Proximate Chemical Composition of Some Wild Grass Seeds: Northern Darfur, Sudan

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بسم الله الرحمن الرحيم

قال تعالى:

وَهُوَ الَّذِي أَنْزَلَ مِنَ السَّمَاءِ مَاءً فَأَخْرَجْنَاهُ بِهِ نَبَاتٍ
كُلُّ شَيْءٍ فَآخَرَجْنَاهُ مِنْهُ حَضْرًا فَآخَرَجْنَاهُ مِنْهُ حَبْإً
مُتَرَأَكِبْ (صدق الله العظيم)

(الأنعام : 99)
Dedication

To my mother who taught me how life is beautiful
and faith is great.

To my dearest husband Gabir who shared me the life
and treated me well.

To my sweetness sons Mohammed and Muwia and to
my little sweet daughter Tomador Elkhansaa, God bless
them and keep them healthy.

To my sister Fatima and to all my friends wish to them
happiness and health and my special friend Sara.
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With my Best wishes to all.
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Abstract

This study was carried out from family graminaceae. The seeds of five grasses, namely were studies: *Dactyloctenium aegyptium* (Abuasaabee), *Eragrostis tremula* (Banno), *Eragrostis Pilosa* (Umehhuge), *Echinchloa Colonom* (Difra) and *Cenchrus biflorus* (Huskanet).

The study covered chemical composition, mineral content and Tannin content.

*Dactyloctenium aegyptium* contains 94.33% DM, 9.47% Ash, 2.17% EE, 6.57% CF, 10.5% CP, 65.6% NFE, 0.2% Ca, 0.4% P, 0.3% K, 0.0088 % Mg, 0.98% Fe and 0.4% Tannin.

*Eragrostis tremula*, contains, 95.0% DM,33.6% Ash, 2.37% EE, 5.43% CF, 9.37%CP, 44.3% NFE, 0.24% Ca, 0.32% K, 0.0068% Mg, 0.49% P, 0.01% Fe, and 0.30% Tannin.

*Eragrostis Pilosa* contains 93.70% Dm, 4.65% Ash, 5.63% CP, 11.83% CF, 69.77% NFE, 0.27% Ca, 0.39% P, 0.27% K, 0.0013% Mg and 0.31% Tannin.

*Echinchloa Colonom* contains 94.20% DM, 7.35% Ash, 10.03% CP, 19.33% CF, 51.77 % NFE, 0.29% Ca, 0.28% P, 0.35% K, 0.0014% Mg, 0.78% Fe, and 0.35% Tannin.

*Cenchrus biflorus* contains, 95.20%DM, 7.96% Ash, 14.20% CP, 14.10% CF, 56.60%NFE, 0.22% Ca, 0.31% P, 0.30%K, 0.0020% Mg, 0.97% Fe and 0.28% Tannin
الخلاصة

أجريت هذه الدراسة في خمسة أنواع من حشائش عائلة النجيليات. وتسمى الحشائش
كما يلي:

(Aragrostis tremula) ، بنو (Dactyloctenium aegyptium)
(Cenchrus biflorus) وحسكنتيت (Echinchloa Colonum) و (Eragrostis Pilosa)

واحتوت الدراسة على التركيب الكيميائي، والعناصر المعدنية و بعض عوامل معاكسة
غذائية (تانين).

أبو اصبع يحتوي على 94.33% مادة جافة ، 9.47% رماد ، 2.17% مستخلص
الأيثر (دهن) ، 6.57% ألياف الخام ، 10.5% بروتين الخام ، 65.6% مستخلص خالي
النيتروجين (كربوهيدرات) ، 0.2% كالسيوم ، 0.4% فسفر ، 0.3% بوتاسيوم ، 0.0088%
ماغنسيوم ، 0.98% حديد و 0.4% تانين.

بنو يحتوي على 95% مادة جافة ، 33.06% رماد ، 2.37% مستخلص الايثر (دهن)
، 5.43% ألياف الخام ، 9.37% بروتين الخام ، 44.3% مستخلص خالي النيتروجين
(كربوهيدرات) ، 0.24% كالسيوم ، 0.01% فسفر ، 0.32% بوتاسيوم ، 0.0068%
ماغنسيوم ، 1.01% حديد و 0.30% تانين.

امبهوج يحتوي على 93.70% مادة جافة ، 4.65% رماد ، 2.37% مستخلص الايثر
(دهن) ، 11.83% ألياف الخام ، 5.63% بروتين الخام ، 44.3% مستخلص خالي النيتروجين
(كربوهيدرات) ، 0.27% كالسيوم ، 0.39% فسفر ، 0.27% بوتاسيوم ، 0.0013%
ماغنسيوم ، 1.18% حديد و 0.31% تانين.

ذفرة يحتوي على 94.20% مادة جافة ، 7.35% رماد ، 5.03% مستخلص الايثر
(دهن) ، 19.33% ألياف الخام ، 10.03% بروتين الخام ، 51.77% مستخلص خالي
النيتروجين (كربوهيدرات) ، 0.29% كالسيوم ، 0.28% فسفر ، 0.35% بوتاسيوم ،
0.0014% ماغنسيوم ، 0.78% حديد و 0.35% تانين.

الحسكنتيت يحتوي على 95.20% مادة جافة ، 8% رماد ، 2.17% مستخلص الايثر
(دهن) ، 14.20% ألياف الخام ، 14.20% بروتين الخام ، 56.60% مستخلص خالي
النيتروجين (كربوهيدرات) ، 0.22% كالسيوم ، 0.32% فسفر ، 0.30% بوتاسيوم ،
0.0020% ماغنسيوم ، 0.97% حديد و 0.28% تانين.
Chapters
CHAPTER ONE

Introduction

Since early prehistoric times demands of human and their domestic animals were satisfied from feed of plant and animal origin. Natural forests continued to be the major source of fodder. Edible parts of the wild plant are mainly leaves, fruits; young stem roots, gums seeds and cereal grains.

For many years the importance of wild plants in subsistence agriculture in developing world as a food supplement and means of survival during times of drought and famine has been overlooked. Generally the consumption of wild plants has been and still is being underestimated (Mukhtar, 2002).

In the past large areas of Africa, people obtained their basic subsistence from wild grasses. In certain places the practice is still continuous – especially in drought years. One survey recorded more than 60 grass species that are known to be sources of food grains. Despite their widespread use and notable value for saving lives during times of distress, these cereal grain have been largely overlooked by both food and plant scientists. Certainly, there has been little or no thought of developing wild grains as modern foods. Gathering grains from grasslands is among the most sustainable organized food production system in the world. It was common in Africa (Niger, Ethiopia, Zambia, Senegal, Mauritania, Morocco, Egypt, Somalia, Chad and Sudan (NRC, 1996).

In Sudan, use of wild cereal grains is common in Southern and Western Kordofan and Darfur. They are endowed with a deep knowledge concerning the use of wild cereal grains. This is particularly true for the use or medicinal plant. This is also done at times or drought, war and hardship.
Some tribes use it very common in all years in good or bad crop production.

Kordofan and Darfur areas are well known for wild cereal grains product. Each possess it's own particular climate and agriculture products.

Darfur region is 160 km from sea lying between latitude 9-20°N and longitude 22-27°E, covering an area of 40.318 km². Darfur is estimated as 1/5 of the total area of Sudan. The population of Darfur region is estimated 6.6 million of which 1.6 million live in Northern Darfur. Most of those live in rural area, about 75%(Abdelmuti, 1991).

The economy of Northern Darfur relies completely upon agriculture and animal husbandry. The estimation of livestock in Darfur (2002), 6,884,218 heads; 1.6% cattle, 7.22% sheep, 6.65% goat and 12.48% camel, which forms about 75% or total animal in Darfur region (Ministry of Animal Resources, 2002).

Most of the inhabitants of Darfur live in rural areas completely dependent upon seasonal rains for cultivation of local crops Dukhun (Pennistum darfurican). They make a large contribution to the national income.

**The Objectives of the Study are: -**

1] Study of five rain fed grasses in Northern Darfur that are essential for livestock feeding.

2] Chemical composition of the five grass seeds obtained from Northern Darfur.

3] Mineral content and anti nutritional factor (Tannin) of these wild grains seeds.
CHAPTER-TWO

Literature Review

2-1-Review of some common grasses and herbs of high nutritional value found in Northern Darfur.


Abuasaabee is a wide spread annual grass that grows on sandy, clay, and heavy soil. It is a drought resistant grass available in Northern Darfur from August to December. Tubiana and Tubiana (1977) reported that, the seeds of Abuassaabee are collected by women over two months or more in good years. In general it is harvest twice yearly (September to December). Young and married women, continue to harvest seeds for over two months to an obtain and amount about 3-4 camel loads (approximately 130 kg per load).

Northern Darfur consumed Abuasaabee during famine at the rate of 64%. In some of the most famine affected areas, the grains which were collected by ants, was dug by the local people and consumed Abdelmuti, (1991). According to Berry (1985) the seed contains 12.6% protein and 4.6% ether extract (E.E.).

As far as chemical composition of grass seed Salih,et al. (1992 ) reported that Abuasaabee contains,13.1% crude protein, 1.9% ether extract, 8.3% Ash, 4.4% crude fiber and 46% starch.

NRC (1996) reported that, Abuasaabee contains, 11,8% crude protein, 1.7% ether extract, 4.0% crude fiber and 56% starch.

2-1-A-1: Botanical description:-

Abuasaabee as annual herb 1-1½ ft. high, stems sometimes prostrate, rooting at the nodes, culms ascending, compressed, 2-3 noded, glabrous smooth. Leaf-sheaths striate, keeled above. Glabrous or scantily hispid, ligule membranous, very short, scantily cilialate, lamina linear,
tapering to a fine point 1-5 in. long, 1/12-1/6 in. broad, glabrous or hispid or hispidly ciliate, the hairs tuber-based. Spikes 2-6 together or rarely solitary, light or dark live grey, ½-1 in. long, rhachis keeled, scabrous. Spikelets 3-5 flowered, spreading at right angles, up to 1/8 in long, glabrous and sometimes exceeding the glumes (Andrews, 1956).

2-1-A-2: Usage of Abu asaabee: -

- Described Abuasaabee as an excellent fodder, sometimes sold in markets as hay and said to be strengthening for horses. (Dalzied, 1948).

- An excellent fodder (Immature, in early stages for Fattening (Sheep) and increase amount of milk fat for cattle (mature).

- Food for human, ground to flour to make porridge, kisra (a local thin bread), Fermented beverage for men. Women utilize Abuasaabee to a kind of dough to make dough (Dilka) mixed with perfume, which they rub and clean their bodies. It has also some medical uses:
  a. Roasting seeds as treatment of abdominal pains.
  b. Raw seeds treatment of some eye disorder.

- Disadvantages: causes constipation in (human).

  Wet mature grass causes bloat in cattle and sheep.

2-1-B: Banno (Eragrostis tremula):-

Banno is sand-loving species, being found in 29 out of 35 sandy sites in Mauritania. In the Sahel it grows in August and standing high through to June. It can make a second crop in the same season under favourable conditions. It is an annual grass that grows abundantly in old cultivations in lighter soils in Darfur province. It is cut and carried into the village to feed village livestock such as cattle, donkeys, goats and sheep. The Banno is quite palatable by animal (NRC, 1996).

Banno in Darfur resembles (Permistum tiphordeum). It is just as high but the stalk is different. Ears are smaller and the grains are scarce they look
like millet grains. This plant is highly prized but rare in quantity. A dense patch of it may be found in the wadies. The women harvest the grain to make porridge for the boys at times of famine. It is feed for horses when there is shortage of millet. The stalk is used in making roofs for houses (Tubiana & Tubiana, 1977).

Literature review for chemical composition of Banno is unavailable now.

2-1-B-2: Botanical Description: -

Banno is tufted annual herb ½-4 ft. high, leafy usually at the base, color culms erect or suberect. Leaves are few, short, up to ¼ in. broad, mouth of sheath slightly hairy. Panicles are avoid to ellipsoid, very loose and open, nodding2-20 in. long, 2-12 in. broad. Spikelets pallid or purplish, scattered linear, often curved (Andrews, 1956).

Common names Banno, bunno (the Sudan) described that Banno is a short-lived grass up to 75cm high. Panicles widely spreading, up to 15cm long, with long-pedicelled yellow-green or purplish spikelets is distributed throughout tropical Africa, India and Buma, in low rainfall areas (NRC, 1996).

2-1-B-2: Usage of Banno: -

- Good fodder for livestock mainly donkeys and horses.
- Porridge and kisra for human at times of famine.
- Making roofs for houses.
- Bedding for millet storage.
- Some customs of marriage, many celebrations and millet harvesting.
- Used for cleaning (Sweepers).
2-1-C: **Difra (Echinochloa colonium) (L.) Link:** -

Difra is an available fodder, enhanced in value when in grain form. It can be very abundant in flooded meadows and the seed is sometimes collected for human consumption (Dalzied, 1948).

Human in both Kordofan and Darfur intensively consumed Difra. Its use as animal fodder or substitute food, it consumed about 57% in Northern Darfur. The seeds are ground for kisra or porridge. It is harvested during August and October (MacLean, 1985).

Difra is one of different kinds of koreeb, it is known under the more general name of Difra. It is harvested twice at a month interval like *Dactyloctenium aegyptium*. It could well be identical with the *Echinochloa column* link, recorded by Gillet in his catalogue (No. 375).

Women harvest Difra in different ways (beaten or broomed). It is harvested just once (Tubiana and Tubiana, 1977).

According to Salih, et al. (1992), Difra contains 10.6% crude protein, 8.7% Ash, 5.9% ether extract, 12.3% crude fiber and 51.1% starch.

NRC (1996), analyzed Difra, contained, 9.5% crude protein, 11.1% crude fiber, 5.3% ether extract, 7.8% Ash and 56% starch.

2-1-C-1: **Botanical Description:** -

Difra is an annual herb, widespread, grows on flooded meadows muddy soil and flat pools, from August to December in Northern Darfur.

Difra is an annual grass, forming small tufts, up to 2 ft. high, columns erect or ascending, branched mostly in the lower part only, soft, glabrous an smooth. Leaves glabrous or glaucous, sometimes with black or purple cross-bands, linear, tapering to a slender acute point, 3-12 in. Long, 1/6-1/4 in. broad, delicately waxy-powdery, panicles erect, mostly straight, at length more or less exerted, 2-5 in, long, and often appressed to the axis for something obliquely spreading, usually distant by much less than their
own length, the lower ones ½-1 in. long forming dense simple moderately stout subsequent sessile false spikes. Spikelets greenish or tinged with purple, crowded, usually approximately 4-ranked, ovate or ovate-lower glum very broadly ovate, acute to somewhat cuspidate at the apex (Andrews, 1956).

2-1-C-2: Usage of Difra:

- An excellent fodder for cattle in all stages. It increased amount of milk production.
- Good for fattening sheep, horses, camels and bulls.
- Ground to flour to make porridge and kisra especially in occasions and celebrations because it is distinguished with white color.
- Seeds boiled with milk or water (rice) in birthdays and certain days in a week.

2-1-D: Umemhuge (*Eragrostis pilosa*):

Common name of Eragrostis pilosa soft love grass. It is annual grass that grows to 1.0 meters (3-3 feet) high, by 0.3m (1.65 ft) wide, prefers sandy loam soil with pH ranging from acid to alkaline and full sun with moderate moisture. This plant has hermaphrodite flowers and is hardly to zone 7 and is pollinated by wind. Habitual: warm temperature regions, roadsides waste places and old-field. It might do well located in cultivated beds. Cultural: succeeds in any good loam or humus rich soil in sunny position prefers a light soil. Germination should take place within two weeks. The seeds can also be sown in situ in mid to late spring; through in a cool summer it may fail to ripen. Seeds are ground into flour and used in famine as food. It can be used regularly in some areas. The seeds are very small and fiddly to utilize. The plant can't grow in shade; it grows from August to December (NRC, 1996).

Literature review for chemical composition of Umemhuge is unavailable now.
2-1-D-1: Botanical Description: -

Umemhuge is a plant found in neighborhood of Wadies, which is harvested over very short period, about two weeks after rains. Its grains are very small; they are gathered like those of *Echinchloa colonum*. The seeds are stored for difficult years (Tubiana and Tubiana, 1977).

Umemhuge is slender annual herb up to 2½ ft. high, culms erect or kneed leaf-sheaths bearded at the mouth, lamina flat or rolled, up 8 in. long, and 1/6 in. broad, glabrous, panicles 1¼-12 in long, up to 4 in. broad, spikelets loosely scattered linear. 4-1 4 flowered, 1/8-1/4 long (Andrews, 1956).

2-1-D-2: Usages of Umemhuge: -

- Early mature stages good fodder for livestock.
- Grounded flour to make porridge, kisra and fermented beverage for men and young boys.
- The plant can be an effective cure for constipation.

2-1-E: Huskaneet (*Cenchrus biflorus*): -

Huskaneet is a drought resistant grass. The seeds are usually available from August to December in Northern Darfur, its inflorescence is clothed in hard bristles forming burrs which stick to clothing and to animals, and it is therefore, classed as a weed of cultivation. However, Huskaneet is an excellent fodder grass and that the seeds can be used as a food or converted into a cooling drink (Dalziel, 1948).

The seed of Huskaneet are collected by rubbing the spikes between two pieces of leather so as to remove the husks from the seeds. These small seeds so obtained are ground and the flour is consumed as kisra (a thin bread) porridge, many people interviewed in the famine areas, especially in Northern Kordofan and Northern Darfur mentioned that they were accustomed to eating it as a delicacy before the famine (Abdelmuti, 1991).
Salih, et al. (1992), reported that, Huskaneet seeds contains 21.3% crude protein 11.3% Ash, 3.2% ether extract, 2.5% crude fiber and 51.4% starch.

**2-1-E-1: Botanical Description:**

Huskaneet is an annual herb, growing on sandy soil, culms erect or ascending from a decumbent base and rooting at the lower nodes, ¼ - 3½ ft. high, simple or branched, 4-8 nodded. Leaf-sheaths compressed and keeled, sebrous upwards, glabrous ligule a densely, ciliate rim, lamina linear or lance oblate linear tapering to fine point, 1¼ - 12 in. long, 1/12-1/3 in. broad, sebrous on both surfaces or smooth beneath. False spikes straw-colored or rarely purplish, dense-cylindrical, 1¼-6 in. long, 1/3-1/2 in. broad, involvers sub sessile or minutely stalked, 1/6-1/3 in. long bristles numerous, united at the base into a shallow crescent-shaped or elliptic disk, those of the outer row shorter and at length horizontally spreading, rigid, prickle-like barbed downwards (Andrews, 1956).

**2-1-E-2: Usages of Huskaneet:**

- An excellent fodder for livestock (immature stages).

Ground to flour to make porridge only in famine period, it's unpalatable, and its difficulty harvesting (thorny plant).

**2-2: Chemical Composition of Grass Seeds:**

Many cereals are members of the graminea or grasses. Seeds are impotent plant food in human diet (Masefield, et al, 1969).

Composition of the seeds varies as much within each cereal species, as it does from one species to another. On the whole moisture content varies from 10-15%, protein from 8-15%, fat from 2-5%.

Cereals remain an important staple food in most countries in many part of rural Africa and Asia provides more than 70% of the energy in the diet. As countries become more affluent the importance of cereals and plant foods provide in general approximately by 30% of the energy, 25%
of the protein and nearly 50% the available carbohydrates in UK diet (Southgate, 1993).

The total nitrogen content of cereal protein is significantly higher than 16% and for this reason the conversion factors used to calculate protein values for cereals in many food composition tables are lower than 6.25 (FAO, 1973).

The cereal grains contain a range of cell wall structures that are a source of dietary fiber. The highest concentration is found in the outer bran layers, also have thickened walls. The amount or fiber in different cereals show considerable variation, milling and fractionation result in great differences in the quantities in flours of different extraction rates (Nyman et al; 1984).

Whole grains are made of rich starch store comprising from 60-80% of seeds. Grains are relatively slow burners; seeds are low in amino acid lysine.

Whole grains have a lot of woody fiber in their coat which help regulates bowel activity. The soluble and insoluble fiber, which also has positive health benefits, to be helpful in preventing constipation and diseases of the digestive tract such as diverticulitis and may have a protective effect against colon cancer (NRC, 1996).

Literature review for chemical composition of Umemhugue and Banno are unavailable now.
2-3: Minerals content of Grass Seeds: -

The minerals composition of plants varies according to many factors, among those are age of the plant, the soil, differences among the species and varieties and climatic or seasonal condition (Smith, 1993).

Out of thirteen minerals, which are recognized as essential to animal body, seven are required in relatively large quantities and thus referred to as Macro-minerals. These are, phosphorous, calcium, potassium, sodium, magnesium, chlorine and sulphur.

Calcium is the most abundant mineral element found in animal body with about 99% or the calcium found in the bones and teeth.

Phosphorous is one of the most important minerals required by animal for normal growth and production and contribute about 1% of the total weight of an animal's body, about 80% of the total quantity is found in the bones.

Potassium is the seventh most abundant element on the earth and is the third most abundant element in the animal body, surpassed only by calcium and phosphorus. The potassium is present primary inside the cells (Mc Donald et al; 2002).

The principal function of potassium in the animal are cellular osmotic balance, acid-base equilibrium, maintenance of normal heart and kidney tissues as a factor in several enzymes and maintaining proper water balance in the body (Mayer, 1990).

Magnesium like potassium is widely distributed in the tissue and the skeleton, which contains up to 70% of the total body content. It's the most abundant divalent intra cellular action and is involved in a large number of metabolic processes.

Magnesium is an essential constituent of the bones and teeth. It takes parts, directly or indirectly, in about 80 known enzymatic reactions. It is particularly essential in the metabolism of sugars (Kerb's cycle) and
participate in the transmission of neuromuscular stimulants (McDonald et al; 2002 and Smith, 1993).

Trace mineral are crucial to health, serving as catalysts for many life-sustaining cellular processes. Yet only in the past thirty years have scientists begun to understand the metabolic function that they play in human body. Iron in the body is more than 90% and combines with protein and it occurs in blood serum as transferrin or ferritin. Iron is present in the spleen, liver, and bone marrow. It has a major role as a host of biochemical reactions (Mayer, 1990).

As far as mineral content of the grass seeds, Salih, et al. (1992) reported that, Abuasaabee contained, 1.07% calcium, 0.38% phosphorus, 0.30% potassium, 0.22% magnesium and 1.21% iron.

Difra contained, 0.05% calcium, 0.41% potassium, 0.22% magnesium, 0.41% phosphorus and 1.08% iron.

Huskaneet contained, 0.15% phosphorus, 0.07% magnesium, 0.07% calcium, 0.17% potassium and 1.07% iron.

According to NRC (1996) analyzed. Abuasaabee contains, 0.096% calcium, 0.35% phosphorus, 0.27% potassium, 0.19% magnesium and 1.09% iron.

Difra contains 0.04% calcium, 0.37% phosphorus, 0.18% magnesium, 0.27% potassium and 1.01% iron.
2-4: Tannins Content of Grass Seeds: -

Seeds contain antinutrient-substances such as saponins, tannins, and protein splitting enzymes, inhibitors and phytates. These compounds reduce the body's ability to access the nutrients in seeds. The type and amount of anti-nutrient varies both with the species of plant with the local variety of the species. Most, but not all, anti-nutrients are destroyed or reduced by cooking, soaking, leaching and sprouting (NCR, 1996).

Tannins are of nutritional importance in most seeds. They are naturally occurring phenolic compounds. The two major groups of tannins are the hydrolyzable tannins and the condensed tannins; the former drives the name from the ease of hydrolysis by acid or enzymes (Tannase), while the later is very resistant to hydrolysis (Bate-Smith, 1975 and Muller, 1980).

Work on seeds content of tannin is rather limited. It is hard to find literature on tannin content of the five grass seeds being studied.
CHAPTER THREE
Material and Methods

3-1: Topography of the study area: -

3-1-1: Location: -

The study area is located in Northern Darfur. It is lies between latitude 14° – 16°N and longitude, 22°- 24°E in north-west position, borderline between Sudan and Chad. The most significant physical features, are some main villages in areas (karnoy, tinna and Forawia), are shown on the map Fig (1).

3-1-2: Climate: -

Northern Darfur lies in the Sudan Sahel zone. Climate is determined by variable movement of intertropical convergence zone and it is associated with rainfall.

The mean annual rainfall, is 239 mm. Analysis shows that, there is a general trend of decline in rainfall. The recent years received low rainfall, with range of 393.7mm-778.6mm. The patterns of rainfall are characterized by Variation. Drought condition prevails and crops fail. The average temperature is high in study area about 19.8°C in winter, 30.7°C in summer.

The soil throughout the study area is shallow sandy, Old sand sheets (Goz), and high permeable, but prone to erosion once, natural vegetation has been removed. Some forms of quartzite, sand stone, mud tone and crystalline.

Water resources in study area are of some concern. There are no rivers, only numerous widies (Hawar, Umsowat, Garadia, Gadeer, karnoy, Tinna, Sonot, Kamo, and seira). Riverbeds are full of water during the
Fig (3:1) The map of the study area
rainy seasons. Some dams, wells, small lakes and pools are found. Vegetation, grassy rangelands are found, located in most study area. The pasture is situated near the pools and wells. Any clan does not own them. Any one may freely take his herds and flocks in their area, but some tribes’ agreement are done.

3-2: Sample Collection: -

Five grasses belong to family graminaceae were studied scientific, Arabic, local and other names are given on table (3:1). I was able to visit the study area in rainy season, during July to August (2006), by Unit Nation plane, under Red- Cross Group protection, photographs for grasses were taken in study area. samples of flora grasses were collected in boxes to be identified, according to genus and species.

Names of each of grasses are shown in table(3:1). The whole plant of each grass was collected for identification. The same is true for seeds from each grass.

3-3: Methods of seeds collection:

The second visit during October to December grass seeds were collected by help of assistance of people living in camps of Chad. The gathering of wild cereal grains is the task of women: -
- Harvest of Abuasaabee seeds, is done by the women, pull off the stalks, using arake with a very short handle, which are made of branches bound with pieces of bark. They left the heaps of ears for a time to dry, then the woman threshed the ears with flattened side of racket. The grains are then wind blown and put in their storages Fig (2)
- Harvest of Umemhuge and Banno. Seeds are collected their seeds by being knocked into a basket with a flattened branch directly without drying or threshing Fig (3) and Fig(4).

Harvest of Difra seeds, have different ways. Before grasse are dry, the grass beaten with a flattened branches and grains fall into
basket in which they are collected. After grass dryness, with the aid of a broom, the grains are separated from the stalk.

- Exactly, crushed the seeds by mortar for hulling, finally grounded to flour or as it is. Fig (5).

- Huskaneet grains bear thorns, are difficult to gather. Its harvest in bad years/short of food. The stalks were broken off with staff, either apiece of wood or leather; the ears were beaten with a flail Fig(6).

The fresh sample from all grasses were stored in cloth bag separately. Each bag had a label showing the type of grasses seeds collected, botanical and local names of the sample.

3-4: Laboratory samples preparation:-

The samples were blended slightly to crush in home blender. The blender was well cleaned, after each sample-crushing blender is cleaned to avoid inter-sample mixing. After grinding samples were collected into label containers. For each grass seed sample was collected separately and kept in a container for analysis. Samples were analyzed in two major laboratories Nutrition Laboratory of Animal Production faculty and Central Veterinary Research Laboratories.

3-5: Laboratory analysis: -

Proximate analysis for chemical components, dry matter (DM), crude protein (CP), crude fiber (CF), Ash, ether extract (EE), and nitrogen free extract (NFE), were determined according to AOAC (1980). Grass seeds were determined for minerals including phosphorus (P), calcium (Ca), potassium (K), Iron (Fe) and magnesium (Mg) by [UNICAM 8625 UV/VE] Spectrometer-England as spectrophotometer.
<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Arabic name</th>
<th>Local name</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dactyloatenium</em></td>
<td>Abu asaabee</td>
<td>Koreeb, Bugo</td>
<td>Comb, fringe grass</td>
</tr>
<tr>
<td><em>Eragrostis</em></td>
<td>Banno</td>
<td>Bila, bini, banno</td>
<td>Lehmeich</td>
</tr>
<tr>
<td><em>Eragrostis</em></td>
<td>Umehhuge</td>
<td>Kowinkowing, Bubo</td>
<td>Poa, wild tef</td>
</tr>
<tr>
<td><em>Echinochloa</em></td>
<td>Difra</td>
<td>Saba, Airi, Sama, Gu</td>
<td>Jungle rice</td>
</tr>
<tr>
<td><em>Cenchrus</em></td>
<td>Huskaneet</td>
<td>Nago, Nogo</td>
<td>Sandbur, kram-kram</td>
</tr>
<tr>
<td><em>pilosa</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>colonum</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>biflorus</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig (3:2) *Dactyloctenium aegyptium* (Abuasaabee)
Fig (3:3) *Eragrostis tremula* (Banno)
Fig (3:4) *Eragrostis pilosa* (Umemhuge).
Fig (3:5) *Echinochloa colunum* (Difra)
Fig (3:6) *Cenchrus biflorus* (Huskaneeet)
Determination of Tannins was carried out using the modified method of vanillin-Hcl in methanol Price, et al. (1978), by UMICAM 8625 UV/VIS spectrophotometer-England. Tannin concentration was expressed as Catechin Equivalent (CE) as follows:-

\[ CE\% = \frac{C \times V \times 100}{W} \]

Where:
- \( C \) = concentration corresponding to the optical density
- \( V \) = volume of extract (ml)
- \( W \) = weight of the sample (mg)

3-6: Statistical analysis: -
The experimental design used was completely randomized design (CRD). Chemical composition data and mineral content were subjected to one way analysis of variance Steel, et al. (1997) using SPSS. Computer program. Means were compared using Duncan’s multiple range test.
CHAPTER FOUR

Results and Discussion

4-1-1-Proximate analysis: -

4-1-1: Dry Matter Content:

Table (4.2) shows the dry matter content of the grass seeds ranged from 93.7% to 95.2%. A mean of 94.5% is higher than the amount reported by Muller (1980) as 90% DM for some seeds. However, it agrees with the range of 94% - 91% reported by (Mukhtar, 2002).

Huskaneet is the highest grass seeds dry matter with 95.20%, whereas Umehuge is lowest with 93.7% DM.

Varied significantly (P ≤ 0.05) differences among the means of seeds Appendix (4).

4-1-2: Ash Content:

Table (4.2) and Appendix (5) Show total Ash content of different grass seeds indicating significant difference (P ≤ 0.05). The mean value ranged from 4.6% to 33.6%. Banno is the highest seed with 33.6%. The result agreed with NRC (1996) except Banno.

Difra contains 7.8% Ash, while Ash content in Huskaneet 7.9%, and lower than those findings Salih, et al. (1992), which is 11.3%. Umehuge seeds are the lowest one with 4.6% Ash.

4-1-3: Oil Content (EE):

Table (4.2) and Appendix (6) give the EE content to the different grass seeds, showing that the oil content ranged from 2.2% to 5.03%.

Difra is highest one 5.03% oil. This agreed with that reported by Salih, et al.(1992), 5.9% oil And NRC (1996), 5.3% oil. The other four seeds are similar in EE content ranged 2-2.2%, was no significant (P ≥ 0.05) difference among the means.
### Table (4.2): Proximate analysis of Grass Seeds

<table>
<thead>
<tr>
<th>Seeds type</th>
<th>DM%</th>
<th>Ash%</th>
<th>CP%</th>
<th>CF%</th>
<th>EE%</th>
<th>NFE%</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dactyloctenium aegyptium</em> (Abuasaabee)</td>
<td>94.33&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>9.47&lt;sup&gt;b*&lt;/sup&gt;</td>
<td>10.53&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.57&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>65.70&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Eragrostis tremula</em> (Banno)</td>
<td>95.00&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>33.60&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.37&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.43&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.27&lt;sup&gt;b&lt;/sup&gt;</td>
<td>44.33&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Eragrostis pilosa</em> (Umemhuge)</td>
<td>93.70&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.63&lt;sup&gt;d&lt;/sup&gt;</td>
<td>5.63&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11.83&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>69.77&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Echinchoa colonium</em> (Difra)</td>
<td>94.20&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.35&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10.03&lt;sup&gt;b&lt;/sup&gt;</td>
<td>19.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51.77&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td><em>Cenchrus biflorus</em> (Huskaneeet)</td>
<td>95.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>14.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.10&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>56.60&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>S E</td>
<td>0.28</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.11</td>
<td>0.69</td>
</tr>
</tbody>
</table>

*Means within the same columns with different superscripts are significantly different (p < 0.05)*
4-1-4: Crude Fiber (CF) content:

Table (4.2) shows the crude fiber content of the different ranging from 5.4% to 19.8% there were significant (P ≤ 0.05) differences. The crude grass seed fiber content is higher than that reported by Salih, et al (1992), Huskaneet contains 2.5%, Difra has the highest crude fiber 19.8% , but Banno is the lowest crude fiber content 5.4% shown in Appendix (7).

4-1-5: Crude protein (CP) Content:

Table (4.2) shows that the protein content of different grass seeds ranging from 5.6% to 14.2% CP, indicating significant (P ≤ 0.05) difference among the types. Huskaneet crude protein content 14% lower than Abdelmuti (1991), 21% crude protein, but Difra crude protein content 10.03% similar with which reported by Salih, et al.(1992), 10.6% crude protein and NRC (1996), 9.5% Crude Protein. Huskaneet is the highest 19.8% CP, Umemhuge is the lowest 5.6% CP shown in Appendix (8).

4-1-6: Carbohydrates (NFE) Content: -

Table (4.2) Analysis of varianc indicates a significant difference in Carbohydrates content, ranging from 44.3% to 69.8% NFE. Amount of carbohydrate content of Difra 51.8% is similar with amount reported bySalih, et al. (1992). Huskaneet carbohydrate content 56.6% is similar with that reported by NRC (1996), 56.0 % NFE. Umemhuge is the highest one 69.8% NFE, Banno is the lowest 44.3% NFE. Appendix (9).
4-2: Minerals Content:

4-2-1: Calcium (Ca) Content:

Table (4.3) shows the mineral content of the five grass seeds. Abuasaabee, Banno, and Huskaneet have approximately the same calcium content ranged from 0.22% to 0.27%. The result of the study showed high value than the values reported by Salih, et al. (1992) and NRC (1996), Abuasaabee contented 0.07% Ca, Difra 0.05% Ca, and Huskaneet 0.07% Ca. The difference between those values may be due to difference soil types. For comparison Difra is the highest seed 0.27% Ca, Huskaneet is lowest seed 0.22% Ca. Appendix (10).

4-2-2: Phosphorus (P) Content:

Table (4.3) shows the phosphorus content of the grass seed, indicating significant difference among the means. It was found that the means value of phosphorus content, ranged from 0.28% to 0.49% P. The Phosphorus content of Abuasaabee 0.42%P, which is similar to the value reported by Abdelmuti (1991) 0.38% phosphorus and NRC (1996) 0.35% P. The comparison shown in Appendix (11).

4-2-3: Potassium (K) Content:

The grass seeds of Potassium shown in table (4.3) there is no significant (P ≥ 0.05) difference among the means. The value of Potassium content is similar like that with the Salih, et al (1992) and NRC (1996) were ranged about 0.3% the means histogram in Appendix (12) shows the comparison too.

4-2-4: Magnesium (Mg) Content:

Magnesium content of the grass seed is given in table (4.3). The mean value is within the range 0.002% to 0.009%. All the grass seeds had low magnesium content than that reported by Salih, et al. (1992) and NRC (1996). Also return to soil types. Huskaneet Difra and Umehhuge were
### Table (4.3) Grass Seeds, Mineral Content

<table>
<thead>
<tr>
<th>Seeds type</th>
<th>Ca%</th>
<th>P %</th>
<th>K %</th>
<th>Mg %</th>
<th>Fe %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dactylorhiza aegyptium</em> (Abuasaabee)</td>
<td>0.22b*</td>
<td>0.43b</td>
<td>0.30a</td>
<td>0.0088a</td>
<td>0.98a</td>
</tr>
<tr>
<td><em>Eragrostis tremula</em> (Banno)</td>
<td>0.24b</td>
<td>0.49a</td>
<td>0.32a</td>
<td>0.0068b</td>
<td>1.01a</td>
</tr>
<tr>
<td><em>Eragrostis pilosa</em> (Umemhughe)</td>
<td>0.27ab</td>
<td>0.39b</td>
<td>0.27a</td>
<td>0.0013c</td>
<td>1.18a</td>
</tr>
<tr>
<td><em>Echinchoa Colonum</em> (Difra)</td>
<td>0.29a</td>
<td>0.28c</td>
<td>0.35a</td>
<td>0.0014c</td>
<td>0.78a</td>
</tr>
<tr>
<td><em>Cenchrus biflorus</em> (Huskaneeet)</td>
<td>0.22b</td>
<td>0.32c</td>
<td>0.30a</td>
<td>0.0020c</td>
<td>0.97a</td>
</tr>
<tr>
<td>SE</td>
<td>0.02</td>
<td>0.02</td>
<td>0.04</td>
<td>0.00034</td>
<td>0.16</td>
</tr>
</tbody>
</table>

*Means within the same columns with different superscripts are significantly different (p < 0.05)*
similar at the means value. Abuasaabee is the highest seeds contain, Umemhuge is the lowest seeds Magnesium content. Appendix (13).

4-2-5: Iron (Fe) Content:
The average seeds content of Iron in the grass seeds are shown in table (4.3). The mean value ranged 0.8% to 1.2%, there are no significant ($P \geq 0.05$) difference among the means. The grasses had high level of Iron. These results are in agreement with Abdelmuti, (1991). The comparison in Appendix (14).
4-3: Tannin Content:

Average of Tannic agent (Tannin) content of the grass Seeds in Table (4.4) and Appendix (15) show the range of tannin content 0.28% to 0.35%.

Mean values indicated no significant differences (P ≥ 0.05), that Abuassaabee and Difra are similar, other seeds were significant (P ≤ 0.05).

The five grass seeds are low in tannin content compared by reading of standard curve of tannin; Abuasaabee and Difra are nearly intermediate.

The standard curve reading:
0.0 –0.4 low Tannin content
0.5 – 0.7 Intermediate
0.8 – 1.5 High
1.6 – 5.0 very high Tannin.
Table (4:4): The means and standard errors of Tannin in the different species

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Species</th>
<th>Mean</th>
<th>S. E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tannin</td>
<td><em>Dactyloctenium aegyptium</em> (Abuasaabee)</td>
<td>0.35 <em>a</em></td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td><em>Eragrostis tremula</em> (Banno)</td>
<td>0.30 <em>bc</em></td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td><em>Eragrostis pilosa</em> (Umehuge)</td>
<td>0.31 <em>b</em></td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td><em>Echinochloa colonium</em> (Difra)</td>
<td>0.35 <em>a</em></td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td><em>Cenchrus biflorus</em> (Huskaneet)</td>
<td>0.28 <em>c</em></td>
<td>0.01</td>
</tr>
</tbody>
</table>

*Means within the same columns with different superscripts are significantly different (p < 0.05)*
Conclusions and Recommendations

Some grass seeds play very important role as food for man and his animals.

Little work has been done on grass seeds consumed in western Sudan, especially northern Darfur. The present work has been done on five of grass seeds belong to family graminaceae. These seeds are used by rural population as substitute food especially in famine times.

These grass were: *Dactyloctenium aegyptium*, (Abuasaabee), *Eragrostis tremula* (Banno), *Eragrostis pilosa* (Umemhuge), *Echinochoa colonum* (Difra) and *Cenchrus biflorus* (Huskaneeet. The study included:-

- Proximate analysis of the grass seed (Dry Matter, Ether Extract, Crude Protein, Crude Fiber, Ash and Carbohydrates).
- Minerals Content (Calcium, Phosphorus, Potassium, Magnesium and Iron).
- Anti-nutritional factor (Tannin).

Not much of research work was carried out on these seeds, extensively in this part. Hence, further research study needs to carried out.

The following recommendation may be useful: -

- More research work need to be directed to wild cereal grains seeds on all the nutrients, i.e: Vitamins, Amino Acids composition, fatty Acids.........etc.
- All processing foods prepared from these seeds must be studied.
- More information needs to be carried out on these wild seeds, on the economic and nutritive value to man and animals.
- Methods of preservation, propagation and protection of these rainfed grasses need to be given some consideration.
References


Appendix
**Appendix (1): The effect of species on nutrient content**

<table>
<thead>
<tr>
<th>Source</th>
<th>Nutrient</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>DM</td>
<td>4</td>
<td>1.12</td>
<td>4.74*</td>
</tr>
<tr>
<td></td>
<td>ASH</td>
<td>4</td>
<td>421.06</td>
<td>1265.72**</td>
</tr>
<tr>
<td></td>
<td>EE</td>
<td>4</td>
<td>5.02</td>
<td>144.68**</td>
</tr>
<tr>
<td></td>
<td>CF</td>
<td>4</td>
<td>103.08</td>
<td>152.79**</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>4</td>
<td>28.04</td>
<td>42.06**</td>
</tr>
<tr>
<td></td>
<td>NFE</td>
<td>4</td>
<td>318.50</td>
<td>223.04**</td>
</tr>
<tr>
<td></td>
<td>TANNIN</td>
<td>4</td>
<td>0.0027</td>
<td>22.27**</td>
</tr>
<tr>
<td>Error</td>
<td>DM</td>
<td>10</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>ASH</td>
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<td>0.33</td>
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</tr>
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<td>10</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CF</td>
<td>10</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>10</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NFE</td>
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<td>1.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TANNIN</td>
<td>10</td>
<td>0.0001223</td>
<td></td>
</tr>
</tbody>
</table>

Appendix (1): presents the analysis of variance carried out on the nutrient content and antinutrition factor (tannin) of five species of grass seeds. There were significant (P<0.05) differences between species in dry matter content and highly significant (P<0.01) differences in ash, ether extract, crude fiber, crude protein, carbohydrate (NFE) and tannin.
Appendix (2): The effect of species on mineral content

<table>
<thead>
<tr>
<th>Source</th>
<th>Minerals</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>CA</td>
<td>4</td>
<td>0.003</td>
<td>3.87*</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>4</td>
<td>0.021</td>
<td>28.92**</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>4</td>
<td>0.0028</td>
<td>0.59NS</td>
</tr>
<tr>
<td></td>
<td>MG</td>
<td>4</td>
<td>0.000037</td>
<td>110.56**</td>
</tr>
<tr>
<td></td>
<td>FE</td>
<td>4</td>
<td>0.0607</td>
<td>0.757 NS</td>
</tr>
<tr>
<td>Error</td>
<td>CA</td>
<td>10</td>
<td>0.0008</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>10</td>
<td>0.0007</td>
<td></td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>10</td>
<td>0.0047</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MG</td>
<td>10</td>
<td>0.00000034</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FE</td>
<td>10</td>
<td>0.0802</td>
<td></td>
</tr>
</tbody>
</table>

Appendix (2) presents the analysis of variance carried out on the minerals content of five species of grass seeds. There were significant (P<0.05) differences between species in calcium content and highly significant (P<0.01) differences in phosphorus and magnesium.
Appendix (3) Overall means of nutrients and minerals across species

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Mean</th>
<th>S. E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>94.49</td>
<td>0.13</td>
</tr>
<tr>
<td>ASH</td>
<td>12.64</td>
<td>0.15</td>
</tr>
<tr>
<td>EE</td>
<td>2.73</td>
<td>0.05</td>
</tr>
<tr>
<td>CF</td>
<td>11.55</td>
<td>0.21</td>
</tr>
<tr>
<td>CP</td>
<td>9.95</td>
<td>0.21</td>
</tr>
<tr>
<td>NFE</td>
<td>57.63</td>
<td>0.31</td>
</tr>
<tr>
<td>CA</td>
<td>0.25</td>
<td>0.01</td>
</tr>
<tr>
<td>P</td>
<td>0.38</td>
<td>0.01</td>
</tr>
<tr>
<td>K</td>
<td>0.307</td>
<td>0.02</td>
</tr>
<tr>
<td>MG</td>
<td>0.0041</td>
<td>0.000</td>
</tr>
<tr>
<td>FE</td>
<td>0.99</td>
<td>0.07</td>
</tr>
<tr>
<td>TANNIN</td>
<td>0.32</td>
<td>0.003</td>
</tr>
</tbody>
</table>
Appendixes (histograms) key:
The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium* : 1
- *Eragrostis tremula* : 2
- *Eragrostis pilosa* : 3
- *Echinochloa colonium* : 4
- *Cenchrus biflorus* : 5

Appendix (4): The dry matter content in different grass seeds

![Bar chart showing dry matter content for different grass species]
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium*: 1
- *Eragrostis tremula*: 2
- *Eragrostis pilosa*: 3
- *Echinochloa colonium*: 4
- *Cenchrus biflorus*: 5

Appendix (5): The amount of Ash content in different grass seeds

![Bar chart showing the Ash content in different grass species with CV = 4.54]
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium* : 1
- *Eragrostis tremula* : 2
- *Eragrostis pilosa* : 3
- *Echinochloa colonium* : 4
- *Cenchrus biflorus* : 5

Appendix (6): The ether extract content in different grass seeds
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium*: 1
- *Eragrostis tremula*: 2
- *Eragrostis pilosa*: 3
- *Echinochloa colonium*: 4
- *Cenchrus biflorus*: 5

Appendix (7): The amount of crude fiber in different grass seeds

CV = 7.11
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- Dactyloctenium aegyptium : 1
- Eragrostis tremula : 2
- Eragrostis pilosa : 3
- Echinochloa colonium : 4
- Cenchrus biflorus : 5

Appendix (8): The amount of crude protein in different grass seeds

CV = 8.20
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium* : 1
- *Eragrostis tremula* : 2
- *Eragrostis pilosa* : 3
- *Echinochloa colonium* : 4
- *Cenchrus biflorus* : 5

Appendix (9): Carbohydrate content of different grass seeds

CV = 2.07
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium*: 1
- *Eragrostis tremula*: 2
- *Eragrostis pilosa*: 3
- *Echinochloa colonium*: 4
- *Cenchrus biflorus*: 5

Appendix (10): Calcium content in different grass seeds

CV = 11.31
Appendix (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium* : 1
- *Eragrostis tremula* : 2
- *Eragrostis pilosa* : 3
- *Echinochloa colonium* : 4
- *Cenchrus biflorus* : 5

Appendix (11): Phosphorus content in different grass seeds

\[ CV = 7.15 \]
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium* : 1
- *Eragrostis tremula* : 2
- *Eragrostis pilosa* : 3
- *Echinochloa colonium* : 4
- *Cenchrus biflorus* : 5

Appendix (12): Potassium content in different grass seeds

CV = 22.24
Appendixes (histograms) key:

The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium*: 1
- *Eragrostis tremula*: 2
- *Eragrostis pilosa*: 3
- *Echinochloa colonium*: 4
- *Cenchrus biflorus*: 5

Appendix (13): The amount of magnesium in different grass seeds

CV = 14.22
The numbers on the X-axis indicate the following:

- *Dactyloctenium aegyptium*: 1
- *Eragrostis tremula*: 2
- *Eragrostis pilosa*: 3
- *Echinochloa colonium*: 4
- *Cenchrus biflorus*: 5

Appendix 14): The iron content in different grass seeds

**Appendixes** (histograms) key:

The numbers on the X-axis indicate the following:
- *Dactyloctenium aegyptium*: 1
- *Eragrostis tremula*: 2
- *Eragrostis pilosa*: 3
- *Echinochloa colonium*: 4
- *Cenchrus biflorus*: 5

Appendix (15): The amount tannin content in different grass seeds

CV = 3.48