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Effect of Foliar Spraying with Stearic Acid on Growth Characteristics for Two Varieties of Bread Wheat

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ABSTRACT

Background: As a result of the excessive use of mineral fertilizers, it has led to an increase in the accumulation of pollutants in the soil and an imbalance in the elements present in it, leading to a decrease in crop growth, productivity and quality, in addition to serious health problems for humans and animals, Therefore, attention in recent research has focused on the use of safe and environmentally friendly materials, including stearic acid.

Methods: A field experiment was conducted at the Agricultural Research Station, College of Agricultural Engineering Sciences - University of Baghdad, during the winter season of 2022-2023. Randomized complete block design (RCBD) within split-plot arrangement with three replications was used. The experiment included two factors, the first within the main plots represented two varieties of wheat (Buhooth 22 and Adana), while the second factor in the sub-plot represented spraying with stearic acid at concentrations of 100, 200, and 300 mg L^{-1}, in addition to the control treatment.

Result: The results revealed that Buhooth 22 resulted in significant increase plant height, chlorophyll content, number of total tillers, plant dry weight and crop growth rate with an increases in percentage of about 4.04%, 7.87%, 9.42%, 2.26% and 2.19%, respectively. The results also exhibited significant with concentration 200 mg L^{-1} in plant height, dry weight, crop growth rate. The concentration of 300 mg L^{-1} resulted in significant increase of flag leaf area, leaf chlorophyll content and total of tillers.

Key words: Buhooth 22, Crop growth rate, Flag leaf area, Total chlorophyll content.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops worldwide for cultivation, production and consumption. In Iraq, it ranks first in terms of cultivated area and production. Despite there is still a large gap between local and global production, as wheat grain yield is affected by several factors, including genetics (varieties), yield varieties with suitable management and including using nutrients. In recent three decades, interest has focused on using safe and environmentally friendly materials, including vitamins, amino acids or organic material (Zeboon, 2018 and 2019; Mahmood and Zeboon, 2019; Baqir and Zeboon, 2019 and 2020; Abed and Zeboon, 2020; Kumar *et al.,* 2023; Zeboon and Baqir, 2023 and 2024; AL-Hashimi and Zeboon, 2024 and Raju *et al.,* 2024). One of these safe and essential nutrients for plants is stearic acid, which is one of the long-chain saturated fatty acids. It is found in plant and animal cells within the triglycerides.

Chloroplast membranes comprise glycolipids, which represent 75% of their lipid membranes, as well as participate in photosynthesis systems first and second (Loll and Saenger, 2005). Other researchers found that using this acid increased growth and yield in many plants due to the stimulation mechanism as a result of its role in the Calvin cycle and the photosynthesis process effectiveness, especially in the Carbon dioxide fixation step, as well as its effect similar to that of hormone in plants (Hamilton *et al*., 2012). Growth delay in some plants is mainly due to decrease in the capacity of the plastid membranes to grow and increases, which is then help as an impairment in photosynthesis (Ravikumar and Jeyam, 2019). It was found that 3-day-old wheat seedlings constitute a substantial source of this acid (Holzl *et al*., 2009). This study was aimed to investigate effect spraying stearic acid to some growth traits of two wheat (*Triticum aestivum* L.) varieties.

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MATERIALS AND METHODS

A field experiment was conducted at field of the College of Agricultural Engineering Sciences, University of Baghdad, Al-Jadriyah during winter season of 2022-2023. The experiment was implemented using a randomized complete block design (RCBD) with three replicates within the split-plot arrangement. The experiment involved two factors: the main factor included wheat varieties (Buhooth 22 and Adana), while the second factor included three concentrations of stearic acid, 100, 200 and 300 mg L^{-1} liter, as well as the control (without spraying acid). Foliar spray was applied at two stages, the first at beginning of tillering stage and the second at the beginning of flowering stage. The crop was sown at row spacing of 20 cm using seed rate of 20 cm

distances 120 kg ha^{-1}. The requirements of the experiment, included fertilization, according to the recommendations as nitrogen at a rate of 200 kg N ha^{-1} was added at three stages (trilling, elongation and booting) and phosphate fertilizer was added at a rate of 100 kg ha^{-1} (P_2O_5) during sowing (Zeboon, 2016). Recommended package and practices were adopted for past management.

RESULTS AND DISCUSSION

Data in Table (1) shows significant results between the two varieties, the concentration of the stearic acid spray, and their interaction. Experimental results revealed that Buhooth 22 recorded significantly highest plant height as compared to Adana. This might have happened due to the genetic capability of the Buhooth 22 variety. These results are consistent with the results of) Baqir and Zeboon, 2019 and Baqir and Zeboon, 2020 and Mahmud *et al*., 2022). Foliar spray of stearic acid 200 mg L^{-1} recorded significantly highest plant height as compared to other treatments. This could be due to the role of stearic acid in enhancing growth, which is similar to the role of hormones in plants) (Hamilton *et al.,* 2012). These results are consistent with those of Abouziena and Abd EL Waheed, (2013). The interaction of wheat cultivars and foliar spray of stearic acid indicated that wheat cultivar Buhooth 22 with foliar spary of 200 mg L^{-1} recorded significant increase in plant height.

Data in Table (1) shows significant results between the concentration of the stearic acid spray. Experimental resnlts verealed that foliar spray of stearic acid 300 mg L^{-1} recorded significantly. Flay leaf prodncing 37.52 cm^2 to other treatmats. The cause for this difference could be due to the vital role stearic acid plays in photosynthesis, especially in dioxide fixation steps (Hamilton *et al*., 2012). The effect of the interaction between the two factors was insignificant for this trait.

Data listed in Table (1) shows significant results between the two varieties, the concentration of the stearic acid spray. Experimental results verealed that Buhooth 22 recovd significantly highest number of fillers with average 548.32 tillers m^{-2} as compared to Adana which recorded 501.09 tillers m^{-2}. This difference could be due to the genetic differences between the two varieties in this trait, as the plants of the Buhooth 22 variety are genetically distinguished by producing more tillers. These results are consistent with (Jaddoa *et al*., 2017; Wahid and AL-Hilfy, 2018; EL-Sayed *et al*., 2018; Baqir and AL-Naqeeb, 2018 and 2019; AL-Hassan and Mahmood, 2023 and Hammood *et al*., 2023). Foliar spray ofstearic acid 300 mg L^{-1} recorded significantly highest number of tillers averging 616.70 tillers m^{-2} as compared to other treatments. These results are consistent with those obtained by (Abouziena and Abd EL Waheed, 2013).

Results in Table (1) refer to significant differences between the varieties, the stearic acid concentrations, and their interaction in the leaves' total chlorophyll content. Buhooth 22, was superior, containing the highest chlorophyll amount in the leaves, reaching 44.87 µg cm^{-3} with an excess percentage of 7.87% compared to Adana. This result is consistent with the findings of Jaddoa *et al*. (2017). Among the different concentration of foliar spray of stearic acid, concentration of 300 m. L^{-1} of the stearic acid Found to be significantly superior in the chlorophyll content With the corresponding value of 46.91 µg on average with an increase

Table 1: Effect of varieties and spraying with stearic acid and their interaction on wheat growth traits during 2022-2023.

Treatment	Plant height (cm)	Flag leaf area (cm^2)	Total number of tillers	Chlorophyll content (Spad unite)	Dry weight (g m^{-2})	Crop growth rate (g.m^{-2} day^{-1})	Biological yield (Mg ha^{-1})
Cultivars							
Adina	80.35	34.03	501.09	41.60	1534.63	17.90	11.37
Buhooth 22	83.60	35.72	548.32	44.87	1569.33	18.69	11.62
LSD (P=0.05)	2.49	NS	22.96	0.78	19.01	NS	0.14
Stearic acid							
0	73.10	30.18	424.37	37.51	1458.11	15.96	10.80
100	80.87	34.87	503.63	42.99	1534.80	17.53	11.37
200	87.51	36.93	554.04	45.54	1611.08	19.91	11.93
300	86.42	37.52	616.70	46.91	1603.92	19.77	11.88
LSD (P=0.05)	0.89	5.11	31.46	1.29	20.52	0.31	0.15
Adina 0	71.61	28.17	389.87	36.42	1433.56	15.62	10.62
100	79.08	33.68	482.75	41.65	1516.23	17.32	11.23
200	83.93	34.48	538.08	44.41	1581.12	18.69	11.71
300	86.78	39.78	593.08	43.93	1607.62	19.97	11.91
Buhooth 22 0	74.59	32.20	458.88	38.61	1482.67	16.30	10.98
100	82.65	36.06	524.51	44.32	1553.37	17.74	11.51
200	91.09	39.37	569.55	46.66	1641.04	21.13	12.16
300	86.06	35.27	640.33	49.88	1600.22	19.58	11.85
LSD (P=0.05)	1.26	NS	NS	1.83	29.02	0.44	0.21

percentage of 25% compared to control. These results are consistent with the findings of Abozeana and Abdel Wahed, 2013. From the same Table, revealed Chlorophyll content in cultivar increased significantly and maximized with concentration of 200 mg L^{-1} to decrease again. In contrast, Buhooth 22 cultivar, the chlorophyll content increased positively with the spray concentration, reaching the maximum at 300 mg L^{-1} concentration, recording 49.88 µg cm^{-3}.

Data shown in Table (1) refer to a significant effect on the varieties, the concentration of spraying stearic acid and their interaction on the crop dry weight. Data presented in Table (1) Revealed that Buhooth 22, having the highest plant dry weight, To the value of 1569.33 g m^{-2}, As compared to Adana. which could be attributed to the superiority of Buhooth 22 and recorded the highest values of plant height, number of tillers (Table 1), number of spike, 1000 grain weight and grain yield (data is not shown), which was reflected in Significant increase in dry weight. These results are consistent with those obtained by (AL-isawi and AL-mehemdi, 2016; Kadom and Jaddoa, 2016; Saudi *et al*. 2016; Baqir and Zeboon, 2019; Baqir and Zeboon, 2020 and Singh *et al*., 2024). Foliar spray of stearic acid with the concentration of 200 mg L^{-1}, Recorded significantly highest dry weight, Which was found to be at par with concentration of 300 mgL^{-1}. This might have happened due to their superiority in the plant height (Table 1), number of spikes, number of spikelets, and number of grains (data is not shown). These results, with the findings of Abouziena and Abd EL Waheed, (2013).

The interaction of wheat cultivars and foliar spray of stearic acid indicated that wheat cultivars Buhooth 22 with foliar spray of 200 mg L^{-1} recorded significant increase in dry weight.

Data in Table 1 shows significant results between the two varieties, the concentration of the stearic acid spray, and thier interction. Expermental results revealed that Buhooth 22 recorded significantly crop growth rate which recorded 11.62 g m^{-2} day^{-1} as compared to Adana. These results are consistent with the findings obtained by (Baqir and Zeboon, 2019; Jaddoa *et al*., 2017). Foliar spray of stearic acid 200 mg L^{-1} recorded significantly highest crop growth rate averging 11.93 m^{-2} day as compared to other treatments.

The interaction of wheat cultivars and foliar spray of stearic acid indicated that wheat cultivar Adana with foliar spray of 300 mg L^{-1} recorded significant increase in CGR.

Data in Table 1 shows significant results between the concentration of the stearic acid spray. Experimental results revealed that foliar spray of stearic acid 200 mg L^{-1} recorded significantly biological yield producing 19.91 mg ha^{-1} as compared to other treatments. The concentration of 200 mg L^{-1} The concentration of 200 mg L^{-1} superiority could be due to its superiority in most growth, including plant height, dry weight at the inflorescence stage. These results are consistent with what was reached by Abozeana and Abdel Wahed (2013). The interaction of wheat cultivars and foliar spray of stearic acid indicated that wheat cultivar Adana with foliar spray of 300 mg L^{-1} recorded significant increase in biological yield.

CONCLUSION

Stearic acid with a concentration of 200 and 300 mg L^{-1} were superior in giving the best results, as the cultivar Buhooth 22 was superior by giving the best results, We suggest using other cultivars with the same concentrations of stearic acid.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish or preparation of the manuscript.

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