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Response of some Grain Sorghum Genotypes to Foliar Spray by Humic Acid

Ali, E.A.; K.A. Abd El-Rahman; I.A. El-Far and A.H. Mohamed

Agronomy Dept., Fac. Agric., Assiut Univ., Egypt
Email: Elkhatyb73@yahoo.com

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Abstract

A field experiment was carried out at Agronomy Department Research Farm, Faculty of Agriculture, Assiut University, Egypt, during 2016 and 2017 seasons to evaluation some sorghum genotypes under different concentrations of humic acid. The experiment was laid out in randomized complete block design (RCBD) using strip-plot arrangement with three replications. The genotypes {Horus, Hybrid 2, Hybrid 305 and Hybrid 306} were assigned vertically while, humic acid concentrations (control, 0.5 ml L^{-1}, 1.0 ml L^{-1},1.5 ml L^{-1},2.0 ml L^{-1} and 2.5 ml L^{-1}) were allocated horizontally. The obtained results showed that the studied grain sorghum genotypes had a significant effect on plant height, panicle length, grain weight $plant^{-1}$, grain and fodder yields traits in the both seasons., furthermore the interaction between grain sorghum genotypes and humic acid concentrations had a significant effect on the plant height in the second season, seed weight $plant^{-1}$ in the first season as well as grains and fodder yields/fed in the two growing seasons. In addition, the maximum average of grain yield $fed.^{-1}$ (26.7 and 25.2 ardab $fed.^{-1}$ in the first and second seasons, respectively) were gained from Hybrid 2 plants which were sprayed by 2.5 ml l^{-1} of humic acid in the first season and Hybrid 306 plants which were sprayed by 2.0 ml l^{-1} in the second one.

Keywords: *Grain sorghum genotypes, Humic acid, Foliar spray, Grains, and fodder yields.*

Introduction

Grain sorghum *Sorghum bicolor* (L.) Moench is one of the important food crops in the world. It is cultivated in many parts of Asia and Africa, where its grains are used to make flat breads that form the staple food of many cultures. The species can be used as a source for making ethanol fuel and in some environments may be better than maize or sugarcane, as it can grow under harsher conditions. It typically has protein levels of around 9 percent, enabling dependent human populations to subsist on it in times of famine, in contrast to regions where maize has become the staple crop. Many factors limiting sorghum production i.e. fertilizers, water, weeds etc, so choosing the suitable genotype and supplement it by nutrient demand increasing grain sorghum production.

Humic acid is an organic compound obtained from decomposed organic material, it contains hydrogen, carbon, oxygen, and nitrogen and plays an important role on soil fertility and plant nutrition. Foliar application of humic acid helps photosynthesis and promotes enzymatic activities, beside inhibit some other enzymes, However, it was found that humic acid help plants to thrive salinity, drought, and heat, and activates several plant reactions (Shalash *et al.* 2011). Fagbenro and Agboola (1993) found that foliar nutrition with humic acid increased leaf biomass, Vasudiran *et al.* (1997) stated that treated plants with humic acid increased grain yield and grain weight, Delfine *et al.* (2005) reported that spraying humic acid on wheat plants increase biological yield, meanwhile, Kauser and Azam (2006) found similar results. Working on wheat, Ulukan (2008) found humic acid increased number of spikes in unit of area, number of grains/spike and grain weight. Sabzevari *et al.* (2010) found similar result on biological yield on wheat. Bulent *et al.* (2011) tested use of Humic acid on a species entitled "Triticum durum Salihli". The results showed that humic acid increases absorption of phosphor, potassium, magnesium, sodium, copper and zinc in plant Dulaimy and El-Fahdawi (2020) showed significant differences among the studied humic acid concentrations. The concentration of (500 mg l^{-1}) was significantly superior compared to the control treatment, with the highest values in most yield parameters of barley. Jamal and Baghi (2014) showed that use of Humic acid had a significant effect on most of studied traits of chickpea and at the level of 1 and 5% probability. Use of 3 kg of Humic acid in each hectare showed more effect in most studied traits. The maximum percentage of protein was obtained in use of 3 kg of Humic acid in each hectare as much as 20.48 percent while the minimum amount (11.41 percent) related to the control group.

Different new grain sorghum genotypes were released. There genotypes need some information about agricultural practices to reach the potentiality of such genotype. Alsadoon and Addaheri (2011) reported that, cultivars exerted a significant influence on 1000-grain weight and grain yield in both seasons. Inkath cultivar produced the highest grain yield which were 6.17 and 6.47 t/ha in spring and fall seasons, respectively. Singh and Sumeriya (2012) showed that plant height was significantly improved by different elite fodder sorghum genotypes. Ochieng *et al.* (2013) found that, variety E1291 showed better yield as compared to Ochuti. Hasssan *et al.* (2014) revealed that sorghum plant height, Panicle weight, Seed index and Grain yield /fed. were affected significantly by studied cultivars in both seasons. Giza 15 cultivar surpassed the Dorado one and gained the highest mean values of mentioned traits in both seasons. Assefa *et al.* (2020) stated that there are significant variation between the studied grain sorghum genotypes in all studied traits, thus the mean values of grain yield ranged from 1300 kg ha^{-1} (Dagim variety) to 2800 kg ha^{-1} (Melkam variety).

So, the objective of this study was to evaluate the response of some grain sorghum genotypes to foliar spray by humic acid.

Materials and Methods

A field experiment was carried out at Agronomy Department Research Farm, Faculty of Agriculture, Assiut University, Egypt, during 2016 and 2017 seasons to evaluation some sorghum genotypes under different concentrations of humic acid.

The soil structure of the experimental site is clay, comprising of 42.60% clay, 30.40% silt and 27% sand with pH of 8.02 and EC 0.74dsm^{-1}. The experiment was laid out in randomized complete block design (RCBD) using strip-plot arrangement with three replications. The genotypes {Horus, Hybrid 2, Hybrid 305 and Hybrid 306} were assigned vertically while, humic acid concentrations (control, 0.5 ml L^{-1}, 1.0 ml L^{-1}, 1.5 ml L^{-1}, 2.0 ml L^{-1} and 2.5 ml L^{-1}) were allocated horizontally. The recommended doses of NPK mineral fertilizers which were 100, 31 and 24 kg fed^{-1} for N, P_2O_5 and K_2O, respectively were added. The NPK fertilizers rates were applied on the form of Urea (46.5%N), Calcium super phosphate (15.5% P_2O_5) and Potassium sulphate (48% K_2O) as a source of nitrogen, phosphorus, and potassium, respectively. Calcium super phosphate were applied during soil preparation, while nitrogen splitting into three equal parts before the second, the third and the fourth irrigation. While, potassium fertilizers were added before the second irrigation. The sorghum genotypes (Horus and Hybrid 2) were obtained from Indian while, the others (Hybrid 305 and Hybrid 306) were obtained from Sorghum Crop Research Section, Field Crop Research Center. Seeds by the rate of 8 kg/fed. were treated by fungicides to increase its ability to germination before sowing which was done on July 2nd and 6th in 2016 and 2017 seasons, respectively. The preceding winter crop was wheat in the two seasons. The plot size was 10.5 m^2 (3 × 3.5 m) contain 5 rows 60 cm apart. Seeds were sown in hills 20 cm apart and thinning at 21 days after planting to secure two plants/ hill.

At harvest, a sample of five guarded plants were taken randomly from each experimental unit to measure yield attributes traits i.e. plant height(cm), panicle length (cm), seed weight plant^{-1} (g) as well as the Grain and fodder yields:

- Grain yield/fed. (Ardab = 140 kg, fed. = 4200 m^2): It was calculated using the grain yield/ plot and then transfer to grain yield fed^{-1}.
- Fodder yield /fed. (ton): It was calculated using the fodder yield/ plot and then transfer to fodder yield fed^{-1}.

All gather data were analyzed with analysis of variance (ANOVA) Procedures, using the SAS Statistical Software Package v.9.2 (SAS, 2008). Differences between means were compared by the revised least significant difference (RLSD) at 5% level of significant (Gomez and Gomez, 1984).

Results and Discussion

A- Yield attributes traits:

A-1. Plant height (cm)

Data presented in Table 1 show that the tested grain sorghum genotypes had a highly significant ($P \leq 0.01$) effect on plant height trait in the two growing seasons. Thus, the tallest grain sorghum plants (200.7 and 198.4 cm in the first and second seasons, respectively) were obtained from hybrid 2 while, the shortest plants (179.2 and 172.2 cm in the two respective seasons) were registered from hybrid 306. This is may be due to the genetic makeup with environmental conditions which was suitable for hybrid 2 grain sorghum genotype than the other studied genotypes.

Similar trend was observed by Hassan *et al.* (2014) and Assefa *et al.* (2020).

Concerning, humic acid concentration effect in this respect, data exhibited in Table 1 reveal that the studied humic acid concentrations had a significant effect on plant height in the first season only. Otherwise, the differences between the tested humic acid concentrations failed to be significant at 5% level of probability in the second season. Whatever, the highest mean values of plant height (189.8 and 188.8 cm in the two respective seasons) were detected from grain sorghum plants which were sprayed by humic acid concentration of 1.5 ml l^{-1} in the first season and sprayed by humic acid concentration of 0.5 ml l^{-1} in the second one. On the contrary, the minimum mean values of plant height (178.2 and 179.4 cm in the two respective seasons) were obtained from grain sorghum plants which were sprayed by tap water (control) in the both seasons. This is to be due to the important role of humic acid in growth of plants. These findings are in a good line with those obtained by Ulukan (2008) and Jamal & Baghi (2014).

Regarding the interaction effect, data presented in Table 1 focus that the interaction between grain sorghum genotypes and humic acid failed to be significant in this respect at 5% level of probability in the first season while, the effect in the second season was highly significant. Whatever, the tallest grain sorghum plants (206.0 and 210.0 cm in the first and second seasons, respectively) were gained from Hybrid 2 grain sorghum genotype plants which were sprayed by 1.5 ml l^{-1} of humic acid in the two growing season.

Table 1. Effect of humic acid concentrations, sorghum genotypes and their interaction on plant height (cm) in 2016 and 2017 seasons.

Seasons	2016							2017						
	Humic acid concentrations							Humic acid concentrations						
Genotypes	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	mean	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	mean
Hybrid 2	183.7	202.0	204.7	206.0	204.7	203.0	200.7	177.3	194.3	198.3	210.0	203.3	207.0	198.4
Hourus	185.0	181.0	178.3	182.3	185.0	181.3	182.2	193.3	196.7	185.0	186.7	188.3	183.7	188.9
Hybrid 305	173.3	175.0	183.3	190.7	180.1	186.0	181.4	175.3	184.3	185.0	184.0	181.7	179.0	181.6
Hybrid 306	170.7	177.7	179.7	180.0	184.0	183.0	179.2	171.7	180.0	166.7	171.7	175.0	168.3	172.2
Mean	178.2	183.9	186.5	189.8	188.5	188.3	-	179.4	188.8	183.8	188.1	187..1	184.5	-

F test and R.L.S.D	F test (2016)	R.L.S.D (2016)	F test (2017)	R.L.S.D (2017)
Genotypes	**	8.4	**	4.8
Humic	*	7.2	N.S	-
Interaction	N.S	-	**	12.2

Where, N.S, * and ** mean non-significant and significant at 5 and 1% of probability, respectively.

A-2. Panicle length (cm)

Data presented in Table 2 show that the tested grain sorghum genotypes had a highly significant ($P \leq 0.01$) effect on panicle length trait in the two growing seasons. Thus, the tallest panicle length (36.9 and 38.7 cm in the first and second seasons, respectively) were obtained from Hourus genotype while, the shortest panicle length (31.4 and 32.5 cm in the two respective seasons) were registered from Hybrid 305 and 306. This is may be due to the genetic makeup with environmental conditions which was suitable for Hourus grain sorghum genotype than the other studied genotypes. Similar trend was observed by Hasssan *et al.* (2014) and Assefa *et al.* (2020).

Concerning, humic acid concentration effect in this respect, data exhibited in Table 2 reveal that the studied humic acid concentrations had a non- significant effect on panicle length in the two seasons. Whatever, the highest mean values of panicle length (34.4 and 34.8 cm in the two respective seasons) were detected from grain sorghum plants which were sprayed by humic acid concentration of 2.5 ml l^{-1} in the both seasons. On the contrary, the minimum mean values of panicle length (33.0 and 33.7cm in the two respective seasons) were obtained from grain sorghum plants which were sprayed by 1.5 ml l^{-1} and 2.5 ml l^{-1} in the first and second seasons, respectively. This is to be due to the important role of humic acid in growth of plants.

Regarding the interaction effect, data presented in Table 2 focus that the interaction between grain sorghum genotypes and humic acid concentrations failed to be significant in this respect at 5% level of probability in the two growing seasons. Whatever, the tallest panicle length (37.7 and 39.2 cm in the first and second seasons, respectively) were gained from Hourus grain sorghum genotype plants which were sprayed by 2.5 ml l^{-1} of humic acid in the two growing season.

Table 2. Effect of humic acid concentrations, sorghum genotypes and their interaction on panicle length (cm) in 2016 and 2017 seasons.

Seasons	2016							2017						
	Humic acid concentrations							Humic acid concentrations						
Genotypes	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean
Hybrid 2	33.7	33.3	33.7	34.2	33.3	35.7	34.0	33.1	32.5	33.3	34.2	32.7	33.7	33.3
Hourus	37.3	36.5	37.5	35.7	36.5	37.7	36.9	39.0	38.9	38.6	38.2	38.1	39.2	38.7
Hybrid 305	30.6	31.9	33.1	30.6	30.6	31.9	31.4	32.7	33.4	32.3	33.0	32.5	33.5	32.9
Hybrid 306	31.3	32.0	32.5	31.3	32.1	32.3	31.9	32.4	32.3	33.4	32.7	31.5	32.7	32.5
Mean	33.2	33.4	34.2	33.0	33.1	34.4		34.3	34.3	34.4	34.5	33.7	34.8	
F test and R.L.S.D	F test			R.L.S.D				F test			R.L.S.D			
Genotypes	**			8.11				**			6.14			
Humic	N.S			_ _ _				N.S			_ _ _			
Interaction	N.S			_ _ _				N.S			_ _ _			

Where, N.S and ** mean non-significant and significant at 1% of probability, respectively

A-3. Seed weight plant^{-1} (g)

Data presented in Table 3 show that the tested grain sorghum genotypes had a highly significant ($P \leq 0.01$) effect on seed weight plant^{-1} trait in the two growing seasons. Thus, the highest mean values of seed weight plant^{-1} (110.0 and 138.2 g in the first and second seasons, respectively) were obtained from Hybrid 2 in the first season and Hybrid 306 in the second one. While, the lowest mean values of seed weight plant^{-1} (74.1 and 87.4 g in the two respective seasons) were registered from Hourus genotype. Similar trend was observed by Hasssan *et al.* (2014) and Assefa *et al.* (2020).

Concerning, humic acid concentration effect in this respect, data exhibited in Table 3 reveal that the studied humic acid concentrations had a highly significant effect on seed weight plant^{-1} (g) in the first season and failed to be significant in the second one. Whatever, the highest mean values of seed weight plant^{-1} (98.9 and 120.9 g in the two respective seasons) were detected from grain sorghum plants which were sprayed by humic acid concentration of 0.5 ml l^{-1} in the first season and sprayed by humic acid concentration of 1.0 ml l^{-1} in the second one. On the contrary, the minimum mean values of seed weight plant^{-1} (79.0 and 108.3 g in the two respective seasons) were obtained from grain sorghum plants which were sprayed by tap water (control) in the first season and 2.5 ml l^{-1} of humic acid in the second one. These findings are in a good line with those obtained by Ulukan (2008) and Jamal & Baghi (2014).

Furthermore, data presented in Table 3 focus that the interaction between grain sorghum genotypes and humic acid concentrations had a highly significant effect in the first season and failed to be significant at 5% level of probability in the second one. Whatever, the maximum mean values of seed weight plant^{-1} (124.6 and 160.5 g in the first and second seasons, respectively) were gained from Hybrid 306 grain sorghum genotype plants which were sprayed by 1.5 ml l^{-1} of humic acid in the first season and the same hybrid plants which were sprayed by 2.0 ml l^{-1} in the second one.

Table 3. Effect of humic acid concentrations, sorghum genotypes and their interaction on seed weight plant^{-1} (g) in 2016 and 2017 seasons.

Seasons	2016							2017						
	Humic acid concentrations							Humic acid concentrations						
Genotypes	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean
Hybrid 2	84.6	112.2	101.9	81.7	122.2	105.7	101.4	138.4	141.6	138.8	123.9	115.3	97.7	126.0
Hourus	70.6	85.7	77.1	67.8	69.6	73.6	74.1	83.3	83.2	110.5	83.4	76.2	88.1	87.4
Hybrid 305	74.9	80.2	77.7	80.7	80.3	86.5	80.0	102.6	108.5	99.3	110.4	96.1	109.0	104.3
Hybrid 306	86.1	117.4	113.5	124.6	102.9	115.8	110.0	13.6	138.3	135.0	126.5	160.5	138.2	138.2
Mean	79.0	98.9	92.5	88.7	93.8	95.4		113.7	117.9	120.9	111.1	112.0	108.3	
F test and R.L.S.D	F test			R.L.S.D				F test			R.L.S.D			
Genotypes	**			10.53				**			16.82			
Humic	**			5.11				N.S			_ _ _			
Interaction	**			9.97				N.S			_ _ _			

Where, N.S and ** mean non-significant and significant at 1% of probability, respectively

B- Grain and fodder yields:

B-1. Grain yield fed.$^{-1}$(Ardab)

Data presented in Table 4 show that the tested grain sorghum genotypes had a highly significant (P ≤ 0.01) effect on grain yield fed.$^{-1}$ trait in the first season and significant in the second one. Thus, the highest mean values of grain yield fed.$^{-1}$ (25.0 and 23.2 ardab fed.$^{-1}$in the first and second seasons, respectively) were obtained from Hybrid 2 in the first season and Hybrid 306 in the second one. While, the lowest mean values of grain yield fed.$^{-1}$ (21.4 and 21.9 ardab fed.$^{-1}$ in the two respective seasons) were registered from Hourus in the first season and Hybrid 305 in the second one. This is to be logic since the same trend was detected regarding grain weight plant^{-1} trait which was mentioned before. These

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finding confirmed with those obtained by Hasssan *et al.* (2014) and Assefa *et al.* (2020).

Concerning, humic acid concentration effect in this respect, data exhibited in Table 4 reveal that the studied humic acid concentrations had a highly significant effect on grain yield fed.$^{-1}$ in the first season and had a non -significant effect in the second one. Whatever, the highest mean values of grain yield fed.$^{-1}$ (24.7 and 23.5 ardab fed.$^{-1}$ in the two respective seasons) were detected from grain sorghum plants which were sprayed by humic acid concentration of 2.5 ml l^{-1} in the first season and sprayed by humic acid concentration of 1.0 ml l^{-1} in the second one. On the contrary, the minimum mean values of grain yield fed.$^{-1}$ (20.5 and 22.0 ardab fed.$^{-1}$ in the two respective seasons) were obtained from grain sorghum plants which were sprayed by distal water (control) in the first season and 1.5 ml l^{-1} in the second one. This is to be logic since the same trend was observed regarding grain weight plant trait as mentioned before. These findings are in a good line with those obtained by Ulukan (2008), Jamal and Baghi (2014) and Dulaimy & El-Fahdawi (2020).

Furthermore, data presented in Table 4 focus that the interaction between grain sorghum genotypes and humic acid concentrations had a highly significant effect in this respect in the both seasons. The maximum average of grain yield fed.$^{-1}$ (26.7 and 25.2 ardab fed.$^{-1}$ in the first and second seasons, respectively) were gained from Hybrid 2 plants which were sprayed by 2.5 ml l^{-1} of humic acid in the first season and Hybrid 306 plants which were sprayed by 2.0 ml l^{-1} in the second one.

Table 4. Effect of humic acid concentrations, sorghum genotypes and their interaction on grain yield fed.$^{-1}$(Ardab) in 2016 and 2017 seasons.

Seasons	2016							2017						
	Humic acid concentrations							Humic acid concentrations						
Genotypes	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean
Hybrid 2	23.9	25.1	25.1	23.5	25.9	26.7	25.0	24.2	23.9	24.0	22.5	22.6	19.7	22.8
Hourus	20.2	24.5	21.0	20.4	21.0	21.5	21.4	23.8	20.4	23.4	22.2	21.8	21.5	22.2
Hybrid 305	16.6	22.4	21.7	23.5	23.9	25.2	22.2	20.6	22.3	23.9	22.0	20.5	22.0	21.9
Hybrid 306	21.4	23.5	25.0	24.3	24.6	25.5	24.1	22.8	22.2	22.6	21.5	25.2	24.8	23.2
Mean	20.5	23.9	23.2	22.9	23.9	24.7		22.8	22.2	23.5	22.0	22.5	22.0	
F test and R.L.S.D	F test		R.L.S.D					F test			R.L.S.D			
Genotypes	**		1.77					*			0.97			
Humic	**		1.34					N.S			_ _ _			
Interaction	**		2.26					**			2.97			

Where, N.S, * and ** mean non-significant and significant at 5 and 1% of probability, respectively

B-2. Fodder yield fed.$^{-1}$ (ton)

Data presented in Table 5 show that the tested grain sorghum genotypes had a highly significant ($P \leq 0.01$) effect on fodder yield fed.$^{-1}$ (ton) trait in the two growing seasons. Thus, the maximum average values of fodder yield fed.$^{-1}$ (15.8 and 21.0 ton/fed. in the first and second seasons, respectively) were obtained from Hourus in the two growing seasons. While, the minimum average values of fodder yield fed.$^{-1}$ (11.6 and 16.8 ton/fed. in the two respective seasons) were registered from Hybrid 305 in the first season and Hybrid

306 in the second one. this is may be due to the genetic makeup with environmental conditions which was suitable for Hourus grain sorghum genotype than the other studied genotypes. These finding confirmed with those obtained by Hasssan *et al.* (2014) and Assefa *et al.* (2020).

Concerning, humic acid concentration effect in this respect, data exhibited in Table 5 reveal that the studied humic acid concentrations had a non-significant effect in the two growing seasons. Whatever, the highest mean values of fodder yield fed.$^{-1}$ (13.7 and 19.8 ton/fed. in the two respective seasons) were detected from grain sorghum plants which were sprayed by tap water (control) in the first season and sprayed by humic acid concentration of 0.5 ml l^{-1} in the second one. On the contrary, the minimum mean values of weight of fodder yield fed.$^{-1}$ (12.9 and 17.6 ton/fed. in the two respective seasons) were obtained from grain sorghum plants which were sprayed by1.5 ml l^{-1} humic acid in the first season and 2.5 ml l^{-1} in the second one. This is to be expected since the same humic acid concentrations gave the highest mean values of plant height and consequently gave the high fodder yield. These findings are in a good line with those obtained by Ulukan (2008), Jamal and Baghi (2014) and Dulaimy & El- Fahdawi (2020).

Here too, Data presented in Table 5 focus that the interaction between grain sorghum genotypes and humic acid had a highly significant and significant effect in this respect in the first and second seasons, respectively. The highest mean values of fodder yield fed.$^{-1}$ (16.8 and 23.2 ton/fed. in the two respective seasons) were gained from Hourus grain sorghum genotype plants which were sprayed by 2.5 ml l^{-1} of humic acid in the first season and from Hourus grain sorghum genotype plants which were sprayed by tap water (control) in the second one.

Table 5. Effect of humic acid concentrations, sorghum genotypes and their interaction on weight of fodder yield fed.$^{-1}$ (ton) in 2016 and 2017 seasons.

Seasons	2016							2017						
	Humic acid concentrations							Humic acid concentrations						
Genotypes	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean	0.0 ml L^{-1}	0.5 ml L^{-1}	1.0 ml L^{-1}	1.5 ml L^{-1}	2.0 ml L^{-1}	2.5 ml L^{-1}	Mean
Hybrid 2	13.3	13.7	13.2	11.6	11.7	11.4	12.5	21.3	21.6	19.6	19.3	17.7	19.5	19.8
Hourus	16.7	15.9	14.4	15.1	16.2	16.8	15.8	23.2	22.1	21.1	21.2	20.5	17.7	21.0
Hybrid 305	11.0	12.4	12.6	12.3	10.7	10.8	11.6	17.2	16.7	15.7	16.4	17.7	18.8	17.1
Hybrid 306	11.5	13.0	12.6	12.8	14.4	14.5	13.1	17.5	17.4	18.3	16.1	16.7	14.5	16.8
Mean	13.1	13.7	13.2	12.9	13.3	13.4		19.8	19.5	18.7	18.3	18.2	17.6	
F test and R.L.S.D	F test			R.L.S.D				F test		R.L.S.D				
Genotypes	**			1.89				**		1.64				
Humic	N.S			_ _ _				N.S		_ _ _				
Interaction	**			1.82				*		2.99				

Where, N.S, * and ** mean non-significant and significant at 5 and 1% of probability, respectively

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استجابة بعض الطرز الوراثية للذرة الرفيعة الحبوب للرش الورقي بحمض الهيوميك

السعدي عبد الحميد علي، كامل علي عبد الرحمن، ابراهيم عبد الباقي رزق الفار وعبد المنعم حسان محمد
قسم المحاصيل – كلية الزراعة – جامعة أسيوط– مصر

الملخص

تم إجراء تجربة حقلية بمزرعة أبحاث قسم المحاصيل، كلية الزراعة، جامعة أسيوط، مصر خلال موسمي ٢٠١٦ و ٢٠١٧ لتقييم بعض الطرز الوراثية للذرة الرفيعة الحبوب تحت تركيزات مختلفة من حامض الهيوميك. نفذت التجربة بتصميم القطاعات كاملة العشوائية باستخدام ترتيب الشرائح المنشقة بثلاثة مكررات. تم وضع التراكيب الوراثية (حورس، هجين ٢، هجين ٣٠٥ وهجين ٣٠٦) راسيا بينما تم وضع تركيزات حمض الهيوميك (اكنترول، ٠,٥ مل لتر$^{-1}$، ١,٠ مل لتر$^{-1}$ ،١,٥ مل لتر$^{-1}$، ٢,٠ مل لتر$^{-1}$ و٢,٥ مل لتر$^{-1}$) أفقيًا. أظهرت النتائج المتحصل عليها أن التراكيب الوراثية للذرة الرفيعة الحبوب محل الدراسة كان لها تأثير معنوي علي ارتفاع النبات وطول النورة ووزن الحبوب للنبات $^{-1}$ ومحصول الحبوب والعلف للفدان في كلا الموسمين. كما أن التفاعل بين التراكيب الوراثية للذرة الرفيعة وتركيزات حامض الهيوميك كان له تأثير معنوي علي ارتفاع النبات فى الموسم الثانى ومحصول الحبوب للنبات فى الموسم الأول وكذلك محصول الحبوب والمحصول العلفى للفدان لكلا الموسمين. بالإضافة إلى ذلك، تم الحصول على الحد الأقصى لمتوسط محصول الحبوب للفدان (٢٦,٧ و ٢٥,٢ أردب للفدان في الموسمين الأول والثاني على التوالي) من نباتات الهجين ٢ التي تم رشها بواسطة حمض الهيوميك بتركيز ٢,٥ مل/ لتر في الموسم الأول ونباتات الهجين ٣٠٦ التي تم رشها بتركيز ٢,٠ مل/ لتر في الموسم الثاني.