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Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.3.Issue.3.2016 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

GROWTH OF CASSAVA PRETREATED WITH CALCIUM CHLORIDE AND WATER IN SOIL CONTAMINATED WITH SPENT ENGINE OIL

Offor, U.S. Akoba Grace , Agbagwaa C and Akonye.I.A.
Department of Agricultural Science,
Ignatius Aguru University of Education
Port Harcourt

ABSTRACT

This study was conducted to evaluate the growth of cassava pre-treated with Calcium Chloride in soil contaminated with spent engine oil. The specific objectives were to assess the phytoremediation capacity of cassava when pretreated with calcium chloride and water, and to compare the rate of pollution tolerance between the two cultivars (TMS 30572 and TMS 4(2)1425) when pre-treated with calcium chloride and water, on the growth parameter (sprouting ability), plant height, leaf number and leaf length, of two cassava cultivar (TMS 30572 and TMS 4(2)1425). Results showed that spent engine pollution generally caused drastic reduction in the growth parameters of cassava and as well as capable of becoming deleterious to cassava growth. Results also showed that, the effects of pre-treatments given to the cultivars planted had influenced on the growth parameters of the plant, depending on oil pollution tolerance ability of the cultivars to the contaminant. TMS 3057 was found to possessed better pollution adaptive mechanisms than the TMS 4(2) 1425 cultivar. It was also observed that cassava cuttings pre-treated/soaked in Calcium Chloride (CaC12) and water (1120) was beneficial in mitigating the adverse effects of spent engine oil contaminated soil than in the controls in terms of sprouting ability, plant height, leaf number and leaf length. While the polluted control were more affected leading to Stunted growth in (TMS 30572) and total crop failure (retarded growth) in the ('FM 4(2)1425), $CaCl_2$ pre-treatment of cultivars planted in polluted soil recorded significant increase in the above mentioned growth parameters than those polluted with water (H_2O). Therefore, this study suggests that $CaCl_2$ proved effective in the development and the growth of *Manihot esculenta* in spent engine oil polluted soil under the experimental conditions.

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Introduction

Soil contamination or soil pollution is caused by the presence of xenobiotic (human made) chemicals or other alteration -in the natural soil environment. It is typically caused by industrial activities, agricultural chemicals, or improper disposal of waste. Agbogidi and Liodu, (2013). Pollution of' the soil with petroleum derivatives is often observed in municipal soil around industrial plants and in areas where petroleum and

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natural gas are obtained (Adam *et al,* 2002), hence oil pollution is a functional and almost inevitable for an oil-based technology and economy dependent country like Nigeria. This calls for attention in all facets of livelihood of growing population. The steady rise in the exploration, production, refining of oil and the uses of it's products and by-products have resulted in the massive degradation of the environment. (Ejemeta, 2005, Agbogidi, 2010).

It has been shown by researchers that the existing mode of indiscriminate disposal of spent engine oil does not only increase pollution incidents in the environment, but it is more prevalent than crude oil pollution (Odjegba and Sade, 2001). The indiscriminate disposal of used oil drain from engine after servicing and spent carbide waste were found to affect plant growth and militate against the normal ecological processes.

The exact effect on plants growing in an area contaminated by spent engine oil and other contaminants vary from plant to plant due to different chemicals in their different compositions. Therefore, there is need for adequate enlightenment on the indiscriminate disposal of spent engine oil.

Cassava belongs to the family euphorbiaceae, and it is extensively cultivated as an annual crop in tropical and sub-tropical regions for it's edible, starchy and tuberous roots. It is a major source of carbohydrate, and an important food crop.

It is used in the processing and preparation of Gari, cassava Flour, Fufu, Starch, Tapioca and industrial purpose. Cassava is the third largest source of carbohydrate food in the tropic after maize and rice (FAO, 1995), and also a major stable food in the developing countries providing basic diet for man and livestock. As one of the most drought tolerant crops, it can be successfully grown on marginal soil giving reasonable yield where many other crops can not do well.

Calcium Chloride ($CaC1_2$) is the ionic compound of calcium and chlorine. It is a salt that behaves as a typical ionic halide, being solid at room temperature and highly soluble in water, its' common application includes, brine (salt water or sea water) for refrigeration, plants, ice and dust control on road etc.

In general, the indiscriminate disposal of spent engine oil into qutter water drains, vacant plots among automobile mechanics that change oil from motor vehicles and generators have been found to be hazardous to both plants and animals. (Anoliedo and Vwioko 2001, Emmanuel *et al* 2006).

Pollution with spent engine oil has been found to retard plant growth and cause death of most aquatic animals. Also, spilled oil pollution make the soil to be less useful for agricultural activities with dependent organisms been adversely affected. It has also been observed that soil polluted with spent engine oil experience physiological drought that affect plant, water relation and root respiration that are necessary for plant nutrient uptake and where plant soil microbes compete for little nutrient available in polluted soil, growth of plant in such soil would adversely be affected (Olayinka and Arinde, 2012).

Spent engine oil is a mixture of several chemicals including low and high molecular weight aliphatic hydrocarbons, aromatic hydrocarbons and heavy metal contaminants making it more diver stating than crude oil pollution.

This study therefore evolve as a result of growing concern as to what is to be done to develop some enhancement agents as a techniques through cultivar pretreatment for the growth of *Manihot esculenta* using different pre-treatment option...

Materials and Method

This experiment was carried out at Ignatius Ajuru university of Education, Teaching and Research Farm, Ndele campus. Two cultivars of cassava were used and was procured from the local farmers at Ndele market, Emouha Local Government Area of Rivers State. The cultivars were- tropical Mosaic Series (TMS) 30572 and TMS 4 (2)1425.

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The spent engine oil used for the pollution treatment was obtained with permission from the power house of the Ignatius Ajuru University of Education Ndele campus.

Polybags were perforated with 3-5 holes for drainage. The polybags filled with top soil were polluted at 3% level with spent engine oil following the method of Offor and Akonye (2006). The 3% pollution was achieved by thoroughly mixing of 450ml of SEO to 17kg of top loamy soil on a concrete floor and was dispensed into the polybags. The control did not receive any SEO pollution treatment.

Calcium chloride and water were used as pre-treatment agents. Both polluted and unpolluted soil, TMS 30573 and MTS 4 (2) 1425 cultivars received the same treatments.

The experimental design used for this research was randomized complete block design (RCB) with five (5) replicates. The experimental set up consisted of the following.

a. Control –no pollution, no pre-treatment.
b. Unpolluted + water (H_20)
c. Unpolluted + 5% calcium chloride
d. 3% pollution + no pre-treatment
e. 3% pollution + water (H_20)
f. 3% pollution +5% calcium chloride (C_aC1_2)

For the purpose of this experiment, the following parameters were used to evaluate the growth of cassava (*Manihot esculenta*) pretreated with calcium chloride ad water in the above experimental set up.

a. **Sprouting Ability:** This was achieved by counting from the day of slanting the stems to when the stems sprouted the numbers of days were recorded.
b. **Plant height:** This was measured 3-4 wks after planting by measuring from the ground level to the shoot tip with a measuring rule.
c. **Leaf number:** This was done by visual counting of the umber of leaves for each cutting per treatments.
d. **Leaf length:** Measure from the base of the leaf to the apex.

Result and Discussion

The varying responses of the growth of cassava cultivars (TMS 30572 and TMS 4 (2) 1425) when pretreated with C_aC1_2 and H_2O in unpolluted and polluted soil are hereby presented.

Plate 1 and 2 shows the Quantitative Observation of TMS 30572 and TMS 4 (2) 1425 growing under Different Pretreatments and Pollution Conditions.

PLATE: 1 TMS 30572

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PLATE: 2 TMS 4 (2) 1425

Figure 1: The sprouting ability of the two cultivars are shown in figure 1. In the unpolluted experiment, the sprouting abilities were generally enhanced and higher than when polluted. The sprouting ability in TMS 30572 was almost 50% lowered by SEO pollution, and in TMS 4 (2) 1425 cultivar. Pollution lowered sprouting of the stems by 40%. Cultivars without pre-treatment under polluted (TMS 4 (2) 1425) sprouted not at all.

C_aC1_2 pre-treatments (in unpolluted and polluted soils) recorded the highest number of sprouted stems and was found to increase the sprouting of cassava than water (H_2O) pre-treatment.

Soil pollution generally impedes or reduces the sprouting ability of cassava especially in the TMS 4 (2) 1425 cultivar, under experimental condition. This had been confirmed from the work of Esenwo *et al* (2006), Siddigue and Adams (2006), which observe that spent engine oil impede or inhibit germination.

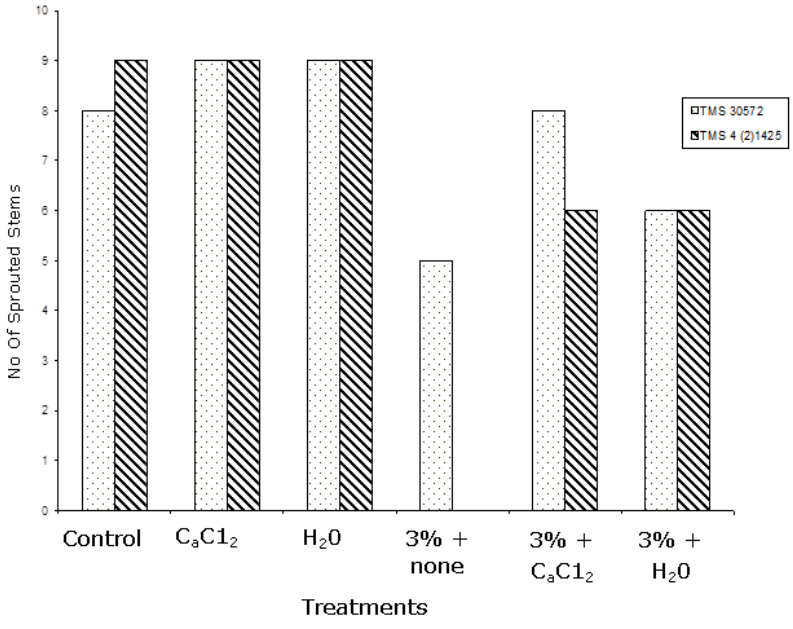

Fig. 1: Sprouting ability of the different cultivars under various treatments

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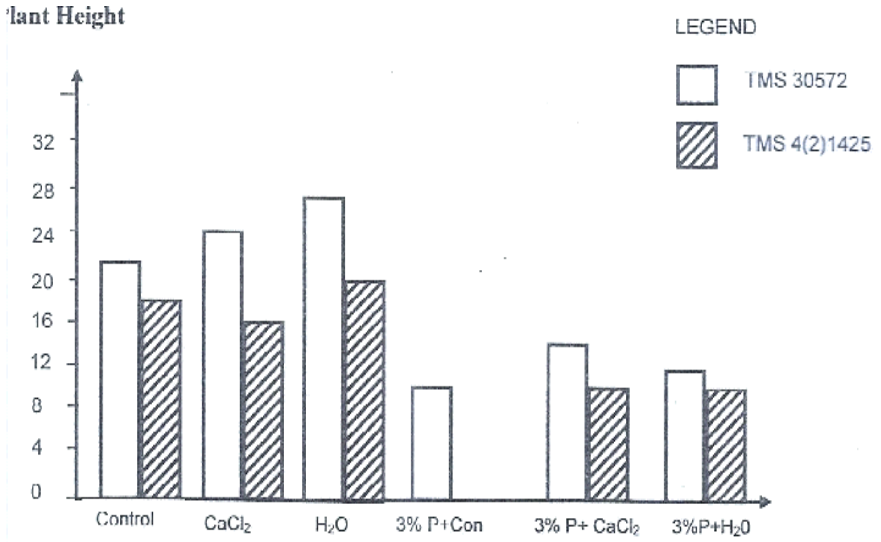

Fig II: Effect of different pre-treatments and spent engine oil pollution on the height of cassava cultivars.

Fig II: shows the effects of pre-treatments and spent engine oil pollution/contamination on the height of cassava cultivars. In the unpolluted experiments, the TMS 3072 pre-treated with $CaCl_2$ and H_2O enhanced the growth in height. But for the TMS 4 (2) 1425, there was no significant effect of pre-treatment between the control and the pretreated cultivars.

In the presence of pollution, the TMS 30572 consistently showed that pre-treatment with $CaCl_2$ and H_2O enhanced growth in height over the polluted control. While in the TMS 4 (2)1425, the pre-treatments improved the growth in height and the survival rate of the seedlings, since none of the seedling survived in the 3% pollution without pre-treatment polluted and control.

In general, pollution depressed growth in height by about 70% in TMS 4(2)1425 and by 40% in TTMS 30572. Anoliedo and Vwioko (2001) has earlier observed that spend engine oil create unsatisfactorily conditions for plant growth thereby resulting to damage to cell membrane and leakage of cell contents as well as

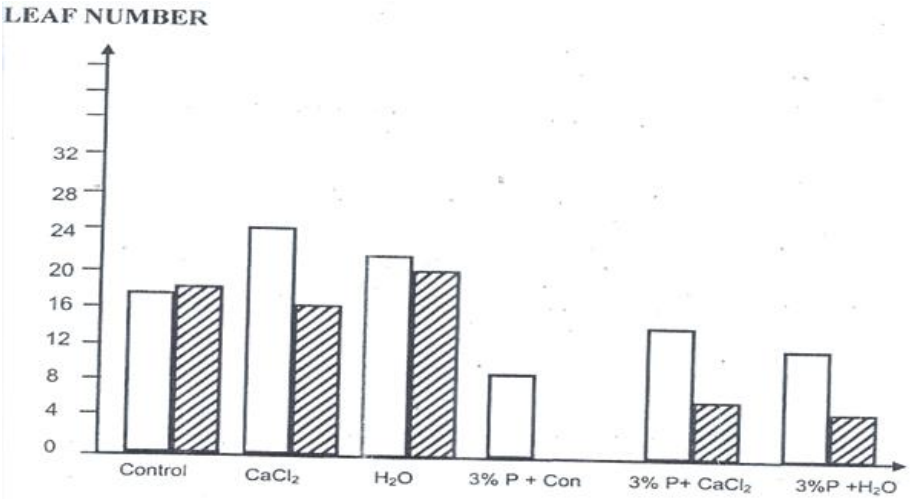

Fig III: effects of different pre-treatments and spent engine oil pollution on the number of leaf.

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From Fig III, in the control experiment, the result showed that $CaCl_2$ and H_2O helps in leaf generation or proliferation and increase the leaf number of cassava (especially the TMS 30572). The highest significant leaf number was obtained in TMS 30572 $CaCl_2$ pre-treatment with H_2O pre-treatment by 24% in H_2O and 17% in control. But when the soil was contaminated with spent engine oil. There was significant reduction in the number of leaves when compared to the control.

Spent engine oil pollution adversely affected the leaf number of the cassava. This may be a result of interference of the oil constituent with photosynthesis and transpiration probably by clogging the stomata.

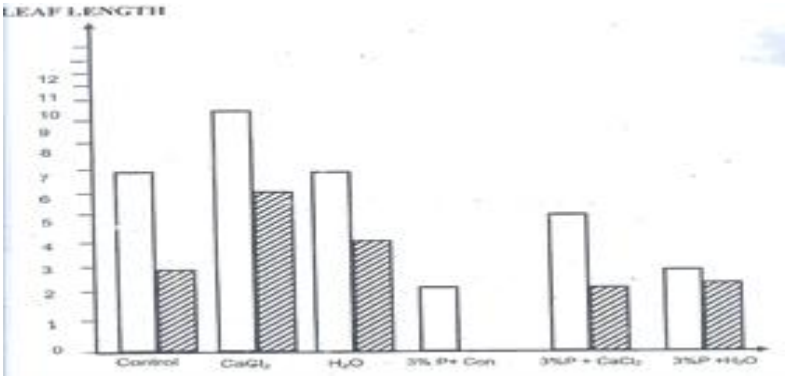

Fig IV: Effects of different pre-treatments and spent engine oil on the leaf length of cassava cultivars (TMS 20572 and TMS 4 (2) 1425).

Figure IV: above shows that leaf length of TMS 30572 in the control experiment was 6.6cm, treatment with $CaC1_2$ recorded 9.5cm, H_2O, 7.2cm, while the leaf length of TMS 4 (2) 1425 in control was 3.1cm, $CaC1_2$, 6.2cm and H_2O, 3.7cm respectively.

However, when they were planted in spent engine oil polluted soil, it was adversely affected and the plant leaf length decreases; TMS 30572; control gave 2.4cm, 3% + $CaC1_2$ was 6.2cm, and 3% +H_2O) recorded 3.1cm while in TMS 4(2) 1425 was as follows 3% + none=Retard, 3% + $CaC1_2$, 2.2cm, 3% + H_2O, 2.3cm respectively.

Soil contamination generally reduces the leaf length of the two cassava cultivars under experimental condition. It has been documented (Cut forth *et al* 1985, Agbogidi 2001) that spent engine like crude oil penetrates plant tissues and in a small way affects the biological, physical, chemical and micro-biological components of the soil in various ways. These destructions must have accounted to the decrease in leaf length of the cultivars used in the study.

This study therefore postulates that laws should be enacted on discriminate disposal of spent engine oil as this is ecological unfriendly to the growth of crops.

References

[1]. Adenipekun, C.O. (2008): Bioremediation of engine polluted soil by pleurotus. Tuber. Region singer a Nigerian whiterot fungus. *African Journal of Biotechnology* 7 (1): 55-58.

[2]. Agbogidi, O.M. (2001): Effects of oil contaminated with spent lubricating oil on the germination of Gmelina Aaborea (Roxb) seeds. *African Journal of natural sciences* 12:11-14

[3]. Anoliedo, G.O and Vwioko D.E. (2001): Tolerance of chromoleana Odorata (L) K and C. grown in soil contaminated with spent lubricating oil. Journal of tropical bioscience 1 (1): 20-24.

[4]. Cutforth, H.W, Shaykerwich, C.F. Cho. C.M. (1985b): Effects of soil, water and temperature on corn (*Zea mays*), root growth during emergence. *Canadian J. Soil Sciences*. 66;445-455.

[5]. Emmanuel O.I Godon O.D. and Nkem A.T. (2006): the effects of oil spillage on crop yield and income in Delta State. Nigeria J. central Eur Agric 7 41-48.

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[6]. Esenowo, G.J. Sam S.M. and A.I. Etuk (2006): Effects of crude oil on germination and early seedling growth of *Telferia accidentalis* in: botany and environmental health botanical society of Nigeria. Uniyo Pp 93-96.

[7]. Odjegba, V.J. and Sadie, A.O. (2002): Effects of spent engine oil on the growth parameters chlorophyll and protein levesl of *amaranthus hybridus L. environmentalist, 22:23-28.*

[8]. Offor, U.S. and Akonye, L.A. (2006): Amendment of crude oil contaminated soil with sawdust and *chromoleana* leaves for optimum plant protection. African *Journal of Biotechnology* 5:770-774.

[9]. Olayinka O and Arinde O. (2012): Effects of spent engine oil on germination and seedling growth of groundnut.

[10]. Siddiqui, S. and Adams, W.A. (2006): The fate of diesel hydrocarbons in soils and their effects on germination of *perennial ryegrass. Environmental toxicology. 17 (I): 49-62.*