European Journal of Agriculture and Forestry Research
Vol.3, No.4, pp.29-37, September 2015
Published by European Centre for Research Training and Development UK (www.eajournals.org)

EFFECT OF CULTURAL PRACTICES ON WEED FLORA COMPOSITION OF SELECTED FIELD CROPS

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ABSTRACT: *The weed flora and seed bank may be influenced by weed management methods, cropping system and crop types. The study aimed at investigating the weed flora composition and weed seed bank characteristics in both arable and tree crops' fields (Theobroma cacao L. (Cocoa), Cocos nucifera L. (Coconut), Elaeis guineensis Jacq. (Oil palm), Manihot esculenta Crantz. (Cassava), Jatropha curcas L. (Jatropha), and Zea mays L.(Maize). In the arable plots, farmers depended on manual hoe weeding for weed control, while regular slashing and ploughing were adopted for weed management in tree crops fields. The overall weed flora is composed of annual broadleaf (58.10 %), grasses (19.40 %), sedges (6.50 %) and shrubs (16 %) in the entire sampled crop fields. Weed seed bank varied across the soil depths and crop fields. Within 0 – 15 cm soil depth, broadleaf (56.90 %), grass (23.80 %) and sedges (19.0 %) were observed. Deeper soil depth of 16 – 30 cm had 57.2 % (broadleaf), 14.3 % (Grass) and 28.6 % (Sedge) across the sampled plots at eight weeks after weed emergence. Different families of weeds identified varied significantly in frequency across the sampled plots. Differences in weed biomass across the crop fields were a reflection of timing and weed management practices and crop canopy formation ($P \leq 0.05$). Plot sown to Oil palm had the highest weed biomass (0.256 kg/m^2), with the lowest in Jatropha (0.038 kg/m^2). The variations in weed composition and weed seed bank in each sampled plot might have resulted from cultural practices, environmental sieve and allelopathic effects of both crops and weeds.*

KEYWORDS: Weed composition, seed bank, environmental sieve and allelopathy

INTRODUCTION

Weeds are undesired plants within certain place of interest to man (Zimdahl, 1999), but share similar adaptation traits with crops. These give them the advantages and allow proliferation in disturbed environment whose soil or natural vegetative cover has been damaged. The differences in ecologies and disturbance influence weed composition (Bell, 2005).

Land cultivation and cropping pattern (agricultural practices) often mimic natural environments where weedy species have evolved. Weeds have excellent adaptive traits to grow and proliferate in human disturbed areas such as agricultural fields, lawns, road sides, constructions sites and water ways. The weedy nature of these species often gives them an advantage over more desirable crop species because they often grow quickly and reproduce quickly, have seeds that persist in the soil seed bank for many years, or have short life span with multiple generation in the same growing season.

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

Different weed species have been identified with various crops (Akobundu 1987; Das, 2011). Preference for crops may stem from similarity in growth factors and conditions, infestation clues from crops (striga and cereals), cropping system, crop plant architecture, plant spacing and season. The weather factors like, rainfall, humidity, temperature and wind also play significant roles in weed infestation of crop fields.

Crop production is hampered by the advent of weeds in cropping systems. The interference of weeds results into considerable yield reduction in the entire cropping system. Efforts were made by farmers to mitigate the menace of weeds and the attendant problems. Burning of field before land preparation, slashing, hoe weeding, weed pressing, fallowing, herbicide application and avoidance of noxious weeds are various weed control methods that have been used with positive response in terms of yield increase and stability. However, these methods are attended by various shortcomings. None has been a panacea to weed infestation problems in agronomic settings. The infusion of modern technology in integrated weed management has been identified to be a sustainable weed management strategy.

Weeds are a major constraint in crop production. The knowledge of weed diversity and biology is of importance in weed management in agronomic setting. Aside low soil fertility that is a common problem in continuous cropping in most tropical agro ecologies; weed infestation is a hidden 'crop yield eater' that must be identified and managed appropriately. Farmers in rainforest/savanna transition agro-ecology are faced with wide range of weeds and management challenges. It is therefore imperative to identify the weeds associated with this agro ecology in relation to crop types and cropping pattern. It is also of importance to identify the weed types, infestation potential and adoptable control measures to combat future weed problem and enhance yield stability.

MATERIALS AND METHODS

Weed flora composition and weed seed bank of *Theobroma cacao* L. *(Cocoa* , *Cocos nucifera* L. (Coconut), *Elaeis guineensis* Jacq. (Oil palm), *Manihot esculenta* Crantz. *(Cassava)*, *Jatropha curcas* L. *(Jatropha)*, and *Zea mays* L.*(Maize)* was observed in Rainforest/Savanna transition agro ecology. The experiment was carried out at the Institute of Agricultural Research and Training (IAR&T) Ibadan (7º38' N, 3º 84' E), in 2013 cropping season. Three quadrant (1m x 1m) samples were taken to determine the weed composition, weed density and weed biomass from selected crop plots. The weeds were identified with the aid of Hand book of West African weeds by Akobundu and Agyakwa, (1987); and at Forest Herbarium Ibadan (FHI). Weed samples were oven dried at 80^0C for 48 hours using Carbolite Oven and later weighed with sensitive scale (And 2000). Soil samples were collected from different selected crops fields randomly by digging 1m x 1m land area to a depth of 0 – 15 cm and 16 – 30 cm. This was replicated three times in each crop field.

Top soil (0 – 15 cm depth) and sub-soil samples (16 – 30 cm depth) collected randomly from each crop field were mixed. Pots were filled with soil sample and watered to enhance weed seed germination. The weed flush was identified 8 weeks after experiment was set up to determine the weed density per pot.

Data was analyzed using Statistical Analysis System (SAS), General Linear Model (GLM). Means were separated with LSD at 5% level of probability.

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

Weed management practices adopted in different crop plots

Cocoa plot – slashing

Coconut plot – slashing

Oil palm plot – Ploughing

Jatropha plot – hoeing and slashing

Cassava plot – hoe weeding

Maize plot – hoe weeding

RESULT

A sample of weed flora composition of arable and tree plots contained thirty weed species which are mainly broadleaf, grasses, shrubs and sedges (Table 1a & 1b). These cut across thirteen weed families. The overall weed flora is composed of 58.1% broadleaf herbs, 19.4% grasses, 6.5% sedges and 16% shrubs. In all sampled plots, Cocoa plot had the highest frequency of broadleaf weeds; this was similar to the cassava and coconut plot. The least frequency of broadleaf was recorded in the Oil palm plot. This was also comparable to the frequency of broadleaf weeds in the Maize plot.

Number of sedges was comparable across the cultivated plots. Jatropha plot had the lowest number of grass weeds. This was comparable with the Oil palm and Maize plot. The frequency of shrubs was comparable between the Cocoa, Jatropha and Oil palm plots. However, Coconut plot recorded the least number of shrubs in the midst of the sampled plots. *Mariscus alternifolius* and *Tridax procumbens* were frequent in 50 % of the sampled plots (Table 2a & 2b).

The seed bank recorded across the cultivated plots differed significantly. This was evident in the number and types of weed in the flush. These were grouped into broadleaf weed, grasses and sedges which formed the majority of the population. The plot sown to Oil palm had the highest number of broadleaf weeds. This was similar to cocoa and maize plot. Cassava and coconut plot had comparable number of broadleaf. This was not different from the lowest number of broadleaf weeds in the Jatropha plot.

The frequency of grasses was at the peak in the Cocoa plot. However, the least number of grass species was recorded in the Jatropha plot. The population of grass spp in other plots was comparable across the sampled plots. Jatropha had the highest and similar number of sedges with maize plot. The least number of sedges was recorded in Cassava plot. This was exactly the same in Coconut and Oil palm.

Mariscus alternifolius appeared in 0 – 30 cm soil depth in all the sampled plots as major and minor weed in equal percentage (50%) (Table 3 & 4). This is an indication of a potential pest of crops in this agroecology.

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

European Journal of Agriculture and Forestry Research
Vol.3, No.4, pp.29-37, September 2015
Published by European Centre for Research Training and Development UK (www.eajournals.org)

Discussion

The nature of crop cultural practices and cropping system/pattern, soil type, moisture content, location and season influenced the variation in abundance and distribution of weed species in crop production settings (Mohler 2001; Sit *et. al.*, 2007). The variation in the weed flora composition in the entire sampled plot is similar to the discoveries of the aforementioned authors. The canopy formation which is influenced by plant spacing, crop type and plant architecture influenced the weed composition and seed bank. Under a dense crop canopy, crop microclimate is generated, which influenced the survival and types of weed flora composition. This in turn determined the type and number of weed seed in the soil.

The cumulative effect of weed management method adopted was also evident in the weed flora composition and the emerging weeds from the seed bank. The allelopathic influence, canopy formation of both crops and weeds might be responsible for environmental sieve that resulted in the disparity between weed flora composition and weed seed bank. The cropping pattern, weed perennation and abiotic factors in the environment evidently determine the weed dynamics, crop performance and weed management strategies.

Cultural practices also affect the type of weed and density of seed bank. The ecological transition phase of the study area also account for weed diversity. The seasonality and weed preference for crops can also influenced the weed flora composition and seed bank recorded in Table 1 to 4.

The emergence of annual weeds in crop field is a common problem and it's a major 'crop yield eater'. In arable field (Maize and Cassava), vigorous weed growth with crops and their quick multiplication through abundant seeds from seed bank in the soil may account for fairly high weed biomass. This is common in most arable crop field, especially in the first few weeks of crop establishment resulting into considerable yield reduction. The hoe weeding method adopted by the farmers' in Maize and Cassava might have contributed to seed bank build if it is not properly timed.

Annual weeds are known for aggressive growth, short gestation period, and early seed production in huge amount. Weeding at or after weed seed maturity will lead to re-infestation of crop field. This will also enhance the emergence of flushes from seed bank. The use of herbicides applied pre-emergence or pre-plant and early post emergence application may tend to reduce the seed bank. Hoe weeding does not guarantee season long weed kill. The farmer is also limited into small holder farmlands. The timing of this operation is a factor if season long weed kill is to be achieved.

The sole maize and cassava plots had low canopy cover. These gave higher advantage to weeds in between the crop plants. This in turn will result into vigorous crop-weed competition. High weed density and weed biomass may result from delayed weeding of plots. In arable cropping where close canopy is anticipated through the use of fertilizer, close spacing and branching variety planted, weed infestation may not be critical.

Cocoa had the highest frequency of broadleaves; this may be attributed to rapid canopy disappearance in the plot due to ageing of the crop plants. The alteration in the crop microclimate generated from gradual canopy reduction may break the environment sieve causing the emergence of diverse weeds.

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

Seed bank difference in plots may be influenced by cropping pattern, weed management method, time of weeding intervention, soil type and biasness of crops. More seed germinated from 0-15cm depth of the soil. This is similar to the findings of Malone (2005); that higher concentration (99%) of seed bank is in 0-10cm of the soil. Higher number of weed emergency from 0-15cm might have resulted from deposition of seeds on soil surface and minimal tillage operations or relatively undisturbed soil environment. The presence of *Maricus alternifolius* in the seed bank of all the sampled plots is an indication of a potential weed problem. A change in the cropping pattern or land may promote *M. alternifolius* as an endemic pest in the future. Weed management strategies must be such that will reduce the seed bank through late season tillage to expose the propagules and timely application of herbicides to further reduce the weed population and their potential from causing any economic damage.

CONCLUSION

Weed composition and seed bank are influenced by cultural practices and the availability of growth factors. This is in line with (Mohler. *et al*., 2001; Sit *et al*., 2007). In agronomic settings under the study area, weeds seed bank decreases with soil depth. This will also help to forecast (Davis *et al*., 2005) and anticipate solutions to weed problems (Derken *et al*., 2002). Integrated Weed Management strategies should be adopted in order to address the shortcomings of various weed control methods and prevent population build up of noxious weeds in agronomic settings.

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Table 1a: Weed flora composition of crop fields

Botanical names	Family	Growth Habit
Axonopus compressus (Sw.) P.Beauv	*Poaceae*	Grass
Paspalum conjugatum P.J.Bergius	*Poaceae*	Grass
Paspalum scrobiculatum L.	*Poaceae*	Grass
Brachiaria deflexa (Schumach.) Robyns	*Poaceae*	Grass
Eleusine indica (L.) Gaertn	*Poaceae*	Grass
Panicum maximum Jacq.	*Poaceae*	Grass
Ageratum conyzoides L.	*Asteraceae*	Herb
Tridax procumbens L.	*Asteraceae*	Herb
Aspilia Africana Pers. C.D. Adams	*Asteraceae*	Herb
Chromolaena odorata (L.) King & H.E. Robins	*Asteraceae*	Herb
Phyllanthus amarus Schum. & Thonn.	*Euphorbiaceae*	Herb
Euphorbia hirta L.	*Euphorbiaceae*	Herb
Euphorbia heterophylla L.	*Euphorbiaceae*	Herb
Acalypha fimbriata Schum. & Thonn.	*Euphorbiaceae*	Herb
Amaranthus viridis L.	*Amaranthaceae*	Herb

Table 1b: Weed flora Composition of crop fields

Botanical names	Family	Growth Habit
Achyranthes aspera L.	*Amaranthaceae*	Herb
Cyathula prostrate (L.) Blume	*Amaranthaceae*	Herb
Commelina benghalensis L.	*Commelinaceae*	Herb
Commelina diffusa Burm.f.	*Commelinaceae*	Herb
Commelina erecta L.	*Commelinaceae*	Herb
Cyperus esculentus L.	*Cyperaceae*	Sedge
Mariscus alternifolius Vahl	*Cyperaceae*	Sedge
*Talinum triangulare (*Jacq.) Wild.	*Portulacaceae*	Herb
Spigelia anthelmia L.	*Loganiaceae*	Herb
Mimosa invisa Mart. ex Colla.	*Mimosoceae*	Shrub
Centrosema pubescens Benth	*Fabaceae*	Herb
Sida acuta Burman.f	*Malvaceae*	Shrub
Combretum hispidium M.A Lawson	*Combretaceae*	Shrub
Boerhavia coccinea Mill.	*Nyctaginaceae*	Herb
Desmodium scorpiurus (Sw)Desv.	*Fabaceae*	Herb

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

Table 2a: Effect of cultural practices on weed composition and frequency

Weed Spp	Coconut-slashing	Cocoa-slashing	Oil palm-ploughing/ slashing	Jatropha-slashing	Maize-hoeing	Cassava-hoeing
Sida acuta	ab	1	ab	ab	6	ab
Boerhavia diffusa	ab	1	ab	ab	ab	ab
Commelina erecta	1	9	ab	ab	ab	ab
Axonopus compresus	ab	7	ab	ab	ab	ab
Paspalum conjugatum	ab	7	ab	ab	ab	ab
Cyathula prostrata	ab	1	ab	ab	1	ab
Phyllanthus amarus	2	1	ab	ab	ab	ab
Paspalum scrobiculatum	1	4	ab	ab	ab	ab
Combretum hispidium	ab	1	ab	ab	ab	ab
Ageratum conyzoides	2	22	ab	ab	ab	ab
Commelina benghallensis	ab	2	1	ab	ab	ab
Brachiavia deflexa	1	7	ab	ab	ab	ab
Desmodium scorpiurus	ab	1	ab	ab	ab	ab
Mariscus alternifolius	5	ab	2	ab	ab	3
Tridax procumbens	10	ab	ab	1	ab	7

ab= absent

Table 2b: Effect of cultural practices on weed composition and frequency

Weed Spp	Coconut-slashing	Cocoa-slashing	Oil palm-ploughing/ slashing	Jatropha-slashing	Maize-hoeing	Cassava-hoeing
Panicum maximum	9	ab	15	ab	ab	ab
Centrosema pubenscene	1	ab	ab	ab	ab	ab
Euphorbia hirta	1	ab	ab	ab	ab	1
Aspilia africana	ab	ab	2	ab	ab	ab
Chromoleana odorata	ab	ab	3	2	ab	ab
Talinum triangulare	ab	ab	ab	3	ab	ab
Mimosa invisa	ab	ab	ab	1	ab	2
Cyporus esculentus	ab	ab	ab	6	ab	ab
Commelina diffusa	ab	ab	ab	3	ab	ab
Achyranthes aspera	ab	ab	ab	ab	ab	7
Euphorbia heterophylla	ab	ab	ab	ab	ab	17
Spigelia antherlmia	ab	ab	ab	ab	ab	4
Amaranthus virids	ab	ab	ab	ab	8	ab
Eleusine indica	ab	ab	ab	ab	9	ab
Acalpha fimbriata	ab	ab	ab	ab	10	ab

ab= absent

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

Table 3. Weed composition at 8 weeks after first flush (0-15cm soil depth)

Weed species	Coconut	Maize	Cocoa	Cassava	Jatropha	Oil palm
Mariscus alternifolius	b	b	b	a	a	a
Cyperus esculentus	ab	ab	ab	ab	b	ab
Boerhavia diffusa	ab	ab	ab	ab	b	b
Cyperus rotundus	ab	ab	ab	ab	b	ab
Euphorbia hirta	b	b	b	ab	b	b
Tridax procumbens	b	ab	b	b	b	b
Mimosa pundica	ab	ab	ab	ab	b	ab
Brachiria deflexa	b	ab	a	ab	ab	ab
Ageratum conyzoides	a	ab	ab	ab	ab	ab
Axonopus compresus	ab	ab	b	ab	ab	ab
Sclerocarpus africanus	ab	ab	b	ab	ab	ab
Commelina diffusa	ab	ab	b	ab	ab	ab
Panicum maximum	ab	ab	b	b	ab	b
Talinum triangulare	ab	ab	b	ab	ab	b
Centrosema pubenscene	ab	ab	b	ab	ab	ab
Phyllanthus amarus	ab	b	ab	b	ab	b
Amaranthus hybridus	ab	b	ab	ab	ab	ab
Eleusine indica	ab	b	ab	ab	ab	ab
Portulaca oleracea	ab	a	ab	ab	ab	ab
Gomphera celosiodes	ab	ab	ab	ab	ab	b

A= major, B = minor, AB = absent

Table 4. Weed composition at 8 weeks (16 - 30cm soil depth)

Weed species	Coconut	Maize	Cocoa	Cassava	Jatropha	Oil palm
Amaranthus viridis	ab	b	ab	b	ab	a
Mariscus alternifolius	a	a	b	ab	a	ab
Scoparia dulcis	ab	ab	ab	a	ab	a
Portulaca oleoracea	b	b	ab	ab	ab	ab
Euphorbia hirta	ab	b	b	ab	ab	b
Brachiaria deflexa	b	ab	a	ab	ab	ab
Tridax procumbens	b	ab	ab	ab	ab	ab

a=major, b=minor, ab=absent

Table 5: Weed density in Crop plots (number of weed/m^2)

Treatment	Broadleaf	Sedges	Grass	Shrub
Coconut	2.0ab	0.33a	1.00a	0.00c
Cocoa	2.33a	0.00a	1.33a	1.00a
Oil palm	0.33c	0.33a	0.33b	0.67ab
Jatropha	1.0bc	0.33a	0.00b	1.00a
Maize	1.0bc	0.00a	0.33b	0.33bc
cassava	1.67ab	0.33a	0.33b	0.33bc
SE	0.20	1.01	0.15	0.12

ISSN 2054-6319 (Print), ISSN 2054-6327(online)

Table 6: Weed density from 0 – 30 cm of soil depth in crop fields

Treatment	Broadleaves	Grasses	Sedges
Coconut	1.67ab	0.67b	0.33c
Cocoa	2.00a	1.33a	1.00b
Oil palm	2.00a	0.33bc	0.33c
Jatropha	1.00b	0.00c	1.67a
Maize	2.00a	0.33bc	1.33c
Cassava	1.33ab	0.33bc	0.33c
SE	0.16	0.15	0.17

ISSN 2054-6319 (Print), ISSN 2054-6327(online)