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Effect of spraying with different levels of Ascorbic acid and yeast extract on the vegetative growth and yield of Pear Trees (*Pyrus communis* L.)

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ABSTRACT

This study was carried out in a private orchard in Daquq district- Kirkuk province on nine-year-old "Le-Conte" pear trees in 2020 growing season, to investigate the effect of spraying with three levels of ascorbic acid (0, 75 and 150mg l^{-1}, three levels of dry yeast extract (0, 2 and 3 g l^{-1}) and their interactions. The study was conducted according to Randomized Complete Block Design (RCBD) with three replicates, one tree was used as an experimental unit. The data were analyzed statistically and the means were compared according to the Duncan polynomial test at 0.05 probability. The results indicated that foliar spray of 150 mg L^{-1}as corbic acid treatment and its combination with yeast extract 3 g l^{-1} treatment increased significantly the shoot length, leaf area, chlorophyll content, TSS% in fruit, fruit set %, number of fruits per tree, fruit weight and yield of tree and Feddan. On the other hand, Foliar spray of yeast treatments had not affected on any studied characteristics except 3 g L^{-1} increased statistically TSS% in pear fruit comparison to the control treatment.

Key words: *Ascorbic acid, Yeast, Pear, Pyrus communis L.*

Introduction

Pears (*Pyrus communis* L.) is a deciduous fruit tree. It belongs to Rosaceae family. It is native to Turkey and the Caucasus and grown in all regions of Europe such as Greece, the Balkans, Spain, the Netherlands, Belgium, and Russia (Janick, 2005). Pear tree is medium in growth and has a straight stem. The pear has a high nutritional value as its fruits contain nutrients, especially potassium, magnesium, vitamins, carbohydrates, etc. It has medical benefits and used to control blood pressure in old age persons, atherosclerosis, kidney disease and treat injuries resulting from heart, kidney and liver diseases (Al-Nuaimi, 2010; Al-Doori *et al*., 2020).

Plant growth promoters play an important role in vegetative and reproductive growth (Hasan *et al*., 2019; Mehdizadeh *et al*., 2019), ascorbic acid is one of the antioxidants, thus its use has increased in the present time, which causes an increase and encouragement of the vegetative and fruiting growth of fruit trees in general. Its effect on plants is similar to the effect of growth regulators that encourage growth (Johnson *et al*., 1999; Bhiah and AL-Zurfi, 2020). It plays a key role in reducing stress caused by temperature and toxins, and stimulates respira-

tion and cell division processes, and enters the transmission system of electrons and protect chloroplasts against oxidation (AlTaey, 2017). Also, Ahmed *et al.* (1997) found that a positive relationship between leaf area for pear trees and their ascorbic acid content. Some researchers studied the effect of spraying with ascorbic acid in many vegetative growth indicators of the seedlings and trees of fruit plants. Al-Araji (2009) and Shayal Alalam (2009) applied their experiments on the characteristics of vegetative growth of peach tree, and they reported a positive effect of ascorbic acid on studied Characteristics.

bio fertilizers offer an economically attractive and ecologically sound means of reducing external inputs and improving quality and quantity (AL-Taey *et al.,* 2019; Al-Khafajy *et al*., 2020; Mehdizadeh and Mushtaq, 2020), dry yeast extract is a source of nutrients for plants because it contains aminoacids, plant hormones, sugars, carbon, nitrogen, phosphorus, potassium, calcium, magnesium and other micronutrient (Manea *et al.,* 2019). It was found that the use of yeast (*Saccharomyces cerevisiae*) as biofertilizer improves vegetative growth and productivity of fruit plants, because its break down into amino acids and vitamins and it can beact as growth regulators. There are some studies referred to that yeast stimulates cell division and has an important role in increasing a quantity of dry substances accumulated in the plant organs due to its efficiency into respiration and photosynthesis process. This is because it contains a high amount of Tryptophane aminoacid which contributes to the initiat or material of IAA auxin, that is directly responsible of cell division, cell wall elasticity and increase the size of a cells, Thus the yeast treatment helps to improve the vegetative growth and fruit quality of fruit trees (El-Tohamy *et al*., 2008). Al-Dulaimi and Jumaa (2012) stated that the foliar spray grape vine "Black Hamburg" variety with 10g L^{-1} of bread yeast increased significantly the leaf area, its chlorophyll content and a number of clusters per vine. AL-Karawi *et al.* (2018) showed that the spraying strawberries by dry yeast (1 and 2 g L^{-1}) led to an increase in the annual vegetative growth characteristics, and the concentration 2 g L^{-1} gave a best result compared to other factors.

This study aimed to improve the vegetative growth and fruiting of Le-Conte pear trees by spraying with ascorbic acid, dry yeast extract and their combinations.

Materials and Methods

This study was carried out in a private orchard in Daquq district - Kirkuk governorate on nine-old-year of Le-conte pear trees during 1/3/2020 to 1/10/2020. The trees were selected as identical in the strength of growth as much as possible, planted at 5×6 m apart, to investigate the effect of foliar spray three levels of ascorbic acid (0, 75 and 150 mg L^{-1}) that were symbolized C_1, C_2 and C_3 respectively, and spray three levels of dry yeast extract (0, 2 and 3 g L^{-1}) which were symbolized (K_1, K_2 and K_3 respectively, and their interaction on some characteristics of vegetative growth, fruit set, fruit traits and yield. The horticultural operations were conducted in a similar manner such as weed, diseases, insects' control, irrigation, hoeing and other horticultural service operations (Al-Allaf, 2017).

Ascorbic acid was prepared and sprayed at the rate of two batches, the first upon full bloom and the second wasone month after full bloom. The yeast extract was prepared in three concentrations discussed above.

The yeast *Sacchromyce cerevisiae* produced by Turksih company Lesaffre was prepared and activated for 24 hours (EL- Tohamy *et al*., 2012). Then, the yeast extract was sprayed in two batches after one day of ascorbic acid was sprayed.

The experiment was carried out according to RCBD in two factors and three replications, and one tree as an experimental unit. The collected data were arranged and analyzed statistically, and the means were compared according to the Duncan's polynomial test at0.05 probability (Al-Rawi and Khalaf-Allah, 2000).

Results

Vegetative growth characteristics

It can be seen in Table 1 that the levels of spraying with ascorbic acid had a significant effect in increasing the shoot length and leaf area of pear trees. The third level (C_3) superior the first (C_1) and second (C_2) levels because it produced the highest values of shoot length (25.91 cm) and leaf area (27.59 cm^2).

It was noticed from the results in the same Table that there were significant differences between the three levels of dry yeast extract in the shoot length and leaf area of the trees. The third level of yeast extract (K_3) was distinguished on producing a high-

est length of shoots (24.71 cm), and surpass significantly the other two treatments (K_1 and K_2).

The results also indicated that the interaction treatments between ascorbic acid and yeast had a significant effect on the studied traits. They increased the shoot length and the area of single leaf, but the highest values of these characteristics (27.11 cm and 28.06 cm^2) observed by the treatment of third level of ascorbic acid and dry yeast together (C_3K_3) which was dominant on all other interaction treatments. The lowest values were 21.88 cm and 25.11 cm^2 for shoot length and leaf area respectively, that were produced by C_1K_1 treatment.

Chlorophyll in leaves and TSS% in fruits

The results in Table 1 indicated that the foliar spraying with ascorbic acid increased significantly the chlorophyll content in leaves and the soluble solids percentage in fruits of pear trees. The third treatment (C_3) was more effective and gave the highest chlorophyll content (12.37 SPAD and 12.51%) to these characteristics respectively, where the first treatment (C_1) gave the lowest values.

Regarding the spraying of dry yeast extract, the third concentration (K_3) solely had a significant increment on chlorophyll content in leaves (12.11 SPAD) exceeded the control and K_2 treatments. Whereas all treatments had not affected on TSS% in pear fruit.

The results also indicated that the interaction treatments between ascorbic acid and yeast extract had a significant effect on the leaf chlorophyll content and the ratio of TSS of pear fruits. It was found that the interaction between the third levels of ascorbic acid and dry yeast extract (C_3K_3) resulted the highest values of chlorophyll content in leaves (12.53 SPAD) and TSS% in fruits (12.63%) and surpass significantly on the other interaction treatments, meanwhile the lowest values were at control treatment (C_1K_1).

Fruits and yield

The results in Table 2 indicated that the increase in the level of spraying with ascorbic acid increased the fruit set percentage, fruits and yield features, and the third level (C_3) was superior in fruit set (7.01%), number of fruits (82.02 fruit $tree^{-1}$), fruit weight (98.78 g), yield of a tree (8.11 kg) and the yield of area unit (4.05 Tons $Feddan^{-1}$). On contrast, the control treatment brought the lowest values for these features.

It was noted from the same Table that increasing the level of spraying with yeast extract increased fruit set %, No. fruits per tree, fruit weight, tree yield (kg) and yield of Feddan unit, especially the treatment of highest concentration (K3) which found out the larger values of fruit set (6.66%), number of fruits per tree (80.44 fruits), fruit weight (91.78 g),

Table 1. Effect of spraying with ascorbic acid and dry yeastextract on vegetative growth, leaves content of chlorophyll and TSS% inpear fruit

Ascorbic acid ($mg\ L^{-1}$)	Yeast Extract ($mg\ L^{-1}$)	Characteristics			
		Shoot length (cm)	Leaf area (cm^2)	Leaf Chlorophyll (SPAD units)	TSS % in fruit
0 (C_1)	0(K_1)	21.88 f	25.11 e	11.09 e	11.97 c
	2(K_2)	21.81 f	25.24 e	11.13 e	12.00 c
	3(K_3)	23.02 e	26.06 d	11.76 d	12.05 c
75 (C_2)	0 (K_1)	22.47 ef	25.14 e	11.34 e	12.03 c
	2 (K_2)	22.94 e	26.38 d	11.95 cb	12.18 c
	3 (K_3)	24.00 d	26.85 c	12.05 bcd	12.19 c
150 (C_3)	0 (K_1)	24.89 c	27.09 c	12.25 abc	12.04 b
	2 (K_2)	25.74 b	27.64 b	12.33 ab	12.50 ab
	3 (K_3)	27.11 a	28.06 a	12.53 a	12.63 a
Ascorbic acid($mg\ L^{-1}$)	0 (C_1)	22.24 c	25.47 c	11.32 c	12.01 c
	75 (C_2)	23.13 b	26.12 b	11.78 b	12.13 b
	150 (C_3)	25.91 a	27.59 a	12.37 a	12.51 a
Yeast extract($mg\ L^{-1}$)	0 (K_1)	23.08 a	25.09 ab	11.56 b	12.01 a
	2 (K_2)	23.49 a	25.51 a	11.80 b	12.23 a
	3 (K_3)	24.71 a	24.74 b	12.11 a	12.29 a

Means not sharing the same letter(s) with each column are significantly different at 0.05 level of probability

tree yield (7.40 kg) and yield of Feddan (3.70 tons) and exceeded K_1 treatment (control) that gave the lowest values of studied characteristics.

Concerning the interaction treatments, the C_3K_3 surpass significantly all other applications and gave the highest ratio of fruit set (7.70%), number of fruits per tree (83.41 fruits), fruit weight (103.33 g), tree yield (8.62 kg) and yield per area unit (4.31ton feddan^{-1}). The lowest values of the studied properties were seemed into the control treatment (C_1K_1) as follows, fruit set (5.09%), No. fruit per tee (78.65 fruits), fruit weight (77.33 g), tree yield (6.08 kg) and yield of feddan (3.04 tons).

Discussion

The results showed the positive role of ascorbic acid as similar growth regulator on studied characteristics, and that may be attributed to ability of ascorbic acid to encourage growth and increase the root area, which in turn increases the rate of absorption of nutrients and increases the leaves area and chlorophyll pigment in leaves. They contribute to more photosynthesis process and thus higher vegetative growth, fruiting, and total soluble solid concentration in fruits (Asselbergs *et al.*, 1997). Also, ascorbic acid has a role in regulating the processes of cell division, respiration and stimulation the bio-manufacturing of amino acids. It also executes a role in converting protein and its participation in the reactions of enzymatic and non-enzymatic reactions in cells (Blokhina *et al.*, 2003). These findings were consistent with Ahmed and Morsy (2001), Khattab and Shaban (2012) and Al-Douri (2014).

The yeast contains large quantities of mineral elements, proteins, carbohydrates and vitamins, which cause an increase in the physiological processes inside the plant. This is improving vegetative growth, leaf area and chlorophyll content of trees. Therefore, the rates of photosynthesis rises and this means the manufacture of larger quantities of carbohydrates which are transferred to different parts of the plant such as stems, branches and fruits (Al-Dulaimi and Al-Rawi, 2015). Also, the yeast contains substances that encourage and regulate growth such as auxins, gibberellins and cytokines. These substances play a major role in the transfer of products of the photosynthesis process to the vegetative parts. Therefore, vegetative growth properties, fruit weight and yield of trees were raised when the pear trees were sprayed with dry yeast extract (Al-Nuaimi, 2005; Al-Douri, 2007). These findings confirm the findings of Saleh (2006); Eman *et al*. (2008) and Basheer (2019).

Conclusion

This work proved the role of foliar spray with ascor-

Table 2. Effect of spraying with ascorbic acid and dry yeast on fruit set, fruits and yield characteristics of pear trees

Ascorbic acid (mg L^{-1})	Yeast Extract (mg L^{-1})	Characteristics				
		Fruit set (%)	No. Fruit per tree	Fruit Weight (g)	Tree yield (kg)	Yield (ton/feddan)
0 (C_1)	0 (K_1)	5.09 f	78.65 c	77.33 g	6.08 f	3.04 f
	2 (K_2)	5.34 ef	78.22 c	78.67 g	6.15 f	3.08 f
	3 (K_3)	5.94 cde	78.80 c	82.00 ef	6.46 f	3.23 ef
75 (C_2)	0 (K_1)	5.85 de	79.00 c	85.00 de	6.71 de	3.36 de
	2 (K_2)	5.99 cd	78.98 c	87.67 cd	6.92 d	3.46 d
	3 (K_3)	6.35 bcd	79.10 c	90.00 c	7.12 d	3.56 d
150 (C_3)	0 (K_1)	6.81 b	80.71 b	94.67 b	7.64 c	3.82 c
	2 (K_2)	6.53 bc	81.94 b	98.33 b	8.06 b	4.03 b
	3 (K_3)	7.70 a	83.41 a	103.33 a	8.62 a	4.31 a
Ascorbic acid (mg L^{-1})	0 (C_1)	5.46 c	78.03 b	79.33 c	6.23 c	3.12 c
	75 (C_2)	6.06 b	79.56 b	87.56 b	6.92 b	3.46 b
	150 (C_3)	7.01 a	82.02 a	98.78 a	8.11 a	4.05 a
Yeast extract (mg L^{-1})	0 (K_1)	5.92 b	79.45 b	85.67 c	6.81 c	3.41 c
	2 (K_2)	5.95 b	79.71 ab	88.22 b	7.04 b	3.52 b
	3 (K_3)	6.66 a	80.44 a	91.78 a	7.40 a	3.70 a

Means not sharing the same letter(s) with each column are significantly different at 0.05 level of probability

bic acid and dry yeast extract on enhancing the vegetative growth, fruit set percentage, fruit and yield of Le-Conte pear trees, especially the concentrations 150 mg L^{-1} ascorbic acid, 3 g L^{-1} dry yeast and their interaction, thus it could be to repeat this experiment with higher concentrations to come up with a proper recommendation.

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