#7540 EVALUATION OF ON-FARM OIL PALM YIELD PARAMETERS IN NIGER DELTA REGION OF NIGERIA

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ABSTRACT

The potential yield of oil palm in smallholder farmers' field has been low due to poor nutrient management. Yield of over 40 tons of fresh fruit bunch hectare^{-1} is realizable with NIFOR tenera material if the plant environment is properly harnessed for the crop beneficiary; however, actual yield of NIFOR tenera material is between 22-25 tons ha^{-1}. A yield survey study was conducted in small and medium scale farmers' fields in Niger delta states of Nigeria where oil palm is predominantly grown to determine the actual yield of oil palm for precise nutritional management. In each of the states three local governments and five communities' local governments were sampled. Three samples were collected from each community. Data collected were fresh fruit bunch (FFB) weight, palm frond petiole cross section and leaf area. Data collected were subjected to analysis of variance and means separated using Ducan Multiple Range Test (DMRT). The results showed that bunch weight palm^{-1} at harvest, bunch weight palm^{-1} year^{-1}, bunch weight tons hectare^{-1}, leaf area and petiole cross section were significantly different in all the local government and state. Bunch weight palm^{-1} at harvest, bunch weight palm^{-1} year^{-1}, bunch weight tons hectare^{-1}, and petiole cross section were significantly highest in Emohua local government area with values of 8.99 kg palm^{-1}, 65.7 kg palm^{-1} year^{-1}, and 9.55 tons hectare^{-1}year^{-1} respectively. Cross river state had the highest bunch weight palm^{-1} at harvest, bunch weight palm^{-1} year^{-1}, bunch weight tons hectare^{-1}, leaf area and petiole cross section of 8.926 kg palm^{-1}, 8.03 tons hectare^{-1} year^{-1}, 56.2 kg palm^{-1} year^{-1}, 5.68 m^2, and 19.9 cm^2 respectively. There was positive correlation between bunch weight, leaf area and petioles cross section in all the local government area. Tenera fruit form had the highest percentage of 93.33 in Emohua and the lowest percentage of 6.67 in Oruk Anam. Nigrescens was the predominant fruit type and 100% was recorded in Itu, Oruk-Anam and Ahoada. This result suggests that oil palm yield in the area is far lower than the average yield of well-nourished and managed NIFOR tenera material in Nigeria

Keywords: Evaluation, oil palm, yield parameters, tenera, NIFOR

INTRODUCTION

Oil palm is a unique tropical crop cultivated mainly for its mesocarp and kernel oil (Woittiez et al., 2017). Crude palm oil is the preferred oil for the diet of Sub-Saharan African people (Corley and Tinker, 2015). A growing demand for palm oil for food and soap industries is due to an increase in population in Africa, which is estimated as 770 million. The use of palm oil for biodiesel has added greatly to the continent's demand for the commodity (Bakoume *et al*., 2017). There is a growing global demand for palm oil because of its universal applicability and increasing population (Murphy, 2014). Oil palm is a uniquely productive tropical crop with a potential fresh fruit bunch (FFB) and palm oil yield capacity well over 40 tons FFB ha^{-1}yr^{-1}

and 10 tons of palm oil $ha^{-1}yr^{-1}$ (Murphy, 2014). Actual yields are between 18 to 30 tons FFB $ha^{-1}yr^{-1}$ and 3-6 tons of palm oil $ha^{-1}yr^{-1}$ and for NIFOR tenera hybrid it is 22 to 25 tons in Nigeria (Donough *et al*., 2010; Okomu, 2018; Okwagwu *et al* 2005). It is a significant crop in Nigeria, occupying over 2.53 million hectares and production stands at 1million ton yr^{-1} (Bassey, 2016). Nigeria's current palm oil production falls far short of the national local consumption and industrial uses (Proshare, 2019). The national production deficit estimated at nearly 2 million metric tonnes is met by importation into the country (Asemota, 2013; Bassey, 2016, Proshare, 2019). This deficit could be due to the fact that of the 2.53 million hectares purportedly cultivated to oil palm in Nigeria, 2.1millions hectares are in the wild and poorly managed (Bassey, 2016). There is every need for planned and co-ordinated best management practices that will impact on oil palm farmers' yield and income and eventually very balanced communities (Corley and Tinker, 2015). In order to bridge the palm oil deficit gap and considering the population of Nigeria which currently stands at about 200 million and consumption of palm oil which is estimated at about 3 million metric tons; the need to increase the farm size and adopt best management practices which promote proper palm nutritional enhancement becomes very pertinent for the development of oil palm industries in Nigeria and also satisfying the palm oil need of the Nigerian populace.

The stem, fronds and leaf are proper agronomic parameters that determine plant vigour (Rankie and Fairhurst, 1999; Fairhurst and Hardter, 2005). If these parameters are not properly developed due to nutrient imbalance, fresh fruit bunch yield will be affected. Therefore, assessment of oil palm agronomic parameters that will help in soil specific and regional fertilizer formulations for the oil palm becomes very necessary if the aim of meeting the palm oil need of Nigeria is to be achieved.

This study evaluated oil palm fresh fruit bunch yield, leaf area and petiole cross section in Niger Delta Region of Nigeria.

MATERIALS AND METHODS

A yield survey study was conducted in small and medium scale farmers' fields in Niger delta states of Nigeria where oil palm is predominantly grown to determine the actual yield of oil palm for precise nutritional management. Three states were marked out for agronomic data collection, in each of the three states three local governments and five communities' local governments were also marked for agronomic data collection. Three samples (fresh fruit bunch weight, leaf area, and petiole cross section) were collected from each community. The area sampled were three local governments of Cross River state (Biase, Akamkpa and Akpabuyo), Akwa Ibom state (Abak, Itu and Oruk Anam) and River state (Ahoada, Emouha and Tai). The samples were collected in three selected farmers' field in each community on June 28, 2020. The samples collected were properly labeled and place in samples bags for further processing. Agronomic data was recorded in a field book and later calculated.

RESULTS AND DISCUSSION

The results of this study showed that bunch weight $palm^{-1}$ at harvest, bunch weight $palm^{-1}$ $year^{-1}$, bunch weight tons $hectare^{-1}$, leaf area and petiole cross section were significantly different in all the local government and state. Bunch weight $palm^{-1}$ at harvest, bunch weight $palm^{-1}$ $year^{-1}$, bunch weight tons $hectare^{-1}$, and petiole cross section were significantly highest in Emohua local government area with values of 8.99 kg $palm^{-1}$, 65.7 kg $palm^{-1}$ $year^{-1}$, and 9.55 tons $hectare^{-1}year^{-1}$ respectively (Table 1). Conversely, bunch weight $palm^{-1}$ at harvest, bunch weight $palm^{-1}$ $year^{-1}$, bunch weight tons $hectare^{-1}$ were lowest in Akamkpa local government area with values of 2.07 kg $palm^{-1}$ 30.5 kg $palm^{-1}$ $year^{-1}$ 4.18 tons $hectare^{-1}year^{-1}$ respectively;

but leaf area and petiole cross section were lowest in Tai local government area with values of 3.45 m^2 and 11.74 cm^2 respectively (Table 1). In addition, Cross river state had the highest bunch weight $palm^{-1}$ at harvest, bunch weight $palm^{-1}$ $year^{-1}$, bunch weight tons $hectare^{-1}$, leaf area and petiole cross section of 8.926 kg $palm^{-1}$, 8.03 tons $hectare^{-1}$ $year^{-1}$, 56.2 kg $palm^{-1}$ $year^{-1}$, 5.68 m^2, and 19.9 cm^2 respectively. However, bunch weight $palm^{-1}$ at harvest, bunch weight $palm^{-1}$ $year^{-1}$, bunch weight tons $hectare^{-1}$ and leaf area was lowest in Akwa Ibom state with values of 3.371 kg $palm^{-1}$, 5.61 kg $palm^{-1}$ $year^{-1}$ 39.2 tons $hectare^{-1}$ $year^{-1}$ and 5.38 m^2 respectively (Table 1). Nigrescens was the predominant fruit type in all the local government and 100% was recorded in Itu, Oruk-Anam and Ahoada while virescens was recorded in Biase local government, Akpabuyo local government, Akamkpa local government, Emohua local government and Tai local government with values of 15.38 %, 6.67 %, 13.35% and 14.29% respectively (Table 1). There was positive correlation between bunch weight, leaf area and petioles cross section in all the local government area. Tenera fruit form had the highest percentage of 93.33 in Emohua local government (Table 2). Fresh fruit bunch weight kg $palm^{-1}$ $year^{-1}$ and fresh fruit bunch weight ton ha^{-1} were lower than the fresh fruit bunch yield of NIFOR hybrid tenera probably because most of the palms were left without adequate care and fertilization. During the period of sampling, most of the farms were overgrown with weeds, hardly pruned, inaccessible and no records of fertilizer application. If oil palm is left unkempt and unfertilized, large amount of nutrient are removed which must be replaced either by recycling of palm waste or by addition of inorganic mineral fertilizers; to avoid yield reduction or else assimilates will be partitioned to vegetative growth during stress instead of reproductive growth (Hartely 1988; Woittiez et al., 2017). Harvesting frequency of once $month^{-1}$ may also be attributed to the low bunch yield observed in all locations. Yield increase over 20 % in palm had been recorded by reducing harvesting frequency from 30 to 7 days (Donough *et al*., 2013). Leaf area was lower than the standard recommended for field palm in all the locations probably because of the fact that the palms in the area were not properly managed or fertilized. The correlation observed in leaf area, petiole cross section with oil palm fresh fruit bunch yield in all the local government sampled indicated that any response in vegetative growth due to the partitioning of assimilates will probably increase fresh fruit bunch yield in these areas. The observed low rate of adoption of NIFOR elite tenera hybrid materials in almost the local government except Emohua indicated lack of awareness on the benefits of using NIFOR tenera hybrid materials. Virescens has previously been found to occur at very low frequency in Africa usually 50 in 10, 000 bunches in grove in Nigeria (Hartley, 1988).This result concluded that bunch yield, leaf area and petiole cross section were lower than the standard recommended for oil palm. This study recommends oil palm best management practices and development of appropriate regional specialty fertilizer for the oil palm.

Table 1. Oil palm fresh bunch yield, leaf area petiole cross section, percentage fruit types and forms local government.

Local government (state^{-1})	Bunch weight (kg) palm^{-1} at harvest	Bunch weight (kg) palm^{-1} year^{-1}	Bunch weight (tons)ha^{-1} year^{-1}	Leaf area (m^2)	Petiole cross section (cm^2)	Tenera (%)	Dura (%)	Nigrescens (%)	Virescens (%)
Biase (cross river)	6.77b	53.8a	7.92ab	4.27bc	15.72b	38.50	61.50	84.62	15.38
Akpabuyo (cross river)	8.74a	60.9ab	8.43a	6.98a	23.22a	53.33	46.67	93.33	6.67
Akamkpa (cross river)	2.07b	30.5c	4.18c	5.31ab	19.65ab	33.33	66.67	86.67	13.33
Abak (Akwa Ibom)	5.31b	43.1c	6.10b	5.23ab	17.13b	60.00	40.00	100.00	0
Itu (Akwa Ibom)	5.69b	47.3bc	6.67a	5.48ab	20.05ab	26.67	73.33	100.00	0
Oruk Anam Akwa Ibom	6.57b	54.8ab	7.76ab	5.86ab	21.41ab	6.67	93.33	100.00	0
Ahoada (Rivers)	3.94b	39.0c	5.81bc	6.43b	21.13ab	58.33	41.67	100.00	0
Emohua (Rivers)	8.99a	65.7a	9.55a	6.68ab	25.71a	93.33	6.67	86.67	13.33
Tai (Rivers)	4.65	40.1c	5.16b	3.45c	11.74c	85.71	14.29	85.71	14.29
S:E	1.551	6.92	0.995	0.598	2.489				

Table 2. Relationship between bunch weight, petiole cross section and leaf area across local government in the three states.

		Bunch weight tons ha^{-1}	Petiole Cross Section (cm^2)	Leaf area (m^2)	Bunch weight at harvest (kg)	Bunch weight (kg) palm^{-1} year^{-1}
Bunch Weight tonsha-1	Pearson Correlation	1				
	N	135				
Petiole Cross Section (cm^2)	Pearson Correlation	0.627**	1			
	N	135	135			
Leaf area (m^2)	Pearson Correlation	0.599**	0.864**	1		
	N	135	135	135		
Bunch weight at harvest (kg)	Pearson Correlation	0.819**	0.503**	0.472**	1	
	N	135	135	135	135	
Bunch weight (kg) palm^{-1} year^{-1}	Pearson Correlation	0.928**	0.646**	0.612**	0.841**	1
	N	135	135	135	135	135

**Correlation is significant at 0.01 level

REFERENCES

Asemota O. 2013. Open forum on agricultural biotechnology (OFAB) in Africa, Nigeria chapter: Modifying the quality of palm oil through biotechnology. 24pp

Bakoume C, Ndiaye O, Okoye MN. 2017. Oil palm development in Africa. *The planter* 93 (1098): 632-641.

Bassey OI. 2016. Overview of oil palm production in Nigeria, comparative, social and environmental impacts: the case of Ekong Amaku Community in Cross River State, Nigeria. Institute of Social Science, Erasmus University of Rotterdam. 10pp.

Corley RHV, Tinker PB. 2015. *The Oil palm*. Fifth edition. Black well Science Ltd 9600 Garington Road, Oxford OX4 2DQ,UK. 562 PP

Donough C, Witt C, Fairhurst T. 2010. Yield intensification in oil palm using BMP as a management tool. In: Proceedings of the International Oil Palm Conference, 1–3 June 2010, Yogyakarta, Indonesian Oil Palm Research Institute.

Donough CR, Cock J, Oberthür T,, Indrasuara K, Gatot AR, Dolong T. 2013. Estimating oil content of commercially harvested oil palm fresh fruit bunches—A step towards increasing palm oil yields. Poster Presented at the PIPOC 2013 International Palm Oil Congress and Exhibition, 19–21 November2013, Kuala Lumpur.

Fairhurst TH, Hardter R. 2005. *Oil palm*. Management for large and sustainable yields. First edition. Oxford graphic printer Pte Ltd. 382 pp

Hartley CWS. 1988. *The oil palm* (*Elaeis guineensis Jacq*.). Third edition. Longmans Publisher, London, UK. 112-113.

Murphy DJ. 2014.The future of oil palm as a major global crop: opportunities and challenges. *Journal of oil palm research* 26 (1): 1-24.

Okomu. 2018. Okomu daily harvest yield data report from harvested fields.

Okwuagwu CO, Ataga CD, Okolo EC, Ikuenobe CE, Ugbah MM. 2005. The production of NIFOR elite tenera hybrid planting material. The NIFOR *EWS*. *A technical report*. 21 pp

Proshare. 2019. The Nigerian Oil Palm Sector Report. Proshare Ecosystem.

Woitiez LS, van Wijk MT, Slingerland M, van Noordwijk M, Giller KE. 2017. Yield gaps in oil palm: A quantitative review of contributing factors. Europ. J. Agronomy 8: 57–77.