Effect of Detasseling and spraying of Gibberellic acid in the growth and yield of some subspecies of yellow corn

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ABSTRACT

A field experiment was conducted during the Autumn Agricultural season for 2017 in two fields of yellow corn farmers in Babylon province with two locations, The first one in the center of Al-Hillah city within the latitude line 32.2513° north and longitude line 44.2352° east, the second in Abu Gharq within the latitude line 32.3146° north and longitude line 44.2217° east, to study the response of three subspecies of yellow corn are (Sweet corn and oily corn and Dent corn), Detasseling, Spraying of Gibberellic acid with a concentration of (100 $mg.L^{-1}$) and their interaction treatments in growth of yellow corn (*Zea mays* L.) and grain yield, The experimental treatments were distributed in the factorial experiment according to the Randomized Complete Block Design (RCBD), with three replicates. The first factor included three subspecies of yellow corn are (Sweet corn and oily corn and Dent corn), The second factor was the Detasseling for the plants of the two intermediate lines of each treatment when the lateral vegetative bud is transformed into a tasseling. The third factor was the spraying of Gibberellic acid at a concentration of (100 $mg.L^{-1}$), The results showed that there was a significant response to subspecies of yellow corn and spraying of Gibberellic acid in most growth and yield indices. The treatment of subspecies oily corn, the Detasseling and spraying of Gibberellic acid at the concentration of (100 $mg.L^{-1}$) was excelled by giving it the highest averages in the indices of vegetative growth, the height of the plant and the number of total leaves and the leaves content of total chlorophyll pigments while the Dent corn treatment was excelled in the number of grains in the plant, the number of grains in the cob, the weight of 500 seeds, the grains yield and the productivity of the plant amounted of (172.1, 188.4 $cm.plant^{-1}$, 13.72, 13.90 $leaf.plant^{-1}$, 73.89, 77.62 SPAD, 622.1, 1.80, 1.87 $cob.plant^{-1}$, 424.2, 436.4 $grain.cob^{-1}$, 157.9 162.8 g, 93.93, 78.92 $g.plant^{-1}$ and 4.978, 4.182 $ton.ha^{-1}$), respectively.

Keywords: Subspecies of yellow corn, Detasseling, Spraying of Gibberellic acid.

تأثير إزالة النورة الذكرية ورش حامض الجبرليك في نمو وحاصل بعض تحت أنواع من الذرة الصفراء

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الخلاصة

نفذت تجربة حقلية أثناء الموسم الزراعي الخريفي لعام 2017 في حقلين لمزارعي الذرة الصفراء في محافظة بابل بموقعين، الاول في مركز مدينة الحلة ضمن خط عرض32.2513 درجة شمالاً وخط طول 44.2352 درجة شرقاً والثاني في ناحية أبي غرق ضمن خط عرض 32.3146 درجة شمالا وخط طول 44.2217 درجة شرقاً، لدراسة استجابة ثلاثة تحت أنواع من الذرة الصفراء هي السكرية و الزيتية والعلفية وإزالة النورة الذكرية ورش حامض الجبرليك بتركيز 100 ملغم لتر$^{-1}$ ومعاملات التداخل بينها في نمو الذرة الصفراء .*Zea mays* L وحاصل الحبوب، تضمن توزيع المعاملات التجريبية في تجربة عامليه وفق تصميم القطاعات العشوائية الكاملة (RCBD) وبثلاثة مكررات تضمن العامل الاول ثلاث تحت نوع من الذرة الصفراء السكرية والزيتية والعلفية، العامل الثاني هو إزالة النورة الذكرية لنباتات الخطين الوسطيين لكل معاملة عند تحول البرعم الخضري الطرفي الى نورة ذكرية وكان العامل الثالث رش حامض الجبرليك بتركيز 100ملغم لتر$^{-1}$، وأظهرت النتائج وجود استجابة معنوية لتحت انواع الذرة ورش حامض الجبرليك في معظم مؤشرات النمو والحاصل وتفوقت معاملة تحت نوع الذرة الزيتية وإزالة النورة الذكرية ورش حامض الجبرليك تركيز 100 ملغم لتر$^{-1}$ بإعطاء أعلى المتوسطات في مؤشرت النمو الخضري وهي ارتفاع النبات وعدد الاوراق الكلية ومحتوى الاوراق من صبغات الكلوروفيل الكلية بينما تفوقت معاملة الذرة العلفية في عدد العرانيص في النبات وعدد الحبوب في العرنوص ووزن 500 بذرة وحاصل الحبوب وإنتاجية النبات، بلغت 172.1 و188.4 سم نبات$^{-1}$ و13.72 و13.90 ورقه نبات$^{-1}$ و73.89 و77.62 SPAD و622.1 و1.80 و1.87 عرنوص نبات$^{-1}$ و424.2 و436.4 حبة عرنوص$^{-1}$ و157.9 و162.8غم و93.93 و78.92 غم نبات$^{-1}$ و4.978 و4.182 طن هكتار$^{-1}$ للموقعين على التتابع .

الكلمات المفتاحية: تحت أنواع الذرة الصفراء. إزالة النورة الذكري. رش حامض الجبرليك.

1. INTRODUCTION

Yellow corn (Zea mays L.) is a Monocotyledons plant belonging to the Poacea family. Its importance comes in achieving global food security, cultivated area and production after wheat and rice crops. This importance is illustrated through the variety of uses of yellow corn, including: Popcorn, sweet corn and oily corn and Dent corn (6). Therefore, it was necessary for specialists to invest in modern agricultural techniques to increase productivity subspecies. Among the most important ways to achieve this goal is the attention to Detasseling for its large role in the hormonal balance in the plant cells (7) or that the Detasseling caused a significant increase of most indicators of vegetative growth and yield, This may be attributed to the increase in the bio-processes for plant cells, including photosynthesis processes, increasing cell division and elongation, the activity and efficacy of enzymes and plant hormones (8, 19) or their effect on the production of proteins and carbohydrates, Or for the purpose of increasing the grains productivity for some subspecies through increasing the duration of pollination and according to the environmental conditions for the experiment area (9). In addition, the spraying of Gibberellic acid at the concentration of (100 $mg.L^{-1}$) encouraged cell division, increased vegetative growth and dry matter accumulation in the plant (10). The results of the applied studies on the subspecies that showed the best response in the vegetative growth indicators as well as the yield indicators (6). This is due to the genetic susceptibility of each genotype in the conversion of manufactured nutrient materials from source to sink. Therefore, the yield represents the other direction after the soil and crop service and all the above. This study was conducted to determine the response of the best subspecies of yellow corn to Detasseling, spraying the Gibberellic acid and its effect on growth and yield.

2. MATERIALS AND METHODS

A field experiment was conducted during the Autumn Agricultural season for 2017 in two fields of yellow corn farmers in Babylon province with two locations, The first one in the center of Al-Hillah city within the latitude line 32.2513° north and longitude line 44.2352° east, the second in Abu Gharq within the latitude line 32.3146° north and longitude line 44.2217° east, Ten random samples of each soil were taken at a different depth (0-30 cm). Samples of each location were mixed homogenously, air-dried, milled and sieved for the purpose of estimating some chemical and physical properties in the soil and water laboratory belonging to the Directorate of Agriculture in Babylon province, as shown in Table (1).

Table 1: Some physical and chemical traits for field soil.

Traits		First location	Second location
Electrical conductivity (dsm^{-1})		3.1	1.4
PH		7.6	7.8
Organic matter (%)		2.05	1.55
Apparent density ($g.cm^{-3}$)		1.3	1.2
Levels of elements availability	Nitrogen availability ($mg.L^{-1}$)	28.7	27
	phosphorus availability ($mg.L^{-1}$)	20.4	13.6
	Potassium availability ($mg.L^{-1}$)	7.41	7.51
Soil texture components	Clay	13.0	35.5
	Silt	28.5	24.5
	Sand	58.5	40.0
Soil texture		**Loamy sand**	**Sandy clay loam**

The soil of the two locations was prepared by plowing it with two perpendicular plowing. During the plowing process, 140 kg.ha-1 of Diamino Phosphate (DAP) was added strewing to each field to ensure that it was mixed with soil (3, 12). The experimental treatments were distributed in the factorial experiment according to the Randomized Complete Block Design (RCBD) (4). The first

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factor included three subspecies of yellow corn are (Sweet corn and oily corn and Dent corn), The second factor was the Detasseling for the plants of the two intermediate lines of each treatment when the lateral vegetative bud is transformed into a tasseling. The third factor was the spraying of Gibberellic acid at a concentration of (100 $mg.L^{-1}$) twice, The first one after 30 days of cultivating and the second was done when Detasseling after 50 days of cultivating, using the 16 L Backpack Sprayer in the early morning (10). The field of each location was divided into three sectors, each sector with dimensions of (53 m x 3 m) and each sector divided into 12 experimental units. The size of each experimental unit was 12 m2 with dimensions of (4 × 3 m), the distances were left between experimental units and replicates, including ditch. The two locations were cultivated: the first one on (17/7/2017) and the second on (20/72017). The synthetic cultivar (Baghdad 3) was used for the subspecies of Dent corn and its scientific name (Zea mays L.) as for subspecies of sweet corn and its scientific name (Zea mays saccharata), the subspecies of Oil corn and its scientific name (Zea mays Oil), the two subspecies of oil and sweet corn (ksc704 and ksc403) were used, respectively. The experimental units were cultivated by placing three seeds in each pit. The distance between each pit was 25 cm and the distance between each line was 75 cm, with rate of five lines in each experimental unit. Thus, the number of plants in the experimental unit was 64 plants. The irrigating process of the experiment was conducted normally. Table (2) shows the chemical analysis of irrigation water in the soil and water laboratory belonging to the Directorate of Agriculture, Babylon province.

Table 2: Chemical Analysis of Irrigation Water

Trait	pH	EC	Ca	Na	Mg	K	NO_3
Value	7.3	0.88	10	3.78	8.5	0.2	18.9
Unit	-	$ds.m^{-1}$	$Meq.L^{-1}$				$mg.L^{-1}$

After the emergence of seedlings is completed, The failed pit were re-cultivated the thinning process was also conducted to one plant in pit after 14 days of cultivation, The control of the thicket was conducted manually by both the Grubbing and weeding process and for both locations during the experiment period. The Diazinon GR (10% effective ingredient) was also used to control the insect of the Corn stem borer (Sesamia cretica L.) by placing it at the Apical meristem of (6 $kg.ha^{-1}$) and for the two times, the first one after 20 days of cultivating and the second one after 14 days of the first control (1). Urea fertilizer containing 46% N was added at the level of (150 $kg.ha^{-1}$) (2). Field indicators of ten conserved plants were randomly selected from the midline and included:

Vegetative growth indicators

Plant height: It was calculated from soil surface to the end of node bearing the tasseling using the steel measuring tape.

The number of leaves: It was calculated for the sample of the ten plants taken randomly by manual counting.

The leaves content of total chlorophyll pigment: it was estimated using a Chlorophyll meter device (type SPAD-502). The reading of a sample of ten randomly selected plants per experimental unit was taken with three readings of the leaf bearing the first cob per plant and then the average was calculated.

The yield indicators

Number of cobs: It was calculated from the random sample and then the average was calculated.

The number of grains in the cob: A 10 samples were taken randomly from the random sample, the number of grains in each cob were calculated and then by the average was calculated.

The weight of 500 seeds and grain yield after taking the grains of the random sample and then 500 grain was numbered from them, and then weighed by a sensitive balance after

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drying the seeds and moisture stability at (15.5%).

RESULTS AND DISCUSSION

First: Indicators of vegetative growth

1- Plant height (cm.plant^{-1})

Table (3) shows there is a significant effect for the experiment treatments in the plant height, when comparing subspecies of yellow corn, Noting the significant superiority of oil yellow corn plants, which gave the highest averages in the plant height amounted of (172.4, 188.4 cm^{-1}) from the locations, respectively compared to the lowest averages for sweet corn plants, which amounted of (161.3, 173.6 cm.plant^{-1}) for the two locations, respectively. It was noted that the effect of the two treatments of Detasseling was not significantly different at the first location, while in the second location, the treatment without Detasseling was significantly excelled by giving it the highest average for plants height amounted of (186.6 cm^{-1}) compared to the Detasseling treatment, which gave the lowest average amounted of (176.6 cm.plant^{-1}), and it is noted that the spraying treatments of Gibberellic acid did not have significant differences for both locations of the experiment. The table also shows that there is a significant effect for the interaction treatments between subspecies of yellow corn × Detasseling which gave the highest average amounted of (176.5, 193.9 cm.plant^{-1}) for the two locations respectively compared to the sweet corn plants X Detasseling which gave the lowest averages amounted of (154.8, 166.9 cm.plant^{-1}) for the two locations, respectively. As for the interaction between the subspecies of yellow corn treatments and the spraying treatments of Gibberellic acid had a significant effect. The subspecies of oil corn plants × the spraying of Gibberellic acid at the concentration of (100 mg.L^{-1}) gave the highest average amounted of (188.7, 200.4 cm.plant^{-1}), respectively. for the two locations, respectively compared to the lowest averages amounted of (159.9 and 169.2 cm.plant^{-1}) for the two locations, respectively, It is derived from the sweet corn plants that are spraying with distilled water only. The table also shows that the triple-interaction between the experiment factors has a significant effect on this trait. The subspecies of oil corn plants × Detasseling × the spraying of Gibberellic acid at the concentration of (100 mg.L^{-1}) gave the highest averages amounted of (200.7, 200.3 cm.plant^{-1}) for the two locations, compared to the lowest averages amounted of (120.5, 131.0 cm.plant^{-1}) for the two locations respectively resulted from sweet corn plants × Detasseling × the spraying with Distilled water. The results of the Analysis of Covariance in Table (3) between the two locations of experiment that the significant differences between the experiment treatments were resulted from the effect of the treatments itselves, Where the effect of the experiment location and the interaction between the influence of the location × the treatments were not significant, although the Coefficient of Variance between the treatments at both locations amounted of (6.5, 5.6), respectively, It is within acceptable limits.

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Table 3: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in plant height (cm.plant^{-1}) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		First location			Second location		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	134.3	140.2	167.8	140.3	146.7	177.3
	with	120.5	161.2	154.8	131.0	168.8	166.9
Oil corn	without	171.6	200.7	176.5	182.8	200.3	193.9
	with	160.9	181.5	167.8	169.8	183.0	182.2
Dent corn	without	164.1	180.1	173.6	171.2	178.0	185.9
	with	141.7	194.3	158.0	193.4	198.4	169.6
LSD 0.05		**18.24**		**12.90**	**17.29**		**12.22**
Effect of Spraying Gibberellic acid		163.6	169.2		180.1	183.1	
LSD 0.05		**NS**		Effect of Subspecies	**NS**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	159.9	162.8	161.3	169.2	177.0	173.6
	Oil corn	176.2	188.7	172.1	176.4	200.4	188.4
	Dent corn	172.9	188.1	165.8	170.8	195.7	182.7
LSD 0.05		**12.90**		**9.12**	**12.22**		**8.64**
Effect of Detasseling	without	168.4			186.6		
	with	167.4			176.6		
LSD 0.05		**NS**			**7.06**		
Coefficient of Variance between treatments		6.5			5.6		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

2- The total number of leaves (leaf.plant^{-1})

Table (4) shows there is a significant effect for the experiment treatments in the trait of the number of leaves, when compared between the Subspecies of yellow corn. It is noted a significant superiority for the plants of oil corn, which gave the highest averages in the number of leaves amounted of (13.72 leaf.plant^{-1}) compared with the lowest averages for sweet corn plants, which amounted of (12.82 leaf.plant^{-1}) for the first location, the second location was not significant. It is noted that the effect of the two treatments of Detasseling, the difference between them did not reach the significant limit in the two locations, respectively. It is also noted that the spraying treatments with the two concentrations of Gibberellic acid did not have significant differences for both locations of the experiment. The table also shows that there is a significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling. The oil corn plants × without Detasseling gave the highest averages amounted of (14.67, 14.70 leaf.plant^{-1}), respectively compared to the sweet corn plants × Detasseling, which gave the lowest averages amounted of (12.55, 12.74 leaf.plant^{-1}) for the two locations, respectively. The interaction between the Subspecies of yellow corn treatments and the spraying of

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Gibberellic acid concentrations had a significant effect. Plants of oil corn subspecies and spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (14.33, 14.90 leaf.plant^{-1}) for the two locations, respectively compared to the lowest averages amounted of (12.14, 12.49 leaf.plant^{-1}) for the two locations, respectively produced from plants of Sweet corn that sprayed with distilled water. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the oil corn Subspecies × without Detasseling × spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (15.53, 15.73 leaf.plant^{-1}), respectively, compared to the lowest averages (10.14, 10.42 leaf.plant^{-1}) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (4) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments itselves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (4.8, 5.2), respectively.

Table 4: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the total number of leaves (leaf.plant^{-1}) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	12.03	14.13	13.08	12.69	15.07	13.63
	with	10.14	13.90	12.55	10.42	14.57	12.74
Oil corn	without	13.40	15.53	14.67	14.07	15.73	14.70
	with	11.80	13.93	13.52	11.07	14.15	13.40
Dent corn	without	13.90	14.77	13.33	14.55	15.20	14.11
	with	11.43	13.77	13.10	11.56	14.85	13.38
LSD 0.05		**10.09**		**0.77**	**1.20**		**0.85**
Effect of Spraying Gibberellic acid		**13.18**	13.57		13.53	13.79	
LSD 0.05		**NS**		Effect of Subspecies	**NS**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	12.14	13.50	12.82	12.49	13.88	13.18
	Oil corn	12.87	14.33	13.72	12.61	14.90	.13 90
	Dent corn	13.10	14.30	13.59	13.21	14.88	13.70
LSD 0.05		**0.77**		**0.54**	**0.85**		**NS**
Effect of Detasseling	without	13.47			13.71		
	with	13.28			13.62		
LSD 0.05		**NS**			**7.06**		
Coefficient of Variance between treatments		4.8			5.2		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

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3- The leaves content of the total chlorophyll pigments (SPAD)

Table (5) shows there is a significant effect of the experiment treatments in the trait of the total chlorophyll to compare between the Subspecies of yellow corn. It is noted a significant superiority for the plants of Dent corn, which gave the highest averages in the total chlorophyll amounted of (73.89, 77.62 %) for two locations compared with the lowest averages for sweet corn plants, which amounted of (64.75, 65.76 %) for two locations, respectively. It is noted that the effect of the two treatments of Detasseling, the difference between them did not reach the significant limit in the two locations, respectively. It is also noted that the spraying treatments with the two concentrations of Gibberellic acid did not have significant differences for both locations of the experiment. The table also shows that there is a significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling. In the first location, The oil corn plants × Detasseling gave the highest averages amounted of (78.91), while in the second location, the Dent corn plants × Detasseling, which gave the highest averages amounted of (85.16) compared to the sweet corn plants × Detasseling that gave the lowest averages amounted of (60.58, 62.77 %) for the two locations, respectively. The interaction between the Subspecies of yellow corn treatments and the spraying of Gibberellic acid concentrations had a significant effect. Plants of oil corn Subspecies and spraying with Gibberellic acid at concentration of (100 $mg.L^{-1}$) gave the highest averages amounted of (78.91, 78.55 %) for the two locations, respectively compared to the lowest averages amounted of (60.58, 62.25 %) for the two locations, respectively produced from plants of Sweet corn that sprayed with distilled water. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the Dent corn Subspecies × Detasseling × spraying with Gibberellic acid at concentration of (100 $mg.L^{-1}$) gave the highest averages amounted of (90.30, 96.13 %), respectively, compared to the lowest averages (51.43, 52.08 %) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (5) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments itselves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (6.8, 7.2), respectively.

The results shown in tables (3, 4, 5) above indicate a significant effect of subspecies in the traits of plant height and number of leaves. This is due to different genotypes used in the experiment, or the genotypes produced for short plants such as sweet corn have the lowest number of leaves compared to the two another subspecies (5), or that the leaf area of yellow corn indicates the efficiency of gene expression, which increases the efficiency of photosynthesis during the critical stages to fill the sinks better as a result of intercepting most of the solar radiation falling better and Highly efficient (13). It is also noted that there is a significant effect in the trait of the leaves content from total chlorophyll, which is attributed to the increase in the leaf area in the unit area which occupied by the plant from the ground and their ability to intercept as much of the light as possible because chlorophyll pigments have the ability to absorb visible light and convert part of it into chemical energy stored in organic compounds (14). The same tables indicate that the Detasseling has an effect that may be positive or negative in the trait of the plant height and number of leaves, The positive effect through increasing the length and width of the leaf and the angle of its intercepting for light or reduce the shading at the top of the plant to the sun to the leaves and the middle and lower or reduce the competition for nutrients or may have a negative impact by decreasing the number of leaves in the plant or plant height decrease

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Although the corn of plants is limited growth (6, 15). The same tables indicate that the spraying of Gibberellic acid at a concentration of (100 mg.L^{-1}) had a significant effect on vegetative growth indicators, Where it caused an increase in the length of the internodes, where Gibberellic works to increase its size from the water, Thus increasing its division and production of new cells or it causes the increase of the leaves content of total chlorophyll pigments and The increase is due

to the increase in the efficiency of photosynthesis and delay the senescence of the leaves, and thus increase the accumulation of dry matter (16). or it increases the bio-processes of the plant, including increased division and elongation of cells, the activity and effectiveness of enzymes and plant hormones, their impact in the manufacture of proteins and carbohydrates and various other enzymatic reactions or May increase the activity of total chlorophyll pigments to absorb the maximum amount of light falling on the leaves and convert the energy into organic compounds (10, 20).

Table 5: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the leaves content of the total chlorophyll pigments (SPAD) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	51.43	69.73	60.58	52.08	72.42	62.77
	with	66.69	71.15	68.92	65.06	73.46	68.74
Oil corn	without	63.79	76.28	65.27	64.65	70.40	69.79
	with	66.75	81.53	78.91	68.77	83.53	74.09
Dent corn	without	59.50	75.19	72.89	60.97	79.20	70.09
	with	70.59	90.30	74.90	74.19	96.13	85.16
LSD 0.05		**8.15**		**5.76**	**8.77**		**6.20**
Effect of Spraying Gibberellic acid		69.03	71.46		70.89	72.59	
LSD 0.05		**NS**		Effect of Subspecies	**NS**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	60.58	68.92	64.75	62.25	69.26	65.76
	Oil corn	65.27	78.91	72.09	66.71	78.55	71.84
	Dent corn	72.89	74.90	73.89	76.69	76.96	77.62
LSD 0.05		**5.76**		**4.07**	**6.20**		**4.39**
Effect of Detasseling	without	69.02			69.47		
	with	71.47			74.01		
LSD 0.05		**NS**			**NS**		
Coefficient of Variance between treatments		6.8			7.2		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

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Second: Indicators of the product and its components

1- The number of cobs in the plant (cob.plant^{-1})

Table (6) shows there is a significant effect for the experiment treatments in trait of the number of cobs in the plant for the two locations, respectively. It is noted that the effect of the two treatments of Detasseling did not significantly affect the two locations, respectively. Also, the spraying treatments with the two concentrations of Gibberellic acid did not have significant differences for both locations of the experiment. The table also shows that there is a significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling, where the Dent corn plants × Detasseling gave the highest averages amounted of (2.05 cob.plant^{-1}), respectively compared to the sweet corn plants × without Detasseling, which gave the lowest averages amounted of (1.49 cob.plant^{-1}), while the second location did not show significant differences in the number of cobs in the plant. The interaction between the Subspecies of yellow corn treatments and the spraying of Gibberellic acid concentrations had not a significant effect for both locations, respectively. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the Dent corn Subspecies × Detasseling × spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (2.24, 2.13 cob.plant^{-1}), respectively, compared to the lowest averages (1.13, 1.47 cob.plant^{-1}) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (6) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments itselves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (10.6, 8.7), respectively.

1- The number of grains in cob (grain.cob^{-1})

Table (7) shows there is a significant effect for the experiment treatments in trait of the number of grains in the cob to compare between the Subspecies of yellow corn. It is noted a significant superiority for the plants of Dent corn, which gave the highest averages in the number of grains in the cob amounted of (424.2, 436.4 grain.cob^{-1}) for two locations, respectively. It is noted that the effect of the Detasseling treatment was not significantly affected in the first location. While in the second location, the Detasseling treatment was significantly excelled by giving it the highest average number of grains in cob amounted of (407.5 grain.cob^{-1}) compared to the without Detasseling treatment which gave the lowest average amounted of (388.0 grain.cob^{-1}), It is also noted that the spraying treatments with the two concentrations of Gibberellic acid did not have significant differences for both locations of the experiment. The table also shows that there is a significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling, where the Dent corn plants × Detasseling gave the highest averages amounted of (499.6, 387.8 grain.cob^{-1}) for the two locations, respectively compared to the sweet corn plants × without Detasseling, which gave the lowest averages amounted of (304.6, 317.6 grain.cob^{-1}) for the two locations, respectively, The interaction between the Subspecies of yellow corn treatments and the spraying of Gibberellic acid concentrations had a significant effect, where plants of Dent corn Subspecies and spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (381.2, 394.3 grain.cob^{-1}) for the two locations, respectively compared to the lowest averages amounted of (274.1, 234.4 grain.cob^{-1}) for the two locations, respectively produced from plants of Sweet corn that sprayed with distilled water. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the Dent corn Subspecies × Detasseling × spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the

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highest averages amounted of (386.7, 392.0 grain.cob^{-1}), respectively, compared to the lowest averages (315.8, 317.2 grain.cob^{-1}) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × without Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (7) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments itselves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (10.8, 6.6), respectively.

Table 6: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the number of cobs in the plant (cob.plant^{-1}) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	1.13	1.73	1.49	1.47	1.79	1.63
	with	1.83	1.89	1.86	1.73	1.82	1.78
Oil corn	without	1.40	1.61	1.50	1.53	1.88	1.72
	with	1.50	1.80	1.65	1.63	1.97	1.77
Dent corn	without	1.25	1.97	1.55	1.57	2.02	1.71
	with	1.87	2.24	2.05	1.77	2.13	1.95
LSD 0.05		**0.30**		**0.15**	**0.26**		**NS**
Effect of Spraying Gibberellic acid		1.68	1.69		1.76	1.78	
LSD 0.05		**NS**		Effect of Subspecies	**NS**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	1.55	1.78	1.68	1.64	1.76	1.74
	Oil corn	1.57	1.60	1.58	1.68	1.82	1.70
	Dent corn	1.69	1.92	1.80	1.81	1.85	1.87
LSD 0.05		**NS**		**NS**	**NS**		**NS**
Effect of Detasseling	without	1.68			1.77		
	with	1.69			1.78		
LSD 0.05		**NS**			**NS**		
Coefficient of Variance between treatments		10.6			8.7		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

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Table 7: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the number of grains in cob (grain.cob^{-1}) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	315.8	336.3	304.6	317.2	342.0	317.6
	with	325.5	343.8	326.1	325.0	347.2	360.3
Oil corn	without	322.3	340.1	348.8	327.9	357.4	348.6
	with	357.1	377.3	375.3	339.3	371.1	355.2
Dent corn	without	329.8	362.0	348.2	333.7	376.8	347.0
	with	338.5	386.7	399.6	328.6	392.0	387.8
LSD 0.05		**70.17**		**49.62**	**44.78**		**31.76**
Effect of Spraying Gibberellic acid		368.4	399.1		382.2	423.3	
LSD 0.05		**NS**		Effect of Subspecies	**NS**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	274.1	280.9	361.4	234.9	272.4	353.7
	Oil corn	309.8	349.4	365.7	346.5	389.0	418.2
	Dent corn	367.2	381.2	424.2	383.5	394.3	436.4
LSD 0.05		**49.62**		**35.09**	**31.67**		**22.39**
Effect of Detasseling	without	387.2			388.0		
	with	400.3			407.5		
LSD 0.05		**NS**			**18.28**		
Coefficient of Variance between treatments		10.8			6.6		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

2- The weight of 500 grains (g)

Table (8) shows there is a significant effect for the experiment treatments in trait of the weight of 500 grains to compare between the Subspecies of yellow corn. It is not noted a difference for the plants of the first location while in the second location, Dent corn plants gave the highest averages in the weight of 500 grains amounted of (162.8 g) compared to the lowest averages for the sweet corn plants which gave an average amounted of (145.3 g). It is noted that the effect of the two treatments of Detasseling and the spraying of Gibberellic acid did not significantly affect the two locations, respectively. The table also shows that there is a significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling in the first location, where the Dent corn plants × Detasseling gave the highest averages amounted of (166.7 g), respectively compared to the sweet corn plants × without Detasseling, which gave the lowest averages amounted of (145.3 g), while the second location did not show significant differences in the weight of 500 grains. The interaction between the Subspecies of yellow corn treatments and the spraying of Gibberellic acid concentrations had a significant effect, where plants of Dent corn Subspecies and spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (171.7, 177.0 g)

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for the two locations, respectively compared to the lowest averages amounted of (140.8, 136.8 g) for the two locations, respectively resulted from plants of Sweet corn that sprayed with distilled water. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the Dent corn Subspecies × Detasseling × spraying with Gibberellic acid at concentration of (100 $mg.L^{-1}$) gave the highest averages amounted of (186.7, 186.6 g) for the two locations, respectively, compared to the lowest averages (121.7, 124.3 g) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × without Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (8) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments it selves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (7.8, 2.9), respectively.

Table 8: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the weight of 500 grains (g) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid ($mg.L^{-1}$)		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid ($mg.L^{-1}$)		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	121.7	126.7	145.3	124.3	149.3	144.5
	with	143.3	155.0	149.2	144.7	164.7	146.0
Oil corn	without	163.3	170.0	148.8	132.7	152.2	159.6
	with	170.0	171.0	162.5	176.3	183.0	164.2
Dent corn	without	138.3	156.7	153.3	142.6	171.0	161.9
	with	150.0	186.7	166.7	152.8	186.6	163.8
LSD 0.05		**20.5**		**14.5**	**7.6**		**NS**
Effect of Spraying Gibberellic acid		152.8	155.8		156.1	157.2	
LSD 0.05		**NS**		Effect of Subspecies	**NS**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	140.8	156.7	148.8	136.8	153.7	145.3
	Oil corn	145.8	166.7	156.2	154.5	169.4	161.9
	Dent corn	144.2	171.7	157.9	148.7	177.0	162.8
LSD 0.05		**14.5**		**NS**	**5.4**		**3.81**
Effect of Detasseling	without	152.1			156.5		
	with	156.5			156.9		
LSD 0.05		**NS**			**18.28**		
Coefficient of Variance between treatments		7.8			2.9		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

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3- The grains yield for plant (g.plant^{-1})

Table (9) shows there is a significant effect for the experiment treatments in trait of the grains yield for plant, when compare between the Subspecies of yellow corn, It is noted a significant superiority for the plants of Dent corn, which gave the highest averages in the grains yield for plant amounted of (93.93, 78.92 g.plant^{-1}) for two locations, respectively, compared to the lowest average for the sweet corn plants, which gave an average amounted of (59.23, 68.52 g.plant^{-1}). As for the two treatments of Detasseling, the Detasseling treatment was significantly excelled by giving it the highest average in this trait amounted of (78.49, 74.28 g.plant^{-1}) for two locations, respectively, compared to the treatment of without Detasseling, which gave the lowest averages amounted of (73.18, 71.80 g.plant^{-1}). It is also noted that the spraying treatments of Gibberellic acid have a significant differences between them in the grains yield for the plantwhich gave the highest averages amounted of (77.67, 73.49 g.plant^{-1}) for both locations, respectively, when spraying with distilled water. The table also shows that there is a significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling, where the Dent corn plants × Detasseling gave the highest averages amounted of (106.97, 87.42 g.plant^{-1}) for the two locations, respectively compared to the sweet corn plants × without Detasseling, which gave the lowest averages amounted of (57.0, 65.00 g.plant^{-1}) for the two locations, respectively. The interaction between the Subspecies of yellow corn treatments and the spraying of Gibberellic acid concentrations had a significant effect, where plants of Dent corn Subspecies and spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (104.55, 81.63 g.plant^{-1}) for the two locations, respectively compared to the lowest averages amounted of (51.82, 63.50 g.plant^{-1}) for the two locations, respectively resulted from plants of Sweet corn that sprayed with distilled water. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the Dent corn Subspecies × Detasseling × spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (112.47, 99.13 g.plant^{-1}), respectively, compared to the lowest averages (20.13, 44.60 g.plant^{-1}) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × without Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (9) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments it selves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (1.4, 1.1), respectively.

1- Grains productivity (tons.ha^{-1})

Table (10) shows there is a significant effect for the experiment treatments in trait of the grains productivity, when compare between the Subspecies of yellow corn, It is noted a significant superiority for the plants of Dent corn, which gave the highest averages in the traits of the grains productivity amounted of (4.978, 4.182 tons.ha^{-1}) for two locations, respectively, compared to the lowest average for the sweet corn plants, which gave an average amounted of (3.139, 3.631 tons.ha^{-1}) for two locations, respectively. It is noted that the two treatments of Detasseling have a significant effect, where the Detasseling treatment was significantly excelled by giving it the highest average in this trait amounted of (4.159, 3.937 tons.ha^{-1}) for two locations, respectively, compared to the treatment of without Detasseling, which gave the lowest averages amounted of (3.878, 3.805 tons.ha^{-1}) for two locations, respectively. It is also noted that the spraying treatments of Gibberellic acid at concentration of (100 mg.L^{-1}) have a significant differences between them in the grains productivity which gave the highest averages amounted of (4.116, 3.895 tons.ha^{-1}) for both locations, respectively, compared to the lowest averages, which amounted of (3.921, 3.847 tons.ha^{-1}) for both locations, respectively, when spraying with distilled water. The table also shows that there is a

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significant effect for the interaction treatments between the Subspecies of yellow corn × Detasseling, where the Dent corn plants × Detasseling gave the highest averages amounted of (5.669, 4.633 tons.ha^{-1}) for the two locations, respectively compared to the sweet corn plants × without Detasseling, which gave the lowest averages amounted of (3.024, 3.466 tons.ha^{-1}) for the two locations, respectively. The interaction between the Subspecies of yellow corn treatments and the spraying of Gibberellic acid concentrations had a significant effect, where plants of Dent corn Subspecies and spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (5.541, 4.326 tons.ha^{-1}) for the two locations, respectively compared to the lowest averages amounted of (2.746, 3.365 tons.ha^{-1}) for the two locations, respectively resulted from plants of Sweet corn that sprayed with distilled water. The table also shows that the triple interaction between the experiment factors has a significant effect on this trait, where plants of the Dent corn Subspecies × Detasseling × spraying with Gibberellic acid at concentration of (100 mg.L^{-1}) gave the highest averages amounted of (5.960, 5.254 tons.ha^{-1}), respectively, compared to the lowest averages (1.067, 2.364 tons.ha^{-1}) for the two locations, respectively that resulted from plants of the sweet corn Subspecies × Detasseling × spraying with distilled water. The results of the Analysis of Covariance in Table (10) between the two locations of the experiment indicate that the significant differences between the experiment treatments were resulted from the effect of the treatments it selves, where the effect of the experiment location and the interaction between the effect of location × treatments were not significant, although the Analysis of Covariance between the treatments at both locations amounted of (1.4, 1.1), respectively. They are within acceptable limits.

Table 9: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the grains yield for plant (g.plant^{-1}) for the Autumn Agricultural season 2017 and for the two locations of experimen

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	20.13	83.50	57.07	44.60	84.20	65.00
	with	39.30	94.00	61.40	49.80	95.47	67.40
Oil corn	without	43.33	80.30	71.43	55.43	75.37	70.03
	with	74.17	99.53	77.23	71.57	84.40	77.98
Dent corn	without	54.17	107.63	80.90	53.27	87.57	70.42
	with	101.47	112.47	106.97	75.70	99.13	87.42
LSD 0.05		**1.79**		**1.27**	**1.32**		**0.94**
Effect of Spraying Gibberellic acid		73.99	77.67		72.59	73.49	
LSD 0.05		**0.73**		Effect of Subspecies	**0.54**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	51.82	66.65	59.23	63.50	72.63	68.52
	Oil corn	61.82	86.85	74.33	64.40	79.88	71.69
	Dent corn	83.32	104.55	93.93	67.20	81.63	78.92
LSD 0.05		**1.27**		**0.81**	**0.94**		**0.66**

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Effect of Detasseling	without	73.18		71.80	
	with	78.49		74.28	
LSD 0.05		**0.73**		**0.54**	
Coefficient of Variance between treatments		1.4		1.1	
Analysis of Covariance between the two locations of experiment					
Effect of location		Effect of treatments		Effect of location × treatments	
NS		**0.001**		**NS**	

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Table 10: Effect of the subspecies of yellow corn, Detasseling and Spraying of Gibberellic acid in the grains productivity (tons.ha^{-1}) for the Autumn Agricultural season 2017 and for the two locations of experiment.

Treatments		**First location**			**Second location**		
Subspecies of yellow corn	Detasseling	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)	Concentration of Spraying Gibberellic acid (mg.L^{-1})		Interaction (subspecies of yellow corn × Detasseling)
		Distilled water	**100**		**Distilled water**	**100**	
Sweet corn	without	1.067	4.425	3.024	2.364	4.462	3.451
	with	2.082	4.982	3.254	2.639	5.059	3.566
Oil corn	without	2.296	4.255	3.786	2.938	3.994	3.711
	with	3.930	5.275	4.093	3.793	4.473	4.133
Dent corn	without	4.870	5.704	4.287	2.823	4.941	3.832
	with	5.377	5.960	5.669	3.012	5.254	4.633
LSD 0.05		**0.095**		**0.067**	**0.070**		**0.049**
Effect of Spraying Gibberellic acid		3.921	4.116		3.847	3.895	
LSD 0.05		**0.039**		Effect of Subspecies	**0.029**		Effect of Subspecies
Interaction (subspecies of yellow corn × Spraying Gibberellic acid)	Sweet corn	2.746	3.532	3.139	3.365	3.849	3.631
	Oil corn	3.276	4.603	3.939	3.413	4.233	3.799
	Dent corn	4.415	5.541	4.978	4.038	4.326	4.182
LSD 0.05		**0.067**		**0.047**	**0.049**		**0.035**
Effect of Detasseling	without	3.878			3.805		
	with	4.159			3.937		
LSD 0.05		**0.039**			**0.028**		
Coefficient of Variance between treatments		1.4			1.1		
Analysis of Covariance between the two locations of experiment							
Effect of location		Effect of treatments			Effect of location × treatments		
NS		**0.001**			**NS**		

The results shown in tables (6, 7, 8, 9, 10) above indicate a significant effect of subspecies treatments in the traits of the yield and its components except for the number of cobs in the plant that did not have a significant effect. Genotype plays an important role in the accumulation of dry matter through its effect on growth indicators, which leads to the influence in the weight of the grain and their speed of growth or that the difference of Genotypes in their ability to produce the yield components (weight and number of grains) lead to the difference in number and weight by nature, genetic factors and growth factors available (5), The results also indicate that there is a significant effect for the treatment of Detasseling in most indicators and its

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components. This is due to the increased efficiency of the source and the sink, which increased the grain filling as a result of increase production of dry matter or that the Detasseling caused increasing survival of the silking active for the longest period is not fully pollination and fertilization to receive the largest number of pollen, which increased the number of grains in the cob (7) Or as a result of the change of the hormonal system in the plant cells, which leads to an increase in the

volume of the sink and thus increase the accumulation of dry matter, which increase the weight of seeds (8, 19), or Detasseling increased the number of cobs in the plant, but one or two cobs are mature as a result of encouraging For the growth of lateral buds (15). The results indicated in the same tables indicate that there is a significant effect for the spraying treatment with Gibberellic acid at a concentration of (100 $mg.L^{-1}$) in the indicators of the yield and its components due to the main role of Gibberellic acid in increasing cell division and accumulation of dry matter in grains and increase grain weight, grain yield and productivity per unit area (10), Or it works to increase the efficiency of the source and the Sink and increase the accumulation of dry matter by delaying the senescence of leaves (11, 20) or may work Gibberellic to increase the permeability of the cell membrane and then increase the cell content of water and thus increase the speed of its division (17), Or increases the size of the cells without affecting the hardness of the cellular walls. It increases the size of the cells and the flow rate of the water to the cells themselves by increasing the concentration of dissolved solids that in increasing the Osmotic pressure. The Gibberellic promotes alpha-amylase activity, which converts both proteins and starch from insoluble form, meaning non-active Osmotic active to soluble active Osmotic form (18, 20).

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