Effects of Palm Oil Mill Effluent (POME) on Smallholder Oil Palm Farming Activities in Agbo Delta State, Nigeria

Okere, R. A[1], Okoronkwo. T. O[2], Apeh, C. C[3], Unuabonah, E[1] and Okeke, C. O[4]

[1]*Agricultural Economics Division, Nigerian Institute for Oil Palm Research, Benin, Edo State.*
[2] *Agricultural Engineering Division, Nigerian Institute for Oil Palm Research, Benin, Edo State.*
[3]*Department of Agricultural Economics, University of Agriculture and Environmental Sciences, Umuagwo, Imo State.*
[4]*Agrionomy Division, Nigerian Institute for Oil Palm Research, Benin, Edo State.*

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*CORRESPONDING AUTHOR

richy4chima@yahoo.com

ABSTRACT

The growing policy concern on the environment cannot be significantly addressed without strict measures in the case of POME. POME is a highly environmental pollution produced by smallholder oil palm mill operators that affects farming activities and its environment. This study was done to analyze the effects of POME on smallholder oil palm farming activities in Agbo, Delta State with the objectives of examining the socioeconomic features of the farmers and determining the effects of POME on their farming activities. A purposive sampling method was employed to randomly select a sample size of 30 smallholder oil palm farmers and analyzed with descriptive statistics and regression model. The result showed that majority of them were in their middle / old age of 40 to 60 years with 66.7% married while 60% of them had family size of 6 and above and 83.7% of 11 years and above farming experiences. The regression result showed that POME had significant and negative effects on age, labour and plant nutrients at 0.05%, farming experience and farm size at 0.1% and household size at 0.01% with positive and significant effects on soil management practices at 0.1% and annual income at 0.05%. The study recommends a synergy between the farmers and biotechnological and allied research centres in connection with the Ministry of Environment through education/ training on the use of biotechnological tools, POME treatment technologies and intensified soil management practices in their operations to control, maintain and regulate their activities for a friendly and sustainable environment.

INTRODUCTION

The economic importance of oil palm led to its rapid cultivation as the output such as palm oil stands at a significant proportion of 40% of global vegetable oil productions (Krungsri Research, 2016) and 80% palm oil production in Nigeria from dispersed smallholder farmers (Solidaridad. 2020). Smallholder farmers are important actors in oil palm sector (Daemeter Consulting, 2015) – managing and planting between 1-5 hectares in Nigeria (Solidaridad, 2020). These farmers play active role in the various production processes and in the value chain. Some are into production process, processing, marketing, utilization down to consumption. Those into processing are the people that extracts the oil from the fruits leaving fiber, nut, Palm Oil Mill Effluent (POME), among others affecting farming activities.

POME is the voluminous liquid waste that comes from the sterilization and clarification process in milling oil palm containing about 90-95% water with residual oil, soil particles and suspended solids. The production of crude palm oil leads to the proportional production or residue of POME, a pollutant that affects smallholder farming activities. This is in tandem with Perez, (1997) who opined that industrial oil palm mill production of one tonne of palm oil leads to a 2.5tonnes of POME production or one tonne of FFB leads to 0.5 tonne of effluent thereby affecting the environment and farming activities of the farmers. POME is a highly environmental polluting substance causing a lot of negative externalities to the environment such as increasing the cost of labour in soil management practices and maintenance of plant nutrients in farming activities. The negative externalities of POME on farming activities in crop land are its biological oxygen demand (BOD) that affects the life of organisms that are useful, low PH and colloidal nature that requires approximates water treatment needed by half a million people within the polluted environment (Brezing, 1986). POME

affects the environment and quality of land as untreated POME readily cause clogging and waterlogging of the soil which kills vegetation including weeds exposing it to degradation that amounts to extra soil improvement practices in their farming activities (Okolie and Ekwuribe, Obasi, Obidiebube and Obasi, 2019). It causes the concentration of major minerals and trace elements that are harmful to living organism required for plant growth (Bankole and Ikhatua, 2009). It is a pollutant that inhibits the growth of soil micro-organisms such as the soil fauna and flora affecting the suitability of the soil for smooth farming activities for crop production. This was observed by Ubani, Onwuneme, Okpashi, Osuji and Nwadike, (2017) who opined that POME is a potent pollutant that inhibits the growth of crops such as Zea may. POME has direct effects on the health of smallholder farmers affecting their capacity for farming activities. It affects farming activities in areas of soil degradation and unsustainable soil resulting to low productivity due to lack of capacity for treated POME with some biotechnological processes and POME treatment technologies such as POMETHANE (Madaki, and Seng, 2013).

However, POME can be of economic benefits when treated with the use of biotechnological processes and modern POME treatment technologies in the sustainable reuse and recovering from waste product to useful one. Treated POME could be used as a cheap organic fertilizer (manure) in farming activities over artificial one (Wu, Mohammad, Jahim, and Anuar, 2009). This is in line with the findings of Oviasogie and Aghimien (2003) that a proper use and safe disposal of POME on the land environment would lead to improved soil fertility and contribute to environmental sustainability for farming activities. The biologically treated POME is used in oil palm plantations for irrigation and as a liquid fertilizer (Wu *et al*., 2009). Pujono, Kukuh, Evizal, Afandi and Rahmat, (2021) stated that POME applied on land could increase the total number of FFB to 40% significance with 38 harvested FFB per month. Despite all these, most smallholder oil palm farmers are constrained in their farming activities as they lack the capacity to modern POME treatment technologies to ameliorate the effects. The aim of this study was to analyze the effects of POME on smallholder oil palm farming activities with the objective of examining the socioeconomic characteristics and determining the effects of POME on smallholder oil palm farming activities.

METHODOLOGY

This study was carried out in Agbo, Delta State. Agbo is the headquarter of Ika South Local Government Area of Delta State. It is located on latitude 6.2541^0N and longitude 6.2057^0 E on the elevation of 130 meters (427 feet) with a population of 45,800 people (Wikipedia Open Data). The area was purposively chosen because of the high concentration and continuous smallholder oil palm farming activities with so many oil palm mill operations that dumps POME in the area. Information that formed the data were obtained from both primary and secondary sources. Primary data was obtained from a well-structured questionnaire used for the analysis. A purposive sampling method was used to select 30 respondents randomly from the list of smallholder oil palm farmers that were affected by POME in the area. The data were analyzed with descriptive statistics such as the frequencies and percentages for the socioeconomic characteristics like; age, sex, marital status, household size, farming experience, farm size, annual income etc while the regression model was used for the effects of POME on smallholder oil palm farming activities. The regression model is implicitly expressed thus:

$Q = (\alpha + YLnX_n)$……..(1)
Where Q = Effects of POME on smallholder oil palm farming activities
X_1= Age (Years)
X_2 = Labour (Man days)
X_3 = Plant Nutrients (No)
X_4 = Soil Mgt Practice (No)
X_5 = Farming Experience (years)
X_6 = Farm Size (Ha)
X_7 = Household Size (No)
X_8 = Annual Income (₦)
e = Error Term
Explicitly expressed, the Semi-log form becomes:
$Q = \alpha + Y_1LnX_1 + Y_2LnX_2 + Y_3LnX_3 + Y_4LnX_4 + Y_5Ln\ X_5 + Y_6LnX_6 + Y_7LnX_7 + Y_8LnX_8 + e$.....(2)
Where: Q, X_1, X_2, X_3, X_4 X_5, $X_6$$X_7$,$X_8$, are as stated above, ln= log, α = constant, $Y_1 - Y_8$ = regression coefficients and e = error term.

RESULTS AND DISCUSSION

Table 1 showed that only 16.7% of the farmers were less than 40 years of age while majority of them (83.3%) aged 40 to 60 years which directly or indirectly depend on the surrounding environment like nearby waters that are affected by POME. This is in consonant with Okereke and Ginikanwa, (2020) who opined that discharged POME into waters (rivers, streams or lakes) contaminates it and denies local people the access to good water for domestic uses and fishing. The result from sex showed the male dominance of (83.3%) to females (16.7%), is an indication of male enterprise. According to Mensah, Amegashie, and Gyasie, (2009), acquisition of

lands for oil palm plantation or farmland with wild groves is male-dominated enterprise transferred from one male generation to another.

The result further showed that 66.7% of the respondents were married, implying that farming activities and the production of POME is mainly carried out by a greater percentage of married people who in the bid to carry out farming activities and process enough oil to cater for their families thereby polluting the environment. The level of education of 50.0% for non-formal education is a problem as they may not take cognizance of the effects of POME on their farming activities and had effective knowledge that equips them with enough environmental pollution control in relation to health and agri-business. The result also showed that 60.0% of the farmers had household sizes of above 6 persons who supplied family labour and feeds from the farm proceeds. The effects of POME might have a significant and direct effect on them in terms of health risks, non- productivity of land in area of discharged untreated POME as it lowers soil productivity (Okwute, and Isu, 2007).

Table 1: Socio-Economic Characteristics of the Smallholder Oil Palm Farmers

Variables	Frequency	Percentages
Age (yrs)		
30-40	5	16.7
41-50	25	83.3
≥ 50	5	16.7
Total	30	100
Sex		
Male	25	83.3
Female	5	16.7.
Total	30	100
Marital status		
Single	5	16.7
Married	20	66.7
Widowed	4	13.3
Divorced	1	3.3
Total	30	100
Educational level		
Non formal	15	50
Primary	10	33.3
Secondary	3	10
Tertiary	2	6.6
Total	30	100
Household size		
1-5	15	50
6-10	10	33.3
≥ 10	5	16.7
Total	30	100
Experience (years)		
1-10	5	16.7
11-20	10	33.3
21-30	10	33.3
≥ 30	5	16.7
Total	30	100
Annual income (₦)		
50000-100000	5	16.7
150000-200000	5	16.7
≥ 2500000	20	66.7
Total	30	100
Farm Size (ha)		
1-2	20	66.7
3-4	5	16.7
≥ 5	5	16.7
Total	30	100

Source: Field Survey (2022).

The long years of farming experience of 11years and above at (83.3%) indicated that it is a long term business with regards to POME production. This shows that the long discharge of POME to the environment has led to a great environmental pollution in the area with several adverse effects on their farming activities in relation to the inhabitants. Despite the effects of POME, the total annual income of them was moderately encouraging at 66.7% from ₦250000 and above per annum not considering the cost of externalities they have caused to the environment that they are not charged to pay. The farm size showed that 83.4% of the respondents had 1-4 hectares of land on the average at the range of smallholder farmers.

The semi log function was the best fit of the regression analysis having the highest coefficient of multiple determination, R^2 of 0.693, indicating that 69.3% variations of the effect of POME on smallholder oil palm farming activities was accounted for by the included explanatory variables such as age, labour, planting materials, soil management practices, household size, farming experience, farm size and annual income with the Adj R^2 being 0.676 and F-Stat of 18.763. The result showed that age was negatively significant at 0.05%, indicating that POME affects farmers age in terms of health issues which have direct effects on their farming activities. POME has a negative and significant effect on labour and plant nutrients at 0.05% in the area. Therefore it decreases the effectiveness of labour use in farming activities and leads to a gradual decrease in the plant nutrients. This shows that intensification of land area used in crop production is imperative (Okere, 2013). Soil management practices such as the use of mulch materials to protect the soil, use of bush fallow or shifting cultivation, crop rotation system in case of mixed cropping and adequate space distance, early planting among others was positively significant at 0.1%. This indicates that increase in the level of soil management practices cushions the effects of POME as a land degradable substance in farming activities (Okere, 2013). Household size was negatively significant at 0.01% level, indicating that POME affects the functional farming activities of the people as most of their lives revolve within their environment. In this case the outcome of the pollution such as the bad odour emission, the contamination of nearby rivers and the degradation of land directly affects the performance of their farming activities (Okereke and Ginikanwa, 2020). Farming experience and farm size had negative and significant effects at 0.1%. This indicates that despite their long term experience and farm sizes, the effects of POME is a threat as affecting the nutrient availability of plants making the soil to lose its vegetative cover (Okereke and Ginikanwa, 2020) which demands for extra land improvement practices that are cost effective. Annual income was positively significant at 0.05% level. It shows that despite the effects of POME, smallholder farmers are making their gains irrespective of the negative externalities to the environment which they are not paying the cost.

Table 2: Result of the Effects of POME on Smallholder Oil Palm farming activities

Variables	Semi-log
Constant	493492.3
	(1.031)
X_1= Age (yrs)	-73253.11(2.325)**
X_2= Labour (man days)	-09.18 (2.390) **
X_3= Plant Nutrient (No)	-0.002 (2.53) **
X_4= Soil Mgt Practice (No)	3.64 (1.86) ***
X_5= Household size (No)	-0.003(3.101)*
X_6= Experience (yrs)	-0.002(1.6803) ***
X_7= Annual income (₦)	3.124(2.144) **
X_8= Farm Size (ha)	-2.753(1.936) ***
R^2	0.693
Adj R^2	0.676
F-value	18.765

Source: Field Survey 2022. Significant at 10%= ***, 5% = ** and 1% = * respectively

Equation form of the Effects of POME on Smallholder Oil Palm farming activities

Q= 493492.3 - (1.013) - 3253.11 (2.159) X_1** - 09.18 (2.390) X_2** - 0.002 (2.53) X_3** + 3.64 (1.86) X_4*** - 0.003 (3.101) X_5* - 0.002(1.6803) X_6 ***+ 3.124(2.144) X_7** - 2.753(1.936) X_8***

CONCLUSION

POME is a highly environmental pollutant causing a lot of negative externalities within the disposed surroundings from oil mill sites. This study was carried out in Agbo Delta State to ascertain the socioeconomic features and the effects of POME on smallholder oil palm farming activities. A purposive random sampling size of 30 respondents were collected and analyzed with the descriptive statistics and the ordinary least square regression model. The revealed that majority of them were in their middle / old age of 40 to 60 years with 66.7% married, 60% of 6 and above family size and 83.7% of 11 years and above farming experiences. The regression result showed that POME had significant and negative effects on age, labour, plant nutrients. household size, farming experience and farm size with positive and significant effects on Soil management practices and annual income. The study recommends that education is the key to knowledge and knowledge is power. Therefore, there should be a synergy between the farmers and biotechnological and allied research centres in connection with the Ministry of Environment through education / training on the use of biotechnological and POME treatment technologies in their operations to control and regulate the activities and intensify soil management practices for efficient, friendly and sustainable environment.

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