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Effect of Genotypes and Tillage Systems in some Growth Characteristic of Maize (*Zea mays* L.)

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Abstract: A field experiment was conducted during autumn season 2018 in Al-Qurna Agriculture research station which is located in about 70 km away north of AL-Basrah Center at 47°.45’ east longitude and 31°00’ north latitude. The aim is to Study the effect of three tillage systems (No tillage; T1, chisel plow a depth of 30 cm plowing + 10 cm disc harrows a depth of 10 cm; T2, Moldboard plow a depth of plowing 30 cm + disc harrows a depth of 10 cm; T3) on some growth characters of some maize genotypes (*Zea mays* L.). The genotypes were Fajer-1 (V1), Baghdad-3 (V2), Al-Maha (V3), Sara (V4). The design of the experiment was randomized complete block design (RCBD) in a split plot arrangement with three replications. The results showed that the tillage system T3 was superior as compared to other tillage systems in stem diameter, while as the treatment T2 was superior in number of days up to 50% tasseling and leaf area. The cultivar Maha (V3) was superior as compared to other cultivars in number of days up to 50% tasseling and leaf area. The interaction between corn genotypes and tillage system was significant on leaf area, that is the genotype V3 under the tillage system T2 gave the highest leaf area reached to 4847.893 cm^2.

Key words: Maize genotypes. Tillage systems. Leaf area. Stem diameter

Introduction

Corn (*Zea mays* L.) is one of the most important food crops grown worldwide. It is the most widely grown cereal in a world. Based on the total area and production, maize is the 3rd most important cereal crop after wheat and rice in the world (Haddadi, 2016). It is widely used as cereals and other forms of food for human as bread and oil, and for feeding of farm animals, in addition to multiple industrial products (Abdullah & Karim, 2019). Variability of genotypes is a key to crop improvement and essential success (Al-Obaidy *et al*., 2015). Corn is cultivated in most governorates of Iraq, but the average yield is still lower than the average of developed agricultural countries, such as United States (1044 T ha^{-1}), Turkey (10.75 T ha^{-1}) and Canada (9.72 T ha^{-1}) (USDA, 2019). Corn cultivars were an important component. Khether (2017) in his study on corn genotypes reported that the maximum leaf area resulted from genotype G_2 5833cm^2 and minimum leaf area resulted from genotype G_1 (4933 cm^2). Kökten & Akçura (2017), in their study on corn during 2 years using twenty five genotypes concluded that, the average stem diameter of Dian genotype was at least 2.60% more than the stem diameter of safak genotype at 5% probability level. The cultivars differed significantly in their response to different tillage treatments (Khorami *et al*., 2018). Tillage is one of the most important processes in the field, it has an important role in improving the physical properties of the soil (Muhsin, 2017), in addition to create a suitable seedbed and helps to increase the root system growth which leads to increase the vegetative growth due to fracture of layers under soil surface (Al-Rubaie & Al-Ubaidi, 2018). The use of mechanized processes is considered the main factor contributing to the total energy inputs in agricultural systems. Tillage represents half of the operations carried out annually in the field. Consequently, there is a potential to reduce energy inputs and production costs by zero tillage (Osunbitan *et al*., 2005; Ozturk *et al*., 2006). A number of researchers had found modern agricultural systems, including zero tillage which is characterized as an agricultural system that eliminates all tillage operations and prepares a seed bed by opening a line to place the seed in the soil. The agricultural systems in a number of countries were used this system of cultivation of crops without tillage because of its many benefits, notably reducing the effort and time required for tillage, reducing the use of machinery (Alrijabo, 2012). Shahzad *et al*. (2015) found during 2 years experiment using three tillage systems that, the maximum Stem diameter resulted from treatment of deep tillage (13.6 mm) and minimum Stem diameter resulted from minimum tillage (12.3 mm). The aim of current study was to determine the response of four corn genotypes to different tillage systems and their impact on the characteristics of growth.

Materials & Methods

A field experiment was conducted during the autumn season 2018 in Al-Qurna Research Station of the Office of Agricultural Research which is located at 70 km to the Basra center at 47°.45 east longitude and 31°.00 north latitude. The aim of this study was to identify the response of four corn genotypes (Fajer-1, Baghdad-3, Al-Maha and Sara) that given the symbols V_1, V_2, V_3 and V_4 to three tillage Systems. No tillage (T_1), chisel plow a depth of 30 cm plowing + disc harrows a depth of 10 cm (T_2), Moldboard plow a depth of plowing 30 cm + disc harrows a depth of 10 cm (T_3).

The experiment was split-plots in R.C.B.D design with three replicates. Tillage systems applied in main plots while corn genotypes applied in sub plots.

The dimensions of experimental units were 2.8×4m with area 11.2 m^2. The distance between the plants was 25 cm, while the distance between rows was 70 cm. Random samples were taken from the experimental soil before plowing from different depths (0-15, 15-30 and 30-45 cm), to estimate some chemical and physical soil properties (table 1). In addition samples of irrigation water were taken to estimate the salinity ratio in irrigation water in laboratories of the College of Agriculture, University of Basrah.

Table (1): Some of physical and chemical properties of the soil field before plowing.

Depth (cm)	pb (Mg m^{-3})	E.C. soil (dsm^{-1})	E.C. water (dsm^{-1})	pH	Texture (gm. kg^{-1})	
0-15	1.48	8.19	2.5	7.65	Sand	100.0
15-30	1.50	8.60			Silt	465.0
30-45	1.50	8.80			Clay	435.0
					Silty loam	

The soil of the experiment was fertilized with 200 kg ha^{-1} triple super phosphate (46% P_2O_5) which added before planting, nitrogen fertilizer as form of urea (46% N) was added at rate of 300 kg ha^{-1} at three timing, the first one at planting, while the second dose added when the plant height was 30 cm and the third dose has been added at the flowering stage (Mohsin, 2007).

Two doses of liquid diazinon (60% active material) 6 litres ha^{-1} was added to avoid corn stalk borer (*sesame criteca*), The first dose was applied 20 days after planting while the second dose applied after 15 days of first dose (Al-Jubouri & Anwar, 2009).

The following characteristics were studied: number of days until 50% tasseling and silking, leaf area was calculated according to (Asekabta, 2018), stem diameter was evaluated on the second internode above the ground with a digital caliper (Mendes Fagherazzi *et al.*, 2018).

The data were analyzed statistically as analysis of variance using the statistical program SPSS (Version 23) according to the split plot design. The means were compared using the least significant differences (L.S.D) at the 0.05 probability level (table 2).

Results & Discussion

Number of Days until 50% tasseling.

Genotypes vary in the duration of tasseling and silking depending on the genotype, morphological characteristics and responsiveness to environmental conditions (Al-Jubouri & Anwar, 2009).

The results explained that the genotypes significantly deferent in number of days until 50% tasseling (table 3). Both genotypes V_3 and V_2 recorded the highest number of days until 50% tasseling. The genotypes V_3 and V_2 recorded 62.222 and 61.778 days. The genotypes V_1 and V4 had the lowest average of the number of days until 50% tasseling which were 60.333 and 60.556 days. This was due to genetic differences between the varieties or perhaps their environmental needs. These results in agreement with results of other researchers Kökten & Akçura, (2017) and Mendes Fagherazzi *et al*. (2018), they reported that corn genotypes had a significant effect on the number of days to tasseling.

Table (2). Mean square of genotypes and tillage systems on growth characteristic of maize.

Sources of variation	df	Number of days until 50% tasseling	. Number of days until 50% silking	Leaf area	Stem diameter
Replicates	2	1.361	2.333	5810.341	0.108
Tillage Systems(T)	2	103.528*	70.750*	984213.724*	124.651*
Error A	4	.0486	0.208	3141.876	0.213
Corn genotypes(V)	3	7.630*	7.333*	273913.108*	14.050*
T × V	6	2.311 ^{ns}	1.515 ^{ns}	99366.691*	14.123*
Error B	18	.0889	0.583	19217.165	0.301
Total	35	-	-	-	-

* Significant at 0.05 probability level; ns Not significant

The results of table (3) revealed that tillage systems have significant effect on the number of days until 50% of tasseling. Moreover the results revealed that T_2 gave the highest days number which reached to 63.333 days. While the tillage system T_1 gave the lowest average which is 58.000 days. This is may be due to increase soil aeration and increase proliferation of roots for uptake of more nutrients by the plant in deep tillage systems, this lead to increase the duration of vegetative growth. Our results was in agreement with results of other researchers Malagi (2010) and Basir *et al.* (2016), which they are reported that tillage systems had a significant effect in the number of days until tasseling.

Number of Days until 50% silking.

Corn genotypes and tillage system had significant effects on number of days until 50% silking.

The results of table (4) exhibited that the highest number of days until 50% silking (65.111 days) was found by V_3 while the average day until 50% silking of V_2 was 64.333 days with insignificant differences from V_3, while the genotype V_1 had the lowest average 63.111 days. This is due to the genotypes varying in the number of days required for tasseling and silking on the species and its morphological characteristics and its responsiveness to environmental conditions. Our results was in agreement with the results of Imorou *et al*. (2018) and Abdullah & Karim (2019), which they are found that corn genotypes had a significant effect on the number of days to silking. The results of table (4) indicated that, the highest number of days until 50% silking (66.083 days) was recorded by T_2, while tillage system T_1 had the lowest average 61.333 days. Due to role of tillage in expanding the growth period of plant and

Table (3): Effect of Corn genotypes and tillage systems on number of days until 50% tasseling.

Tillage systems	Corn genotypes				Tillage system mean
	V_1	V_2	V_3	V_4	
T_1	.59333	57.667	58.000	57.000	.58000
T_2	61.333	64.667	65.667	63.333	.63750
T_3	61.000	63.000	63.000	60.667	61.917
Genotypes mean	60.556	61.778	62.222	60.333	
L.S.D at the 0.05		Genotypes .07707	Tillage systems 0.6067		Interaction N.S

Table (4) effect of Corn genotypes and tillage systems on number of day until 50% silking.

Tillage systems	Corn genotypes				Tillage system mean
	V_1	V_2	V_3	V_4	
T_1	62.667	61.000	61.000	60.667	61.333
T_2	62.667	67.000	68.667	66.000	66.083
T_3	64.000	65.000	65.665	63.667	64.583
Genotypes mean	63.111	64.333	65.111	63.444	
L.S.D at the 0.05		Genotypes 0.6241	Tillage systems 0.3969		Interaction N.S

delayed number of days to tasseling, this reflected on the number of days silking

Leaf area.

The leaf area of the plant was affected significantly by corn genotypes. The results of table 5 shows that the highest leaf area obtained from the V_3 which reached to 4398.841 cm^2 while the leaf area of V_2 was 4341.340 cm^2 and did not differ significantly from V_3 compared to the V_4, which had a leaf area of 40098 cm^2. These differences may be attributed to genetic factors and their interaction with the prevailing environmental conditions, which led to their differences in the leaf area. Our results is in agreement with result of Dadashi *et al*. (2014) and Rubaie & Al-Ubaidi (2018), which they are reported that corn genotypes had a significant effect on the leaf area.

The treatment T_2 was superior by give the highest leaf area which reached to 4512.900 cm^2 compared with T_3 and T_1 treatments which they gave a leaf area reached to 4252.838 and 3940.908 cm^2 respectively (Table 5). Due to the role of tillage in improving favorable condition for plant growth and nutrients were readily available and increased the duration of vegetative growth which led to the increase in leaf area. Our results are in agreement with Malagi (2010) and Ijoyah *et al*. (2013), which they are reported that different tillage systems had a significant effect in the leaf area.

The interaction between the corn genotypes and tillage systems were also significant in this character (Table 5). The highest value of leaf area obtained the tillage system (T_2) and genotype V_3 which reached 4847.893 cm^2 with insignificant differences from T_2 x V_2. While, the interaction $T_1 \times V_4$ had the lowest leaf area reached 3694.677 cm^2

Table (5): Effect of the corn genotypes and tillage systems on leaf area (cm^2).

Tillage systems	Corn genotypes				Tillage system mean
	V_1	V_2	V_3	V_4	
T_1	4070.030	3971.417	4027.510	3694.677	3940.908
T_2	4292.727	4779.897	4847.893	4131.083	4512.900
T_3	4218.840	4272.707	4321.120	4198.687	4252.838
Genotypes mean	4193.866	4341.340	4398.841	4008.149	
L.S.D at the 0.05	Genotypes 113.3150		Tillage systems 48.7872		Interaction 196.2674

Stem diameter

Table (6) showed that various genotypes significantly affected stem diameter. V_4 cultivar was superior by giving the highest mean of stem diameter (24.173mm) compared with V_3, which gave the lowest (21.118 mm). Our results was in agreement with Shi *et al*. (2016) and Mohamed *et al*. (2018), they reported that corn genotypes had a significant effect on the stem diameter.

Table (6) displayed that tillage systems significantly affected stem diameter. High plant stem diameter (25.194mm) was obtained at T_3 tillage system, whereas the lowest plant stem diameter (19.042) was observed in T_1. The cause of the superiority of the tillage systems T_3 is that the mechanism of work of Moldboard plow in dismantling soil and heart of plant remains, created a good conditions for decomposition of organic matter, which is positively reflected in the provision of nutrients, which helped to increase the growth of secondary and main roots.

Table (6): Effect of corn genotypes and tillage system in stem diameter (mm).

Tillage systems	Corn genotypes				Tillage system mean
	V_1	V_2	V_3	V_4	
T_1	16.053	19.303	18.850	21.963	19.042
T_2	25.850	23.923	21.797	23.573	23.786
T_3	25.973	25.113	22.707	26.983	25.194
Genotypes mean	22.626	22.780	21.118	24.173	
L.S.D at the 0.05	Genotypes 0.4484		Tillage systems 0.4017		Interaction 0.7767

Our results was in agreement with Shahzad *et al*. (2015) and Anjum *et al*. (2019), they reported that tillage systems had a significant effect in the stem diameter.

The interaction between corn genotypes and tillage system were also significant in stem diameter (Table 6). The highest value of stem diameter obtained in the tillage system (T_3) and genotype (V_4) which reached 26.983 mm while; the interaction (T_1 x V_1) gave the lowest stem diameter (16.053 mm). This may be due to the combined effect of the tillage system and it is role in creating favourable conditions for the analysis of organic matter, which was reflected in the provision of nutrients, which helped to increase the growth of secondary roots and extension of the roots as well as the variation between the genotypes in the character of stem diameter, which was reflected in increased of stem diameter.

Conclusions.

The results of this study showed that genotypes Baghdad-3 and Al-Maha gave the highest value for most characters; Number of days until 50% tasseling (62.222 and 61.778 days), Leaf area (4341.340 and 4398.841 cm^2) respectively. While the genotype Sara was superior in Stem diameter which was 24.173mm.Corn genotypes generally enhanced using T_2 and T_3 systems compared with T_1. The T_2 and T_3 tillage system led to a significant increase in most of the characteristics of growth, The T_2 tillage system significantly increased the Number of days until 50% tasseling by 7.23%, leaf area by 14.51%. While the T_3 tillage system increased stem diameter by 14.50% compared to the T_1 Tillage system.

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