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PERFORMANCE OF SOME GRAIN SORGHUM (*Sorghum bicolor* l. Moench) GENOTYPES UNDER DIFFERENT SOWING DATES IN EGYPT

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ABSTRACT

Two field experiments were conducted in 2010 and 2011 seasons to investigate the influence of sowing date (April 7, April 27, May 17, June 6, and 26) on growth and yields of some sorghum genotypes (Shandaweel-1 hybrid, Shandaweel-305 hybrid, Shandaweel-306 hybrid and Dorado cultivar) grown in clay loamy soil at Giza Governorate, Egypt. Results obtained showed that growth and yield attributes of grain sorghum were significantly affected by sowing date and genotypes in both seasons.

Delaying sowing from April to late May or June resulted in increasing growth attributes (plant height, number of green leaves, leaf area and total dry weight/plant). Late sowing in June accelerated plant maturity. Sandaweel-305 hybrid plants were the tallest and the earliest in maturity compared to the other genotypes. Sowing Shandaweel-306 hybrid at June produced the highest yield and yield components compared to the other genotypes planted at earlier sowings (April and May). The results also showed that grain yield was positively correlated with panicle weight (r = 0.52), kernel weight panicle^{-1} (r = 0.43), leaf area (r = 0.50) leaf area index (r = 53) and total dry weight (r = 0.43) suggesting that these parameters could be used to estimate sorghum grain yield.

INTRODUCTION

Grain sorghum (*Sorghum bicolor* L. Moench) is one of the most important cereal crops. It is one of the main stable for the world poorest and more food-insecure people. It ranks the fourth of the world cereal crops after wheat, rice and maize. Sorghum is one of the most adapted summer grain crops to drought and heat. In Egypt, Sorghum is grown in Upper Egypt from Giza to Aswan but most of the area (89 thousand hectare) is concentrated in Assiut and Sohag governorates and about 37 thousand hectare in Fayoum governorate (Ezzat *et al*., 2010). In addition, it is a double purpose crop; the vegetative parts are used for animal feeding in summer season where green forage crops are not quite available. The total production of grain sorghum in Egypt is less than the needs of the local consumption (Abdel-Motagally, 2010).

Grain sorghum growth, development, and yield depend on environmental conditions such as temperature and precipitation. The extent of the effect of these environmental conditions may vary depending on sowing dates and locations. Sowing date influences on grain sorghum crop through temperature and soil available water at grain germination (Vanderlip, 1993), vegetative and reproductive success (Prasad et al., 2008 and Bandiougou, 2012), number of days from sowing to physiological maturity and hence, yield and yield components (Jones and Johnson, 1991 and Conley and Wiebold, 2003). Alassane (2012) reported that effect of stress due to environmental factors on final yield may depend upon the growth stage in which it occurs and the genotype. Poornima *et al.* (2008) found that among the different dates of sowing, June 8^{th} sowing led to extensively higher grain yield of sweet sorghum over other dates of sowing. Increase in yield under June 8^{th} sowing might be due to the favorable environment prevailed during the crop growing season.

The effect of sowing date on sorghum yield changed with locations based on environmental conditions prevailing during the crop growing period. Omer (2005) found that grain sorghum and dry matter increased with July and August sowing dates, compared with June, May and April sowing dates at Toshka, Agric. Exp. Station. However, other workers (Johnson *et al.*, 1984, Bryant *et al.*, 1986, Francis *et al.*, 1986, Conley and Wiebold, 2003 and Assefa and Staggenborg, 2010) found higher yields with early sowing.

Significant yield advantage of late sowings over early sowings was observed at Chillicothe, Texas, while the opposite trend was observed at Monday, Texas, where early sowings yielding more than late sowings in each of the three years of the experiment (Clark, 1997). Delaying sowing to early June was advantageous in northeast Nebraska. Irrigated grain sorghum had higher yield with late June sowing compared with early July sowing (Moomaw and Mader, 1991). Further tests were required to enable ranking of sowing date in a manner that would reflect it is affect in establishment, development and yield of grain sorghum under varied seasons and locations. Therefore, efforts are focused on increasing productivity of this crop by growing high yielding genotype under most favorable cultural conditions.

The objective of this research was to study the performance of some grain sorghum genotypes under different sowing dates at Giza, Egypt to optimize sorghum production.

MATERIALS AND METHODS

Two field experiments were conducted in 2010 and 2012 growing seasons under irrigated conditions at Agricultural experimental and Research station, Faculty of Agriculture, Cairo University, Giza governorate, Egypt to evaluate performance of three grain sorghum hybrids and one cultivar under four sowing dates in clay loamy soil. Daily maximum and minimum temperatures, during growing season (from April to October) are presented in Table 1.

Four Egyptian grain sorghum genotypes (three hybrids, i.e. Shandaweel-1, Shandaweel-305, Shandaweel-306 and one cultivar i.e. Dorado) provided by Agric. Res. Sta. were tested under five sowing dates (April 7^{th}, April 27^{th}, May 17^{th}, June 6^{th} and 26^{th}).

Table 1. Monthly temperatures through the period from April to November in 2010 and 2011 seasons at Giza, Egypt.

Month	Temperature (C°) at Giza, Egypt					
	2010			2011		
	Min	Max	Mean	Min	Max	Mean
April	16.0	29.6	22.8	18.5	28.4	23.5
May	19.2	33.9	26.5	18.7	32.8	25.7
June	22.7	37.0	29.4	21.7	35.2	28.5
July	23.9	36.3	30.1	23.5	37.3	30.4
August	25.3	38.3	31.8	23.9	36.5	30.2
September	23.4	35.8	29.6	22.7	35.2	28.9
October	21.5	33.8	27.6	18.7	30.9	24.6
November	17.1	28.6	22.8	13.3	24.5	18.9

Source: Meteorological Observatory (Agric. Res. Center. Giza)

The experimental design was a randomized complete block design (RCBD) in split-plot arrangement with four replications. The tested sowing dates were assigned to the main plots and grain sorghum genotypes to the sub plots. The experimental unit was 20 m^2 (4 ×5 m) with 60 cm row spacing. About 4-5 grains were hand planted in hills spaced 20 cm apart. After three weeks from sowing, the plants were thinned to two. The common field practices at the experimental farm were applied for the ordinary sorghum fields. The first irrigation was applied after 21 days from sowing and the next irrigations were applied at 14 days intervals. Nitrogen was applied after 21 days from sowing at the rate of 100 kg N per fed. From each sub plot a sample of 10 plants were randomly taken at physiological maturity from two internal rows to measure plant height, Leaf area (m^2), Leaf Area Index (LAI), Dry matter production, number of green leaves and panicle dry weight. Ten harvested panicles in each experimental unit were hand threshed and weighted. The kernel weight per panicle was calculated as an average of 10 panicle kernels weight. At maturity stage (at harvest), all plants of the other two internal rows (6 m^2) were hand harvested and dried for estimating the biological and grain yields. Grain yield was calculated as total grain produced per fed corrected to 14 percent moisture. The Growing Degree Days was calculated using the following equation:

$$GDD = \Sigma ([T_{max} + T_{min}]/2) – T_b$$

Where T_{max} and T_{min} represents maximum and minimum daily air temperature respectively, and T_b represents base temperature of sorghum (10 C°). Air temperatures were measured at nearby weather stations (Giza station).

Analysis of variance of RCBD as outlined by Gomez and Gomez (1984) was applied. Analysis of variance over years indicated significant different nearly of all treatment variables. Therefore, analysis of variance was performed separately for each year. To satisfy the assumptions of the ANOVA model, the homogeneity test of variances was verified using Bartlett's test. Mean separation test for significant effects were performed using Duncan's multiple range test (L.S.R) at 5% level of probability (Duncan, 1955). Correlation analysis was used to test the relationship between the days to 50% flowering, Plant height, Number of green leaves, leaf area, leaf area index, biological yield plant^{-1}, panicle weight, kernel weight panicle, harvest index and grain yield**.**

RESULTS AND DISCUSSION

Yield and yield component traits: data in (Table 2 and 3) revealed that growth, yield and its attributes were significantly affected by sowing date and grain sorghum genotypes in both seasons. May and June sowing were accompanied with the highest plant height, number of green leaves, leaf area plant^{-1} and leaf area index at maturity stage in both seasons.

Table 2: Effect of sowing date on some grain sorghum traits in 2010 and 2011 seasons.

Sowing date	Growing seasons					
	2010	2011	2010	2011	2010	2011
	Plant height (cm)		Leaf area index		Panicle weight (g)	
7th April	131.6 d	125.5 c	6.37 d	5.36 d	77.2 d	80.6c
27th April	146.0 c	139.4 b	7.47 c	7.61 c	83.3 c	87.3 c
17th May	167.7 a	161.4 a	7.64 bc	8.15 b	85.2 bc	87.5c
6th June	162.3 b	157.1 a	7.77 b	9.99 a	89.4 b	97.6 b
26TH June	163.5 b	158.9 a	8.38 a	8.34 b	108.7 a	108.5 a
LSD 0.05	3.0	6.5	0.22	0.25	5.2	7.0
	No. of green leaves		Days to 50% flowering		Grains panicle^{-1} (g)	
7th April	8.0 c	8.0 c	81.0 a	71.0 b	46.7 c	48.9 b
27th April	9.0 b	8.9 b	83.1 a	72.2 a	49.3 bc	48.6 b
17th May	10.6 a	10.2 a	71.5 c	65.4 d	50.0 bc	49.7 b
6th June	10.7 a	10.3 a	69.7 c	61.8 e	52.0 bc	55.8 a
26TH June	10.8 a	10.5 a	78.3 b	68.6 c	57.8 a	60.9 a
LSD 0.05	0.9	0.5	2.2	1.2	3.5	5.2
	Leaf area plant^{-1} (m^2)		Dry matter plant^{-1} (g)		Grain yield fed^{-1} (kg)	
7th April	50.4 c	50.2 c	103.2 c	103.7 cd	2055 b	1829 b
27th April	67.4 b	67.3 b	94.4 d	97.6 d	2062 b	1995 b
17th May	74.7 ab	74.3 ab	103.5 c	110.3 bc	2092 b	2139 b
6th June	79.6 a	79.2 a	114.5 b	116.2 ab	2517 a	2540 a
26TH June	73.3 ab	73.0 ab	119.5 a	121.3 a	2713 a	2753 a
LSD 0.05	12.1	7.8	4.5	10.4	220	374

***Means in each column followed by similar letters are not significantly different at the 5 % probability level.**

Number of days from sowing to physiological maturity for all genotypes decreased as sowing date was delayed. This result agrees with result of Conley and Wiebold, (2003) and Bandiougou (2012) at Manhattan and Hutchinson who reported that earlier sowing dates tended to expand the total number of days from sowing to physiological maturity. The decreased in total number of days from sowing to physiological maturity with late sowing (temperature increased) may be attribute to Cumulative Growing Degree Days (C°) to reach physiological maturity to be 1467 for short season hybrids and 1849 for long season hybrid. The time period necessary to reach that GDD is function of variation in daily maximum and minimum temperature throughout the growing season, therefore may depend on sowing date.

Sorghum grain yield showed significant differences for all sowing dates. First and late June sowings recorded significantly higher grain yield (2517, 2540, 2713 and 2753 kg fed-1) in comparison with April or May sowings in both seasons, respectively. The percent of increase in grain yield with first and late of June sowing were 18%, 24%, 21% and 27% over first and late of April and mid of May, respectively. These results are in agreement with those of Abd El-Moneim (2005) and Omer (2010).

Table 3: Effect of genotypes on some grain sorghum traits in 2010 and 2011 seasons.

Sorghum genotypes	Growing seasons					
	2010	2011	2010	2011	2010	2011
	Plant height (cm)		**Leaf area index**		**Panicle weight (g)**	
Shandaweel -1	149.0 c	144.5 c	7.6 b	7.8 b	95.9 b	99.0 a
Shandaweel -305	180.7 a	171.8 a	6.7 d	7.6 c	78.4 c	88.0 b
Shandaweel -306	167.5 b	157.5 b	7.3 c	7.0 d	102.1 a	97.5 a
Dorado	119.6 d	120.0 d	8.6 a	9.2 a	78.6 c	84.7 b
LSD 0.05	2.9	4.5	0.3	0.2	3.9	4.9
	No. of green leaves		**Days to 50% flowering**		**Grain weight panicle^{-1}(g)**	
Shandaweel -1	9.95	9.715	78.6 b	69.2 b	53.6 a	55.6 a
Shandaweel -305	9.97	9.732	72.6 d	63.1 d	50.7 b	50.2 b
Shandaweel-306	9.64	9.283	74.3 c	67.1 c	55.2 a	56.9 a
Dorado	9.84	9.566	81.4 a	71.8 a	45.1 c	48.4 b
LSD 0.05	NS	NS	1.0	0.6	2.1	3.0
	Leaf area (m^2)		**Dry matter yield plant^{-1} (g)**		**Grain yield fed^{-1} (kg)**	
Shandaweel -1	69.1 ab	68.8 b	113.9 b	114.3 ab	2249 d	2176 c
Shandaweel -305	68.5 c	68.5 d	97.5 c	108.4 b	2325 b	2273 b
Shandaweel -306	68.9 b	68.6 c	122.5 a	118.8 a	2388 a	2359 a
Dorado	69.3 a	69.3 a	94.2 c	97.7 c	2263d	2266 b
LSD 0.05	0.4	0.4	5.3	6.4	61	62

***Means in each column followed by similar letters are not significantly different at the 5 % probability level.**

Dry matter yield/ plant significantly differed because of sowing in different dates. First and late of June sowing recorded significantly higher green dry matter yield (114.5, 119.5,116.2 and 121.3 g plant $^{-1}$) which was 14.4%, 19.5%, 12.3% and 17.2 % higher over first and late of April and mid of May in both seasons, respectively. The increase in dry matter yield recorded with first and late of June sowing was as a result of increasing plant height, leaf area, total dry matter production and its partitioning in to different components (leaf, stem and ear head). These findings may be due to optimum temperature and environmental conditions at establishing and at first stage of vegetative growth period in June compared to early sowing.The present results are in conformity with those of Vanderlip (1993), Conley and Wiebold (2003), Omer (2005) and Assefa and Staggenborg (2010).

Increase in grain yield is mainly attributed to significantly higher panicle weight and kernel weight panicle^{-1} as well as total dry matter production, number of green leaves, leaf area, leaf area index, over first, late of April and mid of May. The results reported by Moomaw and Mader (1991) Clark (1997), Omer (2005) and Poornima *et al*. (2008) indicated to obtaining higher yields with late sowing. However, Johnson *et al.* (1984), Bryant *et al.* (1986), Francis *et al.* (1986), Conley and Wiebold (2003) and Assefa and Staggenborg (2010) found higher yields with earlier sowings. Sowing date influences sorghum through temperature and soil available water at grain germination and through different growth stages (Jones and Johnson, 1991 and Bandiougou, 2012).

Dorado cultivar recorded the highest value of leaf area plant^{-1} (69.3 m^2) and leaf area index (9.2 and 8.6) in both seasons however; plants of Shandaweel-305 hybrid were the tallest (180.7 and172cm) and the earliest (63.1 days) in maturity in both seasons.

Results of the interaction between sowing date and genotypes (Table 4 and 6) revealed that the highest leaf area index (11.71) was that of Dorado cultivar plants planted in 6th June in second season. While, the tallest plants (196.3 and 192.3 cm) and the earliest ones were those of shandawee-305 hybrid planted in 17th May and 26th June, respectively.

Table 4. Effect of the interaction between sowing date and genotypes on some growth traits of grain sorghum in 2010 and 2011 seasons at Giza, Egypt.

Sowing date	Grain Sorghum genotypes	Plant height (cm)		Leaf area index		Days to 50% flowering		Biological yield plant^{-1} (g)	
		2010	2011	2010	2011	2010	2011	2010	2011
Apr.7	**Shandaweel-1**	123.5 j	121.1 ij	5.64 f	4.5 l	86.00 b	72.75 b	121.8 bc	115.4 b-d
	Shandaweel-305	154.3e-g	143.5 fe	6.16 ef	5.61k	79.50 e	67.75 ef	74.9 g	85.9 f
	Shandaweel-306	140.8 h	133.8 f-h	6.45 e	4.45 l	73.00 h-j	71.00 c	119.3 b-d	107.0 c-e
	Dorado	107.8 k	103.4 k	7.18 d	6.84 hi	85.50 bc	72.50 b	96.9 f	106.6 c-e
Apr.27	**Shandaweel-1**	149.1 fg	143.5 ef	8.28 bc	6.44 ij	84.25b-d	74.75 a	113.9 c-e	113.3 b-e
	Shandaweel-305	174.2 d	163.8 d	5.87 ef	8.20 f	75.75 fg	66.25 f	79.0 g	105.9 de
	Shandaweel-306	148.0 g	138.4fg	6.41 e	6.29 j	83.25 cd	73.00 b	102.8 ef	84.5 f
	Dorado	112.7 k	112.1jk	9.30 a	9.49 c	89.00 a	74.75 a	82.0 g	86.6 f
May.17	**Shandaweel-1**	160.9 e	151.2 e	7.32 d	8.31 ef	72.00 ij	67.50 ef	113.6 c-e	120.5 b-d
	Shandaweel-305	196.3 a	189.5 a	6.32 e	7.09gh	67.25 k	61.00 h	98.7f	109.5 b-e
	Shandaweel-306	182.1 c	174.3b-d	7.41 d	8.20 f	72.25 ij	62.25 gh	119.5 b-d	123.0 bc
	Dorado	131.5 i	130.4 g-i	9.53 a	9.01 d	74.50 f-i	70.75 c	82.4 g	88.2 f
June.6	**Shandaweel-1**	156.2 e	153.3 e	8.25 b	10.64b	71.00 j	62.50 g	114.4 b-e	115.7 b-d
	Shandaweel-305	186.6 bc	178.4bc	8.54 bc	8.92 d	66.50 k	57.75 j	114.4 b-e	125.9 b
	Shandaweel-306	179.8 cd	167.8cd	8.31bc	8.71de	66.25 k	59.50 i	127.6 b	126.2 b
	Dorado	126.4 ij	128.7 g-i	8.42 b	11.71a	75.00 f-h	67.25 ef	101.6 ef	97.3 ef
June.26	**Shandaweel-1**	155.2 ef	153.3 e	8.61 b	9.06cd	79.50 e	68.50 de	105.90 d-f	106.8 c-e
	Shandaweel-305	192.3 ab	183.6ab	6.43 e	7.97 f	74.00 g-i	62.75 g	120.4 bc	114.6b-d
	Shandaweel-306	186.9 bc	173.4b-d	7.73 cd	7.48 g	76.75 f	69.75 cd	143.4 a	153.6 a
	Dorado	119.7 j	125.5hi	8.31 bc	8.84 d	82. 75 d	73.50 ab	108.1 c-f	110.0 b-e
LSD 0.05		6.57	10.70	0.55	0.44	2.31	1.42	11.8	14.4

***Means in each column followed by similar letters are not significantly different at the 5 % probability level.**

Table 5: Correlation coefficient between yield and some traits of grain sorghum crop.

	1	2	3	4	5	6	7	8	9
1-Grain yield	-								
2- 5% heading	-0.35**	-							
3-Plant height	0.39**	-0.76**	-						
4-LAI	0.58**	-0.33**	0.10S	-					
5-TDM	0.48**	-0.33**	0.46**	0.01NS	-				
6-Panicle weight	0.57**	-0.20NS	0.36**	0.19NS	0.75**	-			
7-Kernel weight/pant	0.51**	-0.21NS	0.31**	0.09NS	0.73**	0.91**	-		
8-No. Leaves	-0.11**NS**	-0.02NS	0.06NS	-0.03NS	-0.08NS	-0.12NS	-0.11NS	-	
9-LA	0.55**	-0.32**	0.18NS	0.87**	0.11NS	0.28*	0.18NS	-0.10NS	-

***, ** and indicate significant, highly significant at 0.05, 0.01 respectively.**

Table 6. Effect of the interaction between sowing date and genotypes on some grain sorghum yield traits in both seasons at.

Sowing dates	Grain Sorghum genotypes	Panicle weight (g)		Grain panicle^{-1} (g)		Grain yield fed^{-1} (kg)	
		2010	**2011**	**2010**	**2011**	**2010**	**2011**
Apr.7	**Shandaweel-1**	91.4 cd	96.6c-e	53.6c-g	58.5 b-d	2173 e	1767 i
	Shandaweel-305	55.1 g	55.7 i	38.6 m	33.5 i	2013 fg	1883 g-i
	Shandaweel-306	86.8 d	93.8 de	52.d-h	55.6 b-e	2016 fg	1825 i
	Dorado	75.4 ef	76.3 h	42.2 k-m	48.2 f-h	2019 fg	1843 hi
Apr.27	**Shandaweel-1**	92.5 cd	97.1 c-e	48.0 h-j	50.9 e-g	2064 e-g	2040 d-f
	Shandaweel-305	77.6 e	91.4 ef	48.4g-j	51.5 e-g	2130 ef	1966 f-h
	Shandaweel-306	96.1b-d	80.3 gh	56.2 a-f	46.6 f-h	2076 e-g	1970 f-h
	Dorado	66.9 f	80.5 f-h	44.5 j-l	45.5 gh	1976 g	2006e-g
May.17	**Shandaweel-1**	92.7 cd	95.3 de	56.8 a-d	53.1d-f	2079 e-g	2100 d-f
	Shandaweel-305	77.8 e	80.1 gh	51.9d-h	47.1 f-h	2070 e-g	2137 de
	Shandaweel-306	97.9 bc	98.5 c-e	50.8 f-i	56.4 b-e	2163 e	2156 d
	Dorado	72.4 ef	76.2 h	40.3 lm	42.1 h	2054 e-g	2162 d
June.6	**Shandaweel-1**	101.0 bc	98.3 c-e	51.2 e-h	55.1 c-e	2573 b-d	2465 c
	Shandaweel-305	71.9 e	102.6 bd	54.7 b-f	57.4 b-e	2443 d	2583 c
	Shandaweel-306	101.1 bc	99.7 b-e	56.3 a-e	59.7 a-d	2583 bc	2534 c
	Dorado	77.5 e	90.0 e-g	45.7 i-k	51.0 e-g	2470 cd	2580 c
June.26	**Shandaweel-1**	101.6 bc	107.6 ac	58.6 a-c	60.2 a-c	2660 ab	2503 c
	Shandaweel-305	103.5 b	110.3 ab	59.8 ab	61.8 ab	2673 ab	2754 b
	Shandaweel-306	128.6 a	115.3 a	60.2 a	66.2 a	2792 a	2891a
	Dorado	100.9 bc	100.7 be	52.7d-h	55.5 b-e	2727 a	2865 ab
LSD 0.05		8.8	11.0	4.7	6.4	137	138

***Means in each column followed by similar letters are not significantly different at the 5 % probability level.**

The superiority of Dorado cultivar and Shandaweel-305 hybrid may be due to their genetic basis. Also optimum temperature and environmental conditions in late sowing might caused better establishments and growth. These results correspond with those of Prasad *et al.* (2008). Abd El-Moneim

(2005) and Omer (2010) reported that plants of grain sorghum Shandaweel-6 hybrid were the tallest whereas; Dorado variety plants were the shortest ones.

Yield and yield component also showed significant differences for all genotypes (Table 3). The highest value of panicle weight plant^{-1}, kernel weight panicle^{-1}, total dry matter and grain yield fedan^{-1} were obtained from Shandaweel-306 hybrid planted in late June, it may due to the interaction between sowing date and sorghum genotypes. These results are corresponded with those of Ezzat *et al*. (2010).

Correlation studies (Table 4) revealed that grain yield was positive correlated with plant height (r = 0.39), LAI at maturity stage (r = 0.55), LAI (r = 58) dry matter yield (r = 0.58), panicle weight plant^{-1}(r = 0.57) and kernel weight panicle (r = 0.51).

CONCLUSION

Sowing date had consistent effect on sorghum grain yield and yield components in both seasons. Sowing in the first and late- April under relatively shorter day length when the plant exposed to colder soil weather temperatures significantly decreased growth and grain yield traits of grain sorghum. When sowing was delayed from first-April to late-June, better yields were obtained from all genotypes due to better environmental conditions and less risk of damage at early growth stages. Panicle weight and kernel weight panicle^{-1} were affected by sowing date. Significant positive correlation was found between grain yield and panicle weight, kernels weight panicle-1 and total dry matter produced. All genotypes can be planted up to late May or first June in environments similar to those observed in this study. The choice of these genotypes would be preferable when sowing is delayed. Continuation of the research is necessary to confirm the results and for more investigation on the effect of sowing date on yield components for more description of increase in yield for genotypes due to delayed sowing in wider range of environment and sowing dates.

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أداء بعض التراكيب الوراثية للذرة الرفيعة للحبوب تحت مواعيد زراعية مختلفة في مصر

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أجريت تجربتان زراعيتان في محطة البحوث والتجارب الزراعية - كلية الزراعة - جامعة القاهرة - مصر في الموسمين الصيفين ٢٠١٠ و ٢٠١٢ تحت ظروف الزراعة المروية لتقييم أثر مواعيد الزراعة (٧ ابريل، ٢٧ ابريل، ١٧مايو، ٦ يونيو و٢٦ يونيو) علي نمو وإنتاج ثلاثة هجن من الذرة الرفيعة للحبوب (شندويل-١ ,شندويل-٣٠٥ وشندويل-٣٠٦ والصنف دورادو). أظهرت النتائج أن نمو وإنتاج التراكيب الوراثية تأثر معنويا بميعاد الزراعة في كلا الموسمين. وقد أدى تأخير الزراعة من أبريل الي النصف الأخير من مايو أو يونيو إلي زيادة خصائص النمو (إرتفاع النبات، عدد الأوراق الخضراء، مساحة الورقة والمادة الجافة). كما أن الزراعة المتأخرة في يونيو أدت الي التبكيرفي النضج. أعلي قيم لطول النباتات وأقل فترة نضج ارتبطت بالهجين شندويل-٣٠٥ مقارنة بالتراكيب الآخرى. أدت زراعة الهجين شندويل-٣٠٦ في يونيو الي الحصول على أعلى محصول حبوب ومكونات المحصول مقارنة بالتراكيب الوراثية الأخرى والتي تم زراعتها في مواعيد الزراعة المبكرة (أبريل ومايو). كما أظهرت النتائج أن محصول الحبوب قد أرتبط إرتباطاً إيجابيا مع وزن القنديل (r = = 0.52) ووزن حبوب القنديل (r = 0.43) ومساحة الورقة (r = 0.50) ودليل مساحة الورقة (r = 53) والمادة الجافة (r = 53) مما يشير إلى أن هذه المعايير يمكن أن تستخدم لتقدير محصول الحبوب للذرة الرفيعة.

قام بتحكيم البحث

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