plant, pod length, number of grains per pod, a hundred grain weight and grain yield per hectare were taken using appropriate tools and methods at harvest. Data obtained were subjected to statistix "10.0" and means between treatments were separated using Dunan's Multiple Range Test (Duncan, 1955).

RESULTS

Table 1 shows that sowing intervals were significant for average number of secondary branches per plant at maturity, days to 50 % flowering and days to first podding. In the two locations and their combined mean, early and mid sowing had the highest number of secondary branches per plant. For days to 50 % flowering, early and mid sowing recorded fewer days in mean of the locations. Similarly, early and mid sowing time had influence on earliness to first podding than late sowing time.

Table 1: Effect of Sowing Intervals on Numbers of Secondary Branches per Plant, Days to 50% Flowering and Days to First podding of African Yam Bean at Mubi, Yola and Mean of the Locations

Treatment Sowing	Number of Secondary Branches/Plant			Days to 50% Flowering			Days to First podding		
Interval	Mubi	Yola	Mean	Mubi	Yola	Mean	Mubi	Yola	Mean
Early	15.6^{a}	18.4^{a}	17.0^{a}	78.6^{c}	79.9^{b}	79.3^{b}	84.3^{b}	86.5^{a}	85.4^{b}
Mid	14.8^{ab}	17.0^{b}	15.9^{a}	81.2^{b}	79.8^{b}	80.6^{b}	76.7^{c}	87.9^{a}	82.3^{b}
Late	14.2^{b}	15.4^{c}	14.8^{b}	84.6^{a}	83.7^{a}	84.1^{a}	91.5^{a}	89.3^{a}	90.4^{a}
SE ±	0.60	0.60	0.60	1.14	1.16	1.19	1.27	1.50	1.99

Sig.	*	***	*	***	***	***	***	***	NS

Means followed by the same alphabet (s) across the column are not significantly different according to Ducan's Multiple Range Test (DMRT) NS = Not significant, * = significant (P≤0.05), and *** = significant (P≤0.001)

Sowing intervals had significant effect on pod dry weight, number of pods per plant and pod length (Table 2). Early sowing recorded higher pod dry weight at Mubi and mean of the locations as there was no significant difference at Yola. For number of pods per plant, mid sowing at Mubi, Yola and the mean of locations recorded highest number of pods per plant. Early sowing and mid sowing recorded highest pod length at Mubi, though in mean of the locations, mid sowing recorded the highest pod length.

Table 2: Effect of Sowing Intervals on Pod Dry Weight, Number of Pods Per Plant and Pod Length of African Yam Bean at Mubi, Yola and Mean of Locations

Treatment	Pod Dry Weight (g)			Number of Pods/Plant			Pod Length (cm)		
Sowing Interval	Mubi	Yola	Mean	Mubi	Yola	Mean	Mubi	Yola	Mean
Early	7.0^{a}	6.6^{a}	6.8^{a}	25.6^{b}	25.9^{b}	25.8^{b}	14.6^{ab}	13.5^{b}	14.0^{b}
Mid	5.7^{b}	6.4^{a}	6.0^{b}	30.6^{a}	32.4^{a}	31.5^{a}	15.5^{a}	15.5^{a}	15.5^{a}
Late	5.5^{b}	5.9^{a}	5.7^{b}	22.0^{c}	23.3^{b}	22.6^{c}	14.0^{b}	13.8^{b}	13.9^{b}
SE ±	0.41	0.44	0.33	1.70	1.70	1.23	0.54	0.52	0.37
Sig.	NS	NS	NS	*	***	**	NS	NS	NS

Means followed by the same alphabet (s) across the column are not significantly different according to Ducan's Multiple Range Test (DMRT) NS = Not significant,* = significant (P≤0.05), ** = significant (P≤0.01) and *** = significant (P≤0.001)

Table 3 shows the effects of sowing intervals on number of grains per pod, hundred grain weight and grain yield of African yam bean. Mid sowing at Mubi and mean of locations recorded highest number of grains per pod, but was not significant at Yola. Mid and late sowing time recorded highest

hundred grain weight in average of the locations. For the grain yield, mid sowing out-yielded other treatments at Mubi, Yola and mean of the locatios (2.22 t/ha, 2.61 t/ha and 2.42 t/ha respectively).

Table 3: Effect of Sowing Intervals on Numbers of Grains Per Pod, Hundred Grain Weight and Grain Yield of African Yam Bean at Mubi, Yola and Mean of Locations

Treatment Sowing	Number of Grains/Pod			Hundred Grain Weight(g)			Grain Yield (t/ha)		
Intervasssl	Mubi	Yola	Mean	Mubi	Yola	Mean	Mubi	Yola	Mean
Early	7.3^{b}	8.0^{a}	7.6^{b}	23.4^{b}	24.3^{b}	23.9^{b}	1.86^{b}	1.92^{b}	1.89^{b}
Mid	8.3^{a}	8.7^{a}	8.5^{a}	26.9^{a}	25.9^{b}	26.4^{a}	2.22^{a}	2.61^{a}	2.42^{a}
Late	6.8^{b}	7.8^{a}	7.3^{b}	22.6^{b}	28.5^{a}	25.6^{ab}	1.94^{b}	2.12^{b}	2.03^{b}
SE ±	0.43	0.43	0.30	0.84	1.25	0.84	0.115	0.117	0.134
Sig.	NS	NS	NS	NS	NS	NS	***	***	***

Means followed by the same alphabet (s) across the column are not significantly different according to Ducan's Multiple Range Test (DMRT) NS = Not significant, and *** = significant (P≤0.001)

DISCUSSION

Mid sowing interval performed higher for most of the parameters, studied due to the fact that the sowing date was the most ideal timing for utilization of growth resources across the plant developmental phases. For example, early sowing might have promoted early reproductive stage which coincided with mid rainy season flower and pod production (Ogah, 2013), when most of them would have been aborted prematurely due to heavy rainfall. Inversely under late sowing conditions many flowers and young pods were likely to have failed to exist as they got affected by cessation of the rainy season. Mishra and Mishra (1980) reported that best result can be obtained when the crop is planted during the mid-rainy season. Early and mid sowing crops performed higher in terms of number of secondary branches due to the fact that comparably late sowing experienced shorter rainfall duration and depletion of growth resources which could support growth than would

happen under early sowing. Karungi *et al*. (2000) reported that sowing time have tremendous effects on crop growth and development. Number of pods per plant and pod length performances were more favourable under the mid sowing due to some reason above, especially as the rainy season transited to cool dry period to proliferate flower initiation and pod elongation (Emmanuel, 2001). Mid sowing favoured the performances of floral initiation and pod development, all the grain components and grain yield in this study, and could therefore stand as the recommended sowing interval.

CONCLUSION AND RECOMMENDATION

In this study, African yam bean revealed high performance in the Northern Guinea Savanna. It was revealed that mid sowing is more suitable for grain yield per hectare in average of the locations and for most of the growth and yield parameters. Mid sowing interval within the midde July is recommended for grain yield.

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