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دراسات على الثبات المحصولي لبعض التراكيب الوراثية الجديدة لسورجم العلف في بيئات مختلفة

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الملخص العربي

تم تنفيذ هذا البحث في أربعة محطات للبحوث الزراعية التابعة لمركز البحوث الزراعية في كل سدس فى بني سويف والجميزة بالغربية و السرو بدمياط وسخا بكفر الشيخ. أقيمت التجربة خلال موسمي ٢٠٠٨ و ٢٠٠٩ . اشتملت الدراسة ١٦ تركيب تم زراعتها فى قطاعات كاملة العشوائية فى اربعة مكررات تحت اربعة ظروف بيئية مختلفة لتقيم جميع التراكيب الوراثية على مستوى الثلاث حشات.

تهدف هذه الدراسة إلى تقدير الثبات الوراثي والمظهري لبعض التراكيب الوراثية الجديدة لسورجم العلف تحت ظروف بيئية مختلفة، والحصول على معلومات عن سورجم العلف من خلال التفاعل بين البيئة والتراكيب الوراثية،و الحصول على أفضل بيئة لاجراء اختبار الثبات الوراثى لسورجم العلف. وكانت التركيب الوراثية المستخدمة هي Piper black ، Sids1 ، Sids2 ، Serw1 ، Serw3 تم انتخابهم من خلال حقل التربية، IS 3192 و IS 3193 ًأدخلت من المعهد الدولي لبحوث المحاصيل فى المناطق شبه الاستوائية ، Giza1ذره علف سكريه، Giza2 حشيشة سودان العاديه، و بعض التراكيب الآخرى أستجلبت من الإكراسات من خلال معهد المحاصيل السكرية و التى تم اختبارها كمحصول علف وهي Rex، Honey ، Browly ، Williams،MN4418 ، MN2756، MN459.

أخذت البيانات على : محصول العلف الأخضر (كجم / قطعة)،محصول العلف الجاف (كجم / قطعة)،طول النبات (سم)، عدد السيقان في مساحة ٠,١٥سم٢.أخذت الحشة الاولى والثانية والثالثة على فترات٦٠، ١٠٠، ١٣٥ يوم من الزراعة.

ويمكن تلخيص أهم النتائج المتحصل عليها كالاتى:

١– الثبات المظهري (إبرهارت وراسل١٩٦٦)

- بالنسبة لصفة المحصول الاخضر فان التراكيب الوراثية Serw 3 وكذلك MN4418 توافرت بها معظم شروط الثبات الوراثى لذلك يمكن القول انها تراكيب ثابتة وراثيا فمثلا نجد ان Serw 3 متوسط انتاجية اعلى من المتوسط العام للعشيرة ٣٩,٤٠ كجم للقطعة وكذلك معامل انحداره ١,٠٢٩ وكذلك فان الانحراف عن خط الانحدار –٠,٢٢١

- بالنسبة لصفة المحصول الجاف وجد ان هناك تراكيب وراثية ثابتة حيث المحصول الجاف اعلى من المتوسط العام، معامل الانحدار لايختلف معنويا عن الوحدة ،و اقل قيمه فى الانحراف عن خط الانحدار. تشتمل هذه المجموعه على Is3192 و Giza2 و Serw3 ، ومتوسط المحصول الجاف لهذه التراكيب ٤,٨١ و ٤,٥٧ و ٥,٤٣ كجم/قطعه على الترتيب.معامل الانحدار لهذه المجموعه من التراكيب الوراثيه بالنظر الى الانحراف عن خط الانحدار ٠,٩٧٣ و ٠,٠٣٩ و ٠,٩١٨ و ٠.٠٣٧ و ١,٠٠٩ و ٠,٠٢ للثلاث تراكيب على الترتيب.
- بالنسبه لعدد السيقان ، نجد ان التراكيب الثابته Giza-1 و sids-1 و serw-3 . حيث لا يختلف معامل الانحدار معنويا عن الوحده ،الانحدار عن خط الانحراف لايختلف معنويا عن الصفر ، وعدد السيقان لها اعلى من جميع المتوسطات.

٢- الثبات الوراثى (تاى ١٩٧١)

- تشير التقديرات الوراثيه (α ، λ) للمحصول الاخضر والجاف وطول النبات و عدد السيقان بطريقة تاى ١٩٧١ ، الى اختلاف كبير بين التراكيب الوراثيه فى قياس الانحدار عن الاستجابه الخطيه(λ) واقل من مدى الاستجابه الخطية لتاثير البيئه (α) .
- بالنسبة لصفة المحصول الأخضر نجد ان التراكيب الوراثية Serw 3 و MN4418 تقع فى منطقة الثبات الوراثى فوق المتوسط على مستوى البيئات.حيث قيمة (α) تساوى صفر(٠.٠٢٩ و ٠,٠٠٣)على الترتيب ،وقيمة (λ) تساوى الوحدة (٠,٠٨٩ و ١,١٩٢) على الترتيب .

STUDIES ON YIELD STABILITY OF NEW FORAGE SORGHUM GENOTYPES IN DIFFERENT ENVIRONMENTS

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ABSTRACT: *The present study was carried out at four Agricultural Research Stations, ARC, to represent most agronomic and climatic conditions across the country during two seasons, 2008 and 2009 .These four locations were Sakha (Kafr El-Sheikh governorate), Gemmeiza (Gharbiya governorate), Sids (Bene Suef governorate) and El-Serw (Dommita governorate).*

The main objective of the present investigation was to study the variation, performance and stability parameters of yield of forage sorghum genotypes, Sorghum bicolor (L.)Monch tested under eight environments (the combination of 2 years X 4 locations).

*For Eberhart and Russell's method (1966**),** genotypes did not respond similarly to the varied environments. As for fresh forage yield, two genotypes might be considered as a phonotypicaly stable. Mean while, the genotypes; piper black, Is3191,Giza1,Sids1,Sids2 and Serw1, showed high relative yield ,regression coefficient more than unity and significant deviation from linearly, hence, might be considered as an environmentally responsive genotypes.*

The genotypic statistic (α and λ) for fresh, dry forage yield, plant height and number of stems for Tai's method, 1971. The genotypes differed greatly in the amount of deviation from the linear response (λ) and to a less extent in the response (α) for environments. Genotypes Serw3 and Mn4418 were average stable genotypes for high yielding environment. λ value were unity (0.089 and 1.192), respectively. Mean while, genotypes Serw3, Mn4418 and Is3192 has differences in main (additive) effects and has low interactions with environments (stable). The genotypes Is3292, Serw 3 and Mn4418 were average stable genotypes.The Serw3 genotypes was located in the favourable environment with average dry forage yield of 5.43 whereas Is3192 and Mn4418were almost at the unfavoured environment with average yield of 4.81 and 5.10 kg/plot ***.****Also, the genotype Giza 2 had located in average stability area for plant height (cm). Giza 2 was considered stable genotypes. Mean while all genotypes were considered unstable genotypes because they were located out of the average stability area. Mean while, the genotypes Is3192, Giza2 and Rex had located in average stability area for number of stems. The main objective of the present investigation was to study the variation, performance and stability parameters of yield of forage sorghum genotypes, Sorghum bicolor (L.)Monch tested under eight environments (the combination of 2 years X 4 locations).*

Key words: *Stability, Different environment, Cuts, Fresh, Dry, Forage, plant height.*

INTRODUCTION

Forage sorghum, sudangrass and sweet sorghum cultivars are considered the most important forage crops in summer seasons for feeding animals and could grown well in Egypt. Stability measures, proposed to further characterize genotype X environment interaction among breeding materials in various stages of germplasm development, have been primarily of two types, the measurement of response to environmental changes and the stability (consistency) of that response. To be useful in a breeding program these measures (yield response and stability) must be heritable, repeatable and provide information useful to the breeder over and above yield per se Casler and Hovin (1984).

The environments where crops grow include several elements in each season. Weather conditions and other factors are important to determine yield potential of a genotype. The yielding ability of most of cultivars varied according to environmental conditions. Plant breeders noticed that different genotypes don't react in similar way to the changes of environment; therefore they have the interest to examine their genotypes for stability under several different environments. The plant breeder refers to produce varieties or hybrids of as near universal adaptation as possible. The information on adaptability and performance stability of genotypes over years and locations is very important for national policy in crop production.

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The main objective of the present investigation was to study the variation, performance and stability parameters of yield and its components in forage sorghum genotypes, *Sorghum bicolor* (L.)Monch tested under eight environments (the combination of 2 years X 4 locations).

MATERIALS AND METHODS

The present study was carried out at four Agricultural Research Stations, ARC, to represent most agronomic and climatic conditions across the country during two seasons, 2008 and 2009 .These four locations were *Sakha* (*Kafr El-Sheikh* governorate), *Gemmeiza* (*Gharbiya* governorate), *Sids* (*Bene Suef* governorate) and *El-Serw* (*Dammit*a governorate).

Sixteen sorghum genotypes were grown in a randomized complete block design (R.C.B.D) with four replications under the eight different environments(four regions x two years). The plot sizes for each genotype was 12 m^2 (4 m long x 3 m wide) consisting of five ridges. Seeds of each genotype with seeding rate was 20 kg/fed. The genetic materials used in the present investigation included, piper black, Sids1, Sids2, Serw1 and Serw3 were selected through breeding program, IS 3192 and IS 3193 were import from ICRASAT, Giza1 was sorghum saccharatum, Giza2 was common sudangrass, MN 4418, MN 2756, MN 450, Rex, Honey, Browly and Williams were imported from ICRISAT, through Sugar crops Research Institute and tested as forage crops, ARC, Egypt.

Nitrogen fertilizer in the form of urea (46.5% N) was applied in three equal doses before the first, second and third cutting. Normal cultural practices for forage sorghum in each locations were followed. The first, second and third cut were taken after 60,100 and 135 days from sowing ,respectively . The preceding crop in first and second season in the four study locations (Sids, Gemmeiza, EL-Serw and Sakha) were; fallow, wheat, wheat and Barseem clover, respectively. Mean while, in second season were fallow, wheat, wheat and Barseem clover, respectively.

Data had recorded for: Fresh forage yield (Kg/Plot), dry forage yield (Kg/Plot), Plant height (cm.) and number of stems in $0.15m^2$.

Statistical analysis:

Single environment analysis and combined analysis over environments for randomized complete block design with four replication was carried out according to Snedecor and Cocharn (1967). Homogenity of experiments variances had computed according to Bartlett, 1937.

Stability method:

A-Eberhart and Russell's method (1966):

The regression of each variety in an experiment on an environmental index and a function of the required deviations from this regression were proposed in this method to provide estimates of the desired stability parameters. Stable genotype in this method is a genotype with; a genotype with high/ desirable mean value, (S^2d) deviation not significantly different from zero and a regression co-efficient equal unity

B-Tai’s model (1971):

This model subdivides the genotype – environment interaction effects of (İ) genotype in to two components; $\hat{\alpha}_i$ and $\hat{\lambda}_{i,}$ based $_{on}$ the principle of structural analysis relation. For the comparison of results, a perfectly stable genotype will not change performance from environment to environment. This is equivalent to α = -1 and λ = 1. Perfectly stable genotypes probably do not exist and plant breeders will have to be satisfied with obtainable levels of stability a perfect stable genotype would not change its performance from one environment to anther. This is equivalent to stating (α = -1 and λ =1).The values (α=0 and λ=1) will be referred to as average stability, whereas, the values (α=>0& λ=1) will be as below average stability. However, the value (α <0 & λ = 1) will be referred to as above average stability.

RESULTS AND DISCUTION

1- Phenotypic stability (Eberhart and Russell1966):

This model provides means for partitioning the genotype environment interaction of each genotype to two parts; the variation due to the response of the genotype to varying environmental indices (sums of squares due to regression) and the unexplainable deviations from the regression on the environment index.Consequently, a preferred stable genotype would have approximately:

b = 1.0, s^2d = 0.0 and a high mean yield

The mean square from analysis of variance for fresh and dry yields kg/plot, plant height (cm) and number of stems on in 0.15m^2 were given in Table (1). Mean squares of the genotype, environments and their interactions were highly significant for fresh and dry forage yields, plant height and in number of styems 0.15m^2 . This significant interaction had brought out difficulty in identifying superior forage yielding sorghum genotypes over environments. Consequently, performance across environments might identify the reaction and the response of each genotype

Table 1

to environmental changes. Significant mean squares of environment (linear) for genotype indicated that, genotypes did not respond similarly to the varied environments.

As for fresh forage yield, the genotypes serw 3 and MN4418 had met the parameters of stability, whereas, (b) values didn't differ significantly from unity (b=1) and s^2d didn't differ significantly from zero (s^2d=0) and had fresh forage yield higher than the over all mean Table (2). Consequently, those two genotypes might be considered as a phonotypicaly stable. Mean while, the genotypes;piperBlack,Is3191,Giza1,Sids1,Sids2 and Serw1, showed high relative yield ,regression coefficient more than unity and significant deviation from linearly, hence, might be considered as an environmentally responsive genotypes.

As for, dry forage yield, stability parameters had classified the studied genotypes to the following groups; a) stable genotypes with; over average mean dry forage yield,a regression coefficient on the environmental index un significantly different from unity and the least deviation from regression .This group included Is3192,Giza2 and Serw3 genotypes. The recorded mean dry forage yields were 4.81,4.57 and 5.43 kg/plot for the three genotypes, respectively. Regression coefficients for that group of genotypes regarded with deviations from regression were 0.973 and 0.039, 0.918 and 0.037 and 1.009 and 0.02 for the three genotypes, respectively.b) average stable genotypes with low mean yield ,regression coefficient less than unity and low deviation from regression. This group included Mn2756,Mn4509,Rex,Browly and Honey .c) average responsive genotypes with high mean yield ,regression coefficient higher than unity and high deviation from regression .This group included, piper black,Is3193,Sids1 and Giza1 where ,the recorded mean yield were 8.24,6.93,6.63

Table 2

and 6.13 kg/plot ,respectively. Values of regression coefficient regarded with s^2d values for that group of genotypes were, 1.4 and 0.217, 1.254 and 0.84, 1.216 and 0.090

and 1.177 and 0.011, respectively. These results similar that obtained by Amin (2006), Haussmann *et al* (2000), Mohamed Saeed and Francis (1983), Barker *et al*(1981), Elmer Gray (1982), Diza *et al* (1987), Madhusudhana *et al* (2003) Scapim *et al* (2000), visser (1992), Bakheit (1990) Also, disagreement with those obtained by Burli *et al* (2004) and kenga *et al* (2003).

Plant height, had not met the parameters of stability, because (b) values differ significantly from unity (b≠1) and (s^2d) differ significantly from zero ($s^2d≠0$). These results were partially inagreement with those obtained by Mosa *et al* (2009), El-Menshawi (2005).

As for the number of stems, the genotypes Giza-1, sids-1 and serw-3 had met the parameters of stability where ,the corresponding stabilitymeasures were b =1.082, s^2d = -0.041, x = 19.98, b =1.114, s^2d = 0.240, x = 20.98, b = 1.0512, s^2d = 0.197 and x = 17.75, respectively.

2-Genotypic stability.

Stability analysis was computed according to Tai's method (1971), where partitioning the genotype environment interaction (GXE) effect of the genotypes into two components (α and λ) was suggested. These estimates (α and λ) were computed for every tested genotype to compare the relative stable entries where, α statistic measures the linear response to environmental effects and λ statistic measures the deviation from linear response in terms of the magnitude variance. The values (α = -1 and λ = 1) will be referred to as prefect stability. The values (α = 0 and λ = 1) will be refereed to as average stability, where, the values (α> 0 and λ = 1) as below average stability and the values (α<0 and λ = 1) as above average stability.

The genotypic statistic (α and λ) for fresh, dry forage yield, plant height and number of stems for Tai's method, 1971 were shown in Table (3). The genotypes differed greatly in the amount of deviation from the linear response (λ) and to a less extent in the response (α) for environments.

Genotypes Serw3 and Mn4418 were average stable genotypes for high yielding environment. The recorded value α were zero (0.029 and 0.003), respectively. λ value were unity (0.089 and 1.192), respectively. Mean fresh forage yields were 39.4 and 37.96 kg/plot, respectively. Mean while, genotypes Serw3, Mn4418 and Is3192 has differences in main (additive) effects and has low interactions with environments (stable). Other genotypes are high interactive , weather located at the favourable or un favourable environment. These results are in harmony with those reported by Mungra K.D., Jadhav B.D., Khandelwal Vikas (2011), The genotypes Is3292, Serw 3 and Mn4418 were average stable genotypes, since, αi values were -0.027, 0.009 and -0.007rgarded by the least deviations from linearity ($λ_i$) with value 0.398, 0.697 and 0.692, respectively. The Serw3 genotypes was located in the favourable environment with average dry forage yield of 5.43 whereas Is3192 and Mn4418were almost at the unfavoured environment with average yield of 4.81 and 5.10 kg/plot .Genotypes Is3193, Sids1, Piper black and Serw1 highly responsive and interactive in favorable environment(unstable)with yield averages of 6.93,6.63,8.24 and 7.42 kg/plot, respectively. Mean while, the genotypes Mn2756, Mn4509, Hony, Rex and Browly were different interaction at unfavorable environments. The recorded mean dry forage yields were 3.76, 3.49, 3.22, 3.93 and 2.95kg/plot, respectively. These results were agreement partially with those obtained by Sabah Attia *et al* (2007), Kumar *et al* (1999), Narkhede *et al* (1997-b).Also, the genotype Giza 2 had located in average stability area for plant height (cm), which had (α = 0.004), (λ = 1.173) and (x = 140.30). Giza 2 was considered stable genotypes. Mean while all genotypes were considered unstable genotypes because they were located out of the average stability area. Mean while, the genotypes I.s.3192, Giza2 and Rex had located in average stability area for number of stems. Which had (α = 0.011), (λ = 1.379)

TABLE 3

and (x = 16.26), (α = 0.005), (λ = 1.300), (x = 15.60), (α = - 0.078), (λ = 1.164) and (x = 14.14). The genotypes I.s.3192, Giza2 and

Rex were considered stable genotypes, because there were located in average stability area. In conclusion, the genotypes Giza2 and serw3 are met the parameters of Eberhart and Russell (1966) and Tai (1971).These results were partially agreement with those obtained by suresh *et al* (1994), and Narkhede *et al* (1997-d).

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دراسات على الثبات المحصولي لبعض التراكيب الوراثية الجديدة لسورجم العلف في بيئات مختلفة

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الملخص العربي

تم تنفيذ هذا البحث في أربعة محطات للبحوث الزراعية التابعة لمركز البحوث الزراعية في كل سدس فى بني سويف والجميزة بالغربية و السرو بدمياط وسخا بكفر الشيخ. أقيمت التجربة خلال موسمي ٢٠٠٨ و ٢٠٠٩ . اشتملت الدراسة ١٦ تركيب تم زراعتها فى قطاعات كاملة العشوائية فى اربعة مكررات تحت اربعة ظروف بيئية مختلفة لتقيم جميع التراكيب الوراثية على مستوى الثلاث حشات.

تهدف هذه الدراسة إلى تقدير الثبات الوراثي والمظهري لبعض التراكيب الوراثية الجديدة لسورجم العلف تحت ظروف بيئية مختلفة، والحصول على معلومات عن سورجم العلف من خلال التفاعل بين البيئة والتراكيب الوراثية،و الحصول على أفضل بيئة لاجراء اختبار الثبات الوراثى لسورجم العلف. وكانت التركيب الوراثية المستخدمة هي Piper black ، Sids1 ، Sids2 ، Serw1 ، Serw3 تم انتخابهم من خلال حقل التربية، IS 3192 و IS 3193 أدخلت من المعهد الدولي لبحوث المحاصيل فى المناطق شبه الاستوائية ، Giza1ذره علف سكريه، Giza2 حشيشة سودان العاديه، و بعض التراكيب الآخرى أستجلبت من الإكراسات من خلال معهد المحاصيل السكرية و التى تم اختبارها كمحصول علف وهي Rex، Honey ، Browly ، Williams،MN4418 ، MN2756، MN459.

أخذت البيانات على : محصول العلف الأخضر (كجم / قطعة)،محصول العلف الجاف (كجم / قطعة)،طول النبات (سم)، عدد السيقان في مساحة ٠,١٥سم٢.أخذت الحشة الاولى والثانية والثالثة على فترات٦٠، ١٠٠، ١٣٥ يوم من الزراعة.

ويمكن تلخيص أهم النتائج المتحصل عليها كالاتى:

١- الثبات المظهري (ابرهارت وراسل١٩٦٦)

- بالنسبة لصفة المحصول الاخضر فان التراكيب الوراثية Serw 3 وكذلك MN4418 توافرت بها معظم شروط الثبات الوراثى لذلك يمكن القول انها تراكيب ثابتة وراثيا فمثلا نجد ان Serw 3 متوسط انتاجيتة اعلى من المتوسط العام للعشيرة ٣٩,٤٠ كجم للقطعة وكذلك معامل انحداره ١,٠٢٩ وكذلك فان الانحراف عن خط الانحدار -٠,٢٢١
- بالنسبة لصفة المحصول الجاف وجد ان هناك تراكيب وراثية ثابتة حيث المحصول الجاف اعلى من المتوسط العام، معامل الانحدار لايختلف معنويا عن الوحدة ،و اقل قيمه فى الانحراف عن خط الانحدار. تشتمل هذه المجموعه على Is3192 و Giza2 وSerw3 ، ومتوسط المحصول الجاف لهذه التراكيب ٤,٨١ و ٤,٥٧ و ٥,٤٣ كجم/قطعه على الترتيب.معامل الانحدار لهذه المجموعه من التراكيب الوراثيه بالنظر الى الانحراف عن خط الانحدار ٠,٩٧٣ و ٠,٠٣٩ و ٠,٩١٨ و ٠.٠٣٧ و ١,٠٠٩ و ٠,٠٢ للثلاث تراكيب على الترتيب.
- بالنسبه لعدد السيقان ، نجد ان التراكيب الثابته Giza-1 وsids-1 و serw-3 . حيث لا يختلف معامل الانحدار معنويا عن الوحده ،الانحدار عن خط الانحراف لايختلف معنويا عن الصفر ، وعدد السيقان لها اعلى من جميع المتوسطات.

٢- الثبات الوراثى (تاى ١٩٧١)

- تشير التقديرات الوراثيه (α ، λ) للمحصول الاخضر والجاف وطول النبات و عدد السيقان بطريقة تاى ١٩٧١ ، الى اختلاف كبير بين التراكيب الوراثيه فى قياس الانحدار عن الاستجابه الخطيه(λ) واقل من مدى الاستجابه الخطية لتاثير البيئه (α) .
- بالنسبة لصفة المحصول الأخضر نجد ان التراكيب الوراثية Serw 3 و MN4418 تقع فى منطقة الثبات الوراثى فوق المتوسط على مستوى البيئات.حيث قيمة (α) تساوى صفر(٠.٠٢٩ و ٠,٠٠٣)على الترتيب ،وقيمة (λ) تساوى الوحدة (٠,٠٨٩ و ١,١٩٢) على الترتيب .

Table (1): Mean squares from the analysis of variance for sorghum genotypes stability according to (Eberhart, Russel's model, 1966).

source of variations	df	Men squares			
		fresh forage yield(Kg / plot)	Dry forage yield (Kg / Plot)	Plant height (cm)	No. of stems (0.15m^2)
Genotypes	15	1302.89 **	60.17 **	7266.06 **	412.77 **
EnV.+ (Geon.x EnV.)	368	——	——	——	——
EnV. (Linear)	1	67735.06 **	909.93 **	270065.00 **	12586.35 **
Geno. x EnV. (Linear)	15	98.44 **	2.78 **	245.36 **	14.89 **
Pooled deviation	352	5.13 **	0.09	37.52 **	0.64
Genotypes					
IS 3192	22	1.207	0.025	16.040 **	0.353
IS 3193	22	8.29 **	0.148	27.473 **	0.970 **
piper black	22	15.087 **	0.281 **	64.890 **	2.239 **
Giza 1	22	3.403 **	0.075	15.732 **	0.220
Giza 2	22	1.24	0.026	8.974	0.333
Sids 1	22	4.008 **	0.154 **	23.308 **	0.501
Sids2	22	1.710 **	0.062	77.011 **	0.173
Serw 1	22	12.512 **	0.289 **	45.328 **	1.594 **
Serw 3	22	0.462	0.043	19.307 **	0.458
MN 2756	22	6.066 **	0.06	46.820 **	0.599
MN 4418	22	0.8	0.042	46.760 **	0.487
MN 4509	22	6.679 **	0.067	38.164 **	0.321
Rex	22	3.214 **	0.07	31.110 **	0.300
Browly	22	8.124 **	0.12	61.489 **	0.868 *
Honey	22	7.468 **	0.077	63.404 **	0.406
Williams	22	1.871 **	0.043	14.926 **	0.498
pooled error	1152	0.791	0.08	8.106	0.493

*,** ; significance at the 0.05 and 0.01 levels of probability , respectively.
n.s; not significantly different.

Table (2): Stability parameters for green yield (Kg / Plot), Plant height (cm) and no. of stem in combined analysis.

Genotypes	Fresh forage yield (Kg / Plot)			Dry yield (Kg / Plot)			Plant height (cm)			No. of stems (0.15m^2)		
	$\bar{x}$	b_i	s^2d_i	$\bar{x}$	b_i	s^2d_i	$\bar{x}$	b_i	s^2d_i	$\bar{x}$	b_i	s^2d_i
IS 3192	36.58	0.967	0.523	4.81	0.973	0.039	144.18	1.019	8.251**	16.26	1.011	0.092
IS 3193	45.68	1.200*	7.608**	6.93	1.254*	0.084	164.18	1.157*	19.684**	22.032	1.143*	0.709**
piper Black	50.69	1.251*	14.403**	8.24	1.400*	0.217**	173.25	1.149*	57.101**	24.41	1.205*	1.977**
Giza 1	42.81	1.095*	2.719**	6.19	1.177*	0.011	157.5	1.085	7.943**	19.98	1.082*	0.041
Giza 2	35.02	0.951*	0.556	4.57	0.918	0.037	140.3	1.004	1.185	15.66	0.994	0.071
Sids 1	44.21	1.128*	3.323**	6.63	1.216*	0.090**	160.77	1.113	15.519**	20.98	1.114*	0.24
Sids2	40.73	1.059	1.026**	5.80	1.111*	0.002	152.57	1.015	69.223**	18.85	1.072	0.088
Serw 1	47.58	1.234*	11.828**	7.42	1.296*	0.225**	167.96	1.144*	37.539**	23.13	1.174*	1.333**
Serw 3	39.40	1.029	0.221	5.43	1.009	0.02	151.59	1.044	11.518**	17.75	1.0512	0.197
MN 2756	30.55	0.852	5.382**	3.76	0.784*	0.003	128.58	0.877	39.032**	13.44	0.865*	0.337
MN 4418	37.96	1.003	0.116	5.1	0.992	0.021	146.98	1.064	38.971**	16.98	1.028	0.226
MN 4509	29.14	0.833	5.995**	3.49	0.765*	0.002	124.91	0.850*	30.375**	12.57	0.844*	0.060
Rex	32.12	0.889	2.530**	3.93	0.839*	0.006	131.89	0.905	23.321**	14.14	0.922*	0.038
Browly	26.38	0.776	7.439**	2.95	0.693*	0.056	116.73	0.811*	53.700**	10.97	0.727*	0.607*
Honey	27.88	0.799	6.784**	3.22	0.718*	0.013	120.63	0.800*	55.615**	11.7	0.805*	0.145
Williams	33.73	0.926	1.186**	4.26	0.848*	0.02	136.15	0.956	7.13*	14.92	0.957	0.236
mean	37.53			5.17			144.89			17.11		
L.S.D (0.05)	0.484			1.57			1.031			1.94		
L.S.D(0.01)	0.576			1.87			1.228			3.10		

*,** ; significance at the 0.05 and 0.01 levels of probability , respectively.
n.s; not significantly different.

Table (3): Mean performance and genotypic statistics (α and λ) for sorghum genotypes (Tai's methods) for the studied characters.

Genotypes	Fresh forage yield (Kg/plot)			Dry yield (kg/Plot)			plant height (cm)			No of stems (0.15m^2)		
	$\bar{x}$	α	λ	$\bar{x}$	α	λ	$\bar{x}$	α	λ	$\bar{x}$	α	λ
IS 3192	36.58	-0.032	1.798	4.81	-0.027	0.398	144.18	0.019	2.098	16.26	0.011	1.379
IS 3193	45.68	0.200	12.338	6.93	0.256	2.341	164.18	0.157	3.591	22.03	0.144	3.766
piper black	50.69	0.251	22.45	8.24	0.403	4.429	173.25	0.149	8.487	24.41	0.207	8.692
Giza 1	42.81	0.095	5.066	6.19	0.178	1.187	157.5	0.085	2.056	19.98	0.082	0.851
Giza 2	35.02	-0.048	1.846	4.57	-0.081	0.424	140.3	0.004	1.173	15.66	-0.005	1.300
Sids 1	44.21	0.128	5.964	6.63	0.2181	2.443	160.77	0.113	3.047	20.98	0.115	1.943
Sids2	40.73	0.059	2.546	5.80	0.112	0.983	152.57	0.015	10.075	18.85	0.072	0.670
Serw 1	47.58	0.234	18.618	7.42	0.299	4.570	167.96	0.144	5.928	23.13	0.175	6.190
Serw 3	39.40	0.029	0.689	5.43	0.009	0.697	151.59	0.044	2.525	17.75	0.071	1.786
MN 2756	30.55	-0.147	9.028	3.76	-0.217	0.943	128.58	-0.122	6.123	13.44	-0.135	2.319
MN 4418	37.96	0.003	1.192	5.10	-0.007	0.672	146.98	0.064	6.116	16.98	0.028	1.901
MN 4509	29.14	-0.166	9.939	3.49	-0.236	1.046	124.91	-0.149	4.99	12.57	-0.156	1.229
Rex	32.12	-0.110	4.784	3.93	-0.162	1.117	131.89	-0.094	4.069	14.14	-0.078	1.164
Browly	26.38	-0.223	12.085	2.95	-0.308	1.891	116.73	-0.189	8.040	10.97	-0.274	3.312
Honey	27.88	-0.201	11.111	3.22	-0.283	1.208	120.63	-0.199	8.29	11.70	-0.195	1.547
Williams	33.73	-0.073	2.784	4.26	-0.152	0.684	136.15	-0.043	1.952	14.92	-0.043	1.941