SUMMARY AND CONCLUSIONS

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Following a preliminary experiment conducted during 1999, this study was carried out during two consecutive seasons of 2000 and 2001 at the Citrus Farm, Faculty of Agriculture, Moshtohor, Kalubia Governorate, to throw some light on the effect of organic manure source namely cattle, poultry and rabbit and method of organic manure application, *i.e.* surface and trench and biofertilizers (N-fixing bacteria) as well as their interactions on tree growth, fruiting and fruit quality of Washington navel orange.

Thirty five-year-old Washington navel orange trees growing on Sour orange rootstock (***Citrus aurantium*** L.) and planted at 5 x 5 m apart in a clay loamy soil were devoted for this investigation. Ninety-six Washington navel orange 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:-

1- Organic manure source

Response of tree growth, fruiting and fruit quality of Washington navel orange to three sources of organic manure namely cattle, rabbit and poultry manure was investigated. According to the recommendation of Horticultural Institute, Ministry of Agriculture, Egypt, the amount of actual nitrogen (g/tree/year) required to orange tree.

= Soil type (loamy soil) x Tree age (max. 15 year)

= 50 x 15 = 750 g/tree/year.

Thereupon, half of the required nitrogen (375 g N/tree/yearly) was satisfied through the organic manure source according its content of nitrogen as follows:-

Cattle manure (1.470% N) about 25.5 kg/tree.

Poultry manure (3.462% N) about 10.8 kg/tree.

Rabbit manure (2.466% N) about 15.2 kg/tree.

2- Method of organic manure application

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

a- **Surface application:** Well decomposed organic manure of the three studied sources were applied superficial and digged in the soil during deep hand hoeing practice (about 20 cm depth) 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 rabbit) was divided equally and applied in the two trenches and covered with trench soil.

3- Biofertilization (N-fixing bacteria)

The remaining N-requirement for each tree was assumed to be partially satisfied through using N-fixing fertilizers. In the first week of March of each season, navel orange trees were inoculated with Nitrobien (50 g/tree) or Rhizobacterien (100 g/tree). The biofertilizers were applied in trenches (40 cm

length x 20 cm width x 20 cm depth). Irrigation was conducted after biofertilizers application.

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:-

1. Tree growth

Under the experiment conditions (Kalubia Governorate), Washington navel orange 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 rabbit. 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 rabbit 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 the positive effect of organic manure in this concern.

On the other hand, Washington navel 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 rabbit. The enhancing effect of organic manure was increased when the organic manure was applied in trenches and provided with Rhizobacterien.

2. Leaf mineral content

Fertilizing Washington navel orange trees with poultry manure enhanced leaf N, K, Ca, Mg, Fe, Zn and Mn content. On the contrary, cattle manure induced the lowest positive effect in this sphere. Besides, rabbit manured trees gave intermediate values of the previously mentioned leaf mineral content. Anyhow, organic manure source, method of application and biofertilizers as well as their interactions 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.

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, rabbit 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.

4. Fruit quality

Poultry manure surpassed cattle manure in enhancing fruit quality whether the fruit physical properties *i.e.* fruit weight, and juice weight) or fruit chemical properties *i.e.* total soluble solids percentage, TSS/acid and ascorbic acid. Besides, rabbit manured trees gave intermediate values of the studied fruit parameters. The stimulative effect of organic manure was enhanced with trench application and Rhizobacterien inoculation. Moreover, the three studied factors failed to induce any 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 Washington navel orange in the form of organic manure in particular poultry manure or rabbit and cattle applied in trenches and supporting with Rhizobacterien.