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SUSCEPTIBILITY OF FIVE CULTIVARS OF SOYA BEAN (G*LYCINE MAX* (L.) MERR.) SEEDS TO SPENT ENGINE OIL

AGBOGIDI, O. M.
Department of Forestry and Wildlife, Faculty of Agriculture,
Delta State University, Asaba Campus, Asaba, Nigeria.

ABSTRACT
This study was carried out in 2008 at the Plant and Soil laboratory of the Faculty of Agriculture, Delta State University, Asaba Campus to evaluate the susceptibility of five cultivars of soyabean (Sam soy l, Bragg, Roanoke, Davis and Clark) to spent engine oil. Seeds (100) were presoaked in water for 24 hours and later soaked in SEO for varying periods (0,1,2, 4, 8,16 and 24 hrs) and those soaked in oil for 0, 1, 2 and 4 days were germinated on moist tissue/ filter paper placed in big Petri dishes. The responses of the soyabean in were both exposure=time and cultivar dependent with the Davis followed by Roanoke cultivars recording highest values which differed significantly ($P \leq 0.05$) from Sam soy 1, Davis and Bragg. The longer the period of seed soaking in oil, the poorer the germination characteristics. No seeds germinated while still soaked in oil. The study has demonstrated that SEO has a highly significant ($P \leq 0.05$) effect of reducing the germination characteristics of the cultivars studied. The study also demonstrated that Davis and Roanoke are the most tolerant soyabean cultivars among the ones examined. The differential sensitivity of plants to SEO toxicity can be exploited in phytoremediation practice by choosing species that are well tolerant to the contaminant.

KEYWORDS: *Glycine max*, susceptibility, spent engine oil, seedling emergence

INTRODUCTION

Soya bean also called soybean or sojabean is native to china. It provides a protein of high biological value. Ngeze (2000) reported that soya bean could be a replacement for meat, egg and milk because the beans contain protein, fat, starch and minerals. It is vital in soil improvement and management. It is an herbaceous annual plant in the family leguminosae and sub-family papilionaceaae. Agbogidi *et al.* (2006a) noted that soyabean is a good source of protein in the prevention of malnutrition in children and perfect forage for ruminants. Agbogidi and Nweke (2006), Christo *et al.* (2008) and Oakwood *et al*. (2008} also stated that soya bean is an excellent good livestock feed and a commercial crop. Brooks *et al*. (2002) and Singh (1987) and Obasa and George (2007) noted that soya bean meal is considered to be the most nutritious and is used as a major protein source in many fish diets. Jidcani *et al*. (1999) had reported that some indigenous foods such as moi-moi, akara, kunun, fura and other cereal foods can be enriched with soya bean products including soy flour, soy paste etc while the soy paste residue (from soymilk production) can be used as egusi in preparing "soy-egusi soup". Jacanas *et al.* (1999) and Tang *et al.* (2005) maintained that when traditional foods are fortified with soya bean products, the protein requirements of both children and adults could be met. There is a renewed interest in the cultivation of soyabean in Nigeria since its introduction to Nigeria in 1908 primarily because of its richness in protein and oil which have been found useful in the manufacturing industries outside its use for local consumption.

Crude oil and its refined products account for over 90% of national income (Agbogidi and Nweke, 2006). Oil pollution of soil has been reported to lead to the buildup of some essential (P, organic carbon, Ca, Mg) and non-essential (Mn, Zn, Pb, Fe, Co, Cu) elements in soil and their eventual translocation to plant tissues. The effects of pollution of soil by spent engine oil has been reported to range from depression of seed germination through growth retardation to death of plants (Vwioko and Fashemi, 2005; Agbogidi and Dolor, 2007; Sharifi *et al.*, 2007). They attributed these negative effects on crop to the presence of heavy metals and other harmful hydrocarbons at toxic levels. Reports on the effects of spent enginn oil on crop plants abound (Anoliefo and Vwioko, 1995; Anoliefo and Edegbai, 2000; Vwioko and Fashemi, 2005; Sharifi *et al*., 2007). Documented reports on the effects of spent engine oil on soya bean is however, scarce. Such data could be useful in remedial studies and provide base line information. It is against this background that this study was conducted. The current study was designed to evaluate the susceptibility of five cultivars of soya bean sown in spent engine oil with a view to identifying and selecting the tolerant one and recommending the same to farmers in the Niger Delta region where oil industrial activities are predominant.

MATERIALS AND METHODS

The experiment was conducted in 2008, at latitude $6^{o}14'$N and longitude $6^{0}49'$E at the Plant and Soil laboratory of the Faculty of Agriculture, Delta State University, Asaba Campus, Nigeria (Asaba Meteorological Office, 2008). The five cultivars of soyabean (Samsoy l, Bragg, Roanoke, Davis and Clark) were sourced from the University of Agriculture, Abeokuta, Ogun State, Nigeria. The spent engine oil was obtained as pooled used engine oil from motor mechanics at different locations in Asaba, Delta

State. The seeds were subjected to viability test using floatation method which involved the steeping of seeds into water in a beaker and the seeds that sank to the bottom were used. Using random samples taken from homogenous population of each seed – type, the five cultivars of *G. max* were presoaked in water for 24 hours and thereafter, in spent engine oil for varying periods of time (0, 1, 2, 4, 8, 16 and 24 hours) and then germinated on moist filter paper placed in big Petri-dishes. The seeds were sown under laboratory conditions following earlier procedure of Anoliefo and Vwioko (1995).

In another experiment, the seeds from the 5 cultivars of *G.* max were presoaked in spent engine oil for 0, 1, 2 and 4 days and thereafter, germinated on moist filter paper placed in big Petri-dishes. Seed soaked in the spent oil were removed at intervals and planted out in Petri-dishes. Soaking of seeds in the oil was done on a large plastic rubber while Petri-dishes lined with tissue paper moistened with water or covered with spent engine oil were used as germinators. For each treatment, a total of 10 seeds was used and replicated four times. The trial was laid out in a randomized complete block design. Readings were taken at 24 hours intervals following the procedure of Anoliefo and Vwioko (1995) and unequivocal emergence of ridicules was used as a critical stage of germination. Parameters measured were germination percentage, days to germination and rate of germination. Percent (%) germination was calculated using this formula. % Germination = (Sprouted seedlings/ Number planted) x 100/1. Days to germination were calculated by counting from the day of sowing to the day of emergence of ridicules while the rate of germination was calculated based on when about 50% of the seeds planted germinated. Data collected were subjected to analysis of variance while the significant treatment means were separated with the Duncan's multiple range tests (DMRT) using Statistical Analytical System (SAS) (2005).

RESULTS AND DISCUSSION

Seeds of soya bean (Davis) presoaked in SEO for 0 hour recorded the highest germination percentage of 98.00% and this value differed significantly from seeds presoaked in the oil for varying periods of time (Table 1) and the difference is relative to the length of hours the seeds were soaked in the oil. The germination percentage of soyabean seeds soaked in the SEO followed the following trend: 0>1>2>4>8>16>24 (Table 1). The seeds presoaked in the oil for 24 hours failed to germinate (Table 1). No germination was recorded for all the cultivars of *G. max* used in the experiment. The results also showed depression in the germination of the five cultivars of *G. max* subjected to spent engine oil the degree and extent of the depression is both exposure-time dependent and species dependent. The longer the time of seed soaking, the lower the percentage germination. With respect to the second experiment where seeds of *G. max* were presoaked in the oil for varying periods of time before sowing in the Petri dishes, no germination was recorded in all the seeds presoaked in the oil while seeds not soaked had 100% germination in all the cultivars. The days to germination and rate of germination were normal but their values differed significantly from those exposed to SEO treatment. No seed germinated while still soaked in the oil. The result indicates that spent engine oil has an acute effect on seed germination. The result also indicates that SEO delayed and depressed seed germination in Soya bean. This finding agrees with the reports of Siddiqui and Adams (2002), Anoliefo and Edegbai (2001). Agbogidi *et al.* (2006c) and Agbogidi and Dolor (2007).

Generally, the pattern of responses of the plant cultivars to the contaminant in terms of percent reduction in germination rate followed an experiential model in all cultivars tested. A linear reduction and similar pattern of exponential reduction in germination of plants following the application of petroleum hydrocarbons had been reported for plants (Adams and Duncan, 2002), *Dacryodes emulous* (Agbogidi and Eshegbeyi, 2006), *Gambaya albida* (Agbogidi and Ejemete 2005) and maize (Agbogidi *et al*., 2006). Other mechanisms surrounding the reduced or absence of germination in oil treated substrates may include some volatile oil compounds which have been shown to have severe inhibitory impact on germination of several plant species as well as the polycyclic aromatic compounds which have been found to have indirect secondary effects including disruption of plant-water-air relationships (Vwioko *et al*., 2006; Agbogidi and Dolor, 2007; Sharifi *et al*., 2007).

Gill e*t al.* (1992) reported that oil endangers the life of seed embryo thereby negatively affecting vital metabolic activities. The observed significant differences throughout the exponential period among the various cultivars showed that oil pollution effects vary with the different plant species. Agbogidi and Ofuoku (2005) stated that the effect of oil in soil and plants is influenced by the oil level as modified by innate genetic characters of the plant. Anoliefo and Vwioko (2001) maintained that oil contains some toxic compounds which may be injurious to plants and their seeds. Germination inhibition may be attributed mainly to the physical surface characteristics of the oil which make it function as a physical barrier to water and oxygen tension encountered by the seeds could have affected the respiratory system of the embryo and hence its viability. This observation is in harmony with prior reports of Terge (1984), Vwioko and Fashemi (2005), Agbogidi *et al.* (2006a), Agbogidi *et al.* (2006b) Agbogidi *et al.* (2006c) and Sharifi *et al.* (2007).

CONCLUSION

The current study evaluated the susceptibility of five cultivars of soyabean to spent engine oil. Generally the pattern of response of the plant cultivars to the contaminant in terms of percent reduction in germination rate followed an exponential model in all cultivars of the soyabean tested. The responses were also both exposure-time and cultivar dependent with the Davis performing best followed by Roanoke and Samsoy l. Bragg recorded the least performance in terms of germination potential. No germination was observed in the all the soyabean cultivars presoaked in the water before soaking again in the oil for 24 hours. Similarly, no seeds germinated while still soaked in the oil. The study has demonstrated that spent engine oil has a significant effect of reducing the germination characteristics of the five indicated that Davis and Roanoke are the most tolerant soyabean cultivars among the ones examined. The differential sensitivity of plants to spent engine oil toxicity can be exploited in phytoremediation practice by choosing species that are well tolerant to the contaminant.

TABLE 1. Germination Characteristics of Five Cultivars of Soya Bean As Affected by Periods of Seeds in Spent Lubricating Oil

	Period of seed presoaking (hours)							
Soyabean cultivar	0	1	2	4	8	16	24	Means
				Percentage germination (%)				
Samsoy 1	67.7	63.0	40.1	26.6	20.0	0	0	35.1d
Bragg	94.6	58.3	36.7	22.4	15.6	0	0	32.5e
Roanoke	97.5	70.2	65.3	38.1	34.2	16.3	0	45.9b
Davis	98.0	73.1	68.2	40.2	38.0	20.4	0	48.3a
Clark	95.8	59.2	38.3	25.6	17.1	0	0	33.7c
Mean	96.52a	64.76b	49.72c	30.58d	24.98e	7.34f	0g	
				Days to germination				
Samsoy 1	5.0	5.0	5.2	6.2	6.8	7.0	0	5.02c
Bragg	4.0	5.1	5.8	6.7	7.4	7.8	0	5.26e
Roanoke	4.0	4.8	5.0	5.9	6.2	6.6	0	4.46a
Davis	4.0	4.6	4.9	5.6	6.1	6.2	0	4.49b
Clark	4.0	5.1	5.4	6.4	6.9	7.0	0	5.04d
Mean	4.1f	4.88e	5.26d	6.16c	6.68b	6.96a	0	
				Rate to germination				
Samsoy 1	10.0	6.3	4.0	2.6	2.0	0.0	0.0	3.6c
Bragg	10.0	5.8	3.6	2.2	1.5	0.0	0.0	3.3d
Roanoke	10.0	7.0	6.5	3.8	3.4	1.6	0.0	4.6b
Davis	10.0	7.3	6.8	4.0	3.8	2.0	0.0	4.8a
Clark	10.0	5.9	3.8	2.5	1.7	0.0	0.0	3.4e
Mean	10.0a	6.46b	4.94c	3.02d	2.48e	0.72f	0g	

Means with different letters are significantly different at P□0.05 using the Duncan's multiple range tests.

TABLE 2. Germination Records of Five Cultivars of Soya Bean as Influenced by Periods of Seed Pre-soaking in Spent Lubricating Oil

Soyabean cultivar	**Period of seed soaking (days) in SLO before germination**				
	0	1	2	4	Means
Samsoy	100.0a	0.0b	0.0b	0.0b	25.0a
Bragg	100.0a	0.0b	0.0b	0.0b	25.0a
Roanoke	100.0a	0.0b	0.0b	0.0b	25.0a
Davis	100.0a	0.0b	0.0b	0.0b	25.0a
Clark	100.0a	0.0b	0.0b	0.0b	25.0a
Mean	100.0a	0.0b	0.0b	0.0b	25.0a
			Days to germination		
Samsoy	5.0a	0.0b	0.0b	0.0b	1.3a
Bragg	4.0a	0.0b	0.0b	0.0b	1.0b
Roanoke	4.0a	0.0b	0.0b	0.0b	1.0b
Davis	4.0a	0.0b	0.0b	0.0b	1.0b
Clark	4.0a	0.0b	0.0b	0.0b	1.0b
Mean	4.0a	0.0b	0.0b	0.0b	1.0b
			Rate of germination		
Samsoy 1	10.0a	0.0b	0.0b	0.0b	2.5a
Bragg	10.0a	0.0b	0.0b	0.0b	2.5a
Roanoke	10.0a	0.0b	0.0b	0.0b	2.5a
Davis	10.0a	0.0b	0.0b	0.0b	2.5aa
Clark	10.0a	0.0b	0.0b	0.0b	2.5a

Mean	10.0a	0.0b	0.0b	0.0b	2.5a

Means in the same column with different letters are significantly different at P□0.05 using the Duncan's multiple range tests.

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