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EFFECTS OF GAS FLARING ON SOME GROWTH INDICES OF MAIZE.

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ABSTRACT

Investigation on the effects of gas flaring on some growth indices of maize was conducted at the SPDC flow station, Elelenwo. Three weeks old healthy seedlings of maize (Zea mays L.) were raised in the nursery before transferring to the field. Five pots (40cm x 50cm each) containing some maize plants were placed at different distances away from the point of gas flare. These placements were 30m, 35m, 40m, 45m and 500m (control) away from the point of flare respectively. The plants were watered twice a week. The plant height, leaf length, breadth and leaf area of Z. mays were measured weekly while shoot dry weight was measured after 12 weeks. The result showed that gas flare caused a decrease in plant height, leaf area and shoot dry weight of maize plant. These effects decreased with increasing distance away from the gas flare point. There was significant different at P<0.05 when the control was compared with other treatments. The means of the parameters analysed were significantly different when subjected to multiple comparison using least significant difference (LSD) test at P<0.05. The maize plants placed at 30m away from the gas flare point were scorched and plants withered due to excessive heat from the flare while 35m and 40m placements dried up and oily particles were found on the leaves.

Key words: Effect, Gas flaring, Growth, Maize

INTRODUCTION

Maize (*Zea mays* L.) belongs to the Family Poaceae (Udoh *et al*., 2005) and is utilized worldwide for both industrial and food purposes. It is also a very important food grain for humans and animals (Udoh *et al*., 2005). Oil production has been going on in Nigeria for over 56 years accompanied with the flaring of associated natural gases. In 1993, Nigeria flared more gas than any other country in the world (Escravos Gas Project, 1993). Singh (1995) also reported that the total emission of CO_2 from gas flaring in Nigeria for the year 1994 amounted to an estimated 35 million tons/year and around 12 million tons/year of methane from Delta and Rivers States. Ebeniro and Avwiri (1996) defined gas flaring as a process of burning excess gas pumped out of an oil well during the process of exploration which emits several gases such as CO, CO_2, CH_4, NO_2, N_2O, HS and heat energy. They further raised this concern that gas flaring activities may be inadvertently changing the climate of the globe through the enhanced green house effect, by past and continuous emissions of CO_2 and other gases which cause the temperature of the troposphere to increase, popularly termed "global warming". Evoh (2002) reported that Nigeria accounts for about 19 per cent of the total amount of gas

flared globally. Odiete (1999) earlier reported that soils near the flare point are not fertile and crops that are at the perimeter of the heat influence are stunted, fruits and tubers are fewer and smaller than the normal size. Odjugo and Osemwenkhae (2009) reported that natural gas flaring affects microclimate and reduces maize yield. Amakiri and Onofeghara (1984) earlier reported that the lost in photosynthetic capability of plants could be as a result of the chloroplast membranes destruction. According to Agbogidi *et al*., (2005), the differential changes in the rate of leaf growth may be associated with anatomical and morphological change caused by the oil pollution. Okonwu *et al.* (2010) also reported that crude oil pollution has adverse effect on germination and development of maize. An interview with local farmers, who farm around the SPDC flow station at Elelenwo and NNPC flow station, revealed that gas flaring affects the photoperiodism of the plant as in the case of maize crop which continues to grow without fruiting. This study therefore, was conducted to examine some of the growth and developmental changes of maize to gas flaring treatment and possibly establish facts and figures for understanding performance of maize in gas flaring sites.

MATERIALS AND METHODS

A total of twenty five planting bags (40cm x 50cm) were used, leaving 10 cm at the upper end for irrigation of water. They were filled with top soil (0 – 15 cm) from the University of Port Harcourt botanical garden. The planting bags were perforated to avoid water logging. Two seeds of maize were planted in each bag to avoid overcrowding and competition among eedlings. The plants were watered twice a week. Three weeks old healthy seedlings of maize were raised in the nursery before transferring to the field. Five pots each were placed at different distances away from the point of gas flare. These placements were at the distances of 30m, 35m, 40m, 45m and 500m (control) away from the gas flare point respectively. The control was taken at 500m because heat from the gas flare was not felt at this point.

The plant height (cm), leaf length and breadth (cm) of *Z. mays* were measured weekly. The leaf area (cm^2) was deduced following the method of McKee (1964). At the end of 12 weeks, dry weights of the shoot of *Z. mays* for different treatments were measured. The data collected were subjected to analysis of variance (ANOVA) and means compared using Least Significant Difference (LSD) at 5% level of probability.

RESULTS

The result showed that the associated gas flare caused a decrease in plant height, leaf length, leaf breadth, leaf area and shoot dry weight of maize plant when compared with the control. These effects decreased with increasing distance away from the gas flare point. There was significant difference at $P<0.05$ when the control was compared with other treatments. The control treatment recorded the highest value for plant height. Four weeks after taking the seedlings to flare site, the plants placed at 30m away from the gas flare were scorched and plants withered due to excessive heat from the flare. Five weeks after, seedlings in 35m and 40m placements dried up and oily particles were found on the leaves. For 45m placement, only few leaves were dried up and oily particles seen on the leaves. However, the control (500m) did not show any trace of oil on the maize parts. The result of gas flaring on some growth indices of maize and statistical analysis of data are shown in Table I.

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Table I: Effect of gas flaring on some growth indices of maize after 12 weeks

Treatment (m)	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	Leaf Area (cm^2)	Shoot Dry weight (g)
30	4.50 ± 0.1155^a	9.84 ± 0.0173^a	0.70 ± 0.0577^a	5.22 ± 0.0115^a	1.80 ± 0.0289^a
35	7.82 ± 0.0058^b	14.04 ± 0.0058^b	$1..18 \pm 0.0058^b$	12.22 ± 0.0058^b	2.60 ± 0.0866^b
40	11.20 ± 0.1732^c	17.18 ± 0.0173^c	1.46 ± 0.0173^c	18.47 ± 0.0173^c	3.90 ± 0.0578^c
45	11.80 ± 0.1155^d	17.00 ± 0.1732^c	1.66 ± 0.0346^d	21.03 ± 0.0115^d	5.80 ± 0.0115^d
500 (Control)	13.92 ± 0.0115^e	20.14 ± 0.0115^d	1.82 ± 0.0058^e	26.92 ± 0.0231^e	7.30 ± 0.0404^e
$LSD_{(0.05)}$	0.3359	0.2472	0.0986	0.0474	0.1633

Mean ± Standard Error. Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD.

The mean values of the treatments showed increased values of plant height, leaf length, leaf breadth, leaf area and shoot dry weight of maize away from the gas flared point 12 weeks after planting. The increased in the mean values are significantly different at $P<0.05$. However, using the least significant difference to compare the means showed that there were significant differences among treatments for plant height, leaf breadth, leaf area, shoot dry weight respectively while 40m and 45m treatments for leaf length were not significantly different when compared. The effect of gas flaring on the plant height, leaf length, leaf breadth, leaf area and shoot dry weight are shown in the Figures (I, II, III, IV, V) respectively.

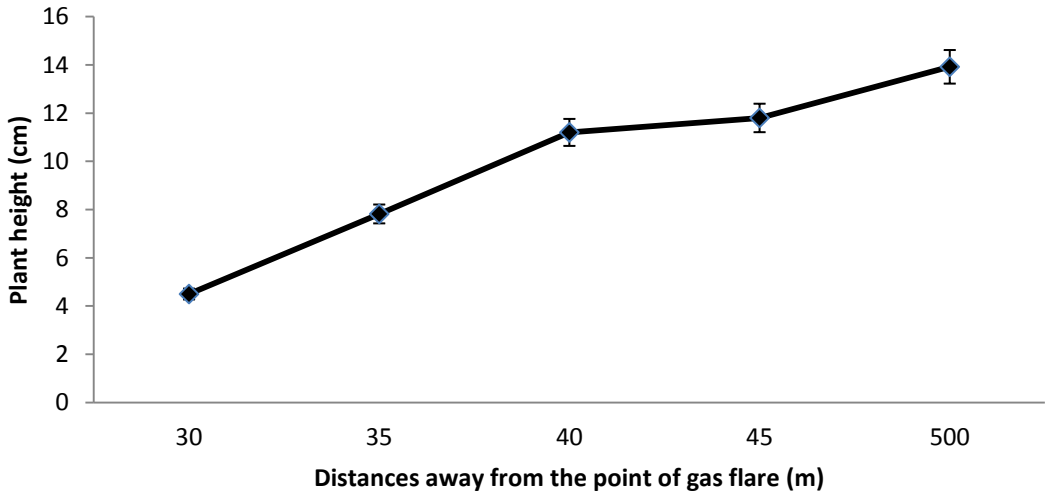

Fig. I: Effect of gas flaring on the plant height of maize

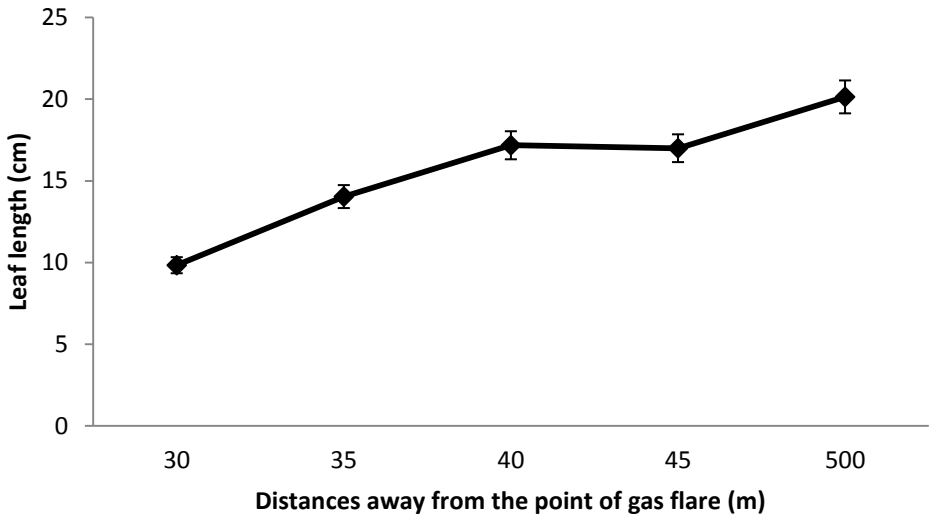

Fig. II: Efect of gas flaring on the Leaf Length of maize

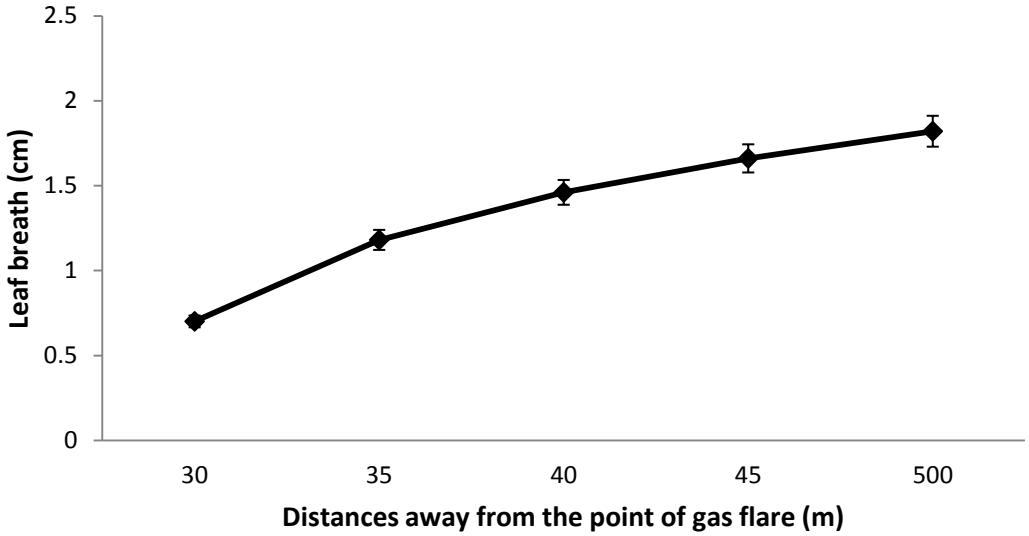

Fig. III: Effect of gas flaring on the Leaf Breath of maize

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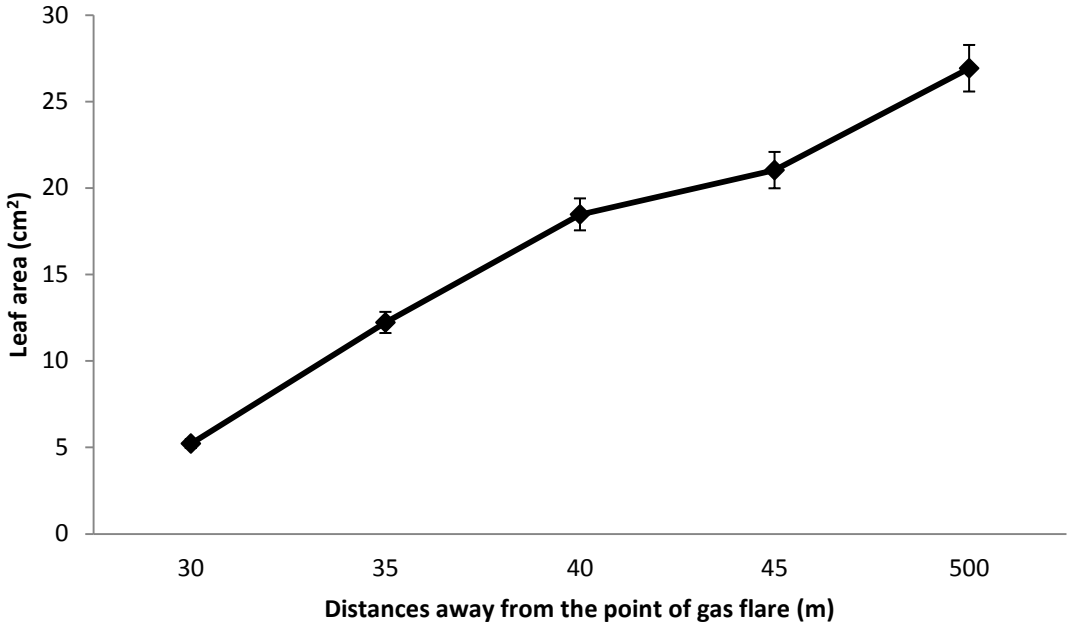

Fig. IV: Effect of gas flaring on the leaf area of maize

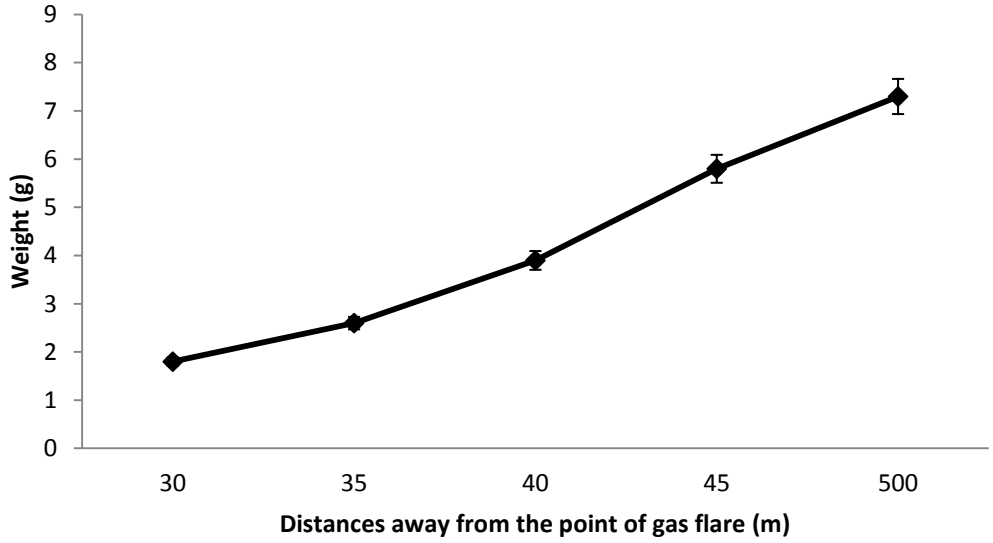

Fig. V: Effect of gas flaring on the shoot dry weight of maize

DISCUSSION

The decreased observed in the plant height, leaf length, leaf breadth, leaf area and shoot dry weight of maize plant grown some distances away from the gas flare point agrees with the work of Dung *et al.*, (2008). The later reported that the decreased dimension of leaf lengths and widths of cassava and pepper crops grown closer to the gas flare point resulted in retardation in crop development. The differences observed could be attributed to heat and other associated effects. The maize plants that were scorched could be as a result of

imbalance imposed by differential temperature regime within the plants and its immediate environment. This may have caused the stomata of the maize plant to open unusually thereby losing its water content and eventual withering of plant due to excess heat influence. This observation agrees with the reports of Oseji (2007) and Orimoogunje *et al.* (2010).

The plants that were closer to the gas flared point showed traces of oil on their leaf surfaces while the control had no trace of oil. The film of oil on the leaf surfaces could reduce photosynthetic rate. According to Amakiri and Onofeghara (1984), the loss of photosynthetic capability of a plant can be largely attributed to the destruction of the chloroplast membranes. Agbogidi *et al.*, (2005) reported that differential changes in the rate of leaf growth may be associated with anatomical and morphological change caused by the oil. Odjugo and Osemwenkhae (2009) reported that natural gas flaring affects microclimate and reduces maize yield. These reports probably supports the reduction observed in the plant height, leaf length, leaf breadth, leaf area and shoot dry weight of the maize plant. The findings showed that there were significant differences at $P<0.05$ among the treatments when compared with the control.

The decrease in the growth of maize exposed to gas flaring could be as a result of heat effect. This heat effect could trigger intolerable high temperatures which are not favourable to maize plant and prompt rapid loss of water from the plant and the soil which causes sudden reduction in the activities of enzymes and in turn causes stomata closure of leaf thereby restricting the exchange of CO_2 and O_2. The resultant effect could lead to reduced photosynthetic activity and invariably the growth of maize. This possibly explains why local farmers in the Niger Delta Area of Nigeria often complain of low yield of maize grown around the gas flare areas. This study recommends that the oil producing companies and policy makers should as a matter of urgency minimize the rate at which these gases are flared into the environment because it causes a lot of damage to plants and threatened human race that depends on maize for food.

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