Results

1- Geographical distribution

During the present study the distribution of both species in all phytogeographical regions of Egypt has been traced. The results show that:

A- Imperata cylindrica

Imperata was recorded in the following localities. Map (2).

Banks of River Nile system

- *Imperata* is distributed on the canal banks of Upper Egypt from Giza to Assiut on the two sides of El-Ebrahimya canal. Also distributed in the Lower Egypt around the canal banks of River Nile and its branches in all provinces: El kalyoubya, El Sharkhya, El Gharbia, Kafr El Sheikh and El Dakahliya.

-The plant is growing also in the waste lands around the cultivated lands of the River Nile system

Red Sea coastal belt

-The plant has been recorded at Qusseir- Safaga road at 23, 30, 35, 38 km north Qusseir but absent southwards.

Sinai Peninsula

-The plant was recorded at Oyoun Mossa and Ras Suder roads in South Sinai**;** also it was recorded in El Sheikh Zoayed in wide range of farm land around the salt marshes area in North Sinai and in Yameet Colony in the two sides of the road of Rafah**.**

Siwa Oasis

-*Imperata* is widely growing in Siwa Oasis in Khmysa, El-Gari and Meshendet. Particularly on the canal banks.

Bahariya Oasis

- The plant was recorded in Bahariya Oasis beside roads and fresh water tube of El-Managem Factory.

-It was recorded in wide areas growing on sand dunes.

- It was recorded in El- Sheikh Ahmed locality on the canal banks of the cultivated land.

B-*Desmostachya bipinnata*

- *Desmostachya* has been recorded in the following localities as shown in Map (2).

Wadi El-Natrun

- The plant is widely distributed around El Hamra lakes on the sand dunes and in the salt marsh of Wadi El-Natrun.

Nile Region

- *Desmostachya* is a dominant species on the two sides of all Railways from Cairo to Alexandria and from Cairo to Assiut southwards.

- It is distributed in the Lower Egypt around the canal banks of the River Nile and its branches in all provinces: El kalyoubya, El Sharkhya, El Gharbia, Kafr El Sheikh and El Dakahliya.

- The plant is dominant on the canal banks of the River Nile and its canals in Cairo, Giza, southwards, Miny, Assiut, Sohag, and Aswan

Bahariya Oasis

-*Desmostachya* was recorded at El Herra, Segam, El-Managem, El Bouty, Khobala, and El Agoos regions, dominant in the habitat of sand dunes of Bahariya Oasis.

Farafra Oasis

- The plant was recorded inTubble Amoun area, 35 km north Farafra.
- It is recorded also at 48 km in the South of Farafra.

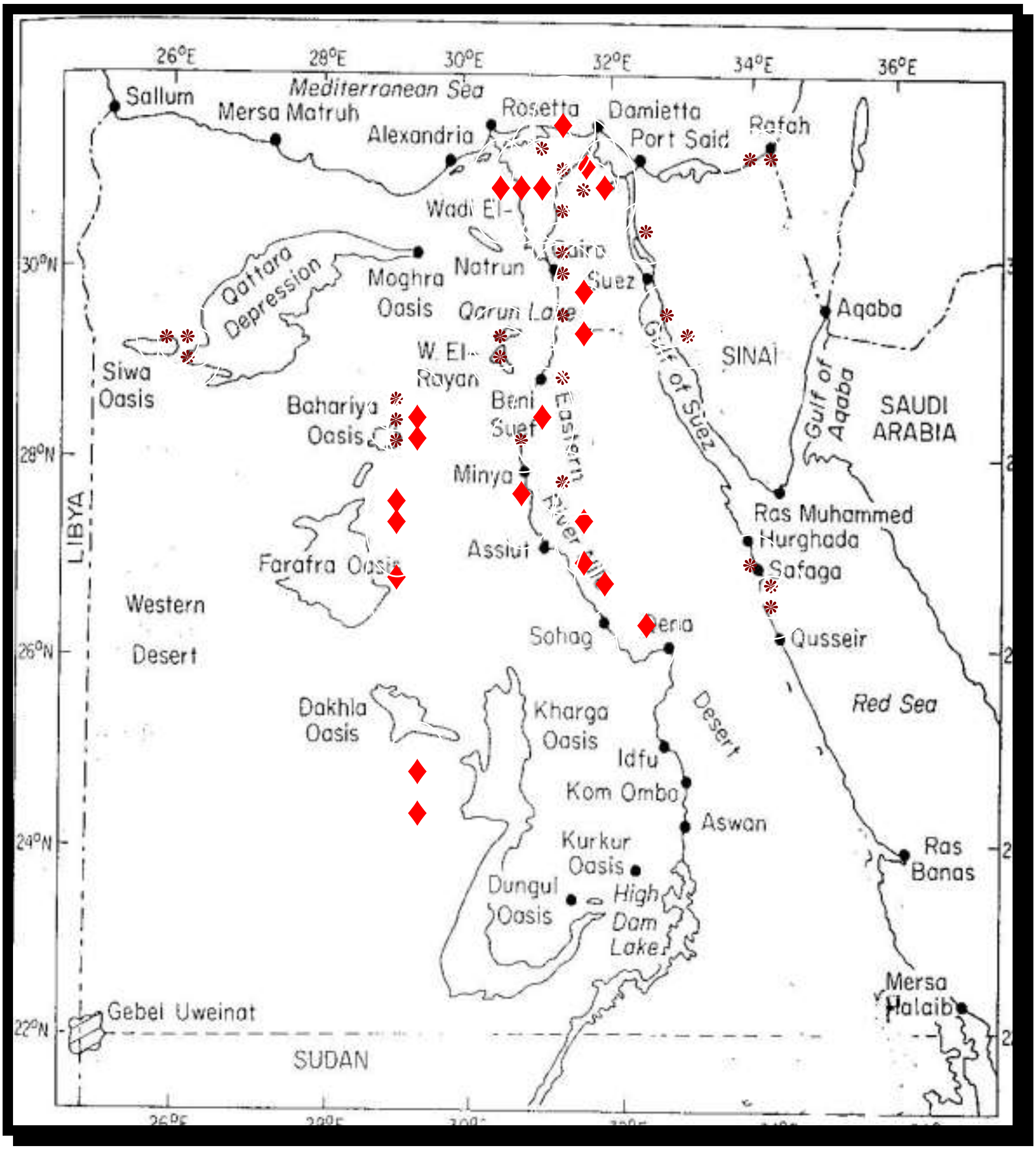
Dakhla Oasis

Desmostachya was recorded at 30 km in the north of Dakhla,

-It was recorded at Bed khallow area, 20 km north Dakhla**.**

Baris Oasis

- *Desmostachya* is distributed in wide areas of Baris Oasis particularly in the wastelands within the cultivated lands at 60 km in the east section of Baris Oasis; it was also recorded at square no16 west of Baris Oasis.



Map (2) Geographical distribution of ⁕ *Imperata cylindrica* and ♦ *Desmostachya bipinnata* in Egypt

2- Vegetation Analysis

2-1 Floristic Composition

The floristic composition of *Imperata cylindrica* and *Desmostachya bipinnata* communities conducted in the different localities of the phytogeographical regions of Egypt are seen in Tables (11-12)

A- *Imperata cylindrica*

The floristic composition of *Imperata* was analyzed in 11 stands, the data obtained are outlined in Table (11), each species has two codes, a number and accompanied abbreviation**.** The number represents the mixed abundance-dominance scale, and the abbreviation symbolizes the growth stage of the species during the time of the study.

Table (11) shows that the number of associated species with *Imperata* in all stands were 14 (2 annual and 12 perennial) belonging to ten different families, these families are Gramineae (*Phragmites australis, Cynodn dactylon* and *Stipagrostis ciliate),* Juncaceae (*Juncus rigidu*s), Leguminosae *(Alhagi graecorum*), Palmae (*Phoenix dactylifera*), Composite (*Conyza stricta* and *Atractylis prolifera*), Umbillifereae (*Eringium criticum*), Solanaceae (*Solanum nigrum*), Resedeaceae (*Reseda alba*),Tamaricaceae (*Tamarix nilotica*) and Zygophyllaceae (*Zygophyllum album* and *Zygophyllum coccineum*). Figure (11) shows the characteristic families associated with the studied plants.

The most common perennial species was *P. australis* which attained presence value of 63.6 %. The least common perennial species was *A. graecorum* and *C. dactylon* with presence value of 36.3 % for each. Table (11) shows that most associated species are flowering in May except perennials. Life forms and chorology of these species are shown in Table (13)

The relation between presence class and the number of species for *Imperata* community type is shown in figure (9). The First class (1-20 %) is represented by ten species; second class (21-40 %) is represented by three species**.** Third class has no species; fourth class (60-80 %) was represented by one species**.** The fifth class was represented by one species (80-100%)

B- *Desmostachya bipinnata*

Nine stands representing *Desmostachya* was analyzed. The localities and types of habitats are summarized in Tables (28-29). The data obtained are incorporated in Table (12) as mentioned before.

Only two species were recorded associated with *Desmostachya* in all stands. One of these species was perennial (*Alhagi graecorum* p = 77%) belonging to leguminosae and the second was annual (*Bassia indica*) attained presence (11.1%) belonging to Chenopodiaceae Figure (11). These two species were recorded green in all locations. Life forms and chorology of these species are shown in table (13)

Figure (10) shows the relationship between presence classes and number of species for *Desmostachya* community type. The first class (1–20%) is represented by one species (*Bassia indica*). Second and fourth classes have no species. Third class (60-80%) was represented by *Alhagi graecorum*. Fifth class (81–100%) is a pure community of *Desmostachya*.

Table (3) Floristic composition of 11 stands representing *Imperata cylindrica* community at different studied localities in Egypt (All the names of species are checked according to **Boulos 1999, 2000, 2002& 2005**)

Species	Life Form	**Stand No.**											**Presence %**
		1 May 2003	2 May 2003	3 June 2003	4 June 2003	5 June 2003	6 June 2003	7 Oct. 2003	8 Oct. 2003	9 Oct. 2003	10 April 2004	11 April 2004	
I. cylinrica L. Beauv	Per	5fr	5fr	5sd	5sd	5sd	5sd	5g	5g	5g	5fl	5fl	100
Phragmites australis (Cav.) Trin.ex Steud.	Per	-	4fr	4sd	-	4sd	-	4g	4g	4g	-	4fl	63.60
Cynodn dactylon (L.) pers.	Per	-	-	-	-	2sd	-	2g	2g	2g	-	-	36.30
Alhagi graecorum Boiss.	Per	-	-	-	-	-	-	2g	2g	2g	-	2fl	36.30
Juncus rigidus Desf.	Per	-	2fr	-	-	-	-	2g	2g	-	-	-	27.2 5
Zygophyllum coccineum L.	Per	2fl	-	-	-	-	-	-	-	-	-	-	9
Tamarix nilotica (Ehrenb.) Bunge	Per	2fl	-	-	-	-	-	-	-	-	-	-	9
Resida alba L.	Ann	3g	-	-	-	-	-	-	-	-	-	-	9
Zygophyllum album L.F.	Per	2fl	-	-	-	-	-	-	-	-	-	-	9
Conyza stricta Willd.	Per	-	-	4fr	-	-	-	-	-	-	-	-	9
Solanum nigrum L.	Ann	-	-	-	-	1fr	-	-	-	-	-	-	9
Stipagrostis ciliata (Desf.) de Winter	Per	-	-	-	-	-	2fr	-	-	-	-	-	9
Atractylis prolifera Boiss.	Per	-	-	-	-	-	1g	-	-	-	-	-	9
Eryngium creticum Lam.	Per	-	-	-	-	-	-	1g	-	-	-	-	9
Phoenix dactylifera L.	Per	-	-	-	-	-	-	-	1fr	-	-	-	9

Table (4) Floristic composition of 9 stands representing *Desmostachya bipinnata* community at different studied localities in Egypt (All the names of species are checked according to Boulos **1999, 2000, 2002& 2005)**

Species	Life form	Stand No.									Presence %
		1 Oct. 2003	2 Oct. 2003	3 Oct. 2003	4 April 2004	5 August 2004	6 August 2004	7 Sep. 2004	8 Sep. 2004	9 Sep. 2004	
D. bipinnata L. Stapf	Per	5sd	5sd	5sd	5g	5fl	5fl	5fr	5fr	5fr	100%
Alhagi graecorum Boiss.	Per	2g	2g	-	-	1g	2g	2g	1g	2g	77 %
Bassia indica (Wight)	Ann	1g	-	-	-	-	-	-	-	-	11.1 %

Per = perennial
Ann. = Annuals

g = green
Fl = flowering
Fr = fruiting
SD = seed dispersal

- = absent
1 = rare
2 = occasional
3 = common
4 = abundant
5 = Dominant

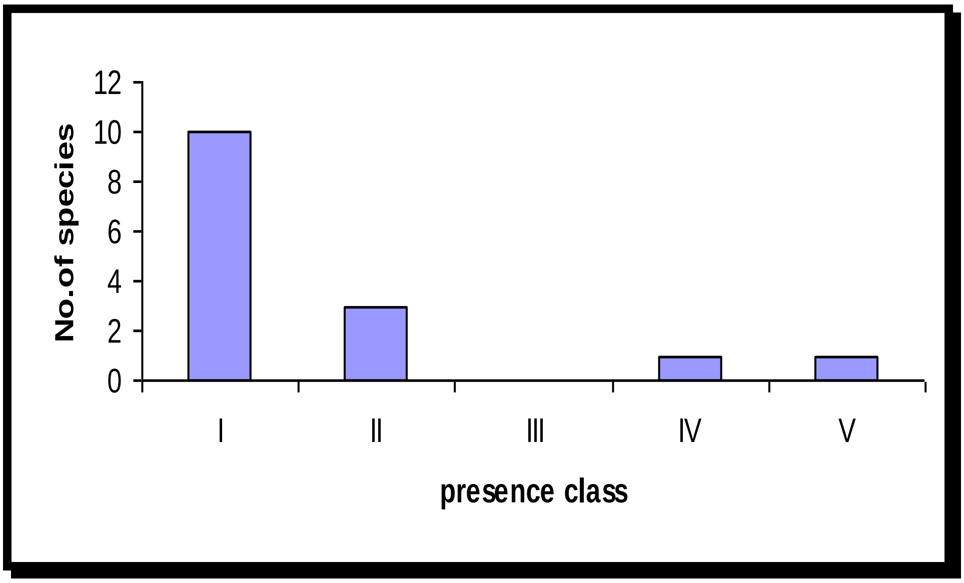


Figure (9) Presence histogram for *Imperata* community type

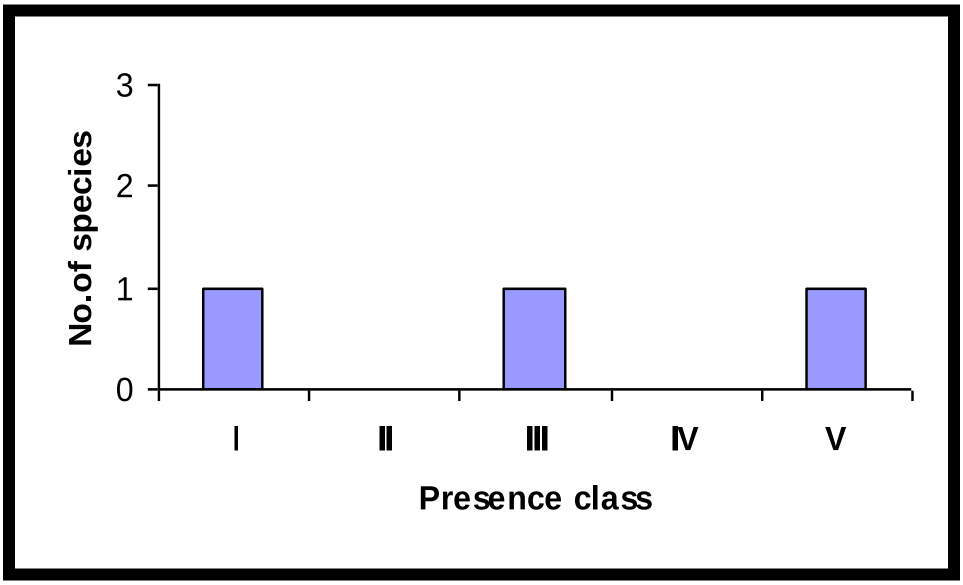


Figure (10) Presence histogram for *Desmostachya* community type

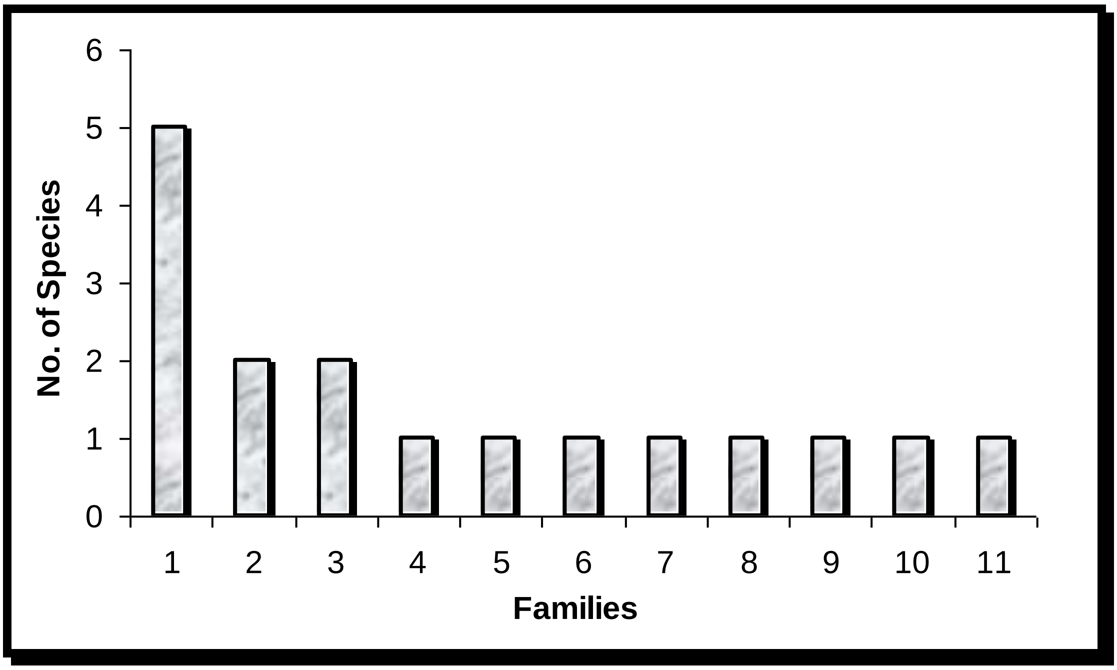


Figure (11) Characteristic families associated with the study plants
1= Gramineae 2=Composite 3= Zygophyllaceae 4= Palmae
5= Chenopodiaceae 6= Solanaceae 7= Umbelliferae 8= Resedeaceae
9= Leguminosaea 10= Tamaricaceae 11= Juncaceae

Table (5) Characteristic families, chorology and life forms of *Imperata* and *Desmostachya* and their associate species (Life forms according to **Raunkiaer, 1928&1934)**

Species	Family	Chorology	Life forms
Imperata cylindrica	Gramineae	Med., Saharo-Arabian, Irano-Turanian	Geophyte
Desmostachya bipinnata	Gramineae	Sudano-zambezian, Saharo-Sindian	Geophyte
Phragmites australis	Gramineae	Med., Saharo-Arabian, Irano-Turanian	Helophyte
Cynodn dactylon	Gramineae	Med., Saharo-Arabian, Irano-Turanian	Geophyte
Alhagi graecorum	Leguminosaeae	Med., Irano-Turanian	Hemicryptophyte
Juncus rigidus	Juncaceae	Med., Irano-Turanian	Rushes
Zygophyllum coccineum	Zygophyllaceae	Saharo-Arabian	Therophyte
Tamarix nilotica	Tamaricaceae	Saharo-Arabian	Phanerophyte
Resida alba	Resedaceae	Med., Irano-Turanian	Therophyte
Zygophyllum album	Zygophyllaceae	Saharo-Arabian	Therophyte
Conyza stricta	Composite	Saharo-Arabian	Therophyte
Solanum nigrum	Solanaceae	Euro-Siberian, Med, Irano-Turanian	Therophyte
Stipagrostis ciliata	Gramineae	Saharo-Arabian	Geophyte
Atractylis prolifera	Composite	Med., Saharo-Arabian	Therophyte
Eryngium creticum	Umbellifereae	Saharo-Arabian	Chaemophyte
Phoenix dactylifera	Palmae	Saharo-Arabian, Sudania	Phanerophyte
Bassia indica	Chenopodiaceae	Saharo-Arabian, Irano-Turanian	Therophyte

2-2 Vegetation Classification

A- *Imperata cylindrica*

Fourteen associated species were recorded in the eleven studied stands representing the 11 localities dominated by *Imperata cylindrica* The application of TWINSPAN classification on the importance value of the recorded 15 species including the dominant species in 11 stands led to the recognition of three groups (Fig.12).The importance value of the different species in different groups are presented in Table (14).Each group comprises a set of stands with greater homogeneity of vegetation.

Group A. This group comprises one stand in sand depression of the Red Sea coastal belt habitat. The dominant species is *I. cylindrica*, which attained the highest IV of 144.8. The indicator species are *Cynodn dactylon* and *Alhagi graecorum.* The most abundant species are *Zygophyllum coccineum* (IV= 42.79) and *Reseda alba* (IV= 70.52). Other associated species is *Tamarix nilotica* (IV = 39.5).

Group B. Vegetation of this group was recorded in four studied stands. The dominant species is *Imperata* with mean IV of 267.9. The indicator species was *Phragmites australis* (IV = 37.32). *Conyza stricta*, *Atractylis prolifera* and *Stipagrostis ciliata* were recorded as occasionally species with mean IV of 85.74, 3.36 and 1.87, respectively.

Group C. This group includes six stands dominated by *Imperata* The indicator species was *Phragmites australis* .The common species are *Juncus rigidus* (IV= 43.13).*Phoenix dactylifera* and *Eringium criticum* are occasionally present and attained IV of 4.96 and 27.42, respectively. The most abundant species are *Cynodn dactylon*

(IV=23.96) and *Zygophyllum album* (IV=57.43). This group is characterized by acidic soil reaction.

Canonical Correspondence Analysis (CCA) is applied for the 15 species recorded in 11 stands dominated by *Imperata cylindrica* As shown in Figure (13), the CCA ordination of stands demonstrates that the vegetation groups produced by TWINSPAN classification are markedly distinguished with a clear pattern of segregation on the ordination plane. Group **A** comprises one stand located in the habitat of the Red Sea coastal sand plains. Group **B** has four stands dominated by *Imperata*, while group **C** contains six stands.

B- *Desmostachya bipinnata*

Three species were recorded in the studied nine stands dominated by *Desmostachya* The application of TWINSPAN classification on the importance value of the recorded 3 species in 9 stands led to the recognition of three groups (Fig.14).The importance value of the different species in different groups are presented in Table (15). Each group comprises a set of stands with greater homogeneity of vegetation.

Group A. One stand is included in this group dominated by *Desmostachya* attained IV of 269.1. The indicator species was *Bassia indica* (IV= 24.19). This group is characterized by sandy soil and high electrical conductivity.

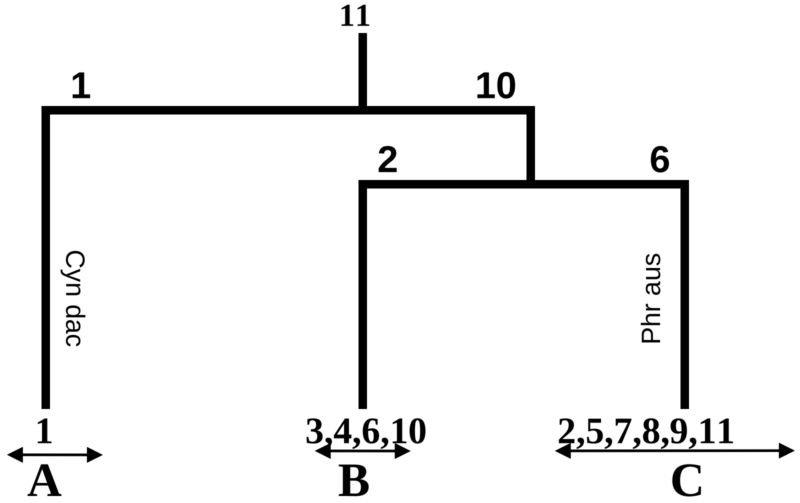
Group B. This group comprises two stands dominated by *Desmostachya* (IV= 300). The indicator species was *Alhagi graecorum.*

Group C. Vegetation of this group was recorded in six stands dominated by *Desmostachya* attained IV of 260.4. The indicator species was *Alhagi graecorum* (IV= 39.3). The habitat of this stands was characterized by medium level of electrical conductivity.

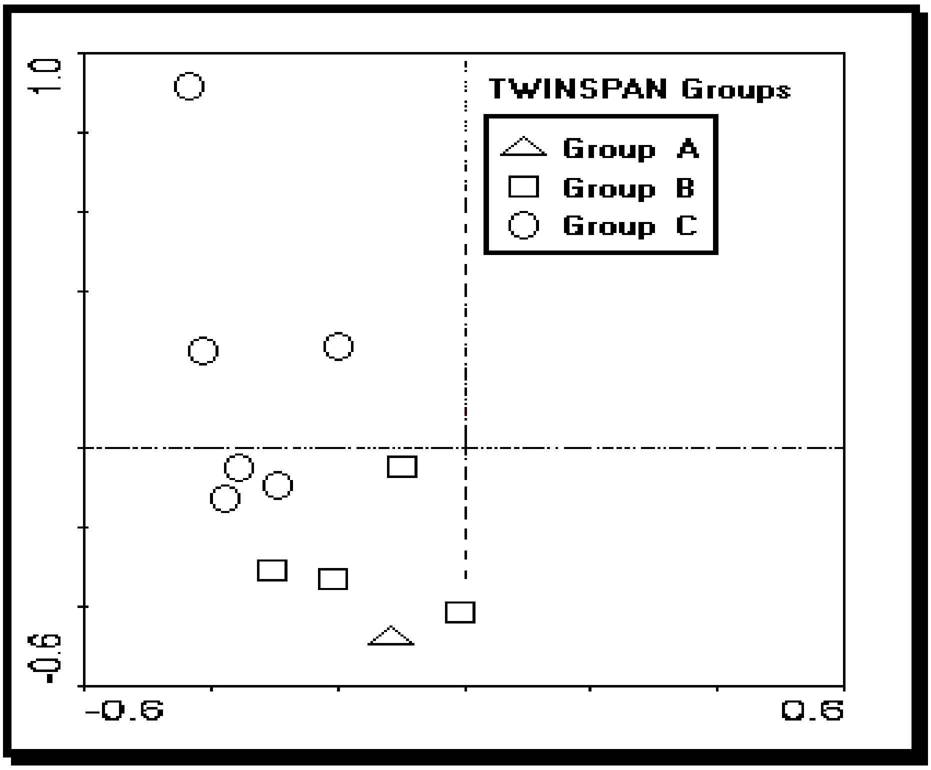
Canonical correspondence Analysis (CCA) was applied for the 3 species recorded in 9 stands dominated by *Desmostachya*. As shown in Figure (15), the CCA ordination of stands demonstrates that the vegetation groups produced by TWINSPAN classification are markedly distinguished with clear patterns of segregation on the ordination plane. Group **A** comprises one stand located at Wadi El-Natrun. Group **B** has two stands dominated by *Desmostachya*, while group **C** contains six stands.

Table (6) Mean and standard deviation of importance value for groups resulting from TWINSPAN classification for *Imperata cylindrica*

Species	Classification groups		
	A	B	C
Imperata cylindrica	144.8	267.9 ± **60.70**	165 ± **51.23**
Zygophyllum coccineum	42.79	-	-
Tamarix nilotica	39.51	-	-
Reseda alba	70.52	-	-
Zygophyllum album	-	-	57.43
Phragmites australis	-	37.32	61.84 ± **22.93**
Juncus rigidus	-	-	43.13 ± **58.95**
Conyza stricta	-	85.74	-
Cynodn dactylon	-	-	23.96 ± **26.42**
Solanum nigrum	-	-	-
Stipagrostis ciliate	-	1.87	-
Alhgi graecorum	-	-	29.68 ± **0.58**
Atractylis prolifera	-	3.36	-
Erynguim criticum	-	-	27.42
Phoenix dactylifera	-	-	4.96



Figure(12) Vegetation dendogram of stands dominated by *Imperata cylindrica* based on importance value of the species

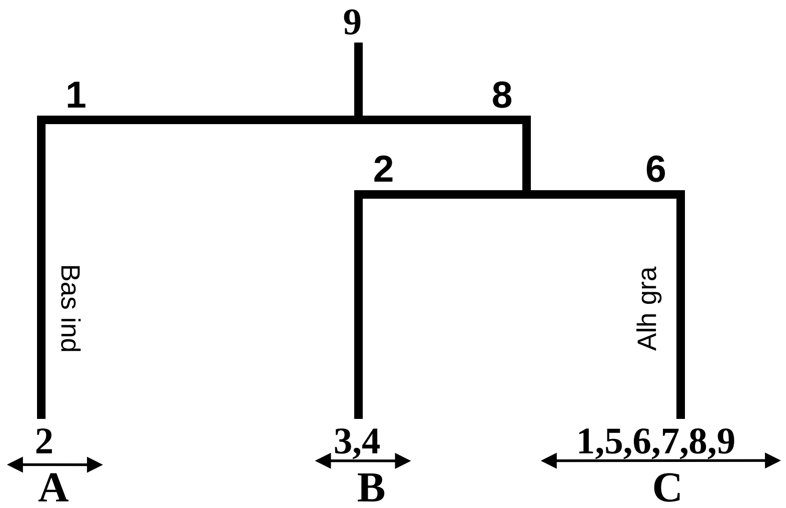


CCA axis 1

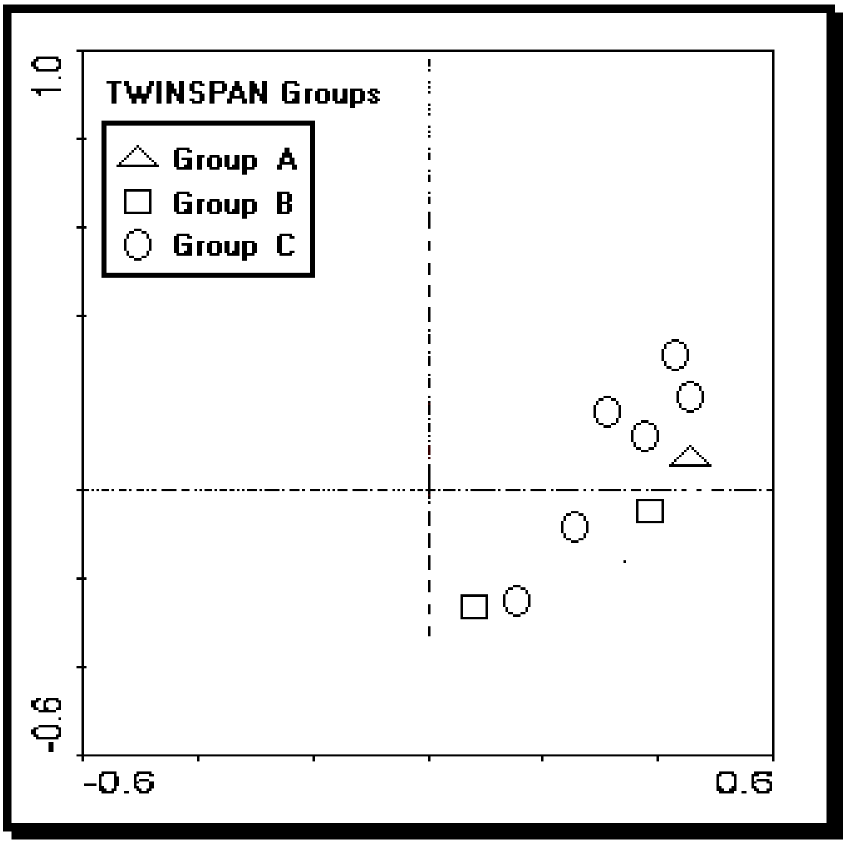
Figure (13) CCA ordination of 11 stands dominated by *Imperata cylindrica* with the identified groups (A–C)

Table (7) Mean and standard deviation of importance value for groups resulting from TWINSPAN classification for *Desmostachya bipinnata*

Species	Classification groups		
	A	B	C
Desmostachya bipinnata	269.1	300	260.4 **± 14.64**
Alhagi graecorum	6.58	-	39.3 **± 14.76**
Bassis indica	24.19	-	-



Figure(14) Vegetation dendogram of stands dominated by *Desmostachya bipinnata* based on importance value of the species



CCA axis 1

Figure (15) CCA ordination of 9 stands dominated by *Desmostachya bipinnata* with the identified groups (A–C)

2-3 Biomass (gm /m²)

Biomass is represented by the total oven dry weight of the plant.

A- *Imperata cylindrica*

Table (16) and Figure (16) showing that the fresh weight and the biomass for eleven stands dominated by *Imperata cylindrica* in different habitats of Egypt**.** The highest value of the fresh weight was recorded in stand 9 (998.9gm/m²) at Siwa Oasis (Reed swamp) and the highest value of the biomass was 534.1 gm/m² in the same stand. The lowest value of the fresh weight was recorded in stand 6 (194.4 gm/m²) at Yameet in north Sinai (undulated soil); while the lowest value of biomass was 113.4 gm/m². Siwa Oasis has medium values of fresh weight in stands 7 and 8 (653.3 and 513.7 gm/m², respectively), while the biomass is attained also medium values in Siwa Oasis at the same stands (498.6 and 520.3 gm/m², respectively). The habitats of sand plains have relatively low values of fresh weight and biomass; stands 3 and 10 have 213.3 gm/m² and 215.5 gm/m² of fresh weight, while the biomass values were 173.4 and 360.7 gm/m², respectively.

B- *Desmostachya bipinnata*

Table (17) and Figure (17) showing that the fresh weight and the biomass for nine stands dominated by *Desmostachya* in different habitats of Egypt**.** The highest value of the fresh weight was recorded in stand 2 (735.6 gm) at Wadi El-Natrun (sand formation around asalt marsh) and the highest value of the biomass was 636.1 gm/m² in the same stand. The lowest value of the fresh weight was recorded in stand 7 (137.2.4 gm) at Farafra Oasis in the Western Desert (sand dunes), while the lowest value of biomass was 79 gm/m² in stand 6 at Bahariya Oasis. Stands 4, 5 and 9 attained medium values of fresh weight (486.2, 435.6 and 418 gm/m², respectively), while the values of the biomass were 116.5, 127.5 and 112.3, respectively.

Table (8) Fresh weight and biomass (dry weight) of *Imperata cylindrica* in different habitats of Egypt

Stand	Habitat	Fresh weight *gm/m²*	Biomassg *gm/m²*
1	Sand plain	413.4	301.2
2	Sand plain	536.2	480
3	Salt sand depression	213.3	173.4
4	Undulated soil	352.7	252.6
5	Sand formations around salt marsh	396.6	293.6
6	Undulated soil	194.4	113.4
7	Reed swamp	653.3	498.6
8	Salt marsh	513.7	520.3
9	Reed swamp	998.9	534.1
10	Sand formation beside road	215.5	360.7
11	Gravel soil around salt marsh	410.9	280.6

Table (9) Fresh weight and biomass (dry weight) of *Desmostachya bipinnata* in different habitats of Egypt

Stands	Habitats	Fresh weight ***gm/m²***	Bio mass *gm/m²*
1	Sandy soil	680.1	621.4
2	Sand formation around salt marsh	735.6	636.1
3	Loamy soil adjacent to fresh water canal	650	598.1
4	Sand dunes	486.2	116.5
5	Sand dunes	435.6	127.5
6	Sand dunes	513.8	79
7	Sand dunes	137.2	189.4
8	On clay soil of irrigation canal	717.8	360.2
9	Gravel soil beside real way	418	112.3

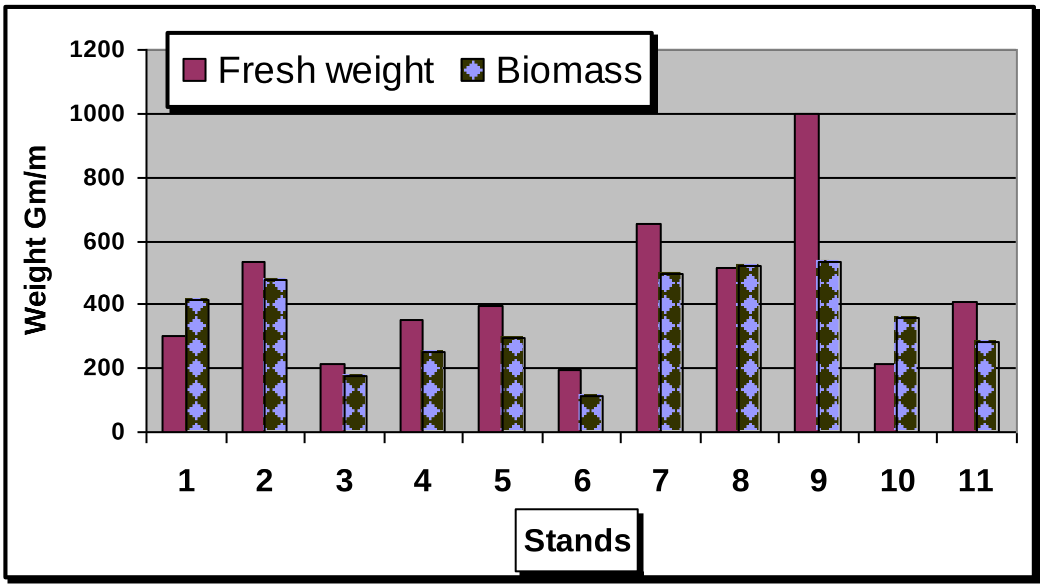


Figure (16) Fresh weight and biomass of *Imperata cylindrica* in different habitats of Egypt

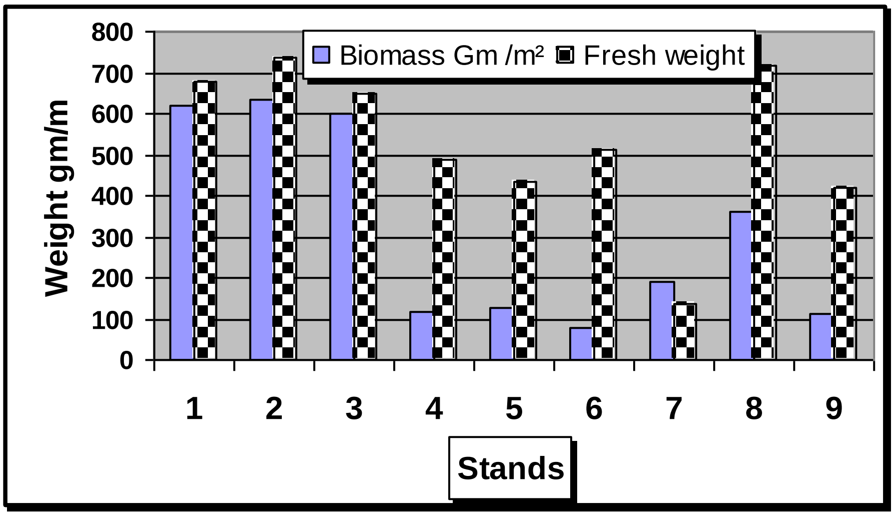


Figure (17) Fresh weight and biomass of *Desmostachya bipinnata* in different habitats of Egypt

2-4 Ecological Relationship

Canonical corresponding analysis (CCA) is used to recognize the relationship between the species composition and underlying environmental factors. Studied species exhibit wide and narrow distribution affected by the variations of the edaphic factors. The correlation between the vegetation and soil characteristics is indicated on the ordination diagram produced by CCA of the stands and the centroides of species-soil relationship. The edaphic characteristic with long arrows is most strongly correlated with the ordination than those with short arrows**.** The direction of these arrows provides an indication, by dropping a perpendicular to an arrow from each species-point**.**

Figure (18) shows that for sand arrow, group B scores the highest values for this variable including *Imperata cylindrica* (dominant species), *Stipagrostis ciliate* and *Reseda alba***.** Species in group **A** such as *Conyza stricta* and *Tamarix nilotica* have mild values. For moisture content and calcium carbonate arrows, group **C** dominated by *Imperata* score higher values including *Solanum nigrum* and *Phragmites australis*, while group **B** score mild value. For silt and organic carbon arrow, group **A*** scores higher values including *Desmostachya bipinnata* (dominant species) and *Bassia indica*. Group **B*** score higher value for PH and potassium arrows, while group **C*** scores higher values of chloride and sulphate including *Alhagi graecorum*. Calcium, magnesium, sodium and gravel arrows are low values for groups dominated by *Imperata*.

From the last data and the biplot ordination diagram produced by **CCA** the most effective environmental factor upon the distribution of groups dominated by *Imperata* is sand factor but groups dominated by *Desmostachya* were more affected by silt and organic carbon contents

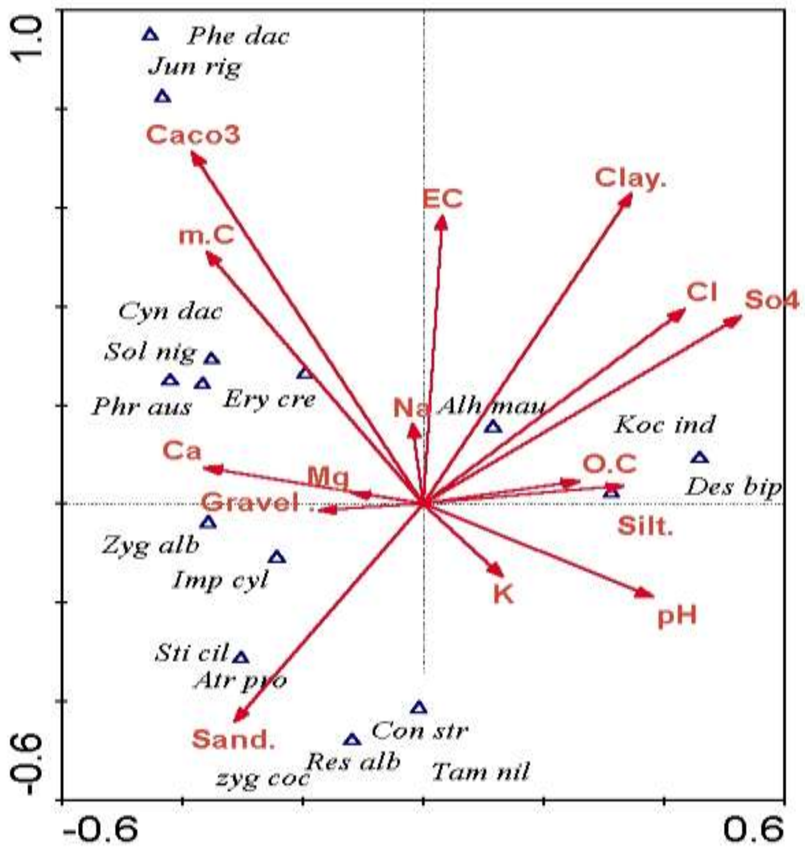


Figure (18) CCA – biplot of studied plant communities in different locations of Egypt and the different soil variables are represented by arrows

Groups (A – B - C) represent ***Imperata cylindrica***
Groups (A* - B* - C*) represent ***Desmostachya bipinnata***

3- Soil Characteristics

A- *Imperata cylindrica*

The physical and chemical soil characteristics in the stands representing the different vegetation groups dominated by *Imperata* are illustrated in Tables (10&11), while data is presented in appendix 2.

Soil physical analysis

The mechanical analysis of the soil samples for the vegetation groups showed variations between these groups.

Gravel. The highest mean value of gravel particles is found in the soil representing group **A** with mean value 30.3 %. Soils supporting group **B** and **C** have relatively low mean values of 13.65 and 11.75, respectively.

Sand. The soil supporting group **B** has the highest mean value of sand with mean value 81.12 %. The lowest mean value was recorded in soils supporting group **A** being 54.9 %. Group **C** has intermediate mean value of 60.58 %.

***Clay*.** Table (10) show that the highest mean value of soil clay content was found in stands representing group **C** with mean value of 18.28 %**.** Groups **A** and **B** have remarkably lower mean values: 7.8 and 7.07%, respectively.

Silt. Group **B** has the highest mean value (14.72 %), while group **A** and **C** have lower mean values 7 and 9.35 %, respectively.

Moisture contents. The highest mean value of soil moistures content was 12.83 % in stands representing group **C.** Group **B** has the lowest mean value of 2.9 %. Soils supporting group **A** has the intermediate mean value of 5.18 %.

Soil chemical analysis

PH value. The soil extract of the different habitats is generally alkaline in their reactions with a narrow range of variations. Group **A** has the highest pH value of 7.7. Group **B** recorded 7.62, while group **C** has acidic reaction of 6.41.

Electrical conductivity (EC). The highest mean value of EC was found in stands representing group **C** with mean value of 24.73 mmohs/cm, while the lower mean value were recorded in group **A** and **B** of 3.1 and 1.76 mmohs/cm., respectively.

Calcium content (Ca^{++}). The highest mean value of calcium content was recorded in group **C** (48.4 m.eq. /l.). Group **A** has the lowest mean value of 22.5 m.eq. /l. Intermediate mean value were recorded in group **B** (30.6 m.eq. /l.).

Magnesium content (Mg^{+2}). The highest mean value of magnesium was attained in group **C** (19.51 m.eq. /l**).** Group **B** has the lowest mean value of 9.62 m.eq. /l**.**

Sodium content (Na^{+}). Group **C** has the highest mean value of 43.21 m.eq./l, while group **B** has attained the lowest mean value of 18 m.eq./l. Intermediate mean value was recorded in group **A** (21.73 m.eq./l.).

Potassium content (K^{+}). Potassium content attained the highest mean value in group **A** 1.48 m.eq./l, while the lowest mean value was recorded in group **B** (0.97 m.eq./l.).

Chloride content (Cl^-). Group **C** has the highest mean value of chloride content (93.6 m.eq. /l), while group **A** has the lowest mean value (14 m.eq./l). Group **B** attained an intermediate value (34 m.eq. /l).

Sulplate content ($SO4^{-2}$). Group **C** has the highest mean value of sulphate content (39.18 m.eq. /l), while group **A** attained the lowest mean value (0.12 m.eq. /l). Group **B** showed an intermediate value (12.81 m.eq. /l).

Organic Carbon.(O.C). Group **B** was attained the highest mean value (1.27 %), while group **A** showed the lowest mean value of organic carbon (0.9 %). Organic carbon of group **C** was in between (1.07 %).

Calcium carbonate (CaCO3). Table (10) shows clearly variations between groups that Group **C** has the highest mean value of calcium carbonate content (11.3 %), while the lowest mean value was recorded in group **B** (4.08 %). Group **A** has an intermediate value of 5.18 %**.**

The correlation coefficient (r) between the different soil variable in the sampled stands is shown in Table (11). Most variables are positively correlated except magnesium, organic carbon; pH, silt, sand and gravel were negatively correlated. Several edaphic variables are significantly correlated with each other where EC, pH and clay show high significant Sodium, moisture content, Calcium carbonate, chloride and organic carbon show limited significant correlation with other edaphic variables. Potassium, sand, silt, sulphate and calcium show low significant correlation, while magnesium and gravel show no significant correlation**.**

Table (10) Mean and Standard deviations of physical and chemical analysis of classification groups for soils of *Imperata cylindrica*

Habitat		Classification Groups A	B	C
No. of species		4	5	9
% of species		23.5	29	52.9
No. of stand		1	4	6
% of stand		5	20	30
Physical properties				
Soil fractions %	Gravel %	30.3	13.65 ± 10.69	11.75 ± 15.16
	Sand %	54.9	81.12 ± 12.65	60.58 ± 13.84
	Clay %	7.8	7.07 ± 3.06	18.28 ± 9.98
	Silt %	7	14.72 ± 6.43	9.35 ± 8.74
M.C %		5.18	5.18	12.83 ± 8.22
Chemical properties				
pH		7.7	7.62 ± 0.59	6.41 ± 1.91
EC mmohs		3.1	1.76 ± 1.78	24.73 ± 24.22
O.C %		0.9	1.27 ± 0.36	1.07 ± 0.34
CaCO3 %		5.25	4.08 ± 1.55	11.3 ± 11.63
Cations m.eq./l	Ca^{++}	22.5	30.6 ± 30.37	48.4 ± 14.07
	Mg^{++}	17.6	9.62 ± 5.53	19.51 ± 12.28
	Na^{+}	21.73	18 ± 13.99	43.21 ± 37.50
	K^{+}	1.48	0.97 ± 0.76	1.27 ± 0.66
Anions m.eq./l	Cl^{-}	14	34 ± 42.21	93.6 ± 44.17
	SO_4^{--}	0.12	12.81 ± 22.53	39.18 ± 32.03

Table (11) Pearson-moment correlation (r) between the different soil variables for *Imperata cylindrica*

	Gravel %	*Sand %*	*Clay %*	*Silt %*	*M.C %*	*PH*	*EC mmohs*	*O.C %*	*CaCO3 %*	*Ca++*	*Mg++*	*Na+*	*K+*	*Cl-*	*So4—*
Gravel %	1														
Sand %	-0.595	1													
Clay %	-0.529	-0.365	1												
Silt %	-0.668	0.995**	-0.276	1											
M.C %	-0.385	-0.511	0.986*	-0.428	1										
PH	0.622	0.257	0.993**	0.165	-0.962*	1									
EC mohs	-0.535	-0.359	0.999**	-0.27	0.985*	-0.994*	1								
O.C %	-0.787	0.963*	-0.104	0.984*	-0.264	-0.008	-0.098	1							
CaCO3 %	-0.448	-0.45	0.995**	-0.365	0.997**	-0.978*	0.99**	-0.197	1						
Ca++	-0.8	-0.005	0.932	0.088	0.86*	-0.967*	0.934	0.26	0.895	1					
Mg++	0.244	-0.924	0.692	-0.884	0.8	-0.606	0.687	-0.79	0.756	0.385	1				
Na+	-0.461	-0.438	0.996**	-0.351	0.996**	-0.98*	0.996*	-0.183	0.99**	0.901	0.747	1			
K+	0.752	0.977*	0.159	-0.992**	0.316	-0.0461	0.152	-0.99**	0.25	-0.207	0.822	0.236	1		
Cl-	-0.758	-0.072	0.954*	0.021	0.893	-0.982*	0.956*	0.195	0.922	0.997*	0.446	0.928	-0.141	1	
So4—	-0.808	0.007	0.927	0.101	0.855	-0.964*	0.93	0.273	0.889	0.999**	0.373	0.895	-0.22	0.996**	1

*Correlation is Significant at 0.05
**Correlation is Significant at 0.01

B- ***Desmostachya bipinnata***

The different soil characteristics in the stands representing the different groups dominated by *Desmostachya* are recorded in Tables (12&13), while data is presented in appendix 2.

Soil physical analysis

The mechanical analysis of the soil samples for the vegetation groups showed low variations between these groups.

Gravel. The highest mean value of soil gravel content was found in stands representing group **C** with mean value of 12.07%, followed by group **B** (13.45%). Soils supporting group **A** have the lowest mean value of 3.9 %.

Sand. The soil supporting group **B** has attained the highest mean value of sand (56.8 %). While the lowest mean value was recorded in soils supporting group **A** and **C** which amounted 51.4 % as shown in Table (15).

***Clay*.** Table (12) shows that the highest mean value of soil clay content was found in stands representing group **A** (23.5 %**).** Group **C** has the lowest mean value 19.41%, while group B attained an intermediate mean value (21.65%).

Silt. Groups **A** and **C** have a high mean values of soil silt (21.2 % and 19.41%) respectively, while group **B** showed an intermediate value (8.2 %).

Moisture contents. The highest mean value of soil moisture content is 8.55 % in stands representing group **B.** Group **A** has the lowest mean value of 2.5 %. Soils supporting group **C** has an intermediate mean value of 3.33 %.

Soil chemical analysis

pH value. The soil extract of the different habitats is generally alkaline in their reactions with a narrow range of variations. Group **B** has the highest PH value of 7.7. Group **C** recorded 7.67, while group **A** has the lowest mean value of 7.3.

Electrical conductivity (EC). The highest mean value of E.C was found in stands representing group **A** with mean value 36 mmohs/cm, while the lowest mean value was recorded in group **B** (7.1). Group C has an intermediate value (16.05 mmohs/cm).

Calcium content (Ca^{++}). The highest mean value of Calcium content was recorded in group **C** (27 m.eq./l.). Group **A** has the lowest mean value of 4 m.eq./l. Intermediated mean value were recorded in group **B** (20.5 m.eq./l.).

Magnesium content (Mg^{+2}). The highest mean value of magnesium was in group **A** attained 41 m.eq. /l**.** Group **C** has the lowest mean value of 9.65 m.eq. /l**.** Group B shows intermediate value (11 m.eq. /l***).***

Sodium content (Na^{+}). Group **A** has the highest mean value of 39 m.eq./l, while group **C** attained the lowest mean value of 21.9 m.eq./l. Intermediate mean value was recorded in group **B** (30.4 m.eq./l.).

Potassium content (K^{+}). Potassium content has the highest mean value in group **A** attained 1.95 m.eq./l, while the lowest mean value was recorded in group **C** (1.03 m.eq./l.).Group B attained an intermediate value (1.61 m.eq./l.).

Chloride content (Cl$^-$). Group **A** attained the highest mean value of chloride content (440 m.eq. /l), while group **B** has the lowest mean value (81 m.eq. /l). Group **C** recorded with an intermediate value (153.9 m.eq. /l).

Sulplate content (So4^{-2}). Group **C** has the highest mean value (97.8 m.eq. /l), while group **B** attained the lowest mean value of 60.3 m.eq. /l. Group **A** has an intermediate value (69 m.eq. /l).

Organic Carbon.* (O.C*). Group **B** was the highest mean value (1.7 %), while group **A** attained the lowest mean value of 0.96 %. Group **C** has a comparable value of Group **B** (1.24%).

***Calcium carbonate* (CaCO3).** Table (12) shows low variations between groups that Group **C** has the highest mean value of calcium carbonate content (4.23 %), while the lowest mean value was recorded in group **B** (3.05 %). Group **A** attained an intermediate value of 3.5 %.

The correlation coefficient (r) between the different soil variable in the sampled stands is shown in Table (13). Most variables are positively correlated except sulphate, sodium, organic carbon; moisture content, clay, sand and magnesium were negatively correlated. The test of significance at two levels (0.01 and 0.05df) was detected. Gravel, clay, ph, Calcium, Magnesium and chloride show significant correlation, while sand, organic carbon, moisture content, Electrical conductivity, calcium carbonate, sodium and potassium show low significant correlation**.**

Table (12) Mean and Standard deviations of physical and chemical analysis of classification groups for soils of *Desmostachya bipinnata*

Habitat		Classification Groups A	B	C
No. of species		3	1	2
% of species		17	5.8	11.8
No. of stand		1	2	6
% of stand		5	10	30
Physical properties				
Soil fractions %	Gravel %	3.9	13.45± 15.62	14 ± 12.07
	Sand %	51.4	56.8 ± 22.48	51.45 ± 13.95
	Clay %	23.5	21.65 ± 16.05	19.8 ± 8.83
	Silt %	21.2	8.2 ± 9.05	19.41 ± 11.76
M.C %		2.5	8.55 ± 9.12	3.33 ± 3.89
pH		7.3	7.7 ± 0.28	7.67 ± 0.19
Chemical properties				
EC mmohs/cm		36	7.1 ± 2.68	16.05 ± 13.29
O.C %		0.96	1.7 ± 0.14	1.24 ± 0.51
$CaCO_3$ %		3.5	3.05 ± 0.07	4.23 ± 2.84
Cations m.eq./l	Ca^{++}	4	20.5 ± 24.74	27 ± 18.23
	Mg^{++}	41	11 ± 8.48	9.65 ± 5.28
	Na^{+}	39	30.4 ± 23.47	21.9 ± 14.41
	K^{+}	1.95	1.61 ± 1.11	1.03 ± 0.50
Anions m.eq./l	Cl^{-}	440	81 ± 26.87	153.9 ± 158.78
	SO_4^{--}	69	60.3 ± 12.44	97.8 ± 75.50

Table (13) Pearson-moment correlation (r) between the different soil variables for *D*esmostachya *bipinnata*

Gravel %	1														
Sand %	0.46	1													
Clay %	-0.88	-0.008	1												
Silt %	-0.566	0.992**	0.127	1											
M.C %	0.566	0.992**	-0.126	-1	1										
PH	0.993**	0.563	-0.83	-0.658	0.657	1									
EC mohs	-0.937	-0.743	0.674	0.818	-0.817	-0.971*	1								
O.C %	0.757	0.93	-0.374	0.967*	0.967*	0.827	-0.937	1							
CaCO3	0.183	-0.785	-0.612	0.705	-0.706	0.068	0.17	-0.502	1						
Ca++	0.973*	0.251	-0.969*	-0.364	0.364	0.941	-0.833	0.589	0.402	1					
Mg++	-0.99**	-0.473	0.884	0.575	-0.574	0.994**	0.94	-0.764	-0.173	0.971*	1				
Na+	-0.89	-0.011	0.999**	0.13	-0.129	-0.832	0.676	-0.377	-0.61	-0.97*	0.886	1			
K+	-0.811	0.14	0.988*	-0.022	0.022	-0.738	0.556	-0.232	-0.723	-0.922	0.805	0.988*	1		
Cl-	-0.97*	-0.663	0.753	0.747	-0.747	0.99**	0.993**	-0.891	0.057	-0.891	0.973*	0.756	0.647	1	
So4—	0.341	-0.67	-0.733	0.58	-0.581	0.23	0.007	-0.355	0.986*	0.546	-0.331	-0.731	-0.826	-0.106	1
	Gravel %	*Sand %*	*Clay %*	*Silt %*	*M.C %*	*PH*	*EC mmohs*	*O.C %*	*CaCO3 %*	*Ca++*	*Mg++*	*Na+*	*K+*	*Cl-*	*So4—*

*Correlation is Significant at 0.05
**Correlation is Significant at 0.01

4- Habitat types

The two investigated grasses: *Imperata cylindrica* and *Desmostachya bipinnata* are growing in various habitats distributed in the different phytogeographical regions of Egypt**.** *Imperata* seems to be widely distributed in Egypt as it grows and predominates in three regions, namely: Red Sea coast, Sinai Peninsula and the Western Desert. Table (14) shows that *Imperata* is dominant in stands (1&2) at Qusseir site in salt affected sand formation of the Red Sea Coast (Plate 1)**.** Also, the plant dominates locations of Siwa Oasis (stands 7, 8, and 9) in the reed swamps habitat in Meshended and Khamysa where, in El Gary it grows in the salt marsh habitat (Plate 2)**.** In Yameet (stand 6) and Ras Suder (stand 4) of Sinai, it is abundant in gravel soils. The Western Desert locations are characterized by different sand formation habitats where *Imperata* dominates sand plains beside the central roads in Bahariya Oasis (stand 10) (Plate 3), but in El Sheikh Ahmed (stand 11) it grows well in gravel soils around salt marshes**.** This grass grows well on the canal banks and the undulated farm lands**.**

Desmostachya, on the other hand, dominates in the areas and depressions of the Western Desert as well as on the canal banks of the River Nile region. Table (15) shows that *Desmostachya* is dominant in sandy and gravel soils, around salt marshes in Wadi El-Natrun and sand dunes of El Hamra Lake (stand 1, 2 and 3) (Plate 4), But in Minya city, Nile Valley (stand 9) it predominates in gravel soil adjacent to the railway Plate (5).It is also common in silty soils of Baris Oasis (stand 8)

Generally, from tables (14&15) *Imperata* represents sandy soils but *Desmostachya* grows in silt and clay soils**.**

Table (14) Habitat types of *Imperata cylindrica* in the eleven localities of Egypt (Abundance- dominance Scale according to **Braun-Blanquet, 1964).**

Regions	**Stands**	**locations**	**Habitats**	**Abundance**
Red Sea cast	**1**	53 km north of Qusseir, Red Sea coast	Sandy soil	Common
	2	30 km north of Qusseir, Red Sea Coast	Sandy soil, salt depression	Abundant
Sinai Peninsula	**3**	Oyoun Mossa South of Sinai	Reed Swamp	Abundant
	4	Ras Suder South of Sinai	Gravel soil	Abundant
	5	El-Shaikh Zoayed North Sinai	Sand plains round salt marshes	Dominant
	6	Yameet region North Sinai	Rocky substrates	Common
Western Desert	**7**	Siwa Oasis Meshended	Reed Swamp	Dominant
	8	Siwa Oasis, El Gary	Salt marsh	Dominant
	9	Siwa Oasis Khamysa	Reed Swamp	Dominant
	10	Bahariya El -Bouty	Sand plains beside central road	Dominant
	11	Bahariya, El-Shaikh Ahmed	Gravel soil round salt marsh	Common

Table (15) Habitat types of *Desmostachya bipinnata* in the nine localities of Egypt (Abundance- dominance Scale according to **Braun-Blanquet, 1964).**

Regions	stands	locations	Habitats	Abundant
Western Desert	**1**	Wadi El-Natrun, Elhamra lake	Salt affected Sand dunes	Dominant
	2	Wadi El-Natrun, Elhamra lake	Salt marshes	Dominant
	3	Wadi El-Natrun, Elhamra lake	Loamy-clay soil	Dominant
	4	Bahariya, Segam	Sand dunes	Dominant
	5	Bahariya Oasis, El-Managem	Sand dunes	Dominant
	6	Bahariya Oasis, Tubble Amoun	Sand dunes	Dominant
	7	20 km north of Farafra Oasis	Sand dunes	Dominant
	8	Baris Oasis, 90 km West of kharga Oasis	Loamy-Clay soil	Common
Rivir Nile	**9**	Minya government, Tall El Amarna	Gravel soil	Dominant

Plate (1) *Imperata cylindrica* community in Qusseir, Red Sea Coast

Plate (2) *Imperata cylindrica* community in Siwa Oasis

Plate (3) *Imperata cylindrica* community in Bahariya Oasis

Plate (4) *Desmostachya* community in Wadi El Natrun Depression

plate (5) *Desmostachya bipinnata* community along the rail way in Minya, Nile valley

Plate (6) *Desmostachya bipinnata* community in Bahariya

5- Morphological characteristics

5-1 Morphological Description

A- *Imperata cylindrica*

Roots are adventitious arise from a region close to the base of the leaves and form a basal nodes of the culms. Rhizomes are creeping, long and branching scaly, whitish in colour covered with scales generally it ends with aerial tufts. Culms are formed of a solid part composed of many internodes and hollow part the height of which varies from 50 to 180 cm. Leaves have a prominent midrib with a flat upper surface and concave lower one. The upper parts of midrib become reduced keels. Panicle 3-22 cm, Spikes are cylindrical in shape obscured by the copious silky white hairs from the callus and glumes. Spikelets 3-6 mm. (**El-Hamy, 1957 and Boulos, 2005).**

B- *Desmostachya bipinnata*

Roots are adventitious arise from a region close to the base of the leaves and form a basal nodes of the culm. Rhizomes are creeping and branching a yellowish white in colour, circular in shape and covered with numerous overlapping scales**.** Rhizomes are branching to give tufts of aerial culms which vary in length between 40-120 cm. Each culm consists of internodes leaves are crowded on the basal internodes of the culms; the number of leaves is no more than seven. Inflorescence comprising of numerous racemes up to 50 cm, 1-4 cm. erect or curving outwards from the main axis. Spikelets narrowly ovate to linear-oblong. Glumes unequal. (**El Hamy, 1957** and **Boulos, 2005)**

5-2 Morphological measurements

Tables (16&17) show that there are two groups of different characters in *Imperata cylindrica* group I of stands 1, 2, 3, 4, 5, 6, 10, and 11 with lowest comparable measurements and group (π) of stands 7, 8, and 9 that were located at Siwa Oasis having different characters. This may explain that this grass has several verities. On the other hand, *Desmostachya bipinnata* has no distinct morphological differences.

Details of the morphological parameters are shown below.

A- *Imperata*

Plant Height

Table (16) and figure (19) show that the highest value of height in *Imperata* was recorded in stand 7 (182 cm) at Siwa Oasis, while stand 3 has the lowest value of height (55 cm) at Oyoun Mossa. Stands 1, 2, 6 and 11 have relatively medium values of height (90, 83, 86 and 82 cm, respectively).

Length of culms

Imperata has the highest value of culms length in Siwa Oasis (86-96 cm.), while the lowest value of culms length was recorded in Bahariya Oasis (37 cm.). Stands 4 and 5 at Ras Suder and El-Shaikh Zoayed attained medium values (48 and 43 cm, respectively).

Length of leaves

Table (16) shows that the highest value of leave length for *Imperata* was recorded in Siwa Oasis and ranged between 137 and 152 cm., while the shortest value of leaves was recorded in stand 3 (48 cm.) at Oyoun Mossa. Stands 2, 4, 6 and 11 have medium values of leave length (76, 70, 68 and 71, respectively).

Width of leaves

Stands of Siwa Oasis are characterized among other stands. These stands attained the highest values of leave width (5.7-6.2 mm.), while stands 1 and 6 at Qusseir and Yameet, respectively have the lowest value (3.5 mm).

Length of spike / cm

Stands 7, 8, and 9 at Siwa Oasis showed the highest value of spike length that ranged between (13.5 and 14.5 cm.), while stand (1) at Qusseir had the lowest value of spike length (8cm.).

B- *Desmostachya*

Plant Height

Height was measured from the soil surface to the end of the spikes at the top part of the culms. From Table (17) we can note that the highest values were recorded in stands 2 and 6 (105 and 115 cm.) located in Wadi El-Natrun and Bahariya Oasis, respectively. The shortest value was recorded in stands 1 and 9 (73 cm.) at Wadi El-Natrun and Minya City. The other stands showed medium height ranging between 80 cm in Bahariya Oasis and 89 cm at Baris Oases.

Length of culms

Table (17) shows that the highest value of culms length were recorded in Wadi El-Natrun (53- 70 cm); while stand 7 at Farafra Oasis had the lowest value (33 cm.) The other stands have a comparable value of culms length that ranged between 35-47 cm.

Length of leaves

The data in Table (17) show that, all values of leave length for *Desmostachya* are comparable. The highest value of leave length was recorded in stand 2 at Wadi El-Natrun 84 cm. while stand 9 has the lowest value of leave length (39 cm.) at Minya. Stands 4, 5, 6, 7, and 8 attained medium values (49, 58, 56, 48 and 51, respectively).

Width of leaves

Table (17) show that width of leaves in *Desmostachya* varied between the highest value of 5.2 mm. at Baris Oasis and the lowest value of 3.2 mm. at Bahariya Oasis, while the other stands attained medium values.

Length of spike / cm

Table (17) shows that stand 5 and 7 have the highest values of spike length 45 and 46cm, respectively. Stand 1 has the lowest value of spike length 32 cm, while the other stands attained comparable values.

Number of leaves / culm

The numbers of leaves per culm are comparable in *Imperata* and *Desmostachya* in all stands. This number is no more than seven but in Siwa Oasis eight leaves per culm were recorded.

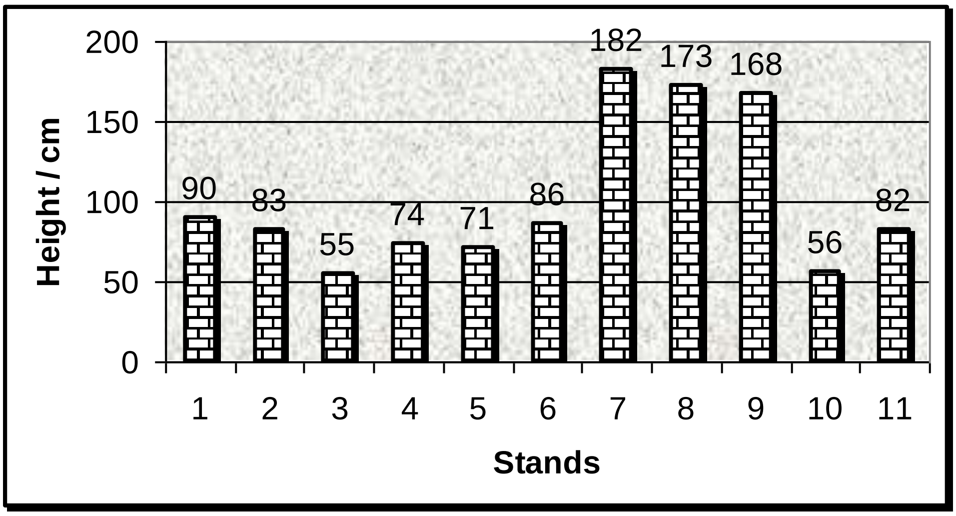


Figure (19) Comparison between heights in stands dominated by *Imperata cylindrica*

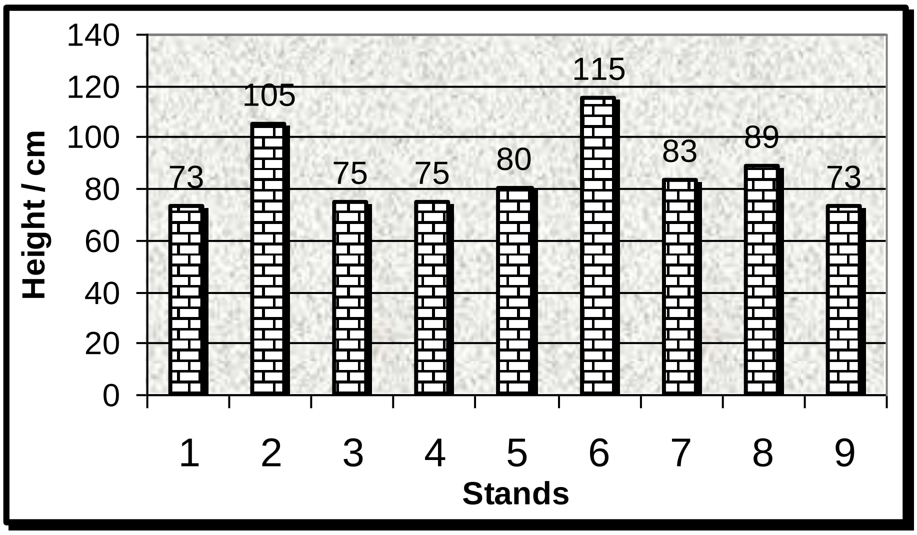


Figure (20) Comparison between heights in stands dominated by *Desmostachya bipinnata*

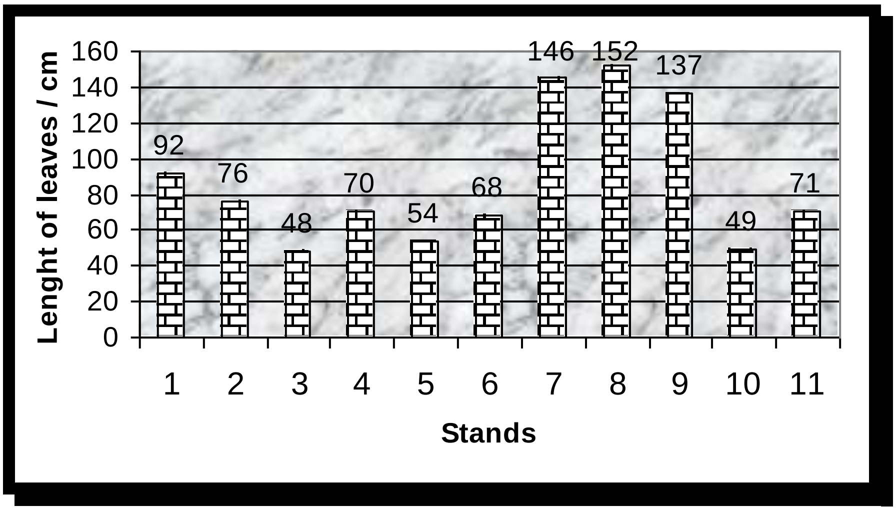


Figure (21) Comparison between Lengths of leaves in stands dominated by *Imperata cylindrica*

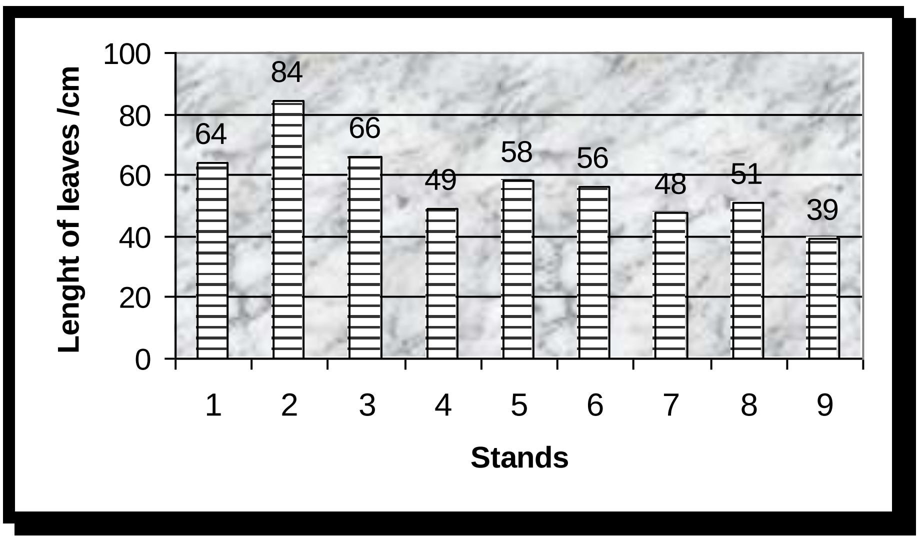


Figure (22) Comparison between lengths of leaves in stands dominated by *Desmostachya bipinnata*

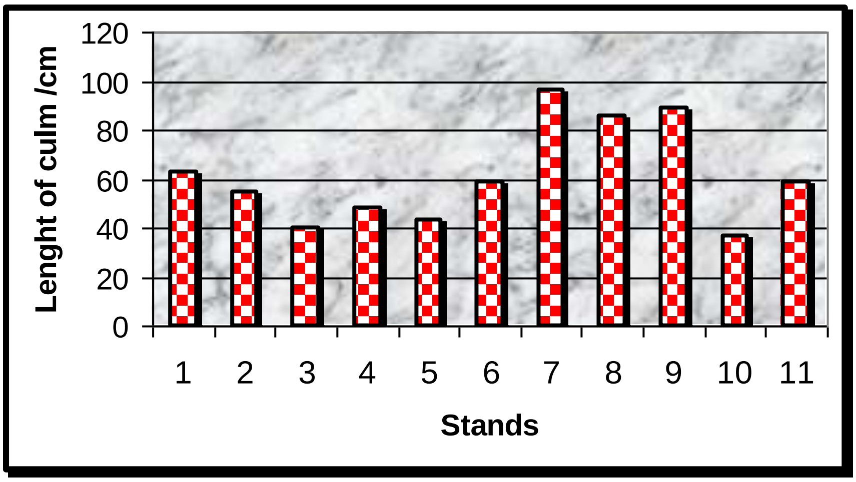


Figure (23) Comparison between Lengths of culms in stands dominated by *Imperata cylindrica*

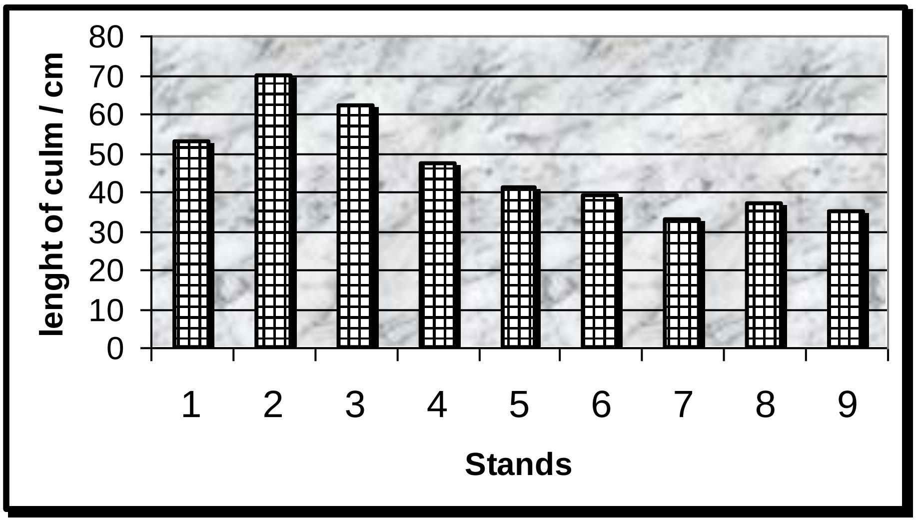


Figure (24) Comparison between lengths of culms in stands dominated by *Desmostachya bipinnata*

Table (16) Morphological measurements of *Imperata cylindrica* in different locations of Egypt

Locations	Stands	height / cm	length of leaves/cm	Length of Culm /cm	Length of spike/cm	width of leaves/mm
Red Sea Coast	**1**	90	92	63	8	3.5
	2	83	76	55	8.3	4.1
Oyoun Mossa	**3**	55	48	40	10	4
Ras Suder	**4**	74	70	48	8	4.2
El-Shaikh Zoayed	**5**	71	54	43	11	3.8
Yameet	**6**	86	68	59	10.5	3.5
Siwa Oasis	**7**	182	146	96	13.5	5.8
	8	173	152	86	14	6.2
	9	168	137	89	14.5	5.7
Bahariya Oasis	**10**	56	49	37	10	4.5
	11	82	71	59	9	4

Table (17) Morphological measurements of *Desmostachya bipinnata* in different locations of Egypt

Locations	Stands	height / cm	length of leaves/cm	Length of Culm /cm	Length of spike/cm	width of leaves/mm
Wadi El-Natrun	**1**	73	64	53	32	3.5
	2	105	84	70	38	4
	3	75	66	62	34	4.8
Bahariya Oasis	**4**	75	49	47	42	3.2
	5	80	58	41	45	4.6
	6	115	56	39	39	3.3
Farafra Oasis	**7**	83	48	33	46	4
Baris Oasis	**8**	89	51	37	34	5.2
El-Minya	**9**	73	39	35	37	3.8

Plate (7) spike of *Desmostachya bipinnata*

Plate (8) spike of *Imperata cylindrica*

6- Phenology

The studied plants are perennial species, differ seasonally in their flowering and fruiting stages. During the vegetative periods it is difficult to distinguish between them.

A- *Imperata cylindrica*

Vegetative growth of *Imperata* occurrs along year around and it has no dormancy stage. Flowering stage started in the middle of March and continue to the end of April. Fruiting period starts at the beginning of May and extends to late of June; seed production follows the fruiting and extended from the beginning of July till its end.figure (25)**.**

This phenology of *Imperata* occurs in all different studied locations.

B- *Desmostachya bipinnata*

Like *Imperata*, the vegetative stage of *D*esmostachya occurs all the year around, but the flowering period starts in July and extends to late of August whereas the fruiting stage starts at the beginning of September and continues to the late of October, seed dispersal started after the end of the fruiting stage and extends to late of November figure(26).

This phenology of *D*esmostachya occurs in all studied locations but in Baris Oasis it differs, where the flowering stage starts in September and continues to the end of October. Fruiting stage starts in the beginning of November; seed production occurs at the end of November and continues to the middle of December.

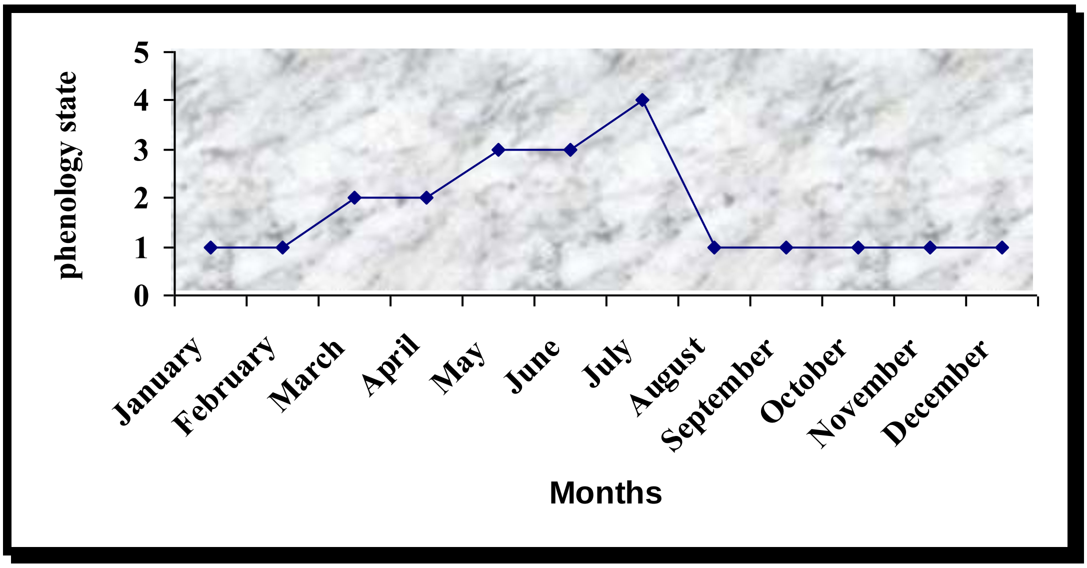


Fig (25) Phenological states of *Imperata cylindrica* in Egypt
1= Vegetative, 2= flowering, 3= fruiting, 4 = seed dispersal

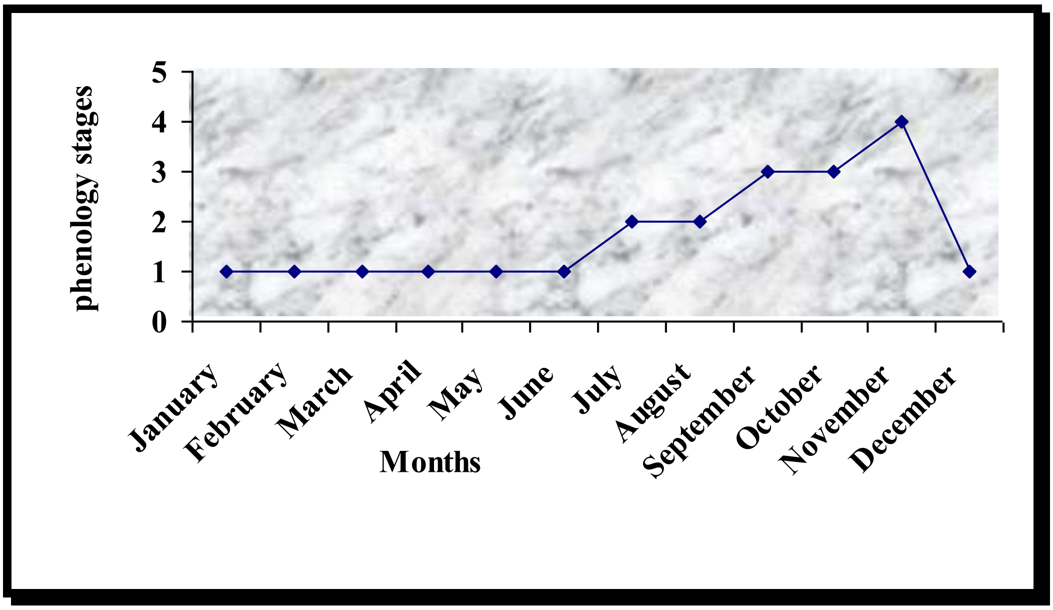


Fig (26) Phenological states of *Desmostachya bipinnata* in Egypt
1= Vegetative, 2 = flowering, 3 = fruiting, 4 = seed dispersal

7- Anatomical characteristics

7-1 Anatomy of the leaves

A- Leaves of *Imperata cylindrica* in Transverse section

The structure of the lamina varies according to the portion of cutting the transverse section in upper, middle and basal region **(El Hamy 1957).** Plates (9-10) show the structure of middle region of the lamina. It is clear that several vascular bundles are lined in the lower surface of the keel. Six vascular bundles of the first order are found separated from each other by 3-4 vascular bundles of second and third order. Each vascular bundle adjoining the lower surface by patches of lignified fibres. Each bundles of the first order consists of protoxylem and metaxylem surrounded by fibrous sheath and the phloem is well defined in second and third bundles. Chlorenchyma cells are well defined in the spaces between each vascular bundle and other. In the keel the upper hypodermis is formed of one layer of thick-walled cells. The thin-walled parenchyma cells are dense founding between lower and upper surface. In the lateral expansions of the blade it is clear that the lower surface contains undulating epidermis and the ribs are well defined and are alternative with bulliform cell. Plate (11). Each ribe contains one vascular bundle and there are some bundles found below the groups of bulliform cells. Also chlorenchyma surrounds the vascular bundles of lateral expansion. The bulliforms cells are located between the large vascular and above the smaller one, this cells are complementary with paranchymatous cells and contain chloroplasts. The stomata are denser in upper surface than in the lower one**.** An aiguillon develops from the bi-cellular papillae.

Plate (9) Middle portion of the blade in transverse section, X 40

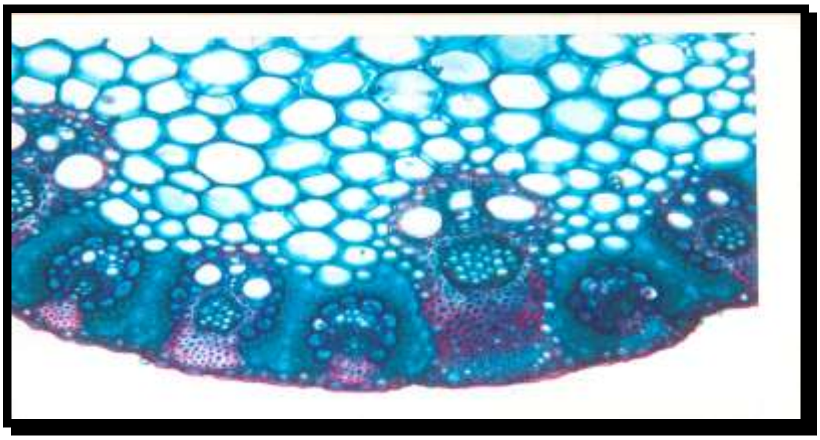


Plate (10) Lower epidermis of the keel in transverse section, X 160

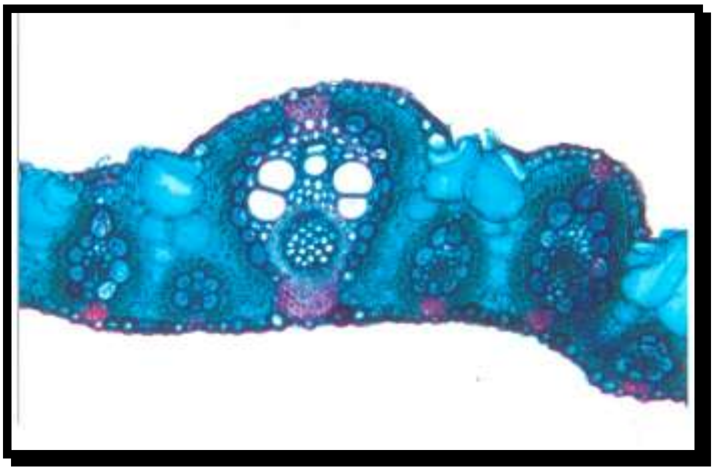


Plate (11) Lateral expansion of blades in Transverse section, x 160

B- Leaves of *Desmostachya bipinnata* in Transverse section

The transverse section shows different structure in the leaves according to the portion of the cutting Plates (12-14) show prominent keel. In the keel and its sides are found large lysigenous air lacunae. The ribs of the lateral expantions of the blade are well marked. They are larger than those found in the portion of the blade. The bulliform cells are well definedand found in grooves. They are absent in the region of the keel and between the two most distal ribs near the margin. The epidermal appendages are numerous, much longer and located on the flanks of the bulliform cells as well as on the lower surface of the blade. The keel is easily recognizable by its larger size; formation of large lysigenous air cavities, the concave upper surface which has a sub-epidermal plate composed of lignified fibers and a greaternumber of vascular bundles subtended on their lower sides by fibers. The vascular bundles of the keel alternative with small groups of lignified elements apposed to the lower epidermis. The vascular bundles of the keel are 7 in number, of which 3are large, and 4 small. The small bundles alternate with the large ones. Below the air lacunae found between each of the above mentioned bundles are the 4 small bundles. The 3 large bundles are of the first order, while the small bundles are either of the third or the fifth order.

In the bundles of the keel, the basal part of the endodermal sheath is not apposed directly on the lower epidermis. But is lined by the extension of the semi-lunar strips of chlorenchyma tissue.

Plate (12) Middle region of the blade in transverse section, X 40

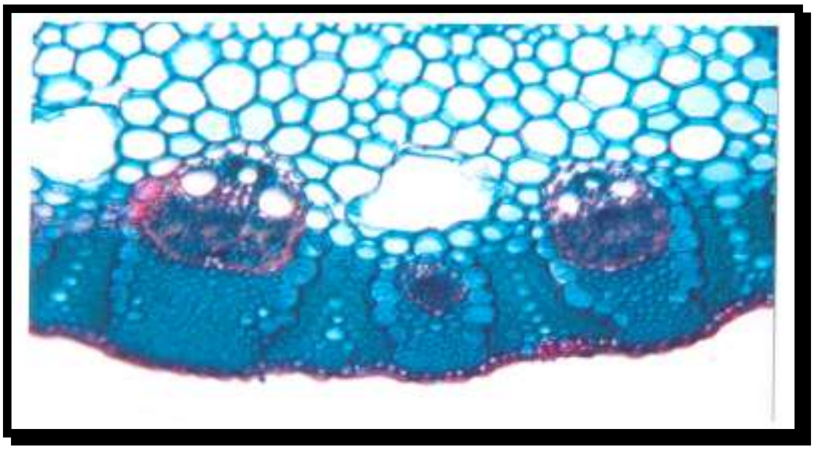


Plate (13) Lower epidermis of the keel in transverse section, X 160

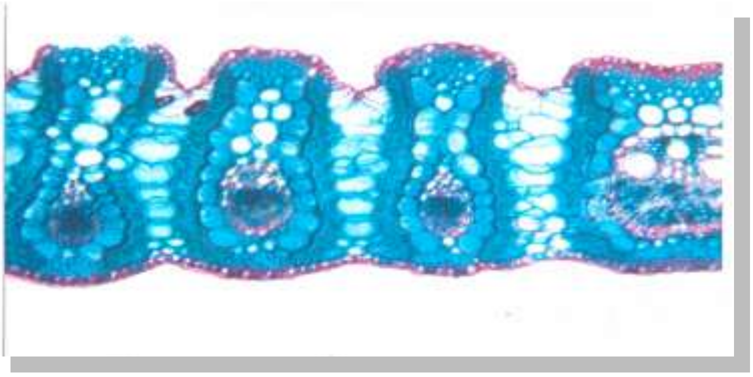


Plate (14) Lateral expansion of the blade in transverse section, x 160

7-2 Anatomy of culms

A- culms of *Imperata cylindrica* in transverse section

Plates (15-16) show a characterized ring of sub cortical cells of fibres among its cells contain bundles of second and third orders alternative with the bundles of first orders which are distributed in the wide paranchymatous cells. Each vascular bundle of the first order is surrounded by fibres sheath and the xylem vessels are well developed as Y shape. The centr of the pith is hollow. The outer layer of the epidermis cells includes elongated silics cells and the hypodermal cells adjointed by the vascular bundles with small patches of fibres. The narrow parenchyma is near to the outer rings of subcortical cells and the paranchymatous incresse in size with nearing to the centres of the culm.

B- culms of *Desmostachya bipinnata* in transverse section

The studies of the different internodes from the base to the top show a decreasing in mechanical tissues and an increasing in assimilatory tissues. Plate (17&18) show that the epidermis is composed of one layer of cells with thickened walls, followed by hypodermal rings of fibrous cells. The vascular bundles are scattered in the ground tissues each one has a sheath of fibres well thickned at closing to the phloem so it appears darked. The small vascular bundles are found between the sub-epedermal cells, the xylem consists of two metaxylem vessels and the phloem attains well appearance. The sclerenchyma cells surround the bundles of more than one layer. The larger vascular bundles (first order) have wider xylem vessels and the phloem fibres are absent. The central portion of the section has air cavity (Plates 17-18).

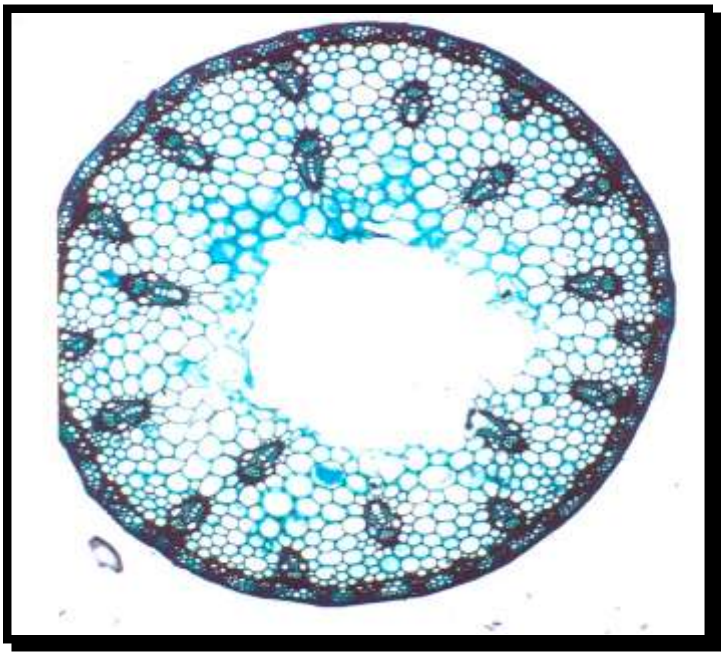


Plate (15) Middle portion of long internode for *Imperata cylindrica* in transverse section, X40

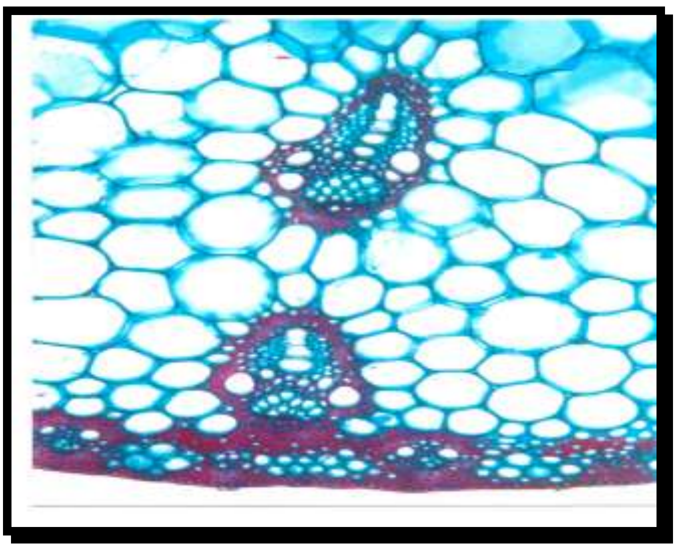


Plate (16) Middle portion of long internode for *Imperata cylindrica* in transverse section, X160

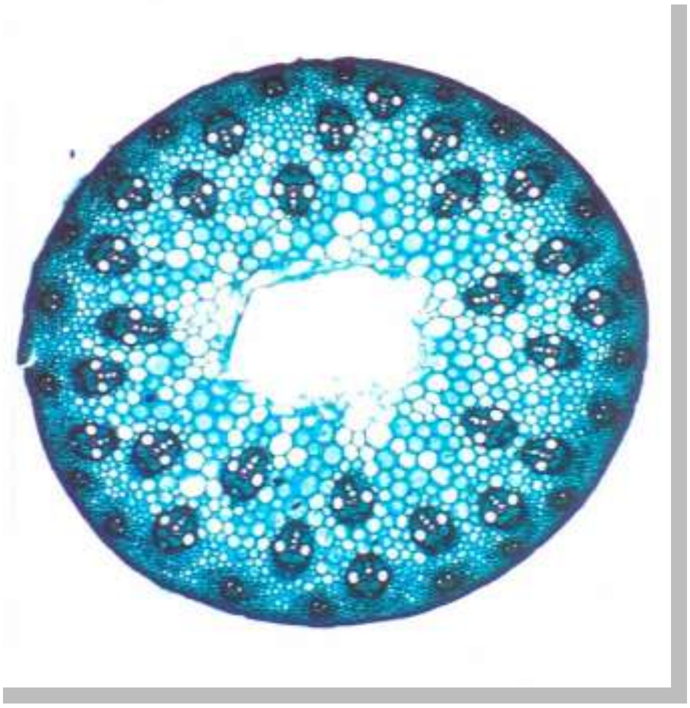


Plate (17) Middle portion of long internode for *Desmostachya bipinnata* in transverse section, X40

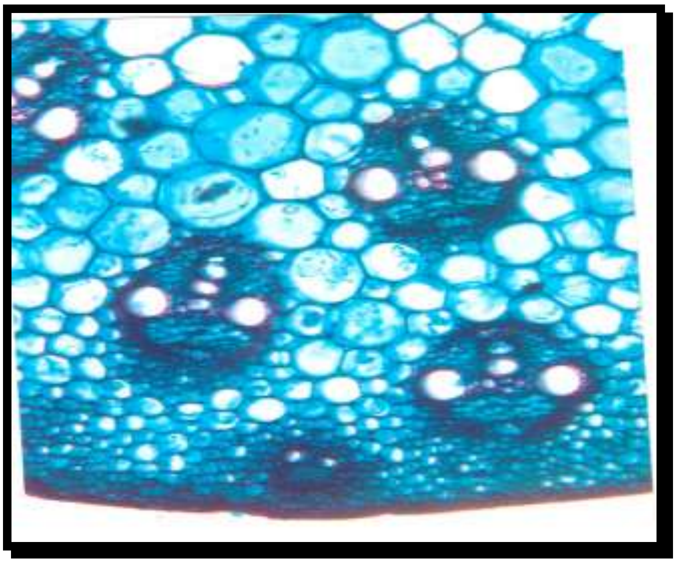


Plate (18) Middle portion of long internode for *Desmostachya bipinnata* in transverse section, X160

7-3 Fiber Length

Length, strength, stability and spinability of fibers are important properties of fiber plants. The present study deals with the length of fibers as it is considered as one of the most important characteristics in industrials purposes. Tables (18-21) and Figures (27-30) show that the fiber plants are classified into two types, short fibers up to (0.59 mm) and long fibers started by 0.6 mm and more. The culms and leaves are two parts of the studied plants were investigated for measuring the fiber length.

A- *Imperata cylindrica*

Long fibers

Long fibers of leaves

Table (19) shows that stand 11 has the highest mean value of long fibers in leaves (1.5 mm), while stand 7 (Siwa oasis) attained the lowest mean value of long fibers (0.74 mm). Stand 1 attained intermediate mean value of long fibers in leaves (1.1mm)

Long fibers of culms

Stands (1&4) attained the highest mean value of long fibers in culms of *Imperata* (0.96 mm), while stand 10 attained the lowest mean value of 0.67 mm. stands 2 and 11 have intermediate mean values of 0.79 mm and 0.75 mm, respectively**.**

Short fibers

Short fibers of leaves

Table (19) shows that stands 5 and 9 attained the highest mean values of short fibers 0.38 mm, while stand 4 has the lowest mean value of short fibers (0.26 mm). Stands 2 and 6 attained intermediate mean values of 0.34 mm and 0.35 mm, respectively.

Short fibers of culms

Stand 10 attained the highest mean value of short fibers in culms of *Imperata* (0.38 mm), while stand 1 has the lowest mean value of short fibers (0.25 mm). Stands 4 and 11 have intermediate mean values of 0.32 mm and 0.31mm, respectively.

Tables (18&19) and Figures (27&28) show the percent of long and short fibers in *Imperata*.The leaves of *Imperata* attained (40–80 %) of long fibers and (20–60 %) of short fibers, while culms of *Imperata* attained (20-70 %) of long fibers and (30-80 %) of short fibers

B-*Desmostachya bipinnata*

Long fibers

Long fibers of culms

Table (20) shows that stand 3 has the highest mean value of long fibers in leaves (1.5 mm), while stand 2 has the lowest mean value of long fiber in leaves (0.79 mm).

Long fibers of leaves

Stand 9 has the highest mean value of long fibers in culms of *Desmostachya* (1.2 mm), while stand 3 attained the lowest mean value of long fibers (0.76 mm). Stand 6 has intermediate mean value of long fibers in culms (0.93 mm).

Short fibers

Short fibers of leaves

Table (21) shows stand 8 attained the highest mean value of short fibers in leaves (0.48 mm), while stand 4 has the lowest mean value of short fibers (0.21 mm). Stands 2, 6 and 7 have intermediate mean values of (0.36 mm).

Short fibers of culms

Stand 8 attained the highest mean value of short fibers in culms (0.44 mm), while stand 1 has the lowest mean value of short fibers (0.26 mm). stand 9 has intermediate mean value of short fibers (0.33 mm).

Tables (20&21) and Figures (29-30) show the percent of long and short fibers in *Desmostachya* The leaves of *Desmostachya* attained (20–90 %) of long fibers and (10–80%) of short fibers, while culms of *Desmostachya* attained (20-60 %) of long fibers and (40-80 %) of short fibers

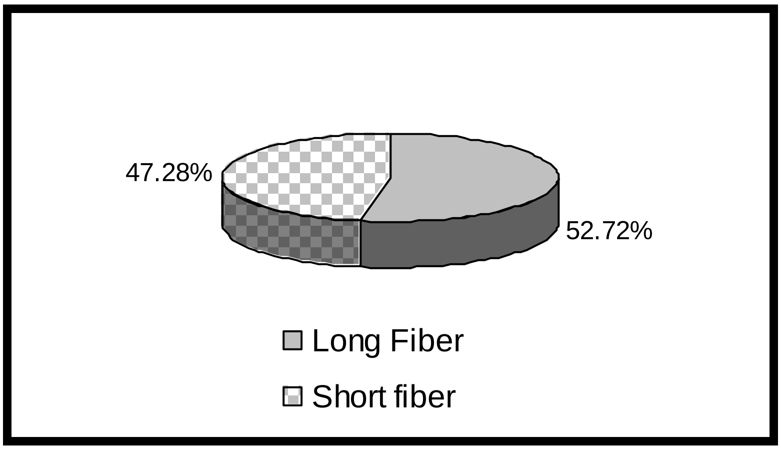


Figure (27) Percentage of long and short fiber in culms of *Imperata cylindrica*

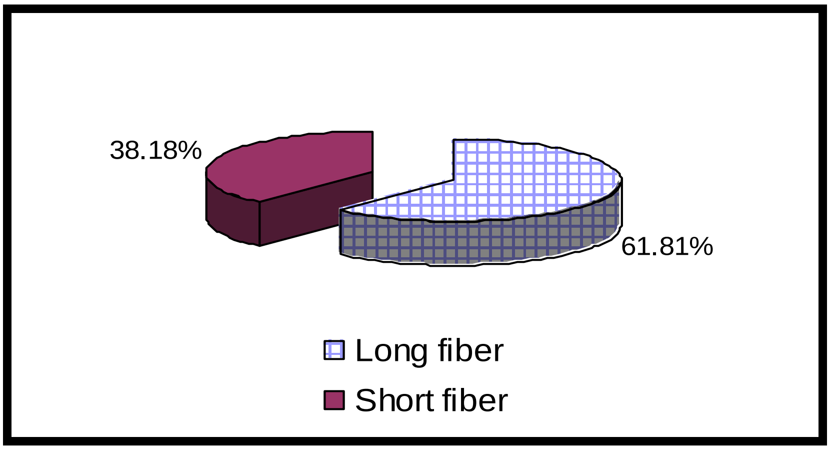


Figure (28) Percentage of long and short fiber in leaves of *Imperata cylindrica*

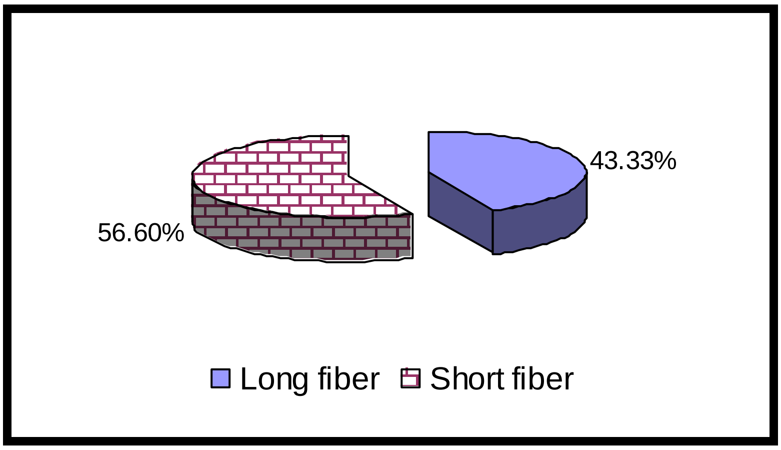


Figure (29) Percentage of long and short fiber in culms of *Desmostachya bipinnata*

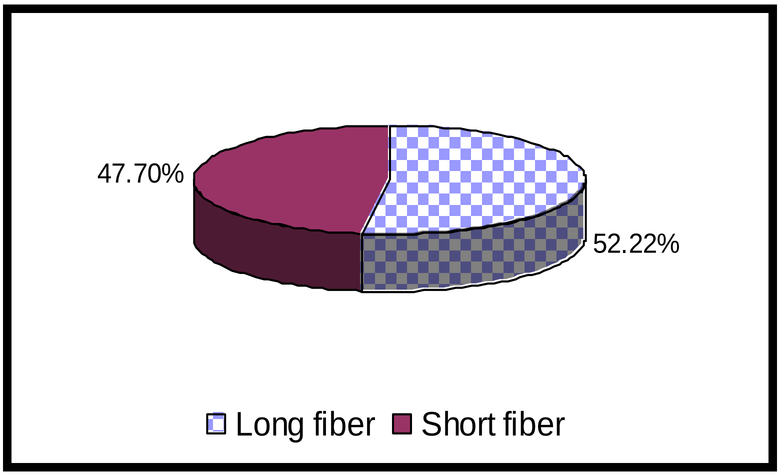


Figure (30) Percentage of long and short fiber in leaves of *Desmostachya bipinnata*

Table (18) The length of 10 fibers of stands representing culms of *Imperata cylindrica*

stands	length fiber / mm										long fiber		short fiber%	
	1	2	3	4	5	6	7	8	9	10	Percent %	Mean / mm	Percent %	Mean / mm
1	0.15	0.8	0.21	1.1	0.7	0.3	0.2	0.39	1	0.87	50	0.96	50	0.25
2	0.82	0.8	0.9	0.6	0.7	0.1	0.48	0.8	0.35	0.5	60	0.79	40	0.37
3	0.6	1.7	0.2	0.4	0.6	0.2	0.73	0.38	0.76	1.2	50	0.74	50	0.28
4	1.1	1.5	0.2	0.12	0.5	0.3	0.8	0.5	0.92	0.24	40	0.96	60	0.32
5	1.2	0.9	0.3	0.5	0.7	0.3	0.7	0.9	0.24	0.3	50	0.88	50	0.35
6	0.2	0.4	0.1	0.4	0.7	0.6	0.29	0.2	0.34	0.8	30	0.72	70	0.29
7	0.8	0.4	1.2	0.9	0.9	0.9	0.25	0.78	0.28	0.4	60	0.94	40	0.33
8	0.9	0.9	0.8	0.7	0.8	0.4	0.28	0.6	0.4	0.35	60	0.82	40	0.35
9	0.4	0.1	0.4	0.3	0.2	0.7	0.89	0.5	0.42	0.47	20	0.82	80	0.37
10	0.6	0.6	0.6	0.4	0.6	0.7	0.3	0.3	0.82	0.62	70	0.67	30	0.38
11	0.8	0.2	0.4	0.6	0.7	0.2	0.3	0.48	0.8	0.15	40	0.75	60	0.31

Table (19) The length of 10 fibers of stands representing leaves of *Imperata cylindrica*

stands	length fiber / mm										long fiber		short fiber%	
	1	2	3	4	5	6	7	8	9	10	Percent %	mean	Percent %	mean
1	1.3	0.89	1.25	0.14	0.38	0.59	1.2	0.18	0.35	0.81	60	1.1	40	0.37
2	1	0.67	0.26	0.49	0.8	0.52	1.3	0.91	0.11	0.74	60	0.9	40	0.34
3	0.3	0.8	1.31	0.55	0.18	0.77	0.21	0.38	0.9	0.17	40	0.94	60	0.29
4	0.86	0.72	0.23	0.2	0.84	0.14	1.5	0.65	0.48	0.71	60	0.88	40	0.26
5	1.2	0.84	0.53	0.27	0.7	0.7	0.48	0.2	0.87	0.46	50	0.82	50	0.38
6	0.53	1.2	0.47	0.72	0.25	1.3	0.9	0.62	0.17	0.8	60	0.92	40	0.35
7	0.8	0.6	0.93	0.74	0.2	0.7	0.68	0.52	0.35	0.19	60	0.74	40	0.31
8	0.34	0.2	1.24	1.5	0.93	0.8	0.64	1.23	0.1	0.82	80	0.97	20	0.27
9	1.1	0.25	0.84	1.2	1.24	0.48	0.96	0.41	1.24	1	70	0.78	30	0.38
10	0.62	0.18	1.2	1.17	1	0.8	0.8	0.75	0.42	0.91	80	0.96	20	0.3
11	0.51	1.25	1	0.95	0.52	0.18	0.78	1.14	1.2	0.27	60	1.5	40	0.37

Table (20) The length of 10 fibers of stands representing culms of *Desmostachya bipinnata*

stands	length fiber / mm										long fiber %		short fiber %	
	1	2	3	4	5	6	7	8	9	10	Percent %	mean	Percent %	mean
1	0.7	0.62	0.3	1.5	0.5	0.42	0.21	0.36	0.85	0.61	50	0.85	50	0.26
2	0.62	0.4	0.4	0.72	0.15	0.2	0.18	1.3	0.56	0.48	30	0.79	70	0.38
3	0.42	1.15	0.31	0.8	0.17	1.18	0.3	0.34	0.3	0.3	20	1.5	80	0.27
4	0.56	0.89	1	0.72	0.14	0.2	0.18	0.44	0.39	0.7	40	0.85	60	0.31
5	1.52	0.1	0.89	0.68	0.75	0.26	0.18	0.37	0.34	0.6	60	0.92	40	0.28
6	0.5	0.13	0.84	0.65	0.43	0.28	0.12	1.1	0.5	0.7	40	0.82	60	0.25
7	1.21	0.54	0.83	0.29	0.81	0.5	0.5	0.5	0.8	0.6	40	0.86	60	0.4
8	1.34	0.29	0.53	0.4	0.8	0.3	0.9	1.12	0.5	0.84	50	1.1	50	0.44
9	0.25	0.18	0.3	0.59	1.4	1.5	0.9	0.68	0.75	0.82	60	0.93	40	0.33

Table (21) The length of 10 fibers of stands representing leaves of *Desmostachya bipinnata*

stands	length fiber / mm										long fiber		short fiber	
	1	2	3	4	5	6	7	8	9	10	Percent %	mean	Percent %	mean
1	0.8	0.2	0.72	0.6	0.53	1.2	0.34	0.77	0.5	0.41	50	0.81	50	0.39
2	0.59	0.64	0.4	0.4	0.68	0.24	0.97	1.5	0.62	0.2	50	0.79	50	0.36
3	0.15	0.75	0.12	0.4	0.36	0.71	0.54	0.82	0.25	0.35	30	0.76	70	0.33
4	0.95	0.95	0.32	0.12	0.72	0.21	0.85	0.88	0.62	0.2	60	0.82	40	0.21
5	0.15	0.28	0.2	0.36	0.21	0.2	0.34	0.82	0.34	0.87	20	0.84	80	0.28
6	0.83	0.27	0.48	0.16	0.58	1.4	0.21	0.62	0.48	0.9	40	0.93	60	0.36
7	0.81	0.17	0.43	0.56	0.82	0.43	0.29	0.84	0.21	0.44	30	0.82	70	0.36
8	1.2	1.3	0.84	0.48	0.86	0.9	0.9	0.75	1	0.83	90	0.96	10	0.48
9	0.28	1.23	1.4	1.8	0.68	0.27	0.46	0.55	1.3	1.8	60	1.2	40	0.39

8- Chemical constituents

8-1 Water content %

Water contents of the plant parts are influenced by the water amount available in soils for the plants. Table (22) and figure (32) show the stands dominated by *Imperata cylindrica.* The highest mean value of water content was recorded in *Imperata* samples in stand 9 (Siwa Oasis) and attained 46.5 %, while *Imperata* samples in stand 2 (Qusseir**)** attained the lowest mean value of 10.2 %. Stands 1,3,4,10,11 attained comparable intermediate mean values for the same plant. Table (23) and figure (34) show the stands dominated by *Desmostachya bipinnata,* that attained the highest mean value of 27.6% in Stand 8 (Bares Oasis), while in stand **7,** *Desmostachya* attained the lowest mean value of 5.1%. The other stands have acomparable intermediate mean values, ranged between 6.4% & 9.2%.

8-2 Crude fiber %

Table (22) shows the stands dominated by *Imperata* The highest mean value of crude fiber was recorded in stand 11 (Bahariya Oasis) attained 41.5%, while the lowest mean value was recorded in stand 3 (Wadi El-Natrun) attained 19.5%. Stands 4, 5 and 6 attained intermediate mean values %**.** Table (23) and figure (34) showed that the highest mean value of crude fiber in *Desmostachya* was recorded in Bahariya Oasis, stand 5 (47 %), while stand 9 attained the lowest mean value of 29.2 %**.** Stand **1** attains intermediate mean value of 34 %**.**

8-3 Total nitrogen %

Total nitrogen is one of the most variables that show the forage value of these grasses. Table (22) and figure (31) show that the highest mean value of total nitrogen in plant parts of *Imperata cylindrica* was recorded in stand 7 (1.54 %), while the lowest mean values were recorded in stands 3 ,9, and 10 (0.31 %) for the same plant. Stands 1, 4 and 8 attained an intermediate mean values of total nitrogen (0.98)**.** The highest mean value of total nitrogen in *Desmostachya bipinnata* was recorded in stand 5 (1.68 %), while the lowest mean value is recorded in stands 3 and 4 (0.31 %). The other stands show varing mean values of total nitrogen as shown in table (23) and figure (33)**.**

8-4 Crude protein %

Total protein is positively correlated with total nitrogen**.** Table (22) and figure (31) show that the highest mean value of total nitrogen in *Imperata* was recorded in stand 7 (9.62%), while stand 3 attained the lowest mean value of 1.96 %. stand 8 (Siwa Oasis) attained intermediate mean value of crude protein (5.25 %).Table (23) and figure (33) show stands dominated by *Desmostachya* The highest mean value of crude protein was recorded in *Desmostachya* in stand 5 (10.5 %) at Bahariya Oasis, while stands 3 and 4 attained the lowest mean value of 1.96 % for the same plant**.**

Table (22) Plant material analysis for stands dominated by *Imperata cylindrica*

Stand	Water Content %	Crude fiber %	Total nitrogen %	Crude protein %
1	27.1	22.15	0.98	6.12
2	10.4	22.65	1.12	7
3	18.7	19.5	0.31	1.96
4	31.3	29.85	0.98	6.12
5	41.3	33.25	1.12	7
6	41.6	31.85	1.4	8.75
7	38.2	37	1.54	9.62
8	53.6	22.5	0.84	5.25
9	46.5	39.1	0.31	1.96
10	34.8	38.5	0.31	1.96
11	21.6	41.5	1.12	7

Table (23) Plant material analysis for stands dominated by *Desmostachya bipinnata*

Stand	Water Content %	Crude fiber %	Total nitrogen %	Crude protein %
1	8.6	34	1.4	8.75
2	7.2	38.6	1.4	8.75
3	13.4	45	0.31	1.96
4	8.3	38.5	0.31	1.96
5	9.2	47	1.68	10.5
6	6.7	42.3	1.54	9.62
7	5.1	36.9	1.4	8.75
8	27.6	31	1.54	9.62
9	6.4	29.2	1.4	8.75

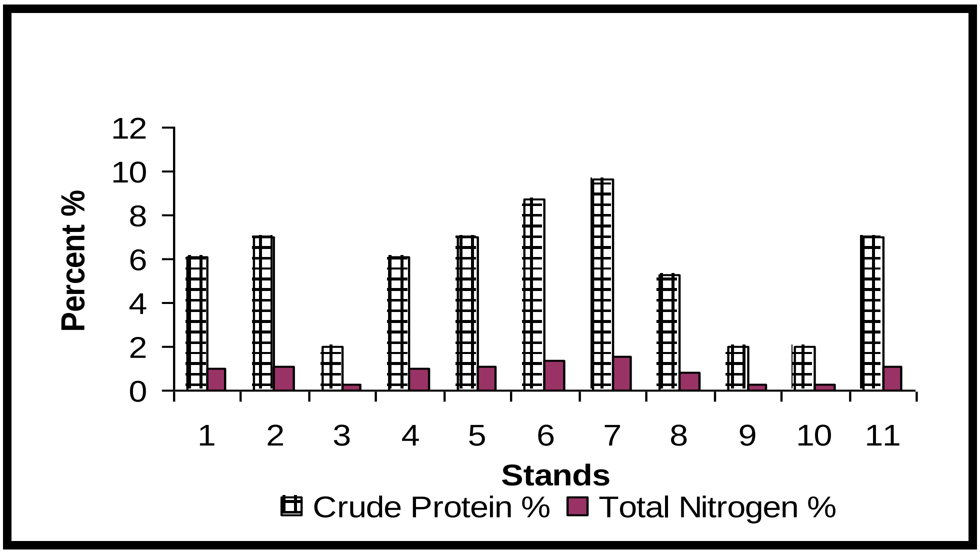


Figure (31) comparison between Total nitrogen and Crude protein in the stands dominated by *Imperata cylindrica*

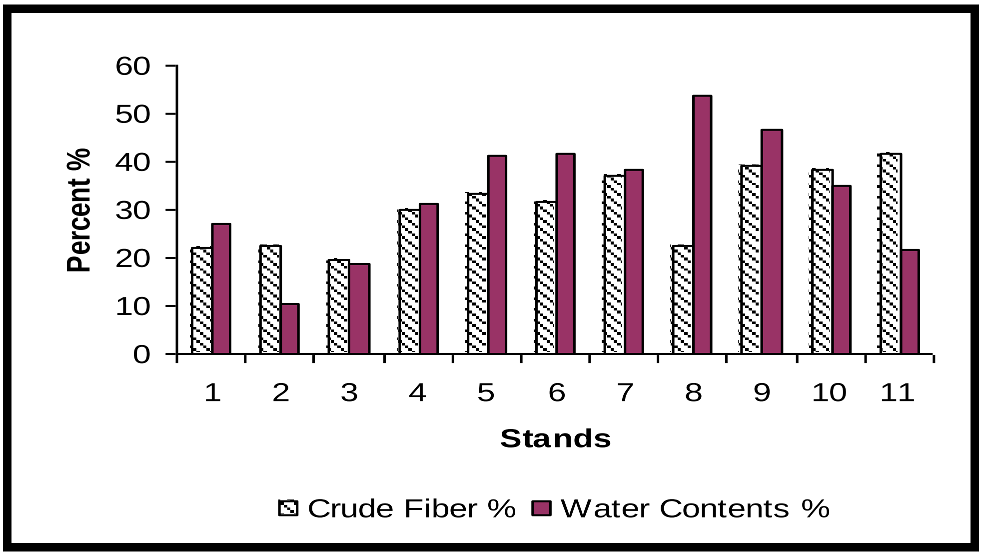


Figure (32) Crude fiber and Water contents in the stands dominated by *Imperata cylindrica*

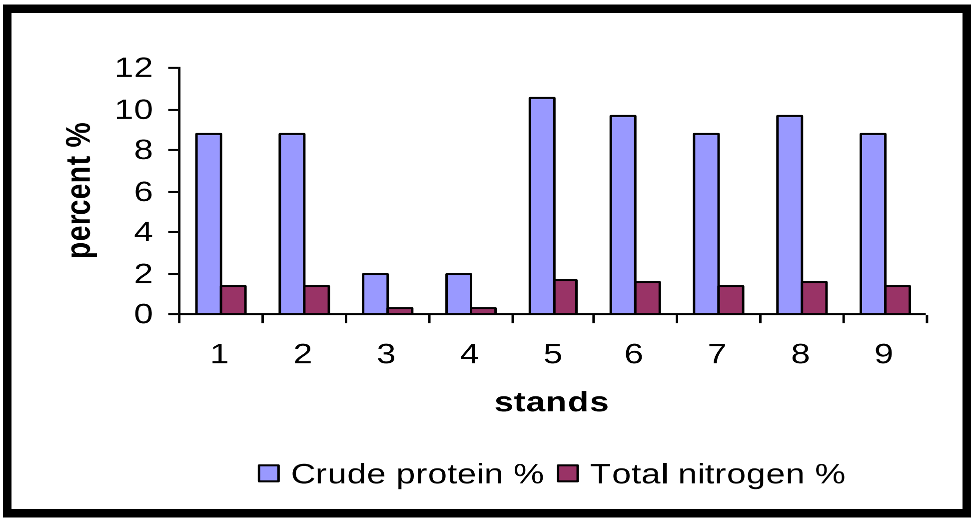


Figure (33) comparison between Total nitrogen and Crude protein in the stands dominated by *Desmostachya bipinnata*

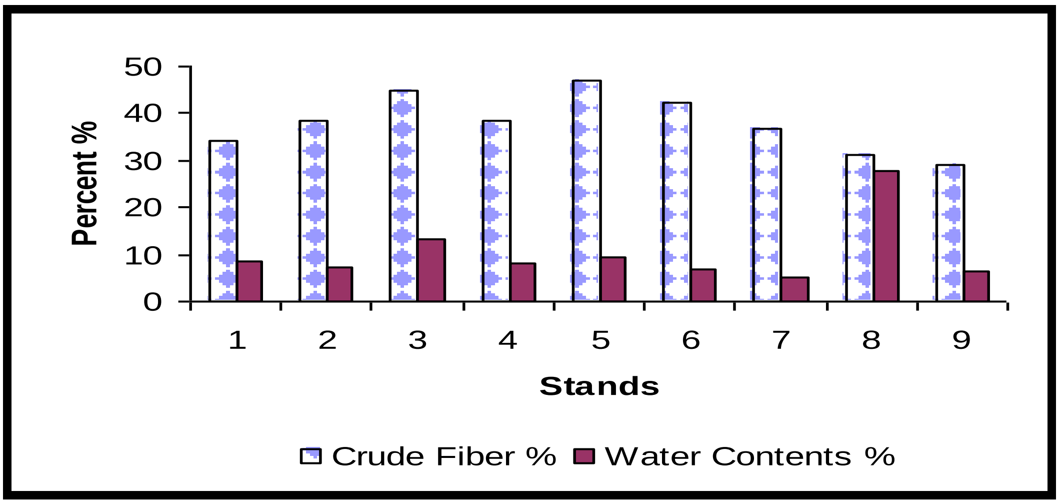


Figure (34) Crude fiber and Water contents in the stands dominated by *Desmostachya bipinnata*