

RELATIONSHIPS BETWEEN GRAIN FILLING DURATION AND GRAIN YIELD IN SORGHUM *Sorghum bicolor* L. (Moench).

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ABSTRACT

Five sorghum varieties (Milo, Kafir, Durado, Rabihe and Ingath), were grown in a field experiment at Al-Khalis station research . spring and autumn seasons of 2008 The aim of the study was to investigate the relationships between grain filling duration (GFD) and sorghum grain yield. This experiment was planted as a randomized complete block design(R.C.B.D.) with three replications. The results showed that significant positive correlations of (GFD) were found among (GFD) with days number to 50% anthesis ,number of days to physiological maturity and grain yield . Significant positive correlation was also noticed among days to 50% anthesis, days number to physiological maturity and grain yield. The linear regression coefficient between grain yield and days to 50% anthesis indicates an increase (22.392, 9.483 kg.ha⁻¹) in grain yield for each additional day required for (GFD).

Key words: Sorghum, Grain Filling Duration (GFD), Grain Yield, Correlation, Regression.

INTRODUCTION

The grain sorghum *Sorghum bicolor* L. (Moench) is used as staple food in human diet as well as used in animal feed. It is the fifth leading cereal crop in the world after Wheat (*Triticum aestivum* L.), Rice (*Oryza sativa* L.), Corn (*Zea mays* L.) and Barely (*Hordeum vulgare* L.). Sorghum grain is the staple food of poor and the most food –insecure people, living mainly in the semiarid tropics (Bibi *et al.*, 2010).

In today's crop productions system with their high yield outputs , improvement in grain filling has become more challenging than ever (Zehedi and Jenner 2003, Kato *et al.*, 2007).

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The grain filling of an annual crops as Sorghum is a fundamental process for the reproduction and survival of the species (Csikasz *et al.* 2002). Grain filling duration has been recognized as an important factor in the determination of grain yield , a positive correlation was found between (GFD)and yield in several crops such as in Corn, Daynard and kannenberg (1976), Octtaviano and Camussi (1981) ,Whereas in Wheat ,Gebeyehou *et al.*, (1982) also found a positive correlation between (GFD) and grain yield . In Safflower , Zapore *et al.* (1995) noticed a significant positive correlation among days to anthesis ,maturity and grain yield ,as result they found an increase (0.036) Kg.ha⁻¹in grain yield for each additional day required for the grain filling.

The primary objective of this research was to study the existence of the relationship in five Sorghum varieties with different length of cycle at spring and autumn seasons.

MATERIALS AND METHODS

Five Sorghum varieties ,Durado , Ingath, Kafir, Milo and Rabihe were grown at Al-Khalis Farming Research Station during spring and autumn seasons of 2008 using a Randomized Complete Block Design (R.C.B.D.) with three replications.

The following characters were studied:

1. Number of days from planting to 50% anthesis .
2. Number of days from planting to physiological maturity.

(Grain Sorghum physiological maturity is characterized by formation of a black layer similar to corn. And the black layer can be found at the kernel base opposite the embryo , grain weight accumulation is complete and moisture typically ranges from (25-35)% when physiological maturity occurs.

3. Grain filling duration (GFD) is the period between flowering and physiological maturity (Przuli and Mladinov ,1999).
4. Grain yield: Individual plots were harvested and grain yield weights were assessed.

The experimental data were statistically analyzed by (ANOVA). Simple correlation equations were calculated between grain yield and components

characters as outlined by Steel and Torrie (1980). The significant differences among treatments were compared with (L.S.D.) at 5% probability level.

RESULTS AND DISCUSSION

The analysis of variance showed significant differences among varieties of Sorghum regarding the number of days to 50% anthesis , number of days to physiological maturity , grain filling duration at both seasons ,but grain yield was significant at autumn season only (Table1). The Varieties (Milo) and (Kafir) showed the highest grain yield following by (Durado) ,(Rabihe) and (Ingath) at two seasons .It was observed when the number of days to physiological maturity and grain filling duration increased, the grain yield increased .The variation for grain filling duration was predominantly due to a larger range of variation in number of days to 50% anthesis and to physiological maturity .

A significant positive correlation on the number of days to anthesis vs. grain yield (0.985, 0.979), days to physiological maturity (0.985,0.998) and grain filling duration (0.984, 0.973) for the spring and autumn respectively. Another Significant positive correlation was found between grain filling duration and grain yield (0.966 , 0.977) . Moreover significant positive correlation between grains filling duration vs. grain yield was also observed in the present investigation (0.966, 0.977) which was being reported for the first time in Sorghum (table3).

Table 1. Means and Mean Squares for (ANOVA) phenological characters and grain yield in Sorghum.

Varieties	Days to 50% anthesis		Days to Maturity		Grain filling Duration		Grain Yield (T/ha)	
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Milo	87	87	146	136	59	49	6.070	6.654
Kafir	83	83	140	130	57	47	5.706	6.008
Durado	79	81	133	127	54	46	5.618	5.820
Rabihe	67	77	118	122	51	45	5.060	5.655
Ingath	63	72	111	116	48	44	4.994	5.014
LSD	3.183	2.995	3.000	3.922	5.875	6.001	n.s.	5.014
S.O.V.	Mean Squares							
Blocks	1.267	3.200	4.200	1.800	2.600	9.600	0.221	0.292
Varieties	310.6 **	99.00 **	111.9 **	44.1 **	59.1 **	275.1 **	0.623 n.s.	4.949 **
Error	1.017	1.196	1.200	2.050	4.6	4.8	0.214	0.173
S.E.	0.582	0.631	0.632	0.826	1.238	1.265	0.267	0.240

*Significant at the .05 and** Significant at the .01 levels of probability, n.s. = not significant

Table 2. Correlation Coefficient among the values of phenological characters and yield at spring and autumn seasons.

characters	season	Correlation Coefficient
Days to anthesis vs. Grain yield	spring	0.985**
	autumn	0.979**
Days to anthesis vs. Days to Maturity	spring	0.985**
	autumn	0.998**
Days to anthesis vs. Grain Filling Duration	spring	0.984**
	autumn	0.973**
Days to Maturity vs. Grain yield	spring	0.983**
	autumn	0.984**
Days to Maturity vs. Grain Filling Duration	spring	0.992**
	autumn	0.958**
Grain Filling Duration vs. Grain yield	spring	0.966**
	autumn	0.977**

**Significant at the 0.01 level of probability.

Table3. Regression Equations among the values of phonological characters and grain yield at spring and autumn seasons.

characters	season	Regression Equations
Regression Equation of Grain yield on Grain Filling Duration	spring	$Y = 2.143 + 9.410X$
	autumn	$Y = 24.735 + 3.167X$
Regression Equation of Grain yield on Days to anthesis	spring	$Y = -47.125 + 22.392X$
	autumn	$Y = 24.712 + 9.483 X$
Regression Equation of Grain yield on Days to Maturity	spring	$Y = -4.982 + 31.80 X$
	autumn	$Y = 52.447 + 12.650X$

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***Sorghum bicolor* L. (Moench). العلاقة بين فترة امتلاء الحبة وحاصل حبوب الذرة البيضاء.**

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الخلاصة

زرعت خمسة أصناف من الذرة البيضاء (Ingath, Rabihe, Durado, Kafir, Milo)، في تجربة حقلية بمحطة أبحاث الخالص خلال الموسمين الربيعي والخريفي 2008 م. وكان هدف البحث علاقة معرفة علاقة الارتباط بين فترة امتلاء الحبة وحاصل حبوب الذرة البيضاء. وطبقت هذه التجربة في تصميم القطاعات العشوائية الكاملة في ثلاثة مكررات. أظهرت النتائج وجود ارتباط معنوي موجب بين فترة امتلاء الحبة مع كل من عدد الأيام إلى التزهير ، وعددها إلى النضج الفسيولوجي ومع حاصل الحبوب. دل الانحدار الخطي بين حاصل الحبوب وعدد الأيام إلى التزهير على أن هنالك زيادة مقدارها (9.483, 22.392) كغم. ه⁻¹ للموسمين الربيعي والخريفي على التوالي في حاصل الحبوب مع كل يوم إضافي لفترة امتلاء الحبة.

كلمات مفتاحيه : الذرة البيضاء ، فترة امتلاء الحبة ، حاصل الحبوب ، الارتباط ، الانحدار .