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THE EFFECT OF AGE AND THE TIME OF TRANSPLANTING ON LEAF AREA, SPECIFIC LEAF AREA AND LEAF LONGEVITY OF POLY BAG OIL PALM SEEDLINGS IN THE FIELD.

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ABSTRACT

Experiment conducted at Calaro Oil Palm Estate near Calabar, Cross River State, Nigeria, to investigate the effect of seedling, age (9, 10, 11, 12 and 13 months) and time of transplanting (the first day of each month from April to September, 1992) on leaf area, specific leaf area and leaf longevity of polybag oil palm seedlings in the field. The results showed that all the factors have varying effect on seedling growth and development. The length of leaf was significantly ($P = 0.05$) influenced by date of transplanting and age of seedling. The leaf width at the mid-point of fully expanded green leaf blade was also influenced by age and date of transplanting into the field. Thus, the result obtained during the first 18 months seedlings transplanted in April/May had increase in size of leaf blade than those transplanted in other months. There was therefore significant increase in leaf area due to increase in leaf size in April and May and this is the period in which seedling growth and development was most expressed. The result also showed that age exerted significant effect on leaf longevity. Seedlings transplanted earlier at 9 and 10 months recorded more leaf death than those of 12 and 13 months.

It is suggested in this study that at the seedling age of 10 to 12 months, transplanting into the field should be done between in April and May for good performance of the crop in the Calaro area of Cross River State of Nigeria.

KEYWORDS:

INTRODUCTION

Oil palm (Elaeis guineensis, 1 jacq) is a prominent cash crop of the humid tropics, grown predominantly by small scale farmers in Nigeria. Oil palm has been one of Nigeria's major export earner, until late seventies when it was replaced by crude oil. The production of palm oil has grown in recent decades because of farmers enthusiasm and the anticipated economic returns that are promising. In Nigeria, oil palm is grown in the basement complex soils of Western and Eastern regions of Nigeria. The crop also strives well in the acid sands of the Coastal plain soils in the South Eastern part of Nigeria. One of the major constraints to oil palm production encountered by farmers is persistent heavy yield lost due to the age of seedlings and time of transplanting into the field.

The numbers of leaves, the size and how long the leaves survive in green condition have a role as photosynthetic apparatus to the growth and development of the seedling Gunn and Sheldrick (1963) found that 7-month old ground nursery seedlings (ii – 12 months from germination) set fruits only a few month after 1 – year old (16 – 17 months from germination), ground nursery seedlings transplanted in the same year and well before their contemporaries held over in the nursery and transplanted as 18 month old seedlings (22 – 23 months from germination) a year later. They also observed that weather conditions prevailing immediately after transplanting had great influence on the field performance of the palms.

Total leaf surface is the function of the number of leaves and their size. Langer (1958) reported an increase leaf area due to increase leaf size. Blackman and Wilson (1954) and Humphery and Robinson (1966) observed an enhanced specific leaf area due to shady. Michell, (1963) in a comparative study reported lower specific leaf area when light intensity increased and Spiertz and Ellen (1972) found that exposure of leaf area to light has some morphological and physiological changes in the crop. Temperature, light and water stress could cause reduction in stomatal closure and affect biochemical processes of photosynthesis in the leaf. Once half photosynthesis has been affected by water stress for hours, recovery is often incomplete and will affect plant growth and development. This study was therefore undertaken to provide more information on the influence of age and time of transplanting of polybag seedlings on leaf area specific leaf area and leaf longevity in the Basement Complex Mica Schist soil of Calaro, Cross River State, Nigeria

MATERIAL AND METHODS

The experiment was conducted at Calaro oil palm estate near Calabar, Cross River State Nigeria. Calaro estate lies between $8_0$14' and 8_0 20'E longitude and 50 14' N and 5_0 18'N latitude, with a rainfall of over 2000mm in a rainforest vegetation of basement complex Gneiss soil (Table 1).

At Calaro oil palm central nursery, sprouted nuts obtained from Nigeria Institute for Oil Palm Research (NIFOR) in 1991 were raised as polybag seedlings of 5 different ages which had been planted as germinated seeds on the first day of each month from March to December and managed in a single-stage nursery as

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Table 1: Average Rainfall |Values from 1990 to 1992

Months	Rainfall (mm) 1990/1991	1991/1992	Temperature (C ^{0}C) 1990 - 1992
January	54.5	74.3	55.9
February	88.6	99.1	60.1
March	185.4	264.0	61.5
April	252.1	232.5	61.0
May	289.6	391.4	58.8
June	312.4	3103.6	55.9
July	384.5	389.2	51.6
August	269.7	273.4	56.7
September	71.2	156.0	50.4
October	84.0	147.1	57.6
November	72.6	24.8	59.5
December	11.4	6.1	58.2
Mean	2176	2261.5	57.3

Source: Meterological Station, Calaro

outlined by Aya (1976). The seedlings were transplanted into the field on 6 planting dates (the first day of each month from April to September 1992). The five ages of seedlings employed in this study were 9, 10, 11, 12 and 13 months from first nursery planting as germinated seeds. The effect of age and date of transplanting treatments were investigated in a 6 x 5 factorial design using 16 palms per plot replicated 4 times. Stratification systems were adopted in selecting the seedlings for planting due to wide variations in height of the different age groups. All seedlings which displayed abnormal characteristics (Bevan and Gray 1969) were rouged out of each group. After measuring the heights of healthy seedlings in each group, an upper and lower height limits were fixed and all seedlings which were above the upper or below the lower limits were rejected. The remaining seedlings in each age group were divided into upper and lower storey in accordance with a predetermined height range. Seedlings from the upper storey in each age group were randomly transplanted into two blocks while those from lower storey in the same age group were similarly transplanted into the remaining two blocks of the experiment. By this arrangement, it was expected that experiment will provide enough information on the influence of seedling size and age on their subsequent field parameters. To really ensure a strict adherence to the stratification principle, the seedling height were re-taken a day after field planting and any seedling which failed to conform with their respective size range were replaced.

Field planting involved preparation of a planting hole, deep and wide enough to just accommodate the entire polyethylene bag in which the seedling was growing, was dug at each planting site prior to the planting operation. The bag was then stripped off from the soil ball encompassing the seedling roots, taking care to avoid injury to the latter and disturbance to the soil ball. The intact ball of earth was then lowered into the prepared hole, adjusting its depth where necessary by partial filling or further excavation until the top of the soil ball was flush with the surrounding soil surface.

The seedling was finally consolidated in position by gently firming the soil around the palm base with the foot while maintaining the palm in an upright position. The process was closely supervised throughout the duration of planting in order to obviate discrepancies due to planting irregularities. A uniform spacing of 8.84m triangular was adopted for this experiment.

To protect the palms against rodents in the field, each palm was safeguarded by a cylindrical collar of wire netting mesh of 2.5cm, height 50.0cm and radius 15.0cm. A mixture of NPK fertilizer in the ratio of 1:1:1:2, using sulphate of ammonia muriate of potash, single super phosphate and magnesium sulphate were applied twice (16 weeks after transplanting and 16 months after first application) at rate of 55g per plant.

Ten palms were randomly selected from each plot for this study. Five leaves per palm that are young and fully developed were selected for leaf area and specific leaf area determination. The length from the

Table 2: The influence of transplanting date on the leaf area of palms transplanted from poly bags into the field.

Date of transplanting	Survivals after 18 months (%)	Average Leaf area Cm^2		Average specific leaf area $Cm^2/_g$	
		After 6 Months	After 12 Months	After 6 Months	After 12 Months
1st April	97.1	89.4	152.5	255.7	390.4
1st May	98.0	95.0	149.2	276.6	417.2
1st June	98.9	71.9	126.4	284.1	443.6
1st July	99.5	69.0	110.0	293.2	456.1
1st August	99.2	58.1	97.5	298.5	475.3
1st September	99.6	29.0	32.1	301.6	481.4
LSD P=0.05		7.88	8.12	12.61	14.84
P=0.01		9.12	11.10	14.95	16.87
P=0.001		10.14	12.21	15.72	17.53

Table 3: The influence of seedling age at transplanting on the leaf area and specific leaf area of palms transplanted from poly bags into the field.

Seedling age (months)	Survivals after 18 months (%)	Average leaf area Cm^2		Average specific leaf area Cm^2/g	
		After 6 Months	After 12 Months	After 6 Months	After 12 Months
9	99.8	25.0	39.2	108.2	189.2
10	99.6	57.2	92.7	292.0	465.1
11	98.1	65.4	118.1	285.1	437.7
12	98.2	76.3	131.0	271.4	394.6
13	97.5	84.1	154.3	252.0	382.1
LSD P=0.05		3.45	6.62	11.83	14.12
P=0.01		5.61	8.43	12.12	15.86
P=0.001		7.42	10.60	14.22	16.17

base to the leaf tip and the width at the mid-point along the length of the blade were measured. Area per leaf blade (LA) was determined as product of leaf length, leaf width and a factor 0.905 (Kemp, 1960). The selected leaves were oven dried at a temperature of 60°C for 48 hours for leaf dry weight (LW) determination. The specific leaf area was calculated as LA/LW (cm^2/g).

Another five leaves per palm from each of the plots were marked for the study of leaf longevity. Date of the leaves emergence was recorded and dates of leaf death were also recorded on the marked leaves from the selected palms. A leaf was regarded as having emerged when any part of it could be seen and it was regarded as dead when more than half of its length has lost the green colour. Leaf longevity for any selected palm was determined as the number of days between the date of leaf emergence and the date of leaf death. These parameters were observed for 18 months.

The crop data were subjected to analysis of variance and the means compared using Fisher's Least Significant Difference (LSD) at 50% level.

RESULTS

The influence of planting date and seedling age on their leaf area, specific leaf area and leaf longevity during the first 12 months are presented in Tables 2, 3, 4 and 5.

The result indicates that transplanting dates and seedling age at transplanting exerted a highly significant effect on leaf growth and expansion in the field. Inspite of the fact that all the polybag seedlings transplanted into the field at different times produced measurable leaf area, the optimum transplanting period for maximum leaf expansion for an extended leaf surface area for photosynthetic activities in the Calaro area of Nigeria were April and May.

Table 4: The influence of seedling age at transplanting on the leaf longevity (days) of palms transplanted from poly bags into the field.

Seedling Age (Months)	Survivals after 18 months (%)	Average Leaf Longevity (Days)	
		After 6 Months	After 12 Months
9	99.4	18	21
10	99.4	28	32
11	98.6	34	49
12	98.0	4.5	54
13	97.0	45	58
LSD P=0.05		3.60	4.10
P=0.01		4.50	6.80
P=0.001		5.70	9.01

Table 5: Influence of transplanting date on the leaf longevity of palms transplanted from poly bags into the field.

Date of transplanting	Average leaf longevity (Days)	
	After 6 months	After 12 months
1st April	44	57
1st May	44	57
1st June	36	48
1st July	31	48
1st August	27	39
1st September	24	37
LSD P=0.05	3.40	4.04
P=0.01	4.26	6.32
P=0.001	5.30	8.20

The result also showed that irrespective of transplanting date, the younger polybag seedlings had greater leaf area to sufficiently attract sunlight than the older ones. The age effect was highly significant on leaf area increases but tended to reduce the specific leaf area. The data on Table 3 indicates that for every transplanting date the 13-month old seedlings had the least leaf area and that the 9-month and 10-month old seedlings had the largest leaf area during the first 12 months in the field. The seedlings transplanted into the field in April and May tended to have greater leaf area than those transplanted later. It is of interest to note that the 13-month old seedlings transplanted into the field in September had very low leaf area during the first 6 months. The data also showed that seedlings which were 11 months older produced their highest leaf area in the month of May.

The data on Tables 4 and 5 indicates the influence of seedling age and date of transplanting of polybag seedlings on leaf longevity.

The result showed that the 9 and 10-month seedlings transplanted into the field in April and May had leaves that survived longer under green condition while palms transplanted in September that are 13-month had short leaf duration.

Date of transplanting and seedling age have both exerted a significant effect on the leaf longevity of polybag seedlings transplanted into the field. The 13-month old seedlings transplanted in September showed the least days a leaf survived under green condition, in both 6 months and 13 months study periods. While the average leaf longevity recorded for 12 months and 13months seedlings transplanted in August and September were lower, the average leaf longevity recorded for the 9 months and 10 months planted in April and May were considerably greater.

DISCUSSION

Seedling age and date of transplanting had positive effect on the exposure time of the leaf, and that might have influenced the pattern of morphological development of polybag seedlings transplanted into the field.

The reduction in the surface area of the leaf blade observed in the 13-month poly bag seedlings transplanted in September correspondingly reduced the photosynthetic activities and may have contributed to the sudden loss of green colour with shorter longevity. The results of this study agrees with the findings of Langer (1958), and those of Spiertz and Eller (1972).

Polybag seedlings of 9 and 10 months old transplanted in April and May created a wider opportunity for extended exposure time of the leaf and photosynthetic activities thus prolonging the green colour and is in agreement with earlier works of Spiertz et al. (1972) This findings suggests that the level of exposure time of a leaf to photosynthetic activities in the polybag seedlings transplanted into field has direct positive effect on the life-span of the leaf. Although the evidence is insufficient to allow firm conclusions to be drawn, but it may be suggested that these two events are not unconnected.

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