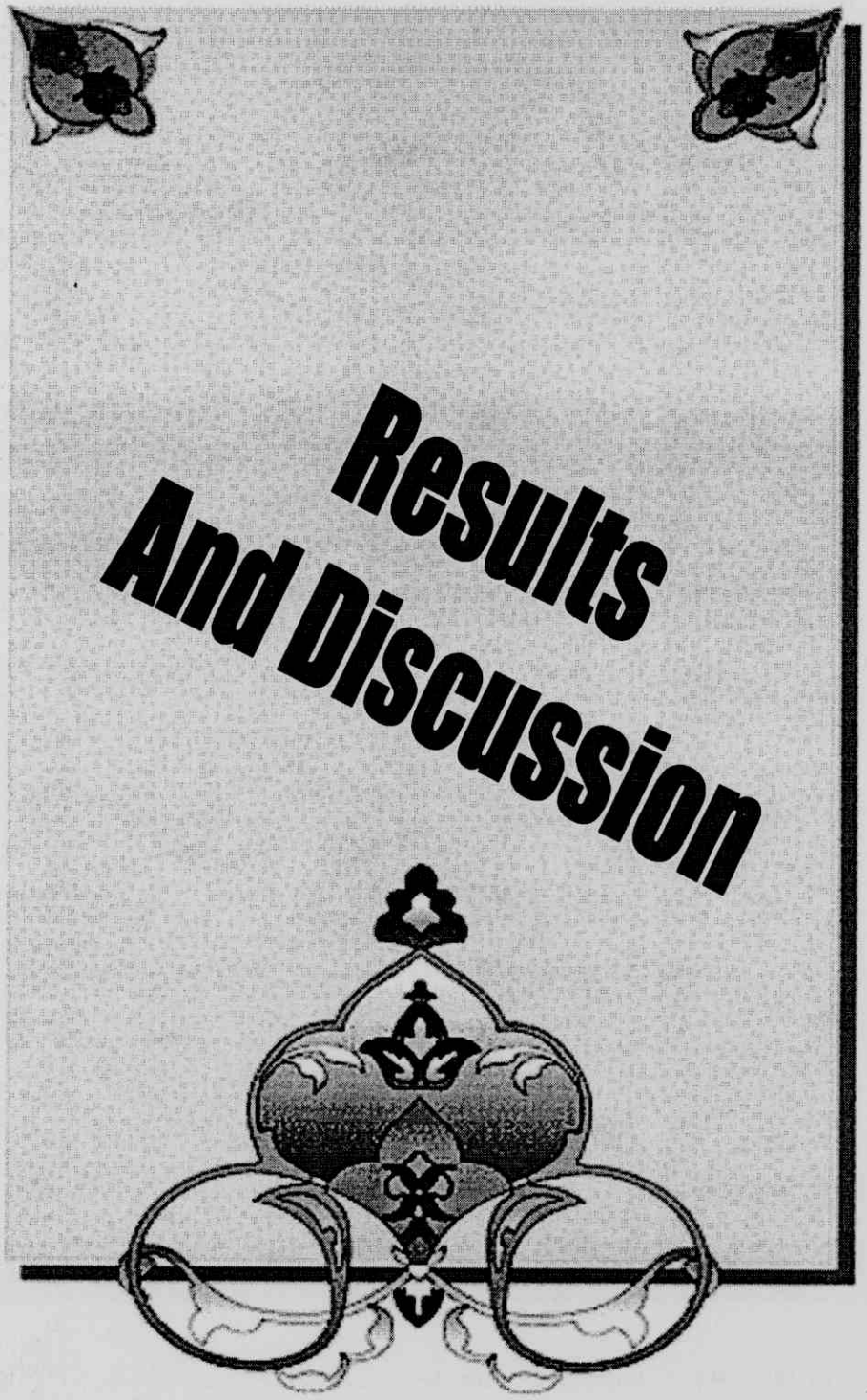
Results
And Discussion

4. RESUITS AND DISCUSSION

Effect of spraying active dry yeast and some micronutrients on

1- Leaf minerals content.

2- Leaf content of chlorophylls and carotenoides.

3- Yield and number of fruits/ trees.

4- Fruit quality.

4-a- physical properties.

4-a-1- Fruit weight.

4-a-2- Juice volume.

4-a-3- Weight of fruit juice.

4-a-4- Fruit volume.

4-a-5- Fruit length.

4-a-6- Fruit diameter.

4-b- Chemical properties

4-b-1- Titratable acidity.

4-b-2- Total soluble solids (TSS).

4-b-3- TSS / acid ratio.

4-b-4- Ascorbic acid.

4.1. Leaf minerals content:

Table (2) shows the effect of spraying active dry yeast and some micronutrients on leaf nutrient content of Balady mandarin trees in "On" year in season 2005. It is clear that, spraying combination of micronutrients and active dry yeast

treatments succeeded in increasing leaf N, P. K, Mn, Zn and B significantly as compared with those of control treatment. Concerning micronutrients treatments, leaves of trees sprayed with H_3BO_4 (0.2%) had higher amounts of Pand B content as compared with that of other micronutrients or yeast treatments.

Furthermore, spraying combination of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly increased leaf N, P, Mn and Zn nutrients as compared with those of the other treatments in 2005 season. In addition, leaf K content was significantly higher in $ZnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%), $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) treatments as compared with that of the other treatments. Both spraying combination of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly gave the highest concentrations of leaf B content as compared with that of the remaining treatments.

In the second season 2006, Table (3) shows that different treatments under study behaved similarly to those of the 2005 season as shown in Table (2), However, spraying combination of $ZnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%), $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly increased leaf N,P and K content as compared with those of the other treatments and control in 2006 season.

Regarding the effect of spraying active dry yeast and some micronutrients on leaf nutrient content of Balady mandarin

trees in "Off" year in season 2005, Table (4) clarify that spraying combination of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) gave the highest significant percentage of N content descendingly followed by the combined treatment of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + yeast (0.2%) and $ZnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) as compared with that of the other treatments and the control. Also, the combination treatments $ZnSO_4$ (0.5%)+ $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly increased leaf P, K, Mn and Zn contents, while, spraying combinations of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%), $ZnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) and $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) gave the highest significant concentrations of leaf B content.

Considering the second season (2006), Table (5) shows that different treatments under study behaved similarly to those aforementioned in season (2005). In addition, Active dry yeast treatment significantly increased leaf P content as compared with that in all other treatments. furthermore, spraying combined treatments $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + yeast (0.2%) gave the highest concentrations of leaf Mn and Zn content among the different treatments Moreover, the spraying combination of $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%), $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly increased leaf B content than that in the other treatments.

Generally , Spraying combination of micronutrients and active dry yeast treatments among the other treatments under

study succeeded in increasing leaf N, P., K, Mn, Zn and B as compared with spraying either active dry yeast and micronutrient treatments alone in "On" year and "Off" year in both seasons.

On the other hand, active dry yeast treatment among the other treatments used under study succeeded in increasing leaf P content in "Off" year in the second season. These results are in general agreed with the findings of **Salem et al., (1995)** and **Sayed (1998).** They reported that spraying Balady mandarin with mixtures of various concentrations of Fe, Mn and Zn increased leaf mineral content. Also, **Badawy- Sabah (2005)** found that yeast induced the highest leaf N, P, Ca, Mg, Fe, Mn and Zn concentrations of Balady mandarin trees. In addition, **El-Saiada (2007)** and **Bakry (2007)** found that the yeast induced the highest leaf N, P, Ca, Mg, Fe, Mn and Zn concentrations of Balady mandarin trees and Jafa orange, respectively.

Table (2). Effect of spraying active dry yeast and some micronutrients on leaf nutrient content of Balady mandarin trees in " On" year. (Season 2005).

Nutrients / Treatments	Percentage (%)			Part Per million (PPM)		
	N	P	K	Mn	Zn	B
Control	2.27 I	0.123 I	0.70 F	24.67 K	25.00 I	37.76G
(1) $ZnSO_4$ (0.5%)	2.47 GH	0.130 H	0.92 E	29.33 K	59.67 BC	40.17 FG
(2) $MnSO_4$ (0.5%)	2.44H	0.150 F	0.98CD	71.00 G	26.67I	40.00 FG
(3)H_3BO_4 (0.2 %)	2.52FG	0.183 B	0.97C-E	40.33 J	30.00IH	47.50D
(4) yeast (0/2%)	2.55EF	0.183B	0.99C	28.00K	35.00 GH	42.00EF
(1+4)	2.59DE	0.183B	1.01BC	43.33IJ	57.33C	42.50EF
(2+4)	2.58D-F	0.183B	0.98C	92.00F	38.33FG	43.17E
(3+4)	2.57EF	0.157E	0.96C-E	45.67I	30.33IH	48.50CD
(1+2)	2.53EF	0.143C	1.07AB	121.67D	65.00AB	39.83FG
(1+3)	2.54EF	0.167D	1.05AB	51.00H	54.67CD	48.00CD
(2+3)	2.55EF	0.147FG	0.92DE	114.00E	46.33E	48.17CD
(1+2+4)	2.65C	0.187B	1.06AB	127.00C	64.00AB	39.00G
(1+3+4)	2.64CD	0.173C	1.07A	75.00G	43.67EF	50.33BC
(2+3+4)	2.72B	0.177C	1.08A	119.67D	38.67FG	51.50B
(1+2+3)	2.57EF	0.173C	1.05AB	136.00B	51.67D	55.00A
(1+2+3+4)	2.78A	0.193A	1.09A	144.67A	67.33A	55.33A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (3): Effect of spraying active dry yeast and some miconutrients on leaf nutrient content of Balady mandarin trees in " On year" (season 2006)

Nutrients / Treatments	Percentage (%)			Part Per million (PPM)		
	N	P	K	Mn	Zn	B
Control	2.24N	0.117I	0.72N	27.33K	29.67FG	35.17I
(1) $ZnSO_4$ (0.5%)	2.30M	0.130H	0.93M	34.00J	47.33C	39.50GH
(2) $MnSO_4$ (0.5%)	2.43L	0.143G	0.98I	93.00E	27.67G	38.17H
(3)H_3BO_4 (0.2 %)	2.54J	0.163DE	0.94L	43.33I	32.00F	44.83CD
(4) yeast (0/2%)	2.58G	0.170C	0.96K	42.33I	43.00D	38.00H
(1+4)	2.59F	0.163DE	1.02E	45.00I	56.00B	41.00FG
(2+4)	2.61E	0.167CD	1.00G	106.33D	43.33D	39.33GH
(3+4)	2.58G	1.153F	0.97J	53.67H	44.33CD	46.50BC
(1+2)	2.45K	0.160E	0.99H	162.00A	46.00CD	42.17EF
(1+3)	2.57H	0.150F	1.01F	73.33G	57.67B	44.17DE
(2+3)	2.55I	0.153F	1.02E	153.67B	44.33CD	46.50BC
(1+2+4)	2.65D	0.183AB	1.04D	162.00A	64.33A	41.83F
(1+3+4)	2.66C	0.187A	1.05C	82.67F	45.67CD	47.33AB
(2+3+4)	2.73B	0.187A	1.04D	140.00C	38.33E	48.33AB
(1+2+3)	2.61E	0.180B	1.07B	144.00C	56.67B	49.00A
(1+2+3+4)	2.75A	0.187A	1.08A	166.0A	67.33A	49.17A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (4): Effect of spraying active dry yeast and some micronutrients on leaf nutrient content of Balady mandarin trees in "Off" year (season 2005)

Nutrients / Treatments	Percentage (%)			Part Per million (PPM)		
	N	P	K	Mn	Zn	B
Control	2.26M	0.117K	0.71C	22.33L	24.33H	37.67G
(1) $ZnSO_4$ (0.5%)	2.36L	0.137J	0.93B	32.67J	58.67B	39.17FG
(2) $MnSO_4$ (0.5%)	2.43K	0.137J	0.95B	84.67F	29.33H	39.17FG
(3)H_3BO_4 (0.2 %)	2.52J	0.160FG	0.99B	44.00I	25.67H	47.17C
(4) yeast (0.2%)	2.54I	0.163EF	0.99B	27.33K	35.00G	39.67E-G
(1+4)	2.62D	0.160FG	1.00B	45.67I	62.67AB	40.33EF
(2+4)	2.59F	0.167E	0.98B	94.67E	36.33G	41.00EF
(3+4)	2.61E	0.153HI	0.95B	48.00I	39.00FG	48.33BC
(1+2)	2.56H	0.157GH	1.06B	128.00C	52.00C	41.83DE
(1+3)	2.56H	0.150I	1.05B	56.67H	50.00CD	47.83BC
(2+3)	2.57G	0.150I	1.05B	114.33D	45.33DE	47.17C
(1+2+4)	2.66B	0.183CD	1.05B	131.67C	64.00AB	43.33D
(1+3+4)	2.65C	0.190AB	1.03B	72.00G	45.67DE	52.00A
(2+3+4)	2.63D	0.180D	1.08B	127.67C	42.33EF	52.60A
(1+2+3)	2.57G	0.187BC	1.03B	145.00B	64.33AB	49.67B
(1+2+3+4)	2.74A	0.193A	1.60A	161.33A	65.33A	53.83A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (5): Effect of spraying active dry yeast and some micronutrients on leaf nutrient content of Balady mandarin trees in "Off" year (season 2006)

Nutrients / Treatments	Percentage (%)			Part Per million (PPM)		
	N	P	K	Mn	Zn	B
Control	2.24J	0.117H	0.72L	32.33J	26.00H	35.33G
(1) $ZnSO_4$ (0.5%)	2.39I	0.133G	0.44K	34.67J	48.00E	37.33FG
(2) $MnSO_4$ (0.5%)	2.39I	0.153DE	1.00F	76.67G	28.33H	38.17EF
(3)H_3BO_4 (0.2 %)	2.46H	0.167C	0.96J	52.00H	26.67H	45.33B
(4) yeast (0.2%)	2.53E-G	0.187A	0.97I	43.00I	53.33G	38.67D-F
(1+4)	2.55DF	0.163C	0.99G	54.00H	61.00BC	40.67C-E
(2+4)	2.58DE	0.183AB	0.98H	98.67E	42.00F	41.50C
(3+4)	2.59D	0.157D	1.00F	53.33H	38.00G	45.50B
(1+2)	2.43H-I	0.147F	1.02E	156.67B	52.33D	42.00C
(1+3)	2.49GH	0.150EF	1.02E	82.00F	45.67E	45.00B
(2+3)	2.52F-H	0.153DE	0.99G	134.00D	48.33E	44.67B
(1+2+4)	2.60CD	0.183AB	1.04D	165.00A	65.33A	41.00CD
(1+3+4)	2.65BC	0.183AB	1.05C	85.67F	45.67E	45.33B
(2+3+4)	2.69AB	0.180B	1.02E	144.00C	38.67G	48.17A
(1+2+3)	2.58DE	0.183AB	1.06B	159.67B	58.00C	49.33A
(1+2+3+4)	2.71A	0.183AB	1.08A	165.33A	62.00B	48.83A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

2. Leaf content of chlorophylls and carotenoides

Table (6) shows the effect of active dry yeast and some different micronutrients on some leaf parameters of Balady mandarin during "On" year trees. It is clear that spraying micronutrient Zn, Mn, B and active dry yeast either single or in combination significantly increased chlorophyll "A" as compared with that of the control in both seasons.

Furthermore, spraying $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) +H_3BO4 (0.2%) + yeast (0.2%) in the first season as well as spraying $MnSO_4$ (0.5%) + yeast (0.2%) in the second season showed the highest values of chlorophyll "A" content, On the other hand, the lowest leaf chlorophyll "A" content was recorded in control trees in both seasons.

Meanwhile, spraying Balady mandarin trees in "On" year with $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO4 (0.2%) + yeast (0.2%) significantly increased leaf content of chlorophyll B as compared with that of the control in both seasons of study. Moreover, in the second season (2006), all other treatments signficantly increased leaf content of chlorophyll B as compared with that of the control.

Regarding leaf carotenoides content they were significantly increased in all used treatments as compared with that of the control in both seasons of study. The highest leaf carotenoides content was recorded from spraying $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) on Balady mandarin during "On" year trees in both seasons.

Moreover, spraying micronutrients and/or active dry yeast statistically increased leaf carotenoides content in "On" year for both seasons of study.

As for the data of "Off" year of Balady mandarin trees, Table (7) that all used treatments in this study significantly increased leaf chlorophyll "A", "B" and carotenoides contents in both seasons as compared with those of the control.

In addition , it is quite evident that using $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) proved to be the most effective combination in enhancing leaf chlorophyll A, B and carotenoides content as compared with that of all other treatments in both seasons.

These results agreed with the findings of **Devi et al., (1997)** and **Meligy (1999)** on Orange trees, and **Sayed (1998)** on Balady mandarin trees. They found that foliar spraying with micronutrients (Fe, Zn and Mn) increased chlorophyll contents and photosynthetic activity. Also, **Qin et al., (1993)** noticed that foliar spray with ferrous sulphate and Zinc sulphate at 0.5% on lemon trees increased leaf chlorophyll content.

Bakry (2007) found that foliar spray with yeast extract on Jafa orange trees increased leaf photosynthetic pigments content.

Table (6): Effect of spraying active dry yeast and some micronutrients on some leaf parameters of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

Season / Treatments	Chlorophyll A mg/L		Chlorophyll B mg/L		Carotenoides mg/L	
	2005	2006	2005	2006	2005	2006
Control	23.79 F	24.84I	14.23B	14.38L	9.913H	9.853K
(1) ZnSO4 (0.5%)	25.44D	25.58G	14.30B	14.58J	10.030D	9.877J
(2) MnSO4 (0.5%)	25.89CD	26.25E	14.27B	14.54K	10.010F	9.877J
(3) H_3BO4 (0.2%)	24.83E	25.67G	14.29B	14.59I	10.033D	9.877J
(4) yeast (0.2%)	26.04C	25.37H	14.35B	14.60H	9.963G	9.880IJ
(1+4)	26.99AB	25.88F	14.38B	14.66E	10.053B	9.887GH
(2+4)	26.63B	27.17A	14.37B	14.63F	10.047C	9.903E
(3+4)	26.67B	25.90F	14.38B	14.61G	10.030D	9.890FG
(1+2)	25.66CD	26.71CD	14.36B	14.61G	10.013F	9.890FG
(1+3)	26.77B	25.60G	14.36B	14.63F	10.033D	9.893F
(2+3)	25.57CD	26.52D	14.64B	14.61G	10.023E	9.883HI
(1+2+4)	26.76B	26.87BC	14.65B	14.69B	10.047C	9.920D
(1+3+4)	26.95AB	26.83BC	14.67B	14.67D	10.053B	9.933C
(2+3+4)	26.83B	26.87BC	14.68B	14.68C	10.057B	9.940B
(1+2+3)	26.85B	26.94B	14.69B	14.67D	10.053B	9.937BC
(1+2+3+4)	27.42A	27.00AB	15.73A	14.75A	10.67A	9.957A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (7): Effect of Spraying active dry yeast and some micronutrients on some leaf parameters of Balady mandarin trees in "Off" year (Seasons 2005 and 2006).

Season / Treatments	Chlorophyll A mg/L		Chlorophyll B mg/L		Carotenoides mg/L	
	2005	2006	2005	2006	2005	2006
Control	23.82G	24.88E	14.26N	14.34O	9.917L	9.850J
(1) ZnSO4 (0.5%)	26.69CD	25.33D	14.32K	14.61J	10.007H	9.880HI
(2) MnSO4 (0.5%)	26.25E	25.85C	14.29L	14.57M	10.013G	9.887FG
(3) H_3BO4 (0.2%)	25.58F	26.12C	14.28M	14.54N	9.973J	9.907E
(4) yeast (0.2%)	26.82B-D	26.09C	14.35I	14.58L	9.957K	9.877I
(1+4)	26.84B-D	25.93C	14.38H	14.64H	9.997I	9.890F
(2+4)	26.92BC	26.14C	14.39G	14.69D	10.027F	9.903E
(3+4)	26.96B	25.96C	14.39G	14.58K	10.007H	9.907E
(1+2)	26.86BC	25.48D	14.33J	14.62I	10.017G	9.887FG
(1+3)	26.60D	25.89C	14.58F	14.65G	10.037E	9.883GH
(2+3)	26.69CD	26.01C	14.63E	14.67E	10.027F	9.890 F
(1+2+4)	26.93BC	26.61B	14.69B	14.70C	10.047C	9.937C
(1+3+4)	26.94BC	26.57B	14.65D	14.71B	10.043CD	9.940C
(2+3+4)	26.86BC	26.76AB	14.67C	14.66F	10.040DE	9.927D
(1+2+3)	26.93BC	26.51B	14.68B	14.67E	10.053B	9.953B
(1+2+3+4)	27.36A	26.99A	14.71A	14.76A	10.063A	9.973A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

3. Yield and number of fruits / trees

Yield of Balady mandarin trees during "On" year was expressed in Table (8) and Figs (1 and 2) as kg and number of fruits per tree. It is well noticed that all the combined treatments significantly gave the highest yield among the other treatments used in this study i.e. Active dry yeast, micronutrients and control treatments in a descending order in both seasons.

Moreover, spraying active dry yeast surprassed spraying Balady mandarin trees in " On " year with micronutrients in enhancing yield in both seasons of study.

However, no significant difference were noticed among the three sources of micronutrients under study i.e. $ZnSO_4$, $MnSO_4$ and H_3BO_4 in this respect for both seasons.

Considering combined treatments, it is quite evident that using $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) proved to be the most effective combination in enhancing number of fruits / tree as well as using $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + yeast (0.2%) which succeeded in raising up the yield significantly among the other used treatments of both seasons. On the contrary, micronutrient treatments were inferior statistically in this sphere but they gave a significant higher yield and number of friuts / tree as compared with that of the control treatment .

Table (9) and Figs (3 and 4) show the effect of spraying. Active dry yeast and some different micronutrients on fruits number and yield (kg) per tree of Balady mandarin during "off" year trees. It is quite evident that all treatments used significantly improved tree yield (No. of fruits/ tree) and yield (kg/tree) under study as compared with that of the control treatment in both seasons.

Table (8): Effect of spraying active dry yeast and some micronutrients on number of fruits and yield (kg) per tree of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

Season / Treatments	No. of fruits / tree		Yield (kg) tree	
	2005	2006	2005	2006
Control	403.33G	410.00I	41.55J	41.14G
(1) ZnSO4 (0.5%)	508.67EF	522.67H	56.29F-I	5575EF
(2) MnSO4 (0.5%)	518.33DFF	535.67GH	55.11HI	56.42EF
(3) H_3BO4 (0.2%)	503.33F	524.67H	54.00I	54.39F
(4) yeast (0.2%)	534.67CD	573.67E	60.78DE	62.72C
(1+4)	540.00CD	592.67D	62.65D	66.97B
(2+4)	526.00DE	620.33C	57.86E-H	67.62B
(3+4)	538.67CD	631.33BC	60.87DE	68.81AB
(1+2)	531.00DE	574.67E	58.23E-H	61.68CD
(1+3)	529.00DE	539.33G	55.55G-I	58.10EF
(2+3)	556.67C	559.00F	59.56D-G	59.63C-E
(1+2+4)	619.00B	631.67BC	75.31A	73.10A
(1+3+4)	622.00B	637.33B	70.91BC	69.77AB
(2+3+4)	623.33B	637.33B	68.36C	71.70AB
(1+2+3)	554.00C	541.67G	60.57DF	58.32DF
(1+2+3+4)	654.00A	662.67A	73.69AB	72.00AB

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

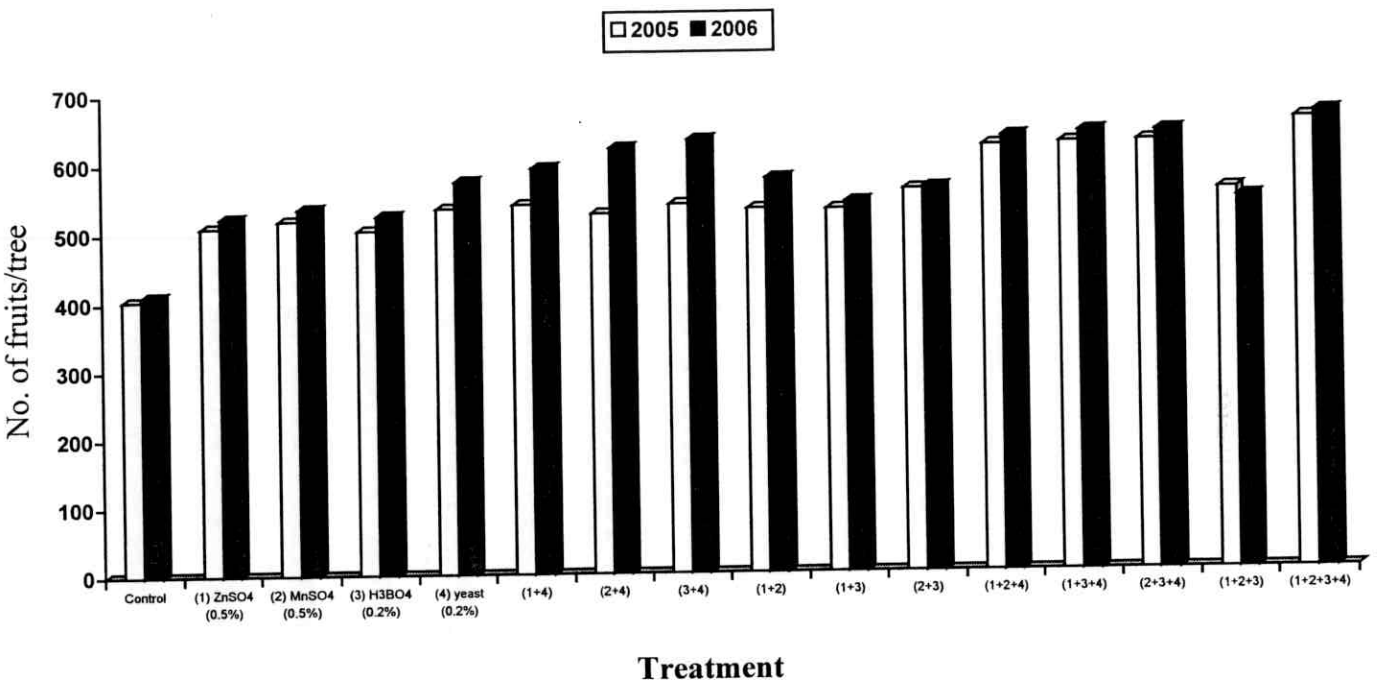

Fig. (1): Effect of spraying active dry yeast and some micronutrients on number of fruits per tree of Balady mandarin in "On" Year (Seasons 2005 and 2006).

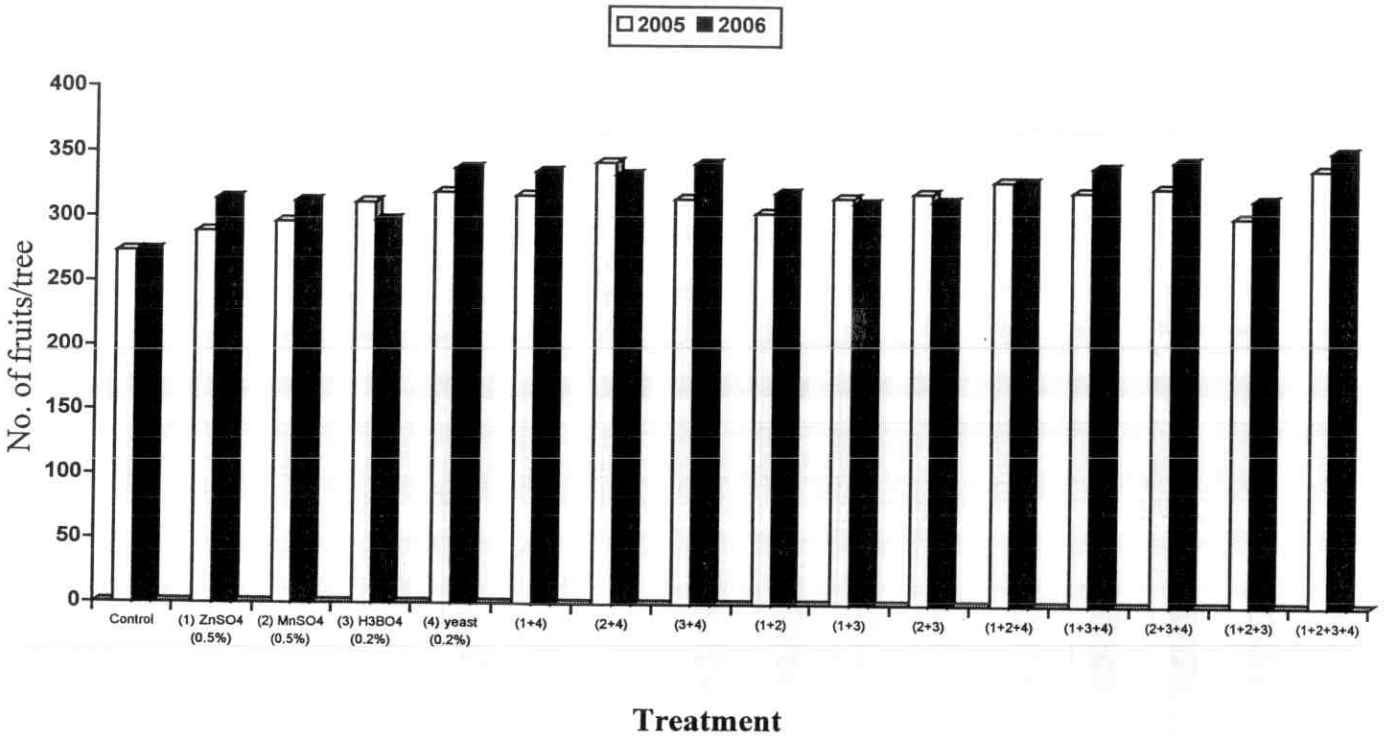

Fig. (2): Effect of spraying active dry yeast and some micronutrients on number of fruits per tree of Balady mandarin trees in "Off" year (Seasons 2005 and 2006).

Concerning the active dry yeast and micronutrient used in this study, spraying active dry yeast treatment was more promising than spraying micronutrient treatments in enhancing yield in both seasons of study.

Furthermore, the application of the three Studied micronutrients $ZnSO_4$ (0.5%), $MnSO_4$ (0.5%) and H_3BO_4 (0.2%) scored statistically similar values of tree yield in the first and second seasons.

Finally, all treatments increased the yield during "On" year and "Off" year of Balady mandarin trees in both seasons as compared with that of the control. In this respect, combined treatments with yeast caused the highest effect in increasing the yield followed by active dry yeast alone , while the lowest increase was obtained from micronutrient treatments alone. These results agreed with the findings of **Tawfeik et al., (2000)** and **Ibraheim et al., (2000)**. They found that combined active dry yeast with any macronutrients was more effective than using active dry yeast alone in improving the yield of Balady mandarin trees.

The obtained results regarding the effect of micronutrient treatments on tree fruiting go in line with those mentioned by **El-Baz (2003).** He found that Zn and B applications either alone or combined significantly increased weight and size of Mandarin fruits as compared with those of untreated trees.

The results of tree fruiting induced by active dry yeast are emphasized by the findings of **Ahmed et al., (1995)** on Balady mandarin and **Bakry (2007)** on Jafa orange. They found that maximum yield / tree (kg) was noticed when these trees were sprayed with active dry yeast.

Table (9): Effect of spraying active dry yeast and some micronutrients on number of fruits and yield (kg) per tree of Balady mandarin trees in "off" year (Seasons 2005 and 2006).

Season / Treatments	No. of fruits / tree		Yield (kg) tree	
	2005	2006	2005	2006
Control	273.33G	273.33G	27.88C	27.70C
(1) ZnSO4 (0.5%)	288.67FG	314.00E	31.20BC	35.57B
(2) MnSO4 (0.5%)	296.33EF	312.33E	31.21BC	33.00B
(3) H_3BO4 (0.2%)	311.67C-E	298.00F	34.91BC	33.77B
(4) yeast (0.2%)	319.67CD	338.33BC	38.00A-C	39.95A
(1+4)	317.33CE	336.00BC	37.76A-C	39.87A
(2+4)	343.00AB	334.00BC	41.73A	39.64A
(3+4)	315.33C-E	342.67A-C	37.94A-C	40.89A
(1+2)	304.67D-F	320.33DE	33.00BC	33.63B
(1+3)	316.67CE	313.00E	35.15BC	34.00B
(2+3)	320.67CD	314.67E	35.70A-C	35.24B
(1+2+4)	330.00AC	330.00CD	39.82AB	39.27A
(1+3+4)	322.33B-D	341.33AC	38.25A-C	39.82A
(2+3+4)	325.67B-D	346.33AB	37.77A-C	40.40A
(1+2+3)	303.00D-F	316.67E	34.94BC	35.88B
(1+2+3+4)	349.00A	354.00A	40.48AB	40.95A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

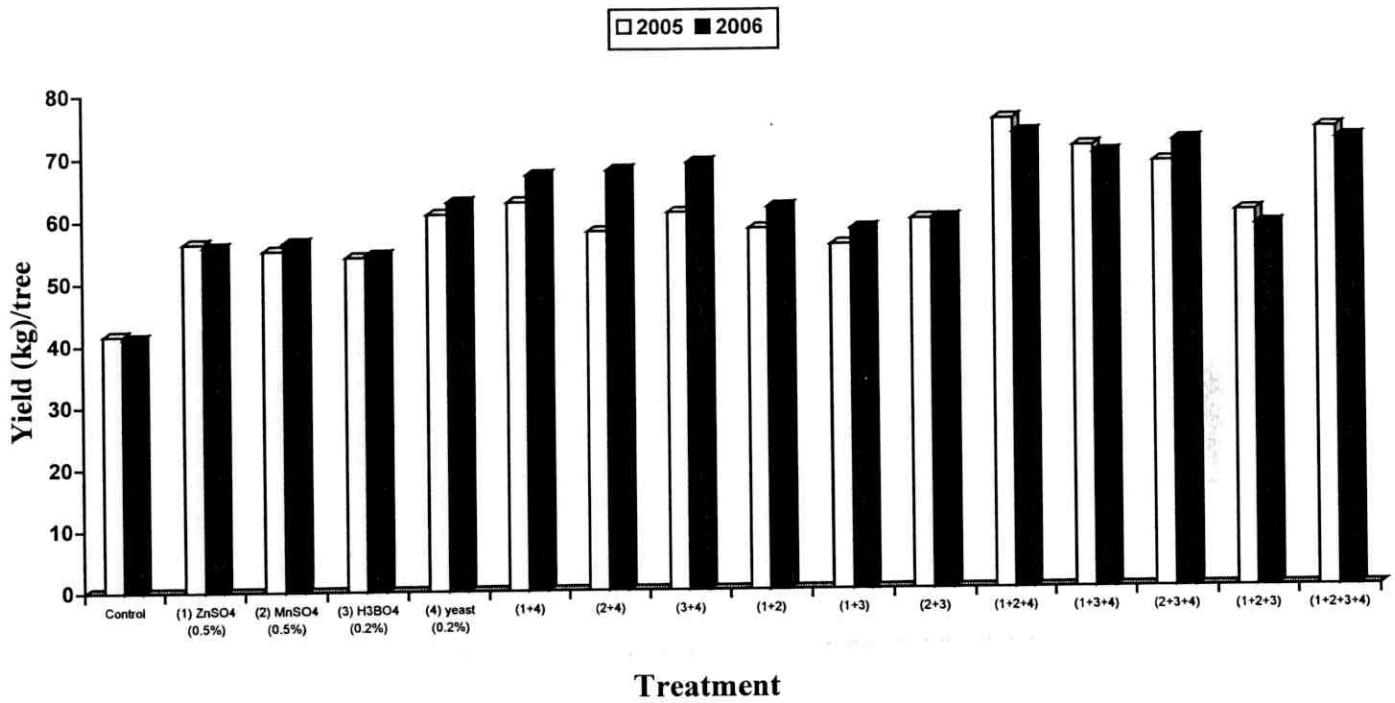

Fig. (3): Effect of spraying active dry yeast and some micronutrients on fruit yield (kg) per tree of Balady mandarin in "On" year (seasons 2005 and 2006).

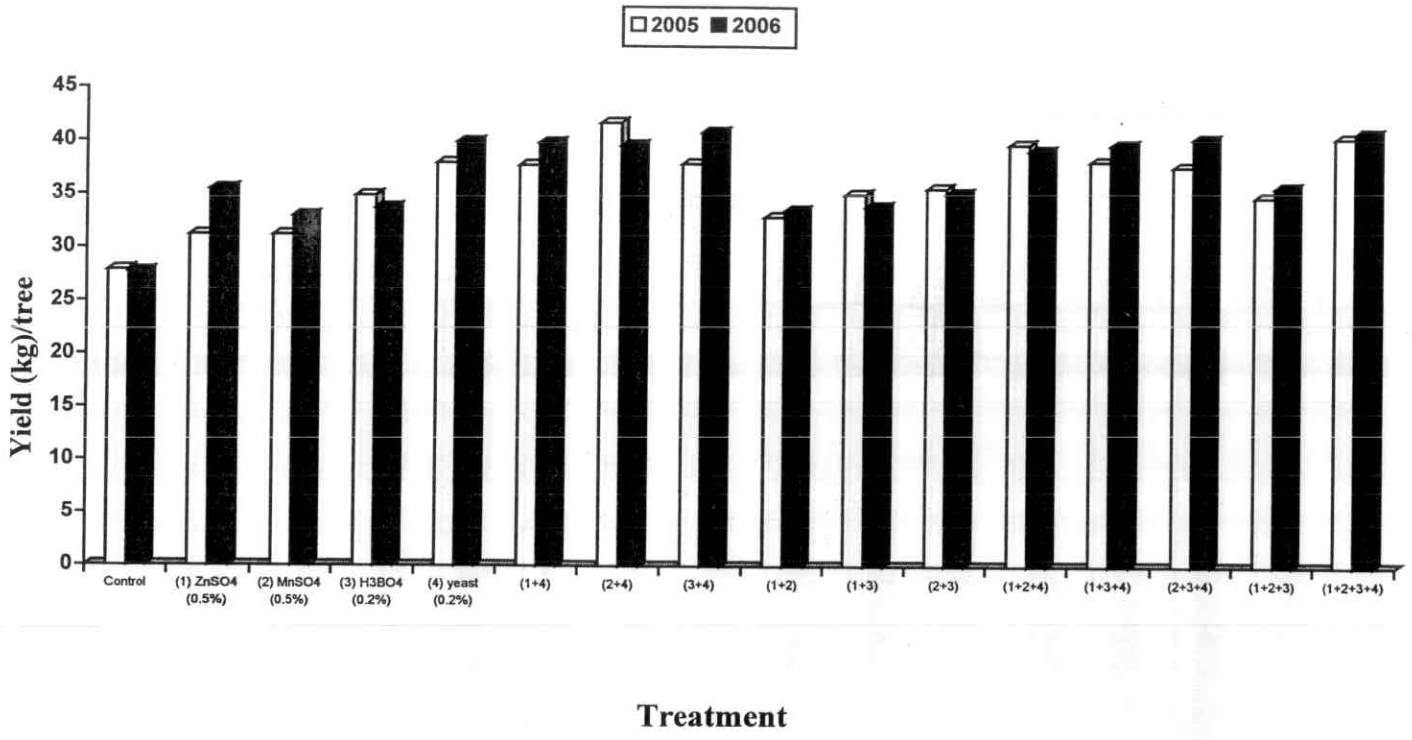

Fig. (4): Effect of spraying active dry yeast and some micronutrients on fruit yield (Kg) per tree of Balady mandarin in "off" year (seasons 2005 and 2006).

4. Fruit quality:

4.a Physical properties

4.a.1. Fruit weight

It is clear that from Data in Table (10) and Fig (5) that spraying Balady mandarin trees in "On" year with all combined treatments with active dry yeast significantly produced heaviest fruit weight as compared with that in micronutrient tretments and control in both seasons of study.

Table (11) and Fig (6) reveals that spraying Balady mandarin trees in "Off" year with active dry yeast either alone or combined with micronutrients significantly increased fruit weight as compared with that of the control in both seasons. In addition, spraying active dry yeast alone significantly increased fruit weight than that of spraying micronutrient treatments.

Furthermore, the interaction between active dry yeast and micronutrient treatments reveals that spraying $MnSO_4$ (0.5%) , ZnSO4 (0.5%) or H_3BO4(0.2 %) combined with active dry yeast at (0.2 %) proved to be the most effective interaction in enhancing fruit weight of Balady mandarin trees in "Off" year as compared with that of conbination (ZnSO4 (0.5 %) + (Mn SO4(0.5 %) , (ZnSO4 (0.5 %) +H_3BO4 (0.2 %) or MnSO4 (0.5 %) + H_3BO4 (0.2 %) in both seasons of study . Other combinations had an intermediate effect on fruit weight among the above mentioned extremes .

4.a.2. Juice volume

Table (10) and Fig (7) show that all treatments used failed to show any constant effect on volume of fruit juice of Balady mandarin trees during " on " year in both seasons of study . for example , spraying Balady mandarin trees with MnSO4 (0.5 %) alone or combined with yeast (0.2 %) , yeast combined with H_3BO4(0.2 %) , and yeast combined with MnSO4(0.5 %) + ZnSO4(0.5 %) significantly decreased volume of fruit juice as compared with that of the control in the first seasons of study , while in the second season there were no significant differences among them .

It is clear from Table (11) and Fig (8) that volume of fruit juice was significantly higher as a result of spraying H_3BO4(0.2 %) or yeast as compared with that of the control in both seasons of study in " Off " year . The other treatments had no constant trend for their effect on volume of fruit juice of Balady mandarin trees in " Off " year

4.a.3. Weight of fruit juice

Table (10) and Fig (9) demonstrate that the combination between $ZnSO_4$(0.5%) + H_3BO_4 (0.2%), $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3Bo_4 (0.2%) proved to be the most efficient combination in enhancing weight of fruit juice in the first season in On- year of Balady mandarin trees. Concerning the three sources of micronutrients used in this study, it is clear that spraying H_3BO_4 (0.2%) treatment mainly in the first season gave the highest values of juice weight than those of both $ZnSO_4$ (0.5%) and $MnSO_4$ (0.5%) micronutrients, which gave

Table (10): Effect of spraying active dry yeast and some micronutrients on fruits physical properties of Balady mandarin in "On" year (seasons 2005 and 2006).

Season / Treatments	Fruit weight (gm)		Juice volume (cm)		Juice weight (gm)	
	2005	2006	2005	2006	2005	2006
Control	103.00H	100.33D	44.87A-C	37.00A	46.20B-D	38.00A
(1) ZnSO4 (0.5%)	110.67B-G	106.67B-D	36.60E	35.17AB	38.60G	36.20A
(2)MnSO4 (0.5%)	106.33F-H	105.33B-D	38.93CD	36.20AB	41.33EG	37.07A
(3)H_3BO4 (0.2%)	107.33D-H	103.67CD	47.20AB	29.83C	50.00AB	30.57B
(4) yeast (0.2%)	113.67B-D	109.33A-C	45.60A-C	35.73AB	48.13A-C	36.47A
(1+4)	116.00B	113.00AB	42.33B-D	33.73AB	41.20E-G	34.97A
(2+4)	110.33B-G	109.00A-C	39.00DE	36.53AB	41.27E-G	37.47A
(3+4)	113.00B-E	109.00A-C	36.00E	33.57AB	37.27G	34.43A
(1+2)	109.67B-G	107.33B-D	42.80B-D	36.00AB	45.20CE	36.73A
(1+3)	105.00GH	107.67B-D	49.00A	33.60AB	51.20A	34.47A
(2+3)	107.00E-H	106.67B-D	40.80C-E	33.23AB	40.57FG	34.07A
(1+2+4)	121.67A	115.67A	36.00E	36.27AB	38.47G	37.70A
(1+3+4)	114.00BC	109.33A-C	46.60AB	34.40AB	43.33D-F	35.60A
(2+3+4)	109.67B-G	111.67AB	49.40A	36.87AB	52.27A	37.53A
(1+2+3)	109.33C-G	107.67B-D	50.00A	34.00AB	51.60A	34.73A
(1+2+3+4)	112.67B-F	108.67A-C	50.00A	33.17B	48.07A-C	35.13A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (11): Effect of spraying active dry yeast and some micronutrients on fruits physical properties of Balady mandarin in "Off" year (Seasons 2005 and 2006).

Season / Treatments	Fruit weight (gm)		Juice volume (cm)		Juice weight (gm)	
	2005	2006	2005	2006	2005	2006
Control	102.00F	101.33E	37.57FG	30.93CD	39.80H	31.40CD
(1) ZnSO4 (0.5%)	108.00DE	112.33A-C	40.20EF	35.47AB	43.32GH	36.00A-C
(2)MnSO4 (0.5%)	105.33EF	105.67C-E	47.67BC	33.23A-D	49.57DE	34.23A-D
(3)H_3BO4 (0.2%)	112.00CD	113.33AB	46.40CD	37.33A	48.73DE	38.33A
(4) yeast (0.2%)	119.00AB	118.00A	44.40C-E	37.00A	47.00E-G	38.20A
(1+4)	119.00AB	118.67A	47.20C	30.63CD	50.33C-E	31.40CD
(2+4)	121.67A	118.67A	52.40AB	34.27A-C	55.53AB	35.20A-C
(3+4)	120.33AB	119.33A	56.13A	29.43D	57.07A	30.27D
(1+2)	108.33DE	105.00DE	52.13AB	33.67A-D	54.53A-C	34.73A-D
(1+3)	111.00C-E	108.67B-D	55.60A	34.60A-C	51.90B-D	35.80A-C
(2+3)	111.33CD	112.00A-C	44.10CE	34.33A-C	46.63E-G	35.13A-C
(1+2+4)	120.67AB	119.00A	40.07EF	33.53A-D	45.70E-G	34.07A-D
(1+3+4)	118.67AB	116.67A	43.60C-E	32.17B-D	48.67DE	32.90B-D
(2+3+4)	116.00A-C	116.67A	46.80C	35.07A-C	49.33DE	36.13AB
(1+2+3)	115.33BC	113.33AB	35.00G	34.77A-C	48.00D-F	35.47A-C
(1+2+3+4)	116.00A-C	115.67AB	41.50D-F	33.27A-D	43.60F-H	34.13A-D

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

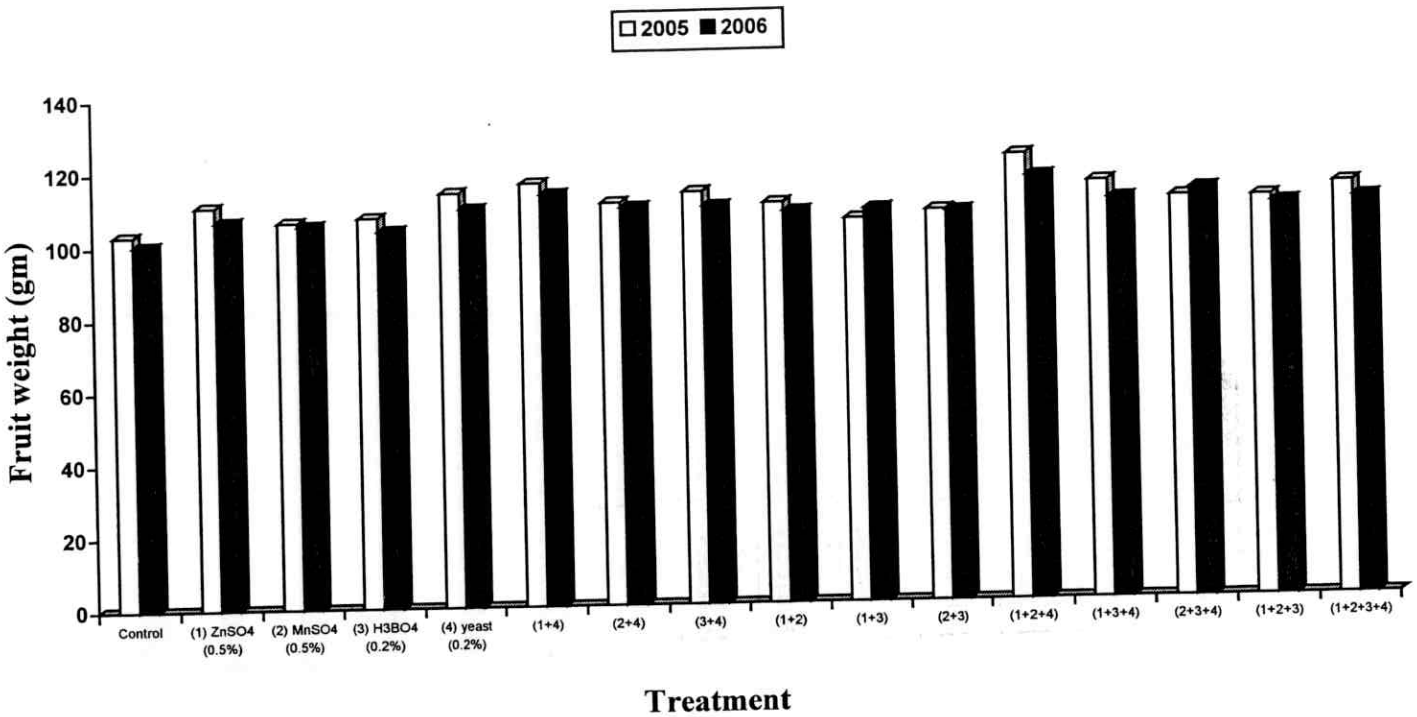

Fig. (5): Effect of spraying active dry yeast and some micronutrients on fruit weight (gm) of Balady mandarin trees in "On" year (Seasons 2005 and 2006)

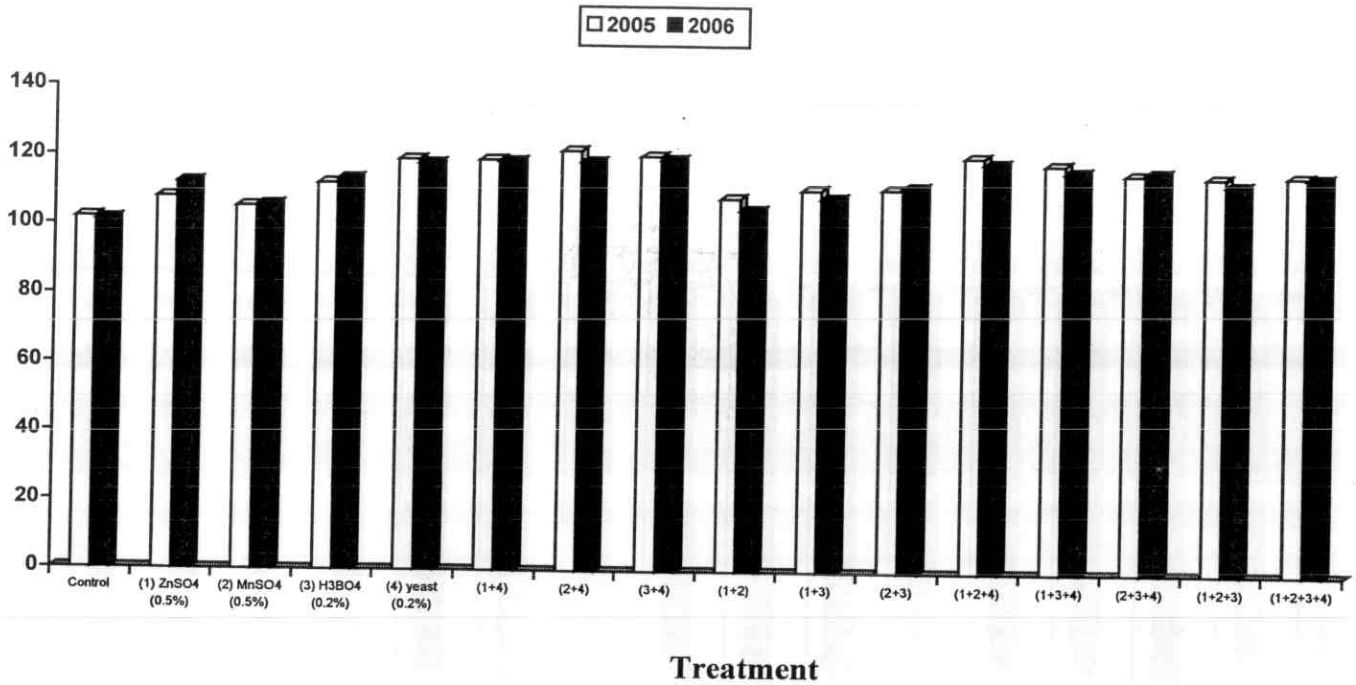

Fig. (6): Effect of spraying active dry yeast and some micronutrients on fruit weight (gm) of Balady mandarin trees in "Off" year (seasons 2005 and 2006).

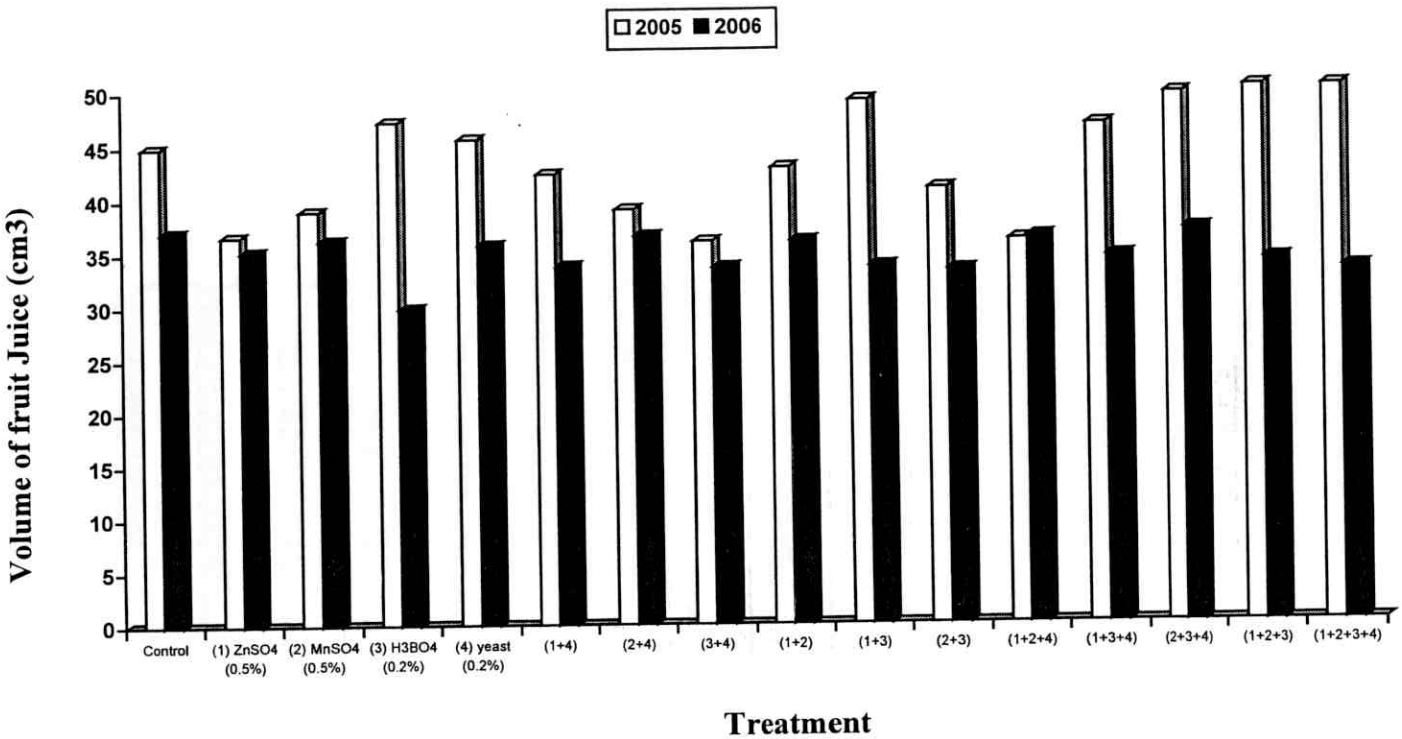

Fig. (7): Effect of spraying active dry yeast and some micronutrients on volume of fruit juice (cm^3) of Balady mandarin trees in "On" year (seasons 2005 and 2006).

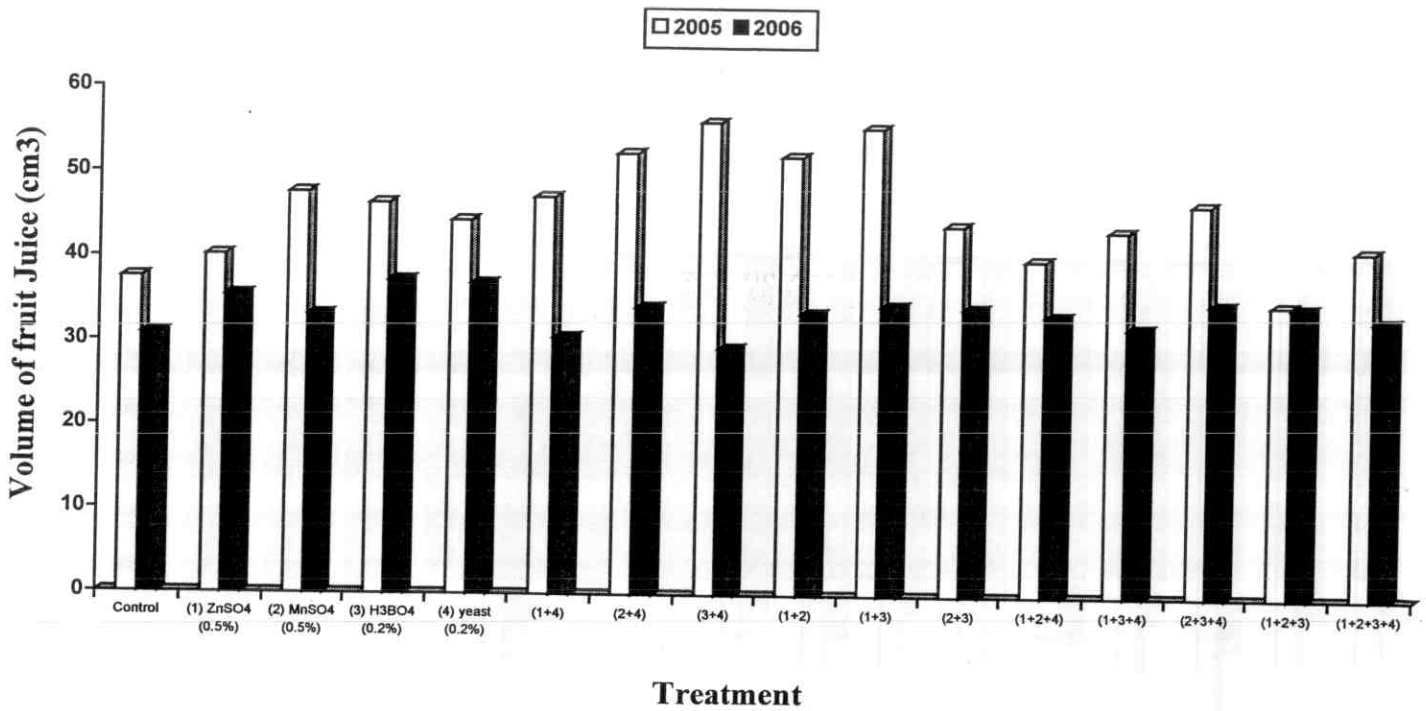

Fig. (8): Effect of spraying active dry yeast and same micronutrients on volume of fruit juice (cm^3) of Balady mandarin trees in "Off" year (seasons 2005 and 2006).

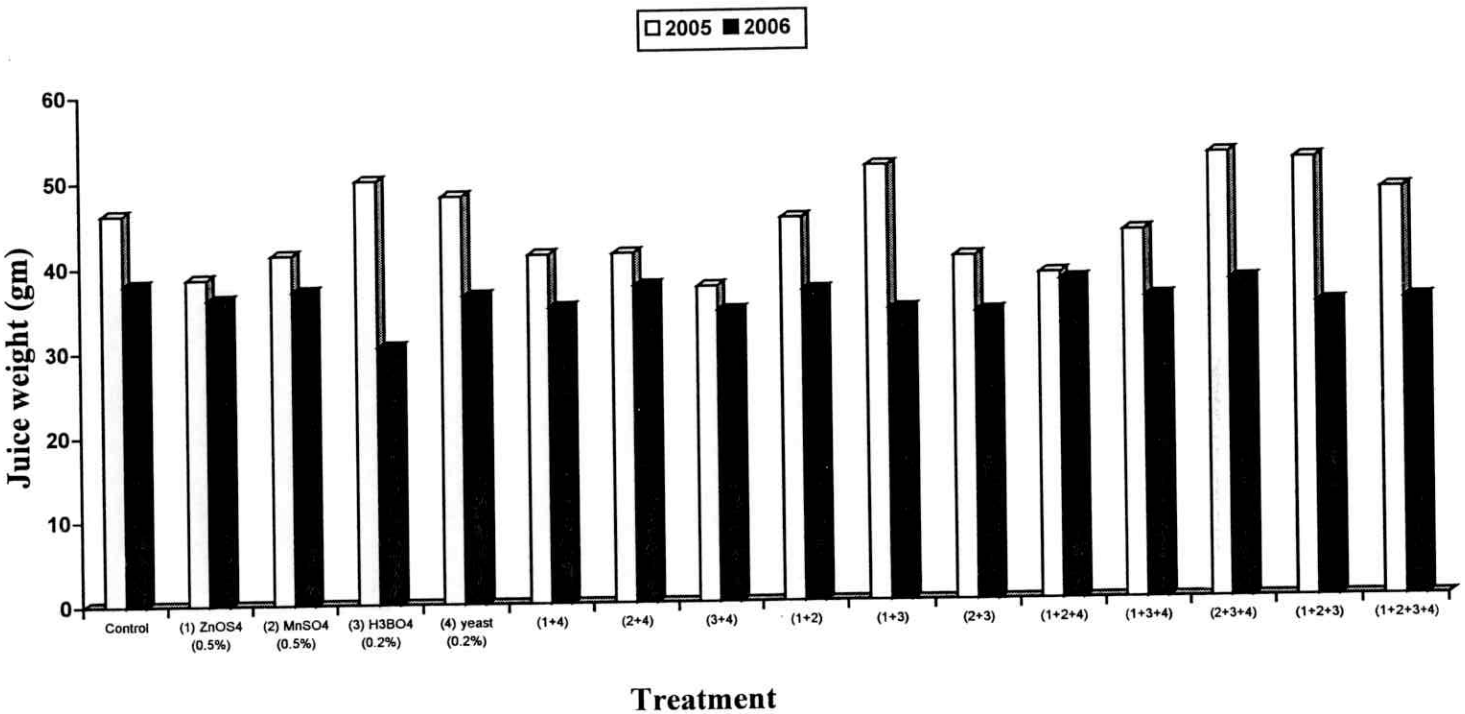

Fig. (9): Effect of spraying active dry yeast and some micronutrients on weight of fruit juice (gm) of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

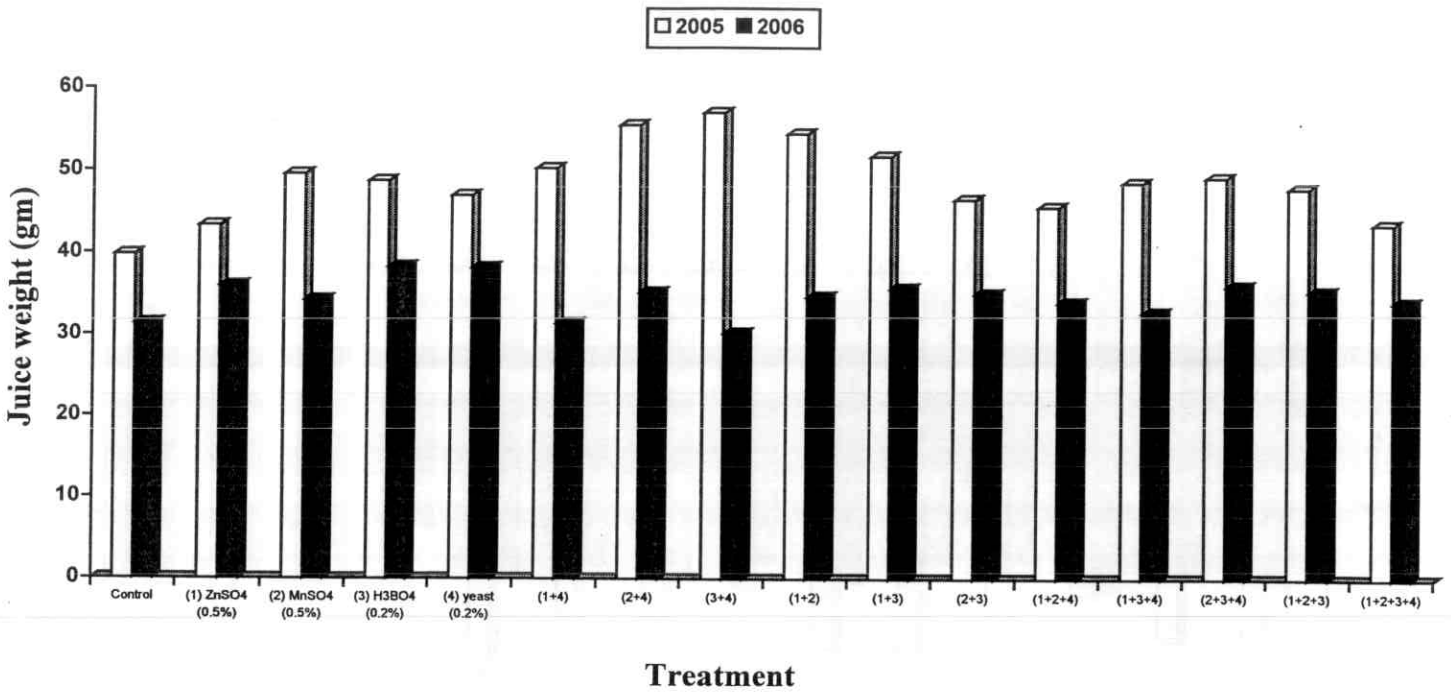

Fig. (10): Effect of spraying active dry yeast and some micronutrients on weight of fruit juice (gms) of Balady mandarin trees in "Off" year (seasons 2005 and 2006).

statistically similar values in this respect. On the other hand, no significant differences were noticed between all treatments used under study in this respect in the second seasons.

Moreover, Table (11) and Fig (10) revealed that spraying H_3BO_4 (0.2%) or yeast(0.2%) alone as well as the combined treatment of $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly increased the weight of fruit juice as compared with that of the control treatment in" Off " year both seasons of study. However, combined treatment of H_3Bo_4 (0.2%) + yeast (0.2%) significantly increased weight of fruit juice in the first season only while it significantly decreased weight of fruit juice in the second season as compared with that of the control for Balady mandarin trees in "Off" year .

4.a.4 Fruit volume:

The date in Tables (12 and 13) and Figs (11 and 12) reveals that in both seasons, all treatments significantly increased fruit volume of Balady mandarin either in "On" year or "Off " year than that of the control treatment however in addition , spraying Balady mandarin trees in "On" year with combined treatments of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + yeast (0.2%) in both season as well as combination between $Znso_4$ (0.5%) + yeast (0.2%) in the second season induced the highest values of fruit volume as compared with that of the other treatments and control.

Furthermore, the interaction between (H_3BO_4 (0.2%) + yeast (0.2%) proved to be the most effective interaction in enhancing fruit volume of Balady mandarin trees in "Off" year in both seasons.

4.a.5. Fruit length

It is clear from Table (12) and Fig (13) that there was no stable trend from season to another for the effect of different treatments in the present study on fruit length . for example , spraying Balady mandarin trees in "On" year with $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) significantly increased fruit length as compared with those sprayed with $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + (H_3BO_4 (0.2%) + yeast(0.2%) and with $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) in the first season while in the second season the opposite trend was found .

Table (13) and Fig (14) demonstrate that the combination between $MnSO_4$ (0.5%) + yeast (0.2%) and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) proved to be the most efficient combination in enhancing fruit length in the first season in "Off" year of Balady mandarin trees. Moreover, all treatments used under study recorded the lowest values of fruit length as compared with the control in the second season except spraying $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3Bo_4 (0.2%)

The result of effect of different treatments in the present study on fruit length of Balady mandarin trees in "Off " year proved the same conclusion as in "On" year. For example , spraying $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3Bo_4 (0.2%) significantly decreased fruit length as compared with that sprayed with $MnSO_4$ (0.5%) + yeast (0.2%) n the first season while in the second season the opposite trend was detected (Table 13 and Fig 14)

4.a.6. Fruit diameter

The data in Table (12) and Fig (15) showed the effect of spraying active dry yeast and some micronutrients on fruit diameter of Balady mandarin trees in "On" year.

From these data, it was clear that while spraying with $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) or $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) significantly increased fruit diameter as compared with that of control or spraying H_3BO_4 (0.2%) + yeast (0.2%) in the first season, there were no significant differences among them in the second season of study.

Concerning the three sources of micronutrients used in this study, it is clear that spraying H_3BO_4 (0.2%) treatment mainly in the first season gave the highest values of fruit diameter than those of both $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) micronutrients which gave statistically similar values in this respect. On the other hand, no significant differences were noticed between all treatments used under study in this respect in the second season.

The data of "Off" year as shown in Table (13) and (Fig 16) revealed that spraying Balady mandarin trees in "Off" year with $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) significantly increased fruit diameter as compared with that of the control treatment in the first season. On the other hand, no significantly differences were noticed between the three sources of micronutrients used in this study during the first season. Moreover, spraying $ZnSO_4$ (0.5%) treatment mainly in the second season gave the highest fruit diameter than those of both $MnSO_4$ (0.5%) and H_3BO_4

Table (12): Effect of spraying active dry yeast and some micronutrients on fruit volume, fruit length and fruit diameter of Balady mandarin in "on" year (Seasons 2005 and 2006).

Season / Treatments	Fruit volume (cm^3)		Fruit length (cm)		Fruit diameter (cm)	
	2005	2006	2005	2006	2005	2006
Control	124.33G	130.00E	4.10B	3.97 A-D	5.13CD	5.13A
(1) ZnSO4 (0.5%)	130.00F	131.33C-E	4.00B	3.57CD	5.00C-E	4.80A
(2)MnSO4 (0.5%)	134.67D-F	140.67B	4.37B	3.73B-D	5.00C-E	4.77A
(3)H_3BO4 (0.2%)	130.33F	137.00B-E	4.20B	4.03AC	5.30BC	4.67A
(4) yeast (0.2%)	146.00AB	142.00B	4.27B	3.73B-D	5.20C	4.80A
(1+4)	146.67AB	148.67A	4.10B	3.80B-D	4.80DE	4.73A
(2+4)	139.33CD	140.33B	4.40B	3.70B-D	5.97C-E	4.87A
(3+4)	134.33D-F	138.33BC	3.47C	3.77B-D	4.70E	4.77A
(1+2)	134.00D-F	135.67B-E	4.33B	4.10AB	5.23C	4.77A
(1+3)	131.67F	130.00D-E	4.00B	3.83B-D	5.10CD	4.77A
(2+3)	139.00C-E	140.00B	4.10B	4.10AB	4.83DE	4.90A
(1+2+4)	151.33A	150.67A	4.00B	3.90A-D	4.83DE	4.90A
(1+3+4)	141.33BC	140.00B	4.33B	3.90A-D	5.13CD	4.67A
(2+3+4)	133.00EF	135.33B-E	4.20B	3.90A-D	5.10CD	5.00A
(1+2+3)	133.67D-F	137.67B-D	4.93A	3.50D	5.57AB	4.80A
(1+2+3+4)	136.33C-F	136.33B-E	4.40B	4.30A	5.77A	4.63A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (13):Effect of spraying active dry yeast and some micronutrients on fruit volume, fruit length and fruit diameter of Balady mandarin in "off" year (Seasons 2005 and 2006).

Season / Treatments	Fruit volume (cm^3)		Fruit length (cm)		Fruit diameter (cm)	
	2005	2006	2005	2006	2005	2006
Control	125.67J	129.33G	4.43A-D	4.27A	5.20BC	4.80A-D
(1) ZnSO4 (0.5%)	142.00C-E	141.00B-F	4.70AB	3.90A-D	5.40AB	5.17A
(2)MnSO4 (0.5%)	136.33F-I	138.67D-F	4.50A-D	3.97A-D	5.47AB	4.97A-C
(3)H_3BO4 (0.2%)	141.00 C-F	141.33B-F	4.40A-D	3.87A-E	5.40AB	4.93A-C
(4) yeast (0.2%)	145.00BC	146.67B	4.47A-D	3.97A-D	5.30A-C	4.95A-C
(1+4)	147.33B	145.67BC	4.27BD	3.57D-F	5.47AB	4.47DE
(2+4)	144.33B-D	144.00B-D	4.73A	3.40F	5.60AB	4.60C-E
(3+4)	156.00A	152.67A	4.70AB	3.43EF	5.53AB	4.40E
(1+2)	140.76C-G	140.00C-F	4.80A	3.83A-F	5.80A	4.77B-D
(1+3)	142.67B-E	140.00C-F	4.67A-C	4.03A-C	5.50AB	4.80AD
(2+3)	132.33I	136.00F	4.67A-C	3.70B-F	5.50AB	4.87A-C
(1+2+4)	138.33E-H	138.00D-F	4.40A-D	3.63C-F	4.90C	4.80A-D
(1+3+4)	133.67HI	143.00B-E	4.47A-D	4.10AB	5.23BC	4.90A-C
(2+3+4)	135.67GI	137.33EF	4.53A-D	3.63C-F	5.40AB	4.70C-E
(1+2+3)	139.00D-G	143.67B-E	4.23CD	4.20A	5-10BC	5.10AB
(1+2+3+4)	142.00C-E	146.00BC	4.10D	3.53D-F	5.33A-C	4.87A-C

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

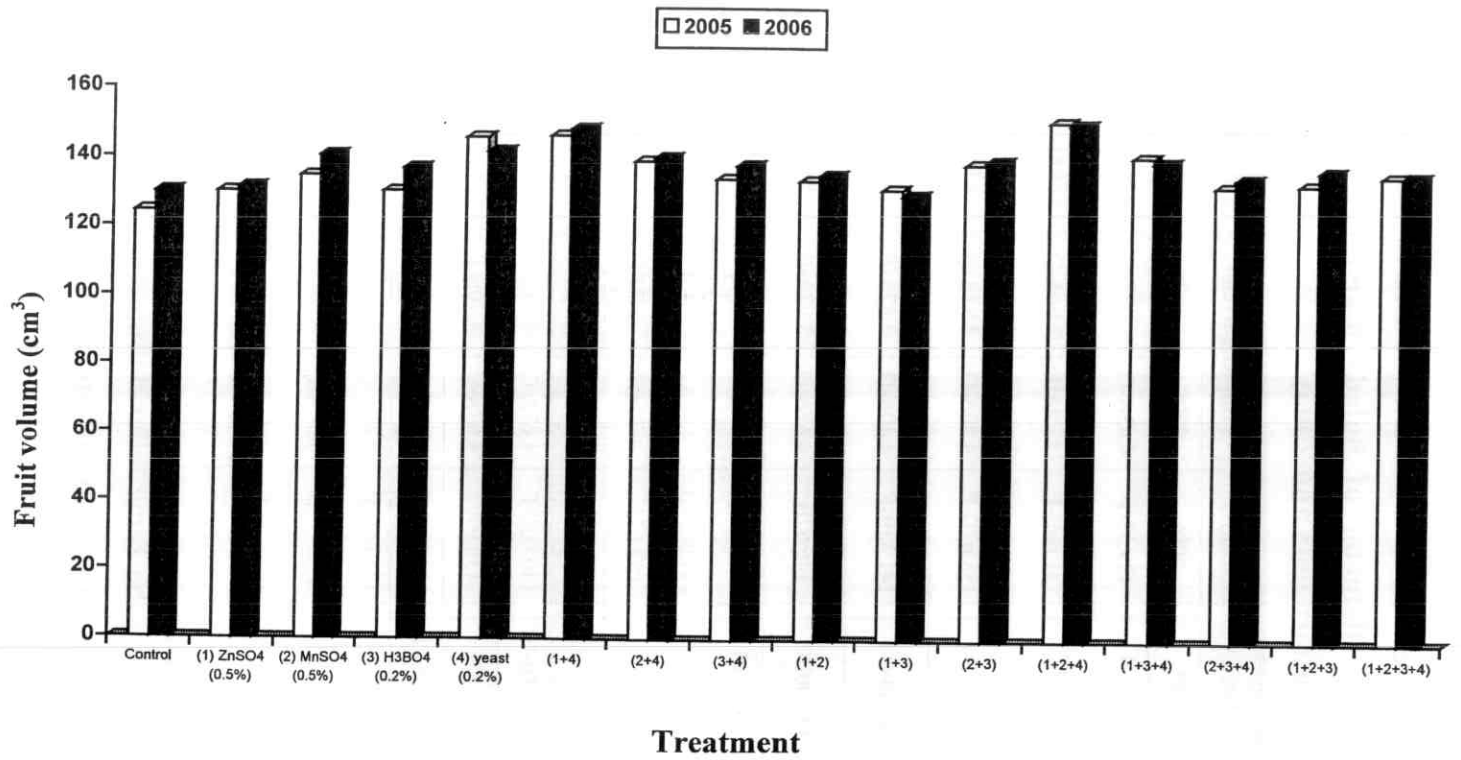

Fig. (11): Effect of spraying active dry yeast and some micronutrients on fruit volume (Cm^3) of Balady mandarin trees in "On" year (seasons 2005 and 2006)

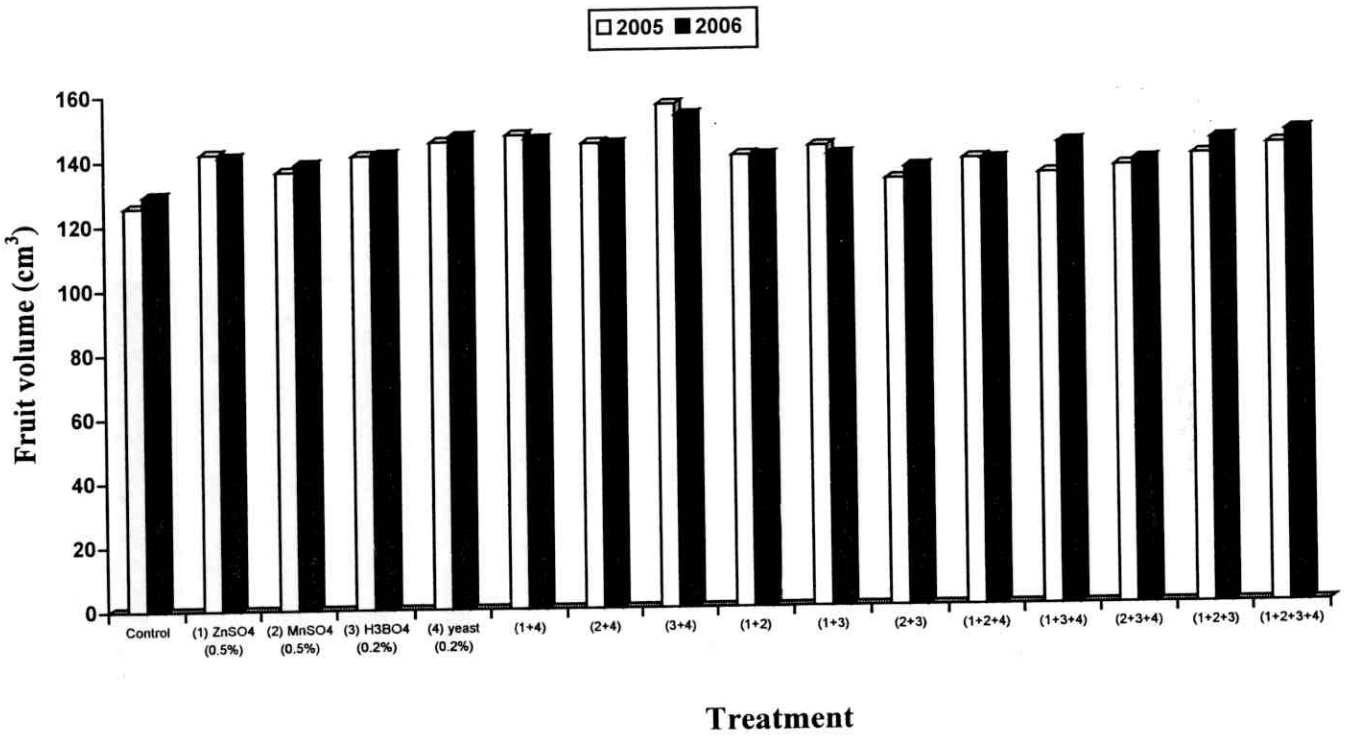

Fig. (12): Effect of spraying active dry yeast and some micronutrients on fruit volume (cm^3) of Balady mandarin trees in "Off" year (Seasons 2005 and 2006).

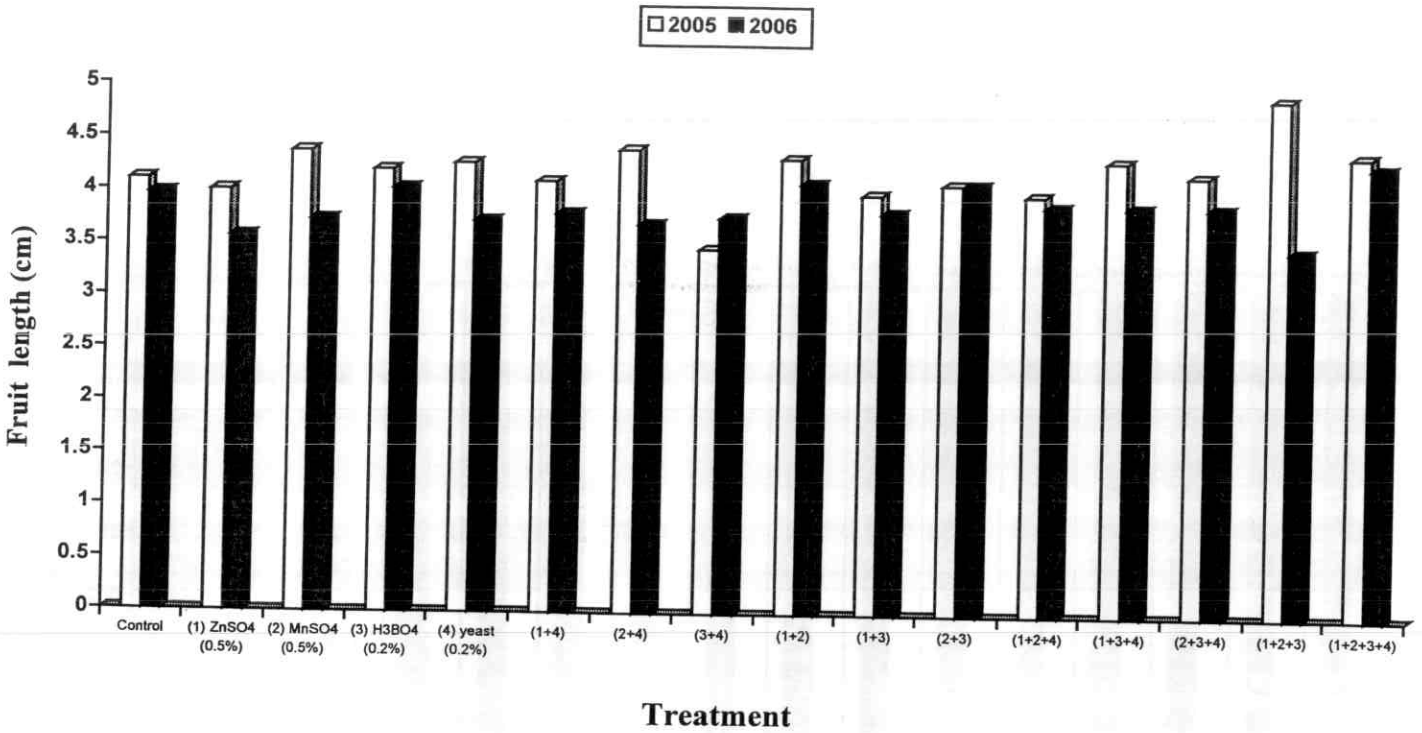

Fig. (13): Effect of spraying active dry yeast and same micronutrients on fruit length (cm) of Balady mardarin trees in "On" year (seasons 2005 and 2006).

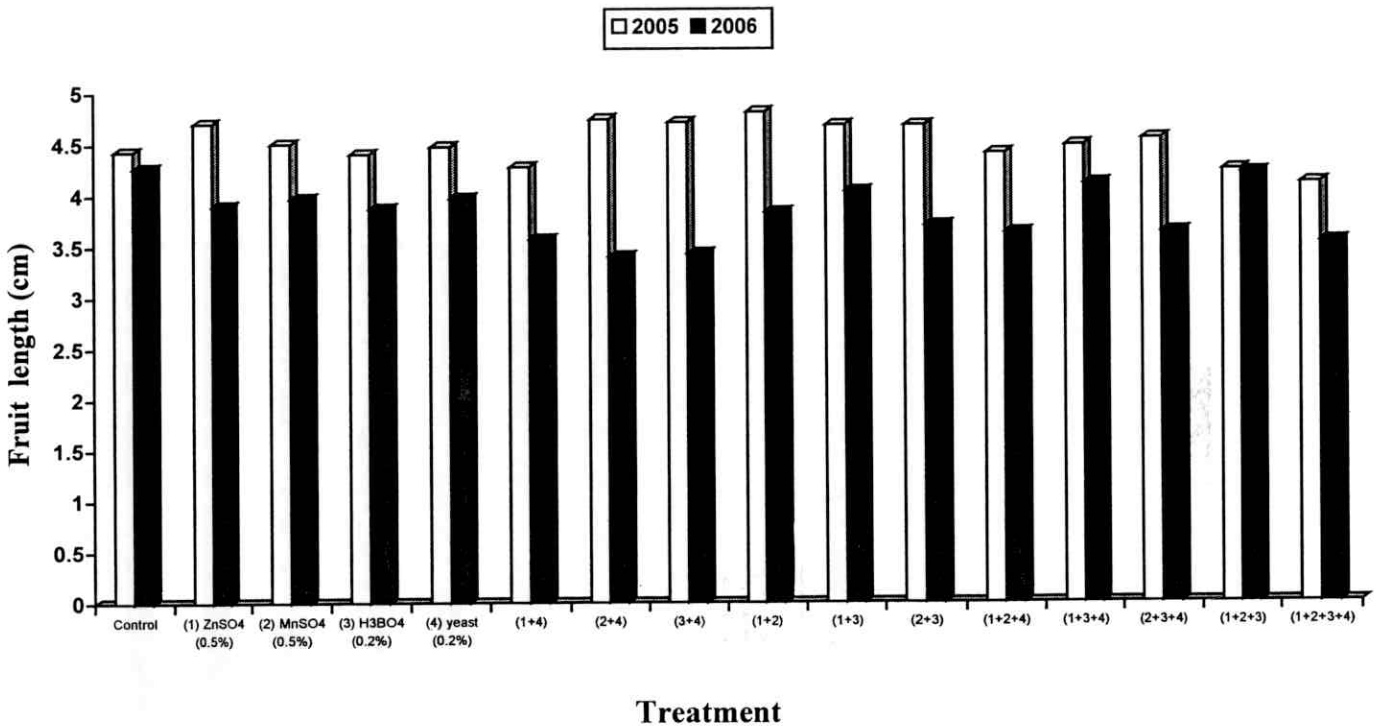

Fig. (14): Effect of spraying active dry yeast and some micronutrients on fruit length (cm) of Balady mandarin trees in "Off" year (Seasons 2005 and 2006).

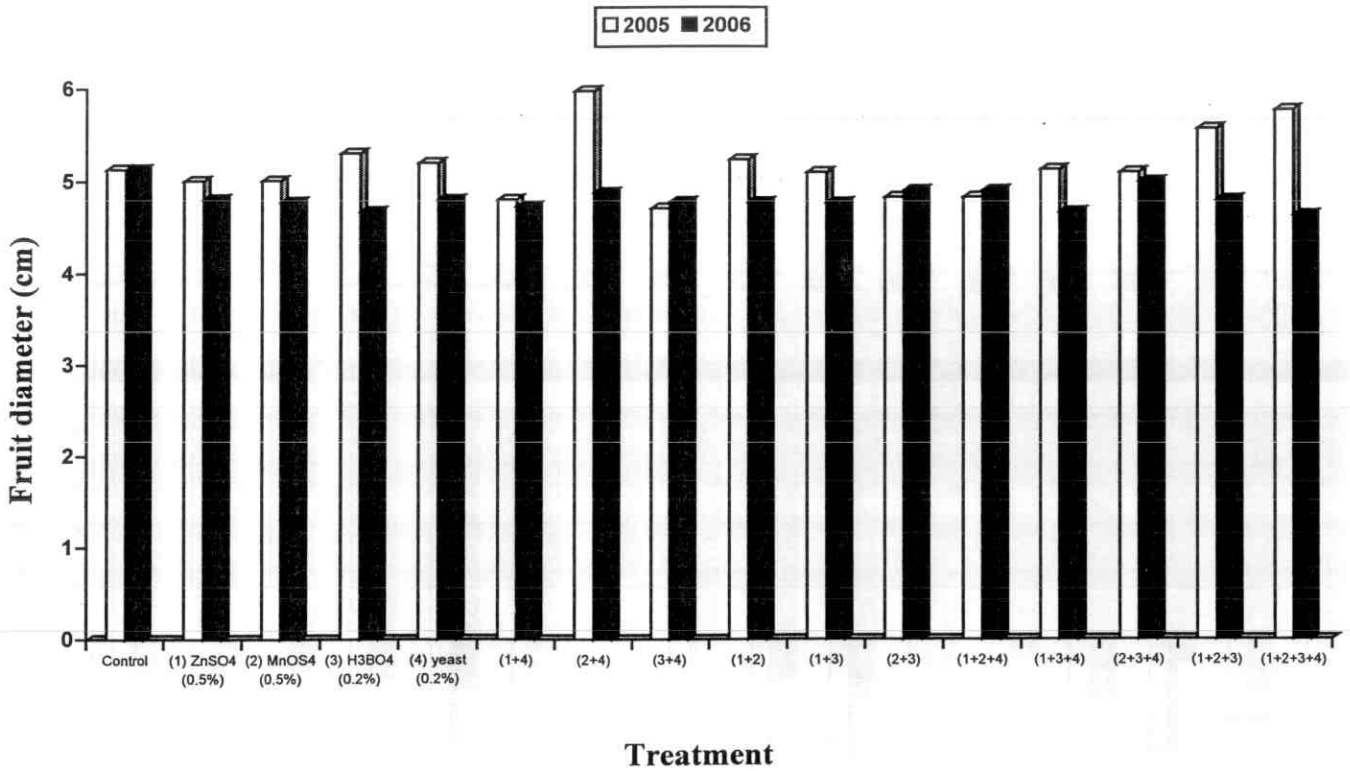

Fig. (15): Effect of spraying active dry yeast and some micronutrients on fruit diameter (cm) of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

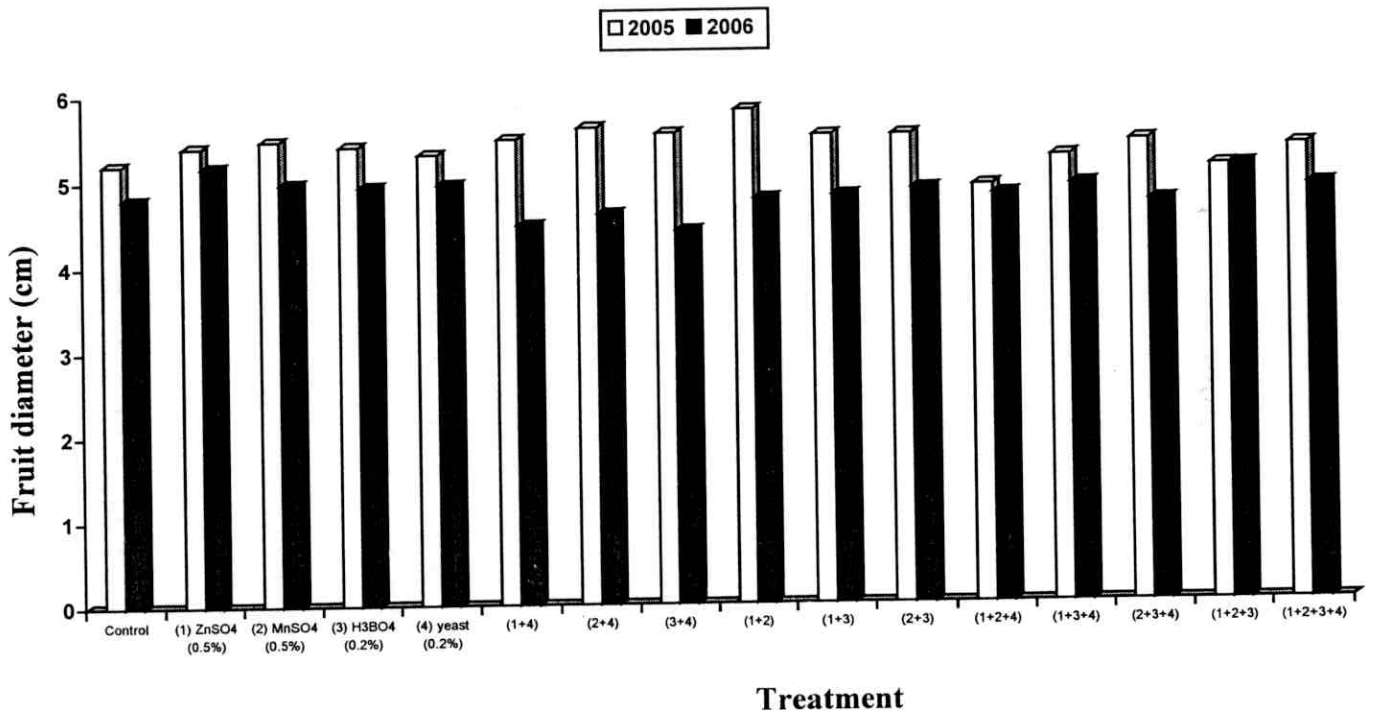

Fig. (16): Effect of spraying active dry yeast and some micronutrients on fruit diameter (cm) of Balady mandarin trees in "Off" year (Seasons 2005 and 2006).

micronutrients, which gave statistically similar values in this respect. This means that there were no constant trends in view of the effect of spraying $ZnSO_4$, $MnSO_4$, H_3BO_4 or yeast alone or combined with each other on fruit diameter of Balady mandarin trees in "Off" year.

Generally, the above results disclosed that the combination treatments enhanced the highest improvement of all physical properties under study. Stimulative effect of boron in plant metabolism includes many physiological aspects, such as nucleic acid metabolism, protein, hormone and carbohydrate biosynthesis as well as translocation, photosynthesis, cell division and cell wall synthesis membrane function. These results partially agreed with the findings of **Ibrahiem et al., (2000)** on Balady mandarin. They mentioned that best results were obtained with combination of active dry yeast and micronutrients which increased fruit quality as compared with that of the control. This may be related to the type of growth limiting factor which affect physical properties of mandarin fruits in each case. **Bakry (2007)** indicated that spray Jafa orange trees with yeast extract improved fruit physical properties. On the other hand, **Sayed (1998) and Badawy (2005)** found that micronutrients treatments gave a little effect on fruit quality of Balady mandarin trees.

4.b. Chemical Properties

4.b.1. Titratable acidity:

It is clear from Tables (14 and 15) and Fig (17) that spraying Balady mandarin trees in "On" year with $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) or $ZnSO_4$ (0.5%) +

$MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) treatment gave the lowest significant values of acidity in both seasons followed by spraying $ZnSO_4$ (0.5%) in the first season then $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) +H_3BO_4 (0.2%) in both seasons as well as $ZnSO_4$ (0.5%) + H_3BO_4 (0.2%) in the first season and $MnSO_4$ (0.5%) ($ZnSO_4$ (0.5%) + yeast (0.2%) in the second season as compared with that of the other used treatments and the control which recorded the highest significant acidity percent in both seasons of study.

Meanwhile, $ZnSO_4$ (0.5%) in the first season and $MnSO_4$ (0.5%) in the second season gave fruits with the lowest values in respect of those of microntreint treatments.

Concerning combination treatments, data disclosed that spraying Balady mandarin trees with combinations $MnSO_4$ (0.5%)+ H_3BO_4 (0.2%) + yeast (0.2%) and $ZnSO_4$ (0.5%)+ $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) gave the lowest values of acidity as compared with that of the other combinations used in this study in both seasons in "On" year trees.

In addition, Tables (16 and 17) and Fig (18) demostrate that all combinations between active dry yeast and some different micronutrients significantly decreased juice acidity percent in both seasons in "Off" year trees. On the contrary, the combinations of $ZnSO_4$ (0.5%) + $MnSO_4$(0.5%) + H_3BO_4(0.2%) + yeast (0.2%) gave the lowest values of acidity in both seasons.

Moreover, both $MnSO_4$ (0.5%) and H_3BO_4 (0.2%) in the first season and $ZnSO_4$ (0.5%) in the second season recorded the lowest values of acidity in respect of those of micronutrients.

Besides, spraying active dry yeast exerted an intermediate effect in this respect in both seasons.

4.b.2 Total soluble solids (TSS)

The data in Tables (14 and 15) and Fig (19) indicate that both spraying of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.2%) + yeast (0.2%) in the first season and $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) Treatments in both seasons as well as $MnSO_4$ (0.5%) + H3BO_4 (0.2%) + yeast (0.2%) in the second season gave fruits with significant higher values of T.S.S than that in the other combinations used in this study in "On" year tree.

Regarding micronutrients and active dry yeast treatments, it is clear that trees sprayed with $MnSO_4$ (0.5%) and H_3BO_4 (0.2%) in the first season as well as H_3BO_4 (0.2%) in the second season significantly increased T.S.S in fruit juice as compared with those sprayed with active dry yeast and other micronutrint treatments.

Furthermore, Tables (16 and 17) and Fig (20) reveals that in both seasons, all treatments gave fruits with significant higher values of T.S.S than that of the control. However, trees sprayed with $ZnSO_4$ (0.5%)+ $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) in both seasons as well as with ($ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) in the second season had the highest significant values of T.S.S in fruit juice as compared with that in the other used treatments and the control in this study.

4.b.3. T.S.S / Acid Ratio

It is obvious from data in Tables (14 and 15) and Fig (21) that spraying Balady mandarin trees with $ZnSO_4$ (0.5%) +

$MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) or $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%)] produced fruits with the highest T.S.S / acid ratio in both seasons of study in "On" year tree as compared with that of the other used treatments and the control. On the other hand, no significant differences were noticed in T.S.S / acid ratio in fruit juice among spraying trees with $ZnSO_4$, $MnSO_4$, H_3BO_4 or active dry yeast in both seasons of study. On the contray, spraying trees with $ZnSO_4$ (0.5%) significantly decreased fruit T.S.S / acid ratio than that spraying with $MnSO_4$ (0.5%) or H_3BO_4 (0.2%) alone in the second season.

In "Off" year, the data in Tables (16 and 17) and Fig (22) revealed that in both seasons, spraying the combinations of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) recorded the highest significant values of fruit TSS/ acid ratio. Other tested combinations of active dry yeast and some different micronutrients gave nearly more or less similar results in this respect. On the other hand, no significant differences were noticed in T.S.S / acid ratio in fruit juice among spraying trees with $ZnSO_4$, $MnSO_4$ and H_3BO_4 in both seasons of study.

4.b.4. Ascorbic acid

It is quite evident from Tables (14 and 15) and Fig (23) that in both seasons, combined treatments between Active dry yeast and some different micronutrient as well as active dry yeast alone in the first season significantly increased juice content of ascorbic acid as compared with those of active dry yeast and micronutrients alone as well as of control treatment in "On" year.

In addition, the highest significant fruit juice content of ascorbic acid was obtained when Balady mandarin trees in "On" year were sprayed with combinations of $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%) + H_3BO_4 (0.2%) + yeast (0.2%) in comparison with the other used treatments and the control in both seasons of study.

Concerning juice content of ascorbic acid of Balady mandarin fruits in "Off" year, data in Table (16 and 17) and Fig (24) showed that spraying $ZnSO_4$ (0.5%) + $MnSO_4$ (0.5%)+ H_3BO_4 (0.2%) + yeast (0.2%) gave the highest significant ascorbic acid content as compared with that of most other treatments and the control in both seasons of study.

Meanwhile, spraying H_3BO_4 (0.2%) mainly in the first season significantly increased fruit juice of ascorbic acid as compared with that of the other two micronutrients used in this study which were similar in their values statistically, but in the second season there were no significant differences in juice content of ascorbic acid among the above mentioned treatments.

On the other hand, spraying $MnSO_4$ (0.5%) or H_3BO_4 (0.2%) gave fruits with higher amount of ascorbic acid values as compared with $ZnSO_4$ (0.5%) in the second season.

Generally, the above results disclosed that the combined treatments enhanced the highest improvement of all chemical properties under study. The stimulative effect of active dry yeast and micronutrients gave satisfactory control on alternate bearing by improving the yield in the "Off" year.

These results partially agreed with the findings of **El-kassas et al., (1987) and Tawfeik et al., (2001).** They all found that spraying a mixture containing active dry yeast and

micronutrations improved chemical fruit quality of Balady mandarin trees. On the other hand, **Hassan et al., (1993)** on Washington Navel orange and **Salem et al., (1995)** on Balady mandarin trees found that foliar spray of mixture of Fe, Zn and Mn (Chelated) alone or in combinations did not affect juice weight percentage, TSS, acidity and TSS/acid ratio. In addition, **Desai et al., (1991)** on sweet orange, **Abo – Zinada (1994)** on Valencia orange and **Hegab (1994)** on Washington Navel orange reported that spraying micronutrients slightly reduced juice acidity. The results of chemical fruit quality induced by active dry yeast are emphasized by the findings of **Ibrahiem et al., (2000), Badawy (2005)** and **Bakry (2007)** who found that spraying of active dry yeast increased TSS/ acid ratio, vitamin C and reducing sugar's of Balady mandarin and Jafa orange trees.

Table (14): Effect of spraying active dry yeast and some micronutrients on fruit chemical properties of Balady mandarin in "On" year (Season 2005)

Properties / Treatments	Titratable acidity %	T.S.S %	T.S.S/ acid ratio	V.C mg/100 ml
Control	1.17A	10.07G	8.61C	40.57E
(1) ZnSO4 (0.5%)	0.90CD	10.50F	11.66B	45.47D
(2)MnSO4 (0.5%)	1.03BC	11.00DE	10.67B	46.87C
(3)H_3BO4 (0.2%)	1.07AB	11.00DE	10.28B	45.53D
(4) yeast (0.2%)	1.03BC	10.90E	10.58B	48.27B
(1+4)	1.00BC	11.00DE	11.00B	48.33B
(2+4)	1.00BC	11.00DE	11.00B	49.00AB
(3+4)	1.01BC	11.00DE	10.89B	48.33B
(1+2)	1.03BC	11.20B-D	10.87B	48.93AB
(1+3)	0.95BD	11.00DE	11.57B	48.30B
(2+3)	1.00 BC	11.33BC	11.33B	49.13AB
(1+2+4)	1.00 BC	11.67A	11.67B	49.00AB
(1+3+4)	1.00BC	11.37BC	11.37B	48.83AB
(2+3+4)	0.75 E	11.10C-E	14.80A	49.20AB
(1+2+3)	0.96B-D	11.40B	11.87B	49.53AB
(1+2+3+4)	0.84DE	11.77A	14.81A	49.80A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (15): Effect of spraying active dry yeast and some micronutrient on fruit chemical properties of Balady mandarin in "On" year. (Season 2006)

Properties / Treatments	Titratable acidity %	T.S.S %	T.S.S/ acid ratio	V.C mg/100 ml
Control	1.15A	10.33D	8.98E	41.17G
(1) ZnSO4 (0.5%)	1.07B	11.00BC	10.28D	47.33DE
(2)MnSO4 (0.5%)	0.96F	11.03BC	11.49BC	46.67EF
(3)H_3BO4 (0.2%)	0.97E	11.27B	11.62BC	46.00F
(4) yeast (0.2%)	1.00C	10.90C	10.90CD	47.67CE
(1+4)	0.95G	11.00BC	11.58BC	48.33B-D
(2+4)	1.00C	10.90C	10.90CD	48.83AB
(3+4)	1.00C	11.27B	11.27BC	48.50B-D
(1+2)	1.00C	10.93C	10.93CD	47.67C-E
(1+3)	1.00C	11.00BC	11.00B-D	48.53BC
(2+3)	1.00C	11.03BC	11.03B-D	47.67C-E
(1+2+4)	0.99D	11.23B	11.34BC	49.00AB
(1+3+4)	1.00C	11.77A	11.77B	49.20AB
(2+3+4)	0.88H	11.80A	13.41A	49.00AB
(1+2+3)	0.96F	10.87C	11.32BC	49.23AB
(1+2+3+4)	0.87I	11.83A	13.60A	49.83A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (16): Effect of spraying active dry yeast and some micronutrients on fruit chemical properties of Balady mandarin in "Off" year. (Seaon 2005)

Properties / Treatments	Titratable acidity %	T.S.S %	T.S.S/ acid ratio	V.C mg/100 ml
Control	1.23A	10.33H	8.40D	41.00G
(1) ZnSO4 (0.5%)	1.14AB	11.17DE	9.80C	44.40F
(2)MnSO4 (0.5%)	1.03CD	11.07E-G	10.75BC	45.93E
(3)H_3BO4 (0.2%)	1.00CD	11.20D-F	11.20B	49.50B-D
(4) yeast (0.2%)	1.09BC	10.80G	9.91C	48.23D
(1+4)	0.98DE	11.07E-G	11.30B	48.43CD
(2+4)	1.00CD	11.10E-G	11.10B	49.43B-D
(3+4)	0.97DE	11.40B-E	11.75B	49.47B-D
(1+2)	1.03CD	11.13D-F	10.81BC	46.07E
(1+3)	0.97DE	11.20D-F	11.55B	48.80B-D
(2+3)	0.99C-E	11.30C-E	11.14B	49.23B-D
(1+2+4)	1.00CD	11.63AB	11.63B	49.40B-D
(1+3+4)	1.00CD	11.47B-D	11.47B	49.36BC
(2+3+4)	0.98DE	11.00FG	11.22B	50.03B
(1+2+3)	0.99C-E	11.53BC	11.65B	49.03B-D
(1+2+3+4)	0.89E	11.90A	13.37A	52.37A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

Table (17): Effect of active dry yeast and some micronutrients on fruit chemical properties of Balady mandarin in "Off" year. (season 2006)

Properties / Treatments	Titratable acidity %	T.S.S %	T.S.S/ acid ratio	V.C mg/100 ml
Control	1.39A	10.37E	7.46F	42.83E
(1) ZnSO4 (0.5%)	1.04C-E	11.00CD	10.58 B-D	44.00DE
(2)MnSO4 (0.5%)	1.12BC	10.87D	9.71DE	45.33D
(3)H_3BO4 (0.2%)	1.19B	11.37A-D	9.55E	45.00D
(4) yeast (0.2%)	1.12BC	11.27A-D	10.06C-E	47.33C
(1+4)	1.00 C-E	11.47AC	11.47B	48.00BC
(2+4)	1.06CD	11.57AB	10.92BC	48.50BC
(3+4)	1.11 BC	11.47AC	10.33C-E	48.67BC
(1+2)	1.00C-E	11.60AB	11.60AB	49.17AB
(1+3)	1.07CD	11.80A	11.08BC	48.50BC
(2+3)	1.05CE	11.47A-C	10.92BC	49.00B
(1+2+4)	1.00C-E	11.63AB	11.63AB	49.00B
(1+3+4)	1.00 C-E	11.47A-C	11.47B	48.67BC
(2+3+4)	0.95DE	11.13B-D	11.72AB	48.67BC
(1+2+3)	1.00C-E	11.70A	11.70AB	49.17AB
(1+2+3+4)	0.93E	11.77A	12.66A	50.43A

Means followed by the same letter within each column of each category are not significantly differed from each other at 5% level.

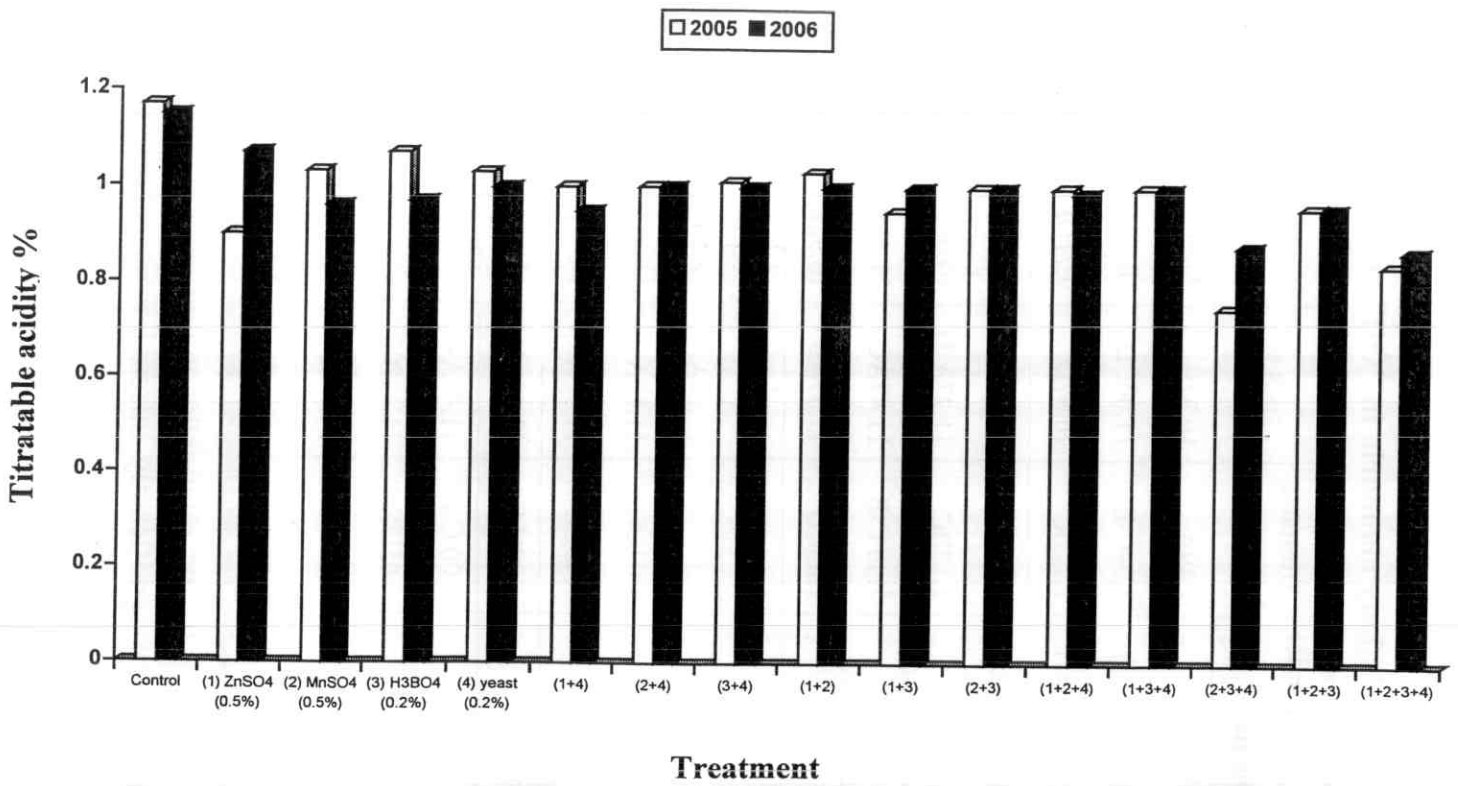

Fig. (17): Effect of spraying active dry yeast and some micronutrients on fruit titratable acidity (%) of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

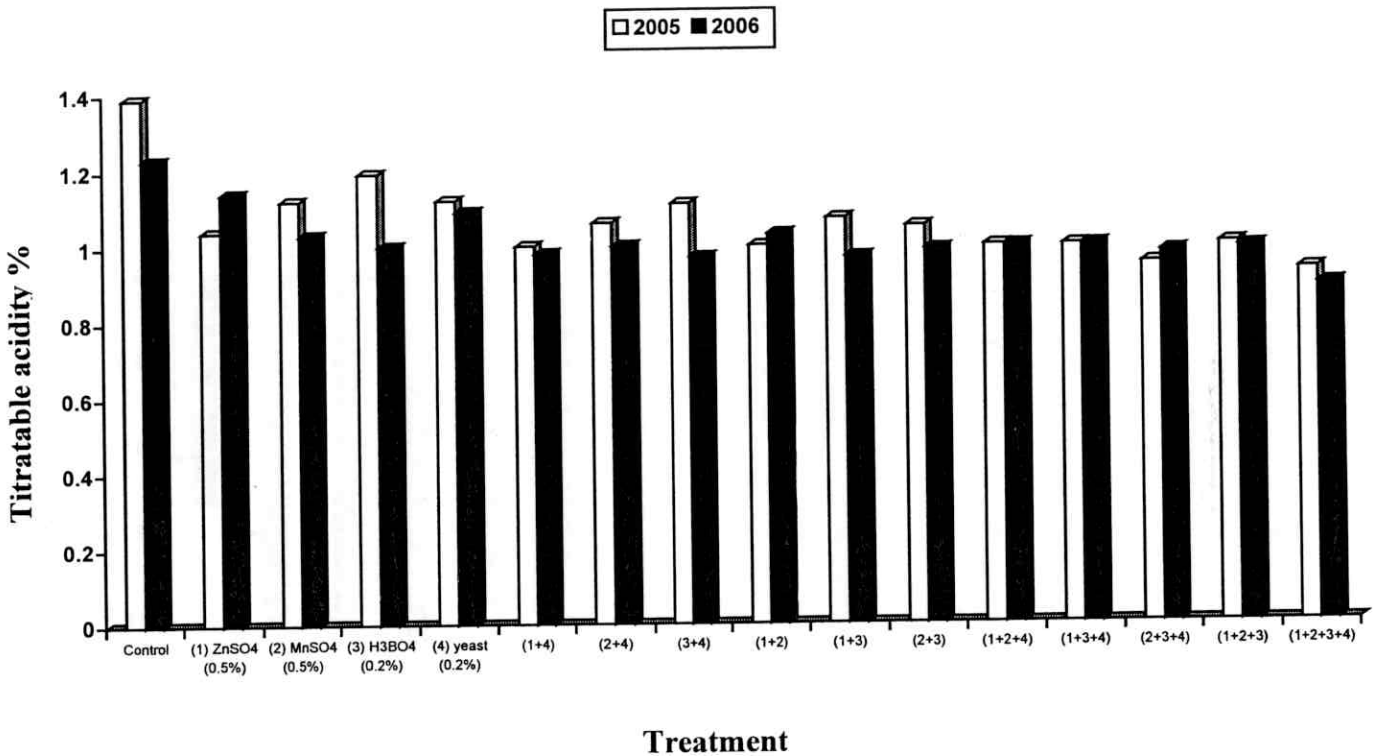

Fig. (18): Effect of spraying active dry yeast and some micronutrients on fruit titratable acidity (%) ratio of Balady mandarin trees in "Off" year (Seasons 2005 and 2006).

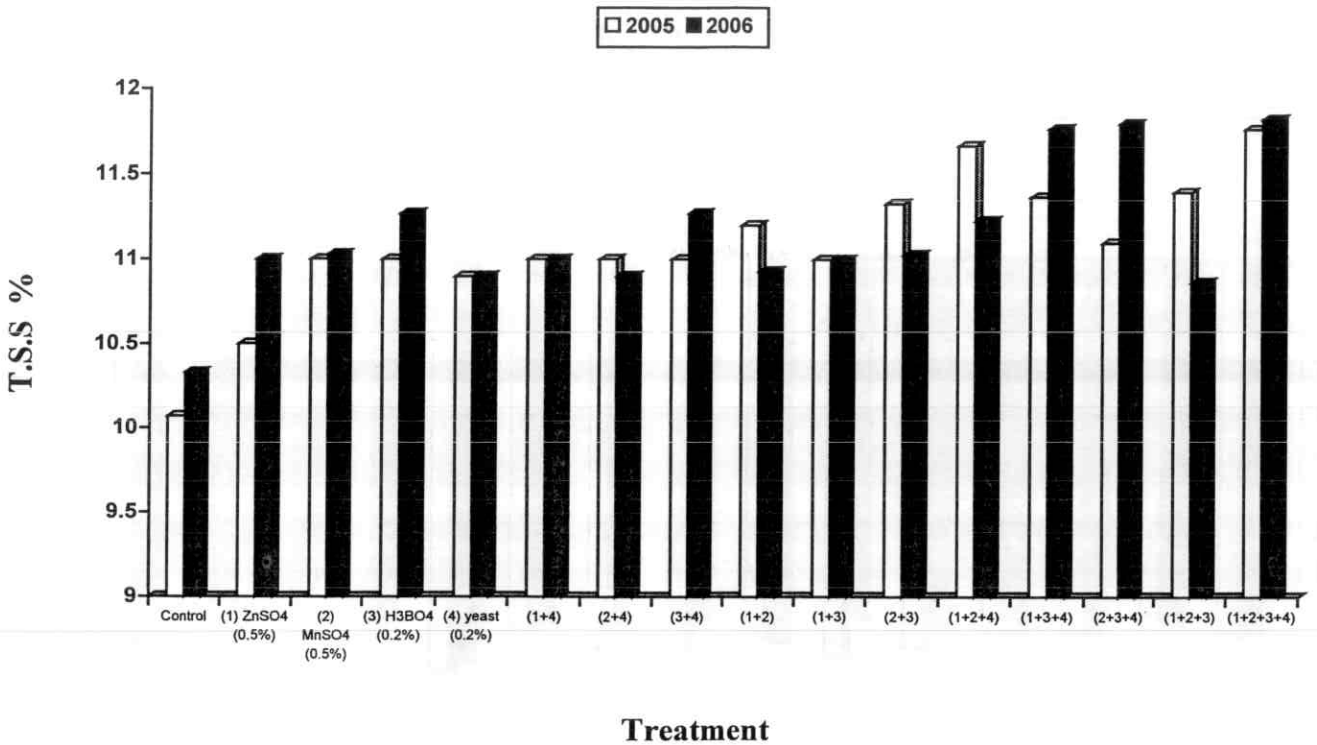

Fig. (19): Effect of spraying active dry yeast and some micronutrients on fruit TSS (%) of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

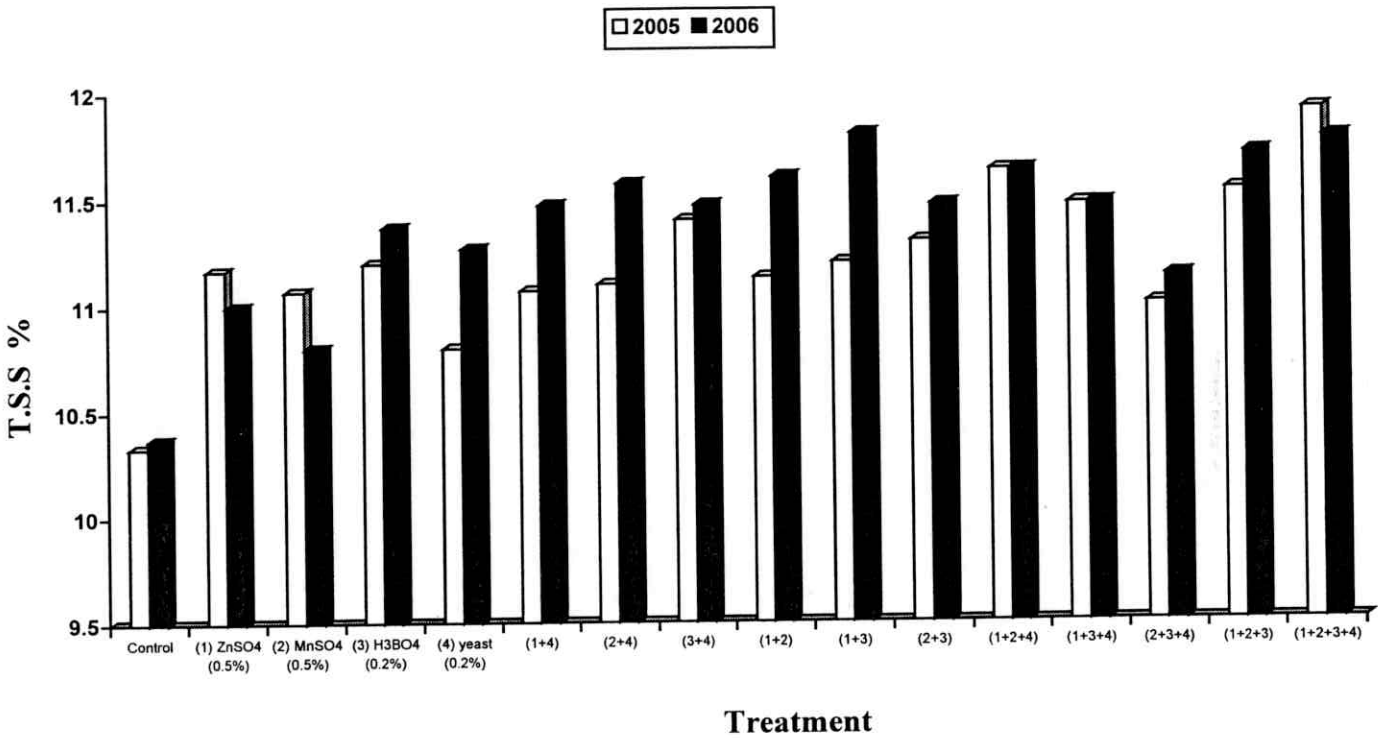

Fig. (20): Effect of spraying active dry yeast and some micronutrients on fruit TSS (%) of Balady mandarin in "Off" year (Seasons 2005 and 2006).

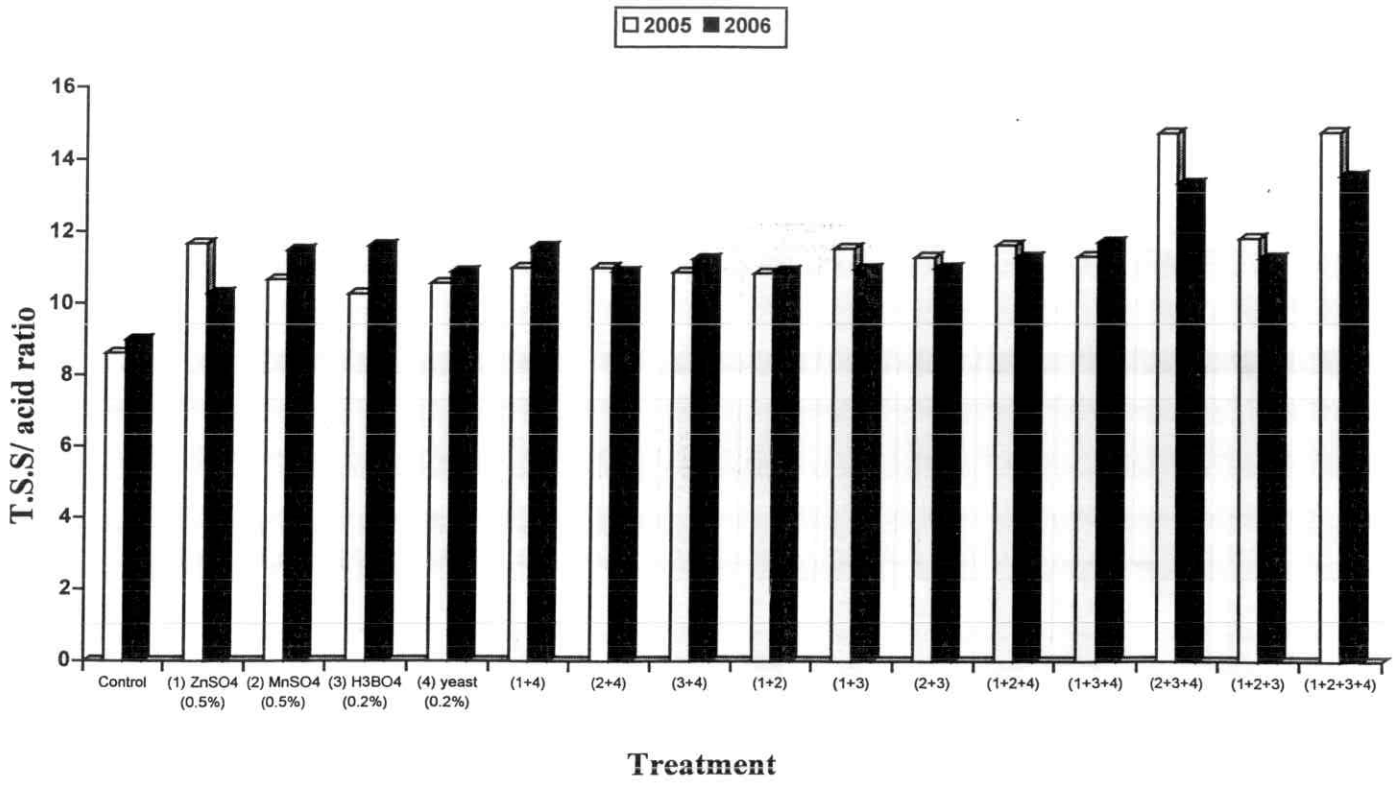

Fig. (21): Effect of spraying active dry yeast and some micronutrients on fruit TSS/acid ratio of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

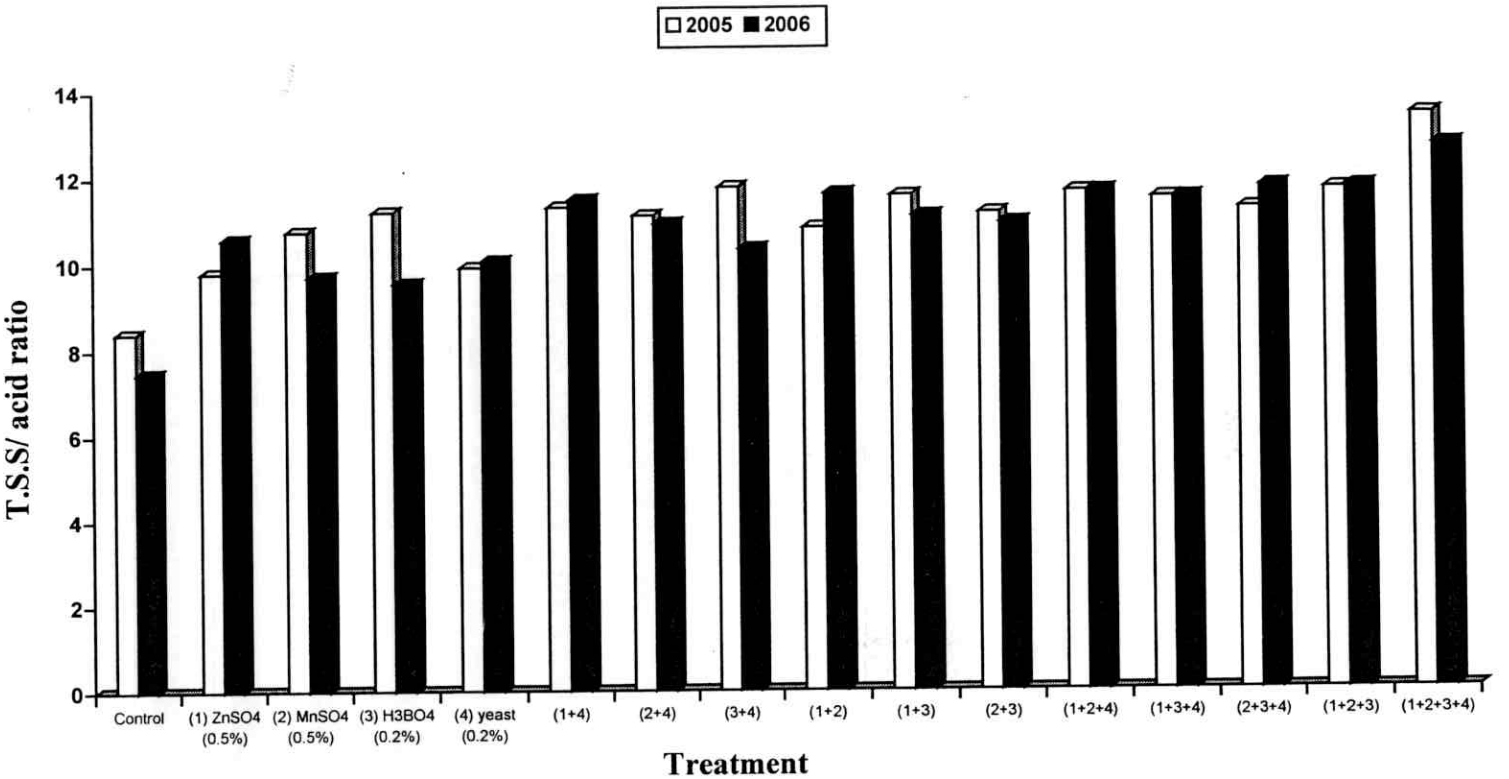

Fig. (22): Effect of spraying active dry yeast and some micronutrients on fruit TSS/acid ratio of Balady mandarin in "Off" year (Seasons 2005 and 2006).

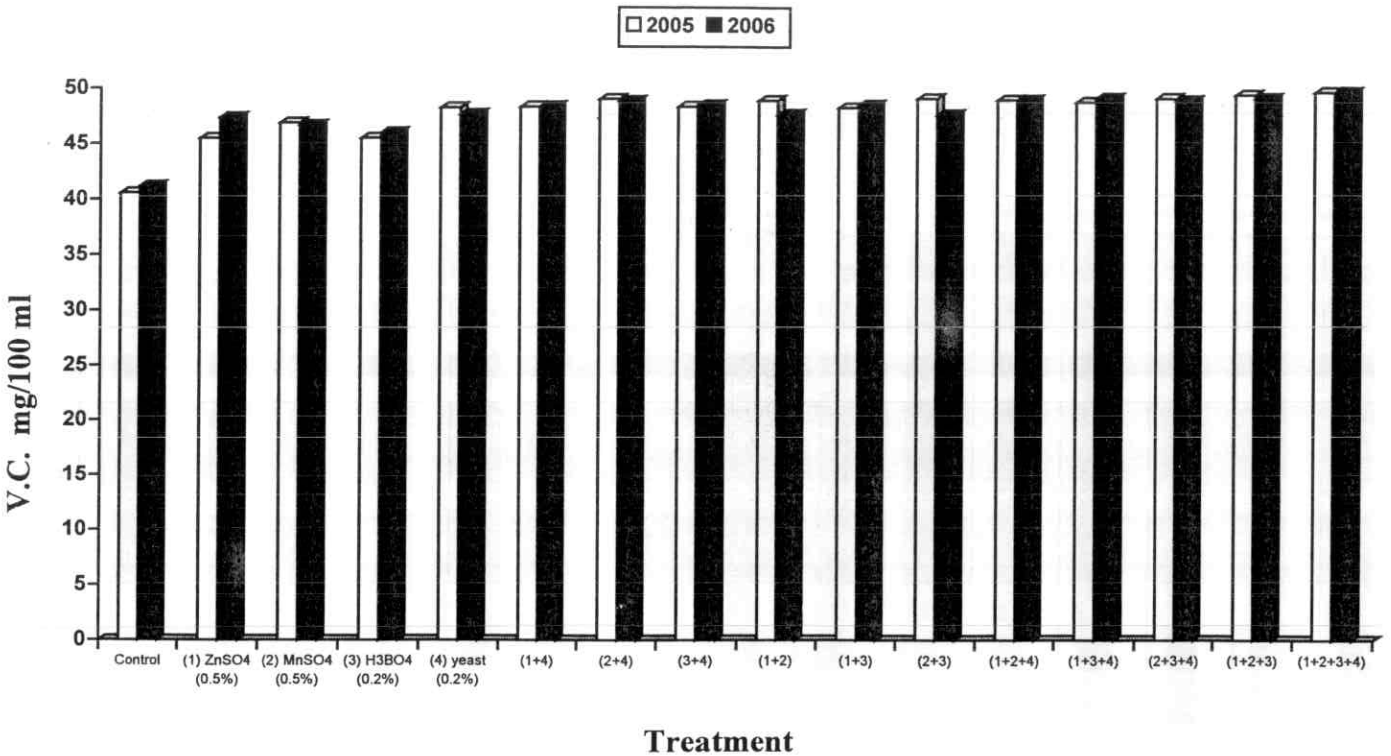

Fig. (23): Effect of spraying active dry yeast and some micronutrients on fruit vitamin C (mg/100 ml) of Balady mandarin trees in "On" year (Seasons 2005 and 2006).

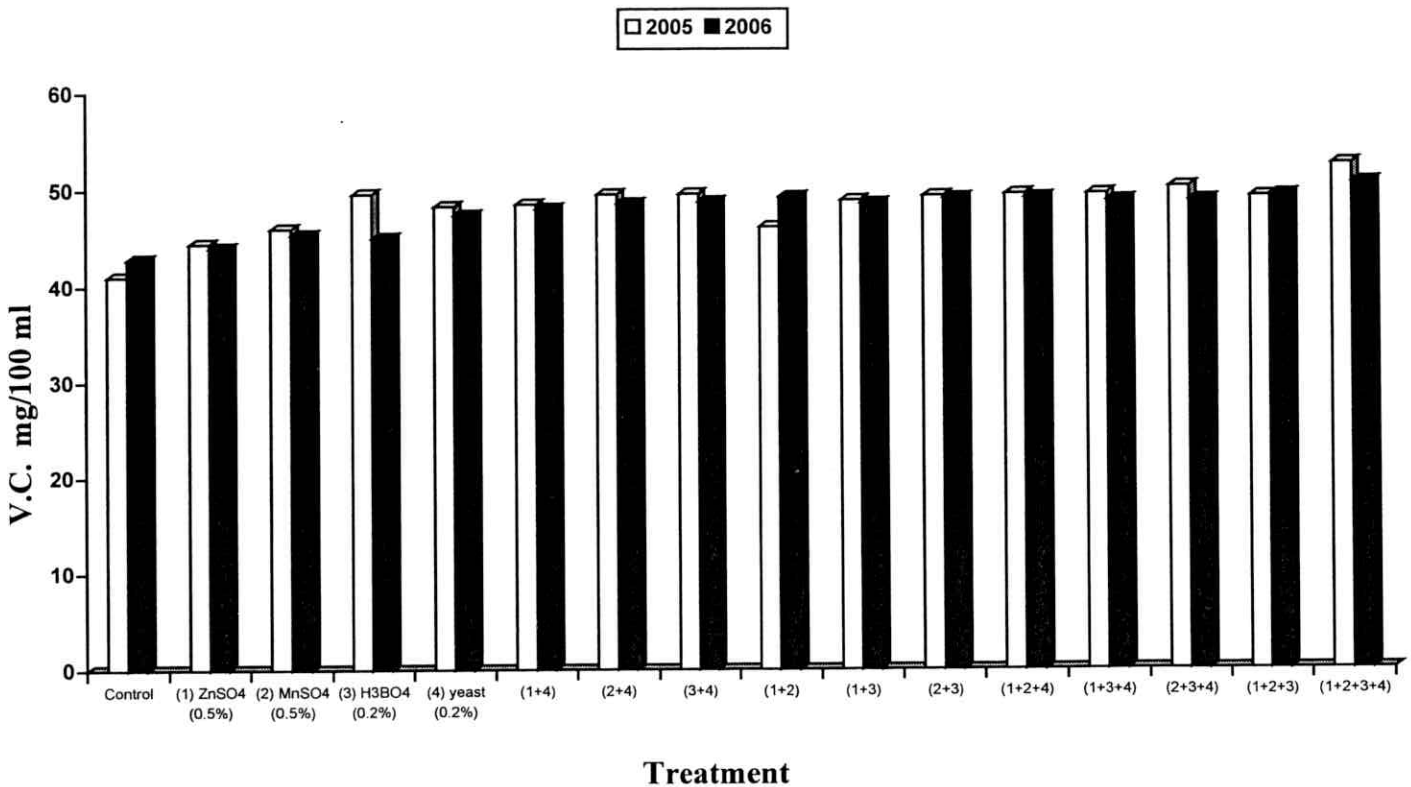

Fig. (24): Effect of spraying active dry yeast and some micronutrients on fruit vitamin C (mg/100ml) of Balady mandarin in "Off" year (Seasons 2005 and 2006).