

Predominant Weeds of Some Cereal Crops in the Scrub Savannah Region of Nigeria

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ABSTRACT

Satu kajian telah dikendalikan untuk menentukan populasi spesies rumpai yang tumbuh di ladang-ladang bijirin (jagung, padi dan betari) di sesetengah tempat kawasan savannah semak-samun Nigeria semasa musim penanaman 1996-1998 dengan tujuan penyediaan maklumat untuk pengurusan rumpai yang berkesan. Enam puluh kawasan di Gubi, Miri, Inkil, Lukshi dan Birshin Fulani dipilih untuk kajian tersebut. Sampel-sampel rumpai dikutip dalam kuadran 50 cm x 50 cm dan dikenal pasti menggunakan teks standard dan koleksi herbarium Abubakar Tafawa Balewa University, Bauchi, Nigeria. Di kawasan kajian, 66 spesies rumpai yang tergolong pada 58 genera dalam 18 keluarga dikenal pasti. Daripada jumlah tersebut, 41 (62.12%) spesies adalah daun lebar, 17 (25.76%) rumpai rumput dan 8 (12.12%) sendayan. Rumpai dominan adalah spesies *Cyperus*, *Commelina*, *Kyllinga*, *Digitaria*, *Echinochloa*, *Imperata*, *Cynodon*, *Leucas* dan *Chloris*. Taburan spesies rumpai adalah mengikut jenis tanaman dan kawasan pengumpulan.

ABSTRACT

A survey was conducted to determine the weed species populations inhabiting cereal farms (maize, rice and sorghum) in some parts of the scrub savannah region of Nigeria during the growing seasons of 1996-1998 with the aim of providing information for effective weed management. Sixty sites in Gubi, Miri, Inkil, Lukshi and Birshin Fulani were selected for the study. Weed samples were collected within 50cm x 50 cm quadrants and were identified using standards texts and collections of the herbarium of the Abubakar Tafawa Balewa University, Bauchi, Nigeria. In the survey sites, 66 weed species belonging to 58 genera within 18 families were identified. Of these, 41 (62.12%) species were broad-leaves, 17 (25.76%) were grass weeds and 8 (12.12%) were sedges. The dominant weeds were *Cyperus*, *Commelina*, *Kyllinga*, *Digitaria*, *Echinochloa*, *Imperata*, *Cynodon*, *Leucas* and *Chloris* species. The distribution of weed species varied with crop type and site of collection.

INTRODUCTION

Maize (*Zea mays* L.), sorghum (*Sorghum bicolor* (L.) Moench) and rice (*Oryza sativa* L.) are the major cereals grown in the scrub savannah region of Nigeria. The yields of these cereals are generally low despite their importance as staple foods and the interest of farmers in production. The factors associated with low yields include erratic rainfall, diseases, low soil fertility, weed infestation and use of un-improved local varieties.

Of these factors, weed infestation is considered a major limitation to cereal

production in this area. Although no accurate data on losses caused by weeds in this area are available, crop losses of between 40-66% (Weber *et al.*, 1995; Udensi *et al.*, 1999) and as high as 100% (Akobundu 1987) have been reported for the Northern Guinea savannah.

Despite the recent development of highly intensive cereal based production systems, weeds and the labour required for weed control are still the most important production constraints in this area. The objective of weed control in cereals is to reduce weed population to levels that do not affect yield, quality and harvesting.

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To achieve this effectively and economically will require a strategy based on the knowledge of the type and distribution of weeds in different localities. However, very little is known about the weed populations affecting cereals in this area. A study of weeds of the northern Guinea Savannah by Weber *et al.* (1995) was limited to Kaduna and Katsina States. Okafor and Adegbite (1991) only carried out a survey of weeds of cowpea fields in Bauchi area.

The objective of this study is to identify the various weeds affecting cereals in some parts of scrub savannah region of Nigeria. The results will provide baseline data for developing weed management strategies.

MATERIALS AND METHODS

A survey of common weed flora of cereal farms was carried out from 1996-1998. The study areas were Inkil, Gubi, Miri, Lukshi and Birshin Fulani. These areas were selected because they are intensively cultivated. The study areas are located in the scrub savannah of Nigeria at an elevation of 609.45m and latitude and longitude of 10° 22'N and 9° 47'E respectively. The area has an average annual rainfall of 905 mm distributed over a growing period of between 150-180 days, which is followed by a pronounced dry season from October to April.

Four farms each devoted to rice, maize or sorghum were randomly selected in each location and were tagged for sample collection. There was no interference in the management practices of the farmers. Weed samples were collected within 50cm x 50 cm quadrants from 10 locations in each farm. Collected weed samples were counted and identified using standard texts (Rains 1968; Akobundu and Agyakwa 1987; Terry and Michieka 1988). Identification was later confirmed at the herbarium of the Abubakar Tafawa Balewa University, Bauchi.

Frequency of occurrence was calculated as the percentage of farms in which a certain weed species was present. The relative occurrence of weed species in relation to crop and site of collection was also estimated.

Data obtained were subjected to two way analysis of variance to determine whether there were significant differences in weeds occurrences between sites of collection and crop type.

RESULTS AND DISCUSSION

Sixty six weeds species belonging to 58 genera within 18 families were identified (Tables 1 and 2). This flora represents about 73% of the total number of weed species identified in the Northern Guinea savannah of Nigeria (Weber *et al.*, 1995). This value is low compared to the 275 plant species recorded around Kano town by Hussain and Karatela (1989). Forty of the genera identified were among the 60 genera recorded by Weber *et al.* (1995). An earlier study by Okafor and Adegbite (1991) in cowpea fields in the Bauchi area recorded 21 weed genera, which were all recorded in this study. Weed species identified consisted of 41 (62.12%) broad-leaves (Table 1), 17 (25.76%) grasses and 8 (12.12%) sedges (Table 2). A similar study by Kandasamy *et al.* (2000) in India recorded a proportion of 46.7% broad-leaves, 43.5% grasses and 9.8% sedges. Jung *et al.* (1999) recorded 9 species of grasses, 44 species of broad-leaves and 3 species of sedges in apple orchards in Korea. About 101 weed species belonging to 32 families were reported from vegetable farms in Kangwon alpic region of Korea (Kim *et al.* 1999). These trends tend to suggest that the distribution of weed species varies with location and crop under cultivation. About 47.69% of all species recorded belonged to the families of Poaceae, Cyperaceae and Asteraceae with the family Poaceae having the highest number of representative species (17). A striking feature of the flora in the cereal farms was the dominance of *Commelina*, *Kyllinga*, *Imperata*, *Digitaria*, *Echinochloa*, *Cyperus*, *Cynodon*, *Leucas* and *Chloris* species which constituted about 13.64% of the total weed species and were found in more than 70% of the fields. *Commelina* and *Digitaria* species regarded as the most common weeds of Bauchi area by Okafor and Adegbite (1991) were also found to be dominant in this study. However, there was a significant increase in the number of dominant weeds in the study area. This increase could be attributed to the rapid changes towards intensive land use and cropping patterns. Earlier studies have shown that the distribution and abundance of weed species in cereal crops depend on the system of cultivation, infestation in previous crops and recurrent bush fires (Tottman and Wilson 1990; Garrity *et al.* 1997).

PREDOMINANT WEEDS OF SOME CEREAL CROPS IN THE SCRUB SAVANNAH REGION OF NIGERIA

TABLE 1
Broad-leaf weed species and the frequency of occurrence (% fields infested)
of cereal farms in the scrub savannah region of Nigeria

Family	Genus	Species	Occurrence (% of farms)
Amaranthaceae	<i>Amaranthus</i>	<i>hybridus</i>	8.76
	<i>Amaranthus</i>	<i>spinosus</i>	6.63
	<i>Alternanthera</i>	<i>sessilis</i>	4.81
	<i>Celosia</i>	<i>leptostachya</i>	3.57
Asteraceae	<i>Ageratum</i>	<i>conyzoides</i>	42.78
	<i>Acanthospermum</i>	<i>hispidum</i>	51.09
	<i>Aspilia</i>	<i>africana</i>	27.71
	<i>Chrysanthemum</i>	<i>americanum</i>	17.54
	<i>Bidens</i>	<i>pilosa</i>	24.92
Caesalpinaceae	<i>Tridax</i>	<i>procumbens</i>	34.78
	<i>Synedrella</i>	<i>nodiflora</i>	15.76
	<i>Cassia</i>	<i>obtusifolia</i>	15.29
	<i>Daniella</i>	<i>oliveri</i>	7.68
Commelinaceae	<i>Commelina</i>	<i>benghalensis</i>	82.54
	<i>Aneilema</i> sp		9.46
Cleomaceae	<i>Cleome</i>	<i>afrospinoso</i>	6.73
Convolvulaceae	<i>Evolvus</i> sp		2.97
	<i>Ipomoea</i>	<i>septaria</i>	19.32
	<i>Ipomoea</i>	<i>dichroa</i>	13.17
Euphorbiaceae	<i>Acalypha</i>	<i>hispidia</i>	16.70
	<i>Euphorbia</i>	<i>heterophylla</i>	13.08
	<i>Euphorbia</i>	<i>hirta</i>	5.76
Labiatae	<i>Hyptis</i> sp		21.50
	<i>Leucas</i>	<i>martinicensis</i>	78.18
Malvaceae	<i>Abuliton</i> sp		17.91
Nyctaginaceae	<i>Boerhavia</i>	<i>erecta</i>	32.11
	<i>Boerhavia</i>	<i>diffusa</i>	4.43
Papilionaceae	<i>Aeschynomene</i>	<i>virginica</i>	16.24
	<i>Crotalaria</i>	<i>cuspidata</i>	4.90
	<i>Desmodium</i> sp		9.10
	<i>Indigofera</i> sp		18.10
Portulacaceae	<i>Talinum</i>	<i>triangulare</i>	2.31
	<i>Portula</i>	<i>oleracea</i>	8.55
Rubiaceae	<i>Oldenlandia</i>	<i>corymbosa</i>	43.36
	<i>Borreria</i> sp		16.37
	<i>Mitracarpus</i>	<i>villosus</i>	22.37
Solanaceae	<i>chuenkia</i>	<i>americanum</i>	41.68
Scrophulariaceae	<i>Buchnera</i>	<i>hispidia</i>	9.67
	<i>Striga</i>	<i>hermonthica</i>	62.33
	<i>Scoparia</i>	<i>dulcis</i>	10.56
Tiliaceae	<i>Corchorus</i>	<i>olitorius</i>	31.43

TABLE 2
Grasses/sedges weed species and the frequency of occurrence (% field infested)
of cereal farms in the scrub savannah region of Nigeria

Family	Genus	Species	Occurrence (% of farms)
Cyperaceae	<i>Cyperus</i>	<i>esculentus</i>	60.14
	<i>Cyperus</i>	<i>rotundus</i>	52.50
	<i>Cyperus</i>	<i>tuberosus</i>	35.22
	<i>Cyperus</i>	<i>sphacelatus</i>	20.29
	<i>Kyllinga</i>	<i>squamulata</i>	76.63
	<i>Mariscus</i>	<i>alternifolium</i>	44.20
	<i>Mariscus</i>	<i>umbellatus</i>	25.40
	<i>Setaria</i>	<i>verticillata</i>	4.96
Poaceae	<i>Brachiaria</i>	<i>deflexa</i>	21.19
	<i>Andropogon</i>	<i>gayanus</i>	10.60
	<i>Chloris</i>	<i>pilosa</i>	71.20
	<i>Eluesine</i>	<i>indica</i>	29.10
	<i>Pennisetum</i>	<i>polystachion</i>	35.60
	<i>Eragrotis</i>	<i>cilianensis</i>	19.60
	<i>Setaria</i>	<i>verticillata</i>	27.28
	<i>Imperata</i>	<i>cylindrical</i>	73.17
	<i>Paspalum</i>	<i>orbiculare</i>	7.98
	<i>Digitaria</i>	<i>longiflora</i>	75.65
	<i>Panicum</i>	<i>maximum</i>	58.30
	<i>Scleragrotis sp</i>		16.48
	<i>Rottboellia</i>	<i>cochinchinensis</i>	44.73
	<i>Cynodon</i>	<i>dactylon</i>	66.01
	<i>Echinochloa</i>	<i>colona</i>	86.43
	<i>Ageratum</i>	<i>conyzoides</i>	51.06
	<i>Euclasta sp</i>		25.84
<i>Dactyloctenium</i>	<i>aegyptium</i>	57.23	

The distribution of weed species according to crop type and area of collection is presented in Tables 3, 4 and 5. Weeds species distribution varied significantly ($P \leq 0.05$) with cereal crop type and site of collection. Rice farms with 38 species which is equivalent to 58.46% of overall species identified had the highest number of species per crop type (Table 3), while sorghum with a record of 32 species (49.23%) had the lowest number of weed species (Table 5). Of the 38 species from rice farms, 8 were sedges, 10 grasses and 20 broad-leaves, with *Cyperus* species and *Echinochloa colona* being the most dominant species. On maize farms, 14 grass species, 2 sedges and 25 broad-leaves were identified. Similarly, sorghum farms recorded 11 grass, 20 broad-leaves and 1 sedge species. *Cynodon*

dactylon and *Striga hermonthica* were the most dominant species in maize and sorghum farms respectively. Nineteen of the species identified were common to rice and maize farms, while 12 species were common to all three crops.

Results of this study provide evidence that there is an increase in the number of dominant weeds and that the distribution of weeds species varies with the area of collection and crop types. Further studies need to be carried out on the determinants of weed communities and the implication in the management of these weeds.

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PREDOMINANT WEEDS OF SOME CEREAL CROPS IN THE SCRUB SAVANNAH REGION OF NIGERIA

TABLE 3
Weed flora of rice farms in the scrub savannah region of Nigeria

Family	Genus	Species	Occurrence by Location (%)				
			Miri	Gubi	Inkil	B/Fulani	Lukshi
Amaranthaceae	<i>Amaranthus</i>	<i>hybridus</i>	6.21	41.87	3.37	-	-
	<i>Amaranthus</i>	<i>spinosus</i>	58.13	11.80	8.59	15.88	9.27
	<i>Alternanthera</i>	<i>sessilis</i>	35.10	30.08	28.22	17.70	17.05
Asteraceae	<i>Celosia</i>	<i>leptostachya</i>	3.21	4.43	3.56	43.35	4.26
	<i>Ageratum</i>	<i>conyzoides</i>	10.67	10.70	53.09	10.01	13.17
	<i>Acanthospermum</i>	<i>hispidum</i>	26.59	21.26	33.10	25.10	30.19
	<i>Aspilota</i>	<i>africana</i>	7.56	17.70	28.22	30.08	35.10
	<i>Chrysanthemum</i>	<i>americanum</i>	-	1.46	-	-	8.81
	<i>Bidens</i>	<i>pilosa</i>	15.08	13.25	12.73	12.89	3.13
	<i>Synedrella</i>	<i>nodiflora</i>	20.26	27.93	11.05	39.84	-
Commelinaceae	<i>Commelina</i>	<i>benghalensis</i>	31.09	41.15	17.13	44.53	31.24
Convolvulaceae	<i>Aneilema</i> sp		3.13	2.89	-	5.08	3.25
	<i>Evolvulus</i> sp	<i>septaria</i>	17.54	24.92	51.09	-	42.26
Cyperaceae	<i>Ipomoea</i>		-	4.14	58.06	11.38	23.02
	<i>Cyperus</i>	<i>esculentus</i>	32.57	55.46	32.12	39.86	58.61
	<i>Cyperus</i>	<i>rotundus</i>	58.06	62.15	32.39	40.61	51.92
	<i>Cyperus</i>	<i>tuberosus</i>	20.20	14.63	18.41	36.99	31.67
	<i>Cyperus</i>	<i>sphacelatus</i>	10.39	5.71	19.65	-	-
	<i>Kyllinga</i>	<i>squamulata</i>	57.62	65.03	70.67	51.92	68.03
	<i>Mariscus</i>	<i>alternifolium</i>	41.87	24.26	33.10	30.19	25.10
	<i>Mariscus</i>	<i>umbellatus</i>	6.21	3.37	14.46	-	3.64
Euphorbiaceae	<i>Setaria</i>	<i>verticillata</i>	10.01	10.67	35.01	13.17	-
	<i>Acalypha</i>	<i>hispida</i>	26.15	17.93	-	5.88	32.39
	<i>Euphorbia</i>	<i>heterophylla</i>	1.74	5.91	14.51	40.67	22.08
Poaceae	<i>Brachiaria</i>	<i>deflexa</i>	21.19	9.18	38.70	-	0.69
	<i>Chloris</i>	<i>pilosa</i>	71.20	33.60	48.14	62.11	59.33
	<i>Pennisetum</i>	<i>polystachion</i>	38.60	13.86	27.31	7.89	41.23
	<i>Paspalum</i>	<i>orbiculare</i>	7.98	26.43	-	18.93	13.54
	<i>Imperata</i>	<i>cylindrical</i>	44.20	73.17	16.48	66.01	57.23
	<i>Digitaria</i>	<i>longiflora</i>	65.60	47.14	75.65	38.13	53.01
	<i>Panicum</i>	<i>maximum</i>	29.20	55.23	30.91	36.55	64.38
	<i>Roettboellia</i>	<i>cochinchinensis</i>	41.06	18.97	58.32	60.23	39.87
	<i>Cynodon</i>	<i>dactylon</i>	53.13	79.67	74.89	55.23	63.22
	<i>Echinochloa</i>	<i>colona</i>	76.51	93.80	69.73	54.21	83.28
Portulacaceae	<i>Talinum</i>	<i>triangulare</i>	0.00	1.76	-	-	-
	<i>Portula</i>	<i>oleraceae</i>	1.84	1.16	8.87	5.02	-
Rubiaceae	<i>Mitracarpus</i>	<i>villosus</i>	7.68	19.32	21.50	-	7.68
Tiliaceae	<i>Corchorus</i>	<i>olitorius</i>	19.05	34.12	28.07	37.22	16.76

TABLE 4
Weed flora of maize farms in the scrub savannah region of Nigeria

Family	Genus	Species	Occurrence By Location (%)				
			Miri	Gubi	Inkil	B/Fulani	Lukshi
Amaranthaceae	<i>Celosia</i>	<i>leptostachya</i>	3.28	4.21	7.51	5.39	8.83
	<i>Amaranthus</i>	<i>spinosus</i>	15.74	1.92	9.15	7.68	24.62
Asteraceae	<i>Bidens</i>	<i>pilosa</i>	8.28	13.04	15.53	9.34	2.76
	<i>Tridax</i>	<i>procumbens</i>	41.07	10.08	3.25	16.57	35.11
	<i>Acanthospermum</i>	<i>hispidum</i>	33.56	11.73	39.04	28.67	25.94
Caesalpiniaceae	<i>Cassia</i>	<i>obtusifolia</i>	-	-	-	6.59	-
	<i>Daniella</i>	<i>oliveri</i>	-	-	2.60	1.73	-
	<i>Cleome</i>	<i>afrospinosa</i>	-	0.85	-	-	6.59
Commelinaceae	<i>Commelina</i>	<i>benghalensis</i>	30.31	9.30	15.68	37.12	22.60
	<i>Aneilema</i> sp		1.61	-	-	1.09	3.88
Convolvulaceae	<i>Evolvulus</i> sp		2.98	3.64	-	2.09	1.85
	<i>Ipomoea</i>	<i>dichroa</i>	6.93	13.86	10.22	12.61	26.27
Cyperaceae	<i>Cyperus</i>	<i>esculentus</i>	34.98	20.16	37.62	26.17	32.23
Euphorbiaceae	<i>Acalypha</i>	<i>segetalis</i>	-	1.06	1.70	1.58	5.24
	<i>Euphorbia</i>	<i>hirta</i>	9.79	15.76	28.25	37.52	34.17
	<i>Leucas</i>	<i>martinicensis</i>	25.84	4.60	-	12.20	9.63
Labiatae	<i>Hyptis</i> sp		-	4.45	1.64	3.21	3.01
Nyctaginaceae	<i>Boerhavia</i>	<i>erecta</i>	33.41	19.92	34.66	35.07	18.34
	<i>Boerhavia</i>	<i>diffusa</i>	3.03	1.56	0.93	-	-
Papilionaceae	<i>Crotalaria</i>	<i>cuspidata</i>	2.32	-	-	3.03	1.61
	<i>Indigofera</i> sp		-	-	-	0.97	1.13
Poaceae	<i>Euclasta</i> sp		13.14	8.22	8.91	2.23	14.67
	<i>Pennisetum</i>	<i>polystachion</i>	8.55	2.98	1.93	3.64	-
	<i>Setaria</i>	<i>verticillata</i>	2.09	1.85	1.01	-	4.03
	<i>Paspalum</i>	<i>orbiculare</i>	6.13	2.23	2.41	1.70	6.11
	<i>Imperata</i>	<i>cylindrical</i>	21.47	16.11	18.22	4.98	-
	<i>Digitaria</i>	<i>longiflora</i>	13.43	18.07	25.28	43.34	14.31
	<i>Panicum</i>	<i>maximum</i>	39.38	34.09	46.53	37.33	23.18
	<i>Rottboellia</i>	<i>cochinchenen</i>	62.12	23.12	61.67	25.28	62.76
	<i>Cynodon</i>	<i>sis</i>	58.12	76.62	67.21	53.10	39.33
	<i>Eragrotis</i>	<i>dactylon</i>	45.35	25.11	15.16	24.08	41.18
	<i>Scleragrotis</i> sp	<i>cilianensis</i>	4.41	7.23	29.57	17.50	23.53
	<i>Chloris</i> sp		18.63	30.09	42.13	28.41	37.16
	<i>Brachiaria</i>	<i>pilosa</i>	5.20	9.61	1.25	12.57	2.59
	<i>Eleusine</i>	<i>deflexa</i>	28.48	31.23	25.02	21.14	13.86
		<i>indica</i>	-	-	-	-	3.88
Rubiaceae	<i>Oldenlandia</i>	<i>corymbosa</i>	-	-	-	-	3.88
Scrophylariaceae	<i>Striga</i>	<i>hermonthica</i>	55.16	19.93	60.33	47.21	34.76
	<i>Buchnera</i>	<i>hispidata</i>	2.04	1.11	-	1.31	3.46
	<i>Alectra</i> sp		14.13	2.82	-	3.67	6.41

TABLE 5
Weed flora of sorghum farms in the scrub savannah region of Nigeria

Family	Genus	Species	Occurrence By Location (%)				
			Miri	Gubi	Inkil	B/Fulani	Lukshi
Amaranthaceae	<i>Amaranthus</i>	<i>spinosus</i>	43.81	21.67	25.43	21.87	33.52
Asteraceae	<i>Acanthospermum</i>	<i>hispidum</i>	29.42	21.90	10.61	19.80	20.53
		<i>Synedrella</i>	<i>nodiflora</i>	9.78	22.44	27.90	11.12
Caesalpinaceae	<i>Cassia</i>	<i>obtusifolia</i>	2.58	-	3.23	-	1.82
	<i>Daniella</i>	<i>oliver</i>	1.38	-	-	-	1.13
	<i>Cleome</i>	<i>afrospinosa</i>	-	2.13	-	-	-
Commelinaceae	<i>Commelina</i>	<i>benghalensis</i>	3.29	3.07	5.39	3.53	6.98
Cyperaceae	<i>Cyperus</i>	<i>esculentus</i>	34.98	20.16	37.62	26.17	32.23
Labiatae	<i>Hyptis</i> sp		13.36	3.76	15.23	-	11.21
	<i>Leucas</i>	<i>martinicensis</i>	29.19	13.74	26.38	7.89	32.01
Malvaceae	<i>Abutilon</i> sp		3.75	8.19	2.04	16.93	-
Papilionaceae	<i>Aeschynomene</i>	<i>virginica</i>	-	-	5.05	-	0.82
	<i>Crotalaria</i>	<i>cuspidata</i>	33.49	-	-	-	-
	<i>Indigofera</i> sp		4.51	5.01	23.01	1.92	4.09
Poaceae	<i>Brachiaria</i>	<i>deflexa</i>	35.04	25.41	60.12	38.20	51.32
	<i>Eragrostis</i>	<i>cilianensis</i>	37.47	8.19	20.44	12.12	16.93
	<i>Andropogon</i>	<i>gayanus</i>	25.48	28.41	43.12	50.93	25.48
	<i>Sclerogrotis</i> sp		2.33	11.84	7.24	2.82	-
	<i>Eleusine</i>	<i>indica</i>	54.20	7.33	36.73	16.10	39.20
	<i>Dactyloctenium</i>	<i>aegyptium</i>	5.94	6.26	9.45	-	4.36
	<i>Digitaria</i>	<i>longiflora</i>	49.95	40.16	36.03	77.81	26.85
	<i>Rottboellia</i>	<i>cochinchen</i>	4.91	31.22	72.63	51.16	21.35
	<i>Cynodon</i>	<i>dactylon</i>	61.09	23.53	27.83	7.92	50.20
	<i>Panicum</i>	<i>maximum</i>	1.39	3.32	-	2.97	2.78
	<i>Chloris</i>	<i>pilosa</i>	8.03	37.42	13.01	12.70	34.59
	<i>Ageratum</i>	<i>conyzoides</i>	33.76	45.11	57.03	28.67	46.43
	Rubiaceae	<i>Oldenlandia</i>	<i>corymbosa</i>	6.42	2.51	-	9.47
Solanaceae	<i>Schwenkia</i>	<i>americanum</i>	4.43	3.16	-	6.27	3.67
Scrophulariaceae	<i>Striga</i>	<i>hermonthica</i>	87.42	51.09	58.82	63.83	75.03
	<i>Buchnera</i>	<i>hispidata</i>	2.71	-	7.81	3.31	1.56
	<i>Scoparia</i>	<i>dulcis</i>	9.27	4.39	3.55	7.89	-
Tiliaceae	<i>Corchorus</i>	<i>oliticus</i>	18.03	51.18	40.71	29.16	13.34

REFERENCES

AKOBUNDU, I. O. 1987. *Weed Science in the Tropics: Principles and Practices*. Chichester, New York, Brisbane, Toronto, Singapore: John Wiley & Sons. 522 p.

AKOBUNDU, I. O. and C.W. AGYAGWA. 1987. *A Handbook of West African Weeds*. Ibadan Nigeria: International Institute of Tropical Agriculture.

GARRITY, D.P., M. SOEKADI, M. VAN NOORDWIJK, R. DELA CRUZ, P.S. PATHAK, H.P.M. GURASENA, N. VANSO, G. NUJJUN and N.M. MAJID. 1997. The *Imperata* grasslands of tropical Asia: Area distribution and typology. *Agroforestry Systems* 36: 1-29.

HUSSAIN, H.S.N. and Y.Y. KARATELA. 1989. Weeds flora of Kano and its environs. *Nigerian Journal of Weed Science* 2: 1-7.

JUNG, J.S., J.S. LEE and C.D. CHOI. 1999. Weed occurrence of apple orchard in autumn. *Korean Journal of Weed Science* 19(3): 185-196.

KANDASAMY, O.S., H.C. BAYAN, P. SANTHY and D. SELVI. 2000. Long term effects of fertilizer application and three crop rotation on changes in weed species in the 68th cropping. *Acta Agronomica Hungarica* 48(2): 149-154.

- KIM, S., G. CHANG, M. AHU, Y. KIM, K. HWANG, J. HUR and D. HAN. 1999. A survey of vegetative crop weeds in Kangwon Alpic area. *Korean Journal of Weed Science* **19(4)**: 288-298.
- OKAFOR, L. I. and M. ADEGBITE. 1991. Predominant weeds of cowpea (*Vigna unguiculata*) in Bauchi State. *Nigerian Journal of Weed Science* **4**: 11-15.
- RAINS, A.B. 1968. A Field Guide to the Commoner Genera of Nigerian Grasses. Zaria, Nigeria: Institute for Agricultural Research. Samaru miscellaneous Paper, 7.
- TERRY, P.J. and R.W. MICHIEKA. 1988. *Common Weeds of East Africa*. Rome, Italy: Food and Agriculture Organisation of the United Nations.
- TOTTMAN, D.R. and B.J. WILSON. 1990. Weed control in small grain cereals. In *Weed Control Handbook: Principles* ed. R. J. Hance and H. Holly, p. 301-328. Oxford, London, Edinburgh, Hoston, Melbourne: Blackwell Scientific Publication.
- UDENSI, E.U., I.O. AKOBUNDU A.O. AYENI and D. CHIKOYE. 1999. Management of Cogon grass (*Imperata cylindrical*) using velvet bean (*Mucuna pruriens var. utilis*) and herbicides. *Weed Technology* **13**: 201-208.
- WEBER, G., K. ELEMOMO and S.T.O. LAGOKE. 1995. Weed communities in intensified cereal-based cropping systems of the Northern Guinea Savannah. *Weed Research* **35**: 167-178.

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