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Effect of Spent Engine Oil on the Germination Ability of Eleven Accessions of African Yam Bean Seeds (*Sphenostylis sternocarpa* Hochst ex A. Rich) Harms

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Abstract: *Laboratory studies were carried out in 2011 at the Plant Science and Biotechnology Laboratory of the College of Natural and Applied Sciences of Michael Okpara University of Agriculture Umudike to investigate the germination ability of eleven accessions of African yam bean seeds in spent engine oil (SEO). The experiment was laid out in Complete Randomized Design (CRD). Seeds of the eleven accession of African yam bean were presoaked in water for 24hours and thereafter soaked in spent engine oil for varying hours 0, 1, 2, 4, 8 and 16 hours. The seeds were placed in Petri dish lined with moist tissue paper. The result obtained showed that the germination percentage, days to germination and rate of germination of the AYB accessions were time and accession dependent. The germination ability of seeds decreased as number of hours soaked in spent engine oil increased. AYB-11, AYB-04, AYB-03 and AYB-07 were more tolerant to oil among the African yam bean accessions studied hence could be considered to be used to boost food security in oil producing areas of the Niger Delta.*

Key words: *African yam bean, spent engine oil, germination ability,*

I. Introduction

African yam bean (*Sphenostylis sternocarpa* Ex. A. Rich Harms) is an underutilized food legume crop in the tropics that is not popular as other major food legumes crop (Azeke *et al.*, Moyib *et al*., 2008). African yam bean (AYB) like other tuberous legumes is a member of the Fabaceae family. African yam bean is cultivated mainly for home consumption and only about 30% of the dry grain produced is sold. It is also planted for soil restoration (Saka *et al* .,2007). African yam bean is a good source of protein, fiber and carbohydrate. It is also rich in minerals such as phosphorous, Iron and potassium and contains some anti-nutrients such as trypsin inhibitor, phytate, tannin and other alkaloids (Nwokolo, 1987; Ajibade *et al*., 2005; Fasoyiro *et al*., 2006). African yam bean is usually cooked and eaten the alone with yam, maize and rice. It can be used to replace cowpea in food preparation especially during the lean period when food is scarce among the rural farmers (Akande, 2009). One limit to the use of African yam bean is that the seeds require a long cooking time because of the hard testa. This is energy and time consuming (Akande, 2009).

Crude oil varies in appearance and composition from one kind to another (Craig 2003, Akaniwor *et al.,* 2007). Effect of auto mechanic due to indiscriminate disposal of spent oil is inevitable (Ogbuehi *et al.,* 2011). Agbogidi and Ejaemete (2005) observed that oil in soil deleterious effect on the biological, chemical and physical properties of the soil depending on the dose, type of the oil and factors. There are relatively large amounts of the hydrocarbon in the used oil including the highly toxic polycyclic aromatic hydrocarbons (Okonokhua *et al.,* 2007*)*. When oil is applied to soil microbiological components of soil are usually negatively affected Benka-Coker and Ekudayo (1997). Although some research work have been conducted on the effects of spent lubricating oil on the germination of some economic crop (Ogbo, 2009; Anoliefo *et al.,* 2001; Okonokhus *et al*., 2007; Srujana and Khan, 2010; Adedakun and Atega, 2007). But there is no information on the effect of spent engine oil on the germination ability of African yam bean hence the objective of this study was to establish germination ability of African yam bean in spent engine oil.

II. Materials And Method

The experiment carried was out in 2011 at the Plant Science and Biotechnology laboratory of the College of Natural and Applied Sciences, of Michael Okpara University of Agriculture Umudike, Umuahia, Abia State. Spent engine oil was obtained from a mechanic workshop in Umuahia, Abia State. Seeds of eleven accessions of *Sphenostylis sternocarpa* collected from different locations were used to determine the germination ability of African yam bean in spent engine oil (Table 1). The seeds were subjected to viability test using floatation technique. The floatation technique was used to remove insect-damage or empty seeds (Mahmut, 2010). The samples were randomly taken from homogenous population of each seed type, the eleven

accessions of African yam bean was presoaked in water for 24 hours and thereafter in 100% spent engine oil for varying periods of time (0, 1, 2, 4, 8, 16 hours) and then allowed to germinate on moist tissue paper placed in Petri-dishes. For each treatment, a total of 20 seeds was used and replicated three times. Experimental design was Complete Randomized Design (CRD). Readings was taken at 24 hours interval and emergence of radicles was used as a critical stage of germination (Agbogidi, 2010).

DETERMINATION OF GERMINATION PERCENTAGE

Percentage germination was determined using the method of Agbogidi (2010):

$$\frac{\text{Number of seedlings that sprouted} \times 100}{\text{Number of seeds planted}} \quad 1$$

DETERMINATION OF DAYS TO GERMINATION

Days to germination were determined using the method of Marli and Santana (2006).

Days to germination as mean length of incubation time. It is a measurement of the average length required for maximum germination of a seed lot, and is expressed in terms of the unit used in making germination counts (hours or days)

DETERMINATION OF RATE OF GERMINATION

The germination rate was calculated as the coefficient of velocity of germination, denoting it as

$$CVG=V=\frac{CV}{100}=\frac{1}{t}$$

Where t = mean germination time, and CV coefficient of velocity.

In time, since the mean rate increases and decreases with 1/t not with t. The rate of germination was determined using Marli and Garcia (2006) method.

DATA ANALYSIS

Data were separately subjected to analysis of variance using GENSTAT Discovery Edition 4 (GENSTAT, 2007) and significant differences were determined using least significant differences (LSD) at 5% level probability.

III. Results And Discussion

The results of the effect of spent engine oil on eleven accessions of African yam bean seeds (*Sphenostylis sternocarpa)* are shown in tables 2-4.

Most of the African yam bean accessions sown on the uncontaminated Petri dish germinated on the 3rd day after sowing with some of the accessions germinated on the 2nd and 5th day. There was highly significant difference ($P<0.01$) with seeds contaminated with spent engine oil (SEO). The germination percentage decreased as the number of hours increased (Table 1). This could be as a result of volatile fractions of oil which have high wetting capacity and penetrating power; it enters the seed coat and kills the embryo. In addition, as oil contaminated soils become compact they may lead to poor wetting ability and increased amount of toxic substances which may result to decrease in germination (Srujana and Anisa, 2010). The presence of spent oil in the soil-plant micro-environment affects normal soil chemistry wherein nutrient release and uptake as well as amount of water get reduced (Nwoko *et al.,* 2007; Odejgba and Sadiq, 2002). Agbogidi (2010) had reported that oil effect on plants are species and variety dependent which agrees with the observation made on this work at 16 hours, some of the accessions were not affected by the toxicity of the oil hence germinated.

The African yam bean accession soaked in spent engine oil for more than 2 hours germination percentage reduced drastically. None of the African yam bean accession germinated while still soaked in spent engine oil. The oil could have endangered the life of the seed embryo and hence lead to the loss of seed viability. This result is in agreement with Agbogidi (2010), Ogbo(2009), Adekakun and Atage(2007), Anoliefo *et al.,* (2001), Srujana and Khan, (2010), Okonokhua *et al.,*(2009). The result also showed that AYB-11, AYB-04, AYB-09, AYB-03, AYB-01, AYB-07 were more tolerant to oil levels in this study. Agbogidi and Nweke(2005), Ogbo,(2009) and Agbogidi(2010) had reported that oil effect on plants are species and variety dependent. Adam and Duncan (2002) and Anoliefo *et al.,(*2001).

IV. Conclusion

The observation made from this research showed that AYB-11, AYB-04, AYB-09, AYB-03, AYB-01, AYB-07 were more tolerant to different level of spent engine oil. Therefore, they can be used to boost food security in Niger Delta area of Nigeria

TABLE 1

Place of collection, collector, helium colour and seed colour of *Sphenostylis sternocarpa* (African yam bean) used in the study

S/No	Place of collection	State	Accession number	Collector	Seed colour	Hiliumcolour
1	Etitiama-Nkporo	Abia	AYB-01	Osuagwu, A.	Brown, White	Black, Brown
2	Etitiulo-Bende	Abia	AYB-02	Osuagwu, S.	Speckled, White	Brown, Black
3	Abam	Abia	AYB-03	Osuagwu, S.	White	Brown
4	Amauwom	Abia	AYB-04	Osuagwu, A	White, Black	Black, Brown
5	Alayi	Abia	AYB-05	Osuagwu, A.	White, Brown	Brown, Brown
6	Itu	Akwa Ibom	AYB-06	Osuagwu, S.	Brown, White	Brown, Brown
7	Ngor-Okpuala	Imo	AYB-07	Okwulehie, I. C.	White, Brown	Black
8	Akaeze	Ebonyi	AYB-08	Nkaa, F.	Marbled	Brown
9	Ishiagu	Ebonyi	AYB-09	Okoro, I. A.	Brown, Marbled	Black, Brown
10	Nsukka	Enugu	AYB-10	Olaitan, T.	Milky	Brown
11	Ankpa	Kogi	AYB-11	Abu, A.	White, Marbled	Black, Brown

TABLE 2

Germination Percentage of African yam bean seeds in spent engine oil

Accessions	Control	1hour	2hour	4hour	8hour	16hour
AYB-01	100	63.30	56.70	40.00	23.30	13.33
AYB-02	100	90.00	80.00	70.00	60.00	0.00
AYB-03	100	66.70	30.00	36.70	20.00	8.33
AYB-04	100	80.00	63.30	46.70	30.00	20.33
AYB-05	100	0.0	0.0	0.0	0.0	0.0
AYB-06	100	0.0	0.0	0.0	0.0	0.0
AYB-07	100	53.30	40.70	33.30	20.00	8.33
AYB-08	100	0.0	0.0	0.0	0.0	0.0
AYB-09	100	66.70	46.70	30.00	18.30	8.33
AYB-10	100	83.3	86.7	70.00	50.00	0.0
AYB-11	100	100	100	98.30	91.70	90.00
LSD 0.01	NS	19.96**	17.44**	15.42**	10.00**	2.762**

NS=Not Significant **=0.01

TABLE 3

Days to germination of African yam bean accession soaked in spent engine oil at different hours

Accessions	Control	1hour	2hour	4hour	8hour	16hour
AYB-01	100	63.30	56.70	40.00	23.30	13.33
AYB-02	100	90.00	80.00	70.00	60.00	0.00
AYB-03	100	66.70	30.00	36.70	20.00	8.33
AYB-04	100	80.00	63.30	46.70	30.00	20.33
AYB-05	100	0.0	0.0	0.0	0.0	0.0
AYB-06	100	0.0	0.0	0.0	0.0	0.0
AYB-07	100	53.30	40.70	33.30	20.00	8.33
AYB-08	100	0.0	0.0	0.0	0.0	0.0
AYB-09	100	66.70	46.70	30.00	18.30	8.33
AYB-10	100	83.3	86.7	70.00	50.00	0.0
AYB-11	100	100	100	98.30	91.70	90.00
LSD 0.01	NS	19.96**	17.44**	15.42**	10.00**	2.762**

NS=Not Significant **=0.01

TABLE 4

Rate of germination of African yam bean accessions

Accessions	Control	1hour	2hour	4hour	8hour	16hour
AYB-01	36.46	26.143	28.357	38.617	26.67	11.67
AYB-02	26.31	33.353	12.543	22.797	23.33	0.000
AYB-03	31.25	20.117	25.117	33.367	20.00	08.33
AYB-04	20.83	33.340	29.437	20.090	30.00	20.00
AYB-05	31.25	0.000	0.000	0.000	0.000	0.000
AYB-06	29.40	0.000	0.000	0.000	30.00	11.67
AYB-07	20.00	33.350	33.483	80.333	20.00	08.33
AYB-08	31.25	0.000	0.000	0.000	0.000	0.000
AYB-09	40.82	26.000	51.667	70.640	36.67	15.00
AYB-10	16.94	31.270	29.493	28.930	15.00	08.30
AYB-11	30.03	30.030	30.030	30.253	20.00	26.67
LSD 0.01	NS	0.5050**	0.7695**	0.3298**	0.2671**	0.4532**

NS=Not Significant **=0.01

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