بسم الله الرحمن الرحيم

Sudan University of Sciences & Technology

College of Agricultural Studies

Study of Variability in Ten Maize (*Zea mays* L.) Genotypes for Some Growth and Yield Characters

A Dissertation Submitted to the Sudan University of Science &Technology in Partial Fulfillment of the Requirements
The of Degree B.Sc. (Honors) in Agriculture (Agronomy)

By:
Mona Adam Eissa Adam
Supervisor: Dr. Nahid Abd Alfattah

Department of Agronomy

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الأيـــــــــــــــة

قال تعالي:

بسم الله الرحمن الرحيم

قَالَ تَعَالَىٰ:

﴿ وَءَايَةٌ لَّهُمُ ٱلْأَرْضُ ٱلْمَيْتَةُ أَحْيَيْنَٰهَا وَأَخْرَجْنَا مِنْهَا حَبًّا فَمِنْهُ يَأْكُلُونَ ﴿٣٣﴾ ﴾

صدق الله العظيم

سورة يس الاية (33)

DEDICATION

To my dear family, father and

mother my brothers

And sisters, and

To my dear friends

Mona Adam

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First I do thank ALLAH who supports me with ultimate help, strength and patience to complete this research successfully.

I would like to express my sincere appreciation to my Supervisor Dr. Atif Elsadig Idris for new support, and guidance from the first step of this research up to its end. My sincere thank is extended to Dr. Nahid Abd Alfattah and to ustazt Ahamed Mahamed Elhaj for there continuous helps.

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ABSTRACT

The experiment was conducted at the Sudan University of Sciences and Technology, College of Agricultural a t studies- Shambat- in winter season of 2016.The Objective of this research was to study variability in ten grain maize (*Zea mays* L.) genotypes for some growth and yield characters. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Five growth and yield characters were measured included 50% days of the tasseling, 50% days of the silking , plant height (cm), grain yield plant ton/ha and 100kernel weight/g .The analysis of variance showed significant difference between maize genotypes for all studied characters except for grain yield plant. The genotype (Hybrid) Mg x H1 scored the highest value (20.17) gm of 100 kernel weight.

الخلاصة

أجريت هذه التجربة بجامعة السودان للعلوم والتكنولوجيا كلية الدراسات الزراعية –شمبات – في الموسم الشتوي لعام 2016 . هدف هذا البحث هو دراسة التباين في عشرة أصناف من الطرز الوراثية للذرة الشامية لبعض صفات النمو والانتاجية . تم تنفيذ التجربة بإستخدام تصميم القطاعات الكاملة العشوائية بثلاثة مكررات. خمسة من صفات النمو والإنتاجية تضمنت ، ايام التزهيرالمذكر ،ايام التزهير المؤنث، طول النبات (سم) ،والانتاجية (طن/للهكتار) ووزن ال 100 حبة. اظهر تحليل التباين وجود فروقات معنوية بين الطرزالوراثية للذرة الشامية لكل الصفات المدروسة في ما عدا صفة انتاجية النبات بالطن للهكتار ، فقد كانت غير معنوية. الطراز الوراثي(الهجين) (Mg xH1) أظهر أعلى قيمة لوزن ال 100 حبة وكانت 20.17 جم.

CHAPTER ONE

INTRODUCTION

Maize (*Zea mays* L.) or Indian corn is one of most important cereals of the world Apart from direct human consumption. Maize grains from important ingredient of poultry and cattle feed (Panda.2009). The grains of maize are used for many industrial products like manufactory of starch, alcohol, acetic and lactic acids, glucose, paper, rayon, plastic, textile, adhesives, dyes synthetic rubber resins, artificial leather and boot polish.

Maize is the world's the most cereal crop after wheat and rice with average yield around 1-4 t/ha. Maize ranks first among cereal and followed by rice, wheat and millets with average yield around 3.7, 2.5 and 1.2 t/ha respectively (Panda.2009).

Due to its high productively, Maize is called as the queen of cereals. Maize grown primarily for grain, second for fodder, raw material for industrial process and direr sifted Products. In the Sudan maize is considered as minor crop in the mid-seventies, maize was grown under rainfall agriculture, in kordafan, Darfur and in small irrigated areas in the northern states. Recently

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More attention is being paid to crop and expansion was noticed under the Gezira and Blue Nile schemes ,the increasing demand for maize for poultry

feed or inter me diary products for human nutrition have led to greater interest of this crop in Sudan (Atif.2011)

The economic importance maize is largely consumed as food various forms. It is also used as animal food, particularly for poultry green maize plants are used as source fodder the carnies a method of starch cooking. Maize is a raw material for dextrose, sorbitol dextrin and high fructose syrup, malt dextrin germ oil, germ meal fiber and gluten products which have application in industries such as alcohol, textile , paper pharmaceuticals, organic chemicals cosmetic and edible oil. Thick axis called the cob is similar to the tassel in that it produces multiple rows of paired (spikelet polystic chorus phyuolaxy) cheny and pared by (Panda, 2009).

In Sudan, few researches were conducted to produce maize hybrids; therefore this study was prepared to study;

1-Variability in ten maize (Zea maize) hybrids for some growth an yield characters

2- To select the most productive genotypes among the ten studied maize genotypes.

CHAPTER TWO

LITERATURE REVIEW

2-1 Phenotypic Variability:

Maize (*Zea mays* L) is saponaceous plant to the family poaceae (Gramineae). The crop originated Mexico and Central America. It is commonly cultivated in tropical areas and grown in summer crop in temperate regions (Skermanand River 1990). The name maize was given by Columbus in his first voyage to the new world. He introduced the crop to Europe and then taken from there to West Africa by Portuguese and subsequently to India (Dowswell *et al,* 1996).

Maize ranks number there after wheat and rice in the world as again crop (Frova *et al,* 1999).the summarized uses of maize in there ways, firstly in human food especially in the tropical areas as cobs, soup or fermenting the grain as alcohol or as flour in form of porridge, secondly in the livestock feeding particularly cattle by cutting the whole plant before maturely thirdly, in industries for making corn flacks, High quality oil.

2-2 Groups of maize:

Maize is often classified in to seven groups and types based on the properties

Of the endosperm and glumes these dent, flint, flour, pop corn, sweet corn (mangeldsorf 1974).described groups follows.

2-2-1 Dent corn (Zea mays indentata) it is commonly grown in the United States and northern Mexico. It is identified by pronounced dent on the top of the kerned. Both curvaceous and soft starch is found in this group. The kerned have a wide range of colors, but yellow and white are the most common in the commercial types. High lysine dent corns have modified opaque endosperm with high content of lysine. An essential nutritional amino acid for humans and animals.

2-2-2 Flint corn (Zea mays indurate) this group is predominant in Europe, Asia, central and south America. Endosperm of this group usually is soft and starchy in the center, but completely enclosed by corneous outer. It consists only of flinty or hard endosperm. The kernels are rounded to the top.

2-2-3 Flower corn (Zea mays amylacea) in this group soft starch occupied entirely the kernels. Kernels have many different colors, but blue and variegated are common. Flower corn used mainly for food.

2-2-4 Popcorn (Zea mays everta) this group different in cooler and size compared to the other groups. It is characterized by a very hard corneos endosperm and small kernel. It has the ability to produce additional ears on the main stalk or tiller. It is restricted to the American countries.

2-2-5 Sweet corn (Zea mays saccharata) this group has translucent kernels that wrinkle at maturity. When ripe it has sweet taste because the endosperm

contains sugar as well as starch. It is familiar to home gardens and of major importance to the frozen and canned food industries, it is grown primarily the United States.

2-2-6 Waxy corn (Zea mays certain) it is grown in East Asia and it is unit firmly dull. The kernels of waxy corn have uniformly dull rather than soft endosperm. The endosperm breaks with a wax like fracture; it is starch consists of amyl pectin. The starch used special foods and adhesive.

2-2-7 Pod corn (Zea mays tunicate) in this group the kernel is endosed in aped or husk and the ear is also enclosed in husk. It may by don't sweet, pop, flint or flow corn in endosperm properties. It is not grown commercially.

2-3 Botanical Description:

Corns as member of the grass family Gramineae have many descriptions common to other grass. It has conspicuous nodes in the stem, single leaf at each node, and the leaves in two opposites' ranks, each leaf consisting of a sheath surrounding the stem. (Kiesselbach, 1949).

2-3-1 Root system:

The root system of corn is deep and fibrous it consists of to sets of roots:-

2-3-1-1 seminal root whose initials are present in the embryo.

2-3-1-2 adventitious roots which arise from stem tissue after germination.

These are often called temporary and permanent, respectively, it had been shown repeatedly that the seminal roots many persist and function throughout the life of the plant.

The seminal roots consist of the radical or primary root and available number of lateral roots which arise adventitiously at the base of the first in torn ode of the stem, just above the scutellar node. Under ordinary field conditions at the usual time of planting corn, the seminal roots grown early horizontal direction for some distance is for turning down ward.

2-3-2 stem:

The stem or stalk of corn plants consists of approximately 24 alternating nodes and inter nodes. The number may vary some what according to regional type and environmental effect approximately, 8 inter node remain very short and under ground forming an inverted corn. Shape basal growing condition, the above ground inter nodes are distributed over stem length of 100 inches or more. With greatest diameter of above 11/4 inches near the ground level the gradual tapers to and low and its top(Kicsselbach,1979).

2-3-3 leaf:

Each leaf consists of a thin, flat expanded blade with a definite midrib and smatter veins and allicker, more rigid sheath with ales conspicuous midrib. Each sheath surrounds the inter node above the node to which it is attached a

leaf consists of an upper and lower epidermis between which in the mesophyll. Consisting largely of parenchyma cell with chloroplasts embedded in the mesophyll the veins of vascular bundles. The epidermis, which is but a single larger of cells in thickness, consists mostly of cell elongated parallel to the veins.

2-3-4 inflorescence:

The maize plant bears tow of inflorescence

2-3-4-1 The staminate or tassel containing male flower which is always terminal and there for, only one tassel is found per stalk.

2-3-4-2 The pistillate in florescence or female inflorescence which develops in to an ear and they are born at the side of the plant in to the axis of the leaves on a short branch known as (shank). They may by more than one per stalk depending up on variety and management practices. The shank consists of modified leaves enclosing ears collectively known as (Kusk) (Panda.2009).

2-4 Crop ecology (Adaptation):

The moisture by evaporation from the soil exceed the amount of water used by the small corn plant as the leaf canopy develops, transpiration in crease and shading relatively reduce the losses from the soil (Izzddein,2004)

The soil fertilizer are more important with corn they any other important cereal. Soils that is very high in their content of available nitrogen will caves lodging of the small grains (Abdelhafeez, 2001)

2-5 literature review

Two field and laboratory experiments more conducted to study variability of grain yield and quality fraits inthir teen maize genotypic, the field experiment was conducted in the winter season of 2015 in the period from November 2015-February 2016.

The results showed that there are significant ($p>0.5$) between 13 maize genotypes for all yield the quality studies traits. The genotypes BOMU scored the highest yield 1286.30 t/ha. Most of the 13 maize genotypes were characterized with yellow and yellow color mixed with other colors (Hager Mo 16) (2015-2016).

CHAPTER THREE

MATERIALS AND METHODS

3-1Experimental site

The experiments was conducted in winter season of 2016, at location Shambat, College of Agricultural Studies, Sudan University of Science and Technology at latitude 15^0 32′ N, longitude 32^0 35′ E and 288 meter above sea level. It is characterized by high heavy cracking clays.

3-2Plant material used

The plant material used consisted 10 lines grain maize hybrids (F1), prepared from diallel crosses conducted at Shambat, College of Agricultural Studies, Sudan University of Science and Technology

3-3 Design and Experimental layout

Evaluation, of the obtained F_1 grain maize hybrids were grown in a randomized complete block design (RCBD), with three replicates. The plot size was maintained as 2 rows x 3 m long for each entry in each replication, with inter and intra row spacing of 80 and 25 cm, respectively.

Land was prepared using disk plowing, harrowing and then ridging. Sowing date was the second week of July2017. Seeds were sown at the rate of 3- 4 seeds per hill. Resowing was carried out before the second irrigation. The plants were later thinned to one plant per hill three weeks after sowing. A dose of 86 -kg N/ha was applied in split equal doses after thinning and before flowering. The crop was irrigated at intervals of 7-12 days, and plots were kept free of weeds by hand weeding.

3-4 Parameters measured

At each plot respectively plants were selected and from them, the following growth and yield parameters were measured included

3-4-1 Plant height (PH)

Plant height was measured in cm from the soil surface to the collar of the last leaf on the plant.

3-4-2 Days to 50% tasseling (DT)

Days to tasseling was taken as the number of days from sowing until 50% of the plants in the plot shed pollen.

3-4-3Days to silking (DS)

days to silking was taken as the number of days sowing until 50% of the plants in the plot started to under go silking, i.e. silk emerged to 2cm length

3-4-4 100-kernel weight (KW)

The weight of 100 kernels in (g) taken at random from the bulk kernels of the ear after threshing.

3-4-5 Grain yield plant (GYP) (kg/ha)

For each plot, the fresh weight of all harvested ears was recorded, air-dried, threshed and weighed, expressed in kg/ha. The grain yield was obtained by converting the yield of the actual harvested area of $m^{2\ to}$ kg /ha.

3-5 Statistical analysis

The analysis of variance (ANOVA) was carried out for the collected data using the Statistical Analysis System (SAS) computer package. The analysis was done .for all characters and then combined. Coefficient of variation (C.V.) for each character and correlation of the characters was computed. Mean performance was compared according to Duncan's Multiple Range Test (DMRT)

Table (3-1): List of 10 maize hybrids used in the study

Hybrid serial No.	Origin
1	Mugtama 1 x Hudeibia 1 (Mg_1 x H_1)
2	Mugtama 1 x Hudeibia 2 (Mg x H2)
3	Mugtama 1 x Hudeibia 3 (Mg x H3)
4	Giza 1 x Hudeibia 1 (G1 x H1)
5	Giza 2 x Hudeibia 1 (G2 x H1)
6	Giza 3 x Hudeibia 1 (G3 x H1)
7	Giza 1 x Hudeibia 2 (G1 x H2)
8	Giza 2 x Hudeibia 2 (G2 x H2)
9	Giza 3 x Hudeibia 2 (G3 x H2)
10	Hudeibia1 x Hudeibia 2(H1 x H2)

CHAPTER FOUR

RESULTS

Phenotypic Variability for yield parameters:

4-1 Plant height(cm):

Analysis of variance for the character showed that there was significant difference between the ten maize genotypes. The highest (217.00) and the lowest (162.80) were obtained the genotypes 14 and 20, respectively the coefficient of variation for this characters was 11.7.

Table (1): plant height

4-2 50% days to tasseling:

Analysis of variance for the character showed that there was significant difference between the ten maize genotypes, the highest (63.00) and the lowest (58.33) were obtained the genotypes 17 and 20 respectively the coefficient of variation for this character was 2.92.

4-3 Days of Silkinsg:

The analysis of variance for the character showed that there were significant differences between the ten genotypes, the highest (69.333) and lowest (64.00) were obtained the genotypes 17 and 12 respectively the coefficient of variation for this characters was 4.51

4-4 100 kerneal weight:

The analyses of variance for the character showed that ten maize genotypes. The highest (20.17) and the lowest (15.70) were obtained the genotypes 16 and 18 respectively the coefficient of variation for this character was 12.90.

4-5 grain yield plant

The analyses of variance for the character showed that there no significant differences between the maize genotypes.

The highest (93.90) and the lowest (59.10) were obtained the genotypes 16and 20 respectively the coefficient of variation for this character was 27.2.

Table (4-3): Means of some growth and yield character of ten hybrid of maize

Hybrids	Plant height(cm)	50%Days of tassel	50%Days of silk	100kernel weight(gm)	Grain yield plant
Mg x H1	217 ^{A}	63.0 ^{A}	69.3 ^{A}	20.17 ^{A}	93.9 ^{A}
Mg x H2	211 ^{A}	62.7 ^{A}	67.3 ^{AB}	19.7 ^{AB}	91.2 ^{A}
Mg x H3	209 ^{A}	61.3 ^{ABC}	67 ^{AB}	19.07 ^{AB}	87.9 ^{A}
G1 x H1	207.7 ^{A}	60.3^{ABCD}	66.67 ^{AB}	18.07 ^{AB}	87.3 ^{A}
G2 x H1	204.8 ^{A}	60 ^{ACDE}	66.67 ^{AB}	18.03 ^{AB}	83.6 ^{A}
G3 x H1	201.7 ^{AB}	59.3^{CDE}	66.67 ^{AB}	17.8 ^{AB}	79.07 ^{A}
G1 x H2	192 ^{AB}	59 ^{CDE}	66.33 ^{AB}	17.2 ^{AB}	76.9 ^{A}
G2 x H2	192 ^{AB}	58.3 ^{DE}	66.33 ^{AB}	16.83 ^{AB}	73.4 ^{A}
G3 x H2	188.2 ^{AB}	58.3^{DE}	64.33 ^{AB}	16.3 ^{AB}	64.2 ^{A}
H1 x H2	162.8 ^{B}	58.3 ^{DE}	64.00 ^{B}	15.7 ^{B}	59.1 ^{A}

Table (4-2): Means squares for growth and yield character of ten hybrid of maize

Character	Replication	Hybrids	Error
Plant height(cm)	83.354	782.83 *	532.77
50%Days to tassel	2.432	10.35776 *	3.0606
50%Days of silk	0.993	6.01818 *	9.000
100kernel	0.474	6.8536 *	5.429
Grain yield plant	33.90	369.1 ^{NS}	470.805

* =Significant differences

NS = No significant differences

CHAPTER FIVE

DISCUSSION

5-1 Phenotypic Variability:

In this study significant difference was revealed among, plant height, days to 50% silking, days to 50% tasseling, 100kernel weight content ant non significant was detected for grain yield plant.

Phenotypic Variability among grain maize for growth yield, and quality characters has been stated by many workers.

The genotypes 16 and 17 scored the highest grain yield among the maize genotypes evaluated in this study. These genotypes could be of a grant value in any maize breeding program for the object of obtaining high yield. Similar results was stated by (Idris and Abuali, 2012).

CHAPTER SIX

CONCLUSIONS

Basted on the results obtained from this study, it could by concluded that:

1- The high variability between maize genotypes obtained in this study for growth and yield characters could be of a great value in any grain maize breeding program.

2- The genotype Mg x H1 scored the highest 100 kernel weight(gm), therefore this genotype could be used by farmers or as a parental line in any maize breeding program.

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