



Journal of Medicinal and Industrial Plants (MEDIP)

<http://medip.uokirkuk.edu.iq/index.php/medip>

Response of Varieties of Sweet Corn to Different Glutamic Acid Concentrations and Planting Distances

Basem S. Nazem, Ammar Wabdan Al-Sadoon, Yousif A.H.M. Al-Hajoj,
Department of Field Crops, College of Agriculture, University of Tikrit, Iraq

* Corresponding author: E-mail: basem76na@tu.edu.iq

ABSTRACT

A field experiment was carried on the autumn season 2020. D in the field of on the farmer mazraea village of Baiji district Saladin governorate to find out the effect of three concentrations of glutamic amino acid were (0, 150, and 200 mg/ L) and three planting distance (10, 20, and 30)cm between hills in growth, yield and quality of two Sweet corn which are Arma and Soleil. Factorial arrangement was used to Randomized complete block design with three. The results indicated that Arma cultivar was superior in 75% tassling and silking of plants (56.74, and 64.33%) respectively, while the Soliel cultivar was superior in protein percentage trait (5.55%). The planting distance 30 cm between hills is superior of traits number of ears (1.14 arnos.plant⁻¹ and 60.33 grain) ear. Plant and grain 300 weight. The concentration of glutamic amino acid 200m.L⁻¹ superior of traits number of ear, grain 300 weight, single plant yield and protein and carbohydrates percentage (1.17 arnus.plant⁻¹, 332.33arnus⁻¹, 63.11grains, 102.77g.plant⁻¹, 5.69 and 9.18%) respectively. The interaction treatment the variety Arma and planting distance 20cm superior in single plant yield g.plant⁻¹ (120.77 g.plant⁻¹). The combination treatment the variety Soleil and planting distance 20cm were superior of protein and carbohydrates percentage traits (6.14 and 10.21%) respectively , The best intervention is to treat 200 ml of Glutamic with a distance of 30 cm and it gave the best results

KEY WORDS:

Sweet corn, Planting distances, Amino acid, Yield and components

Received:

23/01/2024

Accepted:

31/01/2024

Available online:

10/04/2024

© 2023. This is an open access article under the CC by licenses <http://creativecommons.org/licenses/by/4.0>



استجابة صنفين من الذرة السكرية لتراكيز مختلفة من حامض الكلوتاميك ومسافات الزراعة.

باسم شكور ناظم،
عمار وبدان السعدون،
يوسف عبد الحميد الحاجوج
قسم المحاصيل الحقلية، كلية الزراعة، جامعة تكريت، العراق

الخلاصة

نفذت تجربة حقلية للموسم الخريفي 2020 م في حقل قرية المزارعة التابعة لقضاء بيجي محافظة صلاح الدين لمعرفة تأثير ثلاثة تراكيز من الحامض الأميني الكلوتاميك هي (0، 150، 200 ملغم/لتر) و تم استخدام ثلاث مسافات للزراعة (10، 20، 30) سم بين الجور في نمو وحاصل صنفين من الذرة السكرية (ارما و سوليل) واستخدم نظام التجارب العملية وتصميم القطاعات العشوائية الكاملة وبثلاث مكررات. وبينت النتائج تفوق الصنف أرما في 75% في صفات التزهير الذكري والانثوي

النباتات (56.74، 64.33%) على التوالي، بينما تفوق الصنف سوليل في صفة نسبة البروتين (5.55%)، كما أن مسافة الزراعة 30 سم بين الجور تتفوق في الصفات عدد السنابل النبات و وزن 300 حبه (14 سنبله نبات و 60.33 حبة سنبله). تفوق تركيز الحامض الأميني الكلوتاميك 200 مل في صفات عدد العرائيص وعدد الحبوب بالعنوص و وزن 300 حبه وحاصل النبات الواحد ونسبة البروتين والكربوهيدرات (1.17 عرنوس نبات و 332.33 حبه عرنوس 63.11 غم، 102.11 غم نبات و 5.69 % و 9.18%) على التوالي. تفوقت المعاملة التداخلية للصنف ارما ومسافة الزراعة 20 سم في حاصل النبات¹ (120.77 غم نبات). كما تفوقت المعاملة التداخل للسنابل سوليل ومسافة الزراعة 20 سم في صفات نسبة البروتين والكربوهيدرات (6.14 % و 10.21%) على التوالي، ان افضل لتوليفة هي 200 مل حامض الكلوتاميك مع المسافة 30 سم وأعطت أفضل النتائج .

الكلمات المفتاحية: ذرة سكرية، مسافات زراعة، حامض اميني، الصفات الحقلية والجودة .

INTRODUCTION

Sweet Type (*Zea mays* L.) is one of the most popular crops in Australia, the United State of America, Canada, Brazil, and some other South American countries. Seeds have high food using industrial. It can be used in manufacturing many a high percentage of sugar. Also, corn embryos have high percentage of oil (Tarabishi et al 2005). In Iraq, this crop is not getting commercial importance yet due to low yields compared with the global producers. Therefore, to deal with this decline low yield scientific method to capable increase production are required. The distribution of plants on-field geometry plays an important role to increase yield. Knowing the best distances between plants is a useful tool to maximize yield quantity and quality, which is ultimately the goal for producers (Rafiq et al 2010). The high plant densities per unit of the cultivated area have a negative effect on producing high yield because rivalry is occurring between plants. The nutrition that available to a single plant will be less as well as the amount of radiation decreasing because of shading plants, which is reducing the photosynthesis process (Al-Younis ,1980). For that, looking for a new factor to increase corn production is a link between scientists and farmers. Modern plant technologies by adding nutrition through leaves such as amino acids can be used to improving plant growth and development through improving physiological processes (AL Jumaili 2016). This study aims to finding the effect of planting distances with the best concentration of amino acid, and effect of these factors on the growth and yield of sweet corn.

MATERIALS AND METHODS

The experiment fall 2020 in Baiji, Salah Al-Deen Iraq. The aims were understanding the effect of planting distances and glutamic amino acid spraying on the growth and yield of sweet corn for the two cultivars (Arma and Soleil). The seeds were Sownon 1/7/2020 and harvesting the crop on Harvest time 28/9/2020. The experiment design was RCBD with three replications. Each experimental unit had nine rows, three meters long. The distance between rows was 0.75 meters. The distance between plants applied to be (10, 20 and 30) cm. physical and chemical tests of the experiment soil are given in Table 1. The crop was raised as per standard recommendation soil was till and prepared, and fertilizers were added as recommended. Nitrogen fertilizer was used in the amount of 320 kg.h⁻¹ in the form of urea nitrogen 46% two times, the first one was before the planting date, and the second was 50 days after emergence (Al-Dulaimi 2001). Phosphate fertilizer was added ones before the planting date, and it had P₂O₅ 46% with an amount of 86 kg.h⁻¹ (Jalo *et al* 1996). Corn crop managements were applied to the experiment field such as replanting missing plant, weed control 20 days after emergence. Experiment field irrigated as needed. Also, corn stalk insect controlled after 20 days of emergence by using granulated diazonepesticide 10% as an active ingredient. Glutamic acid with three levels, 0, 150, and 200 m.L⁻¹ was sprayed before the flowering period. When the sweet corn plants reached the flowering stage, the studying traits were measured from ten plants that were selected randomly. Factorial arrangement was used to Randomized complete block design with three .The data were analyzed according to the Duncan test and at the level of 5% significance.

Study Traits

- 1-The number of days from planting to 75% tasseling were calculated.
- 2-The number of days from planting to 75% silking.

3-The number of ears.plant⁻¹.

4-The number of kernels.ear⁻¹ was counting the average of the ten plant kernels sample.

5-The weight of 300 kernels was taken a sample from the yield o ten plants after moisture reached 15%.

6-The average yield of kernels. Plant⁻¹ calculated from the weight of the yield of the ten plants, then divided by ten.(Kambal and Webster ,1966)

7- Protein percentage%.

The protein percentage was estimated using the Kjeldahl device in the laboratory of the grain manufacturing company in Tikrit and the nitrogen was estimated by Kjeldahl for its percentage, and then the protein percentage was calculated as follows.

Proteinratio (%) = Nitrogenratio×6.25) (Hart & Fisher 1971).

8- Carbohydrates %.

Carbohydrates were estimated according to Joslyn (1970), and they were as follows.2 grams of fresh corn kernels were taken and put in a test tube, 80 ml of ethyl alcohol was added to the test tube, and the mixture was placed in a water bath for 30 minutes at 60 ° C, and the mixture was placed for 15 minutes in a centrifuge, and then the clear solution was extracted and the volume was completed. The solution was to 25 ml using perchloric acid. 1 ml of the solution was taken and 1 ml of 5% phenol was added to it with 5 ml of sulfuric acid, and the brown color was seen.

Table (1): Some physical and chemical properties of soil.

Properties	Value
Soil texture	Silty clay
Electrical conduction (EC)	1.96 (dc/m)
Nitrogen	1.764%
Available phosphorous	0.02mg Kg ⁻¹
Available Potassium	0.04 mg Kg ⁻¹
pH	6.8
Organic matter	0.8%

RESULT AND DISCUSSION

The number of days from planting to 75% tassling of plants

The results of Table (2) showed that there were significant differences between the cultivars in the number of days from planting until 75% of plants flowering . The cultivar soleil gave shorter period, 55.70 days compared to cultivar Arma. The 20 cm distance between plants gave lower average for the trait, and it was 55.55 days and it did not differ significantly from the average distance 30 cm as the average trait reached 55.66days. The distance 10 between plants reached 57.44 days as duration, and it was the longest compared with other traits. The control trait, 0 ml.L⁻¹ glutamic acid, gave an average of less than 55.22 days compared to the concentration 200 ml.L⁻¹ for the prescription in giving with longest duration of the trait was 57.38 days. The interaction cultivars and plants distances were significant. The cultivar soleil with 20 cm distance was the recorded lowest flowering period, 52.66 days compared with the cultivar Arma and 30 cm distance, which had a longer period, 58.44 days. The reason for the delay in tasseling is due to its impacted by soil temperature more than the air temperature. Also, increasing in plant density led to a decrease in soil temperature. Farther more, there was a competition between plants in obtaining the necessary light to complete physiological processes (Sangoi 2000), consistent with what Al-kaisy (2015) . As for the bilateral interaction between the two varieties and concentrations, the rmaA variety excelled with 200 ml of glutamic acid and gave the highest value amounting to (57.77) days. In contrast, the

Soleil variety with the comparison treatment recorded the lowest value amounting to (54.66) days. Since the first factor, the second factor, and the third factor were significant, the interaction of the two factors and the three factors was significant.

Table (2): effect of amino acid spraying, planting distances and varieties and their interactions on the flowering characteristic of 75% tasseling..

Varieties	Arma			Soleil			Average
	10	20	30	10	20	30	
Concentrations	10	20	30	Concentrations			Soleil
0	56.33 cd	57.00 bc	57.00 bc	52.00 f	54.00 e	55.00 .de	55.22 c
150	56.00 cd	57.33 bc	58.00b	52.00 f	56.00 cd	57.00 bc	56.05 b
200	58.00b	60.00a	60.33a	54.00 e	55.00 de	57.00 bc	57.38 a
Interaction of two types and glutamic	56.77b	58.11a	58.44a	52.66d	55.00 c	56.33 b	
Concentrations	10	20	30	Concentrations			Soleil
0	56.66bc	54.50d	54.50d	0	rmaA		54.66d
150	56.66bc	55.00d	56.50bc	150	.66 56b		55.44cd
200	59.00a	57.16b	56.00cd	200	57.77a		57.00ab
Average	57.44a	55.55b	55.66b	Average	56.74a		55.70b

Different letters within column indicating of significant differences ($p < 0.05$)

The number of days from planting to 75% silking of plants

Table (3) showed that there was a significant difference between cultivars in the time to 75% of silking. Cultivar soleil gave the shortest period for the trait, which reached 63.25 days compared with the cultivar Arma, which gave the longest duration of the trait, which reached 64.33 days. The 30 cm distance gave a shorter duration and it was 63.05 days, while the 10 cm distance gave the longest duration of the trait, and it was 64.50 days. The control treatment, 0 ml.^{L-1} gave the lowest duration of the trait, and it was 63.22 days, and it did not differ significantly from the concentration of 150 ml.^{L-1} as the period reached 63.55 days. The concentration of 200 ml.^{L-1} gave the longest period, and it was 64.611 days. Cultivars and distance interaction was significantly different. The combination soleil cultivar and 20 cm distance gave the lowest duration of the characteristic, which was 60.77 days while cultivar Arma with 20 cm distance show the longest period, 66.88 days, and that could depend on the genetic variation between cultivars (Zaborsky 2004), consistent with what Ahmed (2013), Since the first factor, the second factor, and the third factor were significant, the interaction of the two factors and the three factors was significant.

Table (3). The effect of amino acid spraying, planting distances and varieties and their interactions on flowering characteristics of 75% silking.

Varieties	Arma			Soleil			Average
	10	20	30	10	20	30	
Concentration	10	20	30	Concentrations			Arma
0	63.33 f-c	66.33ab	61.33hi	64.66 cd	61.00ij	62.66h-e	63.22 b
150	63.63f-c	66.66 a	63.00dg	64.33 cd	59.66 j	64.00cde	63.55 b
200	64.66 cd	67.66 a	63.33 i-f	66.33ab	61.66ghi	65.00bc	64.61 a
Interaction of two types and glutamic	63.88 c	66.88 a	62.22 d	65.11 b	60.77 e	63.88 c	
Concentrations	10	20	30	Concentrations			Soleil
0	64.00bc	63.66bc	62.00 d	0	63.66 b		62.77 c
150	64.00bc	63.16 c	63.50bc	150	64.44ab		62.66 c
200	65.50 a	64.66ab	63.66bc	200	64.88a		64.66ab
Average	64.50 a	63.83 b	63.05c	Average	64.33 a		63.25 b

Different letters within column indicating of significant differences ($p < 0.05$)

The number of ears.plant⁻¹

Table(4) displayed that there were no significant differences between cultivars in the number of ears per plant. The 10 and 20 cm distances gave the lowest average of number of ears per plant, and they were 1.06 and 1.08 respectively; however, the highest mean of the trait at 1.14 appear at 30 cm distance. The concentration of 200 ml.L⁻¹ gave the highest number of ears per plant, and it reached 1.17 ears. Plant⁻¹; however, concentration 0 ml. L⁻¹ gave the lowest mean for the trait, which reached 1.03 ear.Plant⁻¹ while the combination between the cultivar soleil and the 30 cm distance gave a higher average for the trait, and it was 1,15 ears. Plant⁻¹. The combination cultivar Arma and the 10 cm distance gave the lowest average, 1.03 ears. Plant⁻¹. Decreasing the plants number in certain area increasing the light density that plant received and that might be the reason for increasing the photosynthesis and contributes to increase in the number of ears per plant the high plant density caused leaking in pollination, which might be reduced the number of ears per plant (Arif *et al* 2010). Since the first factor, the second factor, and the third factor were significant, the interaction of the two factors and the three factors was significant.

Table (4). The effect of amino acid spraying, planting distances and varieties interaction on the characteristic of the number of ear plant⁻¹.

Varieties	Arma			Soleil			Average
Concentrations	10	20	30	10	20	30	
0	1.00d	1.06bcd	1.06bcd	1.00d	1.03cd	1.06bcd	1.03c
150	1.00d	1.13abc	1.10bcd	1.03cd	1.03cd	1.16ab	1.07b
200	1.10bcd	1.20a	1.23a	1.23a	1.06bcd	1.23a	1.17a
Interaction of two types and glutamic	1.13d	1.13ab	1.13ab	1.08bc	1.04cd	1.15a	
Concentrations	10	20	30	Concentrations		Arma	Soleil
0	1.00e	1.05de	1.06cde	0		1.14b	1.04b
150	1.01de	1.08cd	1.13bc	150		1.07b	1.07b
200	1.16b	1.13bc	1.23a	200		1.17a	1.17a
Average	1.06b	1.08b	1.14a	Average		1.10a	1.09a

Different letters within column indicating of significant differences ($p < 0.05$)

The number of kernels.ear⁻¹

The results in table (5) indicated that there were no significant differences between the two cultivars in the number of kernels. Ear⁻¹ while 20 cm distance gave the highest average for the characteristic, 331,16 kernels. Ear⁻¹, and it did not differ significantly from the 30 cm distance. The average of the kernels. Ear⁻¹ was 328,38. The concentration 200 ml. L⁻¹ gave the highest average for the trait, and it was 332,33 kernels. Ear⁻¹. The control treatment, 0 ml. L⁻¹ the lowest average, 309,88 kernels. Ear⁻¹. The combination cultivar Arma and 20 cm distance was the highest average for the trait, and it was 372.11 kernels. Ear⁻¹ while the combination cultivar Arma and the 10 cm distance gave the lowest average for the trait, and it was 284.56 kernels. Ear⁻¹. The number of kernels. Ear⁻¹ is impacted by environmental factors such as light density, temperature, and soil moisture. Increasing plants number per area will increase the competition between plants for water sources, light, which might reduce the number of kernels per plant. Also, that could reduce the leaf area, which plays an important role for plant growth and development (Monneveux *et al* 2005). As for the bilateral interaction between the two varieties and concentrations, the Soleil variety excelled with 200 ml of glutamic acid and gave the highest value amounting to 336.78 kernels. In contrast, the Arma variety with the comparison treatment recorded the lowest value amounting to 311.22 kernels.

Table (5): The effect of amino acid spraying, planting distances and varieties and their interaction on the characteristic of the number of kernels.

Varieties	Arma			Soleil			Average
Concentrations	10	20	30	10	20	30	
0	275.67de	366.67a	291.33cde	306.00cde	268.67e	351.00ab	309.88b
150	289.33cde	363.00a	298.33cde	300.33cde	278.67de	249.00ab	313.11b
200	288.56cde	386.67a	308.33cde	314.67bcd	323.33bc	372.33a	332.33a
Interaction of two types and glutamic	284.56b	372.11a	299.33b	307.00b	290.22b	357.44a	
Concentrations	10	20	30	Concentrations		Arma	Soleil
0	290.83d	317.67bcd	321.17bc	0		311.22b	308.56b
150	294.83cd	320.8bc	323.67bc	150		316.89ab	309.33b
200	301.6cd	355.00a	340.33ab	200		327.89ab	336.78a
Average	295.77b	331.16a	328.38a	Average		318.6a	318.22a

Different letters within column indicating of significant differences ($p < 0.05$)

The weight of 300 kernels

The results showed in table (6) represent that were no significant differences between the two cultivars in the weight of 300 kernels. The 30 cm distance gave the highest average for the trait, which reached 60.33 g and did not differ significantly from the 20 cm distance as it gave an average 57.44 g. The 10 cm distance gave the lowest average for the trait, and it reached 50.889 g. The 200 ml.L⁻¹ concentration showed the highest mean for the trait, and it reached 63.11 g. the control treatment, 0 ml.L⁻¹ showed the lowest mean for the trait, and was 48.72 g. The combination soleil cultivar and the 30 cm distance reached the highest average for the trait of, 61,55 g, while the combination soleil cultivar and the 10 cm distance of 10 cm reduced the trait average to 50.22 g. The reason might be increasing the photosynthesis, which lead to increase the weight of 300 kernels (Al-Nouri & Al-Abadi 2013). Since the first factor, the second factor, and the third factor were significant, the interaction of the two factors and the three factors was significant.

Table (6): Effect of amino acid spraying, planting distances and varieties and their interaction on the weight of 300gm grains.

Varieties	Arma			Soleil			Average
Concentrations	10	20	30	10	20	30	
0	44.00h	50.00fgh	52.00h-e	46.66 h	46.66h	53.00h-d	48.72c
150	48.66gh	63.00 abc	60.66d-a	48.66gh	58.00g-c	62.00 d-a	56.83b
200	58.00g-c	67.66ab	64.66abc	59.33f-b	59.33f-b	69.66a	63.11a
Interaction of two types and glutamic	50.22c	60.22a	59.11ab	51.55c	54.66bc	61.55a	
Concentrations	10	20	30	Concentrations		Arma	Soleil
0	45.33 d	48.33cd	52.50c	0		48.66c	48.77c
150	48.66cd	60.50b	61.33ab	150		57.44b	56.22b
200	58.66b	63.63ab	67.16a	200		63.44a	62.77a
Average	50.88b	57.44a	60.33a	Average		56.51a	55.92 a

Different letters within column indicating of significant differences ($p < 0.05$)

Plant yield (Plant gm⁻¹)

The results show in table (7) indicated that was no significant to increase in the Yield plant yield between the two cultivars. The 30 cm distance increased the average of kernels.Plant⁻¹ to 104.72 gm. Plant⁻¹. The 10 cm distance decreased the average yield of kernels. Plant⁻¹ to 88.88 gm. Plant⁻¹. The concentration of 200 ml.L⁻¹ provided the highest average in the trait, 102.11gm. Plant⁻¹ while the combination Arma cultivar and the 20 cm distance showed the highest average, which

was 120.77 gm⁻¹, but it did not show a significant differ from the combination soleil and the 30 cm distance that gave an average of 119.33 gm. Plant⁻¹. The combination Arma and the 10 cm distance and the combination soleil cultivar and the 20 cm distance gave the lowest average in this characteristic, 84.33 and 84.88 gm. Plant⁻¹ respectively. The increasing in the number of kernels per ear and increasing the weight of 300 kernels in in tables (5 and 6) were increased the yield plant. Since the first factor, the second factor, and the third factor were significant, the interaction of the two factors and the three factors was significant.

Table (7):The effect of amino acid spraying, planting distances, varieties and their interaction on plant yield.

Varieties	Arma			Soleil			Average
Concentrations	10	20	30	10	20	30	
0	82.00de	119.66a	85.66cde	92.66bcd	80.33e	119.00a	96.55b
150	84.66cde	118.00a	90.00e-b	89.66e-b	86.00cde	118.33a	97.77b
200	86.33cde	124.66a	94.66bc	98.00b	88.33e-b	120.66a	102.11a
Lnteraction of two types and glutamic e	84.33c	120.77a	90.11bc	93.44b	84.88c	119.66a	
Concentrations	10	20	30	Concentrations		Arma	Soleil
0	87.33b	100.00 a	102.33a	0		95.78b	97.33ab
150	87.16b	102.00a	104.16a	150		97.55ab	98.00ab
200	92.16b	106.50a	107.66a	200		101.88ab	102.33a
Average	88.89b	102.83 a	104.72a	Average		98.40a	99.22a

Different letters within column indicating of significant differences ($p<0.05$)

Protein percentage(%)

The result of table(8) showed that there were significant differences between the two varieties of Sweet corn .If the soleil variety gave the highest arithmetic mean of the tract was 5.551 % while the variety Arma was gave the lowest average for the Trait amounted to 5.35 %. This result agreed with finding, by Ikam and Farooq (2010) and Llyas *et al* (2014). The distance 30 cm gave the highest arithmetic meanicef the trait, which was (5.86) % compared with the distance of 10 cm,which was (5.11) %. This result was consistent.

The third concentration of glutamic acid gave the highest mean forth e trait of (5.69%) compared to the comparison treatment 0 m.L⁻¹ ,which gave the lowest for the trait of (5.26%).This result was consistent with Fadros *et al* (2019) .The interaction treatment cultivar soleil * distance 30cm gave the highest mean of the trait was (6.14%) compared with the interaction treatment cultivar Aramadistance10 cm was gave the lowest average forth trait was 5.04%. Since the first factor, the second factor, and the third factor were significant, the interaction of the two factors and the three factors was significant.

Table (8): The effect of spraying amino acid concentrations, planting distances and the two varieties and their interaction on the characteristic of protein percentage.

Varieties	Arma			Soleil			Average
Concentrations	10	20	30	10	20	30	
0	4.93 g	5.10 efg	5.50 d	5.06 fg	5.16 efg	5.80 c	5.26 c
150	5.00 fg	5.53 de	5.46 d	5.16 efg	5.33 de	6.10 b	5.40 b
200	5.20 ef	5.33 de	5.76 c	5.33 de	5.80 c	6.53a	5.69 a
Lnteraction of two types and glutamic	5.04 d	5.32 c	5.57 b	5.18 d	5.43 c	6.14 a	
Concentrations	10	20	30	Concentrations		Arma	Soleil
0	5.00 e	5.13 de	5.65 b	0		5.20 c	5.32 c
150	5.08 e	5.33 c	5.78 b	150		5.26 c	5.53 b
200	5.26 cd	5.66 b	6.15 a	200		5.58 b	5.80 a
Average	5.11 c	5.36b	5.86 a	Average		5.35 b	5.55 a

Different letters within column indicating of significant differences ($p<0.05$)

Carbohydrates of percentage (%)

The result of the table (9) showed there was non-significant difference between the two varieties of sweet corn and this result differed with the finding of Llyas et al (2014) The distance 30 cm gave the highest mean for the trait, which reached 9.72 % compared with the distance 10 cm which gave the lowest Average for the trait which was 7.70%. The higher concentration of glutamic acid (200 m.L⁻¹) gave the highest average for the trait was 9.18% compared with the control treatment which gave the lowest average for the trait was 8.13%. The interaction combination cultivar Solil and distance 30cm gave the highest mean of the trait which reached 10.12 % measuring with interaction Arma distance 10 cm, which gave the lowest average for the trait of (7.54%).

Table (9): The effect of spraying amino acid concentrations, planting distances and the two varieties and their interaction on the characteristic of carbohydrates.

Varieties Concentrations	Arma			Soleil			Average
	10	20	30	10	20	30	
0	7.30 k	7.93 j-h	8.83 efg	7.43 ijk	8.23 j-f	9.03 def	8.12 c
150	7.40 jk	7.96 k-g	9.16 cde	7.83 ijk	8.80 h-e	10.56 ab	8.62 b
200	7.93 k-h	8.20 j-f	9.73 cd	8.30 h-f	9.90 bc	11.03 a	9.18 a
Interaction of two types and glutamic	7.54 d	8.03 c	9.24 b	7.85 cd	8.67 b	10.21 a	
Concentrations	10	20	30	Concentrations	Arma	Soleil	
0	7.36 e	8.08 cd	8.93 b	0	8.12 c	8.13 c	
150	7.61 de	8.38 c	9.86 a	150	8.45 bc	8.78 ab	
200	8.11 cd	9.05 b	10.38 a	200	9.18 a	9.17 a	
Average	7.70 c	8.50 b	9.72 a	Average	8.58 a	8.70 a	

Different letters within column indicating of significant differences ($p < 0.05$)

CONCLUSION

There are significant differences between the two cultivars in most of the traits that were studied and through the use of planting distances and spraying with amino acid, and that this study will help to increase the yield of corn

REFERENCES

- Ahmed, M.F. 2013. Diallel analysis and biochemical genetic markers for heterosis and combining ability under two sowing dates of maize inbred lines. *Asian J. of Crop Sci.*, 5(1) : 81 – 94.
- Al-Dulaimi OEM 2001. The response of some genotypes from corn (*Zea mays* L.) to different levels of nitrogen under the conditions of Anbar Governorate. M. Sc. Thesis. College of Agriculture. Anbar University.
- Al-Jumaili IAS 2016. The effect of planting distances and foliar feeding with iron on the growth and yield characteristics of maize, *Anbar Journal of Agricultural Sciences* **14**:2-8.
- Al-Kaisy, K.H.R.A. 2015. Study of Phenotypic Proporties and Productivity For Some Crosses Corn (*Zea mays* L.) in Different Cultivation dates. College of Agric. Univ. of Tikrit. Iraq .Pp:83. 155-211
- Al-Nouri MA, Al-Abadi RFA 2013. The effect of seed size and planting distances on the qualitative characteristics of the grains of two synthetic varieties of corn (*Zea mays* L.). *Tikrit University Journal of Agricultural Sciences* **13**(2):287-297. <https://www.iasj.net/iasj/download/7aed2c2a0189edb4>
- Al-Younis, Abdel Hamid Ahmed. 1980. Principles of field crops, Ministry of Higher Education, pp. 51-67, Iraq.

- Arif M, Tariq M, Jan NU, Khan H, Akbar SA, Khan MJ, Khan A, Khan I, Munir M, Saeed A & Iqbal 2010. Impact of plant population and nitrogen levels on maize. *Pakistan Journal Botany* 42:3907-3913.
- Fadros M, Hussain JO & Munir AT 2019. The morphological, physiological and chemical responses of sweet corn to foliar application of amino acid sbiostimulantss prayed at three growth stages. *Australian Journal of Austerlian Journal of Crop Science* 13(3)412-417.
- Hart FL & Fisher HJ 1971. Modern food analysis. New York, USA: Springer-Verlag New Inc. 24(10):359.
- Ikam UMA & Farooq A 2010. Chemical and nutritional properties of some maize (*Zea mays* L.) varieties grown in NWPP *Pakistan 2010. Pakistan Journal of Nutrition* 9:113-1117
- Jalo RAJ, Saad H & Hamoud KJ 1996. The effect of different levels of fertilizer on corn production. *Iraqi Journal of Agricultural Sciences* 27:96-109.
- Joslyn MA 1970. In Methods food analysis, physical, Chemical and instrumental methods of analysis 2nded .Academic Press. New York and London of Ph. D. Dissertation. Department of Crop Production, University of London.
- Kambal, A.E., And O.J.Webster.1966.Manifestation Of Hybrid Vigor In Grain And The Relation Among The Components Of Yield, Weight Per Bushel,And Height.Crop Sci. 6: 513 - 515.
- Llyas MA, Khan H, Iqbal A & Minhas M 2014. Estimation of carbohydrates, starch protein and oil contents of Maize (*Zea mays* L).*European Academic Research Journal* 2:5230- 5240.
- Rafiq MA, Ali M, Malik A and Hussain M 2010. Effect of fertilizer and Plant densities of yield and protein of autumn planted maize. *Pakistan Journal of Agriculture Science* 47:201-208.
- Sangoi L 2000. Understanding plant density effect on maize growth and development: An important issue to maximize grain yield. *Ciência Rural* 31:159-168.
- Tarabishi Z, Gharibo A, Sa'id A, Muhammad A & Nashat N 2005. Production of field crops (theoretical part) Publications of books and university publications, *University of Aleppo*147pp.
- Zaborsky S 2004. Role of seed production stress factors in hybrid maize production. *Agriculture Science* 47:201-205.