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Research Article

Effect of Time of Application and Application Rate of Spent Oil on Maize Growth

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Abstract

In this study, the effect of different application rates of spent oil (10ml and 20ml) and different application times; 1 week after planting (1WAP), 3 weeks after planting (3WAP) and 5 weeks after planting (5WAP) were investigated on growth and yield components of maize (zea mays). Maize plants were grown and exposed to spent oil at different stages of growth and different application rates, while some plants were not exposed to spent oil, and this group served as control treatment. It was observed that plants exposed to spent oil at 1WAP and 20ml spent oil stopped growing after application of spent oil. The application of 10ml spent oil at 5WAP produced highest values of yield components (maize weight, plant dry weight and leaf length and width) when compared to other treatments. Plants in the control had greater yield than those exposed to spent oil. The growth and performance of the crops at various applications of spent oil and time of application were statistically significant ($p < 0.05$), apart from leaf length at 3WAP (10mls application rate) and 5WAP (10ml application rate), which were statistically not significant ($p > 0.05$). The results obtained from this study shows that increase in application of spent oil to maize farm, especially at early stage affects growth and yield components of maize, and this leads to poor yield.

Keywords: Spent Oil; Application Rate; Time of Application; Week After Planting

Introduction

Spent oil is one of the petro-chemicals reported to be the major source of contamination in Nigeria [1]. Disposal of spent oil into gutters, drains and open places is very common in Nigeria. Spent oil has been reported in some studies of having negative effect on crops. These negative effects are because of the products used in producing oil. Introduction of spilled engine oil into agricultural soil, adversely and severely inhibit plant growth [2]. Apart from oil contamination by oil spillage, automobiles, machines and other equipment contaminate the agricultural environment through the discharge of spent oil. Spent oil is oil collected from automobile workshop, used oil from generators and automobile. Spent oil is produced when used engine oil is removed from generators and automobiles, it contains large amounts of hydrocarbons, and highly toxic polycyclic aromatic hydrocarbons [3], the concentration of this polycyclic aromatic hydrocarbons in spent oil increases with time of usage [4]. Most heavy metals are also contained in condemn oil and this is not noticed in unused engine oil [5]. When these engine oil are bad and contaminated, they are removed, the condemned oil removed is referred to as spent oil. According to Milala., *et al.* [6], oil contamination leads to low plant germination and low crop yield. Some studies reported adverse effect of spent oil on maize growth [7-11]. The discharge of spent oil to the environment affects plant grown in the area. Some of these effects are, poor germination, reduced growth and poor yield. Spent oil been a fluid, spreads in the environment and permeates into the soil, contaminating the soil and water of the environment, and this reduces soil moisture [12]. In Nigeria, there are many mechanic shops, which are located very close to farmlands. Spent oil are disposed to the farm lands at different stages of growth of plants. It is necessary to study the effect of spent oil at this different growth stages of crop. Maize was used as a test crop for this study. This study will help in knowing the effects of spent oil at different stages of maize, and this will help farmers to know when not to allow spent oil contamination in maize farms to improve maize yield.

Methodology

The experiment was carried out at the Department of Agricultural and Bioresources Engineering Experimental Site, Nnamdi Azikiwe University, Awka, during the rainy season of 2022. The study area is located between latitudes 6°15'11.8N and 6°15'5.3E and longitudes 7°7'118N and 7°7'183N and has an elevation of 142m.

Three wooden boxes were filled with loamy soil. Each of the wooden boxes has a length of 2m and width of 1m. Two of the wooden boxes were further divided into three equal segments using woods. The sides of the boxes were completely covered with polythene sack to prevent water from penetrating through the woods, each of the two wooden boxes represented the application rate of spent oil (10ml and 20ml), while each of the segments represented time of application of spent oil; 1 week after planting (1WAP), 3 WAP and 5 WAP. The third box was not divided and this served as control. The maize crop was allowed to grow normally in the control treatment without applying spent oil.

Four plant samples were obtained from each of the segments and the control treatment 6 weeks after the 5th week of application of the spent oil.

The maize cob weight was determined by selecting 4 maize cobs from each of the segments and control treatment and determining their weights.

The dry weight of the plants were determined as described by Milala., *et al*. [6], by selecting four plants from each of the segments and control treatment and drying using oven and weighing. The leaf length and width were also determined by selecting four leaves of four different plants from each segment and control treatment and measuring their length and breadth using the tape. Average of the different yield components (cob weight, dry weight, leaf length and breadth) were also determined. The statistical analysis was done using the excel solver.

Results and Discussion

The resultant cob weights following the various treatments were given in table 1.

From the cob weight in table 1, the plant exposed to 20ml spent oil at 1 week after planting yielded no cob, as the plants stopped growing immediately after the spent oil application. For 3WAP, higher cob weights (average = 56.5g) were obtained from the 10ml application rate than for 20ml application rate (average = 49.5g),

Treatment	10ml	20ml
1 WAP	26	0
	50	0
	40	0
	45	0
Average	40.25	0
3 WAP	30	27
	55	49
	61	59
	80	73
Average	56.5	49.5
5 WAP	44	40
	60	56
	70	61
	114	90
Average	72	61.75
Control	390	
	391	
	399	
	406	
Average	396.5	

Table 1: The cob weight of plants exposed to different levels of spent oil (10ml and 20ml) at different periods (1 WAP, 3 WAP and 5 WAP).

the same trend was also observed in 5WAP were average cob weight for 10ml application rate is 72g, while that for 20ml application rate is 61.75g. The average cob weight for control treatment was 396.5g. The cob weight of plants exposed to different levels of spent oil (10ml and 20ml) at different periods (1 WAP, 3 WAP and 5 WAP) were significantly less than the control treatment ($p < 0.$ 0.05).

From table 2, all the treatments recorded less plant dry weights, when compared to the dry weight of the control. All the treatments also recorded statistically significant p values, when compared to control treatment.

The means of the leaf length and breadth for all the treatments (Table 3) were found to be less than the mean of the control. The leaf length and breadth exposed to different spent oil application rates (10 and 20ml) at different periods (1 WAP, 3 WAP and 5 WAP) were also statistically significant at $p < 0.05$ significant level, when

Treatment	10ml	20ml
1 WAP	80	5
	85	6
	86	9
	89	10
Average	85	7.5
3 WAP	111	100
	113	101
	114	111
	116	114
Average	113.5	106.5
5 WAP	170	149
	179	150
	181	152
	186	154
Average	179	151.25
Control	210	
	230	
	390	
	241	
Average	230	

Table 2: The plant dry weight exposed to different levels of spent oil (10ml and 20ml) at different periods (1 WAP, 3 WAP and 5 WAP).

Treatment	10ml			20ml
1 WAP	L	W	L	W
	60	5.0	2.3	1.4
	63	5.1	2.7	1.6
	69	5.6	2.9	1.9
	70	5.7	3.3	2.1
Average	65.5	5.35	2.8	1.75
3 WAP	80	6.0	69	5.7
	87	6.3	70	5.9
	90	6.3	70	5.9
	94	6.5	75	6.0
Average	87.75	6.27	71	5.87
5 WAP	89	6	71	5.5
	90	7	74	5.7
	93	7.3	78	6
	97	7.4	79	6.3
Average	92.25	6.93	75.5	5.87

Control	L	W
	90	15
	91	14.1
	95	14.1
	11	13.4
Average	96.5	14.15

Table 3: The means leaf length and breadth (cm) of cob exposed to different levels of spent oil (10ml and 20ml) at different periods (1 WAP, 3 WAP and 5 WAP).

compared to control treatment, apart from leaf lengths at 3 WAP and 5 WAP, which recorded non-significant p values ($p > 0.05$).

Reduction in plant growth reported in this work could be due to reduction of the mineral elements required for plant growth, with increase with application of spent oil, similar trend was also reported by Njoku., *et al.* [7]. The negative effects observed may be due to blockages caused by spent oil and this inhibits the early germination and growth.

Conclusion

From this study, it is evident that spent oil has adverse effect on maize yield, this adverse effect worsens with increase in application rate, especially at early stages of maize growth. Disposal of spent oil in agricultural environment should be discouraged as this has negative effect on the crops grown within the vicinity.

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