بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Agricultural Studies

Genetic Variability in Ten genotypes of Maize (Zea mays L.) growth and yield characters.

BY:

Khansa Kheder Hasab elnaby Kobia

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SUPERVISOR:

Dr. Atif Elsadig Idris

Department of Agronomy

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الآيـــــة

قَالَ تَعَالَىٰ:

﴿ تَبَارَكَ ٱلَّذِى نَزَّلَ ٱلْفُرْقَانَ عَلَىٰ عَبْدِهِۦ لِيَكُونَ لِلْعَٰلَمِينَ نَذِيرًا ﴿١﴾ ٱلَّذِى
لَهُۥ مُلْكُ ٱلسَّمَٰوَٰتِ وَٱلْأَرْضِ وَلَمْ يَتَّخِذْ وَلَدًا وَلَمْ يَكُن لَّهُۥ شَرِيكٌ فِى ٱلْمُلْكِ
وَخَلَقَ كُلَّ شَىْءٍ فَقَدَّرَهُۥ تَقْدِيرًا ﴿٢﴾ ﴾ صدق الله العظيم

سورة الفرقان (1-2)

DEDICATION

To my mother

To my dear father

To my sisters

To my teachers

To all my friends and colleagues

This work dedicated

ACKNOWLEDGEMENTS

I am deeply grateful to ALLAH who bestowed me good health and help to accomplish this study. I wish to express my gratitude to my supervisor Dr. Atif Elsadig for his enormous assistance, guidance criticism, advice and supervision through the progress of this study; my full thanks to the teachers and colleagues in the Department of Agronomy. Finally my deep thanks appreciation and gratitude due to the members of my family have been more than helpful

LIST OF CONTENTS

LIST OF TABLES

الخلاصة :

أجريت هذه التجربة في الموسم الشتوي للعام 2016 في المزرعة التجريبية بشمبات كلية الدراسات الزراعية جامعة السودان للعلوم والتكنولوجيا .

الهدف من الدراسة معرفة التباين الوراثي في عشرة طرز وراثية من الذرة الشامية لصفات النمو والإنتاجية والتي تضمنت عدد أيام الإزهار المذكر، عدد أيام الإزهار المؤنث ، سمك الكوز ، عدد الصفوف في الكوز ، عدد الحبوب في الصف الواحد والإنتاجية.

أستخدم تصميم القطاعات العشوائة الكاملة بثلاث مكررات.

أظهرتحليل البيانات وجود فروقات معنوية لصفات عدد أيام الإزهار المذكر، عدد أيام الإزهار المؤنث وسمك الكوز. وعدم وجود فروقات معنوية في عدد الصفوف في الكوز، عدد الحبوب في الصف الواحد والانتاجية .

Abstract

The experiment was conducted at winter season of 2016 at the experimental farm of Shambat, college of Agricultural studies, Sudan University of Science and Technology. The objective of this was study to investigate the genetic variability in ten maize genotypes (Zea mays L.) for some growth yield characters included Days to tasseling , Days to silking, Cob diameter, Number of rows per ear, Number of kernels per row and Grain yield (kg/ha). The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The analysis of variance showed significant differences in days to tasseling, days to silking and cob diameter, and non-significant differences in number of rows per ear, number of kernels per row and grain yield (kg/ha) . The genotype 17scored the highest yield (1122.5) .

CHAPTER ONE

INTRODUCTION

Maize (*Zea mays*-L) is one of the most important cereals in the world.

Apart from direct human consumption, maize grains from an important in gradient of poultry and cattle feed (panda, 1994).The genus Zea belonging to the tribe Maydeae of family gramineae with 10 Pairs of chromosomes which has only one species, Zea mays. The maize was classified by Sturtevant in 1899 in to seven groups or types based on the endosperm of kernels. They are pod corn, popcorn, flit corn, dent corn, flour corn, sweet corn and waxy corn.

Globally, maize is cultivated in an area of 136.4 m\ha with the production of 602.6 MT (panda 1994).

Production of maize is more than 604 million metric tons per year and more than half amount it produced in the U.S.A (FAO.2003).

In the Sudan maize is considered as a minor crop, maize is grown under rain fed agriculture in Kurd fan, Darfur and in small irrigates areas in the northern states. Recently , more attention is being paid to the crop .and expansion was noticed under the Gezira scheme - Blue Nile scheme – White Nile scheme , New governorate etc.

The increasing demand for maize for poultry feed or intermediary products for human nutrition have led to greater interest in this crop in Sudan (Idris, 2012).

Maize is largely consumed as food in various forms. It is also used as animal feed particularly for poultry. Green maize plants are used as fodder .popping the

corn is a method of starch cookery. Maize is growing material for a number of products, glucose, germ oil, high fructose syrup .etc.

Some of products which have application in industries such as alcohol, textile, paper, pharmaceuticals, cosmetics and edible oil. Maize based industry in the driving force of the U.S economy. (Panda, 1994).

Tremendous diversity of maize is a result of centuries of selection, mutation and hybridization. Different kind of grains recognized so far described as under (Dow swell et al, 1996).

In Sudan few research were conducted to produce maize hybrids, there for this study was prepared to study:

1-Variability in ten maize (*Zea mays*_L) hybrids for some growth and yield characters.

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

CHAPTER TWO

LITERATUR REVIEW

2-1 Botanical characteristics

Corn as a member of grass family gramineae have many characteristics common to other grasses.it has conspicuous nods in the stem , single leaf at each node , and the leaves in two opposites ranks , each leaf consisting of a sheath surrounding the stem and an expanded blade connected to the sheath by joint (kiesselbach,1979).

2-1-1 Roots

The root system of corn as of other grasses .consists of two roots

1-Seminal root initials are present in the embryo.

2-Adventitious root which arise form stem tissue after germination.

This are often called temporary and permanent respectively, it had been shown repeatedly that the seminal roots, may persist and function throughout the life or 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 internode of the stem. Just above the scutellar node. Under ordinary field conditions at the usual time of planting com, the seminal roots grow in nearly horizontal direction for some distance is for turning down ward.

2-1-2 Stem

The stem of corn plants consists of approximately 8 internode remain very short and underground forming an inverted con-shape basal end at the stem known as the crown

Under favorable growing condition, the above ground internodes are distributed over a stem length of 100 inches or more. With it is greatest diameter of about 1114 inches near the ground level the stem gradual tapers to and two and it is top (kicsselbach, 1979)

2-1-3 Leaf

Each leaf consists of a thin, flat expanded blade with a definite midrib and smaller veins and a thicker, more rigid sheath with ales conspicuous midrib. Each sheath surrounds the internode above the node to which it is attached a leaf consists of an upper and lower epidermis between which is the mesophyll. Consisting largely of parenchymal cells with chloroplasts embedded in the mesophyll the veins of vascular bundles .the epidermis, which is but a single larger of cells thickness, consists mostly of cells elongated paroled to the veins.

2-1-4 Inflorescence

Corn is normal amonoecions plant with it is functional staminate flowers born in the tassels which terminate the stems and it is functional postulate flowers borne in the ears which terminate all but the basal bandies tillers in the staminate panicle spike lets occur either two florets pars spike let each floret contains three stamens, two lodicules and rudimentary pistil (Kiesselbach, 1949).

2-2 Groups of maize

Maize is often classified into seven groups and types based on the properties. Mangeldsorf (1974) described these groups of follow

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 kernel .Both coriaceous and soft starch are found in this group. Kernel 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 amino acid for human and animals

2-2-2 Flint corn (Zea mays indurate) this group is predominant in Europe ,Asia , Central and south America .This endosperm of this group usually soft and starchy in 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 amylaceae*) in this group soft starch accepted entirely the kernels .kernels have many different colors, but, and variegated are common. Flower corn used mainly for food

2-2-4 popcorn (*Zea mays everta*) this group differs in color and size compared to other groups .It is characterized by every hard corneous 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 cane 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 firmly dull. The kernels of waxy corn have uniformly dull rather than soft endosperm .The endosperm breaks with a waxy like fracture; it is starch consists of amylopectin. The starch is used as special foods and adhesive.

2-2-7 Pod corn (*Zea mays tunieate*) in this group the kernel is enclosed in aped or husk and the ear is also enclosed in husks .It maybe dent ,sweet ,waxy , pop , flint , or flaw corn in endosperm properties .It is not grown commercially .

2-3 phenotypic variability

Maize (*Zea mays* L) is saponaceous plant belongs to the family Gramineae .The crop commonly cultivated in tropical areas and grown as summer crop in temperate regions (Skerman and Rivers 1990). The name maize was given by Columbus in his first voyage to the new world. Phenotypic variability in maize was stated by many investigator e.g. (Idris and Abu ail, 2012, I shag, 2004).

2-4 Crop ecology (adaptation)

The moisture requirements of corn very throughout the growing season. During the first few weeks of sowing. Losses of moisture by evaporation from the soil exceed the mount of water used by the small corn plant as the leaf canopy develops; transpiration increase and shading relatively reduce the losses from the soil (Izeddein, 2004). The soil fertility are more important with corn they any other important cereals. Soils that are very high in their content of available nitrogen will cause loading of the small grains. (Abdelhafeez, 2001).

CHAPTER THREE

MATERIALS AND METHODS

3-1 Experiment site

The experiment was conducted in season 2016, at Shambat, College of Agricultural Studies, Sudan University of Science and Technology at Latitude 15^0 32 N, longitude 32^0 35 E and 407 meter above sea level. It is characterized by high heavy cracking clays

3-2Plant material

The plant material used in this study 10 line (F1) of maize hybrids prepared at Shambat, College of Agricultural Studies Sudan University of Science and Technology

3-3 Design and experimental layout

Evaluation, the obtained F1 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 inter a 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 July. Seeds were sown at the rate of

3-4 seeds per hill. Re sowing 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

3-4-1 Days to 50% tessaling (DT)

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

3-4-2 Days to silking (DS)

Days to silking was taken as the number of days from sowing until 50% of the plants in the plots started to undergo silking, i.e. silk emerged to 2cm length

3-4-3 Cob diameter (CD)

Cob diameter was measured in cm using Vernier Caliper from threshed ears. Measurements were taken on the different parts of the ear i.e., the top, middle and bottom, and the average was then taken

3-4-4 Number of rows per ear (NRE)

An average of three rows taken at random from each ear was used to determine the number of rows of each ear

3-4-5 Number of kernels per row (NKR)

An average of three kernel rows taken at random from each ear was used to determine the number of kernel row of each ear

3-4-6 Grain yield (GY) (Kg/ha)

For each plot, the fresh weight of all harvested, ears was recorded, air-dried, threshed and weight, expressed in kg/ha. The grain yield was obtained by converting the yield of the actual harvested area of 4.0 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 (ASA) computer package .The analysis was done. For all characters and then combined. Coefficient of variation (C.V.) for each characters and correlation of the characters was computed. Mean performance was compared according to Duncan's Multiple Range Test (DMR).

List of 10 maize hybrids used in this study:

Number	Hybrid	Origin
1	11	Mug tama1 x Hudiba1 (Mg1xH1)
2	12	Mug tama1 x Hudiba 2 (Mg1xH1)
3	13	Mug tama1 x Hudiba 3 (Mg1x H1)
4	14	Giza 1 x Hudiba 1 (G1x H1)
5	15	Giza 2 x Hudiba 1 (G1xH1)
6	16	Giza 3 x Hudiba 1 (G1x H1)
7	17	Giza 1 x Hudiba 2 (G1x H2)
8	18	Giza 2 x Hudiba 2 (G1xH2)
9	19	Giza 3 x Hudiba 2 (G1x H2)
10	20	Hudiba 1 x Hudiba 2 (H1xH2)

CHAPTER FOUR

RESULTS

4-1 Phenotypic Variability for yield parameters:

4-1-1 Days to50% teasseling (DT)

The analysis of variance for this character showed that there was significant difference between the ten maize genotypes. The highest (63.000) and the lowest (58.333) were obtained the genotypes 17and 12-16-20 respectively, the coefficient of variation for this characters was 2.92.

4-1-2 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 character was 4.51

4-1-3 Cob diameter:

The analyses of variance for the character showed that there were significant differences between ten maize genotypes, the highest (4.300) and the lowest (3.9000) were obtained the genotypes 11and 15 respectively, the coefficient of variation for this character was 5.79.

4-1-4 Number of rows per ear (NRE):

The analyses of variance for the character showed that there non-significant differences between the ten maize genotypes, the highest (15.333) and the

lowest (13.667) were obtained the genotypes 16 and 14 respectively, the coefficient of variation for this character was 7.94.

4-1-5 Number of kernels per row (NKR):

The analyses of variance for the character showed that there non-significant differences between the ten maize genotypes, the highest (37.333) and the lowest (33.000) were obtained the genotypes 16 and 17 respectively, the coefficient of variation for this character was 9.06.

4-1-6 Grain yield (GY) (Kg/ha):

The analyses of variance for the character showed that there non-significant differences between the ten maize genotypes, the highest (1122.5) and the lowest (691.83) were obtained the genotypes 16 and 17 respectively, the coefficient of variation for this character was 44.58.

Table (4-1): Means of some growth and yield character of ten hybrids of maize:

Hybrids	DT	DS	CD	NRE	NKR	GY
(MgxH1)	60ABCD	66.7AB	4.30A	15.3A	36.7A	885.60A
(MgxH2)	58.3DE	64B	4AB	14A	34A	99.90A
(MgxH3)	59.3CDE	67AB	4AB	14A	35.3A	868.37A
(G1XH1)	60.3ABCD	66.3AB	4AB	13.7A	35.7A	813.60A
(G2xH1)	61.3ABC	66.7AB	30.90B	14.7A	35.3A	783.33A
(G3xH1)	58.3DE	64.3AB	4.30A	15.3A	37.3A	1122.5A
(G1xH2)	63A	69.3A	4.10AB	14.3A	33A	691.83A
(G2xH2)	62.7AB	66.7AB	4AB	14.3A	34.7A	926.20A
(G3xH2)	59CDE	67.3A	4.2AB	14.7A	33.3A	782.2A
(H1xH2)	58.3DE	66.3AB	4AB	15A	33.3A	782.93A
C.V	2.92	4.51	5.79	7.94	9.6	44.58

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

Character	Replication	Hybrids	Error
Days to teasseling	2.432	10.35776 *	3.0606
Days of silk	0.993	6.01818 *	9.000
Cob diameter	3.636	0.05685*	0.0556
Number of rows per ear	-0.14949	0.88485^{Ns}	1.333
Number of kernels per row	-1.15152	6.45455^{Ns}	9.90909
Grain yield	-33825.8	38520^{Ns}	13999

* =Significant differences

Ns = Non significant differences

CHAPTER FIVE

DISCUSSION

5-1 Phenotypic Variability:

In this study significant difference was revealed among, days to 50% silking, days to 50% tasseling, cob diameter, and non-significant was detected for number of rows per ear, number of kernels per ear and grain yield.

Phenotypic variability among grain maize for growth yield and quality characters was bean in stated by many workers.

The genotypes 16 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 result was stated by (Idris and Abuali, 2012).

CHAPTER SIX

CONCLUSION

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

1- The high variability between maize genotypes wereald in this study for growth and yield characters could be of a great value in any grain maize breeding program.
2- The genotype 16 and 20 scored the highest yield t/ha therefore this genotype could be used by farmers on as a parental line in any maize breeding program.

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