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V- SUMMARY AND CONCLUSION

This study was carried out during two consecutive seasons of 2005 and 2006 on Washington Navel orange trees onto sour orange rootstock at the orchard of Sids Hor. Res. Station , Sids Village , Bani Suef Governorate

The merit of this investigation was examining the effect of single or combined applications of three antioxidants namely Ascorbic acid, Amino acids and Vitamin B complex and Algae extract at various concentrations on vegetative growth, leaf chemical composition, yield as well as physical and chemical characters of fruits for Washington Navel orange trees.

The present experiment included the following 24 treatments from single and combined applications of the three antioxidants (Ascorbic acid, Amino acids, and Vitamin B complex) and Algae extract at various concentrations,

1-Control (sprayed with water trees)

2-Spraying Ascorbic acid at 100 ppm

3-Spraying Ascorbic acid at 200 ppm

4- Spraying Ascorbic acid at 400 ppm

5-Spraying Amino acids at 100 ppm

6- Spraying Amino acids at 200 ppm

7- Spraying Amino acids at 400 ppm

8- Spraying Algae extract at 0.1 %

9- Spraying Algae extract at 0.2 %

10- Spraying Algae extract at 0.4 %

11- Spraying Vitamin B complex at 100 ppm

12- Spraying Vitamin B complex at 200 ppm

13- Spraying Vitamin B complex at 400 ppm

14- Spraying Ascorbic acid + Amino acids at mid. conc.

15- Spraying Ascorbic acid + Algae extract at mid. conc.

16- Spraying Ascorbic acid + Vitamin B complex at mid. conc.

17- Spraying Amino acids + Algae extract at mid. conc.

18- Spraying Amino acids + Vitamin B complex at mid. conc.

19- Spraying Algae extract + Vitamin B complex at mid. conc.

20- Spraying Ascorbic acid + Amino acids + Algae extract at mid. conc.

21- Spraying Ascorbic acid + Amino acids + Vitamin B complex at mid. conc.

22- Spraying Ascorbic acid + Vitamin B complex + Algae extract at mid. conc.

23- Spraying Amino acids + Algae extract + Vitamin B complex at mid. conc.

24- Spraying all antioxidants + Algae extract at mid. conc.

Each treatment was replicated three time, one tree per each.

The experiment was set in a complete randomized block design with three replicates , one tree per each.

Amino acids were added in the form of vitalemfort compound containing 18 Amino acids namely glutamic acid, asparatic acid, alanin acid, arganine, cysteine, phenylalanine, glycine, hydroxy proline, histidine , isoleucine , leucine , methionine , proline , serine, tyrosine , threonine , tryptophan and valine.

Antioxidants and Algae extract at the previous concentrations were sprayed three times during each season at growth start (last week of Feb.), just after fruit setting (mid. April and at two months later (mid. June)

During both seasons of the study the following parameters were measured:

1-Growth characters namely shoot length and number of leaves / shoot in the three growth cycles namely Spring, Summer and Autumn as well as the leaf area in the Spring growth cycle.

2-Percentages of N, P and K in the leaves of non- bearing shoots in Spring growth cycle.

3-Percentages of initial and final fruit setting.

4-Yield expressed in number of fruits / tree and weight (kg.)

5-Physical characters of fruits namely fruit weight (g.) and dimensions (height and width in cm) as well as fruit peel weight % and thickness (cm.)

6-Chemical characters of fruits namely total soluble solids %, total acidity %, T.S.S./ acid ratio, total and non reducing sugars % and Vitamin C (mg/ 100 ml Juice)

The same nearly results observed in both seasons could be summarized under the following main items :

1-Growth characters:

Growth characters namely shoot length and number of leaves / shoot in the three growth cycles namely Spring, Summer and Autumn as well as the leaf area in the Spring growth cycle were positively affected by single or combined applications of the three antioxidants namely Ascorbic acid, Amino acids and Vitamin B complex each at 100 to 400 ppm as well as using Algae extract at 0.1 to 0.4 compared to non- application . The stimulation was associated with increasing concentrations of these materials. No measurable promotion on such traits was observed among the higher two concentrations of each material. Combined applications was superior

than the application of each material alone in this respect. Application of Ascorbic acid, Amino acids, Algae extract and Vitamin B complex, in ascending order was very effective in enhancing the investigated growth characters. Using the three antioxidants at the medium concentration (200 ppm) and Algae extract at 0.2 % was responsible for producing the maximum values. The minimum values were recorded on untreated trees.

2-Percentages of N, P and K in the leaves .

They were materially enhanced in response to application of the three antioxidants at 100 to 400 ppm and Algae extract at 0.1 to 0.4 % either singly or in combined applications compared to non-application. There was a gradual stimulation on these nutrients with increasing concentrations of antioxidants and Algae extract. No material increase in these nutrients was detected between the higher two concentrations of these compounds. Vitamin B complex considered the best material followed by Algae extract and Amino acids. Ascorbic acid occupied the last position in this connection. Supplying the trees three times with the three antioxidants each at 200 ppm plus Algae extract at 0.2 % is suggested to be the best treatment responsible for maximizing these nutrients. Untreating the trees gave the minimum values.

3-Percentages of initial and final fruit setting:

Percentages of initial and final fruit setting were greatly improved in response to single and combined applications of the three antioxidants and Algae extract compared to the check treatment. The promotion was depended on using Vitamin B

complex, Algae extract, Amino acids and Ascorbic acid, in descending order. Increasing concentrations of these materials was accompanied with a gradual promotion on percentages of initial and final fruit setting.

Increasing concentrations of antioxidants from 200 to 400 ppm and Algae extract from 0.2 to 0.4 % was followed by a slight promotion on percentages of initial and final fruit setting. The maximum values were detected on the trees received three sprays of a mixture containing the three antioxidants at 200 ppm plus Algae extract at 0.2 % . The lowest values were detected on untreated trees.

4-Yield:

Yield expressed in weight (kg.) and number of fruits / tree was positively affected by single and combined applications of the three antioxidants and Algae extract. A remarkable increment on the yield was observed as a result of using Ascorbic acid, Amino acids, Algae extract and Vitamin B complex, in ascending order. There was a progressive increase on the yield with increasing Antioxidant and Algae extract concentrations. Meaningless increase on the yield was observed among the higher two concentrations of the investigated materials.

Combined applications of Antioxidants and Algae extract was favourable than using each material alone in improving the yield. The best results with regard to yield were obtained on the trees received three sprays of Ascorbic acid, Amino acids and Vitamin B complex each at 200 ppm plus Algae extract at 0.2 % . The untreated trees produced the minimum values.

5-Fruit quality:

Single and combined applications of the three antioxidants at 100 to 400 ppm and Algae extract at 0.1 to 0.4 % resulted in a substantial promotion on fruit quality in terms of increasing fruit weight and dimensions (height and width), total soluble solids, T.S.S./ acid ratio, total and reducing sugars and Vitamin C content and in decreasing fruit peel weight % and thickness and total acidity % rather than non application. The promotion on fruit quality was associated with increasing antioxidants and Algae extract concentrations. Increasing antioxidant concentrations from 200 to 400 ppm and Algae concentration from 0.2 to 0.4 % failed to show measurable promotion on fruit quality. The promotion on fruit quality was attributed to using Ascorbic acid , Amino acids, Algae extract and Vitamin B complex, in ascending order. The promoting effect on fruit quality was ascribed to using combined applications of the antioxidants and Algae extract rather than to single application.

One can state that spraying the trees three times with Ascorbic acid, Amino acids and Vitamin B complex each at 200 ppm plus Algae extract at 0.2 % caused an announced effect on fruit quality. Unfavourable effects on fruit quality were attributed to the neglection of using the three Antioxidants and Algae extract.

Conclusion:

Based on the obtained data in both seasons, it is concluded that:

1-The beneficial effect of using the three antioxidants namely Ascorbic acid, Amino acids and Vitamin B complex in joining with

Algae extract on solving the problem of poor fruit setting of Washington Navel orange trees growing in middle Egypt conditions.

2-The best results with regard to yield and fruit quality of Washington navel orange trees were obtained owing to spraying the trees three times (at growth start , just after fruit setting and at two months later) with a mixture containing Ascorbic acid , Amino acids and Vitamin B complex each at 200 ppm plus Algae extract at 0.2%.

Economical study for the recommended treatment:

The increase on net profit in response to application of the previous recommended treatment over the control treatment reached 3944 and 4506 Egyptian pounds per feddan in both seasons respectively as clearly shown in the following Table

The recommended treatment	**1st season**	**2nd season**
Total costs of horticultural practices (L.E.)	3130	3300
Costs of spraying Ascorbic acid (L.E.)	330	396
Costs of spraying Tryptophan (L.E.)	440	484
Costs of spraying Vitamin B complex (L.E.)	440	484
Costs of spraying Algae extract (L.E.)	716	800
Costs of sprayer motor, labours and wetting agent	280	330
Total costs / fed. (L.E.)	5336	5794
Yield / fed. (tons) (117 trees. Fed)	11.1	11.2
Yield / fed. (L.E.)	9990	1200
Net profit / fed. (L.E.)	5406	4654
Control treatment		
Total costs of horticultural practices /fed. (L.E.)	3130	3300
Yield / fed. (tons) (117 trees / fed.)	4.3	4.2
Yield/ fed. (L.E.)	3870	4200
Net profit / fed. (L.E.)	710	900
The increase over the control treatment	3944	4506

Price of ton fruits in the first and second seasons was 900 and 1000 L.E. respectively.