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Influence of Watering Regime on Germination and Early Growth of African Yam Bean (Sphenostylis Stenocarpa) Under Nursery Condition in Anyigba

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Abstract
A pot experiment was carried out at the nursery site of Faculty of Agriculture, Kogi State University Anyigba. The experiment was carried out to investigate the influence of watering regime on the seedlings of Sphenostylis stenocarpa (African yam bean). The experiment was set up using 5x5 factorial experiments in a completely randomized design (CRD). Five different watering regimes were used: Watering once daily, watering once in two days, watering once in four days, Watering once is six days and the control which was not watered. Twenty-five pots of the same size (8 litres) were used. The same quantity of water (150 ml) was applied on daily basis. The parameters measured were subjected to Analysis of Variance (ANOVA).The means that were found to be statistically significant were separated by Fishers' Least Significant Difference (LSD). The result showed that the best performance of Sphenostylis stenocarpa in terms of watering regime for the treatments which had significant difference are those ones watered once in two days (WOTDs) which gave the best performance of leaf diameter (4.60 cm) and leaf length (10.68 cm) while the ones watered once in four days (WOFDs) were the least in performance giving leaf diameter (2.82 cm) and leaf length (6.96 cm). Therefore, the study recommends watering once in two days for the production of African yam bean in Anyigba.
Keywords: Watering regime, African yam bean, Germination growth, Anyigba.

INTRODUCTION

The African yam bean (*Sphenostylis stenocarpa*) is a climbing legume that grows to a height of over 3 meters and is adapted to lowland tropical conditions. It is one of the lesser known legumes (Apata and Ologhobo, 1990; Ikhajiagbe *et al.,* 2007) and widely cultivated in the Southern parts of Nigeria for its edible seeds and tuberous roots (Okigbo, 1973). African yam bean (*Sphenostylis stenocarpa Hochstex .A. Rich*) is an under-utilized tropical African tuberous legume. It belongs to the class *Magnoliopsida*; order *Fabales*; family *Fabaceae*; subfamily *Papillionideae* and genus Sphenostylis. There are seven species in the genus Sphenostylis (Potter and Doyle, 1994). Of the seven species, African yam bean (AYB) is the most valuable. This arable tuberous legume is important in most indigenous food cultures and in peasant agriculture. The African yam bean is cultivated in many other parts of African. The leaf and floral arrangements as well as the shape and color of seeds of this crop have been determined (Klu *et al.,* 2000; Ikhajiagbe, 2003; Ikjajiagbe *et al.,* 2007). The leaves are stipulate petioles 4-8 cm and reaches a height of 1-3 cm. African yam bean (AYB) is a vigorously climbing herbaceous vine whose height can reach 1.5-3 meters or more.

The cultivation of African yam bean (*Sphenostylis stenocarpa*) is currently localized around Nkwanta and West Districts. It is grown as a minor crop in mixed association with yam and cassava. It is used extensively in various dietary preparations and has potential for supplementing the protein requirements of many families throughout the year. Its current low status as a minor crop means that this potential is largely unexploited. Research efforts are required to improve its agronomic characteristics and promote its cultivation and use as a major crop.

Grain legumes constitute the main source of protein in the diets of the average home. The most important ones are cowpea (*Vigna unguiculata*), groundnut (*Arachis hypogea*) and lima bean (*Phaseolus lunatus*). However, there are other pulses that could help meet dietary needs but are cultivated only in localized areas and used less. These under-exploited legumes include African yam bean (*Sphenostylis stenocarpa*), Bambara groundnut (*Vigna subterrenea*) and pigeon pea (*Cajanus cajan*).

The African yam bean is grown in West Africa, particularly in Cameroon, Cote D'Ivore, Ghana, Nigeria and Togo (Potter, 1992). In Ghana, it is found in localized areas in the Volta Region, where it is grown by peasant farmers as a security crop. It is in danger of extinction in Ghana because of the high premium placed on the major legumes listed above and others such as soybean. An additional problem is that this bean receives no research attention locally.

The African yam bean is grown for both its edible seeds and its tubers. It is a vigorous vine, which

twines and climbs to heights of about 3 meters and requires staking. It flowers profusely in 100 to 150 days, producing brightly-colored flowers, which may be pink, purple or greenish white.

The slightly-woody pods which contain 20 to 30 seeds are up to 30 cm long and mature within 170 days. The plant produces underground tubers that are used as food in some parts of Africa (Duke *et al.,* 1977; Potter, 1992).

MATERIALS AND METHODS

Location of the Experiment

The experiment was conducted under a shade in the front of the glass house in the Faculty of Agriculture, Kogi State University Anyigba. Located at Lat.7°6ᴵN and Long.7°43ᴵE and falls within the Southern guinea savanna zones of Nigeria. Kogi State has a bimodal rainfall with the peak pattern occurring in July and September. The mean rainfall ranges from 1,560 mm at Kabba in West to 1,808mm; at Anyigba in the East (Amhakhian *et al*., 2012). The temperature shows some variation throughout the year. Average monthly temperature varies from 17°C to 36.2°C. Relative humidity is moderately high and varies from an average of 65-85% throughout the year (Amhakhian *et al*., 2012).

Experimental Design and Method

The experiment was designed using a Completely Randomized Design (CRD). Five different watering regimes were used: Watering once daily (DW), Watering once in two days (WOTDs), Watering once in four days (WOFDs), Watering once in six days (WOSDs) and the control (WO) which was not watered. Twenty-five pots of the same size (8 ml) were used for the experiment. There were five treatments with five replications.

Source of Planting Material

The seeds of African yam bean (*Sphenostylis stenocarpa*) were obtained from Agricultural Development Programme (ADP), Anyigba branch of Kogi State, Nigeria.

Parameters measured

The following parameters were measured;

i. **Days to Emergence**
ii. **Plant height**
iii. **Number of Leaves**
iv. **Girth Diameter**
v. **Leaf length**
vi. **Leaf Diameter**
vii. **Biomass Measured**

Statistical Analysis

All the data collected from the experiment were subjected to Analysis of Variance (ANOVA) as described by Snedecor and Cochran (1967) for Completely Randomized Design and Fishers' Least Significant difference was used to separate the means significant difference.

RESULTS

Days to germination

The result obtained for germination shows that there was no significant effect on the different watering regimes on early germination of African yam bean (*Sphenostylis stenocarpa*) (Table 1).

Plant Height

The result obtained for African yam bean height from week 2, 4, 6, 8, 10 and 12 after planting was not significant. The different watering regimes had no significant effect on plants height throughout the different weeks (Table 2).

Girth Diameter

The result obtained for African yam bean girth diameter from week 2, 4, 6, 8, 10 and 12 after planting was not significant. The different watering regimes had no significant effect on girth diameter throughout the different weeks (Table 3).

Number of Leaves

The result obtained for number of leaves of African yam bean from week 2, 4, 6, 8, 10 and 12 after planting was not significant. The different watering regimes had no significant effect on number of leaves throughout the

different weeks (Table 4).

Leaf Diameter

The result obtained for leaf diameter of African yam bean from week 2, 4, 6, and 8 after planting was not significant. However, at week 10 and 12 after planting, there was significant effect between the treatments in which the treatment with watering once in two days (WOTDs) gave the highest leaf diameter (4.60 cm) and (4.74 cm) in both week 10 and 12 while watering once in four days (WOFDs) gave the least leaf diameter (2.82 cm) and (3.30 cm) in week 10 and 12 respectively (Table 5).

Leaf Length

The result obtained for leaf length of African yam bean at week 2, 4, 6, 8 and 12 after planting was not significant. However, at week 10 after planting, there was a significant effect between the treatments in which the treatment with watering once in two days (WOTDs) gave the highest (10.68 cm) and watering once in four days (WOFDs) gave the least (6.96 cm) leaf length (Table 6).

Table 1: Effect of different watering regimes on germination rates of African yam bean (*Sphenostylis stenocarpa*).

TREATMENTS	Days to germination
Control	4
WOTD$_s$	4
WOFD$_s$	5
WOSD$_s$	4
DW	4
Significance	N.S
L.S.D	-
C.V(%)	-

Control (WO)
Watering once daily (DW)
Watering once in two days (WOTDs)
Watering once in four days (WOFDs)
Watering once in six days (WOSDs)

Table 2: Effect of different watering regimes on plant height (cm).

TREATMENTS	Week After Planting (WAP)					
	2	4	6	8	10	12
Control	43.42	122.2	151.80	166.78	172.30	184.84
WOTD$_s$	38.46	73.22	126.82	141.22	148.74	154.68
WOFD$_s$	37.62	77.50	108.52	125.48	142.62	152.14
WOSD$_s$	33.83	91.64	144.36	165.50	177.36	182.36
DW	35.92	80.96	125.30	154.8	166.88	175.02
L.S.D	-		-	-	-	-
C.V (%)	-		-	-	-	-

Table 3: Effect of different watering regimes on girth diameter (cm).

TREATMENTS	Week After Planting (WAP)					
	2	4	6	8	10	12
Control	0.70	0.78	0.86	0.90	0.94	1.04
WOTD$_s$	0.80	0.82	0.86	0.86	0.88	0.92
WOFD$_s$	0.78	0.82	0.82	0.88	0.92	1.02
WOSD$_s$	0.84	0.84	0.88	0.90	0.94	1.02
DW	0.76	0.82	0.86	0.92	0.94	0.96
L.S.D	-	-	-	-	-	-
C.V (%)	-	-	-	-	-	-

Table 4: Effect of different watering regimes on number of leaves.

TREATMENTS	Week After Planting (WAP)					
	2	4	6	8	10	12
Control	2	12.2	20.4	27.6	17.6	32.2
WOTDs	2	6.8	17.6	23.6	17.0	22.4
WOFD$_s$	2	9.2	17.4	22.6	22.6	25.6
WOSD$_s$	2	11.6	23.0	27.8	22.0	19.4
DW	2	8.6	19.4	23.8	18.4	22.6
L.S.D	-	-	-	-	-	-
C.V (%)	-	-	-	-	-	-

Table 5: Effect of different watering regimes on leaf diameter (cm).

TREATMENTS	Week After Planting (WAP)					
	2	4	6	8	10	12
Control	4.06	4.40	4.82	4.94	3.82^{ab}	3.36^{b}
WOTD$_s$	3.00	3.84	4.74	4.92	4.60^{a}	4.74^{a}
WOFDs	3.18	3.72	3.86	4.04	2.82^{c}	3.30^{b}
WOSD$_s$	3.08	4.18	4.32	4.56	3.32^{bc}	3.68^{b}
DW	3.28	4.38	4.80	4.90	3.48^{bc}	4.64^{a}
Significance	**	**				
L.S.D	-	-	-	-	0.86	0.92
C.V (%)	-	-	-	-	**18**	**18**

Means with the same superscripts in a column are not statistically significant at 5% level of probability.

Table 6: Effect of different watering regimes on leaf length.

TREATMENTS	Week After Planting (WAP)					
	2	4	6	8	10	12
Control	8.80	9.34	10.20	10.40	8.48^{b}	8.34
WOTD$_s$	6.62	9.10	10.64	10.82	10.68^{a}	9.76
WOFD$_s$	7.36	8.96	9.30	9.60	6.96^{b}	10.18
WOSD$_s$	7.24	10.50	30.38	11.14	8.20^{b}	9.16
DW	7.16	9.98	10.40	10.42	8.14^{b}	8.70
Significance	*					
L.S.D	-	-	-	-	2.07	-
C.V (%)	-	-	-	-	**18**	-

Means with the same superscripts in a column are not statistically significant at 5% level of probability.

Shoot weight in 30 days

The result shows that both fresh and dry shoot weight of African yam bean taken in the first 30 days has no significance. (Table 7)

Root weight in 30 days

The result shows that there were no significant difference particularly on the root weight of African yam bean seedlings taken in the first 30 days except in the control that had the highest fresh root weight (0.66 g) as compared to watering once in two days which had the lowest fresh root weight (0.04 g) (Table 8).

Shoot weight in 60 days

The result shows that both fresh and dry shoot weight of African yam bean taken in 60 days had no significance. (Table 9)

Root weight in 60 days

The result shows that the fresh root weight of African yam bean was significant giving treatment with watering once in six days (WOSDs) to have the highest fresh root weight (0.07 g) and watering once in four days (WOFDs) had the least (0.04 g) while the dry root weight of African yam bean taken in 60 days had no significance (Table 10).

Shoot weight in 90 days

The result shows that both fresh and dry shoot weight of African yam bean taken in 90 days had no significance (Table 11).

Root weight in 90 days

The result shows that fresh root weight of African yam bean was significant giving watering once in two days (WOTDs) to have the highest fresh root weight (0.35 g) as compared to the control (WO) that had the least (0.10 g) and dry root weight of African yam bean taken in 90 days had no significance (Table 12).

Table 7: Effect of different watering regimes on weight of shoot after 30 days.

TREATMENTS	Weight of Shoot (g)	
	Fresh weight	Dry weight
Control	1.40	0.24
WOTD$_s$	0.49	0.09
WOFD$_s$	0.82	0.15
WOSD$_s$	0.86	0.15
DW	1.15	0.22
L.S.D	-	-
C.V (%)	-	-

Table 8: Effect of different watering regimes on weight of root after 30 days.

TREATMENTS	Weight of Root (g)	
	Fresh weight	Dry weight
Control	0.66^{a}	0.01
WOTD$_s$	0.04^{c}	0.01
WOFD$_s$	0.12^{b}	0.02
WOSD$_s$	0.10^{bc}	0.02
DW	0.07^{bc}	0.01
Significance	*	
L.S.D	0.14	-
C.V (%)	**43**	-

Means with the same superscripts in a column are not statistically significant at 5% level of probability.

Table 9: Effect of different watering regimes on weight of shoot after 60 days.

TREATMENTS	Weight of Shoot (g)	
	Fresh weight	Dry weight
Control	0.98	0.21
WOTD$_s$	1.18	0.25
WOFD$_s$	0.65	0.13
WOSD$_s$	1.10	0.28
DW	1.37	0.31
L.S.D	--	
C.V (%)	-	-

Table 10: Effect of different watering regimes on weight of root after 60 days.

TREATMENTS	Weight of Root (g)	
	Fresh weight	Dry weight
Control	0.06^{a}	0.02
WOTD$_s$	0.06^{a}	0.02
WOFD$_s$	0.04^{b}	0.01
WOSD$_s$	0.07^{a}	0.02
DW	0.06^{a}	0.01
Significance	**	
L.S.D	0.14	-
C.V (%)	**58**	-

Means with the same superscripts in a column are not statistically significant at 5% level of probability.

Table 11: Effect of different watering regimes on weight of shoot after 90 days.

TREATMENTS	Weight of Shoot (g)	
	Fresh weight	Dry weight
Control	1.58	1.16
WOTD$_s$	0.94	0.69
WOFD$_s$	1.44	0.79
WOSD$_s$	1.72	1.14
DW	2.67	2.00
L.S.D	-	-
C.V (%)	-	-

Table 12: Effect of different watering regimes on weight of root after 90 days.

TREATMENTS	Weight of Root (g)	
	Fresh weight	Dry weight
Control	0.10^b	0.03
WOTD$_s$	0.35^a	0.02
WOFD$_s$	0.11^b	0.03
WOSD$_s$	0.17^b	0.03
DW	0.19^b	0.04
Significance	**	N.S
L.S.D	0.13	-
C.V (%)	**52**	-

Means with the same superscripts in a column are not statistically significant at 5% level of probability.

CONCLUSION

From the results of this experiment, it will be concluded that (WOTDs) watering once in two days regime is found to be the best watering regime for growing African yam bean (*Sphenostylis stenocarpa*).

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