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EFFECT OF FOLIAR APPLICATION OF AMINO ACIDS, ORGANIC ACIDS, AND NAPHTHALENE ACETIC ACID ON GROWTH AND YIELD TRAITS OF WHEAT

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Abstract

Growth and yield of the wheat crop in poor semi-dry soil territories suffer from multiple nutrients issues. This study aims to clarify the effect of foliar application of organic acids, amino acids and Naphthalene acetic acid (NAA) on the growth and yield of wheat (*Triticum aestivum L.*). This field trial was designed according to the Complete Randomized Design (CRD) with three replications. Results present that the compound treatment of organic acids and Naphthalene acetic acid (OA+NAA) statistically enlarge the flag leaf (36.37) cm^2 other treatments: amino acids (AA), organic acids (OA), Naphthalene acetic acid (NAA), (AA+OA), (AA+NAA), (AA+OA+NAA), and the control. Control treatment shows the least flag leave area (20.59) cm^2. (AA+NAA) resulted in the highest ratio of chlorophyll (48.63)%. There were significant differences between treatments and the least chlorophyll average with the control and (OA). They made no significant differences in the treats of tillers and spikes number, but for plant height trait. Naphthaleneacetic acid application resulted in the highest plant height mean (95.9) cm, and the control resulted in the least (78.8)cm. (AA+OA+NAA) gave the highest length mean of the ears (11.54) cm, which differs statistically of the rest of the treatments. The least mean of this trait is (8.20) cm with the control.

Keywords: Foliar application fertilizers, amino acids, organic acids, Naphthalene acetic acid, wheat crop.

Introduction

Wheat crop is the world's first economic crop and has nutritional importance in the economy and policy of most countries. More than 35% of the world's population depend on this crop for their food, Khaeim M. Hussein (2013). One of the main advantages that made the wheat crop of great nutritional importance in human life is the balance between proteins and carbohydrates in its grains. Wheat, with the rest of the grain crops (rice, corn, and barley), forms about 65% of the total global grain production and about 50% of protein production, Tilman, D., & Clark, M. (2014); and Gackson (1985). Foliar application of fertilizers recommends to be applied in order increase its production efficiency and maximize the benefit of different fertilizers use efficiency, especially nitrogen, because of the importance of interrelated in the process of protein composition and grain filling, since they a significant part of this fertilizer as a soil fertilizer expose to losses by different ways or fixed in the soil by several factors, Ohyama, (2010); and Alawsy *et al*. (2018). Foliar application technology is an integral part of root feeding is one of the important factors in minimizing losses and rationalizing the high quantities of chemical fertilizers, as well as increasing the efficiency of the use of fertilizer that applied to the soil additional to its direct and rapid effect, Sanyal *et al*. (2018). Organic and amino fertilizers play an important role and have a big benefit to the plant because they contain a wide range of different elements, Souri, (2016). Various organic acids contribute great benefits to plants, such as ensuring integrated plant nutrition increasing the germination rate, activating rooting and shooting growth development, increasing chlorophyll content in light spots and increasing the efficiency of absorption of elements, Perez *et al.* (2015). The amino acids actives plant synthesis efficiency and internal immunity in addition to improves the qualities of growth and yield. Foliar application with micronutrient and micronutrients increases nutrient use efficiency by several times than soil application fertilizers, Jones *et al*. (2013). The developed world should not seek to reduce the nitrogen fertilizer that applied to the soil, but to reduce its losses economically, and in a form that is harmless to the plant or disturbed the ecological balance, Ullah *et al.* (2012). Flag Leaf is one of the most important plant parts in determining crop productivity, Qi-Hua *et al.* (2013). This because it significantly contributes to grain filling during the period from flowering to physiological maturity as a result of its effective contribution to the process of photosynthesis. One of the factors that increase the efficiency of photosynthesis is the provision of enough plant leave area to intercept solar radiation, Long, *et al.* (2015); Luma, (2018). The formation of plant leaves area is usually influenced by fertilization, especially the nitrogen because nitrogen plays a role in increasing the cell division and thus increasing the expansion of the cells. Spikes number determined earlier in growth stages, Chen *et al*. (2009). Studies have confirmed the impact of the number of ears by fertilizer application, especially nitrogen, which is applied in this research as organic fertilizer and amino acids. Alusi (2009) confirmed the increases in the number of spikes significantly with the foliar application of (NPK, NK, NP, and N), at 8%, 11.6%, 12.5%, and 17.7%, respectively. The growth of axillary buds that emerge out of the main stem, in grass plants in general and especially in grain crops, is called tillers, Assuero, and Togenlxi (2010). Tiller pattern in wheat plants is regulated by internal and peripheral factors additional to agricultural service operations. Mineral elements obtained by the plant affect the process of tiller formation, Cruz and Boval (2000). Nitrogen has a positive effect on this process. Faraj and Abdel-Razzaq (2006) found significant differences in the number of tillers with the foliar application of NPK (26.9, 14.2, 16.1, 11.3, 6.0, 6.4 and 8.4) for treatments of NPK, PK, NK, NP, K, P and N, respectively as compared to treatment of water itself. Spike length is a quantitative trait that is linked to the grain yield by its association with the number of spikes per spike, Friend (1965). The biological yield is an index of the total accumulated dry matter produced by the plant during the growing season as a result of the photosynthesis process. Fertilizer foliar application made significant differences in this trait and increased the biological yield, Faraj A., and Abdel-Razzaq (2006).

Methods and Material

A field trial was conducted in a private farm that belongs to a farmer in Dagara county/ Diwaniyah during the winter season 2018-2019 to determine the effect of the foliar application of amino and organic acids and naphthalene acetic acid on the growth and yield of wheat. (24) experimental units of (2.5*2) were prepared. Some chemical and physical proprieties of the soil were determined after collecting random samples from different plots, table (1). Complete Randomized Design (CRD) with three replicates was used. Eight different treatments of (control, amino acids, organic acids, naphthaleneacetic acid, amino acids + organic, amino + naphthalene acetic acid, organic acids, amino acids + organic + naphthaleneacetic acid) were applied. The crop management operations were carried out and the fertilizer of NPK was applied to the soil at the planting date. The plants were regularly irrigated along with rainfall. Treatments were applied to the experimental plots once every two weeks. The total number of treatments is (5) of (0.002 ml/liter) were applied using a special spray.

Table 1: Soil physical and chemical properties.

EC $ds.m^{-1}$	**pH**	**$CaCO_3$**	**Organic matter**	**Total Nitrogen**	**Soil Components ($g.kg^{-1}$)**			**Texture**
		$g.kg^{-1}$			**Sand**	**Silt**	**Clay**	
3.02	7.50	24.90	7.9	0.051	280	390	350	Loam
Micronutrients DTPA($mg.kg^{-1}$)						**Macronutrients ($mg.kg^{-1}$)**		
Pb	Cd	Cu	Zn	Mn	Fe	K	P	N
2.0	0.245	3.66	9.8	13.5	14.7	186	11.8	40.9

The following growth and yield traits were measured as follows:

Plant height (cm): At physiological maturation stage, the height of the plants was measured with a ruler from the base of the main stem of the plant to the base of the spike for 20 randomly chosen for each experimental unit.

Flag leaf area (cm^2): It was measured by taking the length and the width of the flag leaf of twenty plants randomly chosen of each experimental unit according to the following equation, Giunxa and Robedxson, (1994).

Flag leaf area = Length of flag leaf * width of flag leaf at midpoint * 0.95

Total leaf area (cm^2): It was calculated by measuring the length and width of the plant leaves for twenty randomly chosen plants from each plot according to the following equation, Giunxa, and Robedxson, (1994):

Flag leaf area = Length of flag leaf * width of flag leaf at midpoint * 0.95

Leaves Chlorophyll ratio (%): A field chlorophyll meter was used to measure the chlorophyll ratio and the readings were conducted directly in the field. This was done for 20 randomly chosen plant of each plot.

Plant tillers (tiller/plant): The number of tillers of plants per plot was calculated for 20 plants in the same manner.

Biologic yield (gm): It was obtained from as dry matter (grain + straw), Donaldson (1996).

Spike length (cm): Spikes length were measured for 20 randomly from each experimental unit using a ruler inserted from the spike base and the end of the terminal spikelet.

A number of ears (spike/ plant): The number of spikes per plant was calculated for 20 randomly from each experimental unit.

Results and Discussion

Table (2) presents the significant effect of the different treatments on the flag leaf area. Treatment of (OA+NAA) resulted in the highest average area of the flag leaf (35.62) cm, which is a significant increase as compared to the control (19.67) cm. Nevertheless, treatment of (OA+NAA) did not differ significantly of (AA+OA+NAA), (A+NAA), (AA) and (NAA). This may because the nitrogen ratio in these acids is high since nitrogen increases growth rate by increasing the expansion and division of cells and encourages the activity of the meristem and thus increase enlarge the flag leaf area, which agrees with Faraj A., and Abdel-Razzaq (2006).

The mean of chlorophyll percentage was significantly increased with (AA+NAA) (47.58), while the control treatment and (OA) showed the lowest means of 39.64 and 38.29. Wheat tillers and pattern does not affect significantly by the different treatments. The reason may be attributed to the application time because these enhancing fertilizers were applied after the end of this stage of the growth. Treatments made no significant differences between the number of spikes produced per plant, as well. This because there were no significant differences between the tillers number. On the other hand, grain filling degree varied significantly. While treatment of (AA+OA+NAA) resulted in (45.66) g for the 1000 grain weight, the control weighted (30.01) g. This compound treatment made the highest means harvesting index yield, table (3).

They resulted in weighted grain as compared to the control, table (3). Treatment of (NAA) significantly increased plant height. It resulted in the highest mean of (96.0) cm, which did not differ significantly of other treatments, while the control made the lest plant height mean (77.9) cm. It may be due to the fact that organic, amino acids and Dioxins are rich in a wide range of minerals that important of plant growth. Moreover, the existence of nitrogen with these elements plays a positive role in increasing the activity of meristem tissue and cellular division. In addition to the role of amino acids in the building the auxin that has a role in cell divisions, Wareing (1983).

This study recommends the foliar application of fertilizers not only organic fertilizer but also chemical fertilizer to achieve two benefits, which are the maximum benefit of the fertilizers themselves and decreasing soil contamination.

Table 2: Growth vegetative traits.

Treatments	Flag leaf area	Chlorophyll	Tillers number	Plant height	Spikes length
Control	20.593	38.53	4.43	78.8	**8.20**
Amino acid (AA)	27.458	43.88	4.74	94.5	10.52
Organic acids (OA)	21.234	39.38	4.96	91.1	8.9**0**
NAA	28.845	42.46	4.34	95.9	9.48
AA+OA	23.230	44.52	4.56	94.5	8.90
AA+NAA	31.456	48.63	5.18	92.1	9.51
OA+NAA	36.378	47.45	4.73	93.9	9.92
AA+OA+NAA	32.135	46.37	5.97	95.0	11.54
L.S.D	12.491	4.937	7.49	9.36	1.568

Table 3 : Treatments means of yield, harvesting index and weight of 1000 grains traits.

Treatments	Weight of 1000 grains (g)	Harvesting Index	Yield (kg.h)
Control	30.01	23.63	1.16
Amino acid (AA)	35.83	28.32	1.34
Organic acids (OA)	36.84	28.75	1.47
NAA	36.27	28.47	1.45
AA+OA	42.49	30.81	1.56
AA+NAA	40.63	29.99	1.51
OA+NAA	41.55	31.29	1.53
AA+OA+NAA	45.66	32.53	1.60
α=0.05	N.S	3.28	2.74

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