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V. SUMMARY AND CONCLUSION

The present study was undertaken during the two successive 1989-1990 and 1990-1991 seasons at El-Kanater El-Khairia Horticultural Research Station Farm, Galyubia Governorate. Four fruit species namely Washington Navel orange, Selected Malawi mandarin and Selected Sabahia guava (as evergreen fruit species) and Hollywood plum (as a deciduous fruit species) were selected for this study. Washington Navel orange and Selected Malawi mandarin trees were budded on sour orange rootstock, while, Selected Sabahia guava trees were grown on seedling guava rootstocks, besides, Hollywood plum trees were budded on Mariana rootstock. The selected trees (15 for each species) were healthy, nearly uniform in growth vigour, grown at 5 x 5 m. apart on a clay loamy soil and received regularly the same cultural practices.

This study aimed to throw some lights on the following aspects :

1. Vegetative growth characteristics.
2. Seasonal changes of leaf dry matter and mineral content.
3. Back translocation of leaf dry matter and nutrients.
4. Flower bud induction and differentiation.

V.1. Vegetative growth characteristics:

V.1.1. Growth cycles duration:

V.1.1.1. Washington Navel orange:

The growth of Washington Navel orange occurred in three distinctive and consecutive cycles i.e. one in spring, started on March, 2nd & February, 28th and continued till May, 14th & 7th in the 1st and 2nd seasons, respectively (about 74 & 69 days duration). The second growth cycle took place in summer, peeped out onMay, 31th & June, 4th and ceased on July, 27th & 25th (with 58 & 52 days duration) in the first and second seasons, respectively.Besides, the third growth cycle occurred in autumn, began on August, 4th & 9th and ceased onOctober, 10th & 17th (with 68 and 70 days duration) in the 1989 and 1990 seasons, respectrively.

Consequently, the annual growth cycle of Washington Navel orange was 200 and 191 days in the first and second seasons, respectively.

V.1.1.2. Selected Malawi mandarin:

The growth of Selected Malawi mandarin took place in three distinctive and consecutive cycles i.e. one in spring, peeped out on February, 22th & 18th and continued till April 27th & 29th (with about 66-71 days duration) in the first and second seasons, respectively. The second cycle of trees took

place in summer was observed on May, 23th & 29th and ceased on July, 17th & 21th (about 56 and 55 days duration) in the 1989 and 1990 seasons, respectively. The growth of third cycle occurred in autumn, started on July, 25th & August 1st and ceased on September 21th and October, 3rd (59 and 64 days duration) in the first and second seasons, respectively.

Furthermore, the annual growth cycle of Selected Malawi mandarin was 181 and 190 days in the 1st and 2nd seasons, respectively.

V.1.1.3. Selected Sabahia guava:

The growth of Selected Sabahia guava trees produced two growth cycles during the growing season i.e. one in spring started on March, 22nd & 27th and continued till May, 22th and 21th (61 and 57 days duration) in the first and second seasons, respectively. The second growth cycle took place in summer, appeared on June, 4th and 13th and ceased on July 24th and 31th (with about 51 and 59 days duration) in the 1989 and 1990 seasons, respectively.

V.1.1.4. Hollywood plum:

The growth cycle of Hollywood plum trees took place once throughout the growing season i.e. spring growth cycle started on February, 24th & March, 7th and continued until

April 22th & May 6th (with about 58 and 61 days duration) in the first and second seasons, respectively.

V.1.2. Growth intensity (No. of shoots/branch):

V.1.2.1. Washington Navel orange:

The trees produced the highest number of current season's growth of spring cycle on April, 21th & 18th in 1989 and 1990 seasons, respectively. Besides, the highest growth intensity of summer cycle occurred on July, 5th & 9th in the first and second seasons, respectively.

V.1.2.2. Selected Malawi mandarin:

The growth intensity of spring cycle reached the maximum on April, 14th & 10th in the 1st and 2nd seasons, respectively. Moreover, the highest number of shoots per branch produced in summer cycle was noticed on June, 27th & July, 3rd 1989 and 1990 seasons, respectively.

V.1.2.3. Selected Sabahia guava:

Growth intensity of spring cycle reached the highest value on May, 10th & May, 14th in 1989 and 1990 seasons, respectively. Moreover, the highest number of shoots per branch produced in summer cycle was realized on July, 10th & July, 19th in the first and second seasons, respectively.

V.1.2.4. Hollywood plum:

The maximum growth intensity was observed on April, 14th & April, 25th in the first and second seasons, respectively.

V.1.3. Shoot length:

V.1.3.1. Washington Navel orange:

Shoots produced in spring cycle reached to the maximum length on April, 28th and April, 25th in the first and second seasons, respectively. While, shoots produced in summer cycle reached to the maximum length on July, 5th & 9th in 1989 and 1990 seasons, respectively.

V.1.3.2. Selected Malawi mandarin:

Shoot length of spring cycle reached the highest value on April, 21th and April, 17th in the first and second seasons, respectively. Besides, shoots of summer cycle reached the maximum length on June, 27th and July, 3rd in 1989 and 1990 seasons, respectively.

V.1.3.3. Selected Sabahia guava:

The shoots produced in spring cycle reached to the full length onb May, 17th & 21th in 1989 and 1990 seasons, respectively. Moreover, the maximum length of summer cycle was noticed on July, 10th and July, 19th in the first and second seasons, respectively.

V.1.3.4. Hollywood plum:

The shoots reached to the full length on April, 14th and April, 25th in 1989 and 1990 seasons, respectively.

V.1.4. Number of leaves per shoot:

V.1.4.1. Washington Navel orange:

The highest number of leaves per shoot produced in spring cycle was realized on April, 28th & 25th in 1989 and 1990 seasons, respectively. Besides, number of leaves per shoots of summer cycle reached to the maximum on July, 5th & 9th in the first and second seasons, respectively.

V.1.4.2. Selected Malawi mandarin:

Spring cycle shoots produced the maximum number of leaves on April, 14th & 17th in 1989 and 1990 seasons, respectively. Moreover, the highest number of leaves per shoots produced in summer cycle was observed on June, 27th and July, 3rd in the first and second seasons, respectively.

V.1.4.3. Selected Sabahia guava:

Shoots of spring cycle produced the highest number of leaves on May, 10th and May, 21th in 1989 and 1990 seasons, respectively. On the other hand, shoots of summer cycle gave the highest number of leaves on July, 10th & 19th in the first and second seasons, respectively.

V.1.4.4. Hollywood plum:

The highest number of leaves per shoot was produced on April, 14th and May, 2nd in 1989 and 1990 seasons, respectively.

V.1.5. Leaf dimensions (length & width):

V.1.5.1. Washington Navel orange:

The leaf of spring cycle reached to the maximum length and width on April, 28th and 18th in 1989 and 1990 seasons, respectively. Besides, the highest leaf length and width of summer cycle was observed on July, 5th and 9th in the first and second seasons, respectively.

V.1.5.2. Selected Malawi mandarin:

The leaf length and width of spring cycle reached the highest values on April, 21th and April, 17th in the first and second seasons, respectively. Moreover, leaves produced in summer cycle reached to full length and width on June, 27th and July, 3rd in 1989 and 1990 seasons, respectively.

V.1.5.3. Selected Sabahia guava:

Leaf dimensions of spring cycle reached to the maximum on May, 10th and May, 21th in the 1st and 2nd seasons, respectively. In addition, leaves of summer cycle reached the highest dimensions (length and width) on July, 10th 1989 and

on July, 19th 1990.

V.1.5.4. Hollywood plum:

The developed leaves reached to full length and width on April, 14th and May, 2nd in the first and second seasons, respectively.

V.1.6. Leaf shape index (L/W):

V.1.6.1. Washington Navel orange:

On April, 21th, 1989 and April, 11th, 1990 leaf length of spring cycle was about twice and one third as that of the width. Besides, leaf length of summer cycle was about twice and half as that of the width.

V.1.6.2. Selected Malawi mandarin:

The length of the leaves produced in spring and summer cycles were nearly twice as that of the width.

V.1.6.3. Selected Sabahia guava :

Leaf shape index of spring and summer cycles showed fluctuated values in both seasons.

V.1.6.4. Hollywood plum:

The leaf length was about one and half as that of the width in both seasons.

V.1.7. Leaf area:

V.1.7.1. Washington Navel orange:

Leaves produced in spring cycle reached to their full area on April, 28th and 25th in the first and second seasons, respectively. Moreover, leaves of summer cycle reached the highest leaf area on July, 5th & 9th in 1989 and 1990 seasons, respectively.

V.1.7.2. Selected Malawi mandarin:

The leaf area of spring cycle reached the highest value on April, 21th & 17th in 1989 and 1990 seasons respectively. Besides, the leaves produced in summer cycle reached to the full exponsion on June, 27th 1989 and July, 3rd 1990.

V.1.7.3. Selected Sabahia guava:

Leaves produced during spring cycle reached to the maximum size on May, 17th & 21th in the first and second seasons, respectively. In addition, leaves of summer cycle reached to full size on July, 10th and 19th in 1989 and 1990 seasons, respectively.

V.1.7.4. Hollywood plum:

The new developed leaves reached their maximum surface area on April, 14th and April, 25th in 1989 and 1990 seasons, respectively.

V.2. Seasonal changes of leaf dry weight and mineral contents

V.2.1. Seasonal changes of leaf dry weight:

V.2.1.1. Washington Navel orange:

Leaf dry weight expressed as mg/leaf or as percentage increased steadily starting July (the lowest value) reached the peak on January or February.

V.2.1.2. Selected Malawi mandarin:

Leaf dry weight as mg/leaf or as percentage increased gradually from July till it reached the maximum on February.

V.2.1.3. Selected Sabahia guava:

Leaf dry weight (mg. per leaf or as percentage) increased sharply starting from July and reach the peak on November and remained constant during December and January.

V.2.1.4. Hollywood plum:

Leaf dry weight as mg. per leaf reached the highest value in mid-August or September. Meanwhile, when leaf dry weight was expressed as a percentage, mid-July, and mid-October were the months, at which leaf dry matter reached the peak.

V.2.2. Seasonal changes in leaf mineral contents:

V.2.2.1. Seasonal changes of leaf nitrogen content:

V.2.2.1.1. Washington Navel orange:

Leaf nitrogen content expressed as a percentage or as mg. per leaf reached to the peak on November then decreased gradually till recorded the lowest value on March.

V.2.2.1.2. Selected Malawimandarin:

Leaf nitrogen content as mg/leaf reached to the maximum on February. On the other hand, leaf nitrogen content as a percentage showed a fluctuated trend throughout the season.

V.2.2.1.3. Selected Sabahia guava:

December, January, and February were the months at which leaf nitrogen content (mg./leaf) reached to the maximum values whereas October was the month, at which leaf nitrogen content as a percentage recorded the highest value.

V.2.2.1.4. Hollywood plum:

Leaf nitrogen content (mg. per leaf or a percentage) increased gradually starting from May and reached the peak on August and September.

V.2.3. Seasonal changes of leaf phosphorus content:

V.2.3.1. Washington Navel orange:

Leaf phosphorus content (mg./leaf or a percentage) recorded the highest value on November and decreased slightly

during December till February.

V.2.3.2. Selected Malawi mandarin:

The maximum value of leaf phosphorus content, (mg/leaf or a percentage) was observed during November up to February.

V.2.3.3. Selected Sabahia guava:

A gradual increase in leaf phosphorus content (mg/leaf or a percentage) was detected during July up to November.

V.2.3.4. Hollywood plum:

Leaf phosphorus content when expressed as a percentage showed high value on September, October and/or November. Meanwhile, when it was expressed as mg/leaf, it recorded the highest value on May, June, July and August.

V.2.4. Seasonal changes of leaf potassium content:

V.2.4.1. Washington Navel orange:

Leaves of Washington Navel orange had the highest content of potassium (mg/leaf or a percentage) during January and February. Besides, leaf potasium content showed fluctuated values during the rest months.

V.2.4.2. Selected Malawi mandarin:

Leaf potassium content of Selected Malawi mandarin

showed nearly the same trend to that of Washington Navel orange.

V.2.4.3. Selected Sabahia guava:

The maximum value of leaf potassium content as a percentage was observed during the January and February. On the other hand, leaf potassium content as mg/leaf did not showed a definite trend.

V.2.4.4. Hollywood plum:

The highest value of leaf potassium content expressed as a percentage as mg/leaf was detected during September up to October.

V.3. Back translocation of nutrients:

1. Just prior to leaf abscission, the rate of nutrient back translocation to the tree was affected by the species, nutrient element itself, leaf age and the time at which leaf abscised.

2. Dry matter, nitrogen, phosphorus and potassium were always lower in the fallen leaves than the corresponding ones of the intact leaves in all studied species.

3. Concerning Washington Navel orange trees (17.24% &

21.35%) of leaf dry matter, (36.53% & 38.09%) of leaf nitrogen content, (37.92% & 43.14%) of leaf phosphorus content and (31.15% & 35.40%) of leaf potassium content (as mg. per leaf), were backly translocated to the tree just before leaf abscission in 1989-1990 and 1990-1991 seasons respectively.

4. Regarding the Selected Malawi mandarin (18.88% & 19.59%) of leaf dry matter, (21.78% & 24.40%) of leaf nitrogen content, (36.80% & 39.25%) of leaf phosphorus content and (31.15% & 35.40%) of leaf potassium content were backly migrated the tree just prior to leaf abscission in the first and second seasons, respectively.

5. As for guava trees (31.93% & 30.10%) of leaf dry matter, (51.94% & 48.42%) of leaf nitrogen content, (50.35% & 52.06%) of leaf phosphorus content and (43.96% & 42.50%) of leaf potassium content were backly translocated to the tree just prior to lelaf abscission in 1989-1990 and 1990-1991 seasons, respectively.

6. Referring to Hollywood plum trees (7.37% & 9.92%) of leaf dry matter, (20.23% & 22.78%) of leaf nitrogen content, (20.20% & 22.71%) of leaf phosphorus content and (21.87% & 20.00%) of leaf potassium content (as mg./leaf) were backly

migrated to the tree just before abscission in the first and second seasons, respectively.

V.4. Flower bud induction:

1. As for Washington Navel orange trees, flower bud induction starting early in the season, since, about 12.18% (as average of two seasons) of floral bud induction took place in the first half of November and the percentage of inducted buds reached about (72.67%) on January, 29th, meanwhile, the remaining buds presumably inducted during February up to early March.

2. With respect to Selected Malawi mandarin also, flower bud induction took place early in the season, hence 8.75% (an average of the two seasons) of floral induction had occurred prior to November, 20th. However, the percentage of inducted flower buds was greatly increased till reached 54.20% on early February. The rest buds (45.80%) accomplished their induction during February and early March.

3. Considering guava trees, flower bud induction started before November, 18th with rather negligeable percentage being about 4.12% only. By the beginning of February about (61.58%) of the buds had inducted, meanwhile, rest buds (38.42%) inducted thereafter.

4. Regarding Hollywood plum trees, floral induction started very early in the season, where about 31.01% (as average of the two seasons) of the floral induction had occurred prior to June, 20th. By the beginning of September about (69.71%) of the floral buds was inducted, whereas the remainning buds (30.23%) were inducted afterwards.

5. Generally, it could be safly concluded that shoot contents of both total carbohydrates and nitrogen as well as C/N ratio all were gradually increased by advancement of sampling throughout duration of floral bud induction for all studied fruit species. However, various fruit species were slightly differed as each reflected its own characteristic on either rate or continuence of such increase. On the other hand, both total carbohydrates and nitrogen percentages in shoots of different fruit species showed a variable degrees of response with aging, since the increase rate in total carbohydrates was rather high than in nitrogen % and consequently this was certainly reflected is an increase in C/N ratio.

From the previous results, one can conclude that flower bud induction, in all investigated trees of the different species was highly correlated with the nutritional status of tree. As tree carbohydrates, nitrogen increased as flower bud

induction increased.

Under the conditions of Qalyubia Governorate, November, December, January and February were the most important months for flower bud life of evergreen fruit species. Where, the flower bud induction occurred during that period. On the other hand, May, June, July, and August months playan important role in flower bud development in Hollywood plum, since, the flower bud induction took place during the previously mentioned months.

The generative process of Selected Malawi mandarin buds passes through ten stages the first sign of floral differentiation is considered to be the elongation of the axillary growing points which have the dome like shape (1) flattening of the apex (2), sepals primordia and petal initials start to differentiate within sepal primordia (3), appearance of stimens and pistels initial (4), appearance of avarian cavity and bending of the devolping ovules (5), pollen mother cells (6), microspore tetrad (7), mature pollen grains within the anther locules (8), appearance of completely differentiated anatriopus ovules (9) and appearance of embryo sacs (10).

Further more, the course of flower bud initiation and differentiation if Hollywood plum passed through nine distinct stages started with ; dome shaped apex (I), flattening shape (II), sepals and petals primordia (III), stamens primordia (IV), pistels primordia (V), elongation of pistils primordia (VI), appearance of the archesporial cells and ovarian cavity (VII), appearance of mother cells (VIII) and anatropus ovules are distinct inside the ovarian cave.