The Influence of Foliar Sprays on The Growth and Yield of Summer Squash.

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Abstract - Efficacy of foliar sprays of the salicylic acid and zinc on some characters of squash was tested at the spring season (2014) in the research station of agricultural college, Muthanna University. The experiment was a randomized complete block design with 3 replications. Used three different concentrations of the salicylic acid (0, 3 and 5mM) and Zinc used ZnSO4.7H2O with four concentrations (0 , 25 , 50 and 75mM). The highest vegetative growth was found at 5mM concentration of salicylic acid compared with the other concentration it was showed, plant height (64.04cm), total chlorophyll (26.69 SPAD), plant yield (1.211kg/ plant), total yield (23.071 t/h) and the total soluble soiled of carbohydrates, N, P, K, and Zn in the fruit (14.93, 1.73, 0.61, 1.74 and 2.66 percent). While treatment with 25 and 50 mM of Zinc were showing more affected than other concentration in the recipes which were studied. The foliar sprays are the best way to reduce the deficiency of some of nutrient material and it gives the way to enhance the plant resistance against different diseases when used salicylic acid and other material.

Keywords — foliar sprays, salicylic acid, zinc, squash

1. INTRODUCTION

Squash (*Cucurbita pepo* Linn) one of the important vegetable crop which belongs to the Cucurbitaceae Family. The family is one of the largest families in the plant kingdom consisting of the large number of edible plant species. It has a special significance through its potential in treating the early stages of prostate disorder because of the high content of zinc [1].

Use of the foliar spray to get thin membranes which will give a large surface friction, it will be useful under the condition in which the absorption of nutrients through the soil difficult [2].

The salicylic acid is one of the phenolic compounds that are necessary in the biosynthesis of Lignin, which is one of the most important components of the cell wall as well as phenolic compounds, especially Phytoalexin which play important role in chemical protection of the plant against germs, insects and herbivorous [3]. It has a role in the secondary metabolism, which encourage of root growth, gives resistance against infection pathogenesis of the plant, inhibits the biosynthesis of ethylene and improves the quality and quantity of protein [4]. Salicylic acid helps protect nucleic acids and prevents the protein crash, it also impacts on certain genes which associated with the protein that responsible for vital and non-vital stress [5].

The zinc component is one of the important elements necessary for the plant, it is included in the composition of the essential amino acids and resides low concentrations in the bark and affects many vital operations of the plant and play a role in the formation of some important enzymes such as Oxide Reductase, Transferase, Hydrolase, Isomerase and Ligase as well its impact in stimulating the metabolism of proteins, carbohydrates and safety of nucleic acids and cell membranes [6]. Use the more than permissible limits cause a decrease in bio metabolism of chlorophyll a and b and perhaps work as a disincentive for the transition of electrons in the process of photosynthesis, particularly photosystem II [7].

2. MATERIAL & METHODS

The Experiment was carried out for the spring season 2014 at the research station of the Agricultural college / Muthanna University. The experiment was a randomized complete block design with 3 replications, included 12 treatments, three treatments of salicylic acid (S1 = control (distal water), S2 = 3 mM and S3 = 5mM). The foliar spray was done in 23 days after sowing. Four treatments of zinc (ZnSO4.7H2O), Zn1= control (distal water), Zn2 = 25mM, Zn3 = 50mM and Zn4 = 75mM the foliar sprays done in 30 days after sowing.

Squash seeds were sown directly on 06/03/2014, conducted all the necessary agricultural operations of irrigation and others. Took samples of the water of the

Euphrates River from entering the field in both experiments region and analyzed physically and chemically in the laboratories of the Department of Soil Science and Water Resources in the College of Agriculture, University of Muthanna, Table (1), also took a random sample of the soil of the field and at a depth of 30 cm from several locations as it was conducted soil analysis at the central laboratory of soil / College of Agriculture, University of Baghdad, to check some of the physical and chemical characteristics and the results were as shown in Table (2). The required growth measurements were taken after (50) days from sowing.

Studied Characters: -

Samples of five plants were taken at the end of the season to conduct vegetative growth measurements and the referee average. Leaves content of chlorophyll was measured by device Opti-Science CCM-200Plus Chlorophyll Content Meter measurement in the field with units SPAD. Chemical analyzes was conducted in the laboratories of the college of Agriculture - University of Baghdad.

Statistical analysis:-

Analyzed and studied the data and has a comparison of calculations averages by using test L.S.D and moral level of 0.05, and used a statistical system ready Genstat.

3. RESULTS AND DISCUSSION:-

3.1 Characters of vegetative growth and yielding

The treatment (S3) of salicylic acid were showed the highest level of vegetative growth characters, but did not significantly differ in the character of TSS, and no different between S2 and S3 in total chlorophyll and carbohydrates percent (Table 3). The superiority of S3 treatment may be due to the effect of salicylic acid in increased cell division in the apical meristem so increasing plant height, in addition to its ability to improve the effectiveness of the immune of antioxidant in plants, salicylic acid has a mechanism to prevent the crash of chlorophyll as well as the revitalization of the effectiveness of enzyme active (RuBISCO) [8].

Treated with salicylic acid may be estimated root growth and improves the quality and quantity of the protein also improves the plant resistance against stress conditions, so it gives good result in plant height [4]. In addition to the salicylic acid plays an important role in physiological activity of the plant like photosynthesis through its effect on the function of stomata and the rate of transpiration and breathing passages in cucumber [9]. Salicylic acids have a role in increasing the chlorophyll pigment and carotene and accelerate the photosynthesis process and increase the activity of some important enzymes, in addition to increasing the plant hormone levels like auxins and cytokines because of treatment with salicylic acid so it will lead to increased vegetative growth [10].

The increase of carbohydrates may because of the salicylic acid contributes to the movement and transmission of nitrates in the internal plant tissue and construction of synthesis of chlorophyll to increase the photosynthesis mechanism in plants and that will lead to increasing the production of carbohydrates, or to get some changes in cell membranes contribute to bring some elements and entry across cell membranes [11]. These results were consistent with the findings of [8], [12], [13] and [14] on the squash.

Treatments Zn2 and Zn3 of zinc were showing more effected of characters of vegetative growth (Table 4). This due because of the important of zinc, in limited level , to synthesis of amino acid (tryptophan) which important to synthesis of (IAA) and is important in the division and elongation of plant cells that is will led to increase of number of leaves and branching and stem elongate so it will be increase the dry weight of plant , which led to increased vegetative growth strength [15], in addition to the role of zinc in the revitalization of approximately (200) enzyme which is considered an essential component of many enzymes and enters in several important enzymatic reactions it activates the enzyme Decarboxylase and Dehydrogenase and it an essential component in the photosystem II PS-11 [16]. Zinc plays role inactivates the enzyme which is important in Biosynthesis of chlorophyll and bio-metabolism of proteins, carbohydrates, lipids, nucleic acids and the integrity of cell membranes [6]. These results are consistent with the findings of [17], that the spraying with zinc contributes to obtain a significant increase in wet and dry weight of tomato plant, explaining the importance of zinc in regulating of the membrane permeability of the root cells, the membrane permeability increase under deficiency of zinc conditions, in addition to the contribution to reducing the sodium transition, it is believed that the zinc controls the regulatory mechanical function, absorption, the rate of transmission and reduces the toxicity of the sodium and chlorine, it may be has damaged cellular membranes under deficiency of zinc due to the attack of free radicals of oxygen and lipid of

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membranes leading to physiological leak between the cells. These results consistent with what was said by [18], that the spraying nutrient-containing zinc contributes to obtain a significant increase in the height and the number of secondary branches of the tomatoes plants, researchers have explained that the process of photosynthesis will improve under presence of zinc because it stimulates the synthesis of tryptophan, which is an essential compound to form IAA and the latter is responsible for stimulate of plant growth and get an increase in dry weight due to the accumulation of carbohydrates through the more activity to the process of photosynthesis. The decrease of vegetative growth Characters with increasing zinc levels can be attributed to increased zinc from the permissible limits and that leads to a negative effect on most of the plant characters where reducing of the leaves number, root length, total plant height and leaf area, and believed that the accumulation of element in leaves cause inhibition of the electron transport chain (ETC) through oxidative sites occupation in photosystem II (PS II), in addition to reduced effectiveness of the Rubisco enzyme [19]. The effect of toxicity of zinc on plant shows through reduced productivity, slow growth, leaves yellowing and reduction in the Biosynthesis of chlorophyll, and the decline in the chlorophyll A great than of chlorophyll B and decomposition of chloroplasts and the emergence of antagonism with elemental phosphorus and iron, and shows a significant decrease in the concentration of starch with increasing zinc levels for more than 30 mM in the leg and root and high concentrations of zinc may effect on the inhibition of enzymes representation of starch and thus prevent Biosynthesis of starch [6].

3.2 Fruit content of nutrients N, P, K, and Zn

Salicylic acid has significant effects on the fruit content of nutrients N, P and K, while it has no influence on the content of the fruits of zinc Table (5). This may be attributed to the role of salicylic acid to stimulate plant growth, the absorption and transport of nutrients, membrane permeability, the rate of growth and photosynthesis [20]. Add to that the salicylic acid is internal growth regulator involved in regulating physiological processes in plants, contribute to modifying activity of enzymes antioxidant, improves the process of photosynthesis, nutrient uptake, activity of phenolic antioxidants and many vital metabolic compounds [21]. Where it works as an antidote oxidative contributes to scavenge of free roots and thus protect cell membranes and thus gets the absorption and transport of nutrients better [22], As well as the important functions in protecting the nucleic acids and protein to prevent crashes [5]. These results are consistent with the findings of [12], [13] and [22], on the squash plant.

The results of Table - 6 – refer to obtain significant differences between the treatments, where excelled treatment Zn2 morally than the rest in the fruit content of nitrogen and potassium, while there were no significant differences between the Zn2 and Zn3 in the fruits content of phosphorus but both are higher than the rest of the treatments. As for the element zinc, the results showed exceed treatments Zn1 and Zn2 and Zn3 compared with the control treatment while no significantly between them, These findings are consistent with the findings of [23], that the increase in zinc levels increase of potassium levels in the shoot, as that zinc may be controlled on the entry element of Na across plasma membranes which contributes to maintain the integrity of cell membranes and then controlling the permeability, as well as the element deficiency contributes to encourage the uptake of Na causing the negative effects on cell membranes. It is believed that the zinc component controls of regulatory mechanical of the absorption function of Na and Cl and the rate of transmission of them, in addition to its role in reducing the toxicity of these two elements [17]. The effect of zinc on the absorption of nitrogen and potassium may have the dilution effect, while in the case of phosphorus; it is perhaps no antagonism relationship between the zinc and phosphorus [24]. Zinc element gets his rapid absorption and accumulation together at same time after the first six days till the end of the period of growth and this is clear that element is strongly linked to cellular sites [25]. The excess quantities of zinc element contributing to the decline in activity of the stomatal complexes and inhibits the Activity of chloroplasts enzymes and the Peroxisomal, perhaps produce free root, which cause in accelerating the aging compared with plants that receive the perfect amounts of the element. These results consistent with the findings by [26], that the high concentrations of zinc reduce the absorption of phosphorus. The increase of the zinc concentration will increase potassium levels in the plant [23].

4 CONCLUSION

The deficiency of some nutrient material like zinc and other elements in the soil can be reduced by using foliar spraying technique, this technique also can enhance the plant resistance against some plant diseases especially when using salycilic acid and other material.

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TABLE 1
PROPERTIES OF IRRIGATION WATER

Type of Analysis	The unit of measurement spring period
EC	6.2 ds.m-1
TDS	3.1g.L-1
NaCL	12.2%
PH	7.4

TABLE 2
SOME PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE SOIL STUDY

Spring Season 2014		
trait	Unit	value
EC	ds.m -1	17.1
PH	-----	7.2
O.M	gm. Kg -1	15.0
Ca++	meq.L-1	51.0
Na+	meq.L-1	83.5
Cl-	meq.L-1	17.0
HCO3-	meq.L-1	5.1
SO4-	meq.L-1	4.5
Mg	meq.L-1	41.3
CaCO3	gm. Kg -1	150.0
SAR	-----	12.3
N Ready	gm. Kg -1	13.0
P Ready	gm. Kg -1	14.9
K Ready	gm. Kg -1	162.2
Sand	gm. Kg -1	396.0
Silt	gm. Kg -1	360.0
Clay	gm. Kg -1	244.0
The textile :Loamy		

TABLE 3
EFFECT OF SALICYLIC ACID SPRAYING IN SOME GROWTH CHARACTERISTICS OF SQUASH

Salicylic acid	Plant height- Cm	Total chlorophyll- SPAD	TSS	Carbohydrates %	Yield of per plant – kg\plant	Total yield - t\h
S1	59.42	23.80	3.82	14.07	0.81	15.58
S2	60.70	25.20	4.25	14.39	1.05	20.10
S3	64.04	26.69	4.34	14.93	1.21	23.07
L.S.D 0.05	1.76	1.59	N.S	0.68	0.12	1.67

TABLE 4
EFFECT OF ZINC LEVELS IN SOME CHARACTER OF PLANT GROWTH

Zinc	Plant height- Cm	Total chlorophyll- SPAD	TSS	Carbohydrates%	Yield of per plant – kg\plant	Total yield- t\h
Zn1	60.60	25.11	4.00	13.79	0.96	18.46
Zn2	62.45	27.15	4.59	15.48	1.21	23.07
Zn3	64.24	26.13	4.58	15.20	1.16	22.15
Zn4	58.26	22.53	3.38	13.40	0.76	14.65

L.S.D 0.05	2.04	1.83	0.71	0.79	0.14	1.93

TABLE 5
EFFECT OF SALICYLIC ACID SPRAYING IN SOME OF THE CHEMICAL CHARACTERISTICS OF THE FRUITS OF SQUASH

Salicylic acid	The percentage of nutrients elements in fruits			
	N	P	K	Zn
S1	1.56	0.51	1.50	2.60
S2	1.60	0.56	1.61	2.71
S3	1.73	0.61	1.74	2.81
L.S.D 0.05	0.04	0.04	0.07	0.26

TABLE 6
EFFECT OF ZINC SPRAYING IN SOME OF THE CHEMICAL CHARACTERISTICS OF THE FRUITS OF SQUASH.

Zinc	The percentage of nutrients elements in fruits			
	N	P	K	Zn
Zn1	1.64	0.53	1.56	2.53
Zn2	1.77	0.61	1.77	2.68
Zn3	1.63	0.59	1.62	2.74
Zn4	1.48	0.50	1.52	2.88
L.S.D 0.05	0.05	0.05	0.08	0.30

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