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OIL SPILLAGE AND AGRICULTURE: EFFECTS OF SPENT LUBRICATING OIL ON SOIL NUTRIENTS AND YIELD OF SOYBEANS (*GLYCINE MAX L. MERRIL*)

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ABSTRACT

The toxicological effects of spent lubricating oil on two varieties of soybeans TGX 1485-ID and TGX 1448-2E were investigated. Soil chemical analysis before planting and after harvest revealed that there were variable decrease in the levels of Sodium (Na), Potassium (K), Zinc (Zn), Copper, (Cu), Nickel (Ni) and Manganese (Mn) with increasing level of oil contamination. However, the amount of Calcium (Ca), Magnesium (Mn), Iron (Fe) and Cadmium (Cd) was found to have increased in the soil after harvest. Lead (Pb) and Chromium (Cr) were not detected in the contaminated and uncontaminated soils. Spent lubricating oil was found to cause delayed germination, reduced growth and yield parameters in both varieties of soybeans; and with increasing level of oil contamination, the toxicity of the oil to soybeans were more pronounced.

INTRODUCTION

Petroleum hydrocarbons are known to contain a wide range of substances which are potential hazards to man and plants (Moore and Ramamoothly, 1984). Arsenic, for instance accumulates in soils and causes crop defoliation before harvesting while Lead, another constituent of spent lubricating oil, is converted to more toxic compounds in soils (Forth, 1990).

In Nigeria alone, about 3,000 incidents of oil spillage were recorded between the year 1976 and 1980 (Nwankwo, 1983); yet very little has been done to access the impacts of oil spillage on agricultural production. Through oil-spillage, soils are usually contaminated and degraded and since land is usually inadequate in meeting the ever increasing demand of the human population; it is now essential that an assessment is made of the possible deleterious effects of the indiscriminate and accidental discharge of oil on agricultural crops. This will ensure the maximum utilisation of the ecosystem while preserving it's essential nature.

METHODOLOGY

Soils for planting were collected from the Departmental garden and Soil Chemical analysis was carried out in the soil laboratory to determine the levels of micro and macro elements present in soils before planting. Spent lubricating oil was collected from motor mechanic workshops in three different locations in Ibadan and mixed with soils in 21cm diameter plastic pots. Two varieties of soybean seeds TGX 1485-ID and TGX 1448-2E obtained from the International Institute of Tropical Agriculture (IITA, Ibadan) were planted in the plastic pots and each variety was subjected to 3 treatments as stated below:

Treatment 1:	Soil with 0 ml of Spent lubricating oil (per pot)
Treatment 2:	Soil with 50 ml of spent lubricating oil (per pot)
Treatment 3:	Soil with 100 ml of spent lubricating oil (per plot)

Each of these treatments were replicated 10 times and watering was carried out every day. Observations were done on the water retention capacity of soil, germination date, and on growth and yield parameters of plants. At harvest, soil chemical analysis was done to further determine the composition of micro and macro elements in soils.

RESULTS AND DISCUSSION

The results of soil chemical analysis before planting and after harvesting are indicated on Table 1. With increasing level of oil contamination, there was a general decrease in the contents of some micro and macro elements before

contamination more than the other may have been endowed with some favourable genetic factors that are absent in the variety TGX 1448-2E (V_2).

Table 3. Pod Characteristics Of Two Varieties Of Soybeans (V1 & V2) Grown On Control And Oil-Contaminated Soils

Production characteristics	Soybean Variety	Oil contamination level			Variety Grand Mean
		0ml	50ml	100ml	
Number of productive pods (n = 5)	V_2	35.80 ± 6.61	14.80 ± 3.11	3.20 ± 0.83	17.93 ± 16.52b@
	V_1	51.60 ± 1.67	30.40 ± 4.270	6.20 ± 2.38	29.40 ± 22. 71[a]
	CL**				
	Grand mean	43.70 ± 11.17[a@]	22.60 ± 11.03[b]	4.70 ± 2.12[c]	
Number of unproductive pods	V_2	2.20 ± 1.92	2.20 ± 1.48	0.60 ± 0.54	1.66 ± 0.92[a]
	V_1	2.40 ± 2.61	3.00 ± 2.91	1.00 ± 1.00	2.13 ± 1.02[a]
	CL Grand mean	2.30 ± 0.14	2.60 ± 0.56[a]	0.80 ± 0.28[b]	
Percentage productive pods out of total pods	V_2	93.80 ± 5.63	87.80 ± 8.19	87.00 ± 12.0	89.53 ± 3.71[a]
	V_1	95.60 ± 4.72	92.00 ± 7.38	4	90.26 ± 6.37[a]
	CL Grand mean	94.70 ± 1.27[a]	89.90 ± 2.96[ab]	83.20 ± 11.7	
				85.10 + 2.68[b]	
Pod dry weight (g)	V_2	10.90 ± 0.92	3.90 ± 0.80	0.60 ± 0.19	5.13 ± 5.25
	V_1	12.25 ±2.65	6.67 ± 1.34	1.28 ± 0.66	6.73 ± 5.48[a]
	CL Grand Mean	11.5 ± 0.95[a]	5.28 ± 1.95[b]	0.94 ± 0.48	
Dry weight/pod (g)	V_2	0.30 ± 0.30	0.26 ± 0.02	0.19 ± 0.06	0.25 ± 0.05[a]
	V_1	0.23 ± 0.05	0.21 ± 0.04	0.19 ± 0.04	0.21 ± 0.02[b]
	CL Grand Mean	0.21 ± 0.05[a]	0.23 ± 0.03[ab]	0.19 ± 0.00[b]	

Oil contamination level (0ml = control; 50ml oil in soil; 100ml in soil)
**CL = Oil contamination level grand mean
@Grand means on the same row or column with different superscripts are significantly different (P<0.05)

In conclusion, the contamination of soil with spent lubricating oil adversely affected the micro and macro-elements in soils; resulting in reduced growth and productivity patterns in two soybean varieties. It is therefore essential that adequate and relevant legislations are established and enforced locally and internationally on the dispersal of petroleum oils and products to avert the danger of soil nutrient degradation and environmental pollution in the 21st century.

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