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EFFECT OF FOLIAR SPRAYING WITH BILIRUBIN ON MAIZE GROWTH AND YIELD

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Abstract

Afieldexperiment was carried out in the field of experiments collage of Agri. Univ. of Baghdad, Jadriya at spring and autumn seasons 2016 in order to study the response of growth and yield of maize (5018var.) of organic material (Bilirubin) foliar spraying. It was carried out according to the Complete Random Block Design with three replicates, included three concentration (1, 2, 3) mlL^{-1} in addition control treatment which sprinkled with water only. It was sprayed at stage of 12 leaf. The result of experiment showed: most of the traits of the studied growth and the yield of the maize and its components were affected by spraying with bilirubin, the concentration of 2 ml L gave the highest mean of the yield and its component and the percentage of increase in plant yield at this concentration reached 94.65% and 115.07% compared to the comparison treatment for two season respectively.

Key words : Bilirubin, growth, yield, maize.

Introduction

The recent trends in agriculture call for the use of natural compounds or products that are easy to implement with their availability locally, with low economic coast and environmentally safe, accompanied by high efficiency in increasing production because the intensive use of mineral fertilizers has reduced the fertility soil as well as it affectshuman health, So researchers are a look at finding at alternatives that can increase productivity and reduce those disadvantages, including the use of organic fertilizer so we have seen the use of another type of organic matter, namely, which is a waste of cows, which is a source of sources of antioxidants and natural and does not effect on human health or farm animals. The efficiency of photosynthesis increasing is one of the steps that increase the output from the source to interact with genetic expression of the species or variety to reach the highest input for grain or seed according to the crop to obtain the highest production effort, one of the factors to increase the efficiency of photosynthesis is the construction of a high capacity source, which depends on the presence of chlorophyll and the auxiliary pigments of the process of photosynthesis with high efficiency in converting photovoltaic energy into chemical energy used by plants in energy production. The chlorophyll molecule consists of prophyrin, which is a tetrahedral payroll structure with asymmetrical ring in addition to chain of payroll rings and a phaytol chain extending into plastid membranes that interfere with water greasy fatty molecules) Tanaka and Tanaka, (2007, in contrast, the bilirubin molecule found in the animal kingdom was found to consist of a chain of four rings payroll cyclic tetrapyrrolic structure, these foure rings are associated with the non – protein part in a large ring called bilirubin similarity to phytocobilin, as well as the phytochrome pigment, which are sensitive optical receptors found in many floral plants involved in the organization of the date of flowering as well as seed germination and seedling elongation as well as in the size and shape and number of leaves and the composition of chlorophyll and is found in most leaves of plants and in terms of biochemistry is aprotein with bili chromophorey (Wlllows *et al.,* 2004 and Cary *et al.,* 2009) as found that bilepigments is one of a group of compounds called antioxidants as well as damage to the system of cellular genetic (DNA) (Liuxt, 2002, Baranano *et al.,* 2002, Wangner *et al.,* 2007 and Sedlak *et al.,* 2009) from this point has been used different concentrations of bilirubin on the maize crop to increase the efficiency of photosynthesis and reflective on the yield and its components.

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Materials and Methods

A field experiment was carried out in the field of experiments College of Agriculture/University of Baghdad/ Jadriya in the spring and autumn 2016 seasons in order to study the response of the growth and yield of maize (5018 var.) of Bilirubin foliar spraying. The experiment was carried out according to the complete random block design with three replicates included three concentration (1, 2, 3) m L^{-1} sprayed in the 12 leaf stage in addition to the comparison treatment which was sprinted with water only and its symbol (B_0, B_1, B_2, B_3). The soil of the experimented plowed, smoothed and leveled, divided into faro and seed were planted on the distance between faro and another 75 cm and between one plant and another 25 cm, for plant density 53,000 plant ha^{-1}, seed were planted in 4/4/ 2016 for spring season and 30/ 7/2016 for autumn season the experimental requirements were supplemented by the addition of nitrogen fertilizers form urea 400 Kg ha^{-1}, irrigation and weeding operation were carried out as needed. When the plant arrived 75% male flowering stage the following measurements :

1. Plant height: It was measured of five plants randomly selected from the protected plants and measured from the soil surface to the base of the flag leaf.
2. Number of leaves.
3. Leaf area : Measure the length of the leaf under the main ear of the plants and apply the following formula :leaf area = square of length leaf under the ear × 0.75 (EL-Sahookie, 1985).
4. Leaf area index : was measure by using the following equation.

   Leaf area index = Leaf area × plant density
5. Ear height : It was measured of five plants which measured plant height from the soil surface to the base of the main ear.
6. Ear length.
7. Dry weight of plant in physiology maturity stage.
8. CGR (Crop growth rate) gm plant day^{-1}. was calculated in physiology maturity stage using the following equation:

   $CGR= w_2 - w_1/T_2 - T_1$

   CGR =Crop growth rate

   W_1= dry sample weight at T_1 (at sowing date).

   W_2= dry sample weight at T_2 (days after sowing).
9. NAR. (Net assimilation radiation) : was measure by using the following equation :

   NAR= CGR × Leaf area index.

When the plant reached to maturity stage five plant were harvested on 16/7/2016 for spring season and 8/11/ 2016 for autumn season and the following measurements:

1. Number of ears in plant.
2. Number of rows in ear.
3. Number of grains in row.
4. Number of grains in ear.
5. Weight of 100 grain.
6. Plant yield.
7. Biological yield.

Results

Growth traits

The data in table 1 indicate to significant differences of the plant height traits by impact of Bilirubin for spring seasons only, so 3ml L^{-1} (B_3) concentration gave a higher mean of 232.18 cm compared with 0, 1 and 2 ml L^{-1} concentration with an average of 214.24 and 224.13 and 226.73 cm respectively. The 2ml L^{-1} (B_2) concentration was superior in ear high in spring season and 3ml L^{-1} (B_3) concentration in autumn season, 2ml L^{-1} (B_2) concentration didn't differ significantly from the concentration of 3ml L^{-1} and the concentration of 1ml L^{-1} (B_1) in the spring season. Also the 2ml L^{-1} (B_2) concentration was superior in number of leaf in spring season and 3ml L^{-1} (B_3) concentration in autumn season which was no different from the 2mlL^{-1} (B_2) concentration in autumn season, these two concentration gave the highest number of leaves (15.00 and 13.51) leaf in plant respectively.

The leaf area and its index in the spring season was affected by spraying with bilirubin it gave an average of 0.8100 cm and 42.93 when the plants was sprayed with 3ml L^{-1} (B_3) concentration without significant different with 2ml L^{-1} (B_2) concentration, the 2ml L^{-1} (B_2) concentration in dry weight increased by 85.01%,50.28% and 6.59% compared to 0,1 and 3ml L^{-1} concentration in spring season, and 133.19%,37.28% and 13.45% respectively for the autumn season respectively. The increase in dry weight of the plant was reflected in the increase in plant growth rate and in the same (2ml L^{-1} for the two season as it increased by 85.04%,50.30% and 6.59% for the spring season and 133%, 39.93% and 30.53% for the autumn season compared to the 0,1 and 3ml L^{-1} concentration sequentially.

Net photosynthesis reached its maximum mean at the 2mlL^{-1} concentration for the two season with averaged 3.744 and 2.95 for the spring and autumn respectively compared to 1.797, 1.921, 3.389, 1.08, 1.93 and 2.20 at

0,1 and 3 ml L^{-1} concentration for two season respectively. These results was agreed with Nasserallah *et al*., (2018) whose pointed to significant effect for bilirubin in growth traits for wheat crop.

Yield and its components

The data in table 2 indicate that the number of ears was not significantly affected by the spraying of bilirubin and for the spring and autumn season and the length of ear in spring season, while the effect was significant in autumn season. 2ml L^{-1} and 3ml L^{-1} concentration were give the same mean (23.50) cm and an increased 25.33% and 19.47% compared with two concentration 0 and 1 ml L^{-1}. The number of rows in ear was increased by increase of the concentration to 2 ml L^{-1} for this material (bilirubin) to reach 17 row in spring season and 17.33 row in autumn season compared with control treatment (without spraying) which gave 12.67 and 13.67 row for two season respectively, and the same concentration gave the highest average of number of grains in the row amounted to 36.17 and 49.50 grain in row and this concentration significant different from the other of concentrations, that the increase the number of grains in row led to an increase in the number of grains in ear and at the same concentration (2 ml L^{-1}) which gave 588 and 792 grain in the ear and an increase of 46.26%,24.31% and 4.57% in spring season and 63.63%,39.43% and 5.03% for autumn season compared to 0, 1 and 3 ml L^{-1} concentration respectively.

The 2 ml L^{-1} (B2) concentration gave the highest grain 100 weight on average 29.97 gm and 27.75 gm respectively, this concentration didn't differ from 3 ml L^{-1} concentration in spring season only. The increase in number of rows in ear, number of grains in row, number of grains in ear and grain weight led to an increase of plant yield and in the same superior concentration in all the traits (2 ml L^{-1}). So the plants treated with this concentration gave the highest plant yield of 112.9 gm and 168.49 gm compared to 58.0, 92.5, 98.0, 78.3, 115.0 and 158.4 at 0,1 and 3 ml L^{-1} concentration respectively. 2 ml L^{-1} concentration didn't differ significantly from the 3 ml L^{-1} concentration in two season. The biological yield

Table 1: Effect of Bilirubin concentrations on growth maize traits in spring and autumn season 2016.

Treat	Plant high	Ear high	Number of leaf	Leaf area	Leaf area index	Dry weight	Crop growth rate (CGR)	NAR
B_0	214.24	119.8	13.000	0.6208	32.90	226.3	2.514	1.797
B_1	224.13	142.7	14.087	0.7121	37.74	278.6	3.095	1.921
B_2	226.73	149.8	15.000	0.8049	42.66	418.7	4.652	3.744
B_3	232.18	149.0	14.110	0.8100	42.93	392.8	4.364	3.389
L.S.D	6.143	17.03	0.6128	0.0472	2.506	32.16	0.3573	0.4107
Autumn Season								
B_0	159.3	78.1	11.33	0.511	27.08	169.9	2.00	1.08
B_1	160.7	83.5	12.20	0.598	31.68	288.6	3.33	1.93
B_2	171.7	88.7	12.77	0.613	32.47	396.2	4.66	2.95
B_3	179.0	102.5	13.53	0.633	33.55	349.2	3.57	2.20
L.S.D	NS	11.05	1.069	NS	NS	51.21	0.740	0.801

Table 2: Effect of Bilirubin concentrations on yield and component maize traits in spring and autumn season 2016.

Treat	Number of ears	Ear length	Number of rows in ear	Number o grain in rows	Number of grain in ear	Weight of 100 grain	Plant yield	Biological yield
B_0	1.000	18.00	12.67	31.67	402	24.95	58.0	12.00
B_1	1.000	20.17	16.27	29.08	473	27.53	95.5	14.77
B_2	1.667	21.17	17.00	36.17	588	29.97	112.9	22.19
B_3	1.000	20.33	16.25	33.25	565	29.52	98.0	20.82
L.S.D	NS	NS	0.451	2.850	78.3	0.604	26.76	1.704
Autumn season								
B_0	1.000	18.75	13.67	35.33	484	21.92	78.3	9.00
B_1	1.000	19.67	14.67	38.67	568	22.91	115.0	15.28
B_2	1.567	23.50	17.33	49.50	792	27.75	168.4	21.00
B_3	1.633	23.50	16.00	43.50	754	25.30	158.4	18.51
L.S.D	NS	2.302	2.283	5.148	123.7	1.962	14.66	2.694

of the plant increased to 22.19 and 21.00 Mg ha^{-1} at the concentration of 2 ml L^{-1} concentration compared to 12.00 and 9.00 Mg ha^{-1} in comparison treatment (without spraying with bilirubin) and 2 ml L^{-1} concentration didn't differ significantly from the 3 ml L^{-1} concentration in two season, these results was agreed with Nasserallah et al (2018) whose pointed to significant effect for bilirubin in yield and component traits for wheat crop.

Discussion

The results of the present study showed a significant increase in maize yield by 94.65% and 115.07 % from the spraying with bilirubin at 2ml L^{-1} concentration, and 68.96% and 102.29% from the spraying of the same substance at 3ml L^{-1} concentration. The reason is to increase most vegetative traits (plant high, leaf number, leaf area and its index, dry matter of plant, and growth plant rate) at the same concentration, that's mean increasing of plant efficiency to interception solar radiation and this led to increase of net assimilation radiation and increasing of products this process and transmission it's to sinks (ears) and then increasing of the proportion of fertilization and seed set and then increasing of number and weight grain and this led to increasing of plant yield. This maybe due to the effect of this substance (Bilirubin) through enter it's in the organization of the date flowering and size and number of leaves or perhaps its reduce the impact of exposure to environmental stresses through the elimination of the roots of oxidation because this substance (bilirubin) is an antioxidant which reduced the damage of the types of roots effective and prevent damage to the genetic system cell.

Conclusion

From obtained data in this study, we recommend the use of this material (Bilirubin) which is a natural substance that has no effect on the, animal, human health or economical cost, and concentration of 2ml L^{-1} on maize plant due to its obvious effects in increasing the yield and its components. We also recommend conducting experiments that involve spraying or seeds soaking of this substance on other crops.

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