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Study the impact of spraying different concentrations of zinc on the vegetative growth characteristics and biological yield components of wheat plant (*Triticum aestivum* L.) variety Abu Ghraib

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Abstract
The trial was focused on the purpose of enhancing growth and yield of wheat crop by spraying zinc solution. studies showed that zinc spray in specific concentration was lowered not plant's height but an increased harvest index which indicates high conversion rate of assorted photosynthetic products into grains. The remedies, in addition to productivity, reflected a strong improvement in wheat yields, number of spikes per plant and 1000 grain weights. The research is emphasizing that zinc serves a purpose in promoting wheat growth, elevating the grain quality, and increasing the content of the wheat in nutrient value. Besides using zinc for leaves spraying for a desired plant physiological outcome, zinc can also be used in other ways so as to improve soil fertility and overall crop production which in turn will contribute to the sustainability of agricultural systems. The plant height as well as the harvest indices presented highly significant differences between these control and Zinc addition rates i.e. 0.4 tons and 0.8 tons per hectare, decrease wheat plant height which was -4.25% and -7.53% respectively compared to the control treatment. Nevertheless, the harvest index markedly improved in those all trials while the standard treatment remained constant. When the treatment for zinc that use a rate of 0.8 tons for each hectare is sprayed, harvest indices reaches the highest effectiveness than other treatments. Application zinc at the range of 0.4 kg/ha produced a statistically significant wheat yield that was an increase by 55.6 % compared to decreased rate which was maximized at the level of 0.8 kg/ha of spraying. The treatment results were unaffected in terms of the number of spikes per plant or the weight of 1000 grains compared to the results when looking at the yield. When compared to individual leaves (foliar application), the observation that the concentration of zinc on the plant increased, in return, affected the wheat plant yield positively on a dry matter, grains and grain count level.

Keywords: Spraying, zinc, vegetative growth characteristics, biological yield, *Triticum aestivum* L.

Introduction
Among all grasses, wheat (*Triticum aestivum* L.) is, perhaps, one of the main cereal crops, its contribution to human life and food security being tremendous. In today's agriculture, the application of several micronutrients including zinc mostly attracted many people mainly because the nutrient is one of the key constituents in the plant development and growth.
In looking for zinc shortage in the soil, the inspection should give equal attention to the possible causes that seem to stipulate appropriate solutions. Perhaps the cause can be found in improper soil management, including neglect of the application of efficient methods to restore that balance both in environmental and agricultural systems.
Zinc is considered as a significant background nutrient for the healthy growth & development of the wheat plant. Such a approachable practice is a basic one to achieve growth and this is increasingly needed at the time of population boom around the world. Thus, the study is a serious approach to deciphering what zinc spraying on wheat crop development can yield into effective ways to boost farming and increase grain yields substantially. Community to wheat zinc study is the great prior as it can be crucial and averaging effect on plant growth, evolution, quality improvisation and output of volume. The most critical of the nutrients is what's highly vital in promoting the efficiency of the plant in

absorption and use of nutrients and water. Thus the fruitful exploration of these genetic elements can play a critical role in the emerging of several new and creative practices related to wheat farming so as to secure its growth as whole and eventually achieve substantial production [3]. Although the role of wheat in the nutrition and its uptake by zinc in it is incomparable, there are still many aspects that need to be explored further. On the contrary, the main point here is to enlarge the scope of research if we really want to accomplish the goal of wheat cultivation and elevate grain production in a very remarkable manner. The key areas of such research should include thorough investigation on zinc concentrations level in various species of plants, also the environmental significance and the protection of ecological balance should be given attention [4]. This study aims to investigate the effects of spraying different concentrations of zinc on the vegetative growth characteristics and biological yield components of wheat plants, specifically focusing on the Abu Ghraib wheat variety. By understanding how zinc application influences these aspects of wheat growth, we can gain valuable insights into optimizing agricultural practices to enhance crop productivity and quality

Materials and Methods

This research was carried out in order to evaluate the influence of organic in sheen spraying with zinc on the growth of wheat. This study will focus on all aspects of zinc spraying impact starting from plant height which is one of the most significative factors in growth process untill grain weight which is one of vital indicators of production quantity and quality and in the end yield percentage which reflects possible disbalances and a good nutrition the plant should have. Choose proper place for our research and apply soil of required quality to sowing the crop. It was the case that this type of agriculture was situated at Gharaaf area covered by agriculture under Agricultural Guidance Authority of Province of Wasit which had the advantage of being water-rich with good ventilation, number of green spaces in the area that helped the growth of plants to head. The choice of the soil which was made was based on its chemical and physical qualities, such as acidity, nutrient content and its ability to hold and maintain water. The principal properties of the plot considered in the experiment were represented by a clay loam texture and contents of potassium chloride, calcium carbonate, and organic matter as 342.1, 252, and 13.6 g/kg respectively, with a cation exchange capacity of 1 meq/100 g (Table 1).Besides its basic role, which is among others is the contribution of meaning, the soil was also available of the major and minor nutrients to the plant, and among their values were – phosphorous with 9.5, potassium with 16.44 and zinc with 250.2, 0.40 mg/kg respectively. The study conducted in [5] as presented states,

Table 1: Chemical and physical properties of field soil.

Treatments*	Amount	Standard unit
pH number	7.53	--------
Electrical conductivity EC	2.4	Desmens M-1
Minerals carbonates	1 meq/100 g	g/kg
Potassium	16.44	mg.kg-1
Nitrogen organic matter	13.6	g/kg
Phosphorus ready	9.5	mg.kg-1
Soil texture	a clay loam texture	

*Each treatment represents 4 replaces

Wheat crop seeds of the variety Abu Ghraib was sown 1/15/2023 at a rate of 120 kg/ha in equally distanced rows towards 20 cm width by bordering through a Complete Randomized Block Design of the Agricultural Guidance Directorate of Wasit Governorate with four repetition. Following all the tillage, leveling and conditioning activities, the planting process began. Phosphatic and nitrogen formulations were mixed and put evenly into each experimental jars based on technical recommendations for the control and all treatments. Phosphate fertilizer was applied in a single dose before planting, using triple superphosphate (46%) at a rate of 100 kg/ha, while urea fertilizer (46% N) was added at a rate of 200 kg N/ha in three equal doses: in first treatment the grain was sowed, secondly after 1 month of rise, thirdly at vegetative stage for all treatments. The trial preparations were conducted at the sorghum 45 pascale in Sodos weed group under pressure spraying with the backpack sprayer having nozzle opening height of 30 cm and with the top speeds of 400 liters of pesticide for plant coverage.

The derived yield components were obtained from a fixed area of 0.25 square meter at the full maturity of each plot measured using wooden square, where the weighed plants from the quarter-square meter area were counted to find the biological yield; then, the spikes in the harvested sample were counted for grain yield. The grain spikelets were counted for ten random spikes divided evenly among the experiment units and averaged. This was followed by the assessment of grain weight by manually cutting the sample through the lens of a light-reinforcing microscope. To identify the weight of the 1000 grains per experimental unit, a random sample of grains was aspirated from each experimental unit. However, a Randomized Complete Block Design (RCBD) was adopted during the experimentation, and the statistical analyses were made with the use of the GenStat program, whereas the means of the treatments were compared by the least significant difference (L.S.D) test on a 5% level [6]. The pattern of zinc spraying in seed treatment precisely covers the surface of wheat to maximize on the zinc coverage on the wheat. Proper spraying doses are calculated taking into account the soil analysis results and plant zinc needs, since most varieties do not tend to use all the zinc provided by the spraying Particular deadlines of spraying have to be kept to avoid the cases where the solutions are either sprayed before the plant's growth or too late. Compatibility includes correct environmental content such as temperature, humidity, and wind speed to ensure effective spraying [7].

The solution of zinc used in our study is prepared by precisely calculating the correct concentrations of each component. Then, these are gently mixed to achieve the optimal mixture balances. Storing the creation under the best maintenance is what occupies the interest, for the ideal condition should be the dry and temperature stable. Zinc was sprayed on the brassica oil plants as follows: the first round of spraying was at tillering stage and the second at the booting The level of zinc in one liter of spray was 0.4 kg zinc and 0.8 kg zinc sulfate which was the next step is rinsing [8].

Results and Discussion

The study has been design and focused on prevention of the zinc solution to the wheat crops so promotion of growth and yield of wheat crops. The researchers were able to find

favorable results by the correct composition of this medium and storing the solution in the best conditions. Zinc spray performed at certain concentrations acted to show plant height in a decreasing trend where an increase in the harvest index was observed, showed plant's efficiency in converting photosynthetic product into seeds [9, 10]. These treatments had a favorable effect also on productivity, with a significant growth of grain weight per sewer, number of ears per a plant, and an average weight of 1000 grains as outcome. This research illustrates the central role of zinc in augmentation of wheat growth, grain quality improvement, and remarkable nutritional improvement aspects. Results demonstrate that zinc discharge enhance more than just fertility and metabolic of soil, but it also contribute to better crop yields which give a significant increase in the agricultural sustainability as well.

There is an unevenness of plant heights and harvest indix between the treatments and the control treatment (0.4 and 0.8 tons per hectare의 Zinc supplementation), which is clearly seen from the table (Table 2).To determine the effect of applying zinc at 0.4 and 0.8 tons per hectare, scaled plant height was reduced by 4.25% and 7.53% respectively in comparison with the control treatment in which the maximum plant height was observed (94.23 cm).Through the way we achieved the harvest index that is the plants' efficiency in transforming photosynthesis products into grains, it was elevated upwards that led to the treatment of all the shown studies that control the treatments (Table 2).Spreading zinc at 0.8 tons per hectare with spraying recorded the highest harvest index in consultation with other treatments. Plants' height (in cm) is an important benchmark well-related to a plant's growth rate, development and production ability [11]. Stem traits like height and specific weight play a huge role in wheat grain develope, their short-term water storage capacity becomes crucial under drought and heat stress conditions. This is important in the role to provide storage for carbohydrates used for grain filling after flowering [12]. Stem shortness is an economically essential feature of plant breeding tasks since increased plant height dramatically increases a dry matter share which is completely allocated to fruiting growth phase, consequently leading to a decline in spike formation rate numbers, the weight of its grains, and thus participating in the decrease of the final yield. Furthermore, short plant height comes with superb drought tolerance, this might be attributed by the accumulation of glucose in the stem tissue during the period of the vegetative phase. Reduction in plants height could be because their acknowledgement of the fact that iron is the key contributor in the formation of cytochromes and ferredoxin that are necessary in the photosynthesis process therefore there is an increase in their rates and this in turn increase growth rates. The findings, which were similar to those of Hassan *et al.* [9] and Goh *et al.* [10] suggest that a plant with micronutrients shows an increase in the chlorophyll pigment concentration, and then the process of photosynthesis increases along with increase in plant height.

Table 2: The effect of different rates of applying zinc on the vegetative growth characteristics of wheat crop

Treatments*	Plant height (cm)	Biomass (tons.h-1)	Harvest Index
Control (Without spraying)	94.23	10.14	27.66
Spraying zinc at a concentration of 0.4 kg of zinc one liter.	90.28	12.16	30.85
Spraying zinc at a concentration of 0.8 kg of zinc one liter	87.13	15.06	32.32
L.S.D ≤ 0.05	3.09	1.53	2.61

*Each treatment represents 4 replaces

The impact on the yield and its components

The Table 3 hits the spotlight about applying Zinc on 400 g/ha, affecting wheat yield positively. The yield of agricultural production increased by 55.6%, and this leaf growth was maximized when zinc spray at the concentration of 0.8 kg/ha was used. These results were even better than that of the chemicals in the control treatment.

For the traits relevant to yields (Table:4), effects of treatments on the number of spikes per plant and 1000 grain weight were very much like the ones they exerted on yield. The number of zinc spikes per square meter and the weight of 1,000 grains increased by 56.8% and 16.5%, respectively, when 0.4 kg/ha of zinc-supplemented spray were administered, and by 46% and 16.5%, respectively, in subsamples that received 0.8kg/ha. This reflects an increase in the level of reaction by utilizing an increased concentration of the reactant. On the number of grains per spike the, zinc resulted in the decline [15]. The plant concentration of zinc that was influenced by foliar application showed positive results with wheat plants' yield. The dry matter, grain, and grain yield components were visibly better because of that when compared to the control plants. The main cause of this is that the shrinkage in the population of the grass crop led to the expansion of the small plants, which resulted in their ecological disadvantage for water, nutrients, and other factors with the wheat crop. A majority of the yield improvements resulted because of both the number of the spikes and grains per spikes that increased at the same rate in these treatments [16]. The development of the plant due to a sufficient intake of major and micronutrients in the photochemical process is improving the efficiency of photosynthesis. As a result, both the yield of relevant branches and the formation of grain-formed heads have increased. S. Bonn and his compadres rightly said that it is the presence of major and micro nutrients in the wheat plant that makes the plants grow exceptionally well, and this branches – are stimulated as well. This rationally fits in the evidence provided by [17] and [15] who revealed that foliar spraying of micro-nutrients among the field supplied with a macronutrient ratio consistent with plants requirements led to an increased number of branches as the crop grew. Spraying micronutrients led to an increase in the yield of wheat grains. The reason why spraying with a high concentration of zinc may be attributed to giving the highest grain yield rate is because it was a positive reflection of their effect on the vegetative characteristics of the plant, which would increase the process of photosynthesis, energy production, and the transfer of process products from the leaves (source) To other parts of the plant and then to the grains (downstream), which was reflected in an increase in grain yield, and this is what was indicated by [18, 17, 19, 15].

Table 3: The effect of different rates of applying zinc on grain yield and biological yield of wheat.

Treatments*	Grain yield (ton/ha)	Biological Yield (ton/ha)
Control (Without spraying)	3.8	14.00
Spraying zinc at a concentration of 0.4 kg of zinc one liter.	5.8	21.78
Spraying zinc at a concentration of 0.8 kg of zinc one liter	6.7	18.03
L.S.D ≤ 0.05	0.3	1.34

*Each treatment represents 4 replaces

Table 4: The effect of different rates of applying zinc on the yield components of wheat crop.

Treatments*	yield components of wheat crop		
	Number of Spike/m2	Number of grain/spikes	Weight of 1000 grain (g)
Control (Without spraying)	368	36.62	33.72
Spraying zinc at a concentration of 0.4 kg of zinc one liter.	537	30.55	39.30
Spraying zinc at a concentration of 0.8 kg of zinc one liter	577	31.85	41.26
L.S.D ≤ 0.05	34.5	4.00	1.99

*Each treatment represents 4 replaces

Recent studies have shown that regular application of zinc spraying may have unexpected additional effects on wheat growth and even on soil fertility. By providing plants with a large amount of available zinc, their metabolic process is enhanced. This leads to root growth, leaf development, and stem strengthening. In addition, zinc is considered a key component in energy storage and stress regulation in plants.

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