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Impact of farming system practices on weeds in arable farmlands in University of Port Harcourt and environs, Rivers State-Nigeria

Chinedum A Ogazie *, Ikechukwu O Agbagwa and Edache B Ochekwu

Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Nigeria.

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Abstract

Crop production involves the combination of various farming systems practices to produce food and cash crops and at the same time have a reasonable control over weed infestation without course to soil health. Weeds are part of agroecosystems community and are neighbors to our crops and the soil. The work was aimed to investigate the weeds that are common in the sites chosen. A simple reconnaissance weed enumeration survey was adopted for the twenty-two (22) arable farmlands by walk through the farms within and round the boundaries. This was investigated between June 2020 as wet season and in January, 2021 as dry season respectively. A total of 154 weed species were recorded for both wet and dry seasons. The wet and dry seasons had 113 and 120 weed species made up of 37 and 36 families respectively. It revealed 168 broad leaved, 32 grasses and 26 sedges, composed of annual and perennial weed species. All the farms were continuously cultivated and mixed cropped, with 27 crop species identified and recorded. The farmers most preferred crops are *Manihot esculenta* Crantz being a tuberous crop and *Zea mays* L., grain cereal with 90.91% each from the overall percentage of individual crop species recorded from farmers who planted them on their farmland (Table 1) respectively, and been staple food items in most part of Nigeria, while the least cropped species are (*Amaranthus hybridus* L., and *Solanum lycopersicon* L., *Ocimum. americanum* L., and *Solanum sp*.) with 4.54% each respectively which are vegetables to supplement peoples 'diet. Farming systems methods has a tremendous influence on weed species composition in arable farmlands either during the cropping season (wet) or off the season (dry). Some activities are very peculiar within crop production for example bush clearing, and burn, soil tillage in any form or pattern and weed removal either culturally, biological or chemically due impact on weed species in arable farmlands in short or long term and therefore, its impact on crop species and the environment should be minimized and sustained.

Keywords: Farming Systems Practices; Weeds; Arable Farmlands; Wet and Dry Season

1. Introduction

In farming system, many interrelated practices are employed in crop production. Most of these practices for example are slash and burn/shifting cultivation, crop rotation, continuous cropping, mixed cropping, tillage systems, cover crops planting and etc. Some of these practices are either employed to improve soil fertility, smoother weeds, and the application of herbicides to eliminate or reduce weed infestation and reduce weed seed rain back to the soil, fertilizer, compost or farmyard manure application to boost yield and still maintain soil fertility for sustainable crop production [1], [2].

The use of these farming system practices depends on the prevailing circumstances in the study area, location and region. The study area falls within high humid rain forest of Nigeria. It is highly populated and one of the for-most industrial areas in Nigeria and therefore the availability of arable farmland now force farmers to adapt to continuous

* Corresponding author: Chinedum A Ogazie
Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Nigeria.

slash and burn without enough time for fallow. This does not allow the farmland enough time to restore back its lost nutrients.

According to [3] agriculture is the predominant occupation among rural dwellers who are mostly smallholder farmers in Nigeria. They employ some farming system practices which are conducive for them to manipulate and cultivate the soil to plant crops for the teaming population.

Soil is the main source of plant nutrients and at the same time also harbors weeds which come from the soil as weed seedlings which compete with crops for space, light, and nutrients according to[4],[5]. Weeds are known to be serious impediment in crop production and does not allow for more cultivation of the soil and planting of more crops [6]. It causes yield losses and the farmer can spend all the available useful time trying to maintain a weed free farmland. He can sometimes abandoned the crop and weed altogether when the farmer is overwhelmed and also cause injury to him and his animals [7], [8], [9], [10].

Many literatures are available which have reviewed or commented on all the old and new methods in weed control and no single method completely eliminate weeds [11]; [12]; [13]. Weeds when threatened, they also devise other methods to propagate themselves further for example weed resistance to herbicides[14];[15];[16]and the ability to colonize an area and then eliminate the indigenous weed species, production of large number of weed seeds[17];[18];[19].

However, weeds are of course not completely notorious by competing with crop for nutrients, space, and light [4]; [5]**,** weed contribute to the regeneration of an abandoned land, over used or contaminated land [20]. Weeds provide food for man, animals and birds, hiding places and even homes for them as part of the biodiversity components, and weeds major component of the agro-ecosystem, protect the soil from wind and water erosion, provide food and drug for man and also to his animals[21];[9]. Weeds also contribute to soil organic matter accumulation when it decays; provide a conducive environment for micro-biological activities to thrive and to break down some of the plant materials [22];[23].

We also enumerated the crops planted by each individual farmer to evaluate the level of mixed cropping and the impact it has on the weed species in wet and dry season respectively.

In University of Port Harcourt and its environs, there is no data or report on weed species status/diversity on slash and burn embedded into continuously and mixed cropping of arable farmlands as a reference point. Therefore, this study is aimed at establishing the weed species status/diversity in arable farmlands in University of Port Harcourt and its environs taking into consideration of the farming systems methods adopted by the farmers in the study area for example slash, burn and mixed cropping on arable farmlands that have been continuously cultivated for more than 5 years. The information obtained from the study would further serve as database for future review of agricultural farming system practices in a humid high rain forest of Nigeria.

2. Materials and Methodology

These arable farmlands have been cultivated continuously and have been mixed cropped for more than 5 years within and around University of Port Harcourt, Choba, in Rivers State, Nigeria. The study area lies on Longitude coordinates of 4.824167 and 7.033611 and with a Global Positing System (GPS) reading of 4º 49´27.0012”N and 7º.2´0.9996”E.

Twenty-two newly cropped arable farmland were identified and weeds species were enumerated from the arable farmlands by walk through each of the arable farmlands diagonally and round the perimeters for proper view of the weedy species by adopting reconnaissance methods of Muir [24]; [25.

Weed species were identified right in the arable farmlands and further confirmation by busing [26]; [27]; [28]; [29] and the difficult weed species were collected, processed and sent to the University of Port Harcourt Herbarium for proper identification, confirmation and documentation. The enumerations were conducted between June 2020 for wet season and January 2021 for dry season respectively.

The study area experiences rainfall from April to October and from November to March as dry season. The monthly mean maximum temperature ranges from 28ºC to 33ºC and minimum from 17ºC to 24ºC [30]. The soil supports agricultural production of various crop types suitable for the humid forest region of Nigeria according to [31]. Crops mostly cultivated in the study area are enumerated (Table 2).

3. Results

The list of individual weed species identified; crop species, the percentage of the individual crop in order of overall farmers' preference enumerated from the arable farm-lands in the study area are presented in Tables 1 to 3. In Table 1 present list of weed species richness as occurred in all the 22 arable farmlands as 154 for both wet and dry seasons combined belonging to 96 genera in 36 families. Wet and dry season's enumerations were made up of 113 and 120 weed species belonging to 78 and 82 genera and consisted 37 and 36 families. The enumerations for wet and dry seasons revealed annual broad leaves 55, 76; perennial broadleaves 22, 27; annual grasses 10, 15; perennial grasses 4, 5; annual sedges 2, 2; perennial sedges 5, 6 and others 12 and 3**.** The result also revealed 168 broad leaved, 32 grasses and 26 sedges made up of annual and perennials weed species.

In the wet season 40 weed species were not actually observed and recorded in the course of the enumeration and they occurred in the dry season; while in the dry season 33 weed species were recorded, which did not occur in the wet season. However, 78 same weed species occurred in wet and dry seasons respectively.

In Tables 2 and 3, we present 27 crops species recorded from all the arable farmlands in the study area. The result also revealed preference crop species planted by all the farmers in the study area. The crop species that were mostly planted by all farmers include *Manihot esculenta* Crantz, *Zea mays* L.*, Abelmoschus esculentus* Moench*, Telfairia occidentalis* Hook.f., *Xanthosoma* mafaffa Schott*, Dioscorea* rotundata Poir.. The least preferred crop species were *Solanum* sp, *Amaranthus hybridus* L.*, Solanum lycopersicon* L.*, Colocasia esculenta* Schott. The result also indicated the least and highest crop species mixed cropped as 3 and 12 respectively.

$$\text{Crop species percentage across farms} = \frac{\text{total number of individual crop across farms}}{\text{Total number of farmer}} \text{x } 100$$

Table 1 List of weed species enumerated in wet and dry season

Family	Weed species	Wet	Dry	Life form
Euphorbiaceae	*Acalypha ciliata* Forsk	+	+	Abl
Poaceae	*Acroceras zizanioides* Dandy	-	+	Pg
Mimosoideae	*Aeschynomene sp*.	+	+	Abl
Asteraceae	*Ageratum conyzoides* Linn	+	+	Abl
Amaranthaceae	*Alternanthera bettzickiana* (Ragel) Nicholson	+	+	Abl
Amaranthaceae	*Alternanthera sessilis* (Linn.) R.Br. ex Roth	+	+	Abl
Amaranthaceae	*Amaranthus hybridus* Linn.	-	+	Abl
Amaranthaceae	*Amaranthus spinosus* Linn.	-	+	Abl
Amaranthaceae	*Amaranthus viridis* Linn.	+	+	Abl
Asteraceae	*Aspilia africana* (Pers.) C.D. Adams	+	+	Abl
Acanthaceae	*Asystasia gangetica* (Linn.) A. Anders.	+	+	Abl
Poaceae	*Axonopus compressus* (Sw.) P.Beauv.	+	+	Pg
Rubiaceae	*Borreria sp*.	+	+	Abl
Poaceae	*Brachiaria deflexa* (Schumach.) C.E. Hubbard ex Robyns	-	+	Ag
Araceae	*Caladium bicolor* (Ait.) Vent.	-	+	Pbl
Papilionoideae	*Calopogonium mucunoides* Desv.	+	+	Abl
Amaranthaceae	*Celosia leptostachya* Benth.	+	+	Abl
Papilionoideae	*Centrosema pubescens* Benth.	+	+	Pbl
Asteraceae	*Chromoleana odorata* (Linn.) King & Robinson	+	-	Pbl

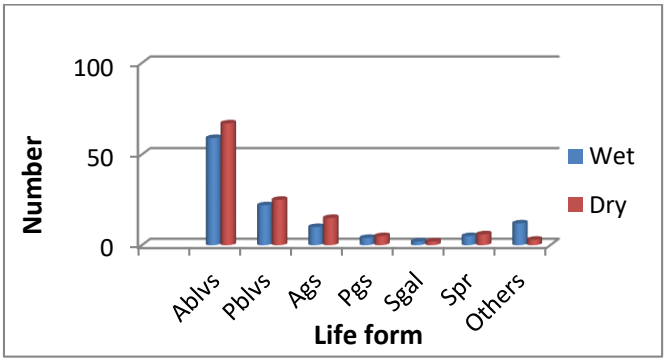
Family	Weed species	Wet	Dry	Life form
Cleomaceae	*Cleome rutidosperma* DC.	+	-	Abl
Lamiaceae	*Clerodendrum sp*.	+	-	Pbl
Araceae	*Colocasia esculenta* (Linn.) Schott	+	-	Pbl
Commelinaceae	*Commelina diffusa Burm*. f. subsp. *diffusa* J.K. Morton	-	+	Pbl
Commelinaceae	*Commelina diffusa* Burm.f.	+	-	Pbl
Commelinaceae	*Commelina erecta* Linn.	+	+	Pbl
Commelinaceae	*Commelina erecta* subsp. *erecta* R.Br.	-	+	Pbl
Commelinaceae	*Commelina thomasii*	-	+	Pbl
Convolvulaceae	Convolvulaceae unidentified	+	-	Abl
Tiliaceae	*Corchorus aestuans* Linn.	+	-	Abl
Tiliaceae	*Corchorus olitorius* Linn.	-	+	Abl
Tiliaceae	*Corchorus tridens* Linn.	-	+	Abl
Zingiberaceae	*Costus afer* Ker-Gawl.	-	+	Pbl
Euphorbiaceae	*Croton hirtus* L'Hérit.	+	+	Abl
Euphorbiaceae	*Croton lobatus* Linn.	+	+	Abl
Acanthaceae	*Cyathula prostrata* (Linn.) Blum	+	+	Abl
Poaceae	*Cynodon dactylon* (Linn.) Pers.	+	+	Pg
Cyperaceae	*Cyperus compressus* Linn.	+	+	Ps
Cyperaceae	*Cyperus distans* Linn.f.	+	-	Ps
Cyperaceae	*Cyperus esculentus* Linn.	+	+	Ps
Cyperaceae	*Cyperus haspan* Linn.	+	+	Ps
Cyperaceae	*Cyperus iria* Linn.	+	-	Ps
Cyperaceae	*Cyperus polystachyus* (Rottb.) P.Beauv. *var. polystachyus*	+	-	Ps
Cyperaceae	*Cyperus pustulatus* Vahl.	-	+	Ps
Cyperaceae	*Cyperus rotundus* Linn.	+	-	Ps
Cyperaceae	*Cyperus tuberosus* Rottb.	-	+	Ps
Poaceae	*Dactyloctenium aegyptium* Willd.	+	-	Ag
Papilionoideae	*Desmodium triflorum* (Linn.) DC.	+	+	Pbl
Poaceae	*Digitaria horizontalis* Willd.	+	+	Ag
Poaceae	*Digitaria longiflora* (Ret.) Pers	+	-	Ag
Rubiaceae	*Diodia sarmentosa* Sw.	+	+	Pbl
Dioscoreaceae	*Dioscorea sp*.	+	-	Abl
Caryophyllaceae	*Drymaria cordata* (Linn.) Willd.	-	+	Abl
Poaceae	*Echinochloa colona* (Linn.) Link	-	+	Ag
Asteraceae	*Eclipta alba* (Linn.) Hassk.	+	+	Abl
Poaceae	*Eleusine indica* (Linn.) Gaertn.	+	+	Ag
Asteraceae	*Eleutheranthera ruderalis* (Sw.) Sch. Bip.	+	+	Abl

Family	Weed species	Wet	Dry	Life form
Asteraceae	*Emilia praetermissa* Milne-Redhead	+	+	Abl
Asteraceae	*Emilia sonchifolia* (Linn.) DC	+	+	Abl
Poaceae	*Eragrostis tenella* (Linn.) P.Beauv. ex Roem. & Schult	+	+	Ag
Asteraceae	*Erigeron floribundus* (H.B. & K.) Sch.Bip.	+	-	Abl
Euphorbiaceae	*Euphorbia heterophylla* Linn.	+	+	Abl
Euphorbiaceae	*Euphorbia hirta* Linn.	+	+	Abl
Euphorbiaceae	*Euphorbia hyssopifolia* Linn.	+	+	Abl
Cyperaceae	*Fimbristylis ferruginea* (Linn.) Vahl	-	+	Ps
Cyperaceae	*Fimbristylis littoralis Gaudet*	+	+	Ps
Tiliaceae	*Glyphaea brevis* (Spreng). Monachino	-	+	Pbl
Acanthaceae	*Gomphrenia celosioides* Mart.	+	+	Abl
Melastomataceae	*Heterotis rotundifolia* (Sw.) Jac.-Fél.	-	+	Abl
Papilionoideae	*Indigofera spicata* Forsk	+	+	Pbl
Convolvulaceae	*Ipomoea cordatotriloba* Dennst.	-	+	Abl
Convolvulaceae	*Ipomoea involucrata* P.Beauv.	+	+	Abl
Cyperaceae	*Kyllinga bulbosa* Beauv.	+	-	Ps
Cyperaceae	*Kyllinga erecta* Schumach.	+	+	Ps
Cyperaceae	*Kyllinga erecta* Schumach. *var. polyphylla* (Kunth) Hooper	+	+	Ps
Cyperaceae	*Kyllinga erecta* Schumacher *var. erecta*	+	-	Ps
Cyperaceae	*Kyllinga pumila* Michx.	+	-	Ps
Cucurbitaceae	*Lagenaria breviflora* (Benth.) Roberty	+	-	Abl
Urticaceae	*Laportea aestuans* (Linn.) Chew.	-	+	Abl
Urticaceae	*Laportea ovalifolia* (Schumach. & Thonn.) Chew	+	-	Pbl
Mimosoideae	*Leuceana leucocephala* (Lam.) de Wit	+	+	Pbl
Linderniaceae	*Lindernia crustacea* (Linn.) *var. diffusa*	+	+	Abl
Linderniaceae	*Lindernia diffusa* (Linn.) *var. diffusa*	+	+	Abl
Linderniaceae	*Lindernia olivariana* Dandy	+	-	Abl
Linderniaceae	*Lindernia sp*.	-	+	Abl
Onagaraceae	*Ludwigia abyssinica* A. Rich	-	+	Abl
Onagaraceae	*Ludwigia decurrens* Walt.	+	+	Abl
Onagaraceae	*Ludwigia erecta* (Linn.) Hara	+	-	Abl
Onagaraceae	*Ludwigia hyssopifolia* (G. Don) Exell	+	-	Abl
Onagaraceae	*Ludwigia octovalvis* (Jacq.) P. Raven	-	+	Abl
Cucurbitaceae	*Luffa aegyptica* Mill	+	+	Abl
Malvaceae	*Malvastrum coromandelianum* (Linn.) Garcke	+	+	Abl
Cyperaceae	*Mariscus alternifolus* Vahl	+	+	Ps
Cyperaceae	*Mariscus flabelliformis* Kunth *var*. *flabelliformis*	+	-	Ps

Family	Weed species	Wet	Dry	Life form
Cyperaceae	*Mariscus longibracteatus* Cerm.	+	-	Ps
Mimosoideae	*Mimosa diplotricha* C.Wright ex Sauvalle	-	+	Abl
Mimosoideae	*Mimosa pudica* Linn.	+	+	Abl
Mimosoideae	*Mimosa sp*.	+	-	Abl
Rubiaceae	*Mitracarpus villosus* (Sw.) DC.	+	+	Abl
Molluginaceae	*Mollugo nudicaulis* Lam	-	+	Abl
Cucurbitaceae	*Momordica charantia* Linn.	-	+	Abl
Rubiaceae	*Oldenlandia corymbosa* Linn.	+	+	Abl
Rubiaceae	*Oldenlandia lancifolia* (Schumach.) DC.	+	+	Abl
Rubiaceae	*Oldenlandia sp*.	-	+	Abl
Poaceae	*Panicum brevifolium* Linn.	+	-	Ag
Poaceae	*Panicum laxum* Sw.	+	+	Ag
Poaceae	*Panicum maximum* Jacq.	+	+	Pg
Poaceae	*Paspalum conjugatum* Berg.	+	+	Ag
Poaceae	*Paspalum scrobiculatum* Linn.	+	+	Ag
Passifloraceae	*Passiflora foetida* Linn.	-	+	Abl
Poaceae	*Pennisetum polystachion* (Linn.) Schult.	-	+	Ag
Piperaceae	*Peperomia pellucida* (Linn.) H.B. & K.	+	+	Pbl
Phyllanthaceae	*Phyllanthus amarus* Schum. & Thonn.	+	+	Abl
Phyllanthaceae	*Phyllanthus fraternus* G.L Webster	+	-	Abl
Phyllanthaceae	*Phyllanthus muellerianus* (O.Ktze) Exell	-	+	Abl
Phyllanthaceae	*Phyllanthus niruri* Linn.	-	+	Abl
Phyllanthaceae	*Phyllanthus niruroides* Müll.Arg	+	+	Abl
Solanaceae	*Physalis angulata* Linn.	+	+	Abl
Lamiaceae	*Platostoma africanum* P. Beauv.	+	+	Abl
Portulacaceae	*Portulaca oleracea* Linn.	+	+	Pbl
Urticaceae	*Pouzolzia guineensis* Benth	+	+	Abl
Papilionoideae	*Pueraria phaseoloides* (Roxb.) Benth.	+	+	Pbl
Solanaceae	*Schwenckia americana* Linn.	+	+	Pbl
Scrophulariaceae	*Scoparia dulcis* Linn.	-	+	Abl
Cyperaceae	Sedges	+	+	Ncl
Papilionoideae	*Senna hirsuta* (Linn.) Irwin & Barneby	+	-	Abl
Poaceae	*Setaria barbata* (Lam.) Kunth	+	+	Ag
Malvaceae	*Sida acuta* Burm. f.	+	+	Pbl
Malvaceae	*Sida cordifolia* Linn.	+	+	Pbl
Malvaceae	*Sida corymbosa* R.E. Fries	-	+	Pbl
Malvaceae	*Sida rhombifolia* Linn.	+	+	Pbl

Family	Weed species	Wet	Dry	Life form
Malvaceae	*Sida veronicifolia* Lam.	-	+	Pbl
Smilacaceae	*Smilax kraussiana* Meisn.	+	-	Pbl
Solanaceae	*Solanum nigrum* Linn.	-	+	Abl
Solanaceae	*Solanum torvum* Sw.	+	+	Pbl
Lamiaceae	*Solenostemon monostachyus* (P.Beauv.) Briq. Subsp. *monostachyus*	+	+	Pbl
Rubiaceae	*Spermacoce ocymoides* Burm.f.	+	-	Abl
Rubiaceae	*Spermacoce ruelliae* DC.	-	+	Abl
Rubiaceae	*Spermacoce verticillata* Linn	+	-	Abl
Longaniaceae	*Spigelia anthelma* Linn.	+	+	Abl
Asteraceae	*Spilanthes uliginosa* Sw.	+	+	Abl
Poaceae	*Sporobolus pyramidalis* P.Beauv.	+	+	Pg
Verbenaceae	*Stachytarpheta cayennensis* (L.C. Rich) Schau.	+	+	Ag
Verbenaceae	*Stachytarpheta jamaicensis* (Linn.) Vahl	-	+	Abl
Poaceae	*Stenotaphrum secundatum* (Walt) Kuntze	-	+	Ag
Asteraceae	*Synedrella nodiflora* Gaertn.	+	+	Abl
Portulacaceae	*Talinum triangulare* (Jacq.) Willd.	+	+	Pbl
Ulmaceae	*Trema orientalis* (Linn.) Blume	-	+	Pbl
Asteraceae	*Tridax procumbens* Linn.	+	+	Abl
Tiliaceae	*Triumfetta cordifolia* A. Rich	-	+	Abl
Tiliaceae	*Triumfetta rhomboidea* Jacq.	+	+	Abl
Asteraceae	*Vernonia cinerea* (Linn.) Less	+	+	Abl
Asteraceae	*Vernonia sp*.	-	+	Abl
Papilionoideae	*Vigna sp.*	+	-	Abl
Araceae	*Xanthosoma mafaffa* Schott	+	-	Pbl

Legend: + =Present; - = absent; Abl = annual bread leaf; pbl = perennial broad leaf; ps = perennial sedge; pg = perennial grass; ncl = not classified

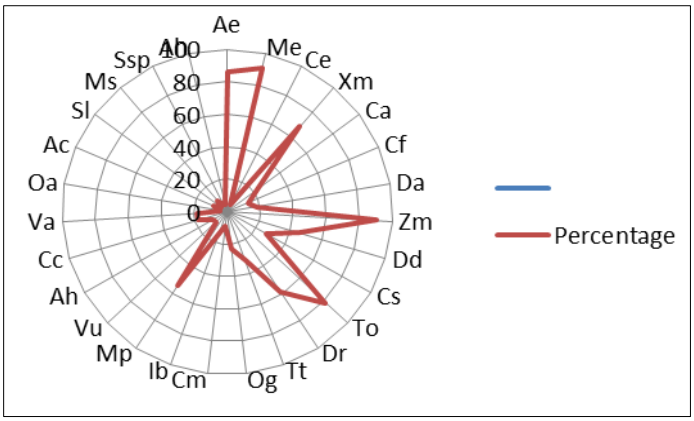


Legend: Ablvs: Annual broad leaves; Pblvs: Perennial broad leaves; Ags: Annual grasses; Pgs: Perennial grasses; Sgsl: Annual sedges; Spr: Perennial sedges; Others.

Figure 1 Composition of weeds based on life form, wet and dry period

Table 2 Farmers Crop Species preference in Percentage (%)

S/n	Binomial nomenclature & authority	Crop species (%)
1.	*Abelmoschus esculentus* (L.) Moench	86.36
2.	*Manihot esculenta* Crantz	90.91
3.	*Colocasia esculenta* (L.) Schott	4.54
4.	*Xanthosoma mafaffa* Schott	68.18
5.	*Capsicum annuum* Linn.	22.72
6.	*Capsicum frutescens* Linn.	13.63
7.	*Dioscorea alata* L.	18.18
8.	*Zea mays* L.	90.91
9.	*Dioscorea dumetorum* (Kunth) Pax	45.45
10.	*Cucumis sativus* L.	27.27
11.	*Telfairia occidentalis* Hook f.	81.81
12.	*Dioscorea rotundata* Poir	59.09
13.	*Talinum triangulare* (Jacq.) Willd.	31.81
14.	*Ocimum gratissimum* L.	22.72
15.	*Cucurbita moschata* Duchesne	9.09
16.	*Ipomoea batata* (L.) Poir	13.63
17.	M*usa paradisiac* L.	54.54
18.	*Vigna* unguiculata L.	9.09
19.	*Arachis hypogaea* L.	9.09
20.	*Citrullus colocynthis* (L.) Schrad	18.18
21.	*Vernonia amygdalina* Del.	18.18
22.	*Ocimum americanum* L.	4.54
23.	*Ananas comosus* (L.) Merill	9.09
24.	*Solanum lycopersicum* L.	4.54
25.	*Mucuna sloanei* Rendle & Fawc.	9.09
26.	*Solanum* sp. L.	4.54
27.	*Amaranthus hybridus* L.	4.54
28.	Total Crop species recorded (27)	100



Legend: Ae: *A. esculentus*, Me: *M. esculenta*, Ce: *C. esculenta*, Xm: *X. mafaffa*, Ca: *C. annuum*, Cf: *C. frutescens*, Da: *D. alata*, Zm: *Z. mays*, Dd: *D. dumetorum*, Cs: *C. sativus*, To: *T. occidentalis*, Dr: *D. rotundata*, Tt: *T. triangulare*, Og: *O. gratissimum*, Cm: *C. moschata*, Ib: *I. batata*, Mp: *M. paradisiac*, Vu: *V. unguiculata*, Ah: *A. hypogaea*, Cc: *C. colocynthis*, Va: *V. amygdalina*, Oa: *O. americanum*, Ac: *A. comosus*, Sl: *S. lycopersicum*, Ms: *M. sloanei*, S: *Solanum sp.*, Ah: *A. hybridus*

Figure 2 Percentage preference of crop species by farmers

Table 3 Crop species planted by farmers

S/N	Binomial nomenclature& authority	NUMBER OF FARMERS AND CROP SPECIES PLANTED																					
		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22
1.	*Abelmoschus esculentus* (L.) Moench	X	X	X	X	X	X	X	X	X	X	0	X	0	X	X	X	0	X	X	X	X	X
2.	*Manihot esculenta* Crantz	X	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.	*Colocasia esculenta* (L.) Schott	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	*Xanthosoma mafaffa* Schott	0	X	0	X	X	X	X	X	X	X	X	X	0	X	0	X	X	X	X	X	X	0
5.	*Capsicum annuum* Linn.	X	X	X	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6.	*Capsicum frutescens* Linn.	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0
7.	*Dioscorea alata* L.	X	0	0	0	0	0	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0
8.	*Zea mays* L.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9.	*Dioscorea dumetorum* (Kunth) Pax	0	X	0	0	0	0	0	0	X	X	0	X	0	0	X	X	X	0	X	X	0	X
10.	*Cucumis sativus* L.	X	X	0	X	0	0	0	0	0	0	0	X	0	0	0	0	X	0	0	0	0	X
11.	*Telfairia occidentalis* Hook f.	0	0	X	X	X	X	X	X	X	X	X	0	X	X	X	X	X	0	X	X	X	X
12.	*Dioscorea rotundata* Poir	0	X	0	X	X	0	0	X	0	X	0	0	X	X	X	X	X	0	X	X	0	X
13.	*Talinum triangulare* (Jacq.) Willd.	0	X	X	X	0	0	0	0	0	0	0	0	X	0	0	X	0	0	X	0	X	0

S/N	Binomial nomenclature& authority	NUMBER OF FARMERS AND CROP SPECIES PLANTED																					
		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22
14.	*Ocimum gratissimum* L.	0	X	0	0	0	X	0	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0
15.	*Cucurbita moschata* Duchesne	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X
16.	*Ipomoea batata* (L.) Poir	0	0	0	X	X	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0
17.	*Musa paradisiac* L.	0	0	0	X	X	X	X	0	0	0	0	X	X	X	X	0	X	X	X	X	0	0
18.	*Vigna unguiculata* L.	0	0	0	X	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0
19.	*Arachis hypogaea* L.	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0
20.	*Citrullus colocynthis* (L.) Schrad	0	0	0	0	0	0	0	0	X	0	0	0	0	0	X	0	0	X	X	0	0	0
21.	*Vernonia amygdalina* Del.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
22.	*Ocimum americanum* L.	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0	0	0	0	0	0
23.	*Ananas comosus* (L.) Merill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0
24.	*Solanum lycopersicum* L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
25.	*Mucuna Sloanei* Rendle & Fawc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	X
26.	*Solanum* sp. L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
27.	*Amaranthus hybridus* L.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0
28.	Total Crop Species Recorded (27)	8	10	6	10	9	9	7	5	11	7	3	7	6	7	10	10	8	6	12	9	7	9

Legend: X=present; 0=nil

4. Discussion

Globally, farming systems methods have so much impacted on the arable farmlands through anthropogenic activities causing different levels of damage to the soil. Some of these resultant impacts are soil erosion, soil degradation, depletion of nutrients, pest and disease infestation, soil impaction etc.[32];[33];[34]. The soil support both crop and weed species and both inter-relate in the course of growth and development for nutrients, space, light, water [35].

In our study which was conducted on the background of slash, and burn, continuous cultivation and mixed cropped without allowing period of rest resulted in the weed richness and diversity in wet and dry seasons (Table 1).

This observation corroborates [36] study revealed a clear effect on land use history on soil fertility and weed pressure because a reduction in cultivation fallow cycle length will increase the buildup of weed populations and put pressure on the farmer's work load by weeding all through the season causing time and other resources waste.

These methods will encourage emergence of weeds in early and late cropping seasons leading to weed species distribution, diversity and their competitiveness with crops. The result shows more weed species for example annual

broad leaves 55, 76; perennial broadleaves 22, 27; annual grasses 10, 15; perennial grasses 4, 5; annual sedges 2, 2; perennial sedges 5, 6 and others 12 and 3 more in the dry than the wet season. This could be as a result of weed management practices applied in the cropping season which influence weed species composition, richness and diversity in the area of study. This is in line with[37] confirmed that weed management strategies in wheat based cropping systems and weed flora interaction significantly influenced diversity and density of individual weed, total, broadleaved and narrow leaved weeds in arable farm-land.

The study area experiences high rain fall and causes about water running across which could carry weed seeds that have capacity to float far beyond its mother stand. Heavy rain fall also encourage weed growth leading to late senescence and increase in biomass. This assertion is in confirmative with [38] that insufficient water caused biomass losses in May and June and this impact was compensated with sufficient rain in late July and August in the study area in China.

This high rain fall could have altered weed seed germination leading to more seedlings germinating and growing into the dry season which increased the high number of weeds in dry season plant forms. This corroborate the assertions [39];[40] that changes in weather conditions have a significant effect on growth of all plants species including crops and weeds.

In wet season 40 weed species were not actually recorded and while in the dry season 33 weed species were recorded. These weed species not recorded and those recorded could be that some were shaded by crop species (Tables 2 and 3) or other bigger weed species as observed by [41] noted that long term use of a winter rye cover crop in maize-soybean system has the potential to meaningfully reduce the size of weed seed bank compared to winter fallow, and while weed seed bank is the source of weed infestation in arable farmland.

It could also be attributed for example that the weeds at seedling stage were very small at that time to be noted or the shoots could have been cut off as result of frequent weeding which was in line with the assertion of [42] that cultivation frequency influenced weed species diversity and composition in flood recession farming which were dominated by dry land arable weed species, while un-cropped or undisturbed site were composed of wet land weed species.

The result also revealed 78 of same weed species which occurred in wet and dry seasons respectively. These weed species which occurred in wet (rainy) and dry are attributed to the ability of weed species to overcome the impact of farming systems methods which were applied in the course of the cropping season for example frequent weeding, cultivation methods applied [42], cropping patterns, crop/weed species interactions, crop and crop cover effects and climate [43], multiple cropping and intercropping [44]. It has been recorded in literature that different cropping systems and weed management strategies have influenced weed infestation in today's agriculture as crop growers seeks ways to feed the growing population of the world. And this corroborates the findings by [37] in a study on weed flora wheat-based cropping systems, that weed management strategies in wheat based cropping systems and weed flora interaction significantly altered diversity and density of individual, total, broadleaved and narrow leaved weeds in arable farm-land.

5. Conclusion

Slash and burn, continuous and mixed cropping of arable farmlands are common practice in the humid high rain forest of Nigeria due to increase in population and demand for available arable farmlands for cropping activities and for other human uses. Continuous use of arable farmland without follow break influences weed species and diversity which constitute a major problem in crop production than any other pest or disease and encouraged by climatic factors. Planting of two or more crops is a common practice in the study area which contributes to sustainable crop production, farmer's food varieties, income and security.

Compliance with ethical standards

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All individual who has contributed to this work has been listed as authors.

Disclosure of conflict of interest

No potential conflict of interest by the authors.

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