Studies on rooting of stem cuttings in some fruit species

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This investigation was conducted for studying propagation ability of three fruit species by stem cuttings during the successive seasons of 1991-92 and 1992-93 for Marianna plum, and 1992-93 and 1993-94 for both guava and annona species. Hardwood and leafy semi-hardwood stem cuttings were the plant materials used for Marianna plum and both Montakhab El-Sabahia guava and Abd El-Razik annona cvs., respectively. Possibility of producing standard nursery plants (survived rooted cuttings) through enhancing rooting ability in cuttings of such important fruit species by applying some preplanting treatments was the main purpose of this work . Hence, the wounding and dipping in various solutions of IBA or NAA either combined with date of cutting preparation ”guava” or solely (annona and Marianna plum) were the investigated factors in this concern. Moreover, changes in some chemical components namely : phenoles, indoles, carbohydrates and nitrogen in cuttings of both guava and annona beside the two formers ones in Marianna plum were also determined . Aaiming to find out the relationship between their level as affected by collection dates from one hand and possibility or difficulty to root from the other.In addition, anatomical studies were also carried out for the basal portion cuttings of such species to throw some lights on the initiation of root primordia and difficults may be reflected negatively either on their initiation or penetration through tissues of cutting. Thus, the following field experiments were included :V.1. Guava :Subtterminal leafy stem cuttings (2 leaves/each) with 15.0 cm. length and 5.0 mm diameter were prepared from semi-hardwood shoots collected at three dates (June, August and October). A factorial experiment was conducted including thirty treatments i.e. combinations between three collecting dates from one hand and ten preplanting applications of dipping the wounded or unwounded cuttings in (water, IBA at 2000/4000 ppm, NAA at 1000/2000 ppm from the other. The treated cuttings devoted for investigating growth parameters response were planted separately in wooden boxes contained sand and peatmoss at 1:1 by volume . The different treatments ”combinations” were arranged in a complete randomized design as each treatment was replicated five times and every replicate was represented by 10 cuttings. Meanwhile, other smaller boxe was devoted for planting treated cuttings needed for anatomical studies .V.2. AnnonaSemi-hardwood leafy cuttings prepared from the subtterminal portion of newly developing shoots were prepared (2 leaves / each) in the same collecting dates of guava . Since, three simple field experiments were conducted each for every date to investigate the response of the aforesaid 10 preplanting application, i.e, dipping in water, IBA at 2000/4000 ppm, NAA at 2000/4000 ppm ”with or without wounding application”. The complete randomized design (with 5 replicates and 10 cuttings per each) was used. Planting of cuttings was done as previously mentioned for guava in theSeran house .V.3. Marianna plum :Hardwood stem cuttings of 25 cm. length and 6-8 mm. diameter prepared from one year old mature shoots collected on December 1st were used, as 100 ones were devoted for each one of the 10 investigated preplanting treatments of dipping the wounded and unwounded cuttings for 10 seconds in water, IBA at 2000/4000 ppm and NAA at 1000/2000 ppm. Then wrapped and stored in a damp mixture of peatmoss + sand (1:1 v) till planting i.e. one month later in rows 20 x 60 cm. apart at the nursery, where treatments were randomly arranged with five replicates per each. Twenty cuttings were devoted for every replicate in case of studying growth parameters with additional 20 cuttings for periodical examinations ofanatomy .Obtained results could be summarized as follows : V.1. Guava

:V.1.1. Changes in chemical constituents of cuttings asaffected by excising date from mother trees :Shoots total indoles, phenoles, carbohydrates and nitrogen contents were determined three times through growing season i.e June, August and October ”collection dates of Montakhab El-Sabahia guava cuttings ”.V.1.1.1. Total indoles :It was slightly increased by the advancement of growing season , since October-collected cuttings showed the highest level .V.1.1.2. Total phenoles :August-collected cuttings contained significantly the lowest level .V.1.1.3 Total carbohydrates :No pronounced changes in total carbohydrates contents of developing shoots were observed along the growing season arouned .V.1.1.4. Total nitrogen :Data obtained revealed that N% was gently decreased with aging , whereas the minimum level was that of October-collected cuttings .V.1.1.5. C/N ratio :It showed a steady increase parallelled to N% decrease.V.1.2. Vegetative growth parameters :In this respect growth parameters in response to both investigated factors namely collecting date of cuttings and some preplanting treatments of wounding and dipping in water and IBA/NAA , as well as their combinations were measured twice i.e 7 weeks from planting (rooting aspects) and 6 months from transplanting (survival percentage and vegetative measurements of rooted cuttings) .V.1.2.1. Rooting aspects (7 weeks from planting) : V.1.2.1.a. Rooting percentage of cuttings :As for specific effect of investigated factors , it was quite evident that August collection followed by October were more suitable than June, while dipping of wounded or unwounded cuttings in IBA at 2000 ppm were the most effective preplanting treatments . On the other hand, combinations of (October-collected cuttings x wounding preceeding dipping in IBA at 4000 ppm) and those between (3 collecting dates x dipping in IBA at 2000 ppm irrespective of wounding application) resulted in the highest rooting percentage. While the reverse was true with those of NAA application, especially at higher concentration (2000 ppm).V.1.2.1.b. Number of roots developed / cutting :Regarding the specific effect of both collecting date and preplanting treatments , data obtained revealed that June collected cuttings exhibited the greatest number of roots per cutting from one hand, while dipping in IBA at 2000 ppm regardless of wounding application were the superior preplanting treatments from the other in this respect .As for the interaction effect, obtained results showed that combinations of dipping the unwounded-June collected cuttings in IBA at 2000/4000 ppm, as well as dipping in IBA at 2000 ppm for wounded cuttings collected either in June or October , all were the superior ones in comparison with others as the number of roots / cutting was concerned .V.1.2.1.c. Root length :Concerning the specific effect of both collecting date and preplanting treatments on length of developed roots, data obtained declared that June and August collection exceeded that of October , while dipping the unwounded cuttings in IBA at 2000 ppm was the superior preplanting treatment. On the other hand, the combination between August collected cuttings and the preplanting treatment of dipping in IBA at 2000 ppm without wounding application showed the most pronounced interaction effect where the tallest roots was resulted .V.1.2.2. Growth parameters of survived rooted cuttings ”6 months from transplanting :Second growth measuring was done 6 months from transplanting the rooted cuttings i.e., followed the aforesaid measurement of rooting aspect. The following parameters were included in this concern :V.1.2.2.a. Survival percentage :Regarding specific effect of both investigated factors i.e. collecting dates and preplanting treatments , data obtained revealed that the highest survival percentage of Montakhab El-Sabahia guava rooted cuttings was closely related to October collected cuttings followed by August collection. Moreover, dipping in IBA either at 2000 or 4000 ppm ”regardless of wounding application” were the most desirable preplanting treatments as resulted statistically in the highest survival percentage of guava rooted cuttings, however lower IBA concentration was more effective in this regard .As for the interation effect , it was so clear that the combinations between October/August collected cuttings from one hand and dipping in IBA at 2000 ppm either cuttings bases were wounded or not from the other were the superior treatments as resulted in a higher survival percentage ranged from 80 to 85% .V.1.2.2.b. Number of leaves per rooted cutting :Regarding the specific effect of collection date, obtained data showed that August or October-collected cuttings induced survived rooted cuttings having significantly higher number of leaves than those of June. As for the specific effect of preplanting treatments , it is quite clear that the richest rooted cuttings in their leaves were induced by dipping the unwounded cuttings in IBA at 2000 ppm followed by those of dipping wounded and unwounded ones in IBA at 2000 and 4000

ppm, respectively .On the contrary, dipping of the unwounded cuttings in water (control) was the inferior . Meanwhile, other investigated preplanting treatments were in between.With respect to interaction effect of both investigated factors, data obtained declared obviously that both combinations between August or October collected cuttings from one hand and dipping in IBA at 2000 ppm without wounding application were the superior ones. Moreover, combinations, between both later collection dates (August and October) from one hand and dipping in IBA at 2000 or 4000 ppm for wounded and unwounded cuttings respectively from the other showed also an interesting effect and ranked second to the aforesaid superior ones in this concernV.1.2.2.c. Leaves dry weight / rooted cutting :Referring the specific effect of both studied factors ”{date of preparing cuttings and preplanting treatments of wounding and dipping in IBA / NAA solutions” besides their interaction effect (effect of their combinations) on the leaves dry weight per an individual rooted cutting of Montakhab El-Sabahia guava cv., present results declare the same trend previously detected with the number of leaves .V.1.2.2.d. Stem dry weight of survived rooted cutting:The survived rooted cuttings of Montakhab El-Sabahia guava cv. followed typically the same trends previously mentioned with leaves regarding the response of their stem dry weight to specific and interaction effects of both investigated factors .V.1.2.2.e. Root dry weight of survived rooted cuttings:It could be concluded that the previously detected trends with the aboveground system ”leaves and stem” regarding their responses to both specific and interaction effects of collecting dates and preplanting treatments were generally found for root dry weight of survived Montakhab El-Sabahia guava rooted cuttings .V.1.2.2.f. Total plant dry weight of survived rooted cuttings :Generally, it could be noticed that the response of total plant dry weight of Montakhab El-Sabahia guava survived rooted cuttings to both specific and interaction effects of collecting dates and preplanting treatments was markedly closed to those previously discussed with theaforesaid growth parameters .V.1.2.2.g. Top / root ratio :Regarding the specific effect of collecting date on top/root ratio, it is clear that June collected cuttings induced guava survived rooted cuttings with the highest ratio. On the other hand, top/root ratio was reacted specifically to the preplanting treatments, where the control (dipping in water without wounding) resulted in the highest value, but the reverse was true with that of NAA application. In addition, preplanting treatments of IBA application were in between due to the balanced responses of both above and under ground systems to such treatments. On the othe hand, regarding the interaction effect, all the desirable combinations resulted in an intermediate value oftop / root ratio .V.1.3. Anatomical examinations :Data obtained showed that root primordia initiated normaly from cambial zone of semi-hardwood stem cuttings ofguava and penetrated outward through cutting tissue with no interference . Moreover, preplanting treatments with IBA especially at 2000 ppm promoted initiation of root primordia from paranchyma cells of pith. On the other hand, the higher rate of survival % gained in guava rooted cuttings could be explained by the well vascular connection between those of developed adventitious roots and the main ones of cuttings.V.2.Annona :V.2.1. Changes in chemical constituents of annonacuttings as affected by collection date :-Regarding total indoles, phenoles, carbohydrates and nitrogen contents of Abd El-Razik annona sub-terminal stem cuttings as affected by collection dates (June, August, October), data obtained during both seasons revealed thefollowing :-V.2.1.1. Changes in total indoles :The level of total indoles was continuously decreased by the advancement of growing season, whereas June collected cuttings contained significantly the highest level. Meanwhile, the reverse was true with October collected ones but those of August were in between in this respect .V.2.1.2. Changes in total phenoles :Generally, it could be concluded that the trend of total phenoles content in response to collection date showednot only less pronounced rate of changes as compared to that previously found with total indoles but also it took the other way around .V.2.1.3. Changes in total content of carbohydrates & nitrogen and C/N ratio :Data obtained revealed obviously that however both carbohydrates % and N% followed two opposite trends showing an insignificant rates of increase and decrease for 1St andnd2 components, respectively. Accordingly, such responses were reflected in increasing C/N ratio with advancement of growing season .V.2.2. Growth measurements :Rooting percentage, number and length of developed roots were the only growth parameters involved in this regard ”due to the failure of annona rooted cuttings tosurvive”.V.2.2.1. Rooting percentage :Data obtained revealed the absolute difficulty of August and October-collected cuttings

to root, while those of June collection exhibited a comparable degree of rooting ability irrespective of the investigated preplanting treatments. However, dipping in IBA at 2000 ppm for the unwounded June-collected cuttings of Abd El-Razik annona cv. was the superior (stimulated the rooting % with about 2-3 times in comparison with the other ones).V.2.2.2. Number of developed roots/cutting :The number of developed roots exhibited per June collected cutting was increased by dipping either in 2000 or 4000 ppm solution of IBA.V.2.2.3. Average length of developed roots :The response of root length to the different preplanting treatments was of minor importance .V.2.3. Anatomical examination :Microscopic examination cleared a presence of sclerenchyma tissues in the cortex which acted as mechanical barrier that prevent root penetration and rooting. IBA treated cuttings induced root primordia from pith tissues beside the cambial ring. The absent of well connection between, vessels of the newly developed adventitious roots from one hand and those of the origin cutting from the other as shown from anatomical examination provides a logic explanation for the absolute failure of the annona rootedcuttings to survive .V.3.Marianna plum :V.3.1. Changes in cuttings contents of total indoles and phenoles as affected by storage and preplantingtreatments:Data obtained declared that the response of both total indoles and phenoles to the storage and preplanting-155-treatments followed two opposite trends whereas the former was increased but later decreased . This finding explains the benefit of storing cuttings of most deciduous fruitspecies before planting .V.3.2. Vegetative growth measurements :V.3.2.1. First measuring (3 months from planting): V.3.2.1.a. Rooting percentage :Regarding the rooting % of hard wood Marianna cutiings in response to the different prestorage treatments , data obtained revealed that dipping in IBA solutions (2000/4000 ppm) resulted in a highly significant increase as compared to other investigated treatments. However, the lower IBA concentration (2000 ppm) significantly exceeded the 4000 ppm conc. from one hand and the wounding application resulted in a relative stimulation in this concern from the other. On the contrary NAA dipped cuttings decreased rooting % thancontrol.V.3.2.1.b. Number of developed roots/cutting :Data obtained declared that prestorage dipping of Marianna plum cuttings in IBA either at 2000 or 4000 ppm resulted significantly in the highest number of developed roots per cutting. However, the response was more pronounced with the unwounded cuttings than the wounded ones. Other prestorage treatments of Marianna cuttings did not affectnumber of roots / cutting.V.3.2.1.c. Average length of root :It is quite clear that length of developed roots was positively responded to both IBA and NAA, however the lower concentrations of both growth regulators was more effective especially with wounded cuttings .V.3.2.2. Second measuring (of survived rooted cuttings, 6 months from the aforesaid one):V.3.2.2.a. Aboveground organs ”No. of leaves, dry weightof leaves and stem per survived rooted cuttings”Data obtained showed that all three parameters followed nearly the same trend of response whereas the greatest number of leaves and heaviest dry weight of both leaves and stem per the individual rooted cuttings were usually related to the prestorage treatments of dipping in IBA especially at 2000 ppm. As for the NAA application two opposite trends, were found i.e positive/negative relationship with number of leaves and weight of leaves and stem , respectively.V.3.2.2.b. Root dry weight / rooted cutting :All preplanting treatments increased the root dry weight of Marianna plum rooted cuttings, but dipping of wounded or unwounded cuttings in IBA at 2000 ppm were thesuperior in this respect.V.3.2.2.c. Total dry weight of rooted cutting :The heaviest weight of total rooted cutting was always concomitant to that preplanting treatment of dipping thewounded cutting in IBA at 2000 ppm followed by those of the unwounded dipped in IBA at the same concentration.V.3.2.2.d. Top / root ratio :Data obtained revealed that the greatest top/root ratio was detected by the survived rooted cuttings of control ”dipping in water without wounding), while the reverse was true with the NAA applied stem cuttings of Marianna plum cv. However, the most favourable treatments (of IBA application) induced rooted cuttings having an intermedinte top/rootratio .V.3.2.2.e. Survival percentage :Obtained results showed that dipping of Marianna plum cuttings in IBA at 2000 ppm induced statistically the highest percentage of survived rooted cuttings followed by those of dipping in IBA at 4000 ppm. However, wounded cuttings tended to be more responsable than the unwoundedones in this respect.V.3.3. Anatomical examination :Microscopical examination pointed out that root primordia initiated normaly from cambial zone and penetrated through the different tissues, without barriers for emerging outside of the cutting. On the other hand, IBA application

enhanced formation of root primordia from paranchyma cells of pith besides that originated from cambial zone. Accordingly, it becomes so easy to explain why stem cuttings of Marianna plum are easy to root especially after dippingin IBA .