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Full Length Research Paper

Response of six cultivars of cowpea (*vigna unguiculata* (l.) walp) to spent engine oil

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Laboratory studies were carried out in 2008 at the Plant and Soil laboratory of the Faculty of Agriculture, Delta State University, Asaba Campus, Delta State, Nigeria to investigate the response of six cultivars (IT81D-699, 1T82 (e-18), IT84S-2246-4, TVx3236, IT90K-277-2 and IT870-94-1) of cowpea to spent engine oil. Seeds of the six cultivars of cowpea were presoaked in water for 24 hours and thereafter, soaked in spent engine oil for varying hours (0, 1, 2, 4, 8 and 16). Other seeds were soaked in the oil for 0, 1, 2, 3 and 4 days before germinated in Petri dishes lined with moist tissue paper. The results showed that the percentage germination, days to germination and rate of germination of the cowpea cultivars were both periods of seed soaking in oil and cultivar dependent. The results also showed that the longer the hours of seed presoaking in the oil, the poorer the germination response of the seeds. No germination occurred while seeds were still in the oil. TVx3236 followed by IT84S-2246-4 were more tolerant among the cowpea cultivars examined hence could be considered for phytoremediation practice in oil producing areas of the Niger Delta.

Keywords: *Vigna unguiculata,* germination response, spent engine oil

INTRODUCTION

Cowpea is an annual, herbaceous legume (Anoliefo *et at.*, 2006). It is a short-day crop sensitive to chilling temperatures but adapted to warm weather and humid conditions (Asumugha, 2002; Islam *et al.*, 2006). It belongs to the family Fabaceae and sub-family Faboidea. The Yoruba in Nigeria locally calls it “ewa” by the Hausa tribe “wake”. It originated from central Africa but it is now widely cultivated in many parts of the tropics and sub-tropics including west Africa and India (Olaleke *et al.*, 2006). The leaves of cowpea are eaten in salad and the immature pods are used as vegetable. The grains are rich source of plant protein to man; they contain mineral salts, vitamins and fats (Ogbo, 2009). The young shoots are eaten like spinach (Adepoju and Marcus, 2000) while the immature seeds are eaten fresh, frozen and canned. It is regarded as poor man’s meat because they are the cheapest source of protein; essential amino acids in them are also in sufficient amount (Biradar *et al*., 2007; Awe, 2008; Omotugba *et al*., 2008). The plant has a lot of industrial potentials (Lambot, 2003). Their high nutritional value characteristics make cowpea a candidate for controlled ecological life support system (CELSS), which uses green plants to supply food, oxygen and purified water for inhabitants of future space, craft and planetary bases. The crop has other uses such as in livestock feed and enhancement of soil fertility as well as a cover crop in agriculture (Duke, 1981). The cultivation of cowpea in recent times has increased tremendously because of its nutritional value to man and livestock.

Various petroleum products are common soil contaminants and often contain potentially hazardous chemicals especially the polycyclic aromatic hydrocarbons (Sharifi *et al.,* 2007). Spent engine oil, usually obtained after servicing and subsequently draining used oil from automobiles and generator engines, are indiscriminately disposed into gutters, water drains, open vacant plots and farms in Nigeria by auto-mechanics and allied artisans with workshops on the

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road sides and open places (Anoliefo and Vwioko, 2001). Atuanya (1987) and Agbogidi and Ejemete (2005) noted that oil in soil has deleterious effects on the biological, chemical and physical properties of the soil depending on the dose, type of the oil and other factors. Benka-Coker and Ekundayo (1995) and Benka-Coker and Ekundayo (1997) also reported that the microbiological components of soil are usually negatively affected when oil is applied to soil. Although, some research works have been conducted on the effects of spent lubricating oil on the germination of some economic crop plants (Anoliefo and Vwioko, 1995; Anoliefo and Vwioko, 2001; Anoliefo and Edegbai, 2000; Agbogidi and Nweke, 2006; Agbogidi *et al.*, 2006a; Agbogidi *et al*., 2006b; Sharifi *et al*., 2007), there is paucity of information on the response of cowpea to spent oil. The aim of this study was to evaluate the germination of six cowpea cultivars as affected by spent engine oil.

MATERIALS AND METHODS

The study was carried out in 2008 at latitude $6^0$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 six cultivars (IT81D-699, IT82 (e-18), IT84S-2246-4, TVx3236, IT90K-277-2 and IT870-94-1) of cowpea were purchased as a single batch from the International Institute for Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria while the spent engine oil was obtained as a pooled used engine oil from 12 different motor mechanic workshops in Asaba, Delta State. The seeds were subjected to viability test using floatation technique. Using randomized samples taken from homogenous population of each seed type, the six cultivars of cowpea were presoaked in water for 24 hours and thereafter, in (100%) spent engine oil for varying periods of time (0, 1, 2, 4, 8 and 16 hours) and then, germinated on moist tissue paper placed in Petri-dishes. The significant of seed presoaking in 100% SEO is that it closely equates the amount released to the environment in the event of disposals. In the same vein, the seeds of the six cultivars of cowpea were presoaked in spent engine oil (SEO) for 0, 1 2, 3, and 4 days and thereafter, germinated in Petri-dishes lined with moist toilet papers. Seeds soaked in the oil were removed at intervals and planted out in Petri dishes. Seed soaking was done in a large plastic bowl while the Petri dishes served as germinators. For each treatment, a total of 100 seeds was used and replicated four times. The set-up was arranged 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 determined were percentage germination, days to germination and rate of germination. Percent (%) germination was calculated using this formula. Number of seedlings that sprouted over/Number of seeds planted multiplied by 100 over 1. Days to germination were calculated by counting from the day of sowing to the day of unequivocal 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 SAS (1996).

RESULTS AND DISCUSSION

All the seeds of the cowpea cultivars sown in the uncontaminated Petri dishes germinated on the 5^{th} day after sowing. Seeds sown in dishes after presoaking in water differed significantly ($P \leq 0.05$) in their germination records (Table 1). A significant ($P \leq 0$ 05) reduction was observed in dishes with seeds presoaked in spend engine oil for varying hours. The reduction was observed to exposure-time dependence. Similarly, percentage germination of cowpea seeds from all the cultivars sown in the dishes without presoaking in SEO differed significantly at the 5% probability level (Table 1). The rate of germination of all the cowpea cultivars also shown a significant reduction ($P \leq 0.05$) as the period (hours) of seed presoaking in the oil increased. The results have shown that oil has an acute effect on seed germination. The seeds soaked in the oil for 16 hours failed to germinate (Table 1).

The results also showed depression in the germination characteristics of the cowpea cultivars tested. No germination was recorded in cowpea seeds soaked in oil for more than 2 hours (Table 2). No seeds germinated while still soaked in the oil. The oil could have endangered the life of the seed embryo and hence lead to loss of seed viability. This finding is in agreement with prior reports of Agbogidi and Nweke (2005), Siddiqui and Adams (2002), Sharifi *et al*. (2007) and Agbogidi (2009). The results also showed that TVx3236 and IT84S-2246-4 were more tolerant to the oil levels used in this study. Agbogidi and Nweke (2005), Agbogidi and Nweke (2006) and Agbogidi (2010) had reported that oil effects on plants are species and variety dependent. The herbicidal properties of oil on plants have also been reported by Adams and Duncan (2002), Agbogidi and Ofuoku (2005), Nwadinigwe and Uzodimma (2005) and Agbogidi and Eshegbeyi (2006).

CONCLUSION

The current study has demonstrated that spent engine oil has a significant effect of reducing the germination characteristics of the six cowpea cultivars tested with the TVx3236 and IT84S-2246-4 showing some levels of tolerance. The different sensitivity of plants to spent oil toxicity can be exploited in phytoremediation practice by choosing species that are well tolerant to the contaminant. TVx3236 and IT84S-2246-4 from the current study could be considered for phytoremediation of spent engine oil polluted sites especially at low concentrations. Such studies should be on increased accumulation (over soaking time) of oil metabolites in these cultivars tissues as well as the measurements of plant uptake and /or degradation of absorbed oil.

Table 1. Germination characters of six cultivars of cowpea as influenced by spent engine oil

	Period of seed presoaking in oil (Hours)						
Cowpea cultivars	0	1	2	4	8	16	Mean
% Germination							
IT81D-699	100.0	62.6	42.4	38.4	32.5	0.0	45.9d
IT82 (e-18)	100.0	67.4	48.7	40.2	36.4	0.0	48.8c
IT84S-2246-4	100.0	73.4	60.2	54.3	48.4	5.4	56.9b
TVx3236	100.0	78.1	69.0	58.4	50.6	15.7	61.9a
IT90K-277-2	100.0	57.6	40.2	37.8	30.7	0.0	44.4e
IT870-941-1	100.0	52.3	35.9	30.6	24.3	0.0	40.5f
Means	100.0a	65.2b	49.4c	43.3d	37.2e	3.5f	
Days to germination							
IT81D-699	5.7	6.6	6.9	7.3	7.6	0.0	5.7d
IT82 (e-18)	5.6	6.7	7.3	7.5	7.7	0.0	5.6c
IT84S-2246-4	5.0	5.5	6.7	6.9	7.1	7.3	6.4a
TVx3236	5.0	5.3	5.4	5.9	6.2	6.4	5.8c
IT90K-277-2	5.2	6.8	7.2	7.4	7.6	0.0	5.7d
IT870-941-1	5.5	6.9	7.4	7.7	7.9	0.0	5.9b
Means	4.5e	6.3d	6.3d	7.1b	7.4a	2.3f	
Rate to germination							
IT81D-699	10.0	7.4	6.3	5.2	5.0	0.00	5.7d
IT82 (e-18)	10.0	7.6	6.5	6.0	5.1	0.0	5.9c
IT84S-2246-4	10.0	8.6	8.2	7.9	7.4	6.2	8.1b
TVx3236	10.0	9.7	9.3	9.0	8.8	6.4	8.9a
IT90K-277-2	10.0	7.3	6.2	5.3	5.0	0.0	5.6d
IT870-941-1	10.0	7.4	6.1	5.1	4.8	0.0	5.6d
Means	10.0a	8.0b	7.1c	6.4d	6.0e		

Means with different letters of a parameter are significantly different at (P 0.05) using DMRT.

Table 2. Germination records of the six cultivars of cowpea as affected by period of seed presoaking in SEO

	Period of seed soaking (days) in SEO before germination					
Cowpea cultivars	0	1	2	4	8	Mean
Percent germination						
IT81D-699	100.0	0.0	0.0	0.0	0.0	20.0c
IT82 (e-18)	100.0	0.0	0.0	0.0	0.0	20.0c
IT84S-2246-4	100.0	60.2	5.1	0.0	0.0	33.1b
TVx3236	100.0	70.2	10.7	0.0	0.0	36.1a
IT90K-277-2	100.0	0.0	0.0	0.0	0.0	20.0c
IT870-941-1	100.0	0.0	0.0	0.0	0.0	20.0c
Means	100.0a	21.7b	2.6c	0.0d	0.0d	
Days to germination						
IT81D-699	5.0	0.0	0.0	0.0	0.0	1.0c
IT82 (e-18)	5.0	0.0	0.0	0.0	0.0	1.0c
IT84S-2246-4	5.0	6.9	8.2	0.0	0.0	4.0a
TVx3236	5.0	6.0	6.7	0.0	0.0	3.5b
IT90K-277-2	5.0	0.0	0.0	0.0	0.0	1.0c
IT870-941-1	5.0	0.0	0.0	0.0	0.0	1.0c
Means	5.0a	2.2c	2.5b	0.0d	0.0d	
Rate to germination						
IT81D-699	10.0	0.0	0.0	0.0	0.0	2.0c
IT82 (e-18)	10.0	0.0	0.0	0.0	0.0	2.0c
IT84S-2246-4	10.0	7.1	3.0	0.0	0.0	4.0b
TVx3236	10.0	8.6	5.4	0.0	0.0	4.8a
IT90K-277-2	10.0	0.0	0.0	0.0	0.0	2.0c
IT870-941-1	10.0	0.0	0.0	0.0	0.0	2.0c
Means	10.0a	2.6b	1.4c	0.0d	0.0d	

Means in same column of a parameter with different letters are significantly different at (P 0.05) using DMRT.

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