A. SUMMARY AND CONCLUSION

The present study was conducted during the two experimental 1997-98 and 1998-99 seasons on fruitful mango trees of three mango cultivars namely; Taimour, Zebda and Hindi Be-Sinnara grown in the Experimental Farm of Horticultural Research Station at El Kheiria Barrage region; Kalubia Governorate.

Because of the great reduction in return of most mango orchards due to non identified means/reasons, therefore this work aimed to face such problem through attempts of evaluating the differential investigated treatments within the two main fields of study included in this investigation. Since, it was hoped to investigate the response of some related factors determining the mango tree productivity i.e, their growth; flowering measurements and nutritional status to the pre-bloom girdling and growth regulators spray viz \( \text{PP}_{333}, \ NAA \text{ and } \text{GA}_3 \) (the 1St field of study). Moreover, it was also aimed to throw some lights on the relationship between the malformation disorder and the comparative level of some endogenous growth substances and other components in different plant organs of the three mango cultivars under study, as well as studying the possibility of minimizing or overcomming such phenomenon through applying the previously mentioned pre-bloom treatments (the 2 r-lci field of study).

Field experimental layout:

In this study, pre-bloom application of late autumn girdling combined with winter spray of three growth regulators (\( \text{PP}_{333} ; \ NAA \text{ and } \text{GA}_3 \)) each at 3 concentrations, beside water spray as control were investigated during both 1997-98 and 1998-99 seasons on the three mango cultivars. Hence, the following 10 foliar sprays treatments were evaluated on either girdled or ungirdled limbs:
1- Water spray (control); 2- PP333 at 500 ppm; 3- PP333 at 1000 ppm; 4- PP333 at 2000 ppm; 5- NAA at 100 ppm; 6- NM at 200 ppm; 7- NAA at 400 ppm; 8- GA$_3$ at 50 ppm; 9- GA$_3$ at 100 ppm and 10- GA$_3$ at 200 ppm.

For arranging the aforesaid 10 spray treatments combined with either girdling or no-girdling application, the complete randomized block design with three replications was employed, whereas each replicate was represented by a single tree. Accordingly; 30 trees were needed for each cultivar. During each season, the required trees were carefully selected in October as being healthy; uniform in vigour and in the expected on—year state in next spring. Four main branches ( limbs ) were carefully selected and tagged on every tree, then two of them were girdled in mid November, while two other ones were left sound with no girdling. Moreover, on each tagged limb 25-30 mature shoots "spring sprouted "were labelled. Growth regulators treatments were applied twice i.e on 15 $n$ of both November and January during each season. Thus, data were recorded as follows:

**V.I. Part one (first field of study):**

Response of growth, flowering measurements and nutritional status of mango trees to girdling and growth regulators application.

**V.I.1. Terminal buds behaviour "sprouting nature "of mature shoots (spring flushed ones):**

The behaviour " sprouting nature " of the terminal buds of the mature labelled shoots " spring flushed " in response to girdling and various spray treatments were evaluated during following spring. Whereas number of each case i.e, a) differentiated into panicles (floral buds); b) vegetatively sprouted (leaf buds) and c) arrested buds (remained dormant) were counted when emergence of new inflorescences was nearly ceased in spring. Then percentage of each case
(dormant, leaf and floral buds) were estimated on the base of the total number of labelled shoots per each limb.

**V.I.2. Vegetative growth measurements:**

In this regard, average length of both normal and malformed newly flushed shoots during following spring in response to the different combinations of autumn girdling and winter PP<sub>333</sub>, NAA and GA<sub>3</sub> sprays was determined in late October during each experimental season.

**V.I.3. Floral measurements " panicle characteristics ":**

The whole inflorescence length, number and average length of main branches (strands) per three panicle’s portions (basal; middle and terminal thirds); number of either total or perfect flowers as well as sex expression

\[
\text{No. of perfect flowers} \times \frac{100}{\text{Total No. of flowers}}
\]

per each panicle portion, beside sex expression% of the whole inflorescence were the investigated floral measurements, regarding their response to the different 10<sup>P</sup>P<sub>333</sub>, NAA and GA<sub>3</sub> spray treatments only during 2<sup>nd</sup> season.

**V.I.4. Nutritional status:**

Leaf mineral composition (N, P, K, Ca, Mg, Fe, Mn and Zn); free amino acids content in both leaves and terminal buds, as well as mature shoots total carbohydrates content were the three investigated nutritional status measurements for the three mango cultivars under study regarding their response to autumn girdling; winter spray with the differential 10<sup>P</sup>P<sub>333</sub>, NAA and GA<sub>3</sub> solutions and their combinations during both experimental 1997—98 and 1998—99 seasons. Whereas, the plant materials needed were periodically sampled (3 times during each season) starting one, three and four month/s after girdling application and V spray had been done i.e., in mid of December; February and March for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> samples, respectively.
V.II. Part two (second field of study):

This division was dealing with investigating the response of both vegetative and floral malformation types in the 3 mango cultivars to the exogenous sprays of the same 10 GA₃, NAA and PP₃₃₃ treatments combined with girdling application as previously mentioned in the former field of study.

In addition, the relationship between some endogenous growth substances (GA₃, IAA, ABA, syringic and tannic acids); indoles and phenols contents in 3 mango cultivars (Taimour, Zebda and Hindi Be-Sinnara) and their susceptibility to malformation from one hand and changes in levels of these components as affected by the PP₃₃₃, NAA and GA₃ spray from the other side were concerned.

V.II.1. Effect of girdling; PP₃₃₃; NAA and GA₃ spray on mango malformation:

The percentage of both vegetative and floral malformation observed on newly spring flushed shoots and panicles in 3 mango cultivars as affected by pre-bloom application of PP₃₃₃, NAA and GA₃ in combination with autumn girdling were investigated during both 1997-98 and 1998-99 seasons.

V.II.2. Mango malformation as related to the endogenous level of some growth substances and other chemical components:

V.II.2.A. Endogenous growth substances level in floral organs (buds/panicles) as affected by PP₃₃₃; NAA and GA₃ application:

GA₃, IAA, ABA, syringic and tannic acids contents in floral buds and panicles sampled at four definite stages of their development (fully swollen bud,
panicle inception, full expanded strands/flowering branches and full bloom stages) as influenced by the exogenous $PP_{333}$, NAA and $GA_3$ applied in mid Nov. & Jan. at 1000, 200 and 100 ppm, respectively were investigated during 2r\textsuperscript{nd} season only for the 3 mango cultivars (Taimour, Zebda and Hindi Be-Sinnara).

V.II.2.B. Pre-sprouting changes in indoles and phenols compounds in different vegetative organs as affected by girdling and $PP_{333}$, NAA and $GA_3$ sprays:

Total indoles and phenols compounds in terminal buds, leaves and stems of the mature spring flushed shoots periodically sampled pre vegetative sprouting i.e, mid of December, February and March were investigated regarding their response to the autumn / winter girdling and $PP_{333}$; NAA and $GA_3$ application during both 1997-98 and 1998-99 seasons.

Data obtained during both seasons could be summarized as follows:

V.I. Part one (1St field of study):

In this concern some measurements of growth, flowering and nutritional status in response to girdling and $PP_{333}$, NAA and $GA_3$ sprays were studied as follows:

V.I.1. Terminal buds behaviour:

A-Specific effect:

Data obtained revealed that sprouting nature of terminal buds responded significantly to specific effect of the 3 investigated factors (girdling, sprayed solutions and growth substances applied). Since, girdling increased flower buds % on the account of both dormant buds % (in all cultivars) and vegetative buds % (in Taimour and Hindi Be-Sinnara only).
Concerning the specific effect of the 3 investigated growth regulators, obtained data revealed that all i.e. PP333; NAA and GA₃ decreased dormant buds % in all cultivars except GA₃ with Zebda cv. Moreover, both PP333 and NAA increased percentage of floral buds %, while GA₃ decreased it than control. In addition, vegetative buds % did not follow firm trend with 3 cvs. in their response to 3 growth substances, however GA₃ was the superior for both Taimour and Hindi Be-Sinnara cvs, while with Zebda cv. PP333 was the most effective.

Referring the specific effect of differential 10 sprayed solutions data obtained revealed that each cultivar followed its own trend, whereas NAA at 200 or 100 ppm during ¹ and ² seasons, respectively resulted in the highest floral buds % associated with the least dormant and a considerable vegetative buds % for Taimour cv. However, With Zebda PP333 at 2000 ppm was the most favourable in this concern, while for Hindi Be-Sinnara cv. NAA at 400 ppm and PP333 at 1000 or 2000 ppm were equally the most effective.

**B. Interaction effect:**

Data obtained regarding the interaction effect revealed that the mango cultivars responded significantly to the various combinations of girdling X 10 differential sprayed solutions of the three PP333; NAA and GA₃ growth substances during both seasons. However, the response varied from one cultivar to another, whereas the highest percentage of floral buds coupled with both lowest dormancy rate and moderate leafy buds % were achieved by spraying the girdled limbs with NAA at 200 or 400 ppm for both Taimour and Hindi Be-Sinnara cvs. respectively. On the other hand, girdling application combined with 2000 ppm PP333 spray was the superior combination with Zebda cv. in this regard as resulted in higher, moderate and lower % of floral, vegetative and dormant buds, respectively.

Contrary to that foliar sprays of girdled or ungirdled limbs with GA₃ at the highest concentration (200 ppm) were the inferior combination in this regard
whereas the (lowest % of floral buds accompanied with higher rates of both dormant and vegetative buds were exhibited.

**IV.I.2. Vegetative growth measurements:**

The average length of both normal and malformed shoots of three mango cultivars in response to specific and interaction effects of (girdling x 3 growth regulators "PP333; NAA and GA₃" x 3 concentrations) was the investigated measurement in this concern.

A. Specific effect:

Concerning the specific effect of girdling application, data obtained revealed that malformed shoots of girdled limbs for both Taimour and Hindi Be-Sinnara cvs. were slightly elongated. However, the normal shoots followed two opposite trends, whereas the length in Taimour cv. was significantly decreased by ringing, while the contrary was detected with both Zebda and Hindi Be-Sinnara cvs. especially as an average of two seasons was concerned.

As for the specific effect of three investigated growth regulators (PP₃₃₃; NAA and GA₃), data obtained displayed that both NAA and GA₃ increased significantly the length of both malformed and healthy shoots, however GA₃ was relatively more effective than NAA, especially with Taimour (both healthy and malformed shoots). The opposite was found with PP₃₃₃ whereas elongation of both healthy and malformed shoots were depressed significantly even with comparing to control.

With regard to the specific effect of 10 differential spray solution, data obtained declared that GA₃ at 200 ppm followed by both NAA at 400 ppm and GA3 at 100 ppm increased significantly the length of either healthy or malformed shoots for 3 mango cultivars. The reverse was found with 2000 ppm PP₃₃₃ spray solution followed by its two other solutions at 1000 and 500 ppm concentrations; as well as water spray. However other sprayed solutions were in between.
B- Interaction effect:

Data obtained revealed that the combinations of either GA$_3$ or NAA each at its highest concentration i.e. 200 and 400 ppm, respectively induced the longest shoots irrespective of girdling was applied or not for both healthy and malformed shoots of 3 mango cultivars. However, the various combinations of PP$_{333}$ at 2000 ppm resulted significantly the shortest shoots followed by those of two other PP$_{333}$ concentrations (1000 & 500 ppm) and water spray.

V.I.3. Flowering measurements:

V.I.3.1. Whole inflorescence length:

NAA and GA$_3$ sprays increased significantly the whole panicle length for all cultivars, especially at their higher concentration i.e, 200 and 400 ppm for both GA$_3$ and NAA, respectively. On the other hand PP$_{333}$ solutions were not effective.

V.I.3.2. Measurements of inflorescence branching:

1. Average length of strand:

A-Specific effect:

Referring length of flowering branch "strand " in relation to specific effect of its locality along the three panicle's portions (thirds), data revealed that three mango cultivars followed typically the same trend. Hence, the length was significantly decreased with the up-ward direction from base to top.

However, no firm trend could be detected with the three cultivars regarding the specific effect of the three growth regulators (PP$_{333}$, NAA and GA$_3$); whereas each cultivar followed its own trend in this respect. Anyhow, 3 growth substances suppressed strands length of Taimour cv.as compared to control, while the trend took the other way around for two other cultivars especially NM
for Zebda and Hindi Be-Sinnara and PP333, or GA\textsubscript{3} for 1\textsuperscript{st} and 2\textsuperscript{nd} cv., respectively.

As for the specific effect of 10 spray PP333; NAA and GA\textsubscript{3} solutions, differences in response were not only too slight but also didn't follow a definite trend for three cultivars in most cases. However, it could be generally concluded that NAA at either 200ppm for Taimour or 400 ppm for two other cvs, as well as GA\textsubscript{3} at 200 ppm except Zebda resulted in a significant increase.

**B-Interaction effect:**

The tallest strands were always in concomitant to those combinations between basal third of panicle from one hand (all cultivars) and the pre-bloom spray with either NAA at 400 ppm for both (Zebda and Hindi Be-Sinnara) or any of NAA and GA\textsubscript{3} at 200 and 50 ppm, respectively for Taimour cv. from the other.

**2. Average number of strands per panicle's portion:**

**A-Specific effect:**

Number of flowering branches per a given panicle portion was responded significantly by its locality along the extend of panicle axis, whereas the fewest number was closely related to the middle third. The opposite was true with either the terminal portion for (both Taimour and Hindi Be-Sinnara cvs.) or the basal one for Zebda, whereas the abundant numbers were significantly presented.

Number of strands was significantly influenced by specific effect of 3 investigated growth substances, whereas all increased it over control except NAA and PP333 with Taimour whereas the reverse was true. Moreover, GA\textsubscript{3} was the most effective for both Taimour and Zebda cvs., from one hand, while with Hindi Be-Sinnara cv. both NAA and PP333 were the superior in this concern.

With regard the specific effect of the 10 sprayed solutions, the most effective solution/s was/were (200ppm GA\textsubscript{3}); (GA\textsubscript{3} at 100/200 ppm and NAA at
400 ppm) and (NAA at 200/400 ppm) for (Taimour), (Zebda) and (Hindi Be-Sinnara) cultivars, respectively.

**B-Interaction effect:**

Two opposite trends were detected regarding the interaction effect of (panicle portion X 3 growth regulators X 3 concentrations) whereas with both Taimour and Hindi Be-Sinnara cvs., the highest number of strands was always in concomitant to such combinations of the terminal panicle third regardless of foliar spray solutions, however sprayed trees with either 500 ppm PP333 or 100 ppm NAA for V and 2"d cultivars, respectively had relatively higher number. Meanwhile, with Zebda combinations of the basal portion showed significantly more abundant numbers of strands than combinations of two other portions.

**V.I.3.3. Flower types and sex expression:**

**A. Specific effect:**

Referring the specific effect of panicle's portion, data obtained displayed obviously that the greatest number of either perfect or total (perfect+ staminate) flowers was generally coupled with the basal panicle's third, while the reverse was true with the terminal portion. However, middle portion was in between. Such trend was true with all cultivars except with the terminal third of Taimour inflorescence, whereas the trend took the other way around as the number of perfect flowers only was concerned. As for the specific effect of 3 growth regulators, It is quite clear that GA$_3$ induced significantly the greatest number of total flowers in all cultivars. However for the No of perfect flowers GA$_3$ was the inferior while NAA was the superior followed by PP333. Meanwhile, data obtained pointed out that NAA at its highest concentration i.e., 400 ppm was the most effective spray solution with all cultivars whereas the greatest number of perfect flowers associated with a relative higher number of total flowers were exhibited.
**B-Interaction effect:**

However, the specific effect of each investigated factor (panicle's portion; 3 growth regulators and their 10 sprayed solutions) was reflected on their combinations from one hand but the rate of response to each factor for a given cultivar did not completely coincide with that of the two other ones from the other side. Therefore, the interaction effect was varied from one cv. to another, whereas the combinations of terminal panicle portion of Taimour cv. and those of basal portion for both Zebda and Hindi Be—Sinnara cvs. showed generally the highest No of both total and perfect flowers, especially when their trees were sprayed with NAA and / or PP333 at both moderate and higher concentrations.

- **Sex expression:**

  **A- Specific effect:**

  Data obtained revealed that sex expression (perfect flowers %) followed typically a firm trend regarding the response to any of the three investigated factors. Whereas the percentage was gradually decreased significantly with the downward direction from terminal to basal portion. Moreover, the NAA exceeded statistically the two other growth regulators (PP333 & GA3) and control, however the 400 ppm NAA was the superior sprayed solution. Such trend was true with three cultivars as the sex expression of various panicle portions was concerned. Moreover, with the whole inflorescence it showed also the superiority of NAA and its 400 ppm concentration.

  **B-Interaction effect:**

  The highest sex expression percentage was always in closed relationship with the terminal panicle thirds of 400 ppm NAA sprayed trees for all cultivars, while the reverse was true with the basal portions of GA3 sprayed trees.
V.I.4. Nutritional status:

V.I.4.1. Leaf mineral composition:

In this regard leaf N, P, K, Ca, Mg, Fe, Mn, and Zn contents of Taimour, Zebda and Hindi Be-Sinnara cvs., in response to specific effect of girdling, sampling date, growth regulators and their sprayed solutions at various concentrations, as well as interaction effect of various combinations between these investigated factors were concerned.

A- Specific effect:

With regard to specific effect of girdling application data obtained during both seasons displayed that girdling application reduced the leaf N, P, K, Ca, Mg, Fe; Mn; and Zn contents. However, differences were more pronounced and significant with N, P, K, as compared to those exhibited with Ca, Mg, Fe, Mn and Zn which did not reach level of significance in some cases.

Referring the periodical changes in leaf mineral composition observed with sampling dates, some of nutrient elements were increased during dormancy period (December to February); then decreased in mid March " starting of tree activity " either sharply like as (N, P and K) or slightly (Mg, Mn, and Zn). However, other i.e., Ca and Fe were continuously increased with advancement of sampling duration.

As for the specific effect of growth regulators and their applied solutions, data obtained during both seasons revealed that both NAA and GA$_3$ increased leaf N, P, K, Ca, Mg and Mn...contents than control, whereas solutions at 400 and 200 ppm were the most effective for NAA and GA$_3$, respectively. However, two opposite trends were detected with PP333, whereas it slightly decreased P, K and Mg below control, but increased others either even compared to both GA$_3$ and NAA (Fe & Zn) or just over control only (N & Ca).
B-Interaction effect:

Regarding the leaf mineral composition in response to the interaction effect of various investigated factors (girdling x sampling date x differential growth regulators sprayed at various concentrations), data obtained revealed that the mid February sampled leaves from the ungirdled limbs exhibited significantly the highest leaf N, P, K, Mg, Mn and Zn contents with spraying the 400 ppm NAA and/or 200 ppm GA$_3$ solutions for the five former elements, as well as the 2000 ppm for Zn in the three mango cultivars. However, with Fe and Ca contents the greatest levels were significantly in closed relationship with the mid March sampled leaves from the ungirdled limbs of 2000 ppm PP$_{333}$ sprayed trees for Fe content and any of 400 ppm NAA; 200 ppm GA$_3$ or 2000 ppm PP$_{333}$ sprayed trees for Ca % in the three mango cultivars.

V.I.4.2. Shoot total carbohydrates content:

Total carbohydrates content in mature shoots of three mango cultivars under study as influenced by the specific effect of a)- sampling date; b)- girdling application; c)- growth regulators and d)- their spray solutions (each growth substance at 3 concentrations + water spray as control) and their combinations (interaction effect) were investigated during both 1997-98 and 1998-99 seasons.

A-Specific effect:

Data obtained displayed clearly that the total carbohydrates level was specifically responded to each of the investigated factors (sampling date; girdling; growth substances and their various spray solutions) during both seasons for 3 mango cvs. Hence, the level was fluctuated through sampling duration, whereas it raised significantly within the period from mid December till mid February to reach its peak, then sharply reduced later at mid March even below that of the mid December sampled shoots. Moreover, girdling resulted in an obvious (significant) increase of total carbohydrates level. As for the specific effect of
growth regulators, it was quite evident that total carbohydrates level was significantly increased by both PP333 and NAA as compared to control, however PP333 was statistically the superior. Meanwhile, GA₃ was equally the same as water spray. Moreover, both PP333 and NM each at its highest concentration were more effective for raising carbohydrates level, while with GA₃ the highest concentration induced the severest reduction.

B. Interaction effect:

The present result revealed that the specific effects of all investigated factors were reflected directly on their combinations. Since, the highest level of total carbohydrates was always in closed relationship to the mid February sampled shoots located on ringed limbs of the PP333 sprayed trees at 2000 ppm, while the reverse was true with the mid March sampled shoots collected from nongirdled limbs of either 200ppm GA₃ or water sprayed trees during both seasons of study, regardless of cultivar.

V.1.4.3. Free amino acids content:

Total amino acids content in both terminal buds and leaves of mature shoots of three mango cultivars (Taimour, Zebda and Hindi Bi-Sinnara) as influenced by specific effect of the investigated factors (sampling date; girdling and exogenous spray with three growth regulators each at 3 concentrations + water spray as control), as well as interaction effect of their differential combinations were studied during both experimental seasons of 1997-98 and 1998-99.

A-Specific effect:

Data obtained revealed that level of free amino acids in both terminal buds and leaves of mature shoots was specifically responded to each investigated factor, whereas girdling increased it significantly in both organs for 3 mango cultivars.
Meanwhile, the response to sampling date exhibited that both organs i.e, terminal bud and leaf each followed its own trend. Since, level of free amino acids was continuously increased from mid December till reached its peak in mid March for terminal bud, while with leaf the peak was detected at mid February and the reverse was found at mid March.

As for the specific effect of evaluated growth regulators (PP$_{333}$; NAA and GA$_3$), all increased significantly free amino acids level than control; in spite of NAA was relatively the most effective in this concern. Such trend was true during both seasons for two organs (leaf and terminal bud) for three cultivars. In addition, NAA solution at 400 ppm was generally the superior followed in most cases by PP$_{333}$ and/or GA$_3$ at 2000 and 200 ppm, respectively.

**B- Interaction effect:**

The highest level of amino acids in terminal buds was always in concomitant to that combination/s of mid March sampled buds from mature shoots arrised on girdled limbs of either 400 ppm NAA sprayed trees or to great extent those sprayed with 200 and/or 2000ppm GA$_3$/PP$_{333}$, respectively. However, with the leaf content, mid February sampled leaves from girdled limbs of NAA, PP$_{333}$ and GA$_3$ sprayed trees at 400, 2000 and 200 ppm respectively were statistically the richest.

Nevertheless, it was also too clear to be noticed that terminal bud was relatively richer organ as compared to leaf pertaining their free amino acids content.
V.II. Part two (second field of study):

V.II.1. Mango malformation in response to girdling application combined with exogenous spray of PP333; NAA and GA3:

A-Specific effect:

Regarding the specific effect of girdling, data obtained declared that incidence of both vegetative and flowering malformation was significantly reduced by such application in both susceptible cultivars (Hindi Be-Sinnara and Taimour). Such trend showed relatively an intermediate response from one hand, but with vegetative malformation it was more pronounced from the other.

Referring the specific effect of 3 growth regulators (PP$_{333}$, NAA and GA$_3$) it could be safely concluded that all investigated growth substances reduced significantly percentage of both malformation types in 3 mango cultivars under study. However, NAA and GA$_3$ were more effective than PP$_{333}$ in this concern.

As for the specific effect of 9 (PP$_{333}$, NAA and GA$_3$) spray solutions, data obtained revealed that all of them reduced percentage of both malformation types in three mango cultivars as compared to control (water spray). However, 400 ppm NAA and to great extent 200 ppm GA$_3$ were statistically the superior in this regard. Meanwhile, those of PP$_{333}$ solutions especially at 500 ppm showed significantly the least reduction rate of malformation % below control.

B. Interaction effect:

Data obtained revealed significantly the beneficial response of malformation to the interaction effect of various investigated factors. However, the trend was slightly modified by mango cultivar and malformation type itself. Anyhow, the girdled limbs of 400 ppm NAA or 200 ppm GA$_3$ sprayed trees exhibited statistically the least percentage of both malformation types. Such trend was true with 3 mango cultivars from one hand, however GA$_3$ combinations were relatively
more effective than NAA ones for Taimour but the reverse was true with Hindi Be-Sinnara from the other.

Contrary to that combinations representing water sprayed trees of the three mango cultivars whether, bases of their limbs were ringed or not showed generally the greatest malformation percentage from the statistical stand point. However, the malformation incidence tended to be relatively lower at ringed limbs than the ungirdled ones in this concern.

In addition, other investigated combinations of the various studied factors were in between the previously mentioned two extremes.

V.II.2. Mango malformation in relation to endogenous level of some growth substances and other constituents:

V.II.2.1. Level of some endogenous growth substances in floral organs as related to their developmental stages; mango cultivar and foliar spray with some growth regulators:

In this regard \( \text{GA}_3 \); IAA; ABA; syringic and tannic acids were the five concerned endogenous growth substances investigated regarding their response to: a)- developmental stages of flower bud/panicle (4-distinct stages i.e, fully swollen bud; bud inception; full expanded panicle prior to full bloom and full bloom stages), b)- mango cultivar (3 mango cvs. varied in their resistance to malformation) and c)- foliar spray with 3 growth regulators.

Data obtained revealed that these five endogenous growth substances could be classified regarding their response to the 3 investigated factors into the following two groups:

**Group A - \( \text{GA}_3 \); IAA and syringic acid:**

These three substances followed generally the same trends, whereas their higher levels were in closed relationship to Zebda " highly resistant cultivar to
malformation" while the reverse was true with both Taimour and Hindi Be-Sinnara (susceptible cvs.). However, Taimour showed the least level, but differences were not so clear with comparing to Hindi Be-Sinnara cv.

In addition level of these substances was increased by the differential growth regulators sprays, however the highest increase in both GA$_3$ and IAA levels were exhibited by NAA spray while with syringic acid GA$_3$ foliar spray was the most effective.

**Group B- Abscissic acid and tannic acid content:**

Both members of such endogenous growth substances group followed different trend to that previously discussed with the aforesaid group. Since, the most resistant cultivar (Zebda) had the lowest values of both ABA and tannic acid, while the reverse was true with both susceptible cultivars (Taimour & Hindi Be-Sinnara). However levels were greater in Taimour than Hindi Be-Sinnara as levels of both ABA and tannic acids were concerned. Moreover, levels of both ABA and tannic acid responded negatively to the three growth regulator sprays, however GA$_3$ foliar spray induced the highest rate of reduction.

Generally, five members of endogenous growth regulators (A & B groups) were reduced with the advancement of developmental stages of flower buds/panicles.

**V.II.2.2. Pre-sprouting changes in indoles and phenols compounds in vegetative organs of some mango cultivars as affected by girdling and PP333,NAA,G A$_3$ application:**

**V.II.2.2.a. Changes in total indoles:**

**A-Specific effect:**

Data obtained during both seasons revealed that total indoles in terminal buds; leaves and shoots of 3 mango cultivars responded specifically to the various investigated factors i.e, girdling; sampling dates and growth regulators
sprayed \((\text{PP}_{333}; \text{NAA and GA}_3)\), as well as their concentrations. Hence, total indoles were increased by girdling, however the response was more pronounced with terminal buds content. Moreover, the level was gradually decreased from mid December till mid March. In addition, 3 growth regulators increased total indoles, whereas NAA was statistically the most effective followed by \text{PP}_{333} \text{ then GA}_3 \text{ ranked last.}

\textbf{B. Interaction:}

The highest level of total indoles was always coupled to the plant material sampled at mid December from girdled limbs of 400 ppm NAA sprayed trees. While the reverse was found with the mid March sampled organs from nongirdled limbs of control trees (water spray).

\textbf{V.II.2.2.b. Changes in total phenols:}

\textbf{A- Specific effect:}

Girdling application increased the level of total phenols in all plant organs employed for determination in 3 mango cultivars. Moreover, the level was decreased with aging from mid Dec. till mid March. However, the specific effect of investigated growth regulators pointed out that both \text{PP}_{333} \text{ and NAA increased phenolic compounds than control. Whereas } \text{PP}_{333} \text{ was the most effective and its sprayed solution at 2000 ppm was the superior in this respect. On the other hand GA}_3 \text{ was not only uneffective but also its application induced a slight reduction in phenolic level even below control.}

\textbf{A-Interaction effect:}

The highest level of total phenolic compounds in all plant organs was always in concomitant to the mid Dec. sampled materials from girdled limbs of
2000 ppm PP333 sprayed trees. While the opposite was found with the mid March sampled materials from nongirdled limbs of either water or GA3 sprayed trees.