
SUMMARY

V- SUMMARY AND CONCLUSIONS

The present investigation was under taken during the two successive seasons of 1999 and 2000 on ten-year-old of both "Costata" and "Hachyia" persimmon cvs. trees grown in the Horticulture Research Station at EL-Kanater region, Kalyobia Governorate.

Trees from each cultivar were carefully selected and devoted for this study. Trees were budded on Trabols rootstock, nearly uniform as possible in their vigour as being representative of orchard as well as received regularly the same horticulture care adopted in the region.

The purpose of this investigation aimed mainly to improve growth, nutritional status and increase productivity of both persimmon cvs. under study through investigating their response to some 18 NK fertilization treatments included, three levels of each N and K fertilizers soil added i.e. (N_0; N_1 and N_2) and (K_0; K_1 and K_2) in combaling with two concentration of zinc foliar spray solution. The applied fertilizers were ammonium sulphate (20.6 % N); potassium sulphate (48 % K_2O) and Nervanide chellated zinc (14 %) for the N, K and Zn sources, respectively. Moreover, 1.2 kg from every ammonium sulphate and Potassium sulphate were soil applied for the second level (N_1 and K_1) while in the third one (N_2 and K_2) the dose was doubled i.e. became 2.4 kg from each N and K fertilizer per tree, meanwhile the first level (N_0 and K_0) was the dose of no N and K fertilizers soil added. As for Zn the spray solution, the chelated zinc at 0.0 and 200 ppm concentrations were used for

the first and second spray solutions (Zn_0 and Zn_1), respectively. However, tap water spray was applied as Zn_0 level (1st concentration).

The corresponding amounts from N and K fertilizers used for every NK level were mixed together and fractionated into two equal doses to be soil applied at the second week of April and the third week of June for the first and second doses, respectively, while the entire P quantity rate added one in early February during each season. phosphorus level was soil applied to all N, K treatments at constant rate once dose of one kg. per tree in the form of super phosphate (15.5 % P_2O_5). However, zinc spray solution either at 0.0 or 200 ppm concentration was applied twice at the last week of both April and June during each season Triton B at 0.1 % concentration was used as a surfactant agent and five liters were found to be sufficient for covering the whole foliage of each tree.

The complete randomized design with four replications an individual tree per each was adopted for arranging the following eighteen combinations of NK x Zn fertilization treatments.

1- Control treatment (N_0K_0 soil applied with no Zinc/ water spray "N_0 K_0+ Zn_0".

2- N_0 K_0 soil applied fertilization + Zn spray at 200 ppm "$N_0K_0Zn_1$".

3- N_0 K_1 soil applied fertilization + Zn_0 "water spray solution".

4- N_0 K_1 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

5- N_0 K_2 soil applied fertilization + Zn_0 "water spray solution".

6- N_0 K_2 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

7- N_1 K_0 soil applied fertilization + Zn_0 "water spray solution".

8- N_1 K_0 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

9- N_1 K_1 soil applied fertilization + Zn_0 "water spray solution".

10- N_1 K_1 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

11- N_1 K_2 soil applied fertilization + Zn_0 "water spray solution".

12- N_1 K_2 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

13- N_2 K_0 soil applied fertilization + Zn_0 "water spray solution".

14- N_2 K_0 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

15- N_2 K_1 soil applied fertilization + Zn_0 "water spray solution".

16- N_2 K_1 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

17- N_2 K_2 soil applied fertilization + Zn_0 "water spray solution".

18- N_2 K_2 soil applied fertilization + Zn_1 "Zn spray at 200 ppm.

Since, these NK x Zn fertilization treatments were evaluated regarding their influence on some vegetative growth measurements, leaf mineral content, some fruiting measurements and some fruit characteristics of both Costata and Hachyia persimmon cvs. trees.

Therefore, the obtained results during both 1999 and 2000 seasons of study could be summarized as follows:

V-I- Vegetative growth measurements

V-I-1- Average increase in shoot length

The greatest increase in shoot length was significantly gained by those of Costata and Hachyia persimmon trees supplied with N_2K_2 treatment, followed by those of the N_2K_1 treated trees. The least average increase in shoot length was statistically induced by the control trees "N_0K_0". Moreover,

differences in the increase of shoot length due to Zn concentration in spray solution without NK applied were less pronounced than those previously discussed with the NK applied rate. Meanwhile, the combinations between the N_2K_2 soil added and the Zn1 "at 200 ppm" foliar spray exhibited statistically the greatest value in shoot length increase of the two persimmon cvs. under study than NK applied rates N_2K_2.

V-I-2- Average number of leaves per shoot

The same trend previously found with the average increase of shoot length was also detected in this regard. However, the N_2K_2 was the superior followed by N_2K_1 whereas, the control treatment"N_0K_0" produced the least number of leaves per shoot. Moreover, it could be generally observed that the highest number of leaves/shoot was always in concomitant with those sprayed trees with Zn_1 (at 200 ppm concentration) than those of the Zn_0 (water spray). However, combinations of the N_2K_2 x Zn_1 treatment resulted in significantly the highest number of leaves/shoot on the contrary the lowest one in this respect had unfertilized trees Zn_0K_0x Zn_0). Such trend was detected during both 1999 and 2000 seasons for Costata and Hachyia persimmon cultivars.

V-I-3- Leaf area (cm^2)

The largest leaves in their area were statistically in closed relationship with those N_2K_2 soil applied rate followed by N_2K_1 treatment, whereas the opposite was observed with those the N_0K_0 treated trees. However, both persimmon cvs. trees were responded significantly with spraying Zn at 200 ppm concentration than the Zn_0 "water spray". Since, the (N_2K_2 x

Zn_1) and (N_2K_1 x Zn_1) combinations exhibited statistically the greatest value in leaf area. Such trend was detected for both Costata and Hachyia persimmon cvs. during 1999 and 2000 seasons of study.

V-I-4- Leaf dry weight (gm.)

The highest value of leaf dry weight was significantly in concomitant the N_2K_2 treated trees, the opposite was found with those trees subjected to N_0K_0 treatment. Also, the leaf dry weight was responsible to the Zn_1 concentration, while induced leaves significantly the heaviest weight as compared to those of the Zn_0 "water spray". Moreover, both the NK level and Zn concentration were reflected on their combinations however, the (N_2K_2 x Zn_1) combination induced leaves with the highest value of dry weight. Such trend was true during both 1999 and 2000 seasons for the two persimmon cvs. under study.

V-I-5- Percentage increment in trunk diameter

The highest value of the NK soil application "N_2K_2" resulted significantly in the greatest value of increase % in trunk diameter followed by "N_2K_1" treated trees. In addition, there area positive relationship between the Zn concentration and increment % in trunk diameter. Moreover, the highest increment % in trunk diameter was significantly in closed relationship with trees subjected to the combinations of (N_2K_2 x Zn_1) then (N_2K_1 x Zn_1) treated trees. Contrary, to that the (N_0K_0 x Zn_0) treatment which induced significantly the lowest value in this respect. Such trend was detected for both Costata and Hachyia persimmon cvs. during 1999 and 2000 season in this study.

V-II- Response of leaf mineral content

V-II-1- Leaf nitrogen content

The leaf N content was increased significantly by increasing the applied rate of the NK. The richest leaves in their N content was statistically gained by those N_2K_2 applied trees followed in descending order by those N_2K_0 and N_2K_1 treatments in the 1st and 2nd seasons, respectively. In addition to, spraying chelated zinc at 200 ppm "Zn_1" increased significantly the leaf N content than the water spray "Zn_0" Moreover, persimmon trees were subjected to the "N_2K_2 x Zn_1" combination resulted in the highest N content in leaves. Such trend was true for both Costata and Hachyia persimmon cvs. during 1999 and 2000 seasons of study.

V-II-2- Leaf phosphorus content

The N_2K_2 treated trees had leaves contained the highest P level during the second (2000) season for the two persimmon cvs, while leaf P content significantly increased by N_0K_1 for Costata cv. and N_2K_0 for Hachyia cv. in 1999 season. However, the lowest leaf P content was in closed relationship to the "N_0K_0" treatment during both 1999 and 2000 seasons. Meanwhile, the response of leaf P content to spraying of zinc was completely absent from the stand point of statistic during both seasons for the two persimmon cvs. in this concern. Moreover, the (N_1K_1 x Zn_1) and (N_2K_0 x Zn_1) combinations exhibited the greatest value of leaf P content during 1999 and 2000 seasons for Costata and Hachyia persimmon cvs. respectively.

V-II-3- Leaf potassium content

The highest NK soil added level (N_2K_2) and (N_1K_2) the greatest leaf K content were obviously recorded, while the opposite was true with the lowest NK added rate i.e. "N_0K_0". Whereas, the leaf K level was generally raised with increasing Zn concentration the "Zn_1" spray solution was significantly more effective than the "Zn_0" solution. Moreover, the combinations between the highest NK soil added rate and Zn concentration i.e. "N_2K_2 x Zn_1" exhibited statistically the greatest leaf K content during both seasons for Costata and Hachyia persimmon cvs. under this study.

V-II-4- Leaf calcium content

Leaf Ca content was significantly responded to the investigated rate of the NK soil applied, whereas, the highest leaf Ca value was significantly exhibited by the N_2K_2 followed by N_2K_1 treatments, however, those of N_0K_0 treatment was significant the poorest leaves in their Ca content. Meanwhile, the Zn1 (at 200 ppm) sprayed trees had leaves richest Ca content than Zn_0 "water spray" treated ones. In addition to that, trees subjected to either "N_2K_2 x Zn_1" or "N_2K_1 x Zn_1" combinations exhibited the values of leaf Ca content, respectively. Such trend was detected during both 1999 and 2000 seasons for the two persimmon cvs. under this investigation.

V-II-5- Leaf magnesium content

The highest value of leaf Mg content was significantly in concomitant to the "N_2K_2" treated trees followed in a descending order by "N_2K_1" level. Whereas, the opposite was true with those subjected to the "N_0K_0" treatment. Moreover, spraying Costata

and Hachyia persimmon trees with Zn solution at 200 ppm concentration increased significantly the leaf Mg content over the water sprayed trees. Furthermore, both "N_2K_2 x Zn_1"and "N_2K_1 x Zn_1" combinations were significantly the most effective in increasing the leaf Mg content. Such trend was true for both Costata and Hachyia persimmon cvs. during 1999 and 2000 seasons of study.

V-II-6- Leaf iron content

Leaf Fe content was increased significantly by increasing the applied rate of the NK to soil. The highest value of leaf Fe content was significantly in concomitant to the "N_2K_2" and "N_2K_1"treatments respectively during both seasons for Hachyia cv. and in the 1st season for Costata cv. only, while both "N_1K_2" and "N_1K_1" treatments were the superiority in the 2000 season. However leaves of the "N_0K_0" rate were significantly the lowest value during 1999 and 2000 seasons. Moreover, spraying the Zn at 200 ppm concentration (Zn_1) increased significantly the leaf Fe content as compared to the water sprayed trees (Zn_0). Furthermore, data revealed that the specific effect of both factors (NK soil added rates and Zn foliar spray) reflected directly on their interaction effect during both seasons of study for the two persimmon cultivars.

V-II-7- Leaf zinc content

The "N_2K_2" and "N_2K_1" treated trees had leaves contained the greatest leaf Zn content, while the opposite was true with those persimmon trees subjected to the "N_0K_0" treatment. However, leaf Zn content responded significantly and generally raised with increasing Zn concentration. Whereas, the

Zn_1 (200 ppm spray solution) was more significantly and more effective than the Zn_0 in all cases. Moreover, either the (N_2K_2 x Zn_1) or (N_2K_1 x Zn_1) combinations exhibited the highest value of leaf Zn content. Such trend was detected during 1999 and 2000 seasons for Costata and Hachyia persimmon cvs. under study.

V-II-8- Leaf manganese content

The richest leaves in their Mn content were in closed relationship statistically with those N_2K_2 applied trees followed by N_2K_1 treatment. Whereas, foliar spray with Zn_1 solution increased significantly the leaf Mn content then the Zn_0 (water spray). In addition, the highest value of leaf Mn content was achieved by those trees subjected to both "N_2K_2 x Zn_1" and "N_2K_1 x Zn_1" treatments, respectively. Trees subjected to N_0K_0 and Zn_0 either singly or together showed significantly the lowest leaf Mn content. This trend was true for both Costata and Hachyia persimmon cvs. during 1999 and 2000 seasons in this study.

V-II-9- Leaf cupper content

The highest value of leaf Cu content was significantly gained by persimmon trees applied with N_2K_2 treatment, whereas the opposite was true with lowest rate i.e. N_0K_0 treated trees which had significantly the poorest leaves in their Cu content. Meanwhile, spraying trees with Zn solution at 200 ppm concentration increased the leaf Cu content over water sprayed trees "Zn_0". Moreover, the N_2K_2 treatment trees and sprayed with Zn_1 solution i.e., "N_2K_2 x Zn_1" combination resulted in significantly increased in the leaf Cu content. . Such trend was

detected for both Costata and Hachyia persimmon during both 1999 and 2000 seasons of investigation.

V-III- Response of some fruiting measurements

In this regard some fruiting measurements namely, fruit set percentage, yield Kg fruit/tree and yield increment percentage over the control were investigated regarding their response to the NK soil applied rate and concentration of chelated Zn spray solution as well as their combinations.

Data obtained revealed that all studied fruiting measurements of both Costata and Hachyia persimmon cvs. were in closed positive relationship with the NK soil added level. Whereas, the N_2K_2 was the superior, while the reverse was true the (N_0K_0). However, with all fruiting measurements an increase was detected by spraying Zn solution at 200 ppm concentration "Zn_1" as compared to the Zn_0 "water spray". Moreover, it could be noticed that the higher NK soil added rate in combination with the Zn_1 spray (at 200 ppm concentration) i.e. the "N_2K_2 x Zn_1" was the most stimulative NK x Zn combination for increasing fruit set %, yield and yield increment % over the control. Anyhow, Such trends of response were true during both 1999 and 2000 seasons for the two persimmon cvs. under study.

V-IV- Response of some fruit characteristics

V-IV-1- Fruit physical characteristics

Concerning the fruit weight and volume, data obtained revealed that both (N_2K_2) and (N_1K_2) and treatments resulted significantly in the greatest value of fruit weight and volume respectively during both seasons of study. Moreover, both fruit

weight and volume were significantly responded to spraying Zn solution at 200 ppm (Zn_1). Furthermore, the treatments (N_2K_2 Zn_1) and (N_1K_2 Zn_1) exhibited statistically the heaviest fruit weight and greatest volume, respectively.

Regarding the fruit length and diameter, data indicated that both (N_2K_2) and (N_2K_1) treatments induced fruit with more elongated length and fruit diameter those of the (N_0K_0) treated trees. Meanwhile, the positive relationships between the Zn concentration and both fruit length and diameter. In addition, the highest value of fruit length and diameter were significantly in closed relationships with trees subjected to the (N_2K_2 Zn_1) treatments during both seasons of study for the two persimmon cultivars.

As for the fruit shape index, data indicated that the trend was no firm to be the same during both seasons as affected by the level of NK soil applied or Zn foliar spray solution. However, all (NK) treatments were no significant effect except with the N2K0 treatment in the first seasons for Costata cv., also the only treatment (Zn1) for Hachyia cv. in 1999 season was induced significant effect.

V-IV-1- Fruit chemical characteristics

Data obtained revealed that the treatments of (N_2K_2), (N_2K_0) and (N_0K_0) significantly induced the highest value of TSS %, Acidity %, T./A. ratio and tannins %, respectively. Whereas, the (N_0K_0), (N_0K_2) and (N_2K_2) treatments resulted significantly in the lowest value of abovementioned characters respectively. Moreover, the highest value of TSS % and T/A ratio were resulted by spraying Zn at 200 ppm concentration,

however (Zn_0) and (Zn_1) sprayed trees were resulted in the lowest both acidity % and tannins %, respectively. In addition the specific effect of both (NK) and (Zn) spray were reflected directly on the interaction effect on all fruit chemical properties under study. Such trend was detected during both 1999 and 2000 seasons of study for both Costata and Hachyia persimmon cvs.