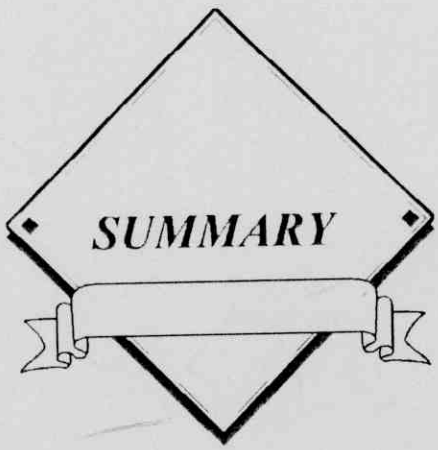
SUMMARY

5- SUMMARY AND CONCLUSION

This investigation has two main experiments:-

Experiment I : Effect of organic manure source, method of organic manure application and biofertilization on tree growth, leaf mineral content, tree fruiting and fruit quality of Balady mandarin.

Following a preliminary experiment carried out during 1999, this study was carried out during two consecutive seasons of 2000 and 2001 at Citrus Farm of Plant Research Department, Nuclear Research Center, Inshas, Egypt, to throw some light on the effect of organic manure source namely cattle, poultry and sheep and method of organic manure application, *i.e.* superficial and trench and biofertilization (N-fixing bacteria) as well as their interactions on tree growth, leaf mineral content fruiting and fruit quality of Balady mandarin.

Ten-year-old Balady mandarin trees growing on Sour orange rootstock (***Citrus aurantium*** L.) and planted at 5 x 5 m apart in a sandy soil were devoted for this investigation. Ninety-six Balady mandarin trees, healthy, nearly uniform in growth vigour and fruiting and received regularly the recommended horticultural practices were selected for this study. However, three factors were studied during the present investigation as follows:-

5.1. Organic manure source

Response of tree growth, fruiting and fruit quality of Balady mandarin to three sources of organic manure namely

cattle, poultry and sheep manure was investigated. According to the recommendation of Horticulture Research Institute, Ministry of Agriculture, Egypt, the amount of actual nitrogen (g/tree/year) required to orange trees

= Soil type (sandy soil) x Tree age (max. 10 year)

= 50 x 10 = 500 g/tree/year.

Thereupon, half of the required nitrogen (250 g N/tree/yearly) was assumed to be satisfied through one of the tested organic manure source according its content of nitrogen as follows:-

Cattle manure (1.47 % N) about 17.0 kg/tree.

Poultry manure (3.46 % N) about 7.22 kg/tree.

Sheep manure (2.46 % N) about 8.93 kg/tree.

5.2. Method of organic manure application

Two methods of organic application of the three tested organic manure sources *i.e.* cattle, poultry and sheep were studied as follows:-

a- **Surface application:** well decomposed organic manure of the three studied sources were applied superficially and digged in the soil during deep hand hoeing practice (about 20 cm depth) conducted in mid-December.

b- **Trench application:** in mid-December of each season, two trenches (100 cm length x 30 cm width x 40 cm depth) were digged on both sides of the tree at 1 m apart from the tree trunk in the direction of irrigation furrows. Thereafter, the estimated amount of each organic manure

source (cattle, poultry and sheep) was divided equally and applied in the two trenches and covered with trench soil.

5.3. Biofertilization (N-fixing bacteria)

The remaining N-requirement for each tree was assumed to be partially satisfied through using materials of N-fixing bacteria. In the first week of March of each season, Balady mandarin trees were inoculated with Nitrobeine (100 g/tree) or Rhizobacterin (50 g/tree). The biofertilizers were applied in trenches (50 cm length x 20 cm width x 20 cm depth). Irrigation was conducted after biofertilizers appliance.

Consequently, this investigation is considered a factorial experiment included three factors (3 organic manure sources x 2 methods of organic manure application x 2 biofertilizers). The treatments were arranged in a completely randomized design and each treatment was replicated four times and each replicate was represented by two trees (plot).

The obtained results could be summarized as follows:-

5.1. Tree growth

Under the conditions of the present study (Kalubia Governorate), Balady mandarin trees gave four distinctive growth cycles per year (spring growth cycle, two growth cycles in summer and autumn growth cycle). Poultry manure succeeded in prolonging the duration of the previously mentioned growth cycles and consequently poultry manured trees showed the longest annual growth followed by those manured with sheep. On the contrary, cattle manure exerted the lowest positive effect in this respect. This stimulative effect on growth cycles duration

was enhanced when the organic manures were applied in trenches and supported with Rhizobacterien. On the other hand, fertilization with poultry manure increased number of produced shoots, shoot length and number of produced leaves/shoot of the different growth cycles, followed descendingly by sheep manure, whereas cattle manure showed the lowest positive effect in this respect. The trench application of organic manure surpassed surface application and Rhizobacterien surpassed Nitrobien in enhancing positive effect of organic manure in this concern.

On the other hand, Balady mandarin trees fertilized with poultry manure gave the highest values of leaf parameters *i.e.* surface area, leaf content of chlorophyll (*a*) and (*b*) and leaf dry weight followed by those manured with sheep. The positive effect of organic manure was increased when the organic manure was applied in trenches and provided with Rhizobacterien.

5.2. Leaf mineral content

Fertilizing Balady mandarin trees with poultry manure enhanced leaf N, K, Ca, Mg, Fe, Zn, cu and Mn content. On the contrary, cattle manure induced the lowest positive effect in this sphere. Besides, sheep manured trees gave intermediate values of the previously mentioned leaf mineral content. Anyhow, organic manure source, method of application and biofertilization failed to induce a pronounced effect on leaf P and Cu content. Besides, the stimulative effect of organic manure source was enhanced when applied in trenches and supported with Rhizobacterien.

5.3. Tree fruiting

Poultry manured trees gave the highest values of fruit set percentage, the lowest values of fruit shedding percentage during the periods of the studied fruit dropping and the highest yield (Kg/tree) or number of fruits/tree. The reverse was true with cattle manured trees. Besides, sheep manured trees gave intermediate values in this respect. The application of organic manure in trenches and enriching with Rhizobacterien increased the positive effect in this concern.

5.4. Fruit quality

Poultry manure surpassed cattle manure in enhancing fruit quality whether the physical properties *i.e.* fruit weight, length, width, juice weight and peel thickness) or chemical properties *i.e.* total soluble solids percentage, TSS/acid and ascorbic acid. Besides, sheep manured trees gave intermediate values of the studied fruit parameters. The stimulative effect of organic manure was improved with trench application and Rhizobacterien inoculation. Moreover, the three studied factors failed to induce significant effect on fruit acidity.

Thereupon, in order to obtain healthy and clear fruits and to avoid environmental pollution through the replacement of mineral fertilization with organic and biofertilizers, it is preferred to satisfy half of nitrogen requirement of Balady mandarin in the form of poultry manure applied in trenches and supported with Rhizobacterien, biofertilization.

Experiment II: Effect of organic manure source, organic manure irradiation and method of organic manure application on growth and leaf mineral content of Sour orange and Volkamer lemon seedlings.

This investigation was conducted during two consecutive seasons of 2000 and 2001 at the Nursery of Plant Research Department, Nuclear Research Center, Inshas, Egypt, to throw some light on the effect of irradiation of three organic manure sources namely cattle , poultry and sheep manure and the method of organic manure application, *i.e.* dry organic manure soil application and organic manure water extract soil application, besides their interactions on plant growth and leaf nutrient content of Sour orange (***Citrus aurantium,* L**) and Volkamer lemon ***(Citrus volkameriana. Ten and Pasq.)*** seedlings. All treatments received Rhizobacterien biofertilizer 5g/pot .

Two-month-old Sour orange and Volkamer lemon seedlings were transplanted individually each in black plastic bag filled with 10 Kg of sandy soil. Selected seedlings were healthy, nearly uniform in growth vigour and received regularly the recommend culture care. However, three factors were studied during the present investigation as follows:-

1- Organic manure source

Response of plant growth and leaf nutrient content of Sour orange and Volkamer lemon seedlings to the three sources of organic manure namely cattle, poultry, and sheep manure was investigated. According to the recommendation of Horticulture Research Institute, Ministry of Agriculture, Egypt, the amount of

actual nitrogen (10g / plant / year) required to citrus seedlings. Thereupon, half of the required amount (5g / plant / year) was suggested to be satisfied through one of the organic manure source according its content of nitrogen as follows.

Cattle manure (1.47 %N) about 340 g / seedling.

Poultry manure (3.46 %N) about 145g / seedling.

Sheep manure (2.8 % N) about 179 g / seedling.

2. Irradiation of dry organic manures

Dry organic manures namely cattle, poultry, and sheep was irradiated with 10 kGy of gamma ray (as safe pathogenic organisms or pests) comparing with non-irradiation of dry organic manures.

3. Organic manure application Method

Two methods of organic manure application of the three tested organic manure sources namely cattle, poultry and sheep were studied as follows :

a- Soil application of organic manure

The calculated amount of each organic manure source was mixed with sandy soil and filled in plastic black bags (pots)[10 kg mixture/pot] at the planting time *i.e.* mid- February of each season.

b- Organic manure water extract soil application.

The three sources of organic manure were applied as soil application of water extract of organic manure through soaking 10, 5, and 5 g of dry cattle, poultry and sheep manure, respectively in one liter of water for 48 hour, then applied as soil

application manure water extract through irrigating the seedlings weekly with 0.5 liter of water extract of organic manure per pot.

Furthermore, in mid-March of each season, Sour orange and Volkamer lemon seedlings were inoculated with Rhizobacterien 5 g /pot applied a round each seedlings as a soil drench treatment. Irrigation was conducted after Rhizobacterien application.

Consequently, this investigation is considered a factorial experimental included three factors (3 organic manure sources X 2 irradiation treatments of organic manure X 2 methods of organic manure application). The treatments were arranged in a completely randomized block design and each treatment was replicated three times and each replicate was represented with five seedlings.

The obtained results could be summarized as follows:-

Firstly: Sour orange seedlings

1-Plant growth parameters

Under the experiment conditions (Kalubia Governorate), Sour orange seedlings manured with poultry succeeded to give the highest growth parameters followed by those manured with sheep. On the contrary, cattle manure exerted the lowest positive effect in this respect. Irradiating organic manure surpassed non-irradiation ones and the soil application of organic manure surpassed water extract of organic manure application in this concern.

On the other hand, Sour orange seedlings fertilized with poultry manure gave the highest values of stem height, stem diameter leaf content of chlorophyll (*a*) and (*b*), number of

leave/seedling, root length, number of roots/seedling, leaf surface area, stem dry weight, leaf dry weight, root dry weight, total dry weight and top/root followed by those manured with sheep. The enhancing effect of organic manure was increased with irradiating organic manure and appliance of organic manure as soil application.

2-Leaf nutrient content

Manuring Sour orange seedlings with poultry manure enhanced leaf N,P, K, Ca, Mg, Fe, Zn and Mn content. On the contrary, cattle manure induced the lowest positive effect in this sphere. Besides, sheep manured trees gave intermediate values of the previously mentioned leaf mineral content. Besides, the stimulative effect of organic manure source was enhanced when irradiating organic manure and applied in soil application.

Secondly: Volkamer lemon seedlings

1-Plant growth parameters

Under the experiment conditions (Kalubia Governorate), Volkamer lemon seedlings with poultry manure succeeded to induce the highest growth parameters followed by those manured with sheep. On the contrary, cattle manure exerted the lowest positive effect in this respect. This stimulative effect on growth parameters was enhanced when organic manners were irradiated and applied as soil application.

On the other hand, Volkamer lemon seedlings fertilized with poultry manure gave the highest values of stem height, stem diameter, leaf content of chlorophyll (*a*) and (*b*), number of

leave/seedling, root length, number of roots/seedling, leaf surface area, stem dry weight, leaf dry weight, root dry weight, total seedling dry weight and top:root ratio followed by those manured with sheep. The enhancing effect of organic manure was increased when the organic manure was irradiated and applied as soil application.

2-Leaf nutrient content

Fertilizing Volkamer lemon seedlings with poultry manure enhanced leaf N,P, K, Ca, Mg, Fe, Zn and Mn content. On the contrary, cattle manure induced the lowest positive effect in this sphere. Besides, sheep manured trees gave intermediate values of the previously mentioned leaf mineral content. Besides, the stimulative effect of organic manure source was enhanced when organic manure was irradiated and applied as soil application.