

The effect of gas flaring on Agricultural production of Okpai, Ndukwa East Local Government Area, Delta State, Nigeria

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Abstract

This study examines the impact of gas flaring on agricultural production of Okpai, Delta State, Nigeria. Questionnaires were administered to elicit information on soil fertility, crop growth and crop productivity. A total of 200 questionnaires were administered using stratified random sampling technique and analysed using tables and percentages. Result shows that gas flaring reduces or lowers level of soil nutrient and fertility. Crop growth and crop yield are affected negatively by gas flaring with plantain being the worst hit.

Keywords: Effect, Gas Flaring, Agricultural Production

INTRODUCTION

The Niger Delta environment is regarded as the vast reservoir of crude oil and gas resources, from where man draws to sustain his economic activities and to ensure his survival (Raheem, 2000). The environment of Niger Delta is degrading, deteriorating and being destroyed by pollution resulting from oil and gas exploration, exploitation and production. This fragile environment is being polluted by the introduction into it of substances and energy that are liable to cause hazards to human health, harmful to living organisms, resources, agricultural activities and production and ecological systems as well as interference with legitimate uses of the environment. Environmental pollution results from the activities of man through technological development and sophistication to manipulate the ecosystem or environment to meet his needs. Through the activities of man on the environment, the environment has been affected both positively and negatively. These effects result from the use of fire and other advanced technology. Some of the various ways by which man's activities affect the environment are land reclamation, irrigation, crop breeding, afforestation among others. On the other hand, some of the negative impacts of man's activities on the environment are soil degradation, soil erosion, air pollution, deforestation, desertification etc which affect farming and farm produce.

However, soil is one of the worst areas of environmental pollution by oil industry in Nigeria. Soil is one of the basic components that support life and productivity in the ecosystem. Flora and fauna as well as man depend on soil for support and effective functioning. This component of the environment is in danger due to oil pollution in Niger Delta. In Okpai, oil exploration and exploitation activities have seriously affected the environment such as soil, water bodies, vegetation, wild life and the atmosphere. Oil production involves the release of materials and substances that are poisonous and have detrimental impact on the environment. Such as cultural environment, atmosphere, hydrosphere (water bodies) and lithosphere (geo-biosphere e.g. soil, flora, climate) (Turner et al., 1990). However, attention will be given to the soil component on which agriculture or farming depend. Indeed man's activities lead to oil spillage, air pollution, land pollution, water pollution, thermal pollution and noise pollution.

Thermal pollution results from the use of fire (burning) directly on the environment. In Okpai, gas flaring is the major source of thermal pollution. This goes on for 24 hours every day, for more than three decades. Thermal pollution causes a distinct micro-climate around the vicinity of operation (Alakpodia, 1989). Degradation and deterioration of soil and the

destruction of vegetation also characterize the area. This affects agricultural potentials, other related activities and practices in Okpai and its environs. Vegetation and the health of the people are not spared from the detrimental effects of gas burning (gas flaring).

Gas flaring is a process that takes place in the oil drilling environments of Nigeria. The crude oil and gas are separated at the flow stations. While the gas is flared at the flow stations, the crude oil is pumped to the refineries. According to Research Initiative (2005), flaring is used to consume waste gases in safe and reliable manner through combustion in an open flame. Gas flaring therefore is a means of safely disposing waste gases through the use of combustion (Evoh, 2002). Evoh (2002) stressed further that with an elevated flare, combustion is carried out through the top of a pipe or stack where the burner and igniter are located. This is a common practice in Okpai in the Niger Delta region, where oil is exploited. Thus, flaring of associated gas must be considered as one of the most significant environmental factors in the Nigeria Oil Industry affecting not only agricultural activities and potentials especially farming but health of the people and the ecosystem generally.

Despite the huge economic benefits of crude oil, the government and the oil companies tend to play down on the detrimental and devastating effects of oil production activities in the environment of Okpai especially on the soil component and its consequent effect on agricultural activity and production which is the main stay of the people. This is why this study is necessary.

Therefore, this study focuses attention on the impact of gas flaring on agricultural activities and production in Okpai, Ndokwa East Local Government Area, Delta State, Nigeria. This is to examine and ascertain as well as make information available on the effects of gas flaring on agricultural production in Okpai area, where there is dearth of information presently.

Before the advent of oil prospecting and production in the Niger Delta Region, the environment was conducive, friendly and viable. The soil was equally fertile and therefore good for farming. Thus, farm produce/yield was high adequate for the subsistence and commercial needs of the people.

However, the activities of the oil company-Nigerian Agip Oil Company Limited (NAOC) through exploration, exploitation and production of oil and gas have constituted great environmental and social problems to the oil bearing community of Okpai in Delta State, Nigeria its enormous economical benefits notwithstanding. One of the major problems is the destruction of the people's livelihood which is the soil and farmlands through gas flaring and oil spillage. The choice of Okpai is because it is the only place/community where NAOC is flaring gas in Ndokwa East Local Government Area with its associated problems.

Gas flaring affects not only the soil but also vegetation, agriculture and crop production (Alakpodia, 1989, 2000; Dosunmu and Amadi, 1996; Gogoi and Baruah, 2002; Ogidiolu, 2003; Efe, 2003). The agricultural soils as well as fresh water and aquatic life have been destroyed by various forms of oil-generated environmental pollution. Farming has become very difficult and even drinking water has become scarce. Flaring activity affects agricultural production of Okpai. This stunts crops growth and impacts negatively on the yield of their crops – cassava, yam, plantain among others.

Effects of gas flaring on Agriculture

Alakpodia (2000) and Ejuwa (2005) stated that the constant heat being emitted from the flare sites make the soil of the adjacent farmland hard and unproductive. Oluwatimilehin (1987) studied the effect of gas flaring on Okro, palm trees and cassava. He observed a depression in flowering and fruiting in these crops. He equally found out that the tubers decreased in length and weight with decreasing distances from the flare sites.

Ukegbu and Okeke (1987) examined the effect of gas flare on the growth, productivity and yield of selected farm crops in Izombe flow station located in Izombe Ohagi/Egbema/Oguta Local Government Area of Imo state. They found out that the impact was about 100% loss in yield in all the crops cultivated about 200 metres away, 45% loss for those about 600 metres and 10% loss in yield for crops about 1000 metres away from the flare. The effects were reduced with increasing distances from the flare.

In the same vein, Dosunmu and Amadi (1996) in their study "Evaluation of the Effects of Gas Flares on the Environment" observed a depression in the growing, flowering and fruiting of maize planted in the flare direction. The study also reveals substantial reduction in the yield of soyabeans with decreasing distances to the flare site.

Gogoi and Baruah (2002) studied the effects of natural gas flare on growth, flowering and yield of rice (*Oryza sativa L*) near an oil installation of ONGC. The inhibitory effect of flare on crop growth, flowering and yield in rice was observed up to 45 metre distance from the gas flare point. They noted also that intensity of damage was more pronounced up to 30 metre distance, particularly on yield attributing parameters – grain panicle, filled grain, high density grain and grain yield.

Obioma (1985) investigated agricultural production decline in the Ogba-Egbema area of Rivers state. Results of his investigation show that insects gathered to enjoy the warmth and light of the gas flares from the forest at night. That the rapid increase in the insect population and the attendant destruction of the crops was quite a new phenomenon that had

come with the oil production. It is not known if the warmth of the gas flares that promote insect reproduction. He however argued that farmers in the area confirmed that these insects have inflicted heavy losses on them by eating and destroying their crops.

Gbadegesin (1997) stated that oil exploration and production in South-eastern Nigeria has adversely affected peasant agriculture, the basis of sustenance of millions of rural inhabitants through a complex web of several negative environmental factors. Farmers find that their crops are no longer abundant and that the crops are stunted in growth as a result of acid rain (Drohan, 2000, Oil for Nothing, 2000 and Kilgour, 2001). Also, Abiodun (2004) stated that farmers have not been spared because plants have withered as much of their farmlands have been laid to waste by acid rain caused by gas flares.

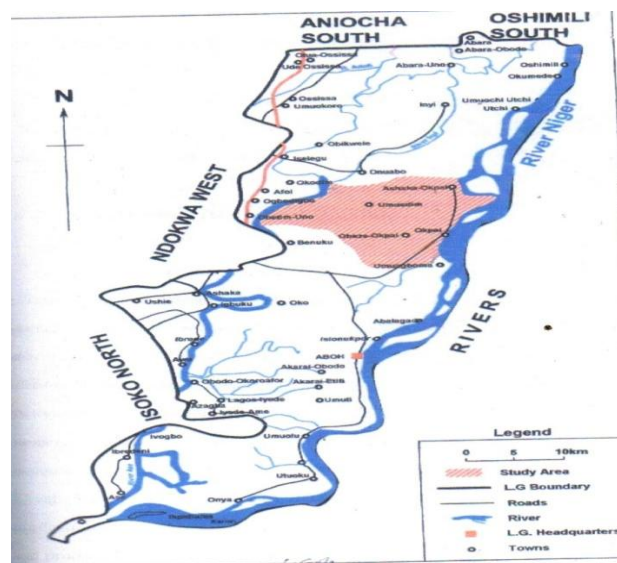
Oil exploration and exploitation have over the last four decades impacted disastrously on the socio-physical environment of the Niger Delta oil-bearing communities, massively threatening the peasant economy –farming and fishing and the environment and hence the entire livelihood and basic survival of the people (Eteng, 1997 and Achi, 2003). Achi (2003) further stated that various harmful and toxic organic compounds when introduced into the natural environment during oil exploitation such as gas flaring, oil spill and several other forms of pollution, changes the geo-chemical composition of the soil, river and other components of the environment. According to him, this in turn affects agriculture and leads to a drastic decline in output in both farming and fishing activities. Stoney (1990) noted that 7.7% of the 797 people interviewed on the socio-economic impact of oil in Nigeria identified farmland pollution as a major problem. According to Olumide (2002), when gas is being flared, the surrounding air is polluted by oxides of nitrogen, carbon, sulphur, particle matter, sulphide and soot from the flares. All these are capable of retarding the growth of cash crop.

MATERIALS AND METHODS

Study Area, Location And Size

Okpai is one of the communities in Niger Delta region of Nigeria. It is rich in oil and gas. Okpai is under the local jurisdiction of Ndokwa East Local Government Council Area of Delta State. Okpai lies within latitudes $5.5^{\circ} 17^{\prime} N$ and $5.2^{\circ} 14^{\prime} N$ of the Equator and longitudes $4^{\circ} 40^{\prime} E$ and $4^{\circ} 45^{\prime} E$ of the Greenwich Meridian. It is located in the lower Niger floodplain of the Central Delta Socio – Economic Zone (EIA of Okpai, 2003). It is bounded in the East by the River Niger, in the West by the Ase River, on the South by Onuabo community and on the North by Umuagboma and Benuku communities.

Okpai people are mainly subsistence farmers with few traders. The crops that are usually grown are cassava, yam, vegetables, plantain and coco-yams. They practice mixed cropping with these crops in combination. Plantation agriculture is carried out in this area with plantain and pineapple dominating (EIA of Okpai, 2003). The Okpai people are of the Ukwani ethnic group with a population of about 2,038 (NPC, 1991) which was projected to 2,324 (NPC, 1996).



Ndokwa East L.G.A Showing Study Area
Source: Lands and Survey, Asaba 2000.

Figure 1. Geographical map of the study Area

Sample Collection

This research made use of survey method. The survey sampled the opinion of Okpai people on the impact of gas flaring agricultural production. The method involved the use of structured questionnaires which were administered to the respondents by the researcher. This work derived its information or data from both primary and secondary sources of data collection. The primary source of data collection includes: questionnaires, personal observation and oral interview. On the other hand, secondary source of data collection include the use of relevant materials from text books, journals, newspapers, periodicals, internet, State Ministry of Environment, Ministry of Land, Survey and Urban Development, University Library and National Population Commission.

Target Population

The total population of Ndokwa East Local Government Area of Delta State was 75,578 (NPC, 1991). While that of Okpai was 2,038 (NPC, 1991). This figure was projected to 2,324 (NPC, 1996). Out of this figure, about 19% are infants, while children of primary school age make up approximately 23% of the population (EIA of Okpai, 2003). Thus, 10% of the adult population, which is approximately 135, was used for the study. However, a total of 200 respondents were used. This includes Agip workers and Okpai people. The respondents were family heads, village leaders, men, women and youths who are farmers as well as workers.

Table 1. Population Size of Okpai

Community	Population (1991)	Population (1996) Projection	% of Adult Population
Okpai – Oluchi	1,198	1,366	792
Obeze-Okpai	398	454	263
Ashaka – Okpai	242	280	162
Umuedim	200	224	130
Total	2038	2,324	1347

EIA of Okpai, 2003. (Federal Ministry of Environment)

Sampling procedure

This research work made use of both stratified random and systematic sampling procedures. The stratified random sampling was used in the administration of questionnaires. Okpai is made up of four sub-communities or clans which are Okpai – Oluchi, Obeze – Okpai, Ashaka – Okpai and Umuedim. Therefore, stratified random sampling is chosen for even coverage of the study area. However, the respondents were drawn from these communities and Agip workers in Kwale/Okpai flow station. Based on the differences in population size between Okpai – Oluchi and other clans – Obeze – Okpai, Ashaka – Okpai and Umuedim, Okpai – Oluchi was administered with 36 questionnaires and others had 33 questionnaires each. While 65 questionnaires were administered to the workers. The questionnaires were administered randomly to the respondents in the study area. The questionnaire was divided into two sections – A and B – of fourteen questions. Section “A” was based on personal profile while section “B” was based on the impact of gas flaring on soil, soil fertility and agriculture. The respondents were asked to state their opinion on the effects of gas flaring on soil, its fertility and agricultural production using very high, high and low. These responses were however rated 3, 2 and 1 respectively using the Likert scale of measuring attitude.

DATA ANALYSIS

The data that were generated for this study were graphically and statistically analysed. The use of tables was employed to present the data. In addition, the rated responses from the questionnaires were calculated using percentages to obtain the perception of the respondents on the effects of gas flaring on soil, its fertility and agricultural production.

Effect of gas flaring on soil and soil fertility

Table 2. Effect of Gas Flaring on Soil of Okpai

RESPONSE	NO OF RESPONDENTS	%
Very High	450	82.6
High	90	16.5
Low	5	0.9
Total	545	100.00

Table 2. shows the impact of gas flaring on soil as analysed using the questionnaire. 82.6% of the respondents agreed to the fact that gas flaring affects soil at a very high rate. 16.5% said it has high effect on soil while only 0.9% said that its effect on soil is low.

Table 3. Effect of Gas Flaring on Soil Fertility

RESPONSE	NO OF RESPONDENTS	%
Very High	360	73.0
High	110	22.0
Low	25	5.0
Total	495	100.00

Table 3 shows the impact of gas flaring on soil fertility as analysed using the questionnaire. 73% of the respondents attest to the fact that gas flaring has very high effect on soil fertility while 22% and 5% of the respondents said it has high and low effects respectively. On the whole, gas flaring has detrimental effect on both soil and its fertility.

Effect of gas flaring on Agriculture /crop yield

Table 4. Effect of Gas Flaring on Agriculture

RESPONSE	NO OF RESPONDENTS	%
Very High	435	81.0
High	90	17.0
Low	10	2.0
Total	535	100.00

Table 4 shows the effect of gas flaring on agriculture from the analysis of questionnaire. The result shows that 81.0% of the respondents said that the effect is very high while 17.0% said it has high effect and 2.0% said it has low effect.

Table 5. Effect of Gas Flaring on Stunting of Crop Growth

RESPONSE	NO OF RESPONDENTS	%
Very High	345	69.0
High	140	28.0
Low	15	3.0
Total	500	100.0

Effects of gas flaring on stunting of crop growth are equally high. This can be seen in Table 5 where 69.0% of the respondents said it has very high effect, 28.0% said its effect is high and 3.0% agreed that it has low effect.

Table 6. Effect of Gas Flaring on Cassava Yield

RESPONSE	NO OF RESPONDENTS	%
Very High	270	58.7
High	160	34.8
Low	30	6.5
Total	460	100.0

Table 7. Effect of Gas Flaring on Yam Yield

RESPONSE	NO OF RESPONDENTS	%
Very High	135	34.0
High	220	55.0
Low	45	11.0
Total	400	100.0

Table 8. Effect Gas Flaring on Plantain Yield

RESPONSE	NO OF RESPONDENTS	%
Very High	345	67.65
High	120	23.53
Low	45	8.82
Total	510	100.00

It is evidently clear that gas flaring has negative effects on crop yield especially the main food crops produced in the area. From the analysis, 58.7% of the respondents said that gas flaring has very high effect, 34.8% high effect and 6.5% low on cassava yield. On yield of yam, 55.0% of the respondents ascertained that its effect on yam yield is high while 34.0% agreed that it has very high effect and 11.0% said its effect is low. The effect on plantain yield can be said to be very high with 67.65% agreeing to this. However, 23.53% of the respondents said the effect is high while 8.82% said its effect on plantain yield is low.

Table 9. Effect of Gas Flaring on Size of Crops Produced

RESPONSE	NO OF RESPONDENTS	%
Very High	300	62.0
High	170	35.0
Low	15	3.0
Total	485	100.0

Table 10. Crop Affected Mostly by Gas Flaring

CROPS	NO OF RESPONDENTS	%
Cassava	50	25.0
Yam	45	22.5
Plantain	105	52.5
Total	200	100.00

As can be seen from Table 9, 62.0% of the respondents agreed that gas flaring affects the size of crops produced at a very high rate. 35.0% said its effects on crop size are high and 3.0% said it is low. It is therefore obvious that gas flaring affects the quality / size of crops produced in Okpai and its environs. However, the crop that is worst hit by gas flaring is plantain with 52.5% attesting to it. This is followed by cassava with 25.0% and yam with 22.5% (Table 10). On the whole, gas flaring affects agricultural production/ yield of the people of Okpai and its environs.

RESULTS AND DISCUSION

The data obtained from the analysis of questionnaire show that gas flaring has detrimental effects on soil, soil fertility, agriculture as well as crop yield with high percentage of the respondents attesting to this. These impacts are felt much on soil fertility, crop growth and production or yield. Personal observation and oral interview reveal that the crops are stunted in growth especially plantain and cassava. The yield size is not spared also. Observation reveals that the worst hit among the main crops cultivated in the area is plantain with little and tiny bunches. This is in consonance with the data in Table 10. The reason that can be deduced from this is that plantain is not a root crop therefore constant heat and exposure to light and associated gases 24 hours every day inhibits flowering and fruition. The inhibition is as a result of continuous light without the dark phase of photosynthesis which is responsible for flowering and fruition of crops. It is very clear that soil fertility in Okpai and its environs is very low. Thus, soil of Okpai is low in soil fertility / nutrients and consequently low in farm produce or yield.

CONCLUSION AND RECOMMENDATION

No doubt, the process of oil and gas prospecting and production pollutes the Okpai environment. Consequently, effort should be made to control and mitigate the environmental problem of the area if meaningful development of the area in terms of agricultural productivity, infrastructure and other socio-economic developments will be achieved. It was equally discovered that the people's main livelihood (farming) was affected with stunting of crop growth and low yield of their main crops as a result of low soil fertility.

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