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Effect of NAA, KNO_3 AND Fe on Some Characteristics of Leaf and fruit of Peach (*Prunus persica* L.) cv. Early coronet

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Introduction

The peach *Prunus persica* is known as a species of prunus, is a member of the family Rosaceae (Grisez et al., 2000). Today, peaches are the third largest commercial fruit in Iraqi Kurdistan Region, after grapes and apples, Duhok is the major producer of peaches in Iraq. The plant crops heavily year after year, this tends to decrease nutrients availability in soil due to continuous removal of nutrients from the soil subsequently, the application of fertilizers to improve yield of plant is required (Westwood, 1978). Auxins such as NAA have been used since long time to improve fruit quantity and quality in many deciduous fruit tree. Antonio and Bettio (2003) showed that treating peaches cv. Diamante by the application of (NAA) at the rate of (30mg.L-¹) led to increase fruit size and to delay the harvesting period of peaches. Ruth et al. (2006) studied the effect of synthetic auxins on fruit size of five cultivars of Japanese plum (Kesselmen'; 'Songold'; 'Black Diamond'; 'Royal Diamond' and 'Royal Zee' by (30 mg.L^{-1} NAA) at the beginning of pit-hardening, caused an appreciable and significant increase in fruit size. The total yield of all five cultivars was also increased dramatically. Since most of Iraqi soils are calcareous and their pH is high (Al-Zubaidi, 1989), this tends to decrease some nutrients availability. Potassium regarded as one of the essential macronutrients for plant growth, development and important for different physiological properties (Ashley et al., 2006). Potassium activates a number of enzymes, including those involved in the synthesis of carbohydrates, and is also involved in the neutralization of organic acids and the promotion of normal cell division and growth (Ruiz, 2006). Iron plays an important role in the activation of chlorophyll and in the synthesis of many heme proteins such as different cytochrome, which participate in different functions in the plant metabolism (Bhandari and Randhawa 1985). Sanz et al. (2002) showed that the treatment of peach cv. with Fe-EDDHA at the level of 50g per tree by adding two rows resulted in a significant increase in leaf chlorophyll content of peach. The objective of this study was to examine the ability of evaluate and determine where NAA, KNO_3 and Fe applied to the canopy of coronet peach to increase yield and improve yield component characteristic.

Materials and Methods

This study was conducted at Seije, 15km north of Duhok city, Kurdistan Region, Iraq in 2008. Trees used for this investigation were four years old peach (*Prunus persica* L) cv. Early coronet budded on seedling peach rootstocks. The experiment was arranged as factorial complete randomize design (RCBD). The comparison among means was tested according to Duncan's multiple range tests at 5% level. The comparison among means was tested according to Duncan's multiple range tests at 5% level. Each tree was foliar sprayed to drip point with a solution containing (0 , 5 ppm NAA , 0, 0.1, 0.2 % KNO_3 and 0, 30, 60ppm Fe) alone or in combination at two times on April 24-2008 and May 25-2008, using 16 Liter sprayer. At the final harvest (1st June), twenty fruits were picked up randomly from each replicate as a composite sample. The measurements: 1-Average Leaf Area (cm^2) 2-Chlorophyll (a) 3-Fruit pulp thickness (mm) 4-Seed Weight (g) 5- Fruit Dry Weight (%) 6- Leaf Nutrient Content (P, K, Ca, and Fe) 7- Flower Bud Initiation (%).

Results

Leaf area (cm^2): Table in table (1) shows that increasing the levels of NAA, KNO_3 and Fe significantly increased leaf area as compared to the control. The highest leaf area (19.53cm^2) was obtained when the trees were treated with 5ppm NAA, 0.2% KNO_3 and 60ppm Fe, whereas the lowest (12.30cm^2) was recorded in the untreated trees.

Chlorophyll (a) content ($mg.g^{-1}$ fresh weight) of leaves: Leaf chlorophyll a was increased significantly by adding NAA, KNO_3 and Fe to the trees. Also tree received 5ppm NAA × 0.2% KNO_3, 5ppm NAA × 60ppm Fe and 0.2% KNO_3 × 60ppm Fe significantly gave the highest leaf chlorophyll (a) content. The interactions of NAA × KNO_3 × Fe showed a significant increase in chlorophyll (a) (data are not shown).

Pulp thickness (mm): The highest significant pulp thickness was attained in fruit sprayed with 5ppm NAA, 0.2% KNO_3 and 60ppm Fe. The maximum significantly pulp thickness was noticed when trees were sprayed with 5ppm NAA × 0.2% KNO_3 × 60ppm Fe which was significantly different from the other interactions and the control (table 2). The same results shown in the seed weights and fruit dry weight when trees sprayed with NAA, KNO_3 and Fe (data are not shown).

Leaf nutrients (%): Data in table (3) shows that the Leaf potassium was increased significantly by increment of NAA up to 5ppm, KNO_3 up to 0.2% and Fe up to 60ppm .The concentration of potassium in the leaves of tree receiving 5ppm NAA, 0.2% KNO_3 and 60ppm Fe was 2.18%, which was surpassed the other interactions. Also leaf phosphorus, leaf calcium, and leaf iron were increased significantly (data are not shown) by adding 5ppm NAA or 0.2% KNO_3 and 60ppm Fe.

Effect of NAA, KNO_3 and Fe on Flower Bud Initiation: Flower buds percentage was not affected significantly by NAA and Fe levels, while the Shoot from trees treated with 0.1 % KNO_3 or 0.2 % KNO_3 gave significantly higher values for flower buds percentage as compared with those received noKNO_3. Concerning the interaction, a significant increase in flower bud percentage was recorded in shoots from trees treated with 0ppm NAA × 0.1% KNO_3 × 60ppm Fe which was significantly different from the untreated trees (table 4).

Discussion

It is observed from the above mentioned results in tables (1, 2, 3, 4, 5, 7, 8, and 9) that a significant increase occurred in chlorophyll (a), leaf area, pulp thickness, seed weight and fruit dry weight, and leaf nutrient contents (P, K, Ca, and Fe).This increasing by foliar spray with (NAA, KNO_3, and Fe) may be attributed to the role of NAA in increasing cell division and elongation and its role in enhancement of metabolite accumulation in leaves, also to increasing photosynthesis which leads to increase chlorophyll content in the leaves. Many studies showed that NAA plays an important physiological role in increasing the division and elongation of the cells. Moreover, it increases permeability of the cell wall which would allow greater amount of water and dissolve material to inter the cell (Heyn, 1993). The reasons behind this may be due to the physiological role of potassium in stimulation of enzymes responsible for carbohydrate synthesis and energy production, so physiological and nutritional status of plant will improve. Hence, potassium was found to be a regulator in closing and opening of stomata (Ashley et al., 2006). Iron is a transition metal, as it exists in more than one oxidation states, that is why it can accept or donate electrons according to the radix potential of the reaction. Large portion of iron is found to be associated with porphyries in the form of cytochromes, which are necessary for the electron transport system in mitochondria as well as chloroplasts. Iron is the main component of ferredoxin which is indispensable for the light reaction of photosynthesis and nitrogen fixation (Awad et al. (2000). Also it is observed from results in tables (10) that a significant increase occurred in flower Bud Initiation, this may be attributed to the role of potassium in activation of a number of enzymes including those involved in the synthesis of carbohydrate. It has been long known that carbohydrate levels in trees affected floral initiation in buds, thus carbohydrate levels must be high in plant tissue at the time of flora initiation to stimulate bud initiation, also potassium influence meristematic tissue growth and photosynthesis (Ruiz, 2006).

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Table (1): Leaf area (cm^2) of peach cv. Early Coronet as influenced by foliar spray of NAA, KNO_3 and Fe.

NAA (ppm)	KNO_3 (%)	Fe(ppm)			NAA × KNO_3	NAA Mean
		0	30	60		
0	0	12.30 l	13.10kl	13.75jk	13.05e	14.02b
	0.1	13.21 kl	13.74jk	14.57h-j	13.84d	
	0.2	14.49 ij	15.20f-i	15.83e-g	15.17c	
5	0	14.97g-j	15.76e-h	16.22e-g	15.65c	17.06a
	0.1	16.38d-f	16.80c-e	17.85bc	17.01b	
	0.2	17.53b-d	18.50ab	19.53a	18.52a	
NAA × Fe	0	13.33f	14.01e	14.72d	KNO_3 Mean	
	5	16.30c	17.02b	17.87a		
KNO_3 × Fe	0	13.64f	14.43e	14.98e	14.35c	
	0.1	14.80e	15.27de	16.21bc	15.43b	
	0.2	16.01cd	16.85b	17.68a	16.85a	
Fe Mean		14.81c	15.52b	16.29a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan’s multiple range test at 5% level.

Table (2): Pulp thickness (mm) of peach cv. Early Coronet as influenced by foliar spray of KNO_3 and Fe.

NAA (ppm)	KNO_3 (%)	Fe(ppm)			NAA × KNO_3	NAA Mean
		0	30	60		
0	0	14.39k	15.63jk	15.95i-k	15.32e	17.23b
	0.1	16.12h-k	17.65g-j	18.66f-i	17.48d	
	0.2	17.87g-j	18.95f-h	19.87e-g	18.90cd	
5	0	18.41g-j	20.10d-g	21.41c-f	19.97c	22.46a
	0.1	21.86c-e	22.92b-d	23.97a-c	22.92b	
	0.2	21.95c-e	25.44ab	26.06a	24.49a	
NAA × Fe	0	16.13d	17.41cd	18.16c	KNO_3 Mean	
	5	20.74b	22.82a	23.81a		
KNO_3 × Fe	0	16.40f	17.86ef	18.68de	17.65c	
	0.1	18.99de	20.29b-d	21.32a-c	20.20b	
	0.2	19.91cd	22.20ab	22.97a	21.69a	
Fe Mean		18.43b	20.12a	20.99a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (3): Leaf potassium (%) of peach cv. Early Coronet as influenced by foliar spray of NAA, KNO_3 and Fe.

NAA (ppm)	KNO_3 (%)	Fe(ppm)			NAA × KNO_3	NAA Mean
		0	30	60		
0	0	1.18h	1.46fg	1.67de	1.44d	1.57b
	0.1	1.35g	1.65de	1.68c-e	1.56c	
	0.2	1.54ef	1.66de	1.93b	1.71b	
5	0	1.37g	1.55ef	1.75cd	1.56c	1.80a
	0.1	1.56ef	1.84bc	1.93b	1.78b	
	0.2	1.95b	2.10a	2.18a	2.08a	
NAA × Fe	0	1.36d	1.59c	1.76b	KNO_3 Mean	
	5	1.63c	1.83b	1.96a		
KNO_3 × Fe	0	1.28e	1.51d	1.71c	1.50c	
	0.1	1.45d	1.74c	1.81bc	1.67b	
	0.2	1.74c	1.88b	2.05a	1.89a	
Fe Mean		1.49c	1.71b	1.86a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (4): Flower initiation in buds of peach cv. Early Coronet as influenced by foliar spray of NAA, KNO_3 and Fe.

NAA (ppm)	KNO_3 (%)	Fe (ppm)			NAA × KNO_3	NAA Mean
		0	30	60		
0	0	31.74d	35.25b-d	34.84b-d	33.94b	42.13a
	0.1	45.79ab	43.96a-c	48.01a	45.92a	
	0.2	46.70ab	45.94ab	46.97ab	46.54a	
5	0	33.49cd	35.84a-d	43.80a-c	37.71b	42.16a
	0.1	42.74a-d	43.73a-c	44.79a-c	43.75a	
	0.2	42.98a-d	45.04a-c	47.05ab	45.02a	
NAA × Fe	0	41.41a	41.72a	43.28a	KNO_3 Mean	
	5	39.73a	41.53a	45.21a		
KNO_3 × Fe	0	32.61b	35.54b	39.32ab	35.83b	
	0.1	44.26a	43.85a	46.40a	44.84a	
	0.2	44.84a	45.49a	47.01a	45.78a	
Fe Mean		40.57a	41.63a	44.25a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.