RESPONSES OF PISTACHIO SEEDLINGS (*Pistacia vera)* TO FOLIAR YEAST AND ZN APPLICATION

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ABSTRACT

This study was conducted carried out 2021 in the fields of Gradarasha, collage of Agricultural Engineering Science, Salahaddin University, Kurdistan Region / Iraq., to investigate the response of pistachio s to foliar yeast at three concentrations (Y0= 0, Y1=10 and Y2= 20 mg.L^{-1})) and three concentrations of chelate Zinc with (Zn0= 0, Zn1= 4 and Zn2= 8 mg.L^{-1}) three times for each one every 15 days, beginning at 1 April on growth characteristics of pistachio (*Pistacia vera* L.) seedlings cv. Musilly. A factorial experiment with three replicates was carried out in a Randomized Complete Design (CRD) using three seedlings for each experimental unit. The obtained results indicated that the growth characteristics and some of leaf content of mineral elements was increased by increasing the concentration of (Yeast and Zinc) as compared with control, foliar spray of yeast at (20 mg.L^{-1}) caused significant increase most of the studied parameters. At the same time, foliar application of zinc fertilization at (8 mg.L^{-1}) gave the highest value of seedling high, leaf area, leaves area/seedlings, root fresh weight and leaves content of Zn. The interaction between the two fertilizer dry yeast and foliar application of zinc by increasing the concentration level caused a significant increase for all growth characteristics and leaf content of mineral elements, at level (Y2 + Zn2 = 20 mg.L^{-1} + 8 mg.L^{-1}) as compare with control.

Key word: Pistachio seedlings, Foliar application Yeast, Zinc, Growth characteristics,

INTRODUCTION

Pistachio (*Pistacia vera* L.) is the principal and one of the most important horticultural products of Kurdistan, which bears commercially valuable edible seeds (Al-Saghir, 2010). As many as 11 different species are found in the pistachio genus, some of which are highly prized for their commercial and cultural value in the Mediterranean and Asian regions. It's a drought-resistant deciduous fruit tree that can withstand scorching summers and dry weather. (Khan *et al.*, 1999 and Al-Saghir,2010).

Yeast (dry bread yeast, DBY) (*Saccharomyces cerevisia*) is a source of phytohormones or Cytokinins as well as enzymes and amino acids, and a stimulant of cell division and enlargement, protein and nucleic acid synthesis, chlorophyll formation and stress tolerance (Shehata *et al.*, 2012). A key enzyme for treadle biosynthesis, Trehalose-6-phosphate synthases, is discovered in yeast extracts (Yeo *et al.*, 2000). It increased growth characteristics, chemical components, total carbohydrates, and yield (Ramadan and Ragab, 2015). Bread yeast is applied to the soil or the leaves of plants as a bio fertilizer (El-Ghamriny *et al.*, 1999). By virtue of its high nutritional content and ability to produce auxins and gibberellins, it was capable of improving the simulative growth

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components that work to accelerate plant cell division and growth (Glick, 1995).

In vegetative and reproductive growth stages, dry bread yeast promoted carbohydrate accumulation and flower production in plants (Barnett *et al.,* 1990). When it's present, it stimulates cell division, protein and nucleic acid synthesis, and chlorophyll synthesis (Wanas 2002 and 2006). It was the purpose of this study to determine how foliar treatments of yeast fungus or Nicotinamide influenced quinoa plants growing in sandy soil in terms of growth, yield, and yield quality, as well as chemical content.

Zinc is a vital nutrient for plant growth and development. As a growth hormone, starch, and seed maturation aid, zinc is essential (Brady and Weil, 2002). When it comes to plant growth, Zn plays a range of important roles that require a consistent supply for optimal growth and productivity (Acquaah, 2002). Enzyme synthesis in plants and hormone production are both dependent on Zn (indole acetic acid). There is a relationship between zinc deficiency in plants and smaller leaves and shorter internodes (Acquaah 2002 and Alloway, 2004).

In addition to tryptophan synthesis, cell division, membrane structure maintenance, and photosynthesis, zinc is essential for the action of a variety of enzymes, including dehydrogenases, isomerases, transphosphorylases, RNA and DNA polymerases. Protein syntheses also benefit from its regulating role (Marschner, 2012). Foliar Zn applications have been used successfully to increase tree vigor, fruit set, and yield in apple (Wojcik, 2007), orange (Hafez and ElMetwally, 2007), and walnut (Keshavarz *et al.*, 2011).

Although zinc is classified as a micronutrient, it is essential for plant development. Among all metals, zinc was required by the greatest number of proteins for catalytic action. Zinc-binding proteins account for roughly 10% of all protein in biological systems. Zinc is essential in biological processes, such as membrane structural integrity and protein synthesis, as well as gene expression. (17) (Vadlamudi and colleagues, 2020).

Zinc is a key micronutrient for plant development and productivity. It also contains the element that was required in modest levels for numerous enzymes and protein functions (ChitraMani & Kumar, P. (2020); Sharma, M., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020).

The aims were to study the effect of foliar application of yeast and zinc on growth of (*Pistacia vera* L.) cv. Musilly seedlings to produce strong root system that grows quickly to be ready for budding and grafting in next season.

Materials and Methods

This study was carried out 2021 in the Gradarasha field to study the effect of foliar application of yeast and zinc on some growth characteristics of pistachio seedlings cv. Musilly, the seedlings had one-year old planted in black poly ethylene bags 20 kg (45 x 30 cm) filled with sandy loam soil. Seedlings were sprayed with yeast at three concentration (Y0 = 0, Y1=10 and Y2 = 20 $mg.L^{-1}$) and chelate Zinc at three concentration (Zn0= 0, Zn1= 4 and Zn2= 8 $mg.L^{-1}$) three times every 15 days starting at 1 April, Tween 20 (0.01%) used as wetting agent, seedlings received routine cultural practices for commercial production including fertilization and irrigation. Seedlings were cut at the soil surface and roots were separated from the soil by washing roots onto sieves then manual separating roots from remaining soils, the fresh roots were weighted in each sample, then, the roots were dried at 70◦C for 48 h.in oven, and percentage of dry matter. A factorial experiment with three replicates was carried out in a Complete Randomized Design (CRD) using three seedlings for each experimental unit, data were statistically analyzed with computer using SAS system (2005) and the difference between treatment

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means significantly tested with Duncan Multiple Range at 5% level. The parameters for each treated seedlings were measured, sapling height, stem diameter, leaf area, number of leaves, number of branches, shoot fresh weight, shoot dry weight, dry weight%, root fresh weight, root dry weight and leaf mineral: N, P, K and Zn.

Results

Data from table (1) shows that all growth characteristics values increased by increasing the yeast concentrations as compared with control, Y2 at (20 mg.L^{-1})level recorded the highest significant values in sapling height, stem diameter, leaf area, leaves number, shoot fresh weight , shoot dry weight, dry weight percentage, root fresh weight and root dry weight which gave (37.56 cm), (1.74 cm), (37.81 cm^2), (30.14), (13.25 g), (6.98 g), (45.13 %), (25.87 g), (13.21 g) respectively. The significant increase in vegetative growth of seedlings characteristics, may be due to yeast is a source of phytohormones, including cytokinines as well as enzymes and amino acids, and a stimulant of cell division and enlargement, protein and nucleic acid synthesis, chlorophyll formation that leads to increase the process of photosynthesis.

Table (2) shows that all growth characteristics significantly increased with increasing the zinc concentrations as compared with control, Zn2 (8 mg.L^{-1}) recorded the highest significant values in seddling height, stem diameter, leaf area, leaves number, shoot fresh weight , shoot dry weight,dry weight percentage, root fresh weight and root dry weight which gave (35.91 cm), (1.94 cm), (36.92 cm^2), (36.27), (13.38 g), (6.19 g), (46.26 %), (33.03 g) and (18.32 g) respectively.

Concerning the effect of active dry yeast concentrations it was clearly observed in table (3) that with increasing concentrations used of yeast significantly increased in leaves, N P, K and Zn which registered (3.01%) (3.43%), and (1.34 (mg.kg-1)), as compared with control, yeast at (20 mg.l^{-1}) level recorded the highest significant values and indicated that the significant increase caused by the yeast in the leaves content of the mineral elements and its readiness to be absorbed by the plants.

Table (4) shows that all leaf minerals values at Zn2 at (8 mg.L^{-1}) increased by increasing the Zinc concentrations as compared with control, and recorded the highest significant values in N P ,K and Zn which gave (3.11%), (0.62%), (3.82%) and (1.30 (mg.kg-1)).

It is clear that interaction between the studied factors revealed that all growth characteristics value caused significant increase at level (Y2 + Zn2 = 20 mg.L^{-1} + 8 mg.L^{-1}) and the highest value recorded in seedling height, stem diameter, leaves number, shoot fresh weight, shoot dry weight, dry weight percentage, root fresh weight and root dry weight which gave (33.58 cm), (1.94 cm), (31.58 cm^2), (33.45), (29.05 g), (13.79 g) (47.46 %), (30.93 g) (16.95 g) respectively.

The interaction between yeast and zinc effected significantly on all leaf minerals value at level (Y2 + Zn2 = 20 mg.L^{-1} + 8 mg.l^{-1}) as compare with control. The highest value recorded in N, P, K and Zn which gave (3.79), (0.70%), (3.97%) and (1.83 (mg.kg-1)) respectively.

Conclusions

According to the results obtained from this study, the significant increase were recorded for vegetative growth characteristics of pistachio seedlings when the seedlings sprayed with Yeast and zinc, the significant values were increased with increasing the

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concentration of Yeast and zinc, the highest significant values were recorded at concentration of (20 mg.L^{-1}) of yeast and at concentration of (8 mg.L^{-1}) of zinc and the interaction effect of both concentration.

These results can be attributed to the fact that yeast has a positive effect on photosynthesis via its effect on the characteristics of leaves and their content of chlorophyll as well as the above mentioned dry material, and that higher composition of the materials produced by photosynthesis, the higher the amount of inorganic nutrients are, so that they can convert the resulting materials from the photosynthesis process to various vital materials which are absorbed. The degree of nutrition required by the plant for maximum development during the vegetative state should be balanced with the availability of adequate quantities of other nutrients. The role of yeast can also be attributed to its effect on enzymatic activity, the production of some plant hormones, the improvement of nutrient absorption ability, the conversion of phosphorus from insoluble to soluble, and increasing its absorbability by plants, all of which increase the content of the mineral elements in the plants. The yeast may also include some of the most important nutrients, such as nitrogen, phosphate, potassium, carbohydrates, and vitamins, which leads to a rise in these. the Zinc is one of the greatest significant micronutrient for growing plants and developments. Zn in plant growth plays a series of vital roles that require a reliable supply for optimal growth (Khalil and Ismael, 2010). and productivity, enzyme synthesis in plants and hormone production are both reliant on Zn.

Vegetative growth of seedlings characteristics was significantly increased with foliar Zn. It is one of the most important micronutrient for plant growth and developments, which plays a range of important roles that require a consistent supply for optimal growth and productivity, enzyme synthesis in plants and hormone production. Vegetative growth traits of seedlings were greatly improved, with zinc being one of the most critical micronutrients for plant growth and development, also serves a variety of vital tasks that require a regular supply for optimal growth and productivity, including enzyme synthesis and hormone production (Indole Acetic Acid).

Table 1: Effect of foliar application of yeast on the growth of pistachio seedlings

Yeast Treatments	Seedling high cm	Seedling diameter cm	Leaf area cm^2	Number of leafs/ seedlings	Shoot fresh weight g	Shoot dry weight g	Dry Shoot weight %	Root fresh weight g	Root dry weight g
Y0	31.76 c	1.26 c	31.03 c	20.86 c	10.09 c	4.26 c	42.22 c	20.11 c	9.55 c
Y1	33.99 b	1.68 b	35.79 b	27.22 b	12.33 b	5.51 a	44.68 b	22.56 b	10.47 b
Y2	37.56 a	1.74 a	37.81 a	30.14 a	13.25 a	6.98 a	45.13 a	25.87 a	13.21 a

* The similar letters vertically between treatments mean there are no significant differences between them using Duncan's Multiple Range test at %5 level

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Table 2: Effect of foliar application of Zinc on the growth of pistachio seedlings

Zinc Treatments	Seedling high cm	Seedling diameter cm	Leaf area cm^2	Number of leafs/ seedling	Shoot fresh weight g	Shoot dry weight g	Dry shoot weight %	Root fresh weight g	Root dry weight g
Zn 0	30.22 c	1.65 c	30.01 c	28.33 c	10.06 c	4.11 c	40.85 c	27.01 c	13.11 c
Zn 1	33.48 b	1.77 b	33.86 b	31.49 b	12.11 b	5.26 b	43.43 b	30.90 b	15.59 b
Zn 2	35.91 a	1.94 a	36.92 a	36.27 a	13.38 a	6.19 a	46.26 a	33.03 a	18.32 a

* The similar letters vertically between treatments mean there are no significant differences between them using Duncan's Multiple Range test at %5 level.

Table 3: Effect of foliar application of yeast on the leaf minerals of pistachio seedlings

Yeast Treatments	N%	P%	K%	Zn (mg.kg-1)
Y0	2.50 c	0.22 c	1.59 c	0.17 c
Y1	2.76 b	0.47 b	2.02 b	0.57 b
Y2	3.01 a	0.66 a	3.43 a	1.34 a

* The similar letters vertically between treatments mean there are no significant differences between them using Duncan's Multiple Range test at %5 level.

Table 4: Effect of foliar application of Zinc on the leaf minerals of pistachio seedlings

Zinc Treatments	N%	P%	K%	Zn (mg.kg-1)
Zn 0	2.51 c	0.28 c	1.57 c	0.22 c
Zn 1	2.56 b	0.44 b	2.64 b	0.68 b
Zn 2	3.11 a	0.62 a	3.82 a	1.30 a

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* The similar letters vertically between treatments mean there are no significant differences between them using Duncan's Multiple Range test at %5 level.

Table 5: Effect of interaction between foliar application of Dry yeast and Zinc on the growth of pistachio seedlings

Yeast Treatments + Zinc Treatments	Seedling high cm	Seedling diameter cm	Leaf area cm^2	Number of leafs/ seedling	Shoot fresh weight g	Shoot dry weight g	Dry shoot weight %	Root fresh weight g	Root dry weight g
Y0 + Zn0	23.18 f	0.18 g	21.37 h	20.93 h	14.23 g	4.39 f	30.85 j	20.11 f	10.12 f
Y0 + Zn1	25.90 e	1.34 f	23.23 g	22.67 g	15.52 f	4.98 f	32.08 i	20.93 f	10.30 ef
Y0 + Zn2	26.63 d	1.56 e	25.97 f	25.63 e	15.78 f	5.54 e	35.10 f	21.34 e	10.38 ef
Y1 + Zn0	26.92 d	1.59 e	25.78 f	24.98 ef	16.21 e	5.89 e	36.33 e	21.57 e	10.95 e
Y1 + Zn1	24.94 e	1.87 b	26.49df	26.87 d	18.90 d	7.21 d	38.14 c	23.86 d	12.04 d
Y1 + Zn2	26.57 d	1.79 c	28.86 c	28.90 c	21.76 c	8.28 c	38.05 c	25.55 c	13.89 c
Y2 + Zn0	29.44 c	1.65 d	27.60 d	26.96 d	21.33 c	8.05 c	37.74 d	25.20 c	13. 32 c
Y2 + Zn1	31.97 b	1.89 b	29. 47 b	30.23 b	26.47 b	11.86 b	45.21 b	28.04 b	15.09 b
Y2 + Zn2	33.58 a	1.94 a	31.58 a	33.45 a	29.05 a	13.79 a	47.46 a	30.93 a	16.95 a

* The similar letters vertically between treatments mean there are no significant differences between them using Duncan's Multiple Range test at %5 level.

Table 6: Effect of interaction of foliar of yeast and Zinc on the leaf minerals of pistachio seedlings

Yeast Treatments + Zinc Treatments	N%	P%	K%	Zn (mg.kg-1)
Y0 + Zn0	2.50 g	0.26 e	1.56 f	0.17 g
Y0 + Zn1	2.55 g	0.38 d	2.60 e	0.64 e
Y0 + Zn2	2.71 f	0.58 c	2.88 d	0.89 d

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Y1 + Zn0	2.68 e	0.57 c	2.90 d	0.31 f
Y1 + Zn1	2.74 e	0.62 bc	3.54 b	0.88 d
Y1 + Zn2	3.21 d	0.65 b	3.79 b	1.42 b
Y2 + Zn0	3.26 c	0.60 bc	3.02 c	0.27 fg
Y2 + Zn1	3.43 b	0.67 b	3.93 a	0.95 c
Y2 + Zn2	3.79 a	0.70 a	3.97 a	1.83 a

* The similar letters vertically between treatments mean there are no significant differences between them using Duncan's Multiple Range test at %5 level.

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