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Effect of Planting Date and Mulching on Emergence, Growth and Yield of White Yam in Southwestern Nigeria

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Abstract: A field experiments were conducted to study the effect of planting date and mulching on emergence, growth and yield of white yam during the 2006-2007 and 2007-2008 cropping seasons in Abeokuta, South-western Nigeria. The general model for selecting the planting date of yam in the two experimental years was 0.1PE <P < 0.5PE. This was partitioned for the purpose of attaining optimal planting date into early and late, respectively as E(P-0.1PE) # 0 designated as T_1 and E(P-0.5PE) # 0 as T_2. For the rest of the season defined by P> PE, the physiological parameters and hydrothermal agro-climatic indices measured during the different phenological stages of yam grown were analyzed with respect to the various treatments. The result showed that model T_1 defined as E(P-0.1PE) # 10mm appeared as the best model that significantly (P < 0.05) influenced emergence rate, phenological growth and tuber yield. Irrespective of mulching materials, it was found that mulching significantly (P<0.05) increased tuber yield by about 6-8 t haG^1 seasonG^1 than the unmulched. Furthermore, grass mulch had tuber yield of about 4-6 t haG^1 seasonG^1 greater than the polythene mulch and the unmulched plots.

Key words: Dioscorea rotundata % Hydrothermal % Mulching % Planting date

INTRODUCTION

Agricultural production in most parts of the tropics is largely rain-fed. Hence, planting depends mainly on the onset and amount of rainfall. However in Nigeria, the onset of the rains is variable from year to year such that farmers find it extremely difficult to accurately determine the reliable beginning of the rain vis-à-vis start of the planting crops. Consequently, the schedules of farm operations are often wrongly phased and as a result incidence of failure of agricultural crops, replanting and ultimate low yield have characterized the agricultural food crops production in Nigeria [1]. Hence, the food security appears threatened considering the important role played by yam in Nigeria and Southwest in particular. For instance, yam apart from being important as a source of energy in the diets of millions of people and some livestock [2], it also has cultural and socio-economic significance [3]. However, for yam *(Dioscorea spp.*) as in other parts of West Africa, timely planting is believed to be a key to a successful harvest in Nigeria. Planting date has been known to contribute to variation in yam yield [4]. Moreover, since soil moisture is essential for the survival of setts before the rain is established, then it is imperative to determine accurately the reliable onsets and cessation of the rain vis-à-vis planting date of yam. Furthermore, the occurrence of wet- season- dry spells which may last for a few days to more than three weeks is another serious limiting factor to agricultural management in South Western Nigeria. Incidence of wet season dry spells particularly during the full vegetative stage when evaporative demand is high can lead to retardation of yield formation. The damage is more severe for field crops with shallow root system [5]. However, for location with good soil moisture retention the plants may manage to utilize soil moisture reserve contained in the pores of the soil, or upon the very limited reserve contained in its own tissue during dry spells between rains. Crop may also adapt physiologically or behaviorally to prevent temporary depletion of the stored tissue moisture in other to prevent impairment of normal physiological function that may cause irreversible damage and plant death, more so that yam is highly susceptible to dry spells that occur during the onset of the rains and particularly before the rain has fully established. Therefore, since yam is planted between the period extending from around the cessation

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of the rains in a given year to the time of onset in the succeeding year, it implies therefore that as soon as germination starts, soil moisture become critical, hence the need for efficient soil moisture conservation strategy in other to optimize soil physical condition affecting the crop yield. Various techniques used by traditional farmers in modifying the on- farm microclimate and efficiency of such techniques in West Africa have been studied and reported [6-10]. For dry season planting, excessive heat which may arise from dry spells following occasional wet days during the period from planting until emergence causes partial drought which usually lead to loss of setts and disparity in emergence. The ultimate effect is growth retardation and reduction in tuber yield and thereby causing economic loss. Therefore soil moisture conservation is necessary in dry season planting of yams. As reported by IITA [11], mulching is very important in yam cultivation. Maduakor *et al.* 1984; Okoh, 2004, Iyang, 2005 reported that majority of the traditional yam farmers in West Africa use different mulching materials for yam cultivation. These materials range from dry grass, palm front to wood shaving. Of recent however, the IITA and some less conservative farmers were already using polythene plastic mulch in production of seed yam. However, research into the use of polythene plastic mulch in yam production is not widespread in Nigeria. This study was undertaken to investigate the effects of planting date and mulching on emergence, growth and yield of white yam (*Dioscorea rotundata)*

MATERIALS AND METHODS

Description of Study Area: This study was conducted at the Teaching and Research farm of University of Agriculture along Alabata road, Abeokuta (7° 15'N, 3°25'E) in Odeda Local Government Area of Ogun State, South Western Nigeria (Fig. 1) during the 2007 and 2008 cropping seasons. The study area is characterized by a tropical climate with distinct wet and dry seasons with bimodal rainfall pattern and mean annual air temperature of about 30°C. The actual rainfall totals during the 2007 and 2008 cropping season were 1177.2 and 1201.6mm, respectively. The region is characterized by relatively high temperature with mean annual air temperature being about 30°C. The soil at the experimental site was categorized as a well-drained tropical ferruginous soil. The A horizon of the soil is an Oxic Paleudulf of the Iwo series with 83% sand, 5% silt and 12 % clay with a pH of 6 considered tolerable for yam cultivation [12].

Experimental Design and Field Measurement: The experimental site, comprised of a piece of land (30 x 60m^2) had previously carried beans and groundnut intercrop but had been fallowed for over 3 years (from 2004-2006). The site was cleared manually using cutlass in November 2006, in preparation for the 2006-2007 cropping following the popular practice by the farmers in the study area. This period marks the preparatory period for the cultivation of early yam planting in the study area. Yam mounds were made manually using African hoe during the two experimental years. The mounds were of height 60cm and spaced 1.5 x 1.5m^2 a walk way of 1m between adjacent row. The mound tillage system was selected for the study not only because it is the most widely use method in the study area, but also because it improves the soil aeration and hydrothermal conditions for crops emergence, root development, crop growth and yield [7].

Three local white yam, *Dioscorea rotundata* cultivars (Efuru, 'A$_1$; Ise-osi 'A$_2$; and Oniyere 'A$_3$) were used. The choice of selection was due to the fact that the cultivars were the most important edible yams widely grown by farmers in the University's extension villages around the study area. During each year of study, rainfall-potential evapotranspiration (P-PE) model according to the procedure of Cocheme and Franquin [13] were followed to determine start and end of planting. The model used in this study was formulated to incorporate farmer's conventional calendar for yam cultivation. Consequently, planting date was selected based on the following general model

$$0.1PE < P < 0.5PE$$

where

PE = Potential evapotranspiration
P = Rainfall
0.1PE = One tenth the potential evapotranspiration
0.5PE = Half the potential evapotranspiration

Two specific planting dates (T$_1$ & T$_2$) generated from the general model above is as below

E(P-0.1PE) # 0 ………….. T$_1$
E(P-0.5PE) # 0 …………… T$_2$

Where

C E(P-0.1PE) # 0 = accumulated difference between rainfall (P) and one tenth the potential evapotranspiration (PE) is zero

C E(P-0.5PE) # 0 = accumulated difference between P and half PE records zero

The terms P, PE, 0.1PE and 0.5PE are as previously defined.

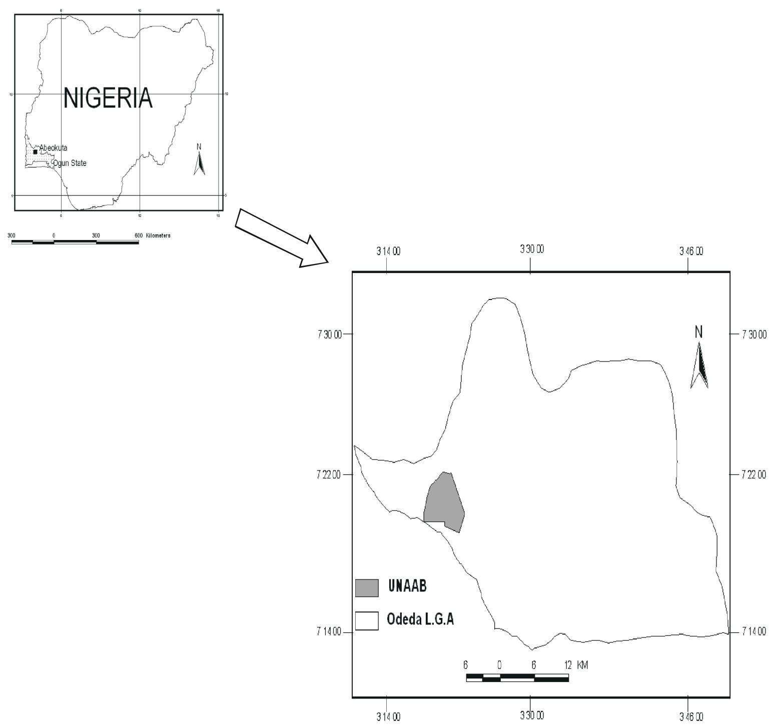


Fig. 1: Location of University of Agriculture, Abeokuta within Odeda Local Government Area in Ogun State, Southwestern Nigeria.

It follows that the two planting dates (T_1 & T_2) in each experimental years were determined from the model. For instance, the planting dates for the 2006-2007 experimental year are as below

- $T_1 = \Sigma(P\text{-}0.1PE) \geq 24$ = March 22 which fell in the 9th decade of 2007
- $T_2 = \Sigma(P\text{-}0.5PE) \geq 259$ = June 5 which fell in the 16th decade of 2007

Whereas the planting dates for the 2007-2008 experimental year happened to be:

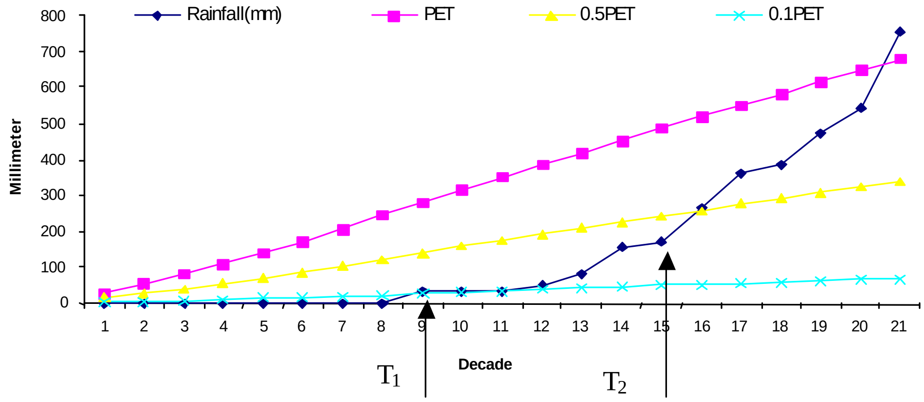
- $T_1 = \Sigma(P\text{-}0.1PE) \geq 10$ = January 21 which fell in the 3rd decade of 2008
- $T_2 = \Sigma(P\text{-}0.5PE) \geq 182$ = April 6, 2008 which fell in the 10th decade of 2008

Fig. 2 and 3 showed the planting dates for the two cropping seasons (2007 and 2008 respectively). Using a new knife, each yam cultivar was cut into yam setts weighing an average of 550g and planted at an average depth of 15cm on mounds. After sprouting, the yams were staked to about 3m high and the vines were trained regularly. No fertilizer and insecticide were applied and all plots were regularly hand weeded. Bush rat was controlled by regular clearing of the surroundings of the project site. The climatic requirements of yam from planting to harvesting were measured according to phenological stages of the crop. In this study, five developmental stages of yam growth cycle form the time-scale for which the collected data have been processed. These growth stages are emergence, vine elongation, vegetative, bulking and Senescence - harvesting.

Method of Evaporation Suppression: The method of evaporation suppression used in the study was basically mulching. Two mulch materials were used:

- Grass mulch = M_1
- Polythene nylon = M_2.

About 40cm diameter of each mound was covered with dry grass mulch. The grass mulch was sourced from the cleared grass land in the University farm area. The polythene nylon of an average size of 70 x 50cm^2 was used. The polythene nylon was perforated and has the side covering the mound as black surface and white surface facing the atmosphere. This was adopted in other



Where

PET = Potential Evapotranspiration

T_1 = date of 1st planting according to P-PE model

T_2 = date of 2nd planting according to P-PE model

Fig. 2: Planting dates as determined by using decadal cumulative rainfall - potential evapotranspiration (P-PE) model in 2007 season.

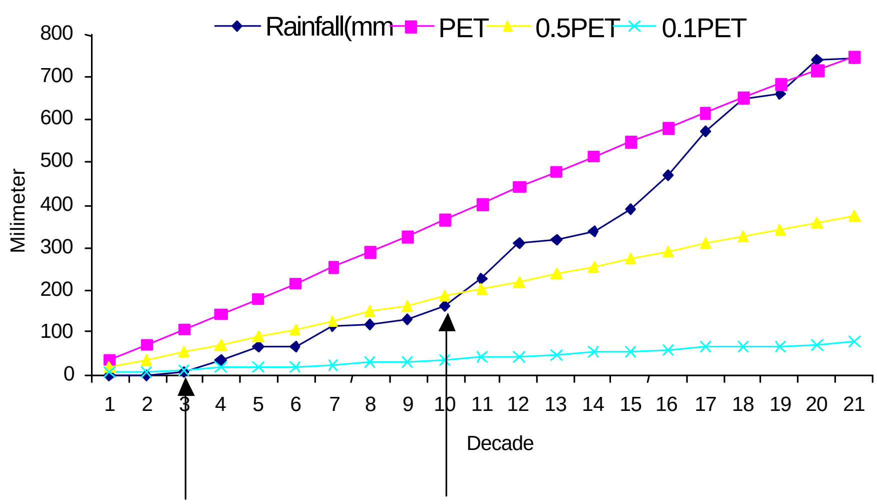


Fig. 3: Planting dates as determined by using decadal cumulative rainfall - potential evapotranspiration (P-PE) model in 2008 season.

to regulate the soil temperature. The black surface is to conserve the Long Wave Radiation while the white surface facing up is to reflect excessive Short Wave Radiation. However, mulching was done after planting usually between 6.30-7.30 am when radiation intensity was nil (in otherwords before sunrises, when the Cambell Stokes Sunshine recorder was unable to receive enough radiation to burn the Sunshine recording card). In addition to the mulched plot, un-mulch treatment was included in the experiment which served as control (C). In other to achieve a proper sprouting and aeration of setts and effective roots development, the mulching materials were removed from mounds during the humid period when accumulated difference between P and PE records zero [i.e. E(P-PE) $ 0]. The mulch was removed on the 25th July, (21st Decade) for 2007 experimental year and June 25th (18th Decade) for 2008 experimental year. This period coincided with the early tuber formation stage of yam. This period according to Machy (2003) is the time when most traditional farmers in West Africa normally remove mulch materials. According to his work, it revealed that if the mulch materials are not removed during the tuber formation stage, it will prevent the infiltration of rainwater to encourage good tuberization.

During each of the phonological stages, daily observation of air temperature (°C), wind speed at a height of 2m (ms^{-1}), rainfall (mm) were made at meteorological enclosure adjacent to the experimental field. Phonological crop growth parameter and yield characters were also measured. Data collected were subjected to analysis of variance (ANOVA) using GenStat Release 7.2 statistical software (Discovery Edition 3) to evaluate the effects of planting date (season) and "mulching and mulching materials". The significant difference of treatment means were determined using least significance difference (LSD) 5% level of probability [14]. The result of yield from experiment using model planting date (T_1 & T_2) and the yield obtained from farmers in University's extension villages around the study area, the data gathered from Ogun State Ministry of Agriculture and Ogun state Agricultural Development Program [Farmer's conventional planting period (F_1 & F_2)]were compared to ascertain the effectiveness of model. The yield from farmers in University's extension villages around the study area were determined from questionnaire administered during the two experimental years.

RESULTS AND DISCUSSION

Data presented in Tables 1 & 3 showed the effect of planting date (T_1 and T_2) on growth while Tables 2 & 4 showed the effect on the yield of white yams grown at Abeokuta during the 2007 and 2008 cropping seasons. It was observed that planting date significantly ($p< 0.001$) influenced emergence rate, vine length, number of leaves, number of branches, number of roots, root length, LAI, tuber length, tuber diameter, tuber weight, number of tuber and harvest yield for 2007 experimental year in which rainfall variability was characterized by late onset of rainfall, prolonged dry spell after planting and during sprouting and emergence period and unbroken succession of wet days during the critical water requirement stage of bulking. Whereas, for the 2008 experimental year, there was no significant difference at $P> 0.05$ between early planting T_1 and late planting T_2 on the emergence rate, vine length, number of branches, number of roots, vine diameter, root length, branch length, tuber length, tuber diameter, tuber weight, number of tuber and harvest yield. However, for the 2008 experimental year, the early planting T_1 had significantly influenced number of leaves and LAI. The highest leaf area and LAI during the early season can be attributed to the adequate moisture availability. The highest LAI was due to high leaves production and retention of leaves during the early planting than the late planting. Leaf area available during tuber bulking period largely determines tuber yield in yam [15-17]. The setts planted during the T_1 planting date was about 23% above those of T_2 planting date.

Fig. 4 & 5 showed that sprouting commenced earlier in the setts planted during T_2 planting date than the setts planted during T_1 planting date. Sprouting commenced at the 4DAP (4 decade after planting) for 2007 T_1 planting date and emergence gradually increased until the 13DAP when the emergence rate reached the maximum; and 1DAP for T_2 planting date until 6DAP for setts planted at T_2 with ranges between 30-100% for T_1 and 20-95% for T_2 and this depend on the mulching material used. This implied that the rate of emergence in T_1 planting was faster (took a longer decade to reach the maximum emergence rate) than the setts of T_2 planting. While, for 2008 cropping season (Fig.6&7) sprouting commenced earlier in setts planted during the T_2 planting date than the setts planted during the T_1 planting date, this trend was similar to that observed in 2007 season. Sprouting commenced at 5DAP for 2008 T_1 planting date and 1DAP for T_2 planting date. It was further observed that for 2008 planting season, the maximum emergence was attained by the 16DAP for T_1 planting and 9DAP for T_2 with ranges between40-100% for T_1 and 40-100% for T_2 particularly under the same mulching materials ($p>0.05$, i.e $p = 0.205$). The emergence rate was similar in range with values from 40-100%. The figures showed that the setts of T_1 planting took a longer decade to reach the maximum emergence rate than the setts of T_2 planting date. Summarily, the difference of 8 decades was observed for 2008 cropping season. Furthermore, by comparing the two experimental years, it was observed that the favourable hydrothermal condition influenced sprouting in yam cultivation in the study area. It was noticed that emergence was about 20% higher at commencement of sprouting and was able to reach maximum emergence rate in 2008 particularly at T_1 planting than in the 2007 experimental year.

The importance of mulching in yam cultivation can not be overemphasized particularly in the study area (Western Nigeria) where supra-optimal soil temperature and severe moisture deficit had been known to cause loss of setts and disparity in emergence and might be expected to reduce growth and tuber yield which will eventually lead to economic loss. The study showed that the effect of mulching and mulching materials on the phenological growth parameters and yield of white yam. It was observed from Tables 5 & 6 that the yam planted under mulched plot was significantly higher in emergence rate, vine length, number of stem branches, number of leaves and LAI than for un-mulched plot. This finding agreed

Table 1: Effect of planting date on growth of three white yams grown at Abeokuta during 2007 cropping season

Factor	Emer.%	Vine length (cm)	No. Branch	No. Leaves	No. roots	Vine Ø (cm)	Branch length (cm)	Root length (cm)	LAI
Planting season									
T1	54.6±5.57	137.6±22.9	21.8±2.04	776.3±98.74	24.3±2.33	1.424±0.06	68.7±5.66	32.8±2.58	1.396±0.32
T2	31.7±4.83	15.3±4.38	15.2±1.92	191.6±29.76	16.2±1.67	1.352±0.05	59.6±5.60	24.5±1.94	0.141±0.04
P	<0.001*	<0.001*	0.017**	<0.001*	0.009*	0.266	0.217	0.016**	<0.001*

*Significant at P< 0.01 **Significant at P< 0.05

Table 2: Effect of planting date on yield and yield characteristic of white yams grown at Abeokuta during 2007 cropping season

Factor	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg)	No of tuber	Harvest yield ton/ha
Planting Date					
T1	30.0±2.73	8.30±0.73	2.60±0.25	1.019±0.13	8.04±1.17
T2	9.4±2.48	2.59±0.67	0.58±0.16	0.370±0.95	1.42±0.41
P	< 0.001*	< 0.001*	< 0.001*	< 0.001*	< 0.001*

*Significant at P< 0.01 **Significant at P< 0.05

Table 3: Effect of planting date on growth of three white yams grown at Abeokuta during 2008 cropping season

Factor	Emer.%	Vine length (cm)	No. Branch	No. Leaves	No. roots	Vine Ø (cm)	Branch length (cm)	Root length (cm)	LAI
Planting Date									
T1	74.0±4.13	381±40.29	25.1±2.97	568.1±57.22	29.4±2.82	1.465±0.05	94±9.13	35.5±2.60	1.230±0.17
T2	68.5±4.6	357±28.03	19.4±2.58	332.6±28.65	21.5±2.19	1.348±0.06	62.7±5.92	28.2±2.02	0.628±0.10
P	0.205	0.424	0.121	<0.001*	0.05**	0.109	0.008*	0.044**	<0.001*

*Significant at P< 0.01 **Significant at P< 0.05

Table 4: Effect of planting date on yield and yield characteristic of three white yams grown at Abeokuta during the 2008 cropping season

Factor	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg)	No of tuber	Harvest yield ton/ha
Planting Date					
T_1	37.7±2.13	11.49±0.644	3.55±0.24	1.133±0.06	12.70±1.16
T_2	34.7±1.56	11.14±0.43	3.13±0.18	1.115±0.03	10.71±1.14
P	0.223	0.575	0.098	0.764	0.043**

*Significant at P< 0.01 **Significant at P< 0.05

Table 5: Effect of mulching and mulching materials on growth of three white yams grown at Abeokuta during 2007 cropping season

Factor	Emer.%	Vine length (cm)	No. Branch	No. Leaves	No. roots	Vine Ø (cm)	Branch length (cm)	Root length (cm)	LAI
Mulching material									
C	14.8±2.71	31.1±15.54	14.3±1.41	239.6±42.56	20.2±2.90	1.272±0.08	58.8±6.82	23.8±3.15	0.044±0.02
M_1	68.4±5.33	150.4±30.21	24.3±2.98	757.2±125.68	23.7±2.97	1.447±0.05	74.9±6.34	32.2±2.84	1.650±0.42
M_2	46.2±5.20	47.7±16.22	16.9±2.43	455.2±117.99	16.9±1.80	1.444±0.05	58.7±7.21	28.9±2.53	0.611±0.21
P	<0.001*	<0.001*	0.010*	<0.001*	0.190	0.049**	0.124	0.079	<0.001*

*Significant at P< 0.01 **Significant at P< 0.0

Table 6: Effect of mulching and mulching materials on growth of three white yams grown at Abeokuta during 2008 cropping season

Factor	Emer.%	Vine length (cm)	No. Branch	No. Leaves	No. roots	Vine Ø (cm)	Branch length (cm)	Root length (cm)	LAI
Mulching material									
C	51.6±3.81	271±34.29	12.6±1.13	255.0±16.7	23.8±4.22	1.261±0.07	68.1±7.09	28.9±3.22	0.339±0.06
M_1	94.0±1.56	476±37.0	32.4±3.72	680.3±65.80	27.8±3.13	1.508±0.06	101.1±12.67	34.7±2.73	1.706±0.17
M_2	68.1±4.30	360±41.91	21.7±3.20	415.8±42.49	24.8±1.98	1.450±0.06	65.9±7.60	32.0±2.87	0.751±0.10
P	<0.001*	<0.001*	< 0.01*	<0.001*	0.700	0.019 **	0.023**	0.408	<0.001**

*Significant at P< 0.01 **Significant at P< 0.05

Table 7: Effect of mulching and mulching materials on yield and yield characteristic of three white yams grown at Abeokuta during 2007 cropping season

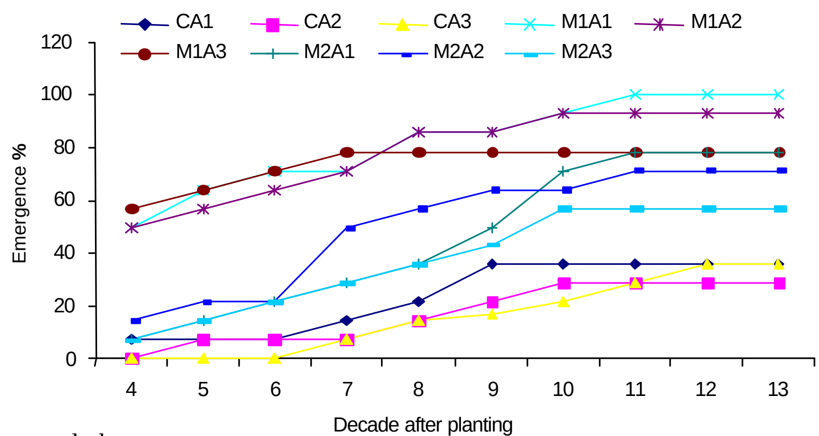
Factor	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg)	No of tuber	Harvest yield ton/ha
Mulch material					
C	10.60±3.91	2.89±1.01	0.84±0.29	0.556±0.23	1.11±0.41
M_1	27.7±2.19	8.30±0.70	2.37±0.30	0.972±0.06	8.74±1.50
M_2	20.8±4.58	5.14±1.45	1.56±0.38	0.556±0.12	4.35±1.14
P	< 0.001*	< 0.001*	< 0.001*	< 0.028**	< 0.001*

*Significant at P< 0.01 **Significant at P< 0.05

Table 8: Effect of mulching and mulching materials on yield and yield characteristic of three white yams grown at Abeokuta during the 2008 cropping season

Factor	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg)	No of tuber	Harvest yield ton/ha
Mulch material					
C	31.8±2.87	9.52±0.75	2.54±0.29	1.078±0.08	6.24±0.87
M_1	39.1±1.71	12.36±0.53	3.97±0.17	1.150±0.03	17.59±0.88
M_2	37.6±1.87	12.08±0.50	3.52±0.21	1.144±0.04	11.28±0.94
P	0.043**	<0.001*	<0.001*	0.567	<0.001*

*Significant at P< 0.01 **Significant at P< 0.05



Where C = unmulched control plots
M1 = Gras mulched plots
M2 = Polythene mulched plots
A1,A2 &A3 = Efuru, Ise osi & Oniyere (White yam varieties)

Fig. 4: Effect of planting date, mulching and mulching materials on sprouting/emergence of three white yam grown at Abeokuta during the T1 planting dates for 2007 cropping season

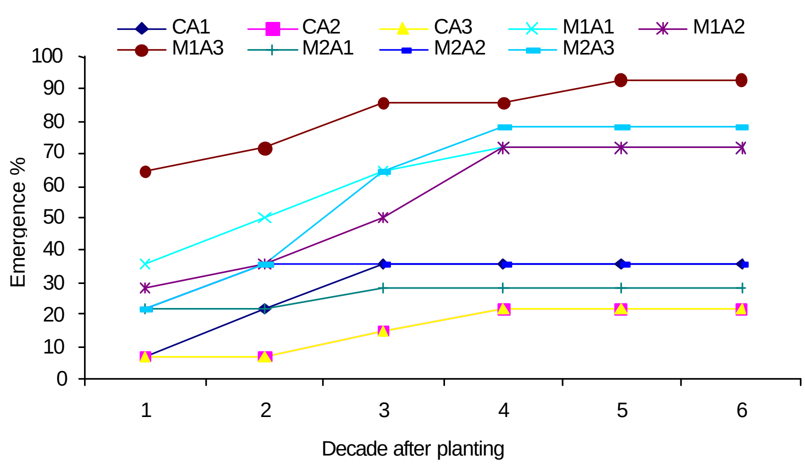


Fig. 5: Effect of planting date, mulching and mulching materials on sprouting/emergence of three white yam grown at Abeokuta during the T2 planting dates for 2007 cropping season

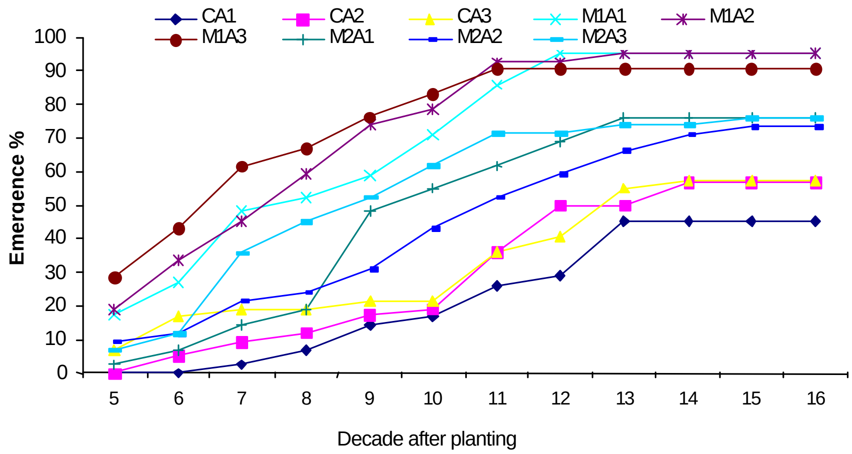


Fig. 6: Effect of planting date, mulching and mulching materials on sprouting/emergence of three white yam grown at Abeokuta during the T1 planting dates for 2008 cropping season

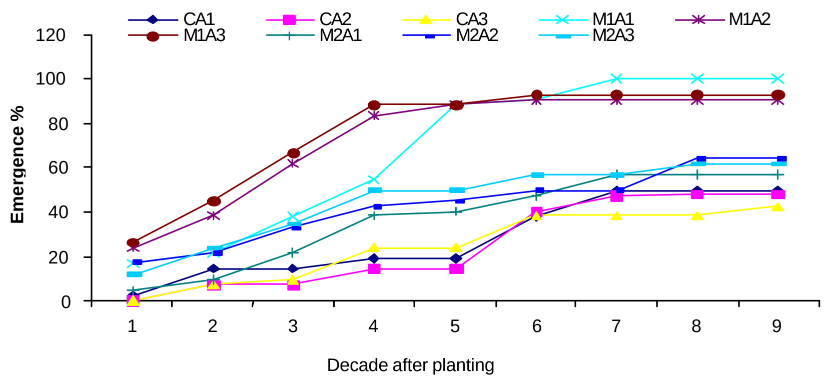


Fig. 7: Effect of planting date, mulching and mulching materials on sprouting/emergence of three white yam grown at Abeokuta during the T2 planting dates for 2008 cropping season

with previous report that the emergence and growth rate of yam seedling were observed to be significantly higher in mulched plots than the un-mulched plot by Olasantan [18]; Odjugo, [19] and Osiru and Hahn, 1994. Increased emergence and more rapid development of setts in mulched yams could be attributed to an increase in soil moisture content and the consequent modification of soil temperature under mulched plots [20,18,10,6,8,]. Furthermore, there was significant difference in these parameters with different type of mulching material used for the two experimental years. The grass mulched significantly improved the growth, development and yield of yam than the perforated white surface up and black surface facing down polythene nylon. The beneficial effects of grass mulch on yam growth could be attributed to the nutrients released by decomposing mulch [6,18] and its physical effect on the possible reduction of nutrient losses by surface erosion and leaching. Furthermore, the beneficial effect of polythene nylon was also discussed by Osiru and Hahn, 1994. He reported that using polythene nylon mulch will considerably improve the production of yam and in particular the seed yam by checking the weed growth. A survey carried out in Nigeria showed tremendous increase in the adoption of the use of polythene nylon, hence there is a clear promise for a future boom in the supply of seed yam in particular [21]. The high rate of emergence associated with mulched treatment must be the basic reason why some traditional farmers in the study area usually mulch their yam immediately after planting [19]. It is interesting to note that there were no significant difference between number of roots, vine diameter and root length of yam planted under mulched and un-mulched plot and also with different type of mulching material used during the two experimental years. The effect of mulching and mulching material on the yield and yield components of yam were also similar in both experimental years. Generally, irrespective of planting date and variety of white yam planted, the yam planted under mulched plots were significantly higher in tuber length, tuber diameter, tuber weight and yield of yam than for un-mulched plot (Tables 7 & 8). It was found that mulching increased tuber yield by about 6-8 t ha^{-1} season^{-1} than the unmulched. This finding also agreed with previous report that the yield and yield components of yam were observed to be significantly higher in mulched plots than the un-mulched plot by Olasantan [18]; Odjugo, [19] and Osiru and Hahn, 1994. However, the significant reduction in the tuber length, tuber diameter, tuber weight and yield of white yam as experienced in the 2007 experimental year as compared to 2008 year could be attributed to the moisture stress that marked the arid period of the 2007 year, thereby causing disparity in yam setts sprouting in all varieties under all mulched and un-mulched plots. Furthermore, there was significant difference in these parameters with different type of mulching material used for the two experimental years. The grass mulched plots were observed to be significantly higher than the perforated white surface up and black surface facing down polythene nylon. Grass mulch had tuber yield of about 4-6 t ha^{-1} season^{-1} greater than the polythene mulch and the unmulched plots. The beneficial effects of mulch on tuber yield particularly during the 2008 experimental year were probably due to favourable hydrothermal regimes of the soil for emergence and early development of yam plants. The mulch was also observed to increase the growth and tuber yield of yams possibly by reducing nutrient losses through controlling runoff and leaching in the raining season. The high yield as experienced in the grass mulch was also attributed partly to the possible influence of decomposed mulch material on increase in soil nutrient status and availability since the grass mulch is known to contain some element of Nitrogen, magnesium, calcium, phosphorus and potassium (Hulugalle *et al.* 1986) and these nutrients, particularly P,N and K are important in the growth and bulking of yam tubers and consequently in the tuber yield [22]. Since fertilizer was not used in the study, the higher growth and tuber yield observed in the grass mulched plots compared to both the perforated white surface up and black surface facing down polythene nylon mulch and the un-mulched plots in the two experimental years was attributed to the effect of decomposed mulch on the nutrient content and in ameliorating soil physical conditions. It is also interesting to note that there was no significant difference between number of tuber of yam planted under mulched and un-mulched plot and with different type of mulching material used during the two experimental year.

Conclusion and Recommendations: From this study, it is obvious that planting date and accumulated difference between P and 0.1PE at planting had significantly influence yield and generally early planting particularly when accumulated difference between P and 0.5PE where comparatively low gave a better yield as compared to later date of planting that had higher values of P and 0.1PE and P and 0.5PE. The model date defined as $\Sigma(P-0.1PE) \leq$ 10mm appeared as best. Hence, for effective yam production in Southwestern Nigeria, farmer's must not delay planting until the accumulated difference between P and 0.1PE exceed 10mm. There was every indication that mulching significantly improved the emergence and development of yam setts and increased tuber yield. The physical effect of the mulch, through reducing nutrient losses by runoff, erosion and leaching and decreasing maximum soil temperature and conserving moisture may have increased growth and tuber yield as compared to un-mulch. The result of the study further revealed that the type of mulching material used also influences the emergence, development and yield of yam. The grass mulch has significantly lower soil temperature and produced higher yield than the polythene mulch. One chemical effect of grass mulch over nylon mulch on yam performance in the study might be the release of nutrients, particularly the nitrogen and phosphorous from decomposed grass while on the other hand the polythene mulch is not biodegradable. However, both mulches have the physical effect of reduction of nutrient losses by surface erosion and leaching and also checks weed growth.

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