4. RESULTS and DISCUSSION

4.1. Tree growth

Data presented in **Tables (5-14)**, show the response of some growth parameters of Costata persimmon trees expressed as number of shoots per branch (growth intensity), shoot length increase, increase in number of leaves per shoot, leaf surface area, leaf dry weight and leaf content of chlorophyll (a&b) and carotene to organic manure source (cattle, poultry and rabbit), organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) as well as their interaction during 2002 and 2003 seasons, besides the average of the two seasons.

4.1.1. No. of shoots/branch (growth intensity)

It is quite clear from **Table (5)** that Costata persimmon trees manured with cattle manure had greater growth intensity i.e., higher number of developed shoots per branch (16.7, 18.6 and 17.6 shoot/branch) as compared with the analogous ones manured with poultry manure (12.4, 14.3 and 13.3 shoot/branch) and rabbit manure (10.2, 12.1 and 11.1 shoot/branch) according to the data of 2002 and 2003 seasons as well as the average of the two seasons, respectively. Besides, both poultry and rabbit manure produced similar effect in this respect from the statistical standpoint.

On the other hand, organic manures namely cattle, poultry and rabbit whether applied superficially or in trenches exerted materially similar effect on number of shoots per branch (growth intensity) of Costata persimmon trees during the two seasons of study, (**Table, 5**).

Furthermore, soil inoculation with Nitrobien failed to produce distinguishable effect on number of shoots per branch (growth intensity) as compared with Rhizobacterien inoculation in 2002 and 2003 seasons, (**Table, 5**).

In addition, the interaction between organic manure source and the application method, (**Table, 6**) shows that cattle manure applied in trenches exerted higher positive effect on growth intensity (21.0, 22.9 and 22.0 shoot/branch) as compared with the other studied combinations during 2002 and 2003 seasons as well as the average of two seasons, respectively. On the contrary, rabbit manure applied superficially induced statistically the least positive effect on growth intensity (8.1, 9.9 and 9.0 shoot/branch) in 2002 and 2003 seasons as well as the average of the two seasons, respectively. Other studied interactions gave more or less similar effect in this concern in both seasons from the statistical standpoint.

Furthermore, the interaction between organic manure source and biofertilization, (**Table**, 7) demonstrates that in both seasons cattle manure whether enriched with Nitrobien or Rhizobacterien induced similarly the highest positive effect on number of shoots per branch (growth intensity) as compared with the other studied interactions. Besides, poultry manure provided with Nitrobien inoculation came next in exerting enhancing effect on growth intensity. Other tested combinations produced similar effect in this sphere from the statistical standpoint.

Additionally, **Table (8)** illustrates that the interaction between organic manure application method and biofertilization failed to exert a differentiated effect on growth intensity of Costata persimmon trees during 2002 and 2003 seasons.

Lastly, the interaction between organic manure source, application method and biofertilization, (**Table, 9**), shows that out of all these studied combinations cattle manure applied in trenches and supported with Nitrobien or Rhizobacterien recorded the highest values of number of shoots per branch in both seasons, followed by poultry manure applied in trenches and provided with Nitrobien inoculation. On the contrary, rabbit manure applied superficially and enriched with Rhizobacterien or Nitrobien inoculation and poultry manure applied superficially and supported with Rhizobacterien showed to be the least effective combinations in enhancing growth intensity of Costata persimmon trees in both seasons in an ascending order. Other studied combinations gave nearly more or less an intermediate values in this concern.

4.1.2. Shoot length increase

It is obvious from **Table (5)** that cattle manured persimmon trees produced the longest shoots (6.9 & 6.3 and 6.6 cm), followed by poultry manured ones (5.5 & 5.2 and 5.3 cm) and lastly rabbit manured trees (5.1 & 4.8 and 4.9 cm) in 2002 and 2003 seasons as well as the average of the two seasons, respectively. However, the differences between the three tested organic manure sources were obvious to be significant at 5% level.

On the other side, the application of organic manure in trenches succeeded in increasing shoot length in the second seasons 2003, only as compared with superficial application. Such enhancing effect disappeared in the first season, (**Table, 5**).

Additionally, soil inoculation with Nitrobien induced statistically similar effect on shoot length as did Rhizobacterien inoculation in the first and second seasons, (**Table, 5**).

Referring to the interaction between organic manure source and application method, data of the average of two seasons (**Table, 6**) declare that persimmon trees manured with cattle manure in trenches produced the longest shoots, followed descendingly by the analogous ones manured with the same organic manure source, but in superficial method. On reverse, rabbit manure, applied superficially produced comparatively the shortest shoots. The remained combinations resulted in shoots similar in their lengths from the statistical standpoint.

In addition, data of the average of the two seasons (**Table, 7**) dealing with the interaction between organic manure source and biofertilization demonstrate that the longest shoots in both seasons of study were observed on persimmon trees manured with cattle manure and inoculated with Rhizobacterien, followed by the corresponding ones manured with the same organic manure source but inoculated with Nitrobien. On the contrary, the shortest shoots were realized on rabbit manured trees, inoculated with Nitrobien. The other studied interactions gave statistically similar values in this sphere.

As for the interaction between organic manure application method and biofertilization, **Table (8)** illustrate that in general, Costata persimmon trees manured in trenches and inoculated with Rhizobacterien produced comparatively the longest shoots in both seasons. Besides, the other studied combinations gave nearly more or less shoots similar in their lengths.

Lastly, data of the average of the two seasons dealing with the effect of interaction between organic manure source, application method and biofertilization on shoot length increase reported in **Table (9)** show that the longest shoots were produced by cattle manured trees in trenches, inoculated with Rhizobacterien followed descendlingly by the corresponding ones manured with the same organic manure source and manured by the same method, but inoculated with Nitrobien and those manured with cattle manure superficially and inoculated with Rhizobacterien. On the contrary, the shortest shoots were observed on persimmon trees manured with rabbit manure in trenches and inoculated with Nitrobien, followed in an ascending order by the analogous ones manured with poultry manure in trenches and inoculated with Nitrobien and those manured superficially with rabbit manure and inoculated with Rhizobacterien. Other studied interactions exerted an intermediate effect in this concern.

4.1.3. Increase in No. of leaves/shoot

It is clear from **Table (5)** that in 2002 and 2003 seasons shoots of rabbit manured trees had higher number of leaves (3.2

& 2.9 and 3.0 leaves/shoot), followed by cattle manured ones (2.9 & 2.7 and 2.8 leaves/shoot) and finally poultry manured trees (2.2 & 2.8 and 2.5 leaves/shoot) in the first and second seasons as well as the average of two seasons, respectively. The differences between the three tested organic manure sources, particularly in the first season, in this respect were significant at 5% level.

Furthermore, the application of organic manure in trenches enhanced the efficiency of organic manure in increasing number of leaves per shoot in the first season, only than did superficial application. Such enhancement of trench application method disappeared in the second season, (**Table**, **5**).

In addition, **Table** (**5**) illustrates that Nitrobien inoculated trees produced higher number of leaves per shoot than did Rhizobacterien inoculated ones in the first season. Such stimulus effect of Nitrobien absent in the second season.

Referring to the interaction between organic mannure source and application method, **Table** (**6**) demonstrates that shoots of cattle and rabbit-manured trees in trenches had statistically similar and higher number of leaves as compared with other tested combinations. On the other hand, rabbit-manured trees superficially produced higher number of leaves per shoot as compared with other tested interactions. The rest combinations gave an intermediate values in this concern.

On the other hand, **Table** (**7**) indicates that when rabbit-manure interacted with Nitrobien, it produced the highest number of leaves per shoots, followed by the interaction between cattle manure and Nitrobien inoculation. The opposite was observed when poultry manure interacted with Nitrobien, hence, this combination gave the lowest number of leaves per shoot. The rest interactions induced statistically similar effect in this respect.

Regarding the interaction between organic manure application method and biofertilization, **Table** (**8**) shows that in

2002 season the application of organic manure in trenches supplemented with Nitrobien inoculation produced comparatively higher number of leaves per shoots. Besides, the remained tested interactions induced statistically similar effect in this respect in both seasons.

Finally, the interaction between organic manure source, application method and biofertilization, **Table (9)** illustrates that cattle and rabbit manure applied in trenches and enriched with Nitrobien as well as rabbit manure applied superficially and provided with Nitrobien induced statistically similar and higher values of number of leaves per shoot as compared with other tested combinations. On reverse, the lowest number of leaves per shoot was produced by the interaction between poultry manure applied superficially and provided with Rhizobacterien, poultry manure applied superficially and enriched with Nitrobien and cattle manure applied superficially and supported with Nitrobien. Other tested combinations came inbetween the previously two mentioned categories.

4.1.4. Leaf surface area

Table (5) shows that poultry manured trees produced leaves with larger surface area (43.13 & 41.19 and 42.16 cm^2), followed by cattle manured ones (38.53 & 38.13 and 38.33 cm^2) and lastly, rabbit manured trees (35.28 & 34.97 and 35.12 cm^2) in the first and second seasons as well as the average of the two seasons, respectively. However, significant differences were pronounced between the three tested organic manure sources.

On the other hand, neither the organic manure application method (superficial or trench) nor the biofertilization (Nitrobien or Rhizobacterien) succeeded in inducing a remarkable effect on leaf surface area of Costata persimmon trees during both seasons of study.

Concerning the interaction between organic manure source and application method, **Table (6)** reveals that the largest leaf surface areas were obtained firstly by poultry manured trees superficially and secondly by those manured with the same organic manure source in trenches in both seasons of study. The reverse i.e., the smallest leaf surface areas were produced by the two application methods of rabbit manure especially when trench application method was used. Besides, the two application methods of cattle manure came inbetween the previously two mentioned catogeries.

Furthermore, **Table (7)** demonstrates that the combination between poultry manure and Nitrobien inoculation resulted in the largest leaf surface area, followed by the combination of cattle manure and Rhizobacterien inoculation and poultry manure combined with Rhizobacterien. The rest combinations exerted similar effect in this respect from the statistical standpoint.

Referring to the interaction between organic manure application method and biofertilization, **Table (8)** indicates that such interactions failed to induce a distinguishable effect on leaf surface area in both seasons of study.

Finally, out of all interactions between organic manure source, application and biofertilization (**Table, 9**) poultry manure applied in trenches supported with Nitrobien inoculation gave the largest leaf surface area, followed by those manured by the same organic manure source superficially and inoculated with Nitrobien or Rhizobacterien as well as the analogous ones manured with cattle manure and supported with Rhizobacterien inoculation. On the contrary, the smallest leaf surface areas were produced in an ascending order by rabbit manured trees in trenches, inoculated with Nitrobien or Rhizobacterien and those manured with cattle manure in trenches provided with Nitrobien inoculation. Other interactions gave inbetween values in this concern.

4.1.5. Leaf dry weight

It is obvious from **Table (5)** that poultry manured trees produced the heaviest leaves as compared with those produced by cattle or rabbit-manured ones in both seasons. Besides, the differences between cattle and rabbit manure in both seasons and between poultry and rabbit manure in the 2003 season in this concern were lacking from the statistical standpoint.

On the other hand, neither organic manure application method (superficial or trench) nor biofertilization (Nitrobien or Rhizobacterien) induced a distinguishable effect on leaf dry weight in both seasons, (**Table, 5**).

In addition, **Table (6)** demonstrates that poultry manure whether applied in trenches or superficially produced the highest positive effect on leaf dry weight. Other studied combinations showed a fluctuated trend during the two seasons of study.

As for the interaction between organic manure source and biofertilization, **Table (7)** shows that poultry manure enriched with Rhizobacterien or supported with Nitrobien and cattle manure provided with Rhizobacterien recorded the highest values of leaf dry weight in descending order. Other combinations gave nearly more or less similar trend in this respect.

Additionally, **Table (8)** shows that the interaction between organic manure application method and biofertation induced nearly similar effect on leaf dry weight from the statistical standpoint.

Finally, **Table (9)** illustrates that out of all studied interactions poultry manure applied superficially and provided with Rhizoacterien and poultry manure applied in trenches and enriched with 'Nitrobien induced statistically similar and higher values of leaf dry weight in both seasons of study. Other combinations showed a fluctuated trend throughout the course of study.

Table (5): Specific effect of organic manure source, application method and biofertilization on some growth parameters of Costata persimmon trees (2002 & 2003 and average).

Factor	No. of shoots/ branch			Shoot length increase (cm)			Increase in No. of leaves/shoot			Leaf surface area (cm^2)			Leaf dry weight (g)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source															
Cattle manure	16.7 A	18.6 A	17.6 A	6.9 A	6.3 A	6.6 A	2.9 B	2.7 B	2.8 B	38.53 B	38.13 B	38.33 B	0.437 B	0.362 B	0.399 B
Poultry manure	12.4 B	14.3 B	13.3 B	5.5 B	5.2 B	5.3 B	2.2 C	2.8 AB	2.5 C	43.13 A	41.19 A	42.16 A	0.495 A	0.437 A	0.466 A
Rabbit manure	10.2 B	12.1 B	11.1 B	5.1 C	4.8 C	4.9 C	3.2 A	2.9 A	3.0 A	35.28 C	34.97 C	35.12 C	0.441 B	0.380 AB	0.410 B
b- Effect of application method															
Superficial	10.6 A	12.6 A	11.6.A	5.7 A	5.2 B	5.4 A	2.8 B	2.7 A	2.7 B	40.40 A	38.78 A	39.59 A	0.460 A	0.370 A	0.415 A
Trench	15.5 A	17.3 A	16.4 A	6.0 A	5.6 A	5.8 A	3.0 A	2.9 A	2.9 A	37.56 A	37.41 A	37.48 A	0.455 A	0.420 A	0.437 A
c- Effect of biofertilization															
Nitrobien	14.5 A	16.4 A	15.4 A	5.4 A	5.3 A	5.3 A	3.0 A	2.9 A	2.9 A	38.01 A	38.08 A	38.04 A	0.446 A	0.362 A	0.404 A
Rhizobacterien	11.8 A	13.6 A	12.7 A	6.3 A	5.5 A	5.8 A	2.5 B	2.7 A	2.6 B	39.95 A	38.12 A	39.03 A	0.469 A	0.429 A	0.449 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (6): Effect of interaction between organic manure source and application method on some growth parameters of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	No. of shoots/ branch			Shoot length increase (cm)			Increase in No. of leaves/shoot			Leaf surface area (cm^2)			Leaf dry weight (g)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	12.4 B	14.3 B	13.5 B	6.8 A	5.8 B	6.3 B	2.4 C	2.4 D	2.4 C	39.61 BC	38.29 B	38.95BC	0.488 B	0.300 C	0.394BC
	Trench	21.0 A	22.9 A	22.0 A	7.2 A	6.8 A	7.0 A	3.3 A	3.0 A	3.1 A	37.45CD	37.97BC	37.71CD	0.386 D	0.425A	0.405ABC
Poultry	Superficial	11.8 B	13.7 B	12.8 B	5.9 B	5.1 D	5.5 C	2.1 D	2.9 AB	2.5 C	44.74 A	42.46 A	43.60 A	0.447 C	0.475 A	0.461AB
	Trench	13.1 B	14.9 B	14.1 B	5.2 C	5.3 C	5.2 C	2.4 C	2.7 C	2.5 C	41.53 B	39.91 B	40.72 B	0.542 A	0.400AB	0.471 A
Rabbit	Superficial	8.1 C	9.9 C	9.0 C	4.5 D	4.7 E	4.6 D	3.1 B	2.8 BC	2.9 B	36.85 D	35.59 C	36.22DE	0.446 C	0.337BC	0.391 C
	Trench	12.4 B	14.4 B	13.4 B	5.7 BC	4.8 E	5.2 C	3.3 A	3.0 A	3.1 A	33.71 E	34.35 D	34.03 E	0.436 C	0.437 A	0.436ABC

Means separation within each column by Duncan's multiple range test, 5% level.

Table (7): Effect of interaction between organic manure source and biofertilization on some growth parameters of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	No. of shoots/ branch			Shoot length increase (cm)			Increase in No. of leaves/shoot			Leaf surface area (cm^2)			Leaf dry weight (g)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	18.1 A	20.0 A	19.0 A	6.5 B	6.0 B	6.2 B	3.2 B	2.8 B	3.0 B	34.15 C	35.20 D	34.67 D	0.421 D	0.325 C	0.373 B
	Rhizobacterien	15.3 A	17.2 A	16.2 A	7.5 A	6.5 A	7.0 A	2.5 C	2.6 C	2.5 C	42.91 B	41.06 B	41.98 B	0.452B	0.400AB	0.426 AB
Poultry	Nitrobien	14.5 B	16.3 B	15.4 B	5.0 DE	5.4 C	5.2 C	2.2 D	2.5 C	2.3 D	45.76 A	44.49 A	45.12 A	0.471 B	0.412AB	0.441 AB
	Rhizobacterien	10.4 C	12.3 C	11.3 C	6.0 BC	5.0 D	5.5 C	2.2 D	3.0 AB	2.6 C	40.50 B	37.89 C	39.19 C	0.518 A	0.462 A	0.490 A
Rabbit	Nitrobien	10.0 C	12.9 C	11.9 C	4.6 E	4.4 E	4.5 D	3.7 A	3.1 A	3.4 A	34.11 C	34.54 D	34.32 D	0.446 C	0.350 BC	0.398 B
	Rhizobacterien	9.6 C	11.4 C	10.5 C	5.5 CD	5.1 D	5.3 C	2.7 C	2.6 C	2.6 C	36.45 C	35.40 D	35.92 D	0.436 C	0.425AB	0.430 AB

Means separation within each column by Duncan's multiple range test, 5% level.

Table (8): Effect of interaction between organic manure application method and biofertilization on some growth parameters of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	No. of shoots/ branch (2002)	(2003)	Average	Shoot length increase (cm) (2002)	(2003)	Average	Increase in No. of leaves/shoot (2002)	(2003)	Average	Leaf surface area (cm^2) (2002)	(2003)	Average	Leaf dry weight (g) (2002)	(2003)	Average
Superficial	Nitrobien	12.3 A	14.1 A	13.2 A	5.8 B	5.4 B	5.6 B	2.7 B	2.6 A	2.6 B	39.80 A	37.45 A	38.62 A	0.434 B	0.338 A	0.386 A
	Rhizobacterien	9.3 A	11.1 A	10.2 A	5.5 B	4.9 C	5.2 B	2.3 B	2.7 A	2.5 B	41.40 A	40.11 A	40.75 A	0.487 A	0.408 A	0.447 A
Trench	Nitrobien	16.7 A	18.7 A	17.7 A	4.9 B	5.1 C	5.0 B	3.3 A	3.0 A	3.1 A	36.62 A	38.70 A	37.66 A	0.458 AB	0.391 A	0.424 A
	Rhizobacterien	14.3 A	16.1 A	15.2 A	7.0 A	6.1 A	6.5 A	2.7 B	2.7 A	2.7 B	38.51 A	36.13 A	37.32 A	0.451 AB	0.450 A	0.450 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (9): Effect of interaction between organic manure source, application method and biofertilization on some growth parameters of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Biofertilization	No. of shoots/ branch (2002)	No. of shoots/ branch (2003)	No. of shoots/ branch Average	Shoot length increase (cm) (2002)	Shoot length increase (cm) (2003)	Shoot length increase (cm) Average	Increase in No. of leaves/shoot (2002)	Increase in No. of leaves/shoot (2003)	Increase in No. of leaves/shoot Average	Leaf surface area (cm^2) (2002)	Leaf surface area (cm^2) (2003)	Leaf surface area (cm^2) Average	Leaf dry weight (g) (2002)	Leaf dry weight (g) (2003)	Leaf dry weight (g) Average
Cattle	Superficial	Nitrobien	13.2 CD	15.1 CD	14.1 CD	6.9 B	5.5 E	6.2 B	2.5 CD	2.4 D	2.4 DEF	36.08 B	35.25 DE	35.66 CD	0.502 C	0.300 D	0.401 CD
		Rhizobacterien	11.7 CD	13.5 CD	12.6 CD	7.1 AB	6.1 C	6.6 B	2.3 DE	2.4 D	2.3 F	43.15 A	41.33 B	42.24 AB	0.475 CD	0.300 D	0.387 CD
	Trench	Nitrobien	23.0 A	25.00 A	24.0 A	6.5 B	6.6 B	6.5 B	3.8 A	3.3 A	3.5 A	32.22 CD	35.15 DE	33.68 D	0.340 G	0.350 CD	0.345 D
		Rhizobacterien	19.0 AB	20.9 AB	19.9 AB	7.8 A	6.8 A	7.3 A	2.8 B	2.7 BC	2.7 BC	42.68 A	40.80 BC	41.74 B	0.432 F	0.500 AB	0.466 BC
Poultry	Superficial	Nitrobien	14.0 CD	15.5 AC	14.9 CD	6.4 B	5.9 D	6.1 B	2.1 EF	2.5 D	2.3 F	45.42 A	43.75 AB	44.58 AB	0.335 G	0.375 BC	0.355 D
		Rhizobacterien	9.7 DE	11.7 DE	10.7 DE	5.2 C	4.2 G	4.7 C	2.0 F	3.3 A	2.6 BCD	44.05 A	41.18 BC	42.61 AB	0.560 B	0.575 A	0.567 A
	Trench	Nitrobien	15.0 BC	16.9 BC	15.9 BC	3.6 E	4.9 F	4.2 D	2.3 DE	2.6 BCD	2.4 DEF	46.10 A	45.23 A	45.66 A	0.607 A	0.450 AB	0.528 AB
		Rhizobacterien	11.2 CD	13.0 CD	12.1 CD	6.7 B	5.7 D	6.2 B	2.4 D	2.7 BC	2.5 CD	36.95 B	34.60 DE	35.77 CD	0.477 CD	0.350 CD	0.413 CD
Rabbit	Superficial	Nitrobien	9.7 DE	11.6 DE	10.6 DE	4.7 CD	5.0 F	4.8 C	3.6 A	3.1 A	3.3 A	36.70 B	33.35 E	35.02 CD	0.465 DE	0.325 CD	0.395 CD
		Rhizobacterien	6.5 E	8.3 E	7.4 E	4.3 DE	4.4 G	4.3 CD	2.5 CD	2.4 D	2.4 DEF	37.00 B	37.82 CD	37.41 C	0.427 F	0.350 CD	0.388 CD
	Trench	Nitrobien	12.2 CD	14.2 CD	13.2 CD	4.5 CD	3.8 H	4.1 D	3.8 A	3.2 A	3.5 A	31.53 D	35.72 DE	33.63 D	0.427 F	0.375 BC	0.401 CD
		Rhizobacterien	12.7 CD	14.6 CD	13.6 CD	6.7 B	5.7 D	6.2 B	2.8 B	2.8 B	2.8 B	35.90 BC	32.97 E	34.43 CD	0.445 EF	0.500 AB	0.472 BC

Means separation within each column by Duncan's multiple range test, 5% level.

4.1.6. Leaf chlorophyll (a) content

Table (10) demonstrates that leaves of poultry manured trees proved to be the richest ones in their chlorophyll (a) content in the second season 2003, only as compared with those of cattle or rabbit manured ones. On the contrary leaves of cattle manured trees showed to be the poorest ones in their chlorophyll (a) content. The differences between the three tested organic manure sources in this respect were obvious to be significant at 5% level. Such differences were missed in the first season 2002.

On the other hand, the two tested organic manure application methods (superficial and trench) produced similar effect on leaf chlorophyll (a) content. Moreover, Nitrobien inoculation failed to produced a differentiated effect on leaf chlorophyll (a) than did Rhizobacterien inoculation in both seasons of study from the statistical view, (**Table, 10**).

Referring to the interaction between organic manure source and application method, **Table (11)** illustrates that in 2003 season the richest leaves in their chlorophyll (a) content were produced by persimmon trees manured superficially with poultry manure. Besides, the application of the three tested organic manure sources (cattle, poultry and rabbit) in trenches produced statistically similar effect on leaf chlorophyll (a) content. On the contrary, the poorest leaves in their chlorophyll (a) content were observed on cattle manured trees superficially than did rabbit manured ones superficially. Such differences between the different studied interactions were lacking in 2002 season from statistical standpoint.

Furthermore, **Table (12)** shows that in 2003 season poultry manure whether enriched with Nitrobien or Rhizobacterien and rabbit manure provided with Nitrobien exerted statistically similar and higher positive effect on leaf chlorophyll (a) content than the combinations of cattle manure supported with Nitrobien or Rhizobacterien and the interaction between rabbit manure and Rhizobacterien. Besides, the differences between the previously three mentioned combinations were so small to reach the significance level. Moreover, all the tested interactions gave statistically similar values in 2002 season.

In addition, the interaction between organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) failed to exert a material distinguishable effect on leaf chlorophyll (a) content of persimmon trees during the two seasons of study, (**Table, 13**).

Lastly, the interaction between the three studied factors i.e., organic manure source (cattle, poultry and rabbit), application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) declares that in 2003 season poultry manure applied superficially and supported with Nitrobien recorded the highest values of leaf chlorophyll (a) content, followed descendingly by the combination of rabbit manure applied in trenches and provided with Nitrobien inoculation and the interaction between (poultry manure x superficial application x Rhizobacterien inoculation). On reverse, the lowest values of leaf chlorophyll (a) content were recorded in an ascending order by the combinations of rabbit manure applied superficially and Rhizobacterien inoculation, cattle manure applied superficially and supported with Nitrobien or Rhizobacterien inoculation. The remained combinations came inbetween the previously two mentioned catogeries. On the other hand, in 2002 season, all the studied combinations resulted from the interaction between the three tested factors induced statistically similar effect on leaf chlorophyll (a) content, (**Table, 14**).

4.1.7. Leaf chlorophyll (b) content

It is quite clear from **Table (10)** that in both seasons, leaves of rabbit and poultry manured trees had statistically similar and higher values of chlorophyll (b) content than the analogous ones borne on cattle manured ones.

In addition, the two studied factors i.e., organic manure application (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) failed to induce a distinctive specific effect on leaf chlorophyll (b) content during the two seasons of study.

Table (11) demonstrates that in 2003 season the application of poultry manure in trenches and rabbit manure either superficially or in trenches produced statistically similar and higher positive effect on leaf chlorophyll (b) content than other tested combinations. Besides, cattle manure whether applied superficially or in trenches produced statistically similar and lower values of leaf chlorophyll (b) content. On the other hand, poultry manure applied superficially produced statistically similar effect on leaf chlorophyll (b) content to the previously mentioned combinations. Moreover, all tested interactions recorded similar values of leaf chlorophyll (b) content from the statistical standpoint in 2002 season.

Regarding the interaction between organic manure source and biofertilization, **Table (12)** reveals that in both seasons leaves of poultry manured trees, enriched with Rhizobacterien and those of rabbit manured trees either supported with Nitrobien or Rhizobacterien recorded similar and higher chlorophyll (b) values as compared with the analogous ones borne on cattle manured trees, inoculated with Nitrobien or Rhizobacterien and poultry manured trees enriched with Rhizobacterien' inoculation. Moreover, the previously three mentioned combinations produced similar effect in this concern.

Furthermore, the interaction between organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) induced statistically similar effect on leaf chlorophyll (b) content, hence the differences were so small to reach the significance level in both seasons of study, (**Table, 13**).

Finally, the interaction between the three studied factors, (**Table, 14**) illustrates that in both seasons, poultry manure applied in trenches supported with Rhizobacterien, rabbit manure applied superficially and inoculated with Nitrobien and rabbit manure applied in trenches and provided with Rhizobacterien had statistically similar and higher values of leaf chlorophyll (b) than the other tested combinations. Besides, most of the remained interactions gave more or less similar values in this respect.

4.1.8. Leaf carotene content

It is clear from **Table (10)** that in 2003 season, leaves of cattle manured trees had higher values of carotene content than the other two tested organic manure sources. Besides, poultry manure exerted statistically the lowest positive effect in this respect. On the other hand, in 2002 season the differences between the three evaluated organic manure sources failed to reach the significance at 5% level.

In addition, the three tested organic manure sources whether applied superficially or in trenches produced statistically similar effect on leaf carotene content in both seasons of study, (**Table, 10**).

On the other side, **Table (10)** demonstrates that in 2003 season inoculation of Costata persimmon trees with Rhizobacterien enhanced leaf carotene content than did Nitrobien inoculation. Such enhancing effect was missed in the 2002 season, hence the two sources of biofertilizers gave statistically similar values in this respect.

Regarding the interaction between organic manure source and application method, **Table (11)** illustrates that in 2003 season the application of cattle manure superficially caused significant increase in leaf carotene content than the other tested combinations. On the contrary, the application of poultry manure superficially showed to be the least efficient combination in enhancing leaf carotene content. The remained combinations produced statistically similar and an intermediate values in this sphere. Besides, in 2002 season the differences between the six tested combinations were lacking from the statistical standpoint.

Referring to the interaction between organic manure source and biofertilization, **Table (12)** reveals that in 2002 season the tested combinations failed to exert a distinguishable effect on leaf carotene content. On the other hand, in 2003 season the enrichment of cattle and rabbit manure with Rhizobacterien inoculation produced similarly higher positive effect on leaf carotene content, followed descendingly by cattle and poultry manure supported with Nitrobien inoculation. On reverse, providing poultry manure with Rhizobacterien inoculation and rabbit manure with Nitrobien inoculation showed to be the least efficient combinations in enhancing leaf carotene content.

Additionally, the interaction between organic manure application method and biofertilization gave statistically similar values of leaf carotene content in both seasons, (**Table, 13**).

Lastly, **Table (14)** shows that in 2003 season out of all studied combinations, cattle manure applied superficially and inoculated with Nitrobien or Rhizobacterien produced statistically similar and higher values of leaf carotene content. On the contrary, rabbit manure applied in trenches and provided with Nitrobien inoculation, poultry manure applied superficially and enriched with Nitrobien and cattle manure applied in trenches and supported with Nitrobien showed to be the least efficient combinations in enhancing leaf carotene content. The rest combinations recorded an intermediate values in this concern. Besides, in 2002 season the interactions of the three tested factors induced statistically similar effect on leaf carotene content.

Generally, cattle manure showed to be the best organic manure source in enhancing number of shoots per branch (shoot intensity), shoot length and leaf carotene content. Moreover, rabbit manure proved to be the most effective organic manure source in exerting positive effect on number of produced leaves per shoot and leaf chlorophyll (b) content. Besides, poultry manure gave the highest values of leaf surface area, leaf dry weight and leaf chlorophyll (a and b) content. On the other hand, the application of organic manure in trenches produced higher positive effect on shoot length and number of leaves per branch (growth intensity) than did superficial application. Besides, the organic manure application method failed to produce a differentiated effect on growth intensity, leaf surface area, leaf dry weight and leaf chlorophyll (a&b) and carotene content. Furthermore, Nitrobien inoculation exerted higher stimulus effect on number of produced leaves per branch, whereas Rhizobacterien inoculation gave higher positive effect on leaf carotene content. Nitrobien and Rhizobacterien exerted statistically similar effect on growth intensity, shoot length, leaf surface area, leaf dry weight and leaf chlorophyll (a&b) content.

Finally, the combination of cattle manure applied in trenches and supported with Rhizobacterien proved to be the most effective interaction in enhancing growth intensity and shoot length. Moreover, rabbit manure applied in trenches and enriched with Nitrobien inoculation produced the highest number of leaves per shoot. Besides, poultry manure applied in trenches and supported with Nitrobien gave the largest leaf surface area. In addition, poultry manure applied superficially when provided with Rhizobacterien inoculation gave the highest leaf dry weight, but when it supported with Nitrobien it recorded the highest values of leaf chlorophyll (a) content, whereas, when it applied in trenches and supplemented with Rhizobacterien it produced the highest positive effect on leaf chlorophyll (b) content. On the other hand, cattle manure applied superficially and supported with Nitrobien or Rhizobacterien gave the highest values of leaf carotene content.

The improvement in tree growth due to the application of organic manure may be attributed to the fact that manures often improve the structure of the soil i.e. directly through their action as bulky diluents in compacted soil, or indirectly when the waste products of animals or microorganisms cement soil particles together. These structural improvements increase the amount of water useful to plants that soils can hold; they also improve aeration and drainge and encourage good root growth by providing enough pores of the right size and preventing the soil becoming too rigid when dry or completely waterlogged and devoid of air when wet. Thereupon, the positive effects of organic manure on plant growth may be attributed to: (a) its prospective physical affects on soil conditions, (b) the nutrients it supplies (c) the way it supplies the nutrients and (d) its enhancing effect on soil content of IAA and cytokinins (**Li** ***et al.*****, 1998**).

On the other hand, the enhancement of tree growth due to trench application of organic manure rather than superficial (application may be due to the fact that the uric acid in fresh manure is decomposed by micro-organisms to give ammonia, which is easily lost if the manure is left exposed to the air (**Cooke, 1982**). Losses of nitrogen by volatilization, of course will still unless the manure is plowed or disked in immediately (**Tisdale** and **Nelson, 1956**).

In addition, the enhancement of tree growth as a result of biofertilization may be attributed to the production of growth regulators as well as to N-fixation (**Rao** and **Dass, 1989**).

The results of organic manure source in enhancing tree growth are coincided with the findings of **Sekiya** ***et al*** **(1983)** on apple, **Tanas'ev (1984)** on apple, **Darfeld** and **Lenz (1985)** on pear, **Awad** ***et al*** **(1993)** on olive, **Abou-Sayed Ahmed (1997)** on Balady mandarin, **Li** ***et al.*** **(1998)** on apple, **Takahashi** ***et al.*** **(1998)** on mulberry, **Ashinov** and **Bekanov (1999)** on cherry, peach, apricot and wild berry, **El-Kobbia (1999)** on Washington navel orange trees, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They mentioned that organic manure affects on tree growth aspects differs according to its source.

On the other side, the results of organic manure application method, regarding tree growth are in accordance with the findings of **Makhmadbekov *et al.* (1984)** on Mayer lemon, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They reported that trench application of organic manure exerted more positive effect on tree growth parameters than did superficial application.

In addition, the enhancing effect of tested biofertilizers are in harmony with the findings of **Nagarjan *et al.* (1989)** on Mulberry, **Haggag** and **Azzazy (1996)** on mango, **Ahmed *et al.* (1997)** on Red Roomy grapevines, **Sharma** and **Bhutani (1998)** on apple, **Mansour (1998)** on apple, **Mahmoud** and **Mahmoud (1999)** on peach, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin trees. They reported that some growth parameters responded better to Rhizobacterien than Nitrobien and the reverse is true.

Table (10): Specific effect of organic manure source, application method and biofertilization on chlorophyll (a & b) and carotene of Costata persimmon trees (2002 & 2003 and average).

Factor	Chlorophyll A (mg/l)			Chlorophyll B (mg/l)			Carotene (mg/l)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source									
Cattle manure	9.8 A	11.1 C	10.4 C	8.45 B	8.95 B	8.70 B	3.57 A	4.07 A	3.82 A
Poultry manure	12.2 A	12.7 A	12.4 A	9.61 A	10.11 A	9.86 A	2.94 A	3.44 C	3.19 C
Rabbit manure	11.3 A	11.8 B	11.5 B	9.71 A	10.21 A	9.96 A	3.32 A	3.82 B	3.57 B
b- Effect of application method									
Superficial	11.0 A	11.6 A	11.3 A	9.16 A	9.66 A	9.41 A	3.33 A	3.83 A	3.58 A
Trench	11.2 A	12.1 A	11.6 A	9.35 A	9.85 A	9.60 A	3.22 A	3.72 A	3.47 A
c- Effect of biofertilization									
Nitrobien	11.3 A	12.3 A	11.8 A	8.93 A	9.43 A	9.18 A	3.04 A	3.54 B	3.29 B
Rhizobacterien	10.9 A	11.4 A	11.1 A	9.58 A	10.08 A	9.82 A	3.51 A	4.01 A	3.76 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (11): Effect of interaction between organic manure source and application method on chlorophyll (a & b) and carotene of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Chlorophyll A (mg/l)			Chlorophyll B (mg/l)			Carotene (mg/l)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	9.5 A	10.4 D	9.9 D	8.43 B	8.93 B	8.68 B	3.97 A	4.47 A	4.22 A
	Trench	10.1 A	11.9 B	11.0 B	8.47 B	8.97 B	8.72 B	3.16 A	3.66 B	3.41 B
Poultry	Superficial	12.9 A	13.4 A	13.1 A	9.24 AB	9.74 AB	9.49 AB	2.67 A	3.17 C	2.92 C
	Trench	11.9 A	11.9 B	11.9 B	9.98 A	10.48 A	10.23 A	3.20 A	3.70 B	3.45 B
Rabbit	Superficial	10.6 A	11.1 C	10.8 C	9.80 A	10.31 A	10.03 A	3.34 A	3.84 B	3.59 B
	Trench	12.0 A	12.4 B	12.2 B	9.61 A	10.12 A	9.86 A	3.31 A	3.81 B	3.56 B

Means separation within each column by Duncan's multiple range test, 5% level.

Table (12): Effect of interaction between organic manure source and biofertilization on chlorophyll (a & b) and carotene of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Chlorophyll A (mg/l)			Chlorophyll B (mg/l)			Carotene (mg/l)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	9.1 A	11.2 B	10.1 B	8.28 B	8.78 B	8.53 B	3.12 A	3.62 B	3.37 B
	Rhizobacterien	10.5 A	11.0 B	10.7 B	8.62 B	9.12 B	8.87 B	4.01 A	4.51 A	4.26 A
Poultry	Nitrobien	12.3 A	12.8 A	12.5 A	8.81 B	9.31 B	9.06 B	3.20 A	3.70 B	3.45 B
	Rhizobacterien	12.1 A	12.6 A	12.3 A	10.41 A	10.91 A	10.66 A	2.68 A	3.18 C	2.93 C
Rabbit	Nitrobien	12.4 A	12.9 A	12.6 A	9.71 A	10.21 A	9.96 A	2.79 A	3.29 C	3.04 C
	Rhizobacterien	10.1 A	10.6 B	10.3 B	9.71 A	10.21 A	9.96 A	3.85 A	4.35 A	4.10 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (13): Effect of interaction between organic manure application method and biofertilization on chlorophyll (a & b) and carotene of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Chlorophyll A (mg/l)			Chlorophyll B (mg/l)			Carotene (mg/l)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	11.5 A	12.2 A	11.8 A	9.24 A	9.74 A	9.49 A	3.08 A	3.58 A	3.33 A
	Rhizobacterien	10.5 A	11.0 A	10.7 A	9.08 A	9.58 A	9.33 A	3.57 A	4.07 A	3.82 A
Trench	Nitrobien	11.0 A	12.4 A	11.7 A	8.63 A	9.13 A	8.88 A	2.99 A	3.49 A	3.24 A
	Rhizobacterien	11.3 A	11.8 A	11.5 A	10.08 A	10.58 A	10.33 A	3.45 A	3.95 A	3.70 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (14): Effect of interaction between organic manure source, application method and biofertilization on chlorophyll (a & b) and carotene of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Biofertilization	Chlorophyll A (mg/l)			Chlorophyll B (mg/l)			Carotene (mg/l)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	Nitrobien	8.9 A	10.1 EF	9.5 FG	8.30 C	8.80 C	8.55 C	3.62 A	4.12 A	3.87 C
		Rhizobacterien	10.1 A	10.6 DE	10.3 EF	8.56 C	9.06 C	8.81 C	4.33 A	4.83 A	4.58 A
	Trench	Nitrobien	9.3 A	12.3 BC	10.8 DE	8.27 C	8.77 C	8.52 C	2.63 A	3.13 E	2.88 E
		Rhizobacterien	11.0 A	11.5 CD	11.2 DE	8.67 C	9.17 C	8.92 C	3.69 A	4.19 C	3.94 BC
Poultry	Superficial	Nitrobien	13.4 A	13.9 A	13.6 A	8.62 C	9.12 C	8.87 C	2.58 A	3.08 E	2.83 E
		Rhizobacterien	12.4 A	12.9 B	12.6 AB	9.86 AB	10.36 AB	10.11 AB	2.77 A	3.27 DE	3.02 DE
	Trench	Nitrobien	11.1 A	11.6 C	11.3 D	9.00 BC	9.50 BC	9.25 BC	3.81 A	4.31 BC	4.06 BC
		Rhizobacterien	11.8 A	12.3 BC	12.0 BCD	10.96 A	11.46 A	11.21 A	2.58 A	3.08 E	2.83 E
Rabbit	Superficial	Nitrobien	12.2 A	12.7 B	12.4 BC	10.80 A	11.30 A	11.05 A	3.06 A	3.56 D	3.31 D
		Rhizobacterien	9.0 A	9.5 F	9.2 G	8.81 BC	9.31 BC	9.06 BC	3.62 A	4.12 C	3.87 C
	Trench	Nitrobien	12.7 A	13.2 AB	12.9 AB	8.62 C	9.12 C	8.87 C	3.52 A	2.04 F	2.78 E
		Rhizobacterien	11.2 A	11.7 C	11.4 CD	10.61 A	11.11 A	10.86 A	4.08 A	4.58 AB	4.33 AB

Means separation within each column by Duncan's multiple range test, 5% level.

4.2. Leaf mineral content

The response of leaf nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc and copper content of Costata persimmon trees to organic manure source (cattle, poultry and rabbit), organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) as well as their interactions during 2002 and 2003 seasons is reported in **Tables (15-29)**.

4.2.1. Nitrogen

It is obvious from **Table (15)** that in 2002 season leaves of cattle manured trees proved to be the richest ones in their content of nitrogen as compared with the analogous ones borne on poultry and rabbit manured trees. Besides, leaf nitrogen content of poultry manured trees was statistically similar to that of rabbit manured ones. On the other hand, in 2003 season cattle manure failed to induce such distinguishable effect on leaf nitrogen content.

Furthermore, organic manure whether applied superficially or in trenches and persimmon trees either inoculated with Nitrobien of Rhizobacterien failed to produce a distinctive specific effect on leaf nitrogen content in both seasons of study, (**Table, 15**).

As for the interaction between organic manure source and application method, **Table (16)** illustrates that in 2002 season the highest values of leaf nitrogen content was observed on leaves of cattle manured trees in trenches. On the contrary, leaves of rabbit manured trees recorded the lowest nitrogen content. Besides, leaf nitrogen content of other combinations recorded statistically similar values. On the other hand, in 2003 season the combination of cattle manure and trench application failed to produce the previous stimulus effect on leaf nitrogen content.

Table (17) shows that in 2002 season cattle manure whether enriched with Nitrobien or Rhizobacterien produce similar and higher values of leaf nitrogen content as compared with other tested combinations. On reverse, rabbit manure provided either with Nitrobien or Rhizobacterien induced statistically similar and the lowest values of leaf nitrogen content. Besides, poultry combinations gave an intermediate value in this concern. Moreover, in 2003 season the six tested combinations exerted similar effect in this sphere.

In addition, the interaction between organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) failed to produce a distinctive effect on leaf nitrogen content of Costata persimmon trees during the two seasons of study, (**Table, 18**).

Finally, the interaction between the three studied factors i.e. organic manure, application method and biofertilization **Table (19)** reveals that in 2002 season the richest leaves in their nitrogen content were produced by cattle manured trees in trenches and inoculated with Nitrobien or Rhizobacterien. On the contrary, the poorest leaves in their nitrogen content were borne on rabbit manured trees superficially and inoculated with Rhizobacterien or Nitrobien and those manured with the same organic manure source in trenches and inoculated with Nitrobien as well as poultry manured trees in trenches and supported with Rhizobacterien inoculation. The rest combinations came inbetween the previously two mentioned catogeries. On the other hand, in 2003 season all the evaluated combinations resulted from the interaction between the three tested factors produce similar effect on leaf nitrogen content of persimmon trees from the statistical standpoint.

4.2.2. Phosphorus

It is obvious from **Table (15)** that organic manure source (cattle, poultry and rabbit), organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) failed to produce a distinguishable effect on leaf phosphorus content of Costata persimmon trees throughout the course of study.

Furthermore, the interaction between organic manure source and application method failed to exert a pronounced differentiated effect on leaf phosphorus content in 2002 and 2003 seasons, (**Table, 16**).

In addition, the combinations resulted from the interaction between organic manure source and biofertilization produced more or less similar effect on leaf phosphorus content, particularly in 2002 season.

On the other side, **Table (18)** illustrates that in both seasons, the application of organic manure superficially or in trenches whether enriched with Nitrobien or Rhizobacterien gave statistically similar values of leaf phosphorus content.

Lastly, the interaction between the three studied factors reveals that in 2002 season, out of all tested interactions leaves of rabbit manured trees in trenches, enriched with Rhizobacterien proved to be the richest ones regarding phosphorus content. On reverse, the lowest values of leaf phosphorus content were shown in those leaves borne on poultry manured trees in trenches, inoculated with Rhizobacterien. Other combinations gave statistically similar values in this concern. Besides, in 2003 season all the tested combinations gave similar values of leaf phosphorus content from the statistical standpoint, (**Table, 19**).

4.2.3. Potassium

It is quite evident from **Table (15)** that the richest leaves in their potassium content were produced by poultry manured trees as compared with those produced by cattle and rabbit manured ones. Such superiority of poultry manure on rabbit manure in this respect disappeared in 2003 season.

Furthermore, the application of three tested organic manure sources in trenches exerted higher positive effect on leaf phosphorus content rather than when application was conducted superficially, (**Table, 15**).

Additionally, Costata persimmon trees whether inoculated with Nitrobien or Rhizobacterien produced leaves similar in their potassium content from the statistical view, (**Table, 15**).

Regarding the interaction between organic manure source and application method, **Table (16)** demonstrates that the highest values of leaf potassium content (1.68 & 1.67 and 1.67%) was produced by poultry manure applied in trenches in the first and second seasons as well as the average of two seasons, respectively. Rabbit manure applied superficially ranked the second in exerting higher stimulative effect on leaf potassium content in both seasons. On the contrary, the lowest values of leaf potassium content were recorded by leaves borne on cattle manured trees superficially (1.12 & 1.17 and 1.14%), followed asendlingly by poultry manure applied superficially (1.23 & 1.27 and 1.25%) in 2002 and 2003 seasons as well as the average of two seasons, respectively.

As for the interaction between organic manure source and biofertilization, **Table (17)** shows that in both seasons poultry manured trees inoculated with Nitrobien recorded the highest values of leaf potassium content of followed descendingly by the analogous ones manured with rabbit and inoculated with Rhizobacterien. Besides, cattle and poultry manure provided with Rhizobacterien and rabbit manure enriched with Nitrobien gave similar and higher values of leaf potassium content than did cattle manure supported with Nitrobien inoculation which recorded the lowest values of leaf potassium content in both seasons.

Furthermore, the application of organic manure in trenches provided either with Nitrobien or Rhizobacterien produced statistically similar and higher values of leaf potassium content than superficial application of organic manure provided with Nitrobien in both seasons of study, (**Table, 18**).

Table (15): Specific effect of organic manure source, application method and biofertilization on leaf N, P and K content of Costata persimmon trees (2002 & 2003 and average).

Factor	Nitrogen (%)			Phosphorus (%)			Potassium (%)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source									
Cattle manure	2.55 A	2.28 A	2.41 A	0.153 A	0.150 A	0.151 A	1.27 C	1.32 B	1.29 B
Poultry manure	2.38 B	2.17 A	2.27 A	0.160 A	0.137 A	0.148 A	1.46 A	1.47 A	1.46 A
Rabbit manure	2.27 B	2.13 A	2.20 A	0.163 A	0.151 A	0.157 A	1.41 B	1.43 A	1.42 A
b- Effect of application method									
Superficial	2.33 A	2.21 A	2.27 A	0.160 A	0.150 A	0.155 A	1.27 B	1.30 B	1.28 B
Trench	2.47 A	2.17 A	2.32 A	0.158 A	0.142 A	0.150 A	1.48 A	1.50 A	1.49 A
c- Effect of biofertilization									
Nitrobien	2.40 A	2.22 A	2.31 A	0.158 A	0.148 A	0.153 A	1.34 A	1.39 A	1.36 A
Rhizobacterien	2.40 A	2.16 A	2.28 A	0.159 A	0.144 A	0.151 A	1.42 A	1.42 A	1.42 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (16): Effect of interaction between organic manure source and application method on leaf N, P and K content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Nitrogen (%)			Phosphorus (%)			Potassium (%)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	2.48 AB	2.32 A	2.40 A	0.152 A	0.147 AB	0.149 A	1.12 E	1.17 E	1.14 E
	Trench	2.61 A	2.23 A	2.42 A	0.154 A	0.152 A	0.153 A	1.41 BC	1.47 BC	1.44 B
Poultry	Superficial	2.35 B	2.26 A	2.30 A	0.160 A	0.145 AB	0.152 A	1.2 3 D	1.27 D	1.25 D
	Trench	2.42 B	2.18 A	2.30 A	0.159 A	0.130 B	0.144 A	1.68 A	1.67 A	1.67 A
Rabbit	Superficial	2.17 C	2.06 A	2.11 A	0.166 A	0.157 A	0.161 A	1.46 B	1.48 B	1.47 B
	Trench	2.37 B	2.20 A	2.28 A	0.160 A	0.146 AB	0.153 A	1.35 C	1.38 C	1.36 C

Means separation within each column by Duncan's multiple range test, 5% level.

Table (17): Effect of interaction between organic manure source and biofertilization on leaf N, P and K content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Nitrogen (%)			Phosphorus (%)			Potassium (%)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	2.48 A	2.36 A	2.42 A	0.154 A	0.153 A	0.153 A	1.17 D	1.22 C	1.19 C
	Rhizobacterien	2.61 A	2.20 A	2.41 A	0.153 A	0.146 AB	0.149 A	1.36 BC	1.41 B	1.38 B
Poultry	Nitrobien	2.46 AB	2.20 A	2.33 A	0.160 A	0.150 A	0.155 A	1.52 A	1.54 A	1.53 A
	Rhizobacterien	2.31 BC	2.15 A	2.23 A	0.159 A	0.125 B	0.142 A	1.39 B	1.39 B	1.39 B
Rabbit	Nitrobien	2.27 C	2.11 A	2.19 A	0.161 A	0.142 AB	0.151 A	1.32 C	1.40 B	1.36 B
	Rhizobacterien	2.27 C	2.15 A	2.21 A	0.165 A	0.161 A	0.163 A	1.50 A	1.46 AB	1.48 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (18): Effect of interaction between organic manure application method and biofertilization on leaf N, P and K content of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Nitrogen (%)			Phosphorus (%)			Potassium (%)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	2.31 A	2.21 A	2.26 A	0.166 A	0.156 A	0.161 A	1.18 B	1.25 B	1.21 B
	Rhizobacterien	2.35 A	2.21 A	2.28 A	0.153 A	0.143 A	0.148 A	1.36 A	1.35 AB	1.35 AB
Trench	Nitrobien	2.50 A	2.23 A	2.36 A	0.154 A	0.140 A	0.147 A	1.49 A	1.52 A	1.50 A
	Rhizobacterien	2.44 A	2.11 A	2.27 A	0.165 A	0.145 A	0.155 A	1.48 A	1.49 A	1.48 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (19): Effect of interaction between organic manure source, application method and biofertilization on leaf N, P and K content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Bioferti-lization	Nitrogen (%)			Phosphorus (%)			Potassium (%)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	Nitrobien	2.37 BCD	2.35 A	2.36 A	0.158 AB	0.155 AB	0.156 A	1.11 F	1.18 DE	1.14 E
		Rhizobacterien	2.60 AB	2.30 A	2.45 A	0.147 AB	0.140 ABC	0.143 A	1.13 F	1.15 DE	1.14 E
	Trench	Nitrobien	2.60 AB	2.37 A	2.48 A	0.149 AB	0.152 AB	0.150 A	1.24 E	1.26 D	1.25 D
		Rhizobacterien	2.62 A	2.10 A	2.36 A	0.159 AB	0.152 AB	0.155 A	1.59 BC	1.68 B	1.63 B
Poultry	Superficial	Nitrobien	2.35 CDE	2.27 A	2.31 A	0.163 AB	0.157 AB	0.160 A	1.36 D	1.46 C	1.41 C
		Rhizobacterien	2.35 CDE	2.25 A	2.30 A	0.158 AB	0.32 BC	0.145 A	1.11 F	1.08 E	1.09 E
	Trench	Nitrobien	2.57 ABC	2.12 A	2.34 A	0.158 AB	0.142 ABC	0.150 A	1.68 B	1.63 B	1.65 B
		Rhizobacterien	2.27 DE	2.05 A	2.16 A	0.161 AB	0.117 C	0.139 A	1.68 B	1.71 AB	1.69 B
Rabbit	Superficial	Nitrobien	2.22 DE	2.02 A	2.12 A	0.177 A	0.157 AB	0.167 A	1.08 F	1.13 DE	1.10 E
		Rhizobacterien	2.12 E	2.10 A	2.11 A	0.156 AB	0.157 AB	0.156 A	1.84 A	1.83 A	1.83 A
	Trench	Nitrobien	2.32 DE	2.20 A	2.26 A	0.146 B	0.127 BC	0.136 A	1.55 C	1.67 B	1.61 B
		Rhizobacterien	2.42 ABC	2.20 A	2.31 A	0.175 AB	0.165 A	0.170 A	1.16 EF	1.09 E	1.12 E

Means separation within each column by Duncan's multiple range test, 5% level.

The combination of superficial application and Rhizobacterien exerted an intermediate values in this respect in both seasons.

Finally, **Table (19)** demonstrates that in both seasons the highest values of leaf potassium content were shown in rabbit manure applied superficially and Rhizobacterien combination, followed descendingly by poultry manure applied in trenches and provided with Rhizobacterien or Nitrobien and cattle manure applied in trenches and inoculated with Rhizobacterien. On the contrary, the inoculation with Rhizobacterien both poultry manure applied superficially or rabbit manure applied in trenches gave similar and lower values of leaf potassium content in both seasons followed in an ascending order by cattle manure applied superficially and inoculated with Rhizobacterien or Nitrobien and rabbit manure applied superficially and inoculated with Nitrobien. The remained combination gave inbetween values in this concern.

4.2.4. Calcium

It is quite clear from **Table (20)** that in 2003 season the richest heaves' in their calcium content were borne on cattle manured trees (1.42%) as compared with the analogous ones produced either by poultry or rabbit manured trees. Besides, poultry and rabbit manure exerted statistically similar effect in this respect. On the other hand, in 2002 season cattle manure failed to exert such superior effect as compared with the other two tested organic manure sources, hence the differences between the three tested organic manure sources were so small to reach the significance level.

Furthermore, each of the evaluated organic manure application method failed to produce a distinctive effect on leaf calcium content, (**Table, 20**).

In addition, the source of biofertilization whether Nitrobien or Rhizobacterien gave statistically similar values of leaf calcium content in both seasons of study, (**Table, 20**).

As for the interaction between organic manure source and its application method, **Table (21)** declares that the resulted combinations of such interaction showed similar values of leaf calcium content from the statistical standpoint in 2002 season. Meanwhile, in 2003 season the application of cattle manure in trenches exerted the highest positive effect, followed descendingly by the application of cattle manure superficially. On contrary, the least enhancing effect on leaf calcium content was produced by rabbit manure applied in trenches. Other tested combinations induced an intermediate values in this sphere.

Additionally, **Table (22)** reveals that in 2002 season the combinations resulted from the interaction between organic manure source and biofertilization produced similar effect on leaf calcium content from the statistical view. Meanwhile, in 2003 season, the combination of cattle manure enriched with Nitrobien took the superiority of enhancing leaf calcium content. The other tested interactions gave similar effect in this concern from the statistical standpoint.

On there side, the interaction between organic manure application method and biofertilization, (**Table, 23**) exerted similar effect on leaf calcium content throughout the course of study.

Finally, most combinations resulted from the interaction between organic manure source, application method and biofertilization gave statistically similar values of leaf calcium content except for cattle manure applied in trenches and inoculated with Nitrobien which recorded the highest positive effect in this concern, whereas rabbit manure applied in trenches and enriched with Nitrobien recorded the lowest values of leaf calcium content in both seasons of study.

4.2.5. Leaf magnesium content

It is clear from **Table (20)** that in both seasons the leaves of cattle manured trees recorded the highest values of magnesium content. Besides, significant differences were lacking between cattle and poultry manure in 2002 season. On the contrary, the leaves of rabbit manured trees showed the lowest values of magnesium content.

Furthermore, leaf magnesium content of Costata persimmon trees showed no response to the application method of organic throughout the course of study, (**Table, 20**).

In addition, Rhizobacterien inoculation enhanced leaf magnesium content than did Nitrobien inoculation in 2002 season, only, (**Table, 20**).

On the other hand, **Table (21)** illustrates that the trench application of cattle manure or poultry manure recorded the highest values of leaf magnesium content in descending order. On reverse, the lowest values of leaf magnesium content were achieved by those borne on rabbit manure applied in trenches, followed ascendingly by those produced by poultry manured trees superficially. Other combinations gave statistically similar and an intermediate values in this respect.

In addition, the average of the two seasons reported in **Table (22)** reveals that cattle manure enriched with Nitrobien proved to be the superior combination in enhancing leaf magnesium content. On the contrary, rabbit manure supported with Nitrobien inoculation showed to be the least efficient combination in improving leaf magnesium content, followed ascendingly by the combination of rabbit manure and Rhizobacterien inoculation. Other combinations produced similar and an intermediate values in this sphere.

Table (23) illustrates that in both seasons the organic manures whether applied superficially or in trenches provided with Nitrobien or Rhizobacterien induced statistically similar effect in this respect.

Finally, data of the average of two seasons show that leaves of poultry manured trees in trenches and inoculated with

Rhizobacterien as well those of rabbit manured trees superficially provided with Rhizobacterien achieved the highest value of magnesium content. On the contrary, rabbit manure applied in trenches and inoculated either with Nitrobien or Rhizobacterien recorded statistically similar and lower values of leaf magnesium content. Other combinations came inbetween the previously mentioned two categories.

4.2.6. Iron

It is obvious from **Table (20)** that in both seasons the richest leaves in their iron content were borne on rabbit manured trees. On the contrary, the lowest values of leaf iron content were observed in those produced by cattle manured trees. However, significant differences between poultry and cattle manure in this respect in 2002 season was lacked.

Furthermore, in 2002 season the superficial application of the three tested organic manure sources surpassed trench application in enhancing leaf iron content. Such positive effect of superficial application missed in the second season 2003 from statistical standpoint, (**Table, 20**).

On the other hand, soil inoculation with Nitrobien or Rhizobacterien induced statistically similar effect on leaf iron content during the two seasons of study, (**Table, 20**).

Regarding the interaction between organic manure source and application method, it is clear from **Table (21)** that as shown from data of average of two seasons cattle manure applied superficially gave higher values of leaf iron content, whereas when the same organic manure source (cattle) was applied in trenches it recorded statistically the lowest values of leaf iron content, followed ascendingly by poultry manure applied superficially. Other tested combinations recorded inbetween values in this concern.

Table (22) reveals that the combinations of rabbit manure provided with Nitrobien and poultry manure enriched with

Rhizobacterien induced statistically similar and higher positive effect on leaf iron content, followed descendingly by the combinations of rabbit manure supported with Rhizobacterien and cattle manure provided with Nitrobien. On reverse, the combinations of cattle manure interacted with Rhizobacterien and poultry manure combined with Nitrobien produced not only similar effect but also the lowest values of leaf iron content.

On the other side, **Table (23)** illustrates that in both seasons the interaction between organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) failed to produce a combination with a distinctive effect on leaf iron content from statistical view.

Finally, data of the average of two seasons reported in **Table (24)** demonstrate that poultry manure applied in trenches and supported with Rhizobacterien, cattle manure applied superficially and enriched with Nitrobien and rabbit manure applied superficially and supported with Nitrobien recorded the highest values of leaf iron content in a descending order. On the contrary, the lowest values of leaf iron content were produced in an ascending order by cattle manure applied in trenches and provided with Rhizobacterien, cattle manure applied in trenches and enriched with Nitrobien and poultry manure applied superficially supported with Rhizobacterien. Other combinations produced an intermediate values in this concern.

Table (20): Specific effect of organic manure source, application method and biofertilization on leaf Ca, Mg and Fe content of Costata persimmon trees (2002 & 2003 and average).

Factor	Calcium (%)			Magnesium (%)			Iron (ppm)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source									
Cattle manure	1.39 A	1.42 A	1.40 A	0.855 A	0.858 A	0.856 A	187 B	189 C	188 C
Poultry manure	1.38 A	1.32 B	1.35 B	0.840 A	0.810 B	0.825 B	196 B	203 B	199 B
Rabbit manure	1.38 A	1.34 B	1.36 AB	0.731 B	0.755 C	0.743 C	209 A	222 A	215 A
b- Effect of application method									
Suerficial	1.37 A	1.37 A	1.37 A	0.810 A	0.811 A	0.810 A	211 A	207 A	209 A
Trench	1.40 A	1.35 A	1.37 A	0.807 A	0.803 A	0.805 A	184 B	202 A	193 A
c- Effect of biofertilization									
Nitrobien	1.37 A	1.37 A	1.37 A	0.774 B	0.802 A	0.788 B	198 A	203 A	200 A
Rhizobacterien	1.35 A	1.37 A	1.36 A	0.839 A	0.815 A	0.827 A	197 A	206 A	201 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (21): Effect of interaction between organic manure source and application method on leaf Ca, Mg and Fe content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Calcium (%)			Magnesium (%)			Iron (ppm)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	1.35 A	1.41 AB	1.38 AB	0.780 C	0.835 C	0.807 D	220 A	224 A	222 A
	Trench	1.43 A	1.43 A	1.43 A	0.930 A	0.881 A	0.905 A	155 D	155 C	155 D
Poultry	Superficial	1.37 A	1.33 BC	1.35 B	0.812 BC	0.755 D	0.783 E	200 BC	176 B	188 C
	Trench	1.40 A	1.31 BC	1.35 B	0.868 AB	0.865 AB	0.866 B	192 C	230 A	211 B
Rabbit	Superficial	1.38 A	1.37 ABC	1.37 AB	0.838 BC	0.845 BC	0.841 C	213 AB	223 A	218 AB
	Trench	1.38 A	1.31 C	1.35 B	0.625 D	0.665 E	0.645 F	206 ABC	222 A	214 AB

Means separation within each column by Duncan's multiple range test, 5% level.

Table (22): Effect of interaction between organic manure source and biofertilization on leaf Ca, Mg and Fe content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Calcium (%)			Magnesium (%)			Iron (ppm)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	1.40 A	1.46 A	1.43 A	0.873 A	0.895 A	0.884 A	191 BCD	205 B	198 B
	Rhizobacterien	1.38 A	1.37 AB	1.37 ABC	0.836 AB	0.821 C	0.828 B	184 D	174 C	179 C
Poultry	Nitrobien	1.41 A	1.34 B	1.37 BCD	0.845 A	0.769 D	0.807 BC	188 CD	171 C	179 C
	Rhizobacterien	1.36 A	1.30 B	1.33 CD	0.836 AB	0.846 B	0.841 B	204 AB	235 A	219 A
Rabbit	Nitrobien	1.32 A	1.31 B	1.31 D	0.690 C	0.696 E	0.693 D	216 A	234 A	225 A
	Rhizobacterien	1.44 A	1.37 AB	1.40 AB	0.773 B	0.809 C	0.791 C	203 ABC	210 B	206 B

Means separation within each column by Duncan's multiple range test, 5% level.

Table (23): Effect of interaction between organic manure application method and biofertilization on leaf Ca, Mg and Fe content of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Calcium (%)			Magnesium (%)			Iron (ppm)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	1.35 A	1.37 A	1.36 A	0.814 A	0.798 A	0.806 A	214 A	214 A	214 A
	Rhizobacterien	1.39 A	1.37 A	1.38 A	0.806 A	0.825 A	0.815 A	208 A	200 A	204 AB
Trench	Nitrobien	1.40 A	1.37 A	1.38 A	0.791 A	0.778 A	0.784 A	183 A	192 A	187 B
	Rhizobacterien	1.40 A	1.33 A	1.36 A	0.824 A	0.829 A	0.826 A	186 A	212 A	199 AB

Means separation within each column by Duncan's multiple range test, 5% level.

Table (24): Effect of interaction between organic manure source, application method and biofertilization on leaf Ca, Mg and Fe content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Biofertilization	Calcium (%)			Magnesium (%)			Iron (ppm)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	Nitrobien	1.29 C	1.34 BCD	1.31 CD	0.832 BCD	0.875 C	0.853 C	226 A	235 B	231 B
		Rhizobacterien	1.42 ABC	1.47 AB	1.44 B	0.727 E	0.795 D	0.761 E	213 ABC	212 C	212 CD
	Trench	Nitrobien	1.52 A	1.59 A	1.55 A	0.915 AB	0.915 B	0.915 AB	156 E	175 D	165 H
		Rhizobacterien	1.35 ABC	1.28 CD	1.31 CD	0.945 A	0.847 C	0.896 BC	155 E	135 E	145 I
Poultry	Superficial	Nitrobien	1.40 ABC	1.37 BC	1.38 BC	0.855 ABC	0.777 D	0.816 D	195 CD	171 D	183 FG
		Rhizobacterien	1.35 BC	1.30 CD	1.32 CD	0.770 CDE	0.732 F	0.751 F	206 ABC	180 D	193 EF
	Trench	Nitrobien	1.42 ABC	1.31 CD	1.36 BC	0.835 BCD	0.770 DE	0.802 D	182 D	171 D	176 GH
		Rhizobacterien	1.37 ABC	1.31 CD	1.34 C	0.902 AB	0.960 A	0.931 A	202 BCD	289 A	295 A
Rabbit	Superficial	Nitrobien	1.37 ABC	1.40 BC	1.38 BC	0.755 DE	0.742 EF	0.748 EF	221 AB	237 B	229 B
		Rhizobacterien	1.39 ABC	1.33 CD	1.36 BC	0.922 AB	0.947 A	0.934 A	204 BC	209 C	206 DE
	Trench	Nitrobien	1.28 C	1.21 D	1.24 D	0.625 F	0.650 G	0.637 G	210 ABC	232 B	221 BC
		Rhizobacterien	1.49 AB	1.41 BC	1.45 AB	0.625 F	0.680 G	0.652 G	201 BCD	212 C	206 DE

Means separation within each column by Duncan's multiple range test, 5% level.

4.2.7. Manganese

Table (25) demonstrates that in both seasons leaves of poultry and rabbit manured trees recorded similar and higher values of manganese content than the analogous ones borne on cattle manured trees.

Furthermore, superficial application of the three tested organic manure sources surpassed trench application method in enhancing leaf manganese content of Costata persimmon trees during the two seasons of study.

In addition, Nitrobien inoculation induced higher positive effect on leaf manganese content than did Rhizobacterien in the first season, only. Such stimulus effect of Nitrobien disappeared in the second season, (**Table, 25**).

Regarding the interaction between organic manure source and its application method, **Table (26)** illustrates that the average of the two seasons declares that the application of the three or tested organic manure sources i.e. cattle, poultry and rabbit superficially exerted similar and higher positive effect than other tested combinations. On the contrary, trench application of cattle manure recorded the lowest values of leaf manganese content of Costata persimmon trees. The rest two combinations produced similar and an intermediate values in this concern.

Concerning the interaction between organic manure source and biofertilization, data of the average of two seasons reported in **Table (27)** demonstrate that the highest values of leaf manganese content were produced in a descending order by the following combinations: rabbit manure provided with Rhizobacterien, poultry manure enriched with Nitrobien and poultry manure supplemented with Rhizobacterien inoculation. On reverse the combination of cattle manure and Nitrobien inoculation recorded the lowest values of leaf manganese content. Besides, the remained two evaluated combinations recorded similar and an intermediate values in this respect.

On the other hand, it is obvious from **Table (28)** that in both seasons the application of the three tested organic manure sources superficially whether enriched with Nitrobien or inoculated with Rhizobacterien produced statistically similar and higher positive effect on leaf manganese content than did other tested combinations. Besides, trench application of organic manures provided with Rhizobacterien inoculation surpassed trench application supported with Nitrobien inoculation in enhancing leaf manganese content in 2002 season, only.

Finally, data of the average of two seasons dealing with the effect of interaction between the three evaluated factors, **Table (29)** illustrates that the combinations recorded the highest values of leaf manganese content could be arranged in a descending order as follows: (rabbit manure x superficial application x Rhizobacterien inoculation), (cattle manure x superficial application x Nitrobien inoculation), (poultry manure x superficial application x Nitrobien inoculation), (poultry manure x superficial application x Rhizobacterien inoculation) and (rabbit manure x trench application x Rhizobacterien inoculation). On the contrary, the lowest values of leaf manganese content were produced in an ascending order by the following combinations: (cattle manure x trench application x Nitrobien inoculation), (cattle manure x trench application x Rhizobacterien inoculation), and (rabbit manure x trench application x Nitrobien inoculation). Other tested combinations recorded inbetween values in this concern.

4.2.8. Zinc

It is obvious from **Table (25)** that in both seasons cattle and poultry manured trees borne leaves similar and higher in their zinc content than those borne on rabbit manured trees.

Furthermore, the application of the three tested organic manure sources either superficially or in trenches exerted similar effect on leaf zinc content of Costata persimmon trees in both seasons from the statistical standpoint, (**Table, 25**).

On the other hand, in 2002 season Nitrobien inoculation surpassed Rhizobacterien inoculation in enhancing leaf zinc content. Such stimulus effect of Nitrobien inoculation disappeared in the second season 2003 as shown in **Table (25)**.

As for the interaction between organic manure source and its application method, **Table (26)** reveals that the highest values of leaf zinc content were produced in descending order by the following combinations: poultry manure applied superficially, cattle manure applied superficially, (cattle manure applied in trenches and rabbit manure applied in trenches) and rabbit manure applied superficially. On reverse, poultry manure applied in trenches recorded statistically the lowest values of leaf zinc content.

In addition, **Table (27)** demonstrates that supplementing cattle manure with Nitrobien inoculation induced the highest positive effect on leaf zinc content. Besides, enhancing poultry manure with Rhizobacterien and providing rabbit manure with Nitrobien produced statistically similar and higher stimulus effect on leaf zinc content than did other combinations. On the contrary, the combinations of cattle manure and Rhizobacterien inoculation as well as rabbit manure and Rhizobacterien inoculation induced statistically similar and lower values of leaf zinc content in both seasons of study.

On the other side, **Table (28)** illustrates that organic manures whether applied superficially or in trenches produced statistically similar and higher values of leaf zinc content when provided with Nitrobien inoculation. On reverse, trench application of organic manure supplemented with Rhizobacterien inoculation recorded statistically lower values of leaf zinc content than did Rhizobacterien inoculation provided with Rhizobacterien inoculation.

Lastly, the interaction between the three tested factors (**Table, 29**) demonstrates that the evaluated interactions could be arranged in descending order regarding their positive effect on leaf zinc content as follows: (cattle manure x superficial application x Nitrobien inoculation), (poultry manure x superficial application x Rhizobacterien inoculation) and (rabbit manure x trench application x Nitrobien inoculation). On the contrary, the lowest values of leaf zinc content were produced by the following combinations (cattle manure x superficial application x Rhizobacterien inoculation), (poultry manure x superficial application x Nitrobien inoculation) and (rabbit manure x trench application x Rhizobacterien inoculation). Other combinations gave an intermediate values in this concern.

4.2.9. Copper

It is clear from **Table (25)** that in both seasons 2002 and 2003 each of the three evaluated factors i.e. organic manure source (cattle, poultry and rabbit), organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) failed to exert its distinctive specific effect on leaf copper of Costata persimmon trees.

On the other side, **Table (26)** demonstrates that the application of cattle and rabbit manure superficially induced similar and higher values of leaf copper content as compared with the other tested combinations. Poultry manure applied superficially induced higher stimulus effect on leaf copper content and raked the second in this descending order. Besides, trench application of cattle and poultry manure recorded similar and higher values of leaf copper content than did rabbit manure applied in trenches.

As for the interaction between organic manure source and biofertilization, **Table (27)** illustrates that the enrichment of cattle manure with Nitrobien or Rhizobacterien inoculation and supplementing poultry manure with Rhizobacterien inoculation and supplementing poultry manure with Rhizobacterien inoculation gave statistically similar and higher values of leaf copper content. On the contrary, supporting poultry and rabbit manure with Nitrobien gave similar and lower values of leaf copper content.

Furthermore, the combinations resulted from the interaction between organic manure application method and biofertilization failed to exert a distinguishable effect on leaf copper content in 2002 and 2003 seasons, (**Table, 28**).

Finally, the interaction between the three evaluated factors, **Table (29)** reveals the Rhizobacterien inoculation provided with superficial application of cattle or poultry manure induced statistically similar and higher values of leaf copper content in both season of study. The lowest values of leaf copper content were produced in an ascending order by the following combinations: (poultry manure x trench application x Nitrobien inoculation) and (rabbit manure x trench application x Nitrobien or Rhizobacterien inoculation). Other interactions recorded an intermediate values in this concern.

Abstractly, cattle manure proved to be the most efficient organic manure source in enhancing leaf nitrogen, calcium, magnesium and zinc content, whereas poultry manure exerted the highest positive effect on leaf potassium, manganese and zinc content, meanwhile, rabbit manure recorded the highest values of leaf iron and manganese content. On the other hand, the three evaluated organic manure sources induced similar effect on leaf phosphorus and copper content. Furthermore, trench application of organic manure enhanced leaf potassium rather than superficial application and the reverse was true with leaf iron and manganese content. Besides, the organic manure application method failed to induce a specific effect on leaf content of nitrogen, phosphorus, calcium, magnesium, zinc and copper.

In addition, Rhizobacterien inoculation surpassed Nitrobien inoculation in improving leaf magnesium and manganese content, whereas the reverse was true with leaf zinc content. Moreover, the two sources of biofertilization exerted similar effect on leaf content of nitrogen, phosphorus, potassium, calcium, iron and copper. Finally, the combination of cattle manure applied in trenches and supported with Rhizobacterien inoculation gave the highest value of leaf nitrogen content, whereas the combination of rabbit manure applied superficially and supplemented with Nitrobien inoculation recorded the highest value of leaf phosphorus content, meanwhile, rabbit manure applied superficially and enriched with Rhizobacterien inoculation showed the highest value of leaf potassium and manganese content. Besides, cattle manure applied in trenches and supported with Nitrobien inoculation gave the highest value of leaf calcium content, whereas poultry manure applied in trenches and provided with Rhizobacterien inoculation recorded the highest values of leaf iron content. Moreover, cattle manure applied superficially when supplemented with Nitrobien caused high significant increase in leaf zinc content, but when enriched with Rhizobacterien inoculation it recorded the highest value of leaf copper content.

The enhancement of leaf mineral content due to the application of organic manure may be explained by the fact that it induces positive effect on physical condition of the soil; creates favourable conditions for root growth and nutrients absorption; it supplies much nutrients and it facilitates the absorption of fixed nutrients by tree roots, (**Cook, 1982**).

In addition, the enhancement of leaf mineral content particularly potassium due to trench application of organic manure may be attributed to the fact that the incorporation of manure in the soil provided a protection against nutrients losses (**Cook, 1982**).

Shortly, the results of leaf mineral content due to organic manure source are in harmony with the findings of **Sekiya** *et al.* (**1983**) on Satsuma mandarin; **Kalu-Singh** *et al.* (**1984**) on mango; **Umemiya** and **Sekiya** (**1985**) on persimmon; **Villasurda** and **Baluyut** (**1990**) on guava; **Smith** (**1994**) on banna; **El-Kobbia** (**1999**) on Washington navel orange, **Moustafa** 2002 on

Washington navel orange and **Salama** 2002 on Balady mandarin. They mentioned that organic manures improve leaf mineral content of different fruit species. Such stimulus effect on leaf mineral content differs according to plant species and organic manure source.

Furthermore, the obtained results of leaf mineral content attributed to the effect of method of organic manure application are in accordance with the findings of **Tkachuk (1983)** on apple; **Bhangoo** *et al.* **(1988)** on grape; **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin.

On the other hand, results of biofertilization concerning leaf mineral content go in line with the findings of **Chockha** *et al.* **(1993)** on sweet orange; **Haggag** and **Azzazy (1996)** on mango; **Ahmed** *et al.* **(1997)** on grapevines; **Awasthi** *et al.* **(1998)** on peach; **Mansour (1998)** on Anna apple; **Mahmoud** and **Mahmoud (1999)** on peach; **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They concluded that the enhancement of leaf mineral content differs according to the biofertilizer type and plant species. In this respect, Nitrobien surpassed Rhizobacterien in improving leaf mineral content in a plant species and the reverse is true in another one.

Table (25): Specific effect of organic manure source, application method and biofertilization on leaf Mn, Zn and Cu content of Costata persimmon trees (2002 & 2003 and average).

Factor	Manganese (ppm)			Zinc (ppm)			Copper (ppm)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source									
Cattle manure	62 B	61 B	61 B	59 A	59 A	59 A	13 A	14 A	13 A
Poultry manure	68 A	70 A	69 A	57 A	60 A	58 A	13 A	14 A	13 A
Rabbit manure	69 A	69 A	69 A	51 B	50 B	50 B	12 A	13 A	12 B
b- Effect of application method									
Superficial	74 A	72 A	73 A	61 A	61 A	61 A	14 A	15 A	14 A
Trench	59 B	61 B	60 B	50 A	52 A	51 B	12 A	13 A	12 A
c- Effect of biofertilization									
Nitrobien	61 B	68 A	65 B	64 A	63 A	63 A	12 A	13 A	12 A
Rhizobacterien	71 A	65 A	68 A	47 B	50 A	48 B	13 A	14 A	13 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (26): Effect of interaction between organic manure source and application method on leaf Mn, Zn and Cu content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Manganese (ppm)			Zinc (ppm)			Copper (ppm)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	72 B	73 A	72 A	63 B	63 B	63 B	14 A	15 A	14 A
	Trench	51 D	49 D	50 C	56 C	55 BC	55 C	12 B	14 B	13 C
Poultry	Superficial	73 B	75 A	74 A	75 A	74 A	74 A	14 A	14 B	14 B
	Trench	63 C	66 C	64 B	39 E	47 C	43 E	12 B	13 C	12 C
Rabbit	Superficial	77 A	69 B	73 A	47 D	46 C	46 D	14 A	15 A	14 A
	Trench	62 C	69 B	65 B	55 C	54 BC	54 C	10 C	12 D	11 D

Means separation within each column by Duncan's multiple range test, 5% level.

Table (27): Effect of interaction between organic manure source and biofertilization on leaf Mn, Zn and Cu content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Manganese (ppm)			Zinc (ppm)			Copper (ppm)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	55 D	64 C	59 E	78 A	77 A	77 A	13 B	14 AB	13 A
	Rhizobacterien	68 B	58 D	63 D	40 D	41 D	40 D	13 B	15 A	14 A
Poultry	Nitrobien	67 B	75 A	71 B	53 C	53 C	53 C	12 B	13 B	12 C
	Rhizobacterien	69 B	65 C	67 C	61 B	68 AB	64 B	14 A	15 AB	14 A
Rabbit	Nitrobien	62 C	66 C	64 D	61 B	60 BC	60 B	12 C	13 B	12 C
	Rhizobacterien	77 A	72 B	75 A	41 D	40 D	40 D	12 C	14 AB	13 B

Means separation within each column by Duncan's multiple range test, 5% level.

Table (28): Effect of interaction between organic manure application method and biofertilization on leaf Mn, Zn and Cu content of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Manganese (ppm)			Zinc (ppm)			Copper (ppm)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	72 A	74 A	73 A	70 A	68 A	69 A	13 A	14 A	13 A
	Rhizobacterien	75 A	71 A	73 A	53 AB	53 A	53 B	14 A	15 A	14 A
Trench	Nitrobien	50 B	63 B	56 C	58 A	58 A	58 AB	11 A	12 A	11 A
	Rhizobacterien	67 A	59 B	63 B	41 B	46 A	43 C	12 A	13 A	12 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (29): Effect of interaction between organic manure source, application method and biofertilization on leaf Mn, Zn and Cu content of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Biofertilization	Manganese (ppm)			Zinc (ppm)			Copper (ppm)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	Nitrobien	71 B	80 A	74 AB	90 A	89 A	89 A	13 B	14 C	13 C
		Rhizobacterien	73 B	66 C	69 CD	35 E	36 E	35 E	14 A	16 A	15 A
	Trench	Nitrobien	39 E	47 E	43 G	66 C	65 BC	65 C	13 B	14 C	13 C
		Rhizobacterien	64 C	51 E	57 F	45 D	46 DE	45 D	12 C	14 C	13 C
Poultry	Superficial	Nitrobien	73 B	75 B	74 AB	72 BC	71 BC	71 BC	13 B	14 C	13 C
		Rhizobacterien	73 B	75 B	74 AB	78 B	77 AB	77 B	14 A	15 B	14 B
	Trench	Nitrobien	62 C	76 B	69 D	35 E	35 E	35 E	10 B	11 E	10 E
		Rhizobacterien	65 C	56 D	60 E	44 DE	50 CD	47 D	14 A	14 C	14 B
Rabbit	Superficial	Nitrobien	74 B	66 C	70 CD	47 D	46 DE	46 D	14 A	14 C	14 B
		Rhizobacterien	80 A	72 B	76 A	47 D	46 DE	46 D	14 A	16 A	15 A
	Trench	Nitrobien	50 D	66 C	58 EF	74 BC	74 B	74 B	10 D	12 D	11 D
		Rhizobacterien	73 B	72 B	72 AB	35 E	35 E	35 E	10 D	12 D	11 D

Means separation within each column by Duncan's multiple range test, 5% level.

4.3. Tree fruiting

The effect of organic manure source (cattle, poultry and rabbit), organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) as well as their combinations on some tree fruiting traits of Costata persimmon i.e. fruit set percentage, fruit drop percentage and yield as number of fruits per tree or yield (kg) per tree during 2002 and 2003 seasons as well as the average of the two seasons is reported in **Tables (30-34)**.

4.3.1. Fruit set percentage

Table (30) illustrates that flowers of cattle manured trees set comparatively higher percentage of fruits that the analogous ones of poultry manured ones in both seasons and those of rabbit manured trees in 2002 season, only. Besides, rabbit manure surpassed poultry manure in increasing the fruit set percentage in 2003 season, only. Moreover, data of the average of two seasons declares that the three tested organic manure sources exerted statistically similar effect in this concern.

In addition, organic manure wheither applied superficially or in trenches on one hand and Nitrobien and Rhizobien on the other one faited to produce a pronounced effect on fruit set percentage [except for superficial application which exerted positively the lower positive effect on fruit set percentage in 2003 season] in both seasons of study and the average of two seasons.

As for the interaction between organic manure source and organic manure application method, **Table (31)** shows that in 2002 season, cattle manure applied in trenches recorded higher values of fruit set percentage as compared with the other tested combinations. Besides, the rest combinations produced statistically similar values in this respect. On the other hand, in 2003 season cattle or rabbit manured trees in trenches induced statistically similar and higher positive effect on fruit set percentage of Costata persimmon trees than the other tested combinations. On the contrary, superficial poultry manured trees produced the least enhancing effect in this respect. Other evaluated interactions gave similarly an intermediate value from the statistical standpoint. Meanwhile, data of the average of two seasons reveal that all studied combinations gave statistically similar values in this sphere.

Regarding the effect of interaction between organic manure source and biofertilization, **Table (32)** indicates that the combination of cattle manure and Rhizobacterien inoculation was the alone interaction which gave a constant trend of higher positive effect on fruit set percentage throughout the two seasons of study. The aforementioned combination recorded higher values of fruit set percentage in 2002 and 2003 seasons. Other evaluated interactions produced a fluctuated trend during the course of study.

In addition, **Table (33)** illustrates that in both seasons of study the different combinations resulted from the interaction between organic manure application method and biofertilization produced similar effect on fruit set percentage from the statistical view.

Finally, out of all combinations resulted from the interaction between organic manure source, application method and biofertilization, **(Table, 34)** cattle manure applied in trenches and enriched with Rhizobacterien recorded constant trend and higher values of fruit set percentage throughout the two seasons. On the contrary rabbit manure applied superficially supported with Nitrobien showed a constant trend of lower values of fruit set percentage in both seasons. Other combinations showed a fluctuated affect from one season to another.

4.3.2. Fruit drop percentage

It is clear from **Table (30)** that cattle manured trees shed comparatively higher percentage of their fruits as shown in the data of the average of two seasons. Besides, poultry and rabbit manure manures recorded statistically similar values throughout the course of study.

Furthermore, the three tested organic manure sources whether applied superficially or in trenches induced more or less similar effect from the statistical view, (**Table, 30**).

In addition, Costata persimmon trees inoculated with Nitrobien or Rhizobacterien shed statistically similar percentage of their fruits during the two seasons of study, (**Table, 30**).

On the other hand, data of the average of the two seasons as shown in **Table (31)** demonstrates that the application of cattle manure superficially increased the percentage of fruit shedding as compared with the other combinations resulted from the interaction between organic manure source and organic manure application method. Moreover, other studied interactions produced statistically similar effect in this respect from the statistical standpoint.

Regarding the interaction between organic manure source and biofertilization, data of the average of two seasons reported in **Table (32)** illustrates that cattle manure whether supported with Nitrobien or Rhizobacterien and rabbit manure enriched with Rhizobacterien exerted similar and higher values of fruit dropping as compared with the other studied combinations. Besides, poultry manure provided with Nitrobien proved to be the best interaction in reducing the percentage of fruit dropping. Moreover, the rest combinations gave statistically similar effect in this respect.

As for the interaction between organic manure application method and biofertilization, data of 2002 and 2003 seasons as well as the average of two seasons recorded in **Table (33)** demonstrates that all the resulted and evaluated combinations gave statistically similar values in this respect from the statistical standpoint.

Lastly, data resulted from the interaction between the three studied factors namely: organic manure source, application method and biofertilization during the two seasons and reported in **Table (34)** illustrates that no distinctive trend of these tested combination could be noticed during the course of study.

4.3.3. No. of fruits per tree

Data of the average of two seasons reported in **Table (30)** shows that rabbit manure borne comparatively higher number of fruits than the corresponding ones manured with cattle or poultry. Besides, significance differences were lacking between poultry and cattle manure in this concern.

Furthermore, organic manure application method failed to produce specific effect on number of fruits per tree throughout the two seasons of study. Moreover, Nitrobien inoculation gave statistically similar effect on number of fruits per tree as did Rhizobacterien inoculation in 2002 and 2003 seasons, (**Table, 30**).

On the other hand, data of the average of two seasons reported in **Table (31)** demonstrates that rabbit manure whether applied superficial or in trenches produced not only similar effect but also higher values of fruits per tree as compared with other tested combinations. On the contrary, cattle manured trees superficially borne the lowest number of fruits from the statistical standpoint. The remained combination exerted similar effect in this concern.

On the other side, data of the average of two seasons shown in **Table (32)** indicates that rabbit manure supported with Nitrobien or Rhizobacterien induced statistically similar and higher values of number of fruits per tree as compared with other combinations. The remained combination gave nearly more or less similar effect in this sphere.

In addition, the interaction between organic manure application method and biofertilization (**Table, 33**) failed to induce distinctive effect during the two seasons of study.

Finally, the data of the average of two seasons resulted from the interaction between the three studied factors, reported in **Table (34)** demonstrates that the highest number of fruits were produced by rabbit manure applied in trenches and enriched with Nitrobien inoculation, followed descendingly by these produced by rabbit manure applied superficially and supported with Rhizobacterien inoculation, rabbit manure applied in trenches and inoculated with Rhizobacterien and poultry manure applied superficially and inoculation with Nitrobien. On reverse, cattle manure applied superficially and supported with Nitrobien recorded the lowest number of fruits per tree. Other tested combinations recorded an intermediate value in this concern.

4.3.4. Yield (g)/tree

Data of the average of the two seasons reported in **Table (30)** show that rabbit manured trees proved to be the highest productive ones as compared with cattle or poultry manured ones. Besides, the lowest yield (kg)/tree was produced by cattle manured ones. Meanwhile, poultry manure gave an intermediate value in this concern.

On the other side, superficial application of organic manure failed to induce a distinctive effect in this respect than did trench application. Moreover, Nitrobien inoculation exerted statistically similar effect on yield (kg) per tree as did Rhizobacterien inoculation during the course of study, (**Table, 30**).

As for the interaction between organic manure source and application method, data of the average of two seasons declare that rabbit manure applied in trench recorded the highest values followed descendingly by rabbit manure applied superficially, poultry manure applied in trenches, poultry manure applied superficially, cattle manure applied superficially and finally cattle manure applied in trenches, (**Table, 31**).

Data of the average of two seasons, regarding the effect of interaction between organic manure source and biofertilization on yield (kg) per tree, **Table (32)** demonstrates that both rabbit manure enriched with Rhizobacterien and poultry manure supported with Nitrobien gave similarly higher values of yield (kg) per tree, followed by rabbit manure enriched with Nitrobien inoculation. Moreover, cattle manure provided with Rhizobacterien and poultry manure supported with Rhizobacterien gave statistically similar values in this respect and higher than those of cattle manure enriched with Nitrobien.

Furthermore, the interaction between organic manure application method and biofertilization failed to produce a distinguishable effect on yield (kg) per tree during the two seasons of study, (**Table, 33**).

Lastly, the highest yield (kg) per tree was observed on rabbit manured trees in trench and supported with Rhizobacterien poultry manured trees superficially and provided with Nitrobien, rabbit manured trees in trenches and supported with Nitrobien and rabbit manured trees superficially and enriched with Rhizobacterien gave similar and higher values in this respect in descending order. On the contrary, cattle manured trees superficially, provided with Nitrobien, cattle manured trees in trenches and enriched with Nitrobien inoculation, cattle manured trees provided with Rhizobacterien inoculation and poultry manured trees superficially supplemented with Rhizobacterien induced similar and lowest positive effect in this concern. Other studied interactions gave inbetween values in this sphere, (**Table, 34**).

Abstractly, cattle manure proved to be most effective organic manure source in enhancing fruit set percentage, but it recorded the highest fruit drop percentage, while rabbit manure

Table (30): Specific effect of organic manure source, application method and biofertilization on some fruiting parameters of Costata persimmon trees (2002 & 2003 and average).

Factor	Fruit set (%)			Fruit drop (%)			No. of fruits/tree			Yield (kg/tree)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source												
Cattle manure	54.31 A	54.13 A	54.22 A	26.34 A	27.56 A	26.95 A	328 B	358 B	343 C	27.11 C	29.36 B	28.23 C
Poultry manure	51.44 B	50.63 B	51.03 A	25.79 A	24.13 B	24.96 B	353 B	386 A	369 B	31.13 B	34.19 A	32.66 B
Rabbit manure	49.75 B	53.56 A	51.65 A	24.00 B	27.19 A	25.58 B	444 A	405 A	424 A	38.30 A	34.96 A	36.63 A
b- Effect of application method												
Superficial	51.13 A	50.33 B	50.73 A	25.31 A	27.25 A	26.28 A	371 A	373 A	372 A	32.00 A	31.81 A	31.90 A
Trench	52.54 A	55.21 A	53.87 A	25.44 A	25.33 A	25.38 A	380 A	393 A	386 A	32.36 A	33.85 A	33.10 A
c- Effect of biofertilization												
Nitrobien	51.67 A	54.58 A	53.12 A	25.01 A	25.33 A	25.17 A	366 A	392 A	379 A	31.78 A	33.54 A	32.66 A
Rhizobacterien	52.00 A	50.96 A	51.48 A	25.74 A	27.25 A	26.49 A	384 A	374 A	379 A	32.58 A	32.13 A	32.35 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (31): Effect of interaction between organic manure source and application method on some fruiting parameters of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Fruit set (%)			Fruit drop (%)			No. of fruits/tree			Yield (kg/tree)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	52.13 B	50.75 B	51.44 A	25.31B	32.00 A	28.65 A	297 C	368 BC	332 C	26.64 C	32.05 C	29.34 D
	Trench	56.50 A	57.50 A	57.00 A	27.38 A	23.13 D	25.25 B	360 B	349 C	354 BC	27.59 B	26.66 D	27.12 E
Poultry	Superficial	52.00 B	48.88 C	50.44 A	26.33A	24.13 C	25.23 B	351 B	378 BC	364 B	30.44 B	32.51 C	31.47C
	Trench	50.88 B	52.38 B	51.63 A	25.25 B	24.69 C	24.97 B	355 B	394 B	374 B	31.83 B	35.86 B	33.84 B
Rabbit	Superficial	49.25 B	51.38 B	50.31 A	24.30 C	25.63 C	24.96 B	464 A	373 BC	418 A	38.94 A	30.88 C	34.91 B
	Trench	50.25 B	55.75 A	53.00 A	23.70 C	28.75 B	26.24 B	425 A	436 A	430 A	37.66 A	39.04 A	38.35 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (32): Effect of interaction between organic manure source and biofertilization on some fruiting parameters of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Fruit set (%)			Fruit drop (%)			No. of fruits/tree			Yield (kg/tree)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	55.63 A	53.00 C	54.31 A	25.49 A	28.75 A	27.12 A	295 C	371 BC	333 C	22.94 C	29.11 C	26.02 D
	Rhizobacterien	53.00 A	55.25 A	54.12 A	27.20 A	26.38 B	26.79 A	362 B	346 C	354 BC	31.29 B	29.60 C	30.44 C
Poultry	Nitrobien	48.50 C	54.13 B	51.31 A	26.67 A	23.13 C	24.90 B	371 B	396 AB	383 B	35.69 A	37.91 A	36.80 A
	Rhizobacterien	54.38 A	47.13 E	50.75 A	24.90 B	25.13 B	25.01 B	335 BC	377 AB	356 BC	26.58 C	30.46 C	28.52 C
Rabbit	Nitrobien	50.88 B	56.63 A	53.75 A	22.88 C	24.13 B	23.50 C	433 A	411 A	422 A	36.71 A	33.60 B	35.15 B
	Rhizobacterien	48.63 C	50.50 D	49.56 A	25.13 B	30.25 A	27.69 A	456 A	399 AB	427 A	39.89 A	36.31 A	38.10 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (33): Effect of interaction between organic manure application method and biofertilization on some fruiting parameters of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Fruit set (%)			Fruit drop (%)			No. of fruits/tree			Yield (kg/tree)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	51.83 A	52.42 A	52.12 A	24.77 A	25.42 A	25.09 A	345 A	293 A	369 A	30.90 A	34.08 A	32.49 A
	Rhizobacterien	50.42 A	48.25 A	49.33 A	25.86 A	29.08 A	27.48 A	397 A	354 A	375 A	33.11 A	29.54 A	31.33 A
Trench	Nitrobien	51.50 A	56.75 A	54.12 A	25.26 A	25.25 A	25.23 A	388 A	392 A	390 A	32.66 A	33.00 A	32.83 A
	Rhizobacterien	53.58 A	53.67 A	53.62 A	25.63 A	25.42 A	25.52 A	371 A	394 A	382 A	32.06 A	34.71 A	33.38 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (34): Effect of interaction between organic manure source, application method and biofertilization on some fruiting parameters of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Biofertilization	Fruit set (%)			Fruit drop (%)			No. of fruits/tree			Yield (kg/tree)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	Nitrobien	45.50 ABC	50.25 DE	50.37 A	25.35 BCD	33.25 A	29.30 A	220 E	362 DEF	291 F	19.65 E	31.65 EF	25.65 E
		Rhizobacterien	49.75 CDE	51.25 D	50.50 A	25.28 BCD	30.75 AB	28.01 B	375 CD	373 DE	374 BCD	33.63 BC	32.45 DEF	33.04 CD
	Trench	Nitrobien	56.75 A	55.75 BC	56.25 A	25.63 BCD	24.25 DEF	24.94 E	370 CD	380 CDE	375 BCD	26.23 D	26.58 G	26.40 E
		Rhizobacterien	56.25 A	59.25 A	57.75 A	29.13 A	22.00 FG	25.55 DE	350 CD	319 F	334 DE	28.95 CD	26.75 G	27.85 E
Poultry	Superficial	Nitrobien	49.00 DEF	51.00 D	50.00 A	26.85 AB	21.00 G	23.92 F	395 BC	425 ABC	410 AB	37.13 AB	39.15 AB	38.14 AB
		Rhizobacterien	55.00 AB	46.75 F	50.87 A	25.88 BCD	27.25 CD	26.56 C	307 D	332 EF	319 EF	23.75 DE	25.88 G	24.82 E
	Trench	Nitrobien	48.00 EF	57.25 AB	52.62 A	26.62 ABC	25.25 DEF	25.94 D	348 CD	366 DEF	357 CDE	34.25 BC	36.68 BC	35.46 BCD
		Rhizobacterien	53.75 ABC	47.50 EF	50.62 A	29.00 CDE	23.00 EFG	23.50 F	362 CD	422 ABC	392 ABC	29.40 CD	35.05 CDE	32.22 D
Rabbit	Superficial	Nitrobien	52.00 ABC	56.00 BC	54.00 A	22.10 E	22.00 FG	22.05 G	420 BC	390 BCD	405 ABC	35.92 AB	31.45 F	33.69 CD
		Rhizobacterien	46.50 F	46.75 F	46.62 A	26.50 ABC	29.25 BC	27.87 B	508 A	356 DEF	432 A	41.95 A	30.30 F	36.15 ABC
	Trench	Nitrobien	49.75 CDE	57.25 AB	53.50 A	23.65 DE	26.25 CDE	24.95 E	447 AB	431 AB	439 A	37.50 AB	35.75 BCD	36.62 ABC
		Rhizobacterien	50.75 BCD	54.25 C	52.50 A	23.75 CDE	31.25 AB	27.50 C	403 BC	441 A	422 AB	37.83 AB	42.32 A	40.07 A

Means separation within each column by Duncan's multiple range test, 5% level.

showed to be the best organic manure source in enhancing tree yield whether expressed as number of fruits per tree or yield (kg) per tree. On the other hand, organic manure application method and biofertilization failed to induce a remarkable effect on the studied tree fruiting traits i.e. fruit set percentage, fruit drop percentage and tree yield as number of fruits per tree or yield (kg) per tree. Finally, cattle manure applied in trenches and supported with Rhizobacterien proved to be the best effectient combination in enhancing fruit set percentage. Besides, the combinations resulted from the interaction between the three studied factors failed to give a constant trend regarding fruit drop percentage. Meanwhile, rabbit manure applied in trenches when supported with Nitrobien inoculation it gave the highest number of fruits per tree and when provided with Rhizobacterien inoculation it recorded the highest yield (kg) per tree.

*In this respect, the enhancement of tree productivity due to the application of organic manure in general and rabbit in particular may be attributed to the following facts: (1) manures improve soil physical conditions, (2) they create more favourable conditions for plant growth and nutrient absorption, (3) they supply much higher nutrient elements, (4) they release much more or less available elements (particularly, P, Fe, Zn and Mn) and (5) they increase the soil content of IAA and cytokinins (**Li et al.**, **1998**).*

The results of tree fruiting induced by organic manure source are emphasized by the findings of **Bacha** and **Abo-Hassan** (**1983**) on date palm, **Marecek** and **Moravek** (**1983**) on apple, **Sekiya** et al. (**1983**) on Satsuma mandarin, **Gasanov** (**1984**) on persimmon, **Kalu-Singh** *et al* (**1984**) on mango, **Motskobili** (**1984**) on Satsuma mandarin, **Tanas'ev** (**1988**) on apple, **Bussi** and **Defrance** (**1987**) on peach, **Gadelha** and **Vieira** (**1988**), **Piatkowski** *et al.* (**1990**) on apple, **Wang** *et al.* (**1991**) on grape, **Ben-Ya-Acov** *et al.* (**1992**) on avocado, **Gouda** *et al.* (**1992**) on grape, **Rabeh** *et al.* (**1993**) on Balady mandarin, **Prabhuram** and **Sathiamoorthy** (**1993**) on banana, **El-Kobbia**

(1999) on Washington navel orange, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They concluded that farmyard manure produced more pronounced positive effect on tree yield. They added that positive effect of organic manure source on tree cropping differs according to plant species.

Furthermore, the obtained results concerning the effect of organic manure application method go in line with the findings of **Fisum** and **Kodzokov (1991)**, **Goede (1993)**, **Moustafa** 2002 and **Salama (2002)**. They summarized that trench application of organic manure enhanced tree fruiting rather than superficial application.

In addition, tree fruiting results produced by biofertilizers are in harmony with the finding of **Akl** *et al.* **(1997)** on Roomy grapevines, **Mansour (1998)** on apple, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They summarized that Nitrobien induced higher positive effect on tree fruiting than did Rhizobacterien and other mentioned that the reverse is true.

4.4. Fruit quality

4.4.1. Fruit physical properties

Tables (35-39) show the response of some fruit physical properties i.e., fruit weight (g), fruit size (cm^3), fruit length (cm), fruit diameter (cm) and fruit shape index (L/D) of Costata persimmon trees to three organic manure sources (cattle, poultry and rabbit manure), two organic manure application methods (superficial and trench) and two biofertilizers (Nitrobien and Rhizobacterien) as well as their interactions during 2002 and 2003 seasons and the average of the two seasons.

4.4.1.1. Fruit weight

Data of 2002 and 2003 seasons and the average of the two seasons reveal that poultry manured persimmon trees produced the heaviest fruits (87, 88 and 88 g), followed descendingly by those produced by rabbit manured ones (86, 86 and 86 g) and finally, cattle manured trees (83, 82 and 82 g) in the first and second seasons and average of the two seasons, respectively. However, the differences in fruit weight between those produced by poultry manured trees and rabbit manured ones in the first season only was lacking from the statistical standpoint, (**Table, 35**).

On the other hand, cattle, poultry and rabbit manure whether applied superficial or in trenches failed to induce any significant effect on fruit weight of persimmon tree in both seasons, (**Table, 35**).

Additionally, persimmon fruits resulted from Nitrobien-inoculated trees were similar in their weight to those produced by Rhizobacterien-inoculated ones from the statistical standpoint, (**Table, 35**).

Table (36) demonstrates that the interaction between organic manure source and application method resulted in poultry and rabbit applied in trenches and cattle manure applied superficial gave the heaviest fruits. On the contrary, cattle manure applied in trenches and rabbit and poultry manure applied superficial gave the lightest fruits in an ascending order in the first and second seasons as well as the data of the average of the two seasons.

Furthermore, the interaction between organic manure source and biofertilizers illustrates that persimmon trees manured with poultry and inoculated with Nitrobien gave the heaviest fruits, whereas those manured with rabbit and inoculated with Rhizobacterien ranked the second in this descending order. On the contrary, persimmon trees manured with cattle and inoculated with Nitrobien and those manured with rabbit and inoculated with Nitrobien as well as those manured with poultry and inoculated with Rhizobacterien gave the lightest fruits in both seasons in an ascending order. Besides, the fruits produced by cattle manured trees, inoculated with Rhizobacterien came inbetween in this respect; (**Table**, **37**).

It is quite evident from **Table (38)** that the interaction between organic manure application method and biofertilization failed to exert a remarkable effect on fruit weight of persimmon tree, except for persimmon trees manured superficially and inoculated with Rhizobacterien produced lighter fruits than those resulted from superficial manured ones, inoculated with Nitrobien in 2002 season, only.

Finally, the interaction between organic manure source, application method and biofertilization resulted in that persimmon trees manured with poultry manure in trenches and inoculated with Nitrobien, followed by those manured with rabbit manure in trenches and inoculated with Rhizobacterien gave the heaviest fruits (**Table**, **39**). On the contrary, the lightest fruits were produced by cattle manured applied in trenches and inoculated by Nitrobien, poultry manure applied superficially and inoculated with Rhizobacterien, rabbit manure applied superficially and inoculated with Nitrobien and cattle manure applied in trenches and inoculated with Rhizobacterien produced negative effect on fruit weight in an ascending order. Besides, other tested combinations exerted an intermediate effect in this respect.

4.4.1.2. Fruit size

It is clear from **Table (35)** that rabbit manured trees recorded higher fruit size values as compared with those produced by cattle and poultry manured ones. However, the differences between rabbit manure, poultry manure and cattle manure in this respect in 2003 season was lacking from the statistical standpoint. On the other hand, poultry manure produced significantly higher positive effect on fruit size than did cattle manure, in 2002 season, but this enhancing effect absent when the average of the two seasons was calculated.

Furthermore, the application method of organic manure exerted a remarkable effect on fruit size in 2002 season, only, hence persimmon trees manured in trenches recorded higher values of fruit size than those manured superficially. This effect disappeared in 2003 season. Consequently, data of the average of the two seasons came in side of trench application.

On the other hand, inoculation of persimmon trees with Nitrobien succeeded in increasing fruit size rather than Rhizobacterien inoculation in 2002 season, only. This effect missed in 2003 season and in the data of the average of the two seasons, (**Table, 35**).

Additionally, **Table (36)** demonstrates that the interaction between organic manure source and application method failed to exert a remarkable effect on fruit size of persimmon trees in 2003 season. On the other side, rabbit manure applied in trenches took the superiority in increasing fruit size, followed by cattle manure and poultry manure applied in trenches in a descending order. On the contrary, cattle manure applied superficially recorded the lowest values of fruit size. In addition, poultry and rabbit manure applied superficially produced not only an intermediate values but also similar effect from the statistical standpoint.

Regarding the effect of interaction between organic manure source and biofertilization on fruit size, **Table (37)** illustrates that in 2003 season all the tested combinations failed to induce a remarkable effect on fruit size. Besides, in 2002 season rabbit manure supplemented with Rhizobacterien inoculation took the superiority in enhancing fruit size, followed descendingly by poultry manure supported with Nitrobien inoculation, cattle manure provided with Nitrobien inoculation and rabbit manure enriched with Rhizobacterien fertilization. On reverse, both cattle and poultry manure provided with Rhizobacterien inoculation produced similarly the least positive effect in this concern.

Furthermore, it is quite evident from **Table (38)** that fruit size parameter showed no significant response to the interaction between organic manure application method and biofertilization in 2003 season. Moreover, the application of organic manure in trenches induced a pronounced positive effect on fruit size as compared with the other combinations. Also, the rest combinations exerted statistically similar effect in this concern.

Lastly, the interaction between organic manure source, application method and biofertilization, (**Table, 39**) shows that the tested combinations produced similar effect on fruit size from the statistical standpoint in 2003 season. Meanwhile, in 2002 season cattle, poultry and rabbit manure applied in trenches and supplemented with Nitrobien proved to be the most efficient combinations in enhancing fruit size of persimmon trees. On the contrary, rabbit manure applied superficially and supported with Nitrobien inoculation and poultry manure applied in trenches and enriched with Rhizobacterien inoculation recorded the lowest values of fruit size. Other interactions came inbetween in this concern.

4.4.1.3. Fruit length

Table (35) reveals that poultry manured persimmon trees produced longer fruits than both cattle and rabbit manured ones in 2003 season. Besides, rabbit manure exerted more positive effect on fruit length than did cattle manure in 2003 season. On the other hand, in 2002 season, organic manure source failed to induce a remarkable effect in this concern.

In addition, fruit length of persimmon trees showed no significant response to the application method i.e., superficial and trench in both seasons of study, (**Table, 35**).

Furthermore, soil inoculation with Nitrobien or Rhizobacterien failed to produce a significant effect on fruit length in 2002 and 2003 seasons as well as data of the average of the two seasons, (**Table, 35**).

As for the interaction between organic manure source and application method, **Table (36)** demonstrates that when poultry manure applied in trenches gave the longest fruits, followed by those produced as a result of rabbit manure applied superficially and/or in trenches. Other combinations gave nearly fruits similar in their length from the statistical standpoint.

Referring to **Table (37)**, the interaction between organic manure source and biofertilization declares that poultry manure enriched with Nitrobien inoculation proved to be the best combination in enhancing fruit length in both seasons, followed by the interactions between rabbit manure and Nitrobien inoculation and poultry manure and Nitrobien inoculation in a descending order. On the other hand, other studied interactions gave nearly more or less similar effect in this respect.

As for the interaction between organic manure application method and biofertilization, **Table (38)** demonstrates that organic manure whether applied superficially or in trenches supplemented with Nitrobien or Rhizobacterien gave similar affects on fruit length of persimmon trees in 2002 and 2003 seasons.

Furthermore, the interaction between the three studied factors i.e., organic manure source, application method and biofertilization (**Table, 39**) demonstrates that out of these interactions, poultry manure and rabbit manure applied in trenches and supported with Nitrobien inoculation gave the highest values of fruit length in both seasons. Other studied combinations gave fluctuated values from one season to another.

4.4.1.4. Fruit diameter

It is obvious from **Table (35)** that organic manure source induced non significant effect on fruit diameter, as shown in data of 2002 and 2003 as well as the average of two seasons, except for poultry manure which recorded lower values of fruit diameter in 2003 season, only.

Furthermore, **Table (35)** demonstrates that organic manure whether applied in trenches or superficial failed to affect fruit diameter in both seasons of study.

On the other hand, soil inoculation with Nitrobien or Rhizobacterien produced statistically fruits similar in their diameter in 2002 and 2003 seasons as well as the average of the two seasons.

In addition, the interaction between organic manure source and application method demonstrates that out of all studied combinations poultry manure applied in trenches produced the widest fruits as noticed in the data of 2002 and 2003 seasons as well the average of the two seasons. Other studied interactions exerted statistically similar effect in this respect, except for cattle manure applied superficially which recorded lower values of fruit diameter in 2003 season and the average of the two seasons, (**Table, 36**).

Regarding the interaction between organic manure source and biofertilization, **Table (37)** illustrates that all studied combinations showed fluctuation from one season to another concerning their effect on fruit diameter.

Furthermore, the interaction between organic manure application method and biofertilization failed to exert a pronounced effect on fruit diameter during the two seasons of study, (**Table, 38**).

As for the interactions between organic manure source, application method and biofertilization, **Table (39)** demonstrates that in both seasons, no constant trend could be noticed on fruit diameter of persimmon trees due the interaction between the three studied factors.

4.4.1.5. Fruit shape index

Data of 2002 and 2003 seasons as well as the average of the two seasons presented in **Tables (35-39)** demonstrate that neither the specific effect of organic manure source (cattle, poultry and rabbit), organic manure application method (superficial and trench) and biofertilization (Nitrobien and Rhizobacterien) nor the interaction between (organic manure source x application method), (organic manure source x biofertilization), (application method of organic manure x biofertilization) and (organic manure source x application method x biofertilization) showed a constant trend throughout the two seasons of study regarding their effect on fruit shape index of Costata persimmon trees.

Conclusively, poultry manure enhanced fruit weight and length more than the other two tested organic manure sources. While, rabbit manure showed to be the best organic manure source in improving fruit size. Besides, organic manure source failed to produce a pronounced effect on fruit diameter and fruit shape index. Moreover, organic manure application method failed to exert a noticeable effect on fruit weight, fruit length, fruit diameter and fruit shape index, but trench application method exerted more positive effect on fruit size than superficial application. On the other hand, biofertilizer type failed to induce remarkable differences in fruit weight, fruit length, fruit diameter and fruit shape index, except for fruit size, which showed positive response to Nitrobien rather than Rhizobacterien.

Finally, poultry manure applied in trenches and enriched with Nitrobien proved to be the best efficient interaction in enhancing fruit weight and fruit length, besides, rabbit manure applied in trenches and supported with Nitrobien showed the highest values of fruit size than other combinations. The interaction between the three studied factors failed to exert any remarkable effect on fruit diameter and fruit shape index.

Table (35): Specific effect of organic manure source, application method and biofertilization on some fruit physical properties of Costata persimmon trees (2002 & 2003 and average).

Factor	Fruit weight (g)			Fruit size (cm^3)			Fruit length (cm)			Fruit diameter (cm)			Fruit shape index (L/D)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source															
Cattle manure	83 B	82 C	82 C	92 C	96 A	94 B	5.3 A	5.3 C	5.3 C	5.2 A	5.5 A	5.3 A	1.02 B	0.96 B	0.99 B
Poultry manure	87 A	88 A	87 A	94 B	95 A	94 B	5.4 A	5.6 A	5.5 A	5.3 A	5.3 B	5.3 A	1.02 B	1.05 A	1.03 A
Rabbit manure	86 A	86 B	86 B	96 A	102 A	99 A	5.4 A	5.4 B	5.4 B	5.2 A	5.5 A	5.3 A	1.03 A	0.98 B	1.00 B
b- Effect of application method															
Superficial	86 A	84 A	85 A	90 B	93 A	91 B	5.4 A	5.4 A	5.4 A	5.3 A	5.5 A	5.4 A	1.01 A	0.98 B	0.99 B
Trench	85 A	86 A	85 A	98 A	102 A	100 A	5.4 A	5.6 A	5.5 A	5.2 A	5.5 A	5.3 A	1.03 A	1.01 A	1.02 A
c- Effect of biofertilization															
Nitrobien	86 A	85 A	85 A	96 A	98 A	97 A	5.5 A	5.5 A	5.5 A	5.4 A	5.5 A	5.4 A	1.01 A	1.00 A	1.00 A
Rhizobacterien	84 A	85 A	84 A	92 B	97 A	94 A	5.3 A	5.4 A	5.3 A	5.1 A	5.5 A	5.3 A	1.03 A	0.98 A	1.00 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (36): Effect of interaction between organic manure source and application method on some fruit physical properties of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Fruit weight (g)			Fruit size (cm^3)			Fruit length (cm)			Fruit diameter (cm)			Fruit shape index (L/D)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	89 A	87 B	88 A	86 D	90 A	88.E	5.3 B	5.0 C	5.1 C	5.2 B	5.5 AB	5.3 B	1.01 B	0.90 E	0.95 D
	Trench	76 C	77 D	76 C	98 B	102 A	100 B	5.3 B	5.6 AB	5.4 B	5.2 B	5.6 A	5.4 A	1.01 B	1.00 C	1.00 BC
Poultry	Superficial	85 B	85 BC	85 B	92 C	89 A	90 D	5.3 B	5.6 A	5.4 B	5.2 B	5.4 B	5.3 B	1.01 B	1.03 B	1.02 B
	Trench	89 A	91 A	90 A	96 B	100.A	98 B	5.5 A	5.7 A	5.6 A	5.4 A	5.2 C	5.3 B	1.01 B	1.09 A	1.05 A
Rabbit	Superficial	84 B	82 C	83 B	92 C	96 A	94 C	5.4 AB	5.4 B	5.4 B	5.4 A	5.5 AB	5.4 A	1.00 B	0.98 D	0.99 C
	Trench	88 A	89 A	88 A	101.A	108 A	104 A	5.4 AB	5.4 B	5.4 B	5.0 C	5.6 A	5.3 B	1.08 A	0.96 D	1.02 B

Means separation within each column by Duncan's multiple range test, 5% level.

Table (37): Effect of interaction between organic manure source and biofertilization on some fruit physical properties of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Fruit weight (g)			Fruit size (cm^3)			Fruit length (cm)			Fruit diameter (cm)			Fruit shape index (L/D)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	80 D	78 E	97.E	96.B	99 A	97.B	5.4 A	5.3 CD	5.3 B	5.3 B	5.4 BC	5.3 AB	1.01 B	0.98 D	0.99 C
	Rhizobacterien	86 BC	85 C	85.C	88 C	93 A	90 D	5.3 B	5.3 CD	5.3 B	5.1 C	5.6 A	5.3 AB	1.03 A	0.94 F	0.98 C
Poultry	Nitrobien	96 A	96 A	96 A	99 A	97 A	98.B	5.6 A	5.5 B	5.5 A	5.5 A	5.3 C	5.4 AB	1.01 B	1.03 B	1.02 B
	Rhizobacterien	79 D	80 DE	79 E	89 C	91 A	90 D	5.3 B	5.8 A	5.5 A	5.1 C	5.4 BC	5.2 C	1.03 A	1.07 A	1.05 A
Rabbit	Nitrobien	84 C	81 D	82 D	94 B	96 A	95 C	5.4 AB	5.7 A	5.5 A	5.3 B	5.6 A	5.4 A	1.01 AB	1.01 C	1.01 B
	Rhizobacterien	88 B	90 B	89 B	99 A	102 A	100 A	5.4 AB	5.2 D	5.3 B	5.2 BC	5.4 BC	5.3 BC	1.03 A	0.96 E	0.99 C

Means separation within each column by Duncan's multiple range test, 5% level.

Table (38): Effect of interaction between organic manure application method and biofertilization on some fruit physical properties of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Fruit weight (g)			Fruit size (cm^3)			Fruit length (cm)			Fruit diameter (cm)			Fruit shape index (L/D)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	89 A	86 A	87 A	88 B	98 A	93 B	5.4 A	5.3 A	5.3 A	5.3 AB	5.6 A	5.4 A	1.01 A	0.94 C	0.97 B
	Rhizobacterien	83 B	83 A	83 A	92 B	96 A	94 B	5.3 A	5.4 A	5.3 A	5.2 AB	5.4 A	5.3 A	1.01 A	1.00 B	1.00 B
Trench	Nitrobien	84 AB	84 A	84 A	105 A	108.A	106 A	5.5 A	5.7 A	5.6 A	5.4 A	5.4 A	5.4 A	1.01 A	1.05 A	1.03 A
	Rhizobacterien	85 AB	87 A	86 A	92 B	99 A	95 B	5.3 A	5.4 A	5.3 A	5.1 B	5.6 A	5.3 A	1.03 A	0.96 C	0.99 B

Means separation within each column by Duncan's multiple range test, 5% level.

Table (39): Effect of interaction between organic manure source, application method and biofertilization on some fruit physical properties of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Biofertilization	Fruit weight (g)			Fruit size (cm^3)			Fruit length (cm)			Fruit diameter (cm)			Fruit shape index (L/D)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	Nitrobien	89 C	87 D	88 C	87 G	91 A	89 CD	5.4 CD	5.0 G	5.2 E	5.4 ABC	5.4 DE	5.4 AB	1.00 DE	0.93 G	0.96 D
		Rhizobacterien	89 C	87 D	88 C	85 GH	89 A	87 DE	5.3 DE	5.1 FG	5.2 E	5.1 CD	5.6 BC	5.3 BC	1.03 BC	0.91 H	0.97 D
	Trench	Nitrobien	71 G	70 H	70 F	105 A	108 A	106 A	5.4 CD	5.6 BC	5.5 BC	5.3 BC	5.5 CD	5.4 AB	1.01 CD	1.01 D	1.01 B
		Rhizobacterien	82 DE	84 DE	83 D	91 DE	96 A	93 B	5.3 DE	5.5 CD	5.4 CD	5.2 CD	5.7 AB	5.4 AB	1.01 CD	0.96 EF	0.98 C
Poultry	Superficial	Nitrobien	94 B	92 C	93 B	94 D	88 A	91 BC	5.5 BC	5.4 DE	5.4 CD	5.4 AB	5.5 CD	5.4 AB	1.01 DE	0.98 E	0.99 C
		Rhizobacterien	77 F	78 G	77 E	90 EF	91 A	90 BC	5.2 E	5.8 A	5.5 BC	5.0 DE	5.4 DE	5.2 CD	1.04 B	1.07 B	1.05 A
	Trench	Nitrobien	98 A	100 A	99 A	105 A	110 A	107 A	5.7 A	5.6 BC	5.6 AB	5.6 A	5.1 GH	5.3 BC	1.01 CD	1.09 A	1.05 A
		Rhizobacterien	81 E	83 EF	82 D	87 FG	91 A	89 CD	5.4 CD	5.7 AB	5.5 BC	5.2 CD	5.4 DE	5.3 BC	1.03 BC	1.07 AB	1.05 A
Rabbit	Superficial	Nitrobien	85 D	80 FG	82 D	83 H	88 A	85 E	5.3 DE	5.6 BC	5.4 CD	5.3 BC	5.8 A	5.5 A	1.00 DE	0.96 D	0.98 D
		Rhizobacterien	82 DE	85 DE	83 D	101 B	108 A	104 A	5.6 AB	5.3 E	5.4 CD	5.6 A	5.2 FG	5.4 AB	1.01 CD	0.98 E	0.99 C
	Trench	Nitrobien	83 DE	83 EF	83 D	105 A	107 A	106 A	5.6 AB	5.8 A	5.7 A	5.3 BC	5.5 CD	5.4 AB	1.05 AB	1.05 C	1.05 A
		Rhizobacterien	93 B	96 B	94 B	97 C	110 A	103 A	5.2 E	5.1 FG	5.1 E	4.8 E	5.7 AB	5.2 D	1.08 A	0.89 I	0.98 CD

Means separation within each column by Duncan's multiple range test, 5% level.

4.4.2. Fruit chemical properties

Tables (40-44) show the response of some fruit chemical properties of Costata persimmon trees i.e. sugar (%), total soluble solids (%), acidity (%), total soluble solids: acid ratio, ascorbic acid (mg/100 ml juice) and tannins (%) to three organic manure sources (cattle, poultry and rabbit manure), two organic manure application methods (superficial and trench) and two biofertilizers (Nitrobien and Rhizobacterien) as well as their interactions during 2002 and 2003 seasons and the average of two seasons.

4.4.2.1. Sugar

It is clear from **Table (40)** that in 2002 season fruits of rabbit manured trees showed to be the richest ones in their sugar content as compared with those produced by poultry or cattle manured ones. Besides, fruit of poultry manure had higher values of sugar content than those of cattle manure. On the other hand, in 2003 season such significant difference between the three evaluated organic manure sources in this respect were lacking.

Furthermore, organic manure application method (superficial and trench) and biofertilizers (Nitrobien and Rhizobacterien) failed to exert a distinctive specific effect on fruit sugar content of persimmon trees during the two seasons of study.

In addition, **Table (41)** reveals that fruit of rabbit manured trees whether applied superficially or in trenches had similar and higher values of sugar content as compared with other combinations. On the contrary, cattle manure applied superficially recorded the lowest values of fruit sugar content. Other tested combinations gave similar and an intermediate values in this concern from the statistical standpoint.

Regarding the interaction between organic manure source and biofertilization, **Table (42)** illustrates that according to data of the average of two seasons the highest values of fruit sugar content were produced by the following combinations in descending order: rabbit manure enriched with Niterobien inoculation, rabbit manure provided with Rhizobacterien and poultry manure supported with Rhizobacterien inoculation. Significant differences were lacking between the previously mentioned combinations. Moreover, the rest combinations exerted statistically similar effect in this concern.

Additionally, the interaction between organic manure application method and biofertilization, (**Table, 43**) failed to produce a combination with distinctive effect on fruit sugar content of Costata persimmon trees during the two seasons of study.

Lastly, data of the average of two seasons reported in **Table (44)** demonstrate that out of all interactions resulted from interaction between the three evaluated factors rabbit and poultry applied in trenches and provided with Rhizobacterien inoculation recorded the highest values of fruit sugar content. On the contrary, cattle manure applied in trenches and supplemented with Rhizobacterien inoculation recorded lower value of fruit sugar content. Other combinations gave statistically similar and an intermediate values in this sphere.

4.4.2.2. Total soluble solids (T.S.S.)

It is obvious from **Table (40)** that in 2002 season fruit of poultry manured trees recorded statistically higher value of total soluble solids percentage as compared with the analogous ones produced by cattle or rabbit manured trees. Besides, fruits of cattle and rabbit manure had similar values of total soluble solids from the statistical standpoint. On the other hand, the differences between the three evaluated orgainc manure sources in this respect in 2003 season were so small to reach the significance level at 5%.

Furthermore, organic manure application method (superficial and trench) on one hand and the two tested biofertilizers (Nitrobien and Rhizobacterien) on the other one failed to induce a distinguishable specific effect from the statistical view, (**Table, 40**).

As for the interaction between organic manure source and its application method, data of the average of two seasons reported in **Table (41)** demonstrate that the poultry combinations i.e. the application of poultry manure either superficially or in trenches produced similar and higher stimulus effect on fruit total soluble solids of Costata persimmon trees. However, the differences between the tested combinations were insignificant except for the combination of rabbit manure and trench application which recorded the lowest value and the differences were significant at 5% level when poultry combinations were concerned.

In addition, data of the average of two seasons reported in **Table (42)** concerning the effect of interaction between organic manure source and biofertilization illustrate that supplementing cattle manure or poultry manure with Rhizobacterien inoculation recorded similar and higher values of fruit total soluble solids percentage. On the contrary, cattle manure enriched with Nitrobien inoculation, followed in an ascending order by rabbit manure supported with Rhizobacterien inoculation recorded lower values in this concern. Other tested combinations gave statistically similar and an intermediate values in this sphere.

On the other side, **Table (43)** illustrates that in 2002 and 2003 seasons the tested organic manures whether applied superficially or in trenches combined either with Nitrobien or Rhizobacterien inoculation failed to induce a distinctive effect on fruit total soluble solids percentage of Costata persimmon trees from the statistical standpoint.

Lastly, data of the average of two seasons reported in **Table (44)** dealing with the effect of interaction between the three evaluated factors on fruit total soluble solids percentage of Costata persimmon trees reveal that the combination of poultry manure applied superficially and enriched with Nitrobien inoculation and the same organic manure source applied in trenches and supported with Rhizobacterien inoculation exerted statistically similar and higher values of fruit total soluble solids percentage, followed descendingly by the combinations of cattle manure applied in trenches and supplemented with Rhizobacterien inoculation and rabbit manure applied superficially and provided with Nitrobien inoculation. On reverse, the lower values of fruit total soluble solids percentage were produced by the combinations of cattle and poultry manure applied in trenches and supported with Nitrobien inoculation. The rest combinations gave an intermediate values in this concern.

4.4.2.3. Total acidity

Table (40) shows that in both seasons fruits of poultry manured trees proved to be more acidic ones as compared with the corresponding ones produced by cattle or rabbit manured trees. However, differences between cattle and rabbit manure in this respect were so small to reach the significance level at 5%.

Additionally, **Table (40)** demonstrates that in 2002 and 2003 seasons neither the organic manure application method (superficial and trench) nor the tested biofertilizers (Nitrobien and Rhizobacterien) produced a distinctive effect on fruit total acidity percentage of Costata persimmon trees from the statistical view.

Regarding the effect of interaction between organic manure source and its application method the combinations of poultry manure particularly trench application, followed by superficial application recorded the highest values of fruit total acidity percentage, followed in a descending order in the same pattern by combinations of cattle manure and lastly the combinations of rabbit manure, (**Table, 41**).

Furthermore, data of the average of two seasons concerning the effect of interaction between organic manure source and biofertilization on fruit total acidity percentage as shown in **Table (42)** indicate that the more acidic fruits were produced by poultry manured trees enriched with Rhizobacterien inoculation and cattle manure supported with Nitrobien inoculation. On the contrary, the lowest values of fruit total acidity percentage were found in fruits of rabbit manuredtrees supplemented with Rhizobacterien inoculation, followed in an ascending order by those produced by cattle manured trees provided with Rhizobacterien inoculation. The remained combinations exerted statistically similar and an intermediate values in this concern.

In addition, **Table (43)** demonstrates that in 2002 and 2003 seasons the interaction between organic manure application method (superficial or trench) and biofertilization (Niterobien or Rhizobacterien) failed to produce a combination with a distinguishable effect on fruit total acidity percentage of Costata persimmon trees from the statistical standpoint.

Finally, the interaction between the three evaluated factors, data of the average of two seasons reported in **Table (44)** reveal that cattle manured trees superficially provided with Nitrobien inoculation and poultry manured trees in trenches and supported with Rhizobacterien gave statistically similar and more acidic fruits. On the contrary, the less acidic fruits were produced by cattle manured trees superficially and enriched with Rhizobacterien; rabbit manured trees in trenches and inoculated with Rhizobacterien and rabbit manured trees superficially and enriched with Nitrobien. The remained combinations exerted statistically similar and an intermediate values of fruit total acidity percentage of Costata persimmon trees.

4.4.2.4. Total soluble solids/acid ratio

It is clear from **Table (40)** that in 2002 season fruits of rabbit manured trees had higher ratio of total soluble solids to acid as compared with those of poultry manure. Moreover, cattle manure exerted inbetween value in this concern. Besides, in 2003 season the differences between the three evaluated organic manure sources in this respect were so small to reach the significance level.

Furthermore, neither the organic manure application method (superficial or trench) nor the biofertilization (Niterobien or Rhizobacterien) induced a distinctive specific effect on fruit total soluble solids: acid ratio of Costata persimmon fruits during 2002 and 2003 seasons.

As for the interaction between organic manure source and its application, **Table (41)** shows that in both seasons all resulted combinations produced statistically similar values of total soluble solids: acid ratio except for poultry manure applied in trenches which produced comparatively lower value of total soluble solids: acid ratio than rabbit manure applied superficially in 2003 season.

On the other hand, supporting cattle and rabbit manure with Rhizobacterien inoculation recorded the highest ratios of total soluble solids/acid. Besides, enriching poultry and rabbit manure with Nitrobien inoculation induced statistically similar ratios in this sphere. On the contrary, the lowest ratios of total soluble solids: acid were produced by cattle manure supplemented with Nitrobien inoculation and poultry manure provided with Rhizobacterien inoculation in an ascending order in both seasons of study, (**Table, 42**).

Additionally, the application of the tested organic manures superficially or in trenches provided either with Nitrobien or Rhizobacterien inoculation gave similar ratios of total soluble solids: acid in both seasons of study from the statistical standpoint, (**Table, 43**).

Lastly, **Table (44)** shows that the highest ratios of total soluble solids: acid were produced by the combinations of (cattle manure x superficial application x Rhizobacterien inoculation), (rabbit manure x trench application x Rhizobacterien inoculation), (rabbit manure x superficial application x Nitrobien inoculation) and (poultry manure x superficial application x Nitrobien inoculation) in a descending order. On reverse, the interaction of (cattle manure x superficial application x Nitrobien inoculation), (rabbit manure x trench application x Nitrobien inoculation) and (poultry manure x superficial application x Rhizobacterien inoculation) recorded ascendingly the lowest ratios of total soluble solids/ acid.

4.4.2.5. Ascorbic acid

It is obvious from **Table (40)** that in both seasons fruits of poultry manured trees showed to be the richest ones in their ascorbic acid content, followed in a descending order by the corresponding ones of rabbit manure and finally, those of cattle manure. However, the differences between the three evaluated organic manure sources were remarkable to be significant at 5% level.

Furthermore, the application of the three tested organic manure sources either superficially or in trenches gave statistically similar effect in this respect during the two seasons of study.

In addition, soil inoculation with Nitrobien surpassed Rhizobacterien inoculation in enhancing fruit content of ascorbic acid in 2002 and 2003 seasons.

As for the interaction between organic manure source and its application, **Table (41)** illustrates that in both seasons poultry manure combinations i.e. superficial and trench application and rabbit manure applied superficially recorded statistically similar and higher values of fruit ascorbic acid content as compared with those of cattle manure combinations (superficial and trench application) and rabbit manure applied in trenches. However, the differences between the previously three mentioned combinations were so small to reach the significance level.

Additionally, **Table (42)** illustrates that poultry manure provided with Nitrobien induced the highest positive effect on fruit ascorbic acid content, followed descendingly by rabbit manure enriched with Nitrobien inoculation. On the contrary, cattle manure supported with Rhizobacterien inoculation induced the lowest positive effect on fruit ascorbic acid content. Besides, the remained combinations exerted statistically similar and an intermediate values in this concern.

On the other hand, **Table (43)** demonstrates that supplementing superficial application of organic manure with Nitrobien inoculation exerted the highest enhancing effect on fruit ascorbic acid content as compared with the other tested combinations. Besides, the remained combinations induced statistically similar effect in this concept.

Finally, the interaction between the three evaluated factors, **Table (44)** demonstrates that the highest values of fruit ascorbic acid content were achieved by the following combinations in a descending order: (poultry manure x superficial application x Nitrobien inoculation), (poultry manure x trench application x Rhizobacterien inoculation), (rabbit manure x superficial application x Nitrobien inoculation) and (poultry manure x trench application x Nitrobien inoculation). On reverse, the lowest values of fruit ascorbic acid content were recorded in an ascending order by the following combinations: (cattle manure x superficial application x Rhizobacterien inoculation), (cattle manure x trench application x Rhizobacterien inoculation), (poultry manure x superficial application x Rhizobacterien inoculation) and (rabbit manure x trench application x Rhizobacterien inoculation). The remained combinations showed an intermediate values in this respect, (Table, 44).

4.4.2.6. Tannins

Tables (40-44) illustrate that in 2002 and 2003 seasons the three evaluated factors i.e. organic manure source (cattle, poultry and rabbit manure), organic manure application method (superficial and trench) and biofertilizers (Nitrobien and Rhizobacterien inoculation) failed to produce lonely a distinctive statistical effect or in a combination a significant interactive effect on fruit tannins content of Costata persimmon trees.

Briefly, rabbit manure proved to be the most efficient organic manure source in enhancing fruit content of sugar and total soluble solids/acid ratio. Moreover, poultry manure showed the highest values of fruit content of total soluble solids, total acidity and ascorbic acid. Besides, the three evaluated organic manure sources exerted similar effect on fruit tannin content. On the other hand, the tested organic manure application methods induced similar effect on the studied fruit chemical properties. In addition, the evaluated 'biofertilizers i.e., Nitrobies and Rhizobacterien exerted similar effect on fruit chemical traits except for fruit ascorbic acid content, hence Nitrobien produced more positive effect than did Rhizobacterien. Finally, the combination of rabbit manure applied in trenches and supported with Nitrobien inoculation recorded the highest value of fruit sugar content, besides, poultry manure applied in trenches and enriched with Rhizobacterien inoculation induced high increase in fruit content of total soluble solids and total acidity, whereas, poultry manure applied superficially and supported with Nitrobien inoculation proved to be the most efficient treatment in enhancing fruit ascorbic acid content. On the other hand, cattle manure applied superficially and provided with Rhizobacterien inoculation scored the highest ratio of total soluble solids: acid. Lastly, the combination between the three evaluated factors failed to produce a distinctive effect on fruit tannins content.

The obtained results of fruit quality due to the use of different organic manure source go in line with the reports of **Sermann** *et al.* **(1975)** on pomes, stones and vines, **Bacha** and **Abo-Hassan (1983)** on date palm, **Sekiya** *et al.* **(1983)** on Satsuma mandarin, **Gasanov (1984)** on persimmon, **Kalu-Singh** *et al.* **(1994)** on mango, **Darfeld** and **Lenz (1985)** on pear, **Umemiya** and **Sekiya (1985)** on persimmon, **Bussi** and **Defrance (1987)** on peach, **Piatkowski** *et al.* **(1990)** on apple, **Gouda** *et al.* **(1992)** on grape, **Rabeh** *et al.* **(1993)** on Balady mandarin, **Huang** *et al.* **(1995)** on Satsnma mandarin, **Silva (1998)** on mango, **El-Kobbia (1999)** on Washington navel orange, **Song** *et al.* **(1999)** on apple, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They mentioned that fruit properties differ in their response to the source of organic manure. On the other hand, the results of organic manure application method are in harmony with the findings of **Bhangoo** *et al.* **(1988)** on vines, **Fisum** and **Kodzokov (1991)** on plum, **Goede (1993)** on mango, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They concluded that the organic manure application method varied in its effect on fruit parameters. Lastly, the results of biofertilizers go in line with the findings of **Das** *et al.* **(1996)** on mulberry, **Akl** *et al.* **(1997)** on Roomy grapevines, **Moustafa** 2002 on Washington navel orange and **Salama** 2002 on Balady mandarin. They reported that the response of fruit quality to a biofertilizer varies from on plant species to another.

Table (40): Specific effect of organic manure source, application method and biofertilization on some fruit chemical properties of Costata persimmon trees (2002 & 2003 and average).

Factor	Sugar (%)			T.S.S. (%)			Acidity (%)			T.S.S/Acid (ratio)			Ascorbic acid (mg/100 ml juice)			Tannins (%)		
	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
a- Effect of organic manure source																		
Cattle manure	14.6 C	17.1 A	15.8 B	23.1 B	24.3 A	23.7 B	0.58 B	0.58 B	0.58 B	39.8 AB	41.8 A	40.8 AB	25 C	23 C	24 C	3.42 A	3.51 A	3.46 A
Poultry manure	15.9 B	17.0 A	16.4 B	23.5 A	24.7 A	24.1 A	0.61 A	0.60 A	0.60 A	38.5 B	41.6 A	40.0 B	30 A	28 A	29 A	3.50 A	3.60 A	3.55 A
Rabbit manure	17.5 A	16.5 A	17.0 A	23.0 B	24.0 A	23.5 B	0.57 B	0.57 B	0.57 B	40.3 A	42.1 A	41.2 A	27 B	25 B	26 B	3.45 A	3.52 A	3.48 A
b- Effect of application method																		
Surface	15.7 A	16.8 A	16.2 A	23.4 A	24.5 A	23.9 A	0.58 A	0.58 A	0.58 A	40.3 A	42.2 A	41.2 A	28 A	26 A	27 A	3.45 A	3.54 A	3.49 A
Trench	16.3 A	16.9 A	16.6 A	23.1 A	24.1 A	23.6 A	0.59 A	0.59 A	0.59 A	39.1 A	40.8 A	39.9 A	27 A	25 A	26 A	3.46 A	3.55 A	3.50 A
c- Effect of biofertilization																		
Nitrobien	16.2 A	16.8 A	16.5 A	23.1 A	24.2 A	23.6 A	0.60 A	0.59 A	0.59 A	38.5 A	41.0 A	39.7 A	29 A	27 A	28 A	3.48 A	3.57 A	3.52 A
Rhizobacterien	15.8 A	17.0 A	16.4 A	23.4 A	24.5 A	23.9 A	0.57 A	0.58 A	0.57 A	40.5 A	42.2 A	41.3 A	25 B	23 B	24 B	3.43 A	3.52 A	3.47 A

Means separation within each column for each specific effect by Duncan's multiple range test, 5% level.

Table (41): Effect of interaction between organic manure source and application method on some fruit chemical properties of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Application method	Sugar (%)			T.S.S. (%)			Acidity (%)			T.S.S/Acid (ratio)			Ascorbic acid (mg/100 ml juice)			Tannins (%)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Superficial	14.5 D	17.2 AB	15.8 BC	23.2 AB	24.3 AB	23.7 AB	0.57 CD	0.58 BC	0.57 BC	40.7 AB	41.8 A	41.2 A	25 B	23 B	24 B	3.40 A	3.49 A	3.44 A
	Trench	14.8 D	17.1 AB	15.9 C	23.0 AB	24.3 A	23.6 AB	0.59 BC	0.59 BC	0.59 AB	38.8 AB	41.0 A	39.9 AB	24 B	22 B	23 B	3.44 A	3.53 A	3.48 A
Poultry	Superficial	15.5 CD	16.6 B	16.0 BC	23.6 A	24.9 A	24.2 A	0.60 AB	0.60 AB	0.60 AB	39.1 AB	41.5 A	40.2 AB	30 A	28 A	29 A	3.50 A	3.61 A	3.55 A
	Trench	16.3 BC	17.5 A	16.9 AB	23.5 A	24.6 AB	24.0 A	0.61 A	0.61 A	0.61 A	38.2 B	40.0 A	39.1 B	30 A	28 A	29 A	3.49 A	3.58 A	3.53 A
Rabbit	Superficial	17.1 AB	16.8 AB	16.9 A	23.3 AB	24.4 AB	23.8 AB	0.56 D	0.58 BC	0.57 D	41.3 A	42.2 A	41.7 A	29 A	27 A	28 A	3.44 A	3.50 A	3.47 A
	Trench	18.0 A	16.4 B	17.2 A	22.8 B	23.6 B	23.2 B	0.57 CD	0.57 C	0.57 CD	40.0 AB	41.4 A	40.6 AB	26 B	24 B	25 B	3.46 A	3.53 A	3.49 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (42): Effect of interaction between organic manure source and biofertilization on some fruit chemical properties of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	Biofertilization	Sugar (%)			T.S.S. (%)			Acidity (%)			T.S.S/Acid (ratio)			Ascorbic acid (mg/100 ml juice)			Tannins (%)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Cattle	Nitrobien	14.8 D	17.6 AB	16.4 BC	22.6 C	23.7 C	23.1 C	0.61 A	0.60 AB	0.60 AB	36.9 C	39.4 C	38.1 D	26 C	24 C	25 C	3.42 A	3.51 A	3.46 A
	Rhizobacterien	14.6 D	16.8 BC	15.7 C	23.7 A	25.0 A	24.3 A	0.56 B	0.57 C	0.56 DE	42.3 A	43.9 A	43.1 A	23 D	21 D	22 D	3.42 A	3.51 A	3.46 A
Poultry	Nitrobien	16.2 BC	16.4 C	16.2 BC	23.5 AB	24.7 AB	24.1 AB	0.61 A	0.59 B	0.60 BC	38.6 BC	41.5 AB	40.0 BC	32 A	30 C	31 A	3.58 A	3.67 A	3.62 A
	Rhizobacterien	15.6 CD	17.7 A	16.6 AB	23.7 A	24.8 AB	24.2 A	0.61 A	0.62 A	0.61 A	38.6 BC	40.0 C	39.3 CD	27 C	25 C	26 C	3.41 A	3.53 A	3.47 A
Rabbit	Nitrobien	17.9 A	16.5 C	17.2 A	23.2 AB	24.3 AB	23.7 AB	0.58 B	0.59 B	0.58 CD	40.2 AB	40.8 BC	40.5 BC	29 B	27 B	28 B	3.46 A	3.53 A	3.49 A
	Rhizobacterien	17.2 AB	16.7 BC	16.9 AB	23.0 BC	23.8 BC	23.4 BC	0.57 B	0.56 C	0.56 E	40.9 AB	42.9 AB	41.9 AB	26 C	24 C	25 C	3.44 A	3.51 A	3.47 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (43): Effect of interaction between organic manure application method and biofertilization on some fruit chemical properties of Costata persimmon trees (2002 & 2003 and average).

Application method	Biofertilization	Sugar (%)			T.S.S. (%)			Acidity (%)			T.S.S/Acid (ratio)			Ascorbic acid (mg/100 ml juice)			Tannins (%)		
		(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average
Superficial	Nitrobien	16.0 A	16.9 A	16.4 A	23.8 A	24.9 A	24.3 A	0.59 A	0.61 A	0.60 A	40.5 A	41.0 A	40.7 A	31 A	29 A	30 A	3.47 A	3.56 A	3.51 A
	Rhizobacterien	15.4 A	17.3 A	16.3 A	23.1 A	24.2 A	23.6 A	0.58 A	0.56 A	0.57 A	40.1 A	42.9 A	41.5 A	24 B	22 B	23 B	3.42 A	3.51 A	3.56 A
Trench	Nitrobien	16.6 A	17.2 A	16.9 A	22.4 A	23.5 A	22.9 A	0.61 A	0.59 A	0.60 A	36.7 A	40.1 A	38.3 A	27 AB	25 AB	26 AB	3.50 A	3.57 A	3.53 A
	Rhizobacterien	16.2 A	16.8 A	16.5 A	22.9 A	24.9 A	23.9 A	0.58 A	0.59 A	0.58 A	41.1 A	41.6 A	41.3 A	26 B	24 B	25 B	3.43 A	3.52 A	3.47 A

Means separation within each column by Duncan's multiple range test, 5% level.

Table (44): Effect of interaction between organic manure source, application method and biofertilization on some fruit chemical properties of Costata persimmon trees (2002 & 2003 and average).

Organic manure source	application method	Bioferti-lization	Sugar (%)			T.S.S. (%)			Acidity (%)			T.S.S/Acid (ratio)			Ascorbic acid (mg/100 ml juice)			Tannins (%)		
			(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Average	(2002)	(2003)	Averag
Cattle	Superficial	Nitrobien	14.6 D	17.3 ABC	15.9 ABC	23.2 CDE	24.1 BCD	23.6 BCD	0.62 A	0.64 A	0.63 A	37.3 CD	38.0 C	37.6 D	28 BCD	26 BCD	27 CD	3.42 A	3.51 A	3.46 A
		Rhizobacterien	14.5 D	17.2 ABC	15.8 BC	23.4 CDE	24.7 ABC	24.0 BCD	0.54 C	0.53 F	0.53 D	43.6 A	46.5 A	45.0 A	22 F	20 F	21 F	3.38 A	3.47 A	3.42 A
	Trench	Nitrobien	14.9 CD	17.8 AB	16.3 ABC	22.1 G	23.3 D	22.7 E	0.61 AB	0.57 CDE	0.59 BC	36.6 D	40.8 BC	38.7 CD	25 DE	23 DE	24 E	3.41 A	3.50 A	3.45 A
		Rhizobacterien	14.7 D	16.3 CD	15.5 C	23.9 ABC	25.4 ABC	24.6 AB	0.58 B	0.62 AB	0.59 AB	40.9 ABC	41.2 BC	41.0 BC	24 EF	22 EF	23 EF	3.47 A	3.56 A	3.51 A
Poultry	Superficial	Nitrobien	15.8 CD	15.9 D	15.8 BC	24.6 AB	25.9 A	25.2 A	0.61 AB	0.59 BCD	0.59 AB	40.6 ABC	43.5 AB	42.0 B	36 A	34 A	35 A	3.63 A	3.72 A	3.67 A
		Rhizobacterien	15.2 CD	17.3 ABC	16.2 ABC	22.7 EFG	23.9 CD	23.3 CDE	0.61 AB	0.61 AB	0.60 AB	37.5 CD	39.6 BC	38.5 CD	24 EF	22 EF	23 EF	3.38 A	3.51 A	3.44 A
	Trench	Nitrobien	16.6 ABC	16.8 BCD	16.7 ABC	22.4 FG	23.5 D	22.9 E	0.61 AB	0.59 BCD	0.58 BC	36.6 D	39.5 BC	38.0 D	29 BC	27 BC	28 BCD	3.54 A	3.63 A	3.58 A
		Rhizobacterien	16.1 BCD	18.2 A	17.1 A	24.7 A	25.7 AB	25.2 A	0.62 A	0.63 A	0.62 A	39.7 BCD	40.5 BC	40.1 BCD	31 B	29 B	30 B	3.45 A	3.54 A	3.49 A
Rabbit	Superficial	Nitrobien	17.6 AB	16.2 CD	16.9 AB	23.7 BCD	24.8 ABC	24.2 ABC	0.55 C	0.59 BCD	0.57 CD	43.5 A	41.7 BC	42.6 AB	30 BC	28 BC	29 BC	3.37 A	3.46 A	3.41 A
		Rhizobacterien	16.6 ABC	17.4 ABC	17.0 AB	23.0 DEF	24.1 BCD	23.5 CDE	0.59 AB	0.57 DE	0.58 BC	39.1 BCD	42.7 AB	40.9 BC	28 CD	26 CD	27 D	3.51 A	3.55 A	3.53 A
	Trench	Nitrobien	18.2 A	16.8 BCD	17.5 A	22.6 EFG	23.8 CD	23.2 DE	0.62 A	0.59 BC	0.60 AB	36.9 D	39.8 B	38.3 CD	28 BC	26 BC	27 BCD	3.55 A	3.60 A	3.57 A
		Rhizobacterien	17.8 AB	15.9 D	16.8 AB	23.0 DEF	23.6 D	23.3 CDE	0.54 C	0.55 EF	0.54 D	42.6 AB	43.2 AB	42.9 AB	24 EF	22 EF	23 EF	3.38 A	3.47 A	3.42 A

Means separation within each column by Duncan's multiple range test, 5% level.