SUMMARY

This study was carried out to study the morphological, hormonal and metabolic changes occurring during the different stages of growth and development of *Ficus carica* tree and fruit and to relate the growth and development to these changes. Ten trees nearly similar in size, vigor and cropping were chosen from an open field at El-Safa village, Toukh city, Qalubiya Governorate. Plant samples ere collected during the growing season 2001from April till November. The studied variety was Sultani variety which is a local variety of unknown origin, thought to be grown in Egypt since long time. It belongs to the common type in which the varieties are completely parthenocarpic. This variety produces two crops of fruits annually. Fruits of the first crop are born on shoots of previous season's growth on the second half of May and ripened on the second half of August. Fruits of the second crop are produced on shoots of the current season's growth on the first half of September and ripened on the end of October.

The present investigation includes two experiments; the first experiment concerned with the morphological, hormonal and metabolic changes accompanied the growth and development of *Ficus carica* tree (shoots and leaves) as well as the physical and chemical properties of the soil in which the experimental plant was grown. The second experiment concerned with the morphological, hormonal and metabolic changes accompanied the growth and development of *Ficus carica* fruit.

For determination of the hormonal and metabolic changes accompanying the growth and development of fig tree and fruit the collected samples are classified as follows;

a- The buds, shoots and leaves samples are classified into the stages namely bud emergence (1 days old shoot), leaf appearance (16 days old shoot), fruit set (46 days old shoot), fruit maturity (136 days old shoot) and senescence (226 days old shoot) stages.

b- The first crop fruits were classified into five groups namely stages A, B, C ,D and E (full mature) on the basis of fruit age. These stages represented 18, 36, 54, 72 and 90 days old fruits.

The obtained results can be summarized in the following:

1-The tree is medium sized deciduous tree (shrub) with light brownish gray bark. The branches tend to spread laterally and are characterized by their tendency to grow widely. The tree height is 2.24m.

2- The main stem height is 85cm, with diameter of 13 cm. Branching started at height of 48 cm above the ground surface. The main stem branched into 4 main branches which divided into 9 secondary branches. The later divided into 21 shoots.

3-The vegetative growth started on the first of April, the leafing-out started on the second half of April, the fruit setting occurred in the second half of May and the defoliation began on the second half of November.

4- The growth of *Ficus carica* tree followed the simple sigmoid growth curve where the growth took place in two slow phases interrupted by a rapid one. The active vegetative growth and fruitting were followed by a temporary dormancy (senescence) period which occurs at the end of summer and lasts till early autumn, followed by a permanent quiescent period during winter (abscission stage).

5- The shoot length and diameter increased gradually through the first stages of the growing season, then the growth became vigor at the fruit maturity stage after that the increase became gradual again.

6- The shoot dry matter generally increased through the growing season, while the moisture content showed a reverse trend.

7- The buds, fruits and leaves numbers increased directly with progress in the growth season till mid October. After that and by the onset of the senescence stage on the second half of November, the buds and leaves numbers decreased as some buds became dormant and the leaf abscission occurred while all the fruits were picked up.

8- *Ficus carica* leaves are large in size, long petioled, ovate shaped, entire to three lobed, with obtuse apex, wavy margins, cordate base and palmate ; vines.The upper surface is smooth and dark green while the lower surface is rough, light green with dense hairs. The leaves show some variations in the leaf form.

9- The leaf area per shoot increased gradually through the first month of the growth period then increased in a violent way till reaching a peak at mid October after that the leaf area decreased at the senescence stage.

10- The dry matter increased gradually through the different stages of leaf development reaching a peak at mid October after that the dry matter decreased at the senescence stage.The moisture content exhibited a reverse trend to that of the dry matter.

11- There are slight variations in fruit shape between fruits of the two crops. The fruits of the first crop were round shaped in the later stages of fruit life while those of the second crop were oblate shaped at the same stages.

12- Sultani fruits showed various stages of green color until the middle stage (54 and 30 days old fruit for the first and the second crops). The final color reached by Sultani fruits is dark red with brown purple shades. Coloration always begins from around the ostiole at the apex to the base.

13- Fruits of Sultani variety in their increase in fresh weight and volume, 'followed double sigmoid growth curve in both crops where the growth took place in two rapid phases interrupted by a slow one. The fruits of the second crop were less in volume and fresh weight than fruits of the first crop.

14- Fruits of Sultani variety showed relatively higher values of specific 'gravity at the end of fruit life. Fruits of the second crop possess relatively less values of specific gravity especially at the last stages of fruit life.

15- The fruit dry matter increased with the fruit age at the early stages then decreased at stage 13 for both crops and increased again at the end of the fruit life.

16- The first crop of Sultani showed lower moisture content at the last stage of fruit life, while fruits of the second crop showed relatively higher moisture content at the end of fruit life.

17- The endogenous auxins in the alcoholic extracts increased markedly from the early stage of buds development, reached their peak levels at fruit maturity stage (136 days old shoot) then decreased sharply by the onset of the senescence stage (226 days old shoot). On the other hand the maximum level of auxins in was found at the early stage of fruit life (18 days after fruit set) then the hormone level decreased sharply through the next stages after that it increased suddenly again in full mature fruit (90 days after fruit set).

18- The development of fig buds is accompanied with a remarkable decrease in the levels of the endogenous gibberellins at the early stages of development, followed by a sharp increase reaching a maximum level at fruit set stage (46 days old shoot) then decreased sharply to a minimum level at the fruit maturity stage (226 days old shoot). After that it increased again at the senescence stage.

The gibberellin content in fig fruit increased at the early stages reaching a peak at the stage B (36 days old) followed by a continuous decreases till a minimum level at the fully mature stage.

19- The abscisic acid content in buds increased towards the fruit maturity stage (136 days old shoot) reaching a maximum level then decreased sharply at the senescence stage. While the abscisic acid increased sharply at the early stages of fruit life then decreased at the middle stage and increased again reaching a maximum level at the full mature fruit (90 days old).

20- The total chlorophylls (a + b) comprised the main bulk of total pigments through all stages of leaf development.Total chlorophylls contents, increased through the different stages of development reached a peak level at fruit maturity stage then decreased at the senescence stage.

21- The percentage of carotenoids content increased gradually from the early stage of leaf development to a maximum level at the fruit set stage then decreased attaining a minimum level at the fruit maturity stage then increased again at the senescence stage

22- The shoot reducing sugars increased markedly by fruit setting reaching a maximum level then decreased sharply at the fruit maturity stage and continued its decline towards the senescence.

The reducing sugar in leaf was maximum value at the leaf appearance stage then the sugar content decreased by fruit setting. Although this decline was reversed and the sugar content increased at the fruit maturity. After that the sugar content decreased suddenly to a minimum level by the onset of the senescence stage (first dormancy).

The fruit content of reducing sugars was greater than the sucrose content through the last stages only. The ripening of fig fruit was accompanied by an increase in the level of reducing sugars content where they made up less than 20% of the total sugar content at early stages and increased rapidly to make up 75% of the sugar at the full mature fruit.

23- The shoot sucrose content attained maximum level at bud emergence stage then decreased by the leaf appearance till reaching a minimum level on the fruit maturity after that the sucrose level increased at senescence stage.

The leaf sucrose content attained the minimum level at the leaf appearance stage then it increased attaining a maximum level at the fruit maturity stage after that the sugar level dropped of sharply at the senescence stage.

The fruit sucrose content decreased at the early stages of fruit development then increased attaining a maximum levels at stage C (54 days old) then decreased to a minimum level at stage E.

24- The polysaccharide content of shoots decreased sharply towards the fruit set stage and increased again at fruit maturity stage, after that the polysaccharide content decreased to a minimum amount by the onset of the senescence stage.

The polysaccharide content increased with the age of the leaf where it attained the minimum level in the juvenile leaf and the maximum level in the senescent leaf.

In fruit the polysaccharides content increased through the early stages, then decreased at the later stages of fruit development attaining a minimum level at the full mature fruit.

25- The total sugars in shoot increased attaining maximum value towards the fruit set stage then decreased till a minimum level at the senescence stage. While the total sugars content in leaves decreased by the fruit setting, followed by a sharp increaseto a maximum level at the fruit maturity stage after that the level decreased sharply at the senescence stage.

The fruit total sugar contents increased continuously through the different stages of fruit development reaching a maximum level at the full mature fruit.

26- The amino nitrogen content of the shoot increased to a maximum by leaf appearance then decreased towards the fruit maturity stage then increased slightly at the senescence stage.

In leaves the amino- N cotent achieved maximum levels at the leaf appearance stage then decreased sharply towards the senescence stage.

The amino- N fruit achieved maximum levels at the early stage then decreased towards the end of fruit life.

27- The total soluble nitrogen content in shoot increased at the leaf appearance stage then decreased continuously towards the senescence.

The total soluble nitrogen content in leaf decreased continuously towards the senescence while in the fruit the total soluble nitrogen

decreased at the early stages of fruit development then increased at the latest stages achieving a maximum level at the full mature fruit.

28- The protein-N in shoots and leaves showed the same trend as the total soluble nitrogen. while in fruit the protein-N increased at the *early* stages then decreased till attaining a minimum levels at the fully mature fruit.

29-The electrophoretic analysis of the leaf proteins revealed Proteins with molecular weights of 58.85 and 13.18 showed more stability during the different stages of leaf development, indicating that these two proteins were acting as the characteristic proteins of fig leaves.

30- The amount of total-N in shoot and leaf exhibited the same trend as the total soluble nitrogen and protein N. The amount of total-N in fruit decreased with fruit age till attain minimum level at stage D (72 days old fruit) then increased at the end of the fruit life.

31- The shoot Ca content increased at the early stages then decreased towards the fruit maturity stage and increased again at the senescence stage.

While the leaf Ca decreased through the different stages of development except the senescence stage at which the Ca content increased suddenly to a maximum level.

The Ca concentration markedly increased through the different stages of fruit development but it decreased at the stage E (full mature fruit).

32- Potassium represented the major mineral nutrient in fig shoot, leaf and fruit. The shoot K- content increased by the setting of fruits to a maximum value then declined sharply by the ripening of fruits and attained the minimum concentration at the senescence stage.

With respect to the leaf K- concentration it was found that the leaf K concentration declined as the season progresses. This decline continued till the final harvest. However the leaf K- concentration increased again' by the onset of the senescence stage.

The fruit K content decreased at the early stages of fruit development then increased sharply at the middle stage then decreased again towards the end of the fruit life.

33- The shoot Na and Mg concentrations increased at the early stages then decreased as the season progresses till the final harvest. After that the concentration of the two minerals increased at senescence stage.

The leaf Na and Mg concentrations decreased as the season progresses till the final harvest. After that the concentration of the two minerals increased at senescence stage.

The fruit Na concentration decreased through the early stages of development, then increased through the next stages. The concentration decreased again at the full mature fruit. While the fruit Mg concentrations increased through the all stages but decreased at the full mature fruit.

34- With respect to the shoot P content, it increased through the different stages of development except the fruit maturity at which the P content dropped off then it increased again at the senescence stage.

The leaf P content, on the other hand, generally increased with the increase in leaf age except the fruit set stage at which the P content dropped off to a minimum level.

The fruit P content decreased through the early stages then increased sharply at the middle stage after that decreased again towards the full mature fruit.

35- The Fe concentration in the shoot tissues increased at the early stages then decreased towards the fruit maturity stage, then increased at the senescence stage.

While the leaf Fe concentration decreased at the fruit set stage then increased towards the senescence stages.

The fruit Fe concentration decreased through the early stages then increased at the middle stage then decreased again at stage *D* then increased to a maximum concentration at the full mature fruit.

36- The shoot Mn decreased at the early stages then increased as the season progresses attaining maximum level at the senescence stage.

The leaf Mn attaining the maximum amount at the leaf appearance stage after that the concentration decreased at the next stages then increased again at the senescence stage.

For the fruit Mn, it generally increased through the different stages of fruit development, except the stage D.

37- The shoot Zn content in tissues increased as the seasons progresses except the fruit maturity stage at which the minimum Zn content occurred.

The leaf Zn content decreased at the early stages then increased towards the senescence stage at which the maximum level occurred.

The Zn content of fruit generally increased with the fruit age except the stage D at which the concentration dropped off to a minimum level.

38- With respect to the Cu content it represents the lowest constituent of the mineral content. The shoot Cu content decreased at the early stages then increased sharply by fruit setting then decreased again at fruit maturity. After that the concentration increased at the senescence stage.

On the other hand the leaf Cu content decreased by the fruit setting and become unchanged at fruit maturity and then increased to maximum level at the senescence stage.

The fruit Cu content increased through the early stages of development then decreased at the next stages and finally increased again to maximum value at the full mature stage

39- The granuleometric analysis of the soil samples indicated that the silt fraction was the predominate in the soil sample while the clay fraction was the second component, the soil is silty clay.

40- The hydrogen ion concentration and electric conductivity increased in the bottom layer than the surface layer.

41- The chemical analysis of the soil sample indicates that the soil contain no carbonates while the bicarbonates chlorides and sulphates increased with the soil depth, also the cations content (Ca, Mg, Na and K) increased in the lower depths.