WEEDS DISTRIBUTION AND ABUNDANCE IN IRRIGATED FIELDS OF WHITE NILE STATE

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Abstract

Field survey was conducted during the summer season of 2011- 2012 to determine the weed flora and weed dominance at the irrigated sites of White Nile State. The State was divided into six irrigated sites from which a total of thirty- five fields were selected and ten quadrates ($1m^2$) from each field were taken randomly. In each quadrate individual weed species were recorded. Field frequency, uniformity and mean field density were also determined for each weed. Fifty five weed species belonging to twenty- four families (three monocotyledonous and twenty- one dicotyledonous) were recorded. *Brachiaria eruciformis*, *Brachiaria reptans*, *Thunbergia annua* and *Ipomoea cordofana* were the most dominant weed species in most fields. The highest Abundance Index were recorded by *Ipomoea cordofana* at El Salam and El Dawium counties (208.16 and 116.35), *Brachiaria eruciformis* at Um Remta and El Gebalen counties (158.80 and 79.23), *Brachiaria reptans* at Kosti (116.54) and *Momordica balsamina* at Gezira Aba county (90.06). *Brachiaria eruciformis* showed the highest MFD and Uniformity at El Salam and Um Remta Counties (19.11 and 80.00), respectively, and highest frequency value was recorded by *Ipomoea cordofana* (142.86) at El Salam County. The AI which used as weed survey method is to evaluate the weed management strategies and the change of weed species in weed communities through years.

Key words: White Nile, Weeds, Abundance index

Introduction

Weeds are the main problem in agricultural production. Their effects are felt either directly, by reducing crop yield, or indirectly through interfering with utilization of land and water resources and through harmful effects to human welfare (Radosevich et al., 1997 and Aldrich and Kremer, 1997). The degree of damage depends mainly on weed number, weed biomass and leaf-area index compared to the crop (Roush and Radosevich, 1985). The effect of weed numbers, time of emergence, period of weeds presence, life cycle difference and weed weight on crop yield are also reported (Aldrish and Kremer, 1997). Seeds are essential for annual and perennial weeds that reproduce through seeds only, to complete their life cycle (Gulden and Shirtliffe, 2009). The abundance and distribution of weeds in a certain area depend mainly on the quality and quantity of the seeds in soil (Gulden, et al., 2003). Variation in weeds distribution and abundance in cropping system is different depending on location, soil type, season, cultural practices and crop type (Mohler, 2001; Sit et al., 2007).

White Nile State is located in the center of Sudan between latitudes 12° and 13.3° N and longitudes 31° and 33.3° E. It is delimited by Khartoum State in the north, North Kordofan State in the west, South Kordofan State and Republic of Southern Sudan in the southeastern and Al-Gezira and Sennar States in the east. The area of the State is 39.701 square kilometers. The State lies within the semi-desert zone and characterized by sandy soils in various areas. The annual rainfall varies from 300 mm in the north to 600 mm in the south (WFP, 2006). The irrigated production system is practiced along the river by pumping irrigation water from the river. The major crops are sorghum, cotton, wheat and millet to some extent in addition horticultural crops at small scale (FS, 2010).

The first step in developing any weed control strategy is to describe and understand the weed flora causing the problems, and link to the agricultural methods being used. This information will help in predicting future weed problems (Karar et al., 2005).

Due to lack of past weeds survey in White Nile State areas, it was obliged undertaking weed survey to enable creation of information of weeds species density and distribution. This data will help to understand the problem extent, and how to develop management practices. Therefore, the objective of this study was to conduct survey in different areas of White Nile

State to determine the common and prevalent weed species in the area and to highlight the distribution and density of weed species in the state.

Materials and methods

Field survey was conducted in irrigated fields during season 2011- 2012. The surveyed area was divided into six counties; El Salam, Kosti, Gebalen, Gezira Aba, ElDawium and Um Remta; from which a total of thirty- five fields were selected. From each field, a number of samples were randomly taken by adopting the stratified random sampling procedure described by Thomas (1991). Ten stratified samples were taken from each field in "W" pattern with an interval of 50 spaces apart using a $1m^2$ quadrate. In each quadrate, individual weed species were identified, counted and recorded. Weed density were recorded for each species in the quadrate. The unidentified species were later identified using the relevant flora. Photographs were taken for each weed species (seedling and mature) and specimens of each species were pressed, mounted and kept at Weed Research Program Herbarium at Wad Medani- Gezira State.

Data analysis

Mean field density (MFD), frequency (F) and uniformity (U) were the only quantitative measures used for abundance index (AI) determination (Moeini et al., 2008). These measures were obtained for each species by the following formulas:

Density $(D_{ki}) = \dfrac{\sum_1^m Z_j}{m}$

D_{ki} is value of (number of plants in m^2) species k in field i and Z_j is number of plants in quadrate j.

$MFD_k = \dfrac{\sum_1^n D_{ki}}{n}$

MFD_k indicated the MFD of species k. D_{ki} is the density of species k in field i and n is the total number of fields surveyed.

Frequency $(F_k) = \dfrac{\sum_1^n Y_i}{n}$

F_k is the frequency value of species k, Y_i is the presence (1) or absence (0) of species k in field i and i is number of fields surveyed.

Uniformity $(U_k) = \dfrac{\sum_1^n \sum_1^m X_{ij}}{\sum_1^m m_i}$

U_k is the uniformity value of species k, X_{ij} is the presence (1) or absent (0) of species k in quadrate j in field I, m is the number of quadrate for each field.

$$\text{Abundance Index } (AI_k) = MFD_k + F_k + U_k$$

Results

As shown in Table 1, fifty five species of weeds belonging to 24families (3 monocotyledons and 21 dicotyledonous) were identified in the surveyed area.

In El Salam, the highest MFD was illustrated by *Brachiaria eruciformis* (19.11), and the lowest MFD (0.06) was shown by *Aristida adscensiois* (Table 2). The MFD of other weeds were between 0.06 to 2.8 (Table 2).

The highest frequency value was recorded by *Ipomoea cordofana* (142.86), followed by *Brachiaria eruciformis* (74.29), *Momordica balsamina* (65.71). Other frequency values were between 40 and 2.86. (Table 2).

As shown in Table 2, the first rank in Abundance Index (AI) was *Ipomoea cordofana* (208.16), pursued by *Brachiaria eruciformis* (125.90), *Momordica balsamina* (95.3).

At Kosti County, the highest MFD was recorded by *Brachiaria reptans* (9.69), and the lowest MFD (0.03) was recorded by *Cynotis axillaries* and *Tribulus terrestris* (Table 3).

Higher frequencies were recorded by *Brachiaria reptans* (62.86), *Panicum hygrocharis* (42.86), *Phyllanthus niruri* (42.86), *Rhynchosia minima* (40), *Brachiaria eruciformis* (31.43), *Ipomoea sinensis* sp. *blepharosepla* (31.43) and *Momordica balsamina* (31.43). *Amaranthus viridis*, *Corchorus olitorus*, *Cynotis axillaries*, *Euphorbia acalyphoidis*, *Panicum repens* and *Tribulus terrestris* recorded lower frequencies (2.87)(Table 3).

High AI was recorded by *Brachiaria reptans* (116.54), *Phyllanthus niruri* (75.17), *Panicum hygrocharis* (74.49) and *Rhynchosia minima* (70.34), while low AI was recorded by *Cynotis axillaries* and *Tribulus terrestris* (4.89) (Table 3).

The MFD at Gebalen County recorded by *Brachiaria reptans*, *Brachiaria eruciformis*, *Zaleya pentandra* and *Ocimum basilicum* were 5.89, 4.23, 2.23 and 2.03, respectively. Other weeds recorded MFDs between 1.3 to 0.03 (Table.4).

Brachiaria eruciformis and *Ocimum basilicum* gave frequency values of 40.00.*Ipomoea cordofana*, *Momordica balsamina, Zaleya pentandra, Brachiaria reptans, Dinebra*

retroflexa, *Ischaemum afrum* and *Sonchus cornutus* gave frequency values between 31.43 and 22.86. Other weeds gave frequency values between 17.14 and 2.86 (Table 4).

As shown in Table 4, *Brachiaria eruciformis*, *Ocimum basilicum*, *Ipomoea cordofana*, *Zaleya pentandra*, *Brachiaria reptans*, *Momordica balsamina*, *Dinebra retroflexa, Sonchus cornutus and Ischaemum afrum* gave higher AI values (79.23- 43.17). Other weeds gave AI values between 32.77 – 5.39.

As Shown in Table 5, weed diversity at Gezira Aba County was less than that of the other counties. *Momordica balsamina* present the highest MFD (3.63) followed by *Thunbergia annua* (1.77). The same weeds recorded high frequency values (31.43-20.40). Other weeds recorded frequency values of 22.86-2.86.

Momordica balsamina, Thunbergia annua, *Euphorbia acalyphoidis*, *Phyllanthus maderaspatensis*, *Xanthium brasilicum*, *Abutilon glaucum*, *Cyperus rotundus* and *Ipomoea cordofana* recorded AI values between 90-31.66 (Table 5).

Table 6 shows mean field density (MFD), frequency (F) and abundance index (AI) at El Dawium County. *Zaleya pentandra* showed high MFD (6.20), followed by *Thunbergia annua* (5.40), *Cynotis axillaries* (3.60), *Ipomoea cordofana* (3.26), *Ipomoea sinensis* sp. *blepharosepala* (3.06), *Leucas urticifolia* (2.91) and *Digera muricata (*2.46). High frequency was recorded by *Ipomoea cordofana* (71.43), *Zaleya pentandra* (57.14), *Digera muricata* (42.86) and *Tribulus terrestris* (40.00), *Aristolochia bracteolate,* (37.4) *Ipomoea sinensis* sp. *blepharosepala* (37.4) and *Leucas urticifolia* (37.14). The lowest frequency was recorded by *Solanum dubium* (2.86).

Ipomoea cordofana ranked first in AI (116.35), pursued by *Zaleya pentandra* (96.68), *Digera muricata*(70.31),*Tribulus terrestris*(64.25), *Ipomoea sinensis* sp. *blepharosepala*(61.87), *Leucas urticifolia*(61.72), *Aristolochia bracteolate* (59.70), *Momordica balsamina*(54.86), *Brachiaria eruciformis* (51.62) and *Thunbergia annua* (50.64), *Abutilon glaucum*(46.44) and *Sonchus cornutus*(46.47)(Table 6).

At Um Remta County, the highest MFD was recorded by *Brachiaria eruciformis* (10.23), pursued by *Eclipta alba* (6.00), *Dinebra retroflexa* (2.97), *Sorghum arundinaceum* (2.51),

Abutilon glaucum (2.23), *Cynotis axillaries* (2.06) and *Cynodon dactylon* (1.37). The least MFD was recorded by *Solanum dubium* and *Thunbergia annua* (0.09) (Table 7).

Brachiaria eruciformis (68.57), *Eclipta alba* (57.14)and *Dinebra retroflexa*(34.29) recorded high frequency values (34.29 – 68.57). The lowest frequency values were obtained by *Aristida adscensiois*, *Solanum dubium*, *Sonchus oleraceus* and *Thunbergia annua* (2.86) (Table 7).

Brachiaria eruciformis recorded first rank in AI (158.80), followed by *Eclipta alba* (129.81), *Dinebra retroflexa* (77.26), *Sorghum arundinaceum* (64.42), *Abutilon glaucum* (51.75), *Cynodon dactylon* (44.70), *Aristolochia bracteolate* (43.82) and *Ischaemum afrum* (43.65)(Table 7).

Table1. Weed species in the surveyed area

Weed species	**Family**
Amaranthus viridis L.	Amaranthaceae
Aristolochia bracteolate Lam.	Aristolochiaceae
Aristida adscensiois L.	Poaceae
Abelmoschus esculentus L.	Malvaceae
Abutilon glaucum (Forst.f.) Schlecht.	Malvaceae
Acalypha indica L.	Euphorbiaceae
Brachiaria eruciformis (J. E. Smith) Griseb	Poaceae
Brachiaria reptans L.	Poaceae
Cynotis axillaries	Commelinaceae
Cynodon dactylon (L.) Pers.	Poaceae
Cucumis melo var. *agrestis* Naud.	Cucurbitaceae
Cyperus rotundus L.	Cyperaceae
Corchorus olitorus L.	Tiliaceae

Corchorus fasicularis Lam.	Tiliaceae
Chloris virgata SW.	Poaceae
Cymbopogon nervatus (Hochst) Chioy.	Poaceae
Cadaba rotundifolia Forsk.	Capparidaceae
Celosia argentea L.	Amaranthaceae
Digera muricata (L.) Mart	Amaranthaceae
Dinebra retroflexa (Vahl.) Panzer.	Poaceae
Dichanthium annlatum (Forsk) Stapt.	Poaceae
Datyloctenium aegyptium (L.) Beauv.	Poaceae
Euphorbia aegyptiaca Bioss.	Euphorbiaceae
Eclipta alba (L.) L., Mart.	Asteraceae
Echinocloa colona (L.) Link.	Poaceae
Euphorbia acalyphoidis Hochst. ex Boiss.	Euphorbiaceae
Farsetia longisiliqua Dence.	Brassicaceae
Heliotropium sudanicum F.W. Andr.	Boraginaceae
Indigofera oblongifolia Forsk.	Fabaceae
Ischaemum afrum (J. F. Gmel.) Dandy.	Poaceae
Ipomoea cordofana Choisy.	Convolvulaceae
Leucas urticifolia (Vahl) Benth.	Laminaceae
Leptadenia heterophylla (Del) Dence.	Asclepiadaceae
Momordica balsamina L.	Cucurbitaceae
Merremia emarginata (Burn.f.)Hallier f.	Convolvulaceae
Ocimum basilicum L.	Laminaceae

Oxygonum atriplicifolium (Meisn.) Mart.	Polygonaceae
Phyllanthus maderaspatensis L.	Euphorbiaceae
Phyllanthus niruri L.	Euphorbiaceae
Panicum hygrocharis Steud.	Poaceae
Portulaca oleracea L.	Portulaceae
Portulaca quadrifida L.	Portulaceae
Polygala erioptera DC.	Polyglaceae
Rhynchosia minima var *minima* (L.) DC.	Fabaceae
Rottboellia exaltata L.f.	Poaceae
Sorghum arundinaceum (Desv.) Stapf.	Poaceae
Sonchus cornutus Hochst.exOliv. &Hiern.	Asteraceae
Sonchus oleraceus L.	Asteraceae
Setaria pumila (Poir.) Roem. &Schult.	Poaceae
Solanum dubium Fresen.	Solanaceae
Sesbania sesban (L.) Merr.	Fabaceae
Sinapis arvensis	Brassicaceae
Thunbergia annua Hochst. ex Nees	Acanthaceae
Tribulus terrestris L.	Zygophyllaceae
Xanthium brasilicum Vell.	Asteraceae
Zaleya pentandra (L.) Jeffery.	Aizoaceae

Table 2.Frequency (F), uniformity (U), mean field density (MFD) and abundance index (AI) of weed species at El Salam County

Weed Species	MFD	Frequency	Uniformity	Abundance index
Ipomoea cordofana	2.80	142.86	62.50	208.16
Brachiaria eruciformis	19.11	74.29	32.50	125.90

Momordica balsamina	0.91	65.71	28.75	95.37
Ocimum basilicum	1.89	40.00	17.50	59.39
Corchorus fasicularis	1.23	40.00	17.50	58.73
Leucas urticifolia	2.20	37.14	16.25	55.59
Aristolochia bracteolate	0.48	34.28	15.00	49.76
Euphorbia aegyptiaca	1.26	28.57	12.50	42.33
Dactyloctenium aegyptium	0.57	22.86	10.00	33.43
Dinebra retroflexa	0.40	22.86	10.00	33.26
Thunbergia annua	0.26	22.86	10.00	33.11
Brachiaria reptans	0.60	20.00	8.75	29.35
Phyllanthus maderaspatensis	0.43	20.00	8.75	29.18
Rottboellia exaltata	0.63	17.14	7.50	25.27
Digera muricata	0.46	17.14	7.50	25.10
Euphorbia acalyphoidis	0.31	17.14	7.50	24.96
Polygala erioptera	0.23	17.14	7.50	24.87
Abutilon glaucum	0.20	17.14	7.50	24.84
Panicum hygrocharis	1.20	14.29	6.25	21.74
Phyllanthus niruri	0.17	11.43	5.00	16.60
Corchorus olitorus	0.11	11.43	5.00	16.54
Sonchus cornutus	0.11	11.43	5.00	16.54
Dichanthium annulatum	0.11	8.57	3.75	12.44
Portulaca quadrifida	0.40	5.71	2.50	8.61
Heliotropium sudanicum	0.17	5.71	2.50	8.39
Aristida adscensiois	0.06	5.71	2.50	8.27
Cynotis axillaries	0.06	5.71	2.50	8.27
Xanthium brasilicum	0.09	2.86	1.25	4.19
Acalypha indica	0.06	2.86	1.25	4.16
Cymbopogon nervatus	0.06	2.86	1.25	4.16
Zaleya pentandra	0.06	2.86	1.25	4.16

Table 3.Frequency (F), uniformity (U), mean field density (MFD) and abundance index (AI) of weed species at Kosti County

Weed species	MFD	Frequency	Uniformity	Abundance index
Brachiaria reptans	9.69	62.86	44.00	116.54
Phyllanthus niruri	2.31	42.86	30.00	75.17
Panicum hygrocharis	1.63	42.86	30.00	74.49
Rhynchosia minima	2.34	40.00	28.00	70.34
Ipomoea sinensis sp. *blepharosepala*	4.31	31.43	22.00	57.74

Brachiaria eruciformis	2.34	31.43	22.00	55.77
Momordica balsamina	0.60	31.43	22.00	54.03
Sonchus cornutus	1.00	25.71	18.00	44.71
Cynodon dactylon	4.34	22.86	16.00	43.20
Echinocloa colona	0.37	22.86	16.00	39.23
Indigofera oblongifolia	2.11	20.00	14.00	36.11
Aristolochia bracteolate	0.23	20.00	14.00	34.23
Acalypha indica	0.23	20.00	14.00	34.23
Setaria pumila	0.71	17.14	12.00	29.86
Euphorbia aegyptiaca	0.46	17.14	12.00	29.60
Ipomoea cordofana	0.26	14.29	10.00	24.54
Corchorus fasicularis	0.51	11.43	8.00	19.94
Abelmoschus esculentus	0.11	11.43	8.00	19.54
Rottboellia exaltata	0.11	11.43	8.00	19.54
Sorghum arundinaceum	0.63	8.57	6.00	15.20
Solanum dubium	0.49	8.57	6.00	15.06
Phyllanthus maderaspatensis	0.14	8.57	6.00	14.71
Thunbergia annua	0.14	8.57	6.00	14.71
Digera muricata	0.09	8.57	6.00	14.66
Heliotropium sudanicum	0.09	5.71	4.00	9.80
Corchorus olitorus	0.09	2.86	2.00	4.94
Panicum repens	0.09	2.86	2.00	4.94
Amaranthsus viridis	0.06	2.86	2.00	4.91
Euphorbia acalyphoidis	0.06	2.86	2.00	4.91
Cynotis axillaries	0.03	2.86	2.00	4.89
Tribulus terrestris	0.03	2.86	2.00	4.89

Table 4.Frequency (F), uniformity (U), mean field density (MFD) and abundance index (AI) of weed species at Gebalen County

Weed species	MFD	Frequency	Uniformity	Abundance index
Brachiaria eruciformis	4.23	40.00	35.00	79.23
Ocimum basilicum	2.03	40.00	35.00	77.03
Ipomoea cordofana	1.31	31.43	27.50	60.24
Zaleya pentandra	2.23	28.57	25.00	55.80
Brachiaria reptans	5.89	25.71	22.50	54.10
Momordica balsamina	0.51	28.57	25.00	54.08
Dinebra retroflexa	0.43	25.71	22.50	48.64

Sonchus cornutus	0.57	22.86	20.00	43.43
Ischaemum afrum	0.31	22.86	20.00	43.17
Panicum hygrocharis	0.63	17.14	15.00	32.77
Merremia emarginata	0.31	11.43	10.00	21.74
Xanthium brasilicum	0.20	11.43	10.00	21.63
Leucas urticifolia	0.17	11.43	10.00	21.60
Phyllanthus maderaspatensis	0.14	11.43	10.00	21.57
Rhynchosia minima	0.14	11.43	10.00	21.57
Panicum repens	0.11	11.43	10.00	21.54
Dactyloctenium aegyptium	0.11	8.57	7.50	16.19
Phyllanthus niruri	0.11	8.57	7.50	16.19
Thunbergia annua	0.09	8.57	7.50	16.16
Abutilon glaucum	0.06	5.71	5.00	10.77
Setaria pumila	0.06	5.71	5.00	10.77
Digera muricata	0.09	2.86	2.50	5.44
Portulaca quadrifida	0.09	2.86	2.50	5.44
Aristolochia bracteolate	0.03	2.86	2.50	5.39
Corchorus fasicularis	0.03	2.86	2.50	5.39
Corchorus olitorus	0.03	2.86	2.50	5.39
Chloris virgata	0.03	2.86	2.50	5.39
Dichanthium annulatum	0.03	2.86	2.50	5.39
Euphorbia acalyphoidis	0.03	2.86	2.50	5.39
Eragrostis megastachya	0.03	2.86	2.50	5.39
Solanum dubium	0.03	2.86	2.50	5.39
Sesbania sesban	0.03	2.86	2.50	5.39

Table 5.Frequency (F), uniformity (U), mean field density (MFD) and abundance index (AI) of weed species at Gezira Aba County

Weed species	MFD	Frequency	Uniformity	Abundance index
Momordica balsamina	3.63	31.43	55.00	90.06
Thunbergia annua	1.77	25.71	45.00	72.49
Euphorbia acalyphoidis	1.34	22.86	40.00	64.20
Phyllanthus maderaspatensis	1.23	20.00	35.00	56.23
Xanthium brasilicum	0.71	17.14	30.00	47.86
Abutilon glaucum	0.40	17.14	30.00	47.54
Cyperus rotundus	0.89	11.43	20.00	32.31

Ipomoea cordofana	0.23	11.43	20.00	31.66
Sonchus cornutus	0.23	5.71	10.00	15.94
Sesbania sesban	0.11	5.71	10.00	15.83
Aristolochia bracteolate	0.06	5.71	10.00	15.77
Cucumis melo var. *agrestis*	0.06	5.71	10.00	15.77
Panicum hygrocharis	0.06	5.71	10.00	15.77
Digera muricata	0.09	2.86	5.00	7.94
Portulaca quadrifida	0.06	2.86	5.00	7.91
Solanum dubium	0.06	2.86	5.00	7.91
Setaria pumila	0.06	2.86	5.00	7.91
Heliotropium sudanicum	0.03	2.86	5.00	7.89
Zaleya pentandra	0.03	2.86	5.00	7.89

Table 6.Frequency (F), uniformity (U), mean field density (MFD) and abundance index (AI) of weed species at El Dawium County

Weed species	MFD	Frequency	Uniformity	Abundance index
Ipomoea cordofana	3.26	71.43	41.67	116.35
Zaleya pentandra	6.20	57.14	33.33	96.68
Digera muricata	2.46	42.86	25.00	70.31
Tribulus terrestris	0.91	40.00	23.33	64.25
Ipomoea sinensis sp. *blepharosepala*	3.06	37.14	21.67	61.87
Leucas urticifolia	2.91	37.14	21.67	61.72
Aristolochia bracteolate	0.89	37.14	21.67	59.70
Momordica balsamina	0.57	34.29	20.00	54.86
Brachiaria eruciformis	1.86	31.43	18.33	51.62
Thunbergia annua	5.40	28.57	16.67	50.64
Sonchus cornutus	1.23	28.58	16.66	46.47
Abutilon glaucum	1.20	28.57	16.67	46.44
Panicum hygrocharis	1.49	20.00	11.67	33.15
Xanthium brasilicum	1.11	17.14	10.00	28.26
Cynotis axillaries	3.60	14.29	8.33	26.22
Cadaba rotundifolia	1.29	14.29	8.33	23.90
Corchorus fasicularis	0.43	14.29	8.33	23.05
Setaria pumila	0.43	14.29	8.33	23.05
Sinapsis arvensis	0.34	14.29	8.33	22.96
Rhynchosia minima	0.31	14.29	8.33	22.93
Ocimum basilicum	0.34	11.43	6.67	18.44

Weed species	MFD	Frequency	Uniformity	Abundance index
Farsetia longisiliqua	0.20	11.43	6.67	18.30
Portulaca oleracea	1.69	8.57	5.00	15.26
Sorghum arundinaceum	0.63	8.57	5.00	14.20
Ipomoea cairica	0.57	8.57	5.00	14.14
Portulaca quadrifida	0.20	8.57	5.00	13.77
Acalypha indica	0.17	8.57	5.00	13.74
Cynodon dactylon	0.14	8.57	5.00	13.71
Euphorbia acalyphoidis	0.20	5.71	3.33	9.25
Euphorbia aegyptiaca	0.11	5.71	3.33	9.16
Phyllanthus niruri	0.09	5.71	3.33	9.13
Echinocloa colona	0.06	5.71	3.33	9.10
Solanum dubium	1.49	2.86	1.67	6.01

Table 7. Frequency (F), uniformity (U), mean field density (MFD) and abundance index (AI) of weed species at Um Remta County

Weed species	MFD	Frequency	Uniformity	Abundance index
Brachiaria eruciformis	10.23	68.57	80.00	158.80
Eclipta alba	6.00	57.14	66.67	129.81
Dinebra retroflexa	2.97	34.29	40.00	77.26
Sorghum arundinaceum	2.51	28.57	33.33	64.42
Abutilon glaucum	2.23	22.86	26.67	51.75
Cynodon dactylon	1.37	20.00	23.33	44.70
Aristolochia bracteolate	0.49	20.00	23.33	43.82
Ischaemum afrum	0.31	20.00	23.33	43.65
Phyllanthus niruri	0.29	17.14	20.00	37.43
Cynotis axillaries	2.06	14.29	16.67	33.01
Corchorus fasicularis	0.26	14.29	16.67	31.21
Celosia argentea	0.23	14.29	16.67	31.18
Sinapsis arvensis	0.37	11.43	13.33	25.13
Euphorbia aegyptiaca	0.31	11.43	13.33	25.08
Xanthium brasilicum	0.26	11.43	13.33	25.02
Echinocloa colona	0.17	11.43	13.33	24.93
Panicum repens	0.17	11.43	13.33	24.93
Cyperus rotundus	0.86	8.57	10.00	19.43
Sonchus cornutus	0.17	8.57	10.00	18.74
Rhynchosia minima	0.11	5.71	6.67	12.50
Sesbania sesban	0.06	5.71	6.67	12.44
Sonchus oleraceus	0.29	2.86	3.33	6.48
Aristida adscensiois	0.20	2.86	3.33	6.39

Solanum dubium	0.09	2.86	3.33	6.28
Thunbergia annua	0.09	2.86	3.33	6.28

Discussion

Fifty five species of weeds belonging to 24 families (3 monocotyledons and 21 dicotyledonous) were identified in the surveyed area. *Brachiaria eruciformis*, *Brachiaria reptans*, *Thunbergia annua* and *Ipomoea cordofana* were abundant in most of the surveyed fields.

Ipomoea cordofana had the highest AI values in AlSalam and El Dawium counties, while *Brachiaria eruciformis* recorded the highest value at El Gebalen and Um Remta counties. *Brachiaria reptans* were observed only at Kosti, AlSalam and Gebalen counties with highest value of AI at Kosti County. However, this weed, *Brachiaria reptans,* is the main problematic weed in irrigated fields in the White Nile State and it increases the cost of hand weeding (farmers, personal communications). High AI values of *Zaleya pentandra* was recorded at El Dawium and Gebalen Counties while low AI values of this weed were recorded at AlSalam and Gezira Aba Counties. However this weed was not observed in Um Remta County.

Hamdoun (2006) reported the presence of 64 weed species in irrigated fields of White Nile Sugar Project, were *Panicum hygrocharis*, *Trianthema pentandra*, *Sporobolus humifusus*, *Eragrostis diplachnoides*, *Ipomoea* spp., *Portulaca quadrifida*, *Indigofera oblongifolia* and *Cyperus rotundus* showed the high relative abundance weeds. ElKhawad and Osman (2014) reported that *Sesbania sesban* was the high AI weed at Rera and Sasareb, *Ipomoea cordofana* at Sheik Omer and *Phyllanthus niruri* at Demyat, Debera and ElSedera sectors of the New Halfa Agricultural Scheme fields. In Iran several studies were done on weed flora, Kakhkiet al., (2013) reported the most dominant broadleaved weeds in irrigated wheat fields of Zanjan province were *Polygonum aviculare*, *Galium tricornatum* and *Tragopogon* sp., while the most dominant grassy weeds were *Secale cereale*, *Alopecurus mysuroides*, *Bromus tectorum* and *Poabulbosa*. He also stated that *Convolvulus arvensis*, *Chenopodium album*, *Cardaria draba* and *Cirsium arvense* were most important disturbing plants prior to harvesting.

Hassannejad and Ghafarbi (2012) observed 65 weed species in alfalfa fields of Tabriz- Iran. *Bromus tectorum*, *Crepis sancta*, and *Tragopogon graminifolius* with 30.25, 25.56 and 22.16 Relative Dominance were the most important weeds. Moeini et al., (2008) showed that 87 weed species were observed within irrigated wheat fields in Tehran province. The most important broadleaved weed species were *Descurania sophia*, *Polygonum aviculare*, *Fumari availlantii* Loisel. and *Galium tricornatum*, respectively. Dominant grass weed species were *Avena ludoviciana*, *Hordeum spontaneum* and *Secale cereale*, respectively. *Convolvulus arvensis*, *Cirsium arvense* and *Cardaria draba* were the most widely distributed plants prior to harvesting in irrigated wheat fields of Tehran province, respectively.

High value of MFD of species illustrate it has more competitive ability than other species, while the high value of Frequency and Uniformity characterize its compatibility with the soil and climate conditions (Moeini et al., 2008).

This study provided information about weed flora and abundance in the White Nile State-Sudan and baseline information for future weed surveys, weed management strategies and priorities in weed research for the state.

References

Aldrich, R.J. and Kremer, R. J., 1997.Principles in weed management 2[nd]Edition.Iowa State University Press. USA. Pp. 472.

ElKhawad, M. and Osman, A.S. 2014. Determination of weed flora and abundance index in New Halfa Agricultural Scheme. In: The 3rd Conference on Pests management in Sudan. Agricultural Research Corporation, Wad Medani, Sudan 2014.

FS (2010).Food Security in the White Nile State of Sudan Pp.86

Gulden, R. H. and Shirtliffe, B. M., 2009. Weed Seed Banks: Biology and Management. Pp 7

Gulden, R. H., Harbuck, K. Z. and Shirtliffe, B. M.,2003.Weed Seed Bank Dynamics and Composition.

Hamdoun, A. M. 2006. The vegetation of the White Nile Sugar Project.White Nile Sugar Company, Khartoum- Sudan.Pp 138.

Hassannejad, S. and Ghafarbi, S. P. 2012. Introducing new indices for weed flora studies. International Journal of Agriculture and Crop Sciences. Vol. 4(22):1653-1659.

Kakhki, S. H. N., Moeini, M.M., Nejad, S. H., Jafary, H. and Aleefard, M. 2013. Weed population indices in irrigated wheat fields of Zanjan Province of Iran. Pakistan Journal of Weed Sciences Research, 19(2): 123-156.

Karar R. O., 2003. Studies of the weed ecology of the Gezira scheme, Sudan: an ecological and socio- economic perspective. Ph.D. Thesis. University of Liverpool, Liverpool, UK.

Karar, R. O., Mohamed, B. F. and Marrs, R. H., 2005.Factors influencing the weed flora in the Gezira Scheme, Sudan. Weed Research, 45: 121-129.

Moeini, M., M.A. Baghestani and H. Rahimian., 2008.Introducing abundance index for assessing weed flora in survey studies. Weed Biology. Manage. 8: 172-180.

Mohler, C. L., 2001. Weed life history: identifying vulnerabilities. Pp. 40-98 in M. Liebman, C.L.Parker, V.T. and Fryer, S.L. (2004). Ecology of Soil Seed Banks Academic Press, New York. pp. 3-8.

Radosevich, S. R., Holt, J. and Claudio Ghersa., 1997. Weed ecology: Implications for management. 2ndedition.Wiley& Sons, New York. Pp589.

Rahimian H., 2004. Invasive plants. In: Weed biology and Management (ed. By Inderjit). Kluwer Academic, Dordrecht, the Netherlands. 1-28.

Roush, M. L. and Radosevich, S. R.,1985. Relationships between growth and competitiveness of four annual weeds. Journal of Applied Ecology 22. (3): Pp 895-905.

Sit, A. K., Bhattacharya, M., Sarkar, B. and Aruachalam, V., 2007. Weed floristic composition in palm gardens in plains of Eastern Himalayan region of west Bengal. Current Science. 92. (10). Pp 1434-1439.

Thomas, AG. And Dale,MRT., 1991. Weed survey system used in Saskatchewan for cereal and oil seed crops. Weed Science. 33, 34-43.

WFP, 2006.Sudan Annual Needs Assessment 2006. Food security report, regional overviews and recommendations. A collaborative report of World Food Programme (WFP), the

Food and Agriculture Organization (FAO), Non Governmental Organizations (NGOs), Government of Sudan and Government of Southern Sudan Counterparts. Compiled by WFP Sudan, February 2006.Pp. 93.