

# Physiological studies on dormancy of apple buds

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This investigation was carried out on mature "Anna" apple trees grown in a private orchard at El-Khatatba region, Menofia Governorate, during 95/96 and 96/97 seasons. The trees are 6-years old and planted at 3 x 4 m apart in a sandy breaking dormancy materials such as dormex, thidiazuron, yolk mineral oil and urea with different concentrations on bud burst, flowering, maturity and storability of "Anna" apples. The obtained data are statistically analysed and summarized as follows:

I- The percent of spur bud burst

- 1-The application of dormex and TDZ as breaking dormancy materials increased spur bud burst % with all concentrations used. However, the treatments of 4.0% dormex and 0.04% TDZ were more effective than others.
- 2-The treatments of yolk mineral oil and urea were nearly similar with control and exhibited the least values of spur bud burst.
- 3-4% dormex treatment was more effective than 2 or 3% concentrations in increasing spur bud burst %.

On contrary, TDZ at 0.02, 0.03 or 0.04% were effective and reduced the costs than dormex.

II. Index values of floral spur bud burst

- 1.An evident in floral spur bud burst was obtained with increasing the days after treatments (accumulation of more chill units) either in treated or untreated trees.
- 2.Generally, it could be concluded that 4% dormex or 0.04% TDZ greatly increased index values of floral spur bud burst compared with urea or mineral oil treatments. However, no significant differences were obtained between urea or mineral oil treatments in their effect on floral spur bud burst.
3. Dormex and TDZ treatments were effective than urea or mineral oil treatments in hastening floral spur bud burst.

III. Spur bud % reached full bloom

- 1-Spur buds % reached full bloom were increased with advancing in growing season regardless of the used treatments. The dormex and TDZ treatments were effective than urea and mineral oil in overcoming the problems of warm winter.
- 2-The treatment of 4% dormex was more effective than other treatments in increasing spur bud % reached full bloom.
- 3-TDZ at 0.02, 0.03 or 0.04% treatments were similar in affecting spur buds % reached full bloom. So, the treatment of 0.02% are economically preferred.
- 4-The treatments of 2, 4 or 6% mineral oil were similar in their effect on spur buds % reached full bloom. However, 12% urea treatment was superior than 8 or 10% in increasing spur buds % reached full bloom.

IV. Yield attributes

1. Fruit set %The different treatments greatly affected fruit set % where an evident increase in fruit set % with all dormex, TDZ and urea. However, a decrease in fruit set % was obtained with mineral oil compared with control. The great effect on fruit set % was obtained with the higher concentrations i.e. 4% dormex, 0.04% TDZ and 12% urea.

### SUMMARY AND CONCLUSION

- 1-Mineral oil treatments reduced fruit set % than control especially with 2% concentrations.
2. Number of retained fruits / tree-The number of retained fruits / tree differed with different treatments where the highest number of retained fruits were obtained with dormex and TDZ. However, the treatments of mineral oil and urea had reduced the number of retained fruits / tree compared with control. The treatment of 4% dormex was more effective in increasing the number of retained fruits followed by 3% and 2% with no significant differences between the last concentrations.
- All TDZ treatments increased the number of retained fruits than control but 0.04% treatment was superior than 0.03 or 0.02%.
- The treatments of urea and mineral oil reduced the number of retained fruits with all used concentration than control.
3. Total yield (kg / tree)-There were an evident increase in total yield with all used treatments compared with control. The high yield was obtained with 4% dormex and 12% urea.
- A significant differences were recorded between 2, 3 and 4% dormex where 4% was superior. On contrary, no significant differences between different concentrations of TDZ, mineral oil or urea.

The increase in total yield with the application of bud breaking materials could be attributed

to the increase in buds opening, flowering % and fruit set. SUMMARY AND CONCLUSION 72V. Harvest date and days earlier than control All used treatments hastened fruits maturation than control and the great effect was obtained with 4% dormex treatment which caused 15 days earlier than control. Mineral oil treatments had a slight effect on harvest date of "Anna" apples and nearly similar with control. It could be noticed that dormex was more effective followed by TDZ, urea whereas mineral oil came later in affecting fruit maturity of "Anna" apples. IV. Fruit quality Fruit firmness of "Anna" apples was reduced with all used treatments of breaking dormancy materials except mineral oil treatments. No significant differences between different treatments or control on T.S.S % or acidity. However, a slight effects to some treatments were noticed. An evident effect to different treatments on peel anthocyanin content of "Anna" apples were obtained. The treatments of TDZ, mineral oil and urea produced fruits with high content of peel anthocyanin pigment than control. On the other hand, all dormex treatments produced poor colorations fruits than control. IIV. Average length of new shoots and average numbers of leaves / shoot 1- All treatments produced taller new shoots than control except 10 and 12% urea treatments. SUMMARY AND CONCLUSION 732- The tallest shoots were obtained with 4% dormex in both seasons, whereas the shortest shoots were obtained with 10 and 12% urea (first seasons) and 8, 10 and 12% urea and mineral oil 2, 4 and 6% mineral oil (second season). 3- Number of leaves were increased with all dormex and thidiazuron treatments whereas, it was decreased with mineral oil and urea treatments. 4- In first season, TDZ treatments were superior than dormex in increasing number of leaves, whereas in second season, all treatments increased number of leaves than control. HIV. Buds contents of endogenous harmones 1- No significant differences between different treatments on endogenous hormones of "Anna" apple buds at the day of treatments (20 Dec. of both seasons). 2- After 30 days of treatments (20 Jan.), there were an evident increase in endogenous auxin with all treatments except 2% mineral oil. 3- The highest level of endogenous auxin was observed with 4% dormex although no significant differences were obtained between 2, 3 or 4% dormex. The same findings were also noticed with TDZ concentrations. 4- All treatments increased endogenous gibberellins of "Anna" treated buds but the great effect was more pronounced with 4% dormex than other treatments. 5- There were a decrease in abscisic acid in treated buds with all treatments than control, but dormex and TDZ were effective than urea or mineral oil treatments. SUMMARY AND CONCLUSION 746- The decrease in abscisic acid and the increase in auxin and gibberellins levels of treated "Anna" apple buds are the main factor in breaking dormancy of treated trees. IVV. Storage ability 1. Discarded fruits % 1- All bud breaking agent materials increased discarded fruits % during storage at  $0^{\circ}\text{C} \pm 2$  and 90% RH than control. 2- All dormex and TDZ treated fruits were exhibited the high discarded fruit % than M.0 or untreated fruits. 3- The increase in discarded fruits % with dorm ex and TDZ materials could be attributed to the increase in fruit respiration and consequently the lost in fruit components and increasing the discarded fruits. 4- Generally, it could be concluded that bud breaking agent materials are used for early production of Anna apples. Consequently, it is not important to store these treated fruits, but it could be useful with the bulk production with short storage duration. 2. Weight loss % 1- The high weight loss % was obtained with dormex treatments especially with 4% treatment. 2- The increase in weight loss % of bud breaking agent materials treated fruits was due to the increase in water loss and respiration process. 3. Shelf life (in days) SUMMARY 011) CONCLUSION 751- Generally, shelf life was decreased with increasing storage life either in treated or untreated fruits. 2- After 30 days of cold storage, no significant differences between control or 2% dormex was observed. 3- No significant differences were detected between mineral oil or urea treated trees. 4- The decrease in shelf life of bud breaking agent materials treated fruits was due to the increase in water loss which caused fruit shrinkage. 4. Fruit firmness (lb / inch') 1- All dormex and TDZ treatments were produced fruits with less firmness than control. 2- Mineral oil and urea treatments produced fruits with high firmness than other treatments or control. 5. Total soluble solids (T.S.S %) 1- No significant differences between different treatments were detected at the beginning of cold storage periods. 2- The increase in T.S.S.% with increasing fruit storage life could be attributed to the activity of 13-amylase enzyme which turn the starch to sugars and consequently increase T.S.S. %. 6. Titratable acidity (gm malic acid / 100 gm fresh weight) 1- No significant differences were noticed between different treatments in

titratable acidity.2-The decrease in fruit acidity with increasing storage life could be attributed to the consumption of acids in fruit respiration during Krebs's cycle pathway.

### SUMMARY AND CONCLUSION

767. Non-soluble calcium content (mg / 100 gm dry weight)

- 1-All used treatments decreased non soluble calcium content than control except mineral oil treatment.
- 2-Decrease of non soluble calcium content is related with increasing fruit firmness.
- 3-An evident decrease in non-soluble calcium content in treated or non-treated fruits was obtained with advanced in cold storage periods.
- 4-The reduction of non-soluble calcium content with advanced in cold storage periods is due to the transformation of non-soluble calcium form to soluble calcium form by enzyme system.

8. Soluble calcium content (mg / 100 gm dry weight)

I - A reduction in soluble calcium content with advanced in cold storage periods was noticed.

- 2-Soluble calcium content increased fruit firmness decreased and the fruits become more soft, this was noticed with dormex treated fruits. Moreover, after 30 days of cold storage, mineral oil treatment produced fruits with less values of soluble calcium content which means producing firm fruits.
- 3-The application of dormex and thidiazuron (TDZ) produced soft fruits and had a short storage life. Generally, it could be recommended by spraying "Anna" apple trees with 4% dormex or 0.04% thidiazuron during 20 Dec. These treatments are important and effective in breaking buds dormancy and advanced flowering and fruiting. However, the application of urea and mineral oil could be used as a supplementary treatments for dormex and TDZ.