P- ISSN 1991-8941E-ISSN 2706-6703
2021,15 (1) :8–15
Journal of University of Anbar for Pure Science (JUAPS)
Open Access

Effect of Planting Dates and Spraying with Gibberelic acid on Some Yield and the Quality Traits of Corn (*Zea mays* L.)

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ARTICLE INFO
Received:15 /1/2021
Accepted: 28/ 3/ 2021
Available online: 1/6/2021

DOI: 10.37652/juaps.2022.172397

Keywords:
Corn, gibberelic acid ,
Planting dates.

A B S T R A C T

The present study attempts to determine the best planting date and concentration of spraying with gibberellin to improve the performance and quality of maize's growth and yield traits. This investigation was carried out in the district of Tarmiyah - Baghdad governorate to study the effect of planting dates and spraying with gibberellin on the growth and yield of corn (Zea mays L.) of the variety (Buhooth 106) for the summer farming season in 2020. The experiment was applied according to the Randomized Complete Block Design (R.C.B.D) with the split plot system, using four planting dates (1/7, 10/7, 21/7, and 28/7/2020) and four concentrations of gibberellin (0, 150, 250, and 350 mg. Liter-1). The best significant superior value was recorded on 21/7/2020 by interference with a concentration of 350 mg. L-1 in most of the traits, as it was recorded (221.14 cm) for the height of the plant, (45.39%) for chlorophyll, (300.33 g) for the weight of 1000 kernel, (13.54 tons. h-1) for the grain yield, (18.84 rows. ear -1) for the number of rows in ear, (14.27%) for protein, and (5.22%) for oil. Whereas it significantly exceeded the date 28/7/2020 by an interference with the concentration of 350 mg. L-1 in the two traits of the number of grains in the row and the gibberellin content in leaves, its values were (44.62 grain. row-1 and 46.09 µmol) respectively. Accordingly, it is concluded that the optimal intervention mixture is determined to be an intrusion with a concentration of 350 mg. L-1 at the date of 21/7/2020 was included in the majority of the traits tested.

1. INTRODUCTION

Corn crop (*Zea mays* L.) belongs to the Poaceae family, and it is one of the cereal food crops in the world that has received the attention of many researchers. It is of important economic value which occupied the third rank after wheat and rice crops in terms of global area and production and it is considered one of the most strategic crops. Its importance, on the one hand, is due to its versatility, as it is used in human nutrition in poor countries since its grains contain a high percentage of carbohydrates (81%), protein (10.6%) and oil (4.6%), in addition to its pills which contain vitamins B1, B2 and E [1,2]. On the other hand, it is regarded as an essential component in animal nutrition as well as other industrial purposes such as the use of its stems and leaves in the manufacture of paper. Moreover, it is a crop that tolerates biotic and abiotic stresses due to its growth in a wide range of different climatic conditions [3]. Due to the economic importance of the corn crop, it still suffers from a great disparity in agriculture with the productivity of the world, which was the result of several factors, the most.

Important one is the use of unapproved varieties [4]. Determining the appropriate planting date is important for the productivity of corn because the different planting dates negatively affect the grains and their components as the average temperature for the period from germination to the emergence of the inflorescence flower has a great effect on the length of the flowering period. Early planting leads to the formation of short plants due to the acceleration of their growth as a result of high temperatures that coincide with flowering and thus negatively affect the vitality of pollen, resulting in pollination failure and an increase in infertility grains. The delay in planting leads to the ripening during the rainy season, difficulty in harvesting and drying the grains which results in a crop loss. Therefore, planting the crop at the appropriate and specified date has an increase in the yield components and an increase of the yield as well [5].

Gibberellins are considered as one of the natural plant hormones formed within the various tissues in plants, whether high-end plants (monocotyledon or dicotyledon) or immature plants [6].Gibberellin stimulates seed germination and sex determination as well as regulates the transition from juvenile to adulthood stimulating flowering

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in long day plants [7].In addition, it is also a factor in cell elongation and division [8].

2. MATERIALS AND METHODS

This experiment was conducted in Baghdad governorate / Tarmiyah district to study the effect of *planting* dates and spraying with gibberellin on the growth and yield traits of the *Zea mays* L plant of the variety (Buhooth 106) for the summer agricultural season on 2020, after conducting agricultural operations that include plowing the soil twice, smoothing and leveling. The research was designed according to Randomized Complete Block Design (R.C.B.D) with three replications of the split plot system, whereas the planting dates occupied the main factor represented by four dates (1, 10, 21 and 28/7/2020). As for gibberellin acid concentrations, the secondary factor occupied four concentrations (0, 150, 250 and 350 mg…Liter^{-1}).

Gibberellin acid was prepared by taking (1 gram) of the active ingredient and weighed with a sensitive scale dissolved in one liter of distilled water to prepare the base solution (stock). Then, it was stored in an opaque bottle and (150, 250 and 350 ml) were taken from the base solution separately to complete the volume to (1000 ml) with distilled water for each one of them in order to obtain concentrations of (150, 250, 350 mg. Liter^{-1}). It was sprayed on the vegetative parts of the plant by a noon sprinkler in the early morning with the use of a diffuser (Al Zahi). Spraying was carried out when the plant had reached 16 leaves and the Male organs had appeared. The soil was divided into three replicates, each one contains (16) experimental units with an area of (3x4 m^2) for the experimental unit. The cultivation was carried out with a row system where (2-3seeds) were placed in one jaw, the distance between one jaw and another (25cm) and between one row and another (75cm), Triple superphosphate fertilizer 200 kg. h^{-1} was added in one batch at planting. The urea fertilizer (46% N) was added by 400 kg. h^{-1}, with two batches, the first at planting and the second after 40 days of adding the first batch. The corn stalk borer insect was controlled with the granulated diazinon pesticide at a concentration of (10%) and at (6 kg. h^{-1}). The bushes were sawed manually to get rid of and to perform service and irrigation operations until the end of the season. Harvesting the crop was conducted when reaching full maturity (120 days after the date of planting each date). Two lines were identified from the middle for each experimental unit, and 5 samples were taken from each line in order to perform all the measurements required for the study.

2.1. Study Traits

2.1.1. Plant Height (cm)

The average of five randomly *selected* plants were taken from each experimental unit and measured from the soil surface to the lower node of the male inflorescence.

2.1.2. Total Chlorophyll Percentage (%)

The percentage of chlorophyll was estimated at full bloom by a *Spectrophotometer* by taking a reading of the fourth leaf.

2.1.3. Weight of 1000 Kernels (gm)

One thousand (1000) randomly selected grains were taken after *dispersing* ear for each experimental unit, weighed with a sensitive scale, and their weight was recorded.

2.1.4. Total Grain Yield (tons. h $^{-1}$)

It was extracted from the product of the average plant seeds × plant *density* used per hectare, depending on the cultivated area [9].

2.1.5. Number of Rows in Al-Ear (row. ear $^{-1}$)

It was calculated by taking five randomly selected ear from each *experimental* unit after the plant reached full maturity, and then extracting the average for the number of rows in the ear.

2.1.6. Number of Grains in a Row (grain. Row^{-1})

It was calculated by taking five randomly selected ear from each experimental unit after the plant reached the stage of full maturity, *then* extracting the average for the number of grains in one row of the ear

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2.1.7. Gibberellin Content of Leaves (micromol)

GA3 gibberellin content was determined according to the method [10].

2.1.8. Protein Percentage (%)

The percentage of protein was estimated using the Kejldahl device by [11], to extract the nitrogen percentage, including the calculation of the protein percentage. Protein percentage (%) = nitrogen percentage (%) x 5.75.

2.1.9. Oil Percentage (%)

The percentage of oil was estimated by using the Soxhelet apparatus and *by* following the standard method as it is reported in [12].

2.2. Statistical Analysis

The statistical analysis of all results was carried out on the basis of variance analysis of the studied traits according to global experiments with a randomized complete block design (R.C.B.D) according to the split system in the program (Statistical Analysis System SAS-V9, 2002). The mean of the coefficients was compared using a multi-range Duncan test with a probability level

(5%). According to this test, the averages followed by similar alphabetical letters do not differ significantly from each other, whereas averages following different letters do differ significantly from each other [13].

Table (1): Some traits of the physical and chemical of the soil

The Character	Unit	value
PH	_____	7.30
E.C	$ds.m^{-1}$	1.23
N (available)	$mg.\ kg^{-1}$	30.97
K (available)	$mg.\ kg^{-1}$	184.00
P (available)	$mg.\ kg^{-1}$	10.21
Organic matter	$g.\ kg^{-1}$	9.00
Soil Texture		Mixture clay
pH water	_____	7.5
E.C water	$ds.m^{-1}$	1.46

3. RESULTS AND DISCUSSION

3.1. Plant Height (cm)

Table (2) shows the effect of planting dates and spraying with gibberellins and the interaction between them in the trait of plant height for the corn crop. The third planting date recorded the highest average of (199.67 cm), which was significantly higher than the first and fourth dates, but this superiority was not significant for the second date, and the first date recorded the lowest average (172.10 cm). As for gibberellins, the third concentration gave the highest average of (201.*58* cm) and significantly superior to the other concentrations, while the lowest average was recorded for the control treatment, which reached (171.38 cm). Regarding the interaction, the interfering treatment between the third date and the third concentration recorded the highest average (221.14 cm), which was significantly higher than the other intervention treatments. Otherwise, the interaction treatment between the first date and the control treatment recorded the lowest average of (157.59 cm).

Table (2): The effect of planting dates and gibberellins concentrations and the interaction between them on the trait of plant height (cm)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L^{-1})	Second concentration (250 mg. L^{-1})	Third concentration (350 mg. L^{-1})	Average of dates
First date (1/7/2020)	**157.59 i**	**167.25 h**	**178.36 g**	**185.22 ef**	**172.10 b**
Second date (10/7/2020)	**178.75 g**	**187.27 e**	**195.40 d**	**214.08 b**	**193.88 a**
Third date (21/7/2020)	**181.63 fg**	**189.95 e**	**205.95 c**	**221.14 a**	**199.67 a**
Fourth date (28/7/2020)	**167.58 h**	**176.24 g**	**181.75 fg**	**185.86 ef**	**177.86 b**
Average of gibberellin	**171.38 d**	**180.18 c**	**190.37 b**	**201.58 a**	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

The reason for this superiority may be due to the convenience of the planting date in which the appropriate environmental conditions for the crop were provided in terms of temperature and climate [14[. In addition to the role of gibberellin in the elongation and division of cells through auxin, because gibberellin increases the level of endogenous oxin by its effect on the process of building auxin or the process of preventing oxidation [15, 16].

3.2. Total Chlorophyll Percentage (%)

In Table (3), it is noticed that the third planting date is substantially superior to all other dates with the highest average of (39.37%), but it did not outperform the second date and the lowest average was at the first and fourth dates (35.55 and 34.46%), respectively. For gibberellin, it gave the highest average of the third concentration, as it reached (41.02%), which was significantly superior to all other concentrations, while the lowest average for the control treatment was (33.24%). The same table also shows a significant superiority of the interference between the dates of planting and gibberellin, where the interference between the third date and the third concentration was recorded. The third highest average was (45.39%). On the contrary, the lowest average was recorded by the interference between the fourth date and the control treatment (30.84%). This superiority can be explained by the suitability of the date of cultivation, which provided favorable conditions during this period of illumination and intensity [17, 18]. Also, the important role of gibberellin, which led to an increase in the size of chloroplasts and an increase in the number of grana units that were most concentrated in chlorophyll, and these results were in agreement with [19, 20, 21].

Table (3): The effect of planting dates and gibberellins concentrations and the interaction between them on the trait of chlorophyll percentage (%)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L^{-1})	Second concentration (250 mg. L^{-1})	Third concentration (350 mg. L^{-1})	Average of dates
First date (1/7/2020)	**32.21 j**	**34.81 hi**	**36.91 fg**	**38.30 de**	**35.55 b**
Second date (10/7/2020)	**35.01 gh**	**37.60 ef**	**39.42 cd**	**42.69 b**	**38.68 a**
Third date (21/7/2020)	**34.92 hi**	**36.50 fg**	**40.66 c**	**45.39 a**	**39.37 a**
Fourth date (28/7/2020)	**30.84 k**	**33.27 ij**	**36.03 fg**	**37.70 ef**	**34.46 b**
Average of gibberellin	**33.24 d**	**35.54 c**	**38.25 b**	**41.02 a**	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

3.3. Weight of 1000 Grains (gm)

Table (4) shows the weight of 1000 grains for planting dates, the highest *average* recorded by the third date was (263.06 g) with superiority over all other dates but not significantly, while the first date recorded the lowest average of (243.15 g). The third concentration of the gibberellins was the highest average with a value of

(281.50 g), which was significantly superior to all other concentrations, while the lowest average was recorded for the control treatment (221.35 g). Regarding the interfering treatments, the third date with the third concentration showed the highest average of (300.33 g), as it exceeded significantly *over* all other intervention treatments.

Table (4): The effect of planting dates and gibberellins concentrations and the interferences between them on the trait of 1000 grains (g)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L^{-1})	Second concentration (250 mg. L^{-1})	Third concentration (350 mg. L^{-1})	Average of dates
First date (1/7/2020)	216.82 j	239.87 h	253.37 g	262.55 f	243.15 a
Second date (10/7/2020)	221.80 i	253.18 g	267.31 e	283.58 b	256.47 a
Third date (21/7/2020)	224.30 i	252.42 g	275.21 d	300.33 a	263.06 a
Fourth date (28/7/2020)	222.46 i	240.10 h	255.42 g	279.54 c	249.38 a
Average of gibberellin	221.35 d	246.39 c	262.83 b	281.50 a	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

In contrast, the interfering treatment recorded the first date, with the control treatment showing the lowest average (216.82 g). The role of gibberellin in enhancing the activity of the enzyme Alfa Amylase, which converts both proteins and starch from the insoluble (inactive osmotic) state to the active and soluble osmotic form, could explain this superiority. This increases the process of storing food that is transferred, and the grains become more complete, resulting in an increase in weight [22]. In addition to the important role of gibberellin in increasing the efficiency of the photosynthesis process and delaying the aging of the leaf [23].

3.4. Total Grain Yield (tons. h $^{-1}$)

It is noticed from Table (5) that there is a significant superiority for the second and third planting dates by a significant difference over the first date with their values amounting to (11.00 and 11.16 tons. h^{-1}) respectively. Besides, this superiority was not significant with the fourth date and the first date recorded the lowest arithmetic mean of (9.08 tons. h^{-1}). Regarding gibberellins, the third concentration gave the highest average (12.62 tons. h^{-1}), which was significantly superior to the other concentrations, while the control treatment gave the lowest average (7.99 tons. h^{-1}). The same table also indicates a significant superiority of the two interfering treatments: the first between the second date and the third concentration, and the second between the third date and the third concentration with the highest arithmetic mean of (13.46 and 13.54 tons. h^{-1}), respectively, with a significant difference over all the other interfering treatments, which were, on the contrary, less successful. The arithmetic mean of the interfering treatment, the first date with the control treatment, was (7.39 tons. h^{-1}). This increase is attributed to the effect of planting date on the yield of grains, as when the aging of the leaves is delayed and their green activity remains for a longer period. The grain yield increases as a result of the high photosynthetic products accumulated in the grains of corn, as the grain yield is related to its component that is affected by the high content of chlorophyll [24].

Table (5): The effect of planting dates and gibberellins concentrations and the interferences between them on the trait of the total grain yield (tons. h^{-1})

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L^{-1})	Second concentration (250 mg. L^{-1})	Third concentration (350 mg. L^{-1})	Average of dates
First date (1/7/2020)	7.39 h	8.31 fg	9.37 e	11.25 c	9.08 b
Second date (10/7/2020)	8.03 g	10.41 d	10 .12 b	13.46 a	11.00 a
Third date (21/7/2020)	8.52 f	10.20 d	12.38 b	13.54 a	11.16 a
Fourth date (28/7/2020)	8.00 g	9.63 e	11.27 c	12.23 b	10.28 ab
Average of gibberellin	7.99 d	9.64 c	11.28 b	12.62 c	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

In addition *to* that, the role of gibberellin increases the outputs of the photosynthesis process and the accumulation of dry matter in the grains through its role in increasing growth, elongation, expansion of cells and the transfer of stored food from the stem to the pollination tissue as well as its effect on the ovaries during the critical phase of grains [25].

3.5. Number of Rows in Ear (row. ear $^{-1}$)

We infer from the results of Table (6) that the best date of planting to *gain* the number of rows in ear is the third date, which is superior to all other planting dates, by recording the highest average (14.90 row. arnous^{-1}), but this superiority was not significant, while the first date was given the lowest average (13.34 row. ear $^{-1}$). The concentrations of gibberellin recorded the highest mean at the third concentration, reaching (17.12 row. ear^{-1}), with a significant superiority over all other concentrations. In contrast, the control treatment recorded the lowest average of (10.19 row. ear^{-1}). With regard to the interference between the planting dates and the concentrations of gibberellins, the interference between the third dates with the third concentration gave the highest average (18.84 row. ear^{-1}) with a significant superiority over all other interferences, while the lowest arithmetic average of the interference was between the first and third dates, with the control treatment of (9.75 and 9.98 row. ear^{-1}), respectively.

Table (6): The effect of planting dates and gibberellins concentrations and the interferences between them on the trait of the number of rows in ear (row. ear^{-1})

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L-1)	Second concentration (250 mg. L-1)	Third concentration (350 mg. L-1)	Average of dates
First date (1/7/2020)	9.75 h	11.76 f	15.07 c	16.78 b	13.34 a
Second date (10/7/2020)	10.59 g	13.39 e	14.34 d	15.69 c	13.51 a
Third date (21/7/2020)	9.98 h	13.71 e	17.07 b	18.84 a	14.90 a
Fourth date (28/7/2020)	10.42 g	13.48 e	17.22 b	17.15 b	14.57 a
Average of gibberellin	10.19 d	13.08 c	15.92 b	17.12 a	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

The reason for such significant superiority is the planting date appropriate for the flowering stage. The delay in the planting date exposes plants in the flowering stage to high temperature problems, which results in poor pollination and fertilization, as high temperatures weaken the fullness of grains [26, 27]. Gibberellin also plays a role in improving crop growth parameters by growing vegetative growth, which leads to an increase in carbon representation, and then increasing the transfer of processed materials to places where they are stored in grains [28].

3.6. Number of Grains in a Row (grain. row^{-1})

Table (7) shows the effect of planting dates and gibberellin concentration, and the interference between them in the trait of a number of grains in the row for corn ear. It indicates that there was a superiority for the fourth planting date with the highest average of (34.70 grain. row^{-1}), but this superiority was not significant with other planting dates. It was the lowest average at the third date with (32.56 grain. row^{-1}). With regard to gibberellins, the third concentration was significantly superior to all other concentrations by giving it the highest average (41.87 grain. row^{-1}), and the lowest average was recorded by the control treatment (24.84 grain. row^{-1}). As for the interference, the interventional treatment for the fourth date and third

Concentration recorded the highest average (44.62 grain. row^{-1}), and a significant superiority over all other interfering treatments. On the contrary, the interference record for the second date and the control treatment was the least average (24.30 grain. row^{-1}). The reason behind this significant superiority is the convenience of the planting date and the concentration of gibberellin in improving the rate of foodstuff processing for grains with carbohydrates with its effect on the activity of chlorophyll as well as its effect on increasing the transport speed from the source to the downstream [4].

Table (7): The effect of planting dates and gibberellins concentrations and the interferences between them on the trait of the number of grains per row (grain. row $^{-1}$)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L-1)	Second concentration (250 mg. L-1)	Third concentration (350 mg. L-1)	Average of dates
First date (1/7/2020)	24.90 h	30.89 Fg	34.65 e	40.80 bc	32.81 a
Second date (10/7/2020)	24.30 h	29.98 G	36.99 d	42.45 b	33.43 a
Third date (21/7/2020)	25.27 h	29.08 G	36.27 de	39.62 c	32.56 a
Fourth date (28/7/2020)	24.91 h	32.62 F	36.64 d	44.62 a	34.70 a
Average of gibberellin	24.84 d	30.64 C	36.13 b	41.87 a	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

3.7. Gibberellin Content in Leaves (micromole)

Concerning the results of Table (8) which include the effect of planting dates and gibberellins and the interference between them in the quality of the content of gibberellin leaves, the significant superiority was present for the third and fourth planting dates over other dates with the best average of (40.15 and 38.39 micromole) respectively, while the first and second dates were given the lowest average (33.21 and 32.01 micromole), respectively. With regard to gibberellins, the two concentrations were the most superior, the second and third (39.23 and 39.38 micromole), respectively, on all the other concentrations, and the control treatment recorded the lowest average of (29.29 micromole). When tracking the results of the same table, we find the superiority of the interfering treatment for the fourth planting date with the third concentration of the gibberellin (46.09 micromole) significant over all other interfering treatments, and the interference record for the first and second dates with the control treatment of gibberellin was the lowest average of (26.86 and 26.88 micromole), respectively. It can be explained that such significant superiority of gibberellin in leaves at this level comes from the availability of appropriate environmental conditions at this date of planting, as this led to the activity of proteins responsible for increasing the ability of their association with other recipient sites and thus the activity of gibberellins increases [29].

Table (8): The effect of planting dates, gibberellin concentrations, and the interferences between them on the trait of gibberellin content (micromole)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L-1)	Second concentration (250 mg. L-1)	Third concentration (350 mg. L-1)	Average of dates
First date (1/7/2020)	26.86 i	32.76 g	34.98 f	38.24 e	33.21 b
Second date (10/7/2020)	26.88 i	34.40 f	38.55 e	28.21 h	32.01 b
Third date (21/7/2020)	35.39 f	37.97 e	42.25 c	44.97 b	40.15 a
Fourth date (28/7/2020)	28.04 h	38.30 e	41.11 e	46.09 a	38.39 a
Average of gibberellin	29.29 c	35.86 b	39.23 a	39.38 a	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

The explanation for this is an increase in the molecules of the enzymatic conjugate Acetyl-COA, which is needed for mevalonic acid to produce gibberellin [30[, as well as the increased levels of ROS (Reactive Oxygen

Species) that affect the synthesis, metabolism and transport of auxins [31].

3.8. Protein Percentage (%)

The results of Table (9) shows that the best date for the planting of the protein trait was for the second and third dates, where they record the highest average (11.00 and 11.10%) respectively, with a significant difference from the rest of the other dates, in contrast, the first and fourth dates recorded the lowest average (9.68 and 9.72%), respectively. With regard to gibberellins concentrations, the third concentration was significantly superior to all other concentrations, with the highest average (12.32%). On the contrary, the control treatment recorded the lowest average (8.39%). Consequently, the results of the same table show that the better interference was significantly superior to the protein percentage trait between the third planting date and the third concentration of gibberellin, which reached (14.27%). In contrast, the least interference was between the first and fourth planting dates, with the control treatment reaching (8.10 and 8.07%), respectively. This superiority can be attributed to the role of gibberellin in stimulating protein synthesis, nitrates, and reductive enzymes that affect protein synthesis and stimulate ribosome construction, and this is in agreement with [32].

Table (9): The effect of planting dates and gibberellins concentrations and the interferences between them on the trait of protein percentage (%)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L^{-1})	Second concentration (250 mg. L^{-1})	Third concentration (350 mg. L^{-1})	Average of dates
First date (1/7/2020)	8.10 i	9.67 fg	10.17 E	10.78 d	9.68 b
Second date (10/7/2020)	8.85 h	9.99 f	11.91 c	13.25 b	11.00 a
Third date (21/7/2020)	8.53 h	9.91 f	11.69 c	14.27 a	11.10 a
Fourth date (28/7/2020)	8.07 i	9.42 g	10.39 e	10.99 d	9.72 b
Average of gibberellin	8.39 d	9.75 c	11.04 b	12.32 a	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

3.9. Oil Percentage (%)

Table (10) includes the effect of planting dates and gibberellins, and the interferences between them in the ratio of oil of corn. The best significant superiority of planting dates was at the second, third and fourth dates, with the highest average of (4.67, 4.64 and 4.76%) respectively, with a significant difference from the first date which recorded the lowest average (4.15%) for the gibberellins. The third concentration recorded the highest average of (5.02%), while the control treatment recorded the lowest average of (3.96%). With regard to the effect of the interference between the date treatments and the gibberellin treatment of the oil percentage, it gave the highest arithmetic average. The interference between the third date and the third concentration reached (5.22%), thus achieving the highest significant difference over all other interactions. At the same time, the interference treatment between the first date and the control treatment recorded the lowest arithmetic average (3.38%). This significant superiority can be approved according to the effect of the gibberellin growth regulator and its important role in regulating the biological building processes and thus leading to an increase in the construction of various metabolites, including oil. Furthermore, there is a positive role on plant metabolism and growth in general, which was reflected on the oil content of grains and this is consistent with [33,34]. In addition to the convenience of the planting date which is consistent with [35].

Table (10): The effect of planting dates and gibberellins concentrations and the interferences between them on the characteristic of oil percentage (%)

Gibberellin Concentrations / Planting dates	Control (0)	First concentration (150 mg. L^{-1})	Second concentration (250 mg. L^{-1})	Third concentration (350 mg. L^{-1})	Average of dates
First date (1/7/2020)	3.38 i	3.99 h	4.48 f	4.76 de	4.15 b
Second date (10/7/2020)	4.12 g	4.64 e	4.86 cd	5.07 b	4.67 a
Third date (21/7/2020)	4.04 g	4.49 f	4.84 cd	5.22 a	4.64 a
Fourth date (28/7/2020)	4.31 f	4.75 de	4.94 bc	5.05 b	4.76 a
Average of gibberellin	3.96 d	4.47 c	4.78 b	5.02 a	

- Similar letters indicate that there are no significant differences according to the Duncan multi-range test and below the probability level (0.05).

4. CONCLUSIONS

From this research, we conclude that the best interference combination was between the third planting date (21/7/2020) and the third gibberellin concentration (350 mg. Liter^{-1}) for most of the yield and specificity of maize.

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تأثير مواعيد الزراعة والرش بالجبرلين في بعض صفات الحاصل والنوعية للذرة الصفراء (*Zea mays* L.)

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الخلاصة:ـ

نفذ البحث في قضاء الطارمية- محافظة بغداد لدراسة تأثير مواعيد الزراعة والرش بالجبرلين في نمو وحاصل الذرة الصفراء(*Zea mays* L.) صنف (بحوث 106) للموسم الزراعي الصيفي 2020. طبقت التجربة وفق تصميم القطاعات العشوائية الكاملة(R.C.B.D) بنظام الالواح المنشقة و ذلك باستخدام اربعة مواعيد زراعة (7/1 , 7/10 ,7/21 و2020/7/28) و اربع تراكيز من الجبرلين (0 ،150 ،250 و350 ملغم. لتر$^{-1}$) اذ سجل افضل تفوق معنوي عند الموعد 7/21 /2020 بالتداخل مع التركيز 350 ملغم . لتر$^{-1}$ في اغلب الصفات اذ سجل (221.14سم) لارتفاع النبات، (45.39 %) لنسبة الكلوروفيل (300.33 غم) لوزن 1000 حبة، (13.54 طن. ه$^{-1}$) لحاصل الحبوب، (18.84صف.عرنوص$^{-1}$) لعدد الصفوف بالعرنوص، (14.27%) للبروتين و(5.22 %) للزيت. بينما تفوق معنويا الموعد 7/28 /2020 بالتداخل مع التركيز 350 ملغم. لتر$^{-1}$ في صفتي عدد الحبوب بالصف ومحتوى الجبرلين بالأوراق التي بلغت قيمتيهما (44.62 حبة. صف $^{-1}$ و46.09 ميكرومول) على التوالي. نستنتج من هذه الدراسة ان أفضل توليفة تداخلية هي عند الموعد 7/21 /2020 بالتداخل مع التركيز 350 ملغم. لتر$^{-1}$ في اغلب الصفات المدروسة. ان الهدف من هذه الدراسة هو تحديد افضل موعد زراعة وتركيز رش جبرلين لتحسين اداء وجودة صفات النمو والحاصل للذرة الصفراء.

الكلمات المفتاحية:- الذرة الصفراء – الجبرلين – مواعيد الزراعة .(pANCA (60.93 ng\ml), (10.31ng\ml). \ c ANCA (35.78 ng\ml), (8.341ng\ml.

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