

physiological studies on mango fruits handling

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This study was carried out on mango fruits of Alphonse cultivar, during two successive seasons of 1996 and 1997. Twenty seven fruitful trees of about 20 year old were devoted for this study during both seasons. The above mentioned selected trees were grown in the farm of Horticultural Research Institute, El-Kanater, Kalubia Governorate, Egypt, with a main purpose for studying the following:-

V-I-Determination of maturity indices:- The main purpose was aimed to establish fruit maturity indices of Alphonse mango cv. by which the suitable picking stage of such perishable fruits could be easily determined. Consequently the periodical changes in both fruit physical and chemical characteristics were studied through the last stage of fruit development, since fresh weight, dimensions, shape index, flesh firmness, texture, specific gravity, rind color, TSS%, total acidity %, TSS/acid ratio, ascorbic acid content, total sugars and total carotenoids content of fruit were included in this respect.

V-2-Effect of some prestorage treatments on fruit keeping quality:-

1. Soaking fruit for 2-3 minutes either in hot water (45°C).
2. Soaking fruit in borax solution at 6%.
3. Soaking fruit in vapor-Gard at 2%.
4. Washing fruit with tap water as control.

were investigated under different conditions of storage as follows:-

V-2-1- Ambient condition (room temperature of 27°C : 2 and 55-65 % R.H.)

V-2-2- Cold storage either at 8°C, 10°C, BOC or intermittent system with 80-90% R.H.

• Fresh weight loss %, decay % (discarded fruits %), flesh fruit firmness, fruit texture, fruit colour, TSS %, acidity %, TSS/acid ratio, ascorbic acid content, total Sugars, and total carotenoids content of Alphonse mango fruits were periodically determined in relation to the above mentioned storage treatments. The obtained results of the present investigation could be summarized as follows:-

V-I-Changes in physicochemical properties leading to maturity of developing Alphonse mango fruits:

1. **Fruit fresh weight:-** Alphonse mango fruit was gradually increased significantly till reached its maximum value at maturity stage after 135 days from full bloom during both 1996 and 1997 seasons.
2. **Fruit dimensions:-** obtained data revealed clearly that the previously mentioned trend of the fruit fresh weight was similar to that detected with both fruit dimensions i.e., length and diameter, each was increased gradually and significant and reached its maximum value at maturity stage after 135 days from full bloom during both seasons of study.
3. **Fruit shape index:-** However, no statistical difference were induced regarding fruit shape index (fruit length: fruit diameter) after 135 days from full bloom, but a very little reduce in its value were observed.
4. **Fruit flesh firmness:-** Obtained results declared that fruit flesh firmness of Alphonse mango cv. was gradually decreased and significantly as the season was advanced till reaching its minimum value at maturity stage i.e, after 135 days from full bloom. At maturity stage it become 19.6 and 19.13 lb/inch² for the 1996 and 1997 seasons, respectively.
5. **Fruit texture:-** With respect to the periodical changes in Alphonse mango fruits texture, it is obvious that it was gradually decreased and significantly by advancement of fruit age till reached maturity stage during the study.
6. **Fruit specific gravity:-** Specific gravity was increased gradually and significantly to reach its maximum value at maturity stage, specific gravity for Alphonse mango fruits reached 1.51 and 1.62 for 1996 and 1997 seasons, respectively.
7. **Fruit colour:-** The peel colour as gradually changed from the very dark green "7.50 2/4" after 105 days to strong green colour "7.50 4/4 or 4/6" at 135 days from full bloom. Moreover, pulp colour was changed from light yellow 5Y 8.12 or 8.5/4 to yellow 5Y 8.5/8 during the two seasons of study.
8. **chemical properties:-** Data obtained increased gradually and significant by increase in fruit juice TSS %, TSS/acid ratio, ascorbic acid content, total sugars and carotenoids content and decreased total acidity by fruit aging till maturity stage during both

seasons of study.

IV-2-Effect of some prestorage treatments on keeping quality of Alphonsemango fruits under different conditions of storage:

IV-2-1- Effect of some prestorage treatments on keeping quality of Alphons Mangofruits under ambient temperature.

1. In this regard Alphonse mango fruits were stored under room temperature, after they had received one of the following prestorage treatments: a - Washing with tap water "control"; b- Soaking for 2-3 minutes either in hot water "45°C" or solution of borax at 6% concentration and c- Immersions in vapor Gard solution at 2%. Data obtained during the periodical response of some fruit physical and chemical properties to the different treatments during the whole duration of storage could be summarized as follows:

V-2-1-1- Effect on fruit physical characteristics:

1. Concerning the specific effect of prestorage treatments on physical characteristics, obtained results, revealed that immersion of Alphonse mango fruits in a vapor Gard solution showed the lowest value in weight loss % followed by dipping in borax solution, and dipping in hot water, while, washing in tap water ranked last in this respect. In addition, the specific effect of prestorage treatments on both fruit firmness and fruit colour took the other way around during both seasons of study.
2. With respect to the specific effect of storage period on physical characteristics, from the obtained data, it could be noticed that Alphonse mango fruits showed obviously a continuous reduction in their fresh weight with extending storage duration. In addition, both fruit firmness and fruit texture took the other way around during both seasons of study.
3. A significant effect was detected as a result of the interaction between prestorage treatments and storage periods, where Alphonse mango fruits treated with vapor Gard solution and stored for 9 days under room condition had the lowest value in fresh weight loss % and exhibited the highest values of both fruit firmness and fruit texture as compared with control during the two seasons of study.
4. Data obtained showed that, the peel ground colour was generally changed from dark green colour to light green colour after 6 days from storage, then it changed to strong yellow colour after 9 days in both hot water and control treatments. In addition, fruit treated with both borax and vapor Gard changed from dark green colour to green yellow colour after 6 days from storage followed by changed to yellow colour after 9 days from storage during 1996 and 1997 seasons.

IV-2-1-2- Effect on fruit chemical characteristics:

1. Regarding the specific effect of prestorage treatments on fruit chemical characteristics, data obtained displayed that immersion of Alphonse mango fruits in vapor Gard solution resulted in the lowest values of TSS%, ascorbic acid content, total sugars and fruit carotenoids content followed borax solution. In addition no significant effect could be observed on fruit juice total acidity during both seasons of study.
2. Concerning the specific effect of storage periods, the obtained data declared that a significant increase was detected on fruit juice TSS%, ascorbic acid, total and sugars and carotenoids content continuously as duration of storage was extended until the end of storage while total acidity took the other way around during 1996 and 1997 seasons.
3. The obtained data showed that a significant interaction was found between prestorage treatments and storage periods, where, Alphonse mango fruits treated with either borax or vapor Gard solutions and stored at 9 days under room condition had the lowest values of fruit juice TSS%, acidity, ascorbic acid content, total sugars and carotenoids contents as compared with other treatments during both seasons.

IV-3- Effect of different temperatures of cold storage treatments on keeping quality of Alphonse mango fruits:

IV-3-1- Effect on fruit physical characteristics:

- 1- Regarding the specific effect of different temperature of cold storage treatments on physical characteristics, it is quite evident that, stored Alphonse mango fruits at the temperature of 13°C showed the highest values of weight loss % and discarded fruits. percentage followed in a decreasing order by storage at 10°C and 5°C. On the other hand stored fruits at intermittent treatment had the lowest value in this respect. On the other hand, both fruit firmness and fruit texture took the other way around during the study.
- 2- Concerning the specific effect of storage periods on physical characteristics, data obtained showed clearly that both loss in fresh weight % and discarded fruit percentage took place continuously as storage period was extended during both seasons of study. In addition, both fruit firmness and fruit texture were decreased with the extension of storage time to reach its minimum values at the end of storage period (40 days) during the two seasons of study.
- 3- A significant response to the interaction effect between the different cold storage temperatures and time of storage, was found. However, refrigerated storage under 13°C for 40 days, showed the highest value of weight loss % and

discarded fruit percentage while fruit firmness and fruit texture had the lowest value in this concern during the two seasons of study. In addition, refrigerated storage under intermittent treatment for 40 days had the lowest value of weight loss % and discarded fruit percentage as compared with other treatments but response of both fruit firmness and fruit texture took the other way around during 1996 and 1997 seasons.

4- Concerning the periodical changes in fruit colour of Alphonse mango fruits data showed that the peel fruit was colour changed from dark green to light yellow under intermittent system after 40 days from storage, while fruits stored at 5°C changed to light green after 20 days, from storage then changed to light yellow after 30 days followed by strong yellow after 40 days from storage. As for the fruit pulp colour, it was changed under intermittent treatment from light yellow to yellow colour after 20 days from storage followed by strong yellow colour after 30 days from storage, then changed to orange yellow colour after 40 days. In addition, pulp fruit colour was changed light yellow to strong yellow colour after 30 days then changed to orange yellow colour after 40 days from storage.

• V-3-2- Effect on fruit chemical characteristics:

1- Concerning the specific effect of different temperatures (cold storage) on chemical characteristics, it could be observed generally that the values of TSS %, TSS/acid ratio, total sugars and carotenoid contents increased with increasing storage temperature while total acidity, and ascorbic acid contents took the other way around in this respect during the two seasons of study.

2- Regarding the specific effect of storage periods, it could be shown that a gradual increase in TSS %, TSS/acid ratio, ascorbic acid content, total sugars and total carotenoids were obviously occurred as the storage duration was advanced while total acidity took the other way around during 1996 and 1997 seasons.

• 3- A significant interaction between different temperatures of cold storage and storage periods was shown. However, Alphonse mango fruits stored under 13°C for 40 days exhibited the higher values of TSS %, and TSS % / acid ratio during the two seasons of study. Moreover, stored mango fruits under intermittent treatment for 40 days had the highest value of ascorbic acid content, total sugars and total carotenoids content during 1996 and 1997 seasons.

4- While respect to shelf life of Alphonse mango fruits as influenced by cold storage temperature, it could be safely concluded that stored fruits under intermittent system showed more ability for 4 days of shelf life followed in a decreasing order by those stored under 13°C, 10°C and 5°C during both 1996 and 1997 seasons.

IV-4- Effect of some prestorage treatments on keeping quality of Alphonse mango fruit under different temperature of cold storage:

1- V-4-1- Effect on fruit physical characteristics:

1- Concerning the specific effect of different cold storage temperatures on fruit physical characteristics, results indicated a significant increase in fresh weight loss % and percentage of discarded fruits with increasing the temperature of cold storage in both 1996 and 1997 seasons. On the other hand, Alphonse mango fruits had the lowest value of both fruit firmness and fruit texture under the highest temperature of cold storage during both seasons.

2- With respect to the specific effect of storage periods on fresh weight loss % and discarded fruit % data obtained showed a significant increase with extension of storage time while the response of both fruit firmness and fruit texture took the other way around during the two seasons of study.

3- Regarding the specific effect of prestorage treatments, on fresh weight loss % and discarded fruits %; the obtained data showed that the vapor Gard treatment decreased significantly fresh weight loss % and discarded fruits % followed in a increasing order by Borax treatment, hot water treatment, and control treatments in this respect, respectively. Moreover, vapor Gard treatment significantly increased both fruit firmness and fruit texture followed in a decreasing order by borax, hot water, and control treatments in this respect during both seasons of study.

4- A markable interaction was shown between different temperatures of cold storage, storage periods and prestorage treatment. Meanwhile, immersion of Alphonse mango fruits in vapor Gard solution and stored under 5°C for 40 days had the lowest value of fresh weight loss % and discarded fruit % as well as showed the highest value of both fruit firmness and fruit texture during 1996 and 1997 seasons. On the other hand, control treatment took the other way around in this respect.

5- Concerning the fruit colour of Alphonse mango fruits, it is quite evident that, seasonal changes in fruit peel colour take place through different storage whereas it changed from dark green colour to yellow colour. Also, fruit pulp colour passed through different shades from light yellow colour to orange yellow colour at the end of storage but these shade differed from treatment to another during the study.

IV-4-2- Effect on

fruit chemical characteristics:-1- Regarding the specific effect of different temperatures of cold storage on chemical characteristics showed that TSS%, TSS/acid ratio, ascorbic acid content, total sugars and carotenoids contents increased with increasing storage temperature, where stored mango fruits at 13°C had the highest values followed in descending order by those at 10°C and 8°C. In addition, response of the total acidity took the other way around during both seasons of study. 2- With respect to the specific effect of storage periods, it could be shown that a significant increase was found in TSS%, TSS/acid ratio, ascorbic acid content, total sugars and carotenoids contents. were obviously occurred as a storage duration was advanced while total acidity took the other way around during the two seasons of study. 3- Regarding the specific effect of prestorage treatments, the obtained data revealed that dipping Alphonse mango fruits in vapor Gard solution had the lowest values of TSS%, TSS/acid ratio, ascorbic acid content, total sugars and total carotenoids content followed in an increasing order by borax prestorage treatment followed by hot water prestorage treatment while control treatment had the highest values in this respect--- ...- _._,-- ._. -during 1996 and 1997 seasons; In addition fruit juice total acidity took the other way around. 4- A considerable interaction between different temperature of cold storage, storage periods. , and prestorage treatments was found. In this respect, immersion mango fruits in vapor Gard solution and stored under s-c for 40 days had lowest values of fruit loss %, discarded fruit %, TSS/acid ratio and carotenoids content while total acidity showed the highest value during both seasons of study. In addition both total sugars and total ascorbic acid content showed no definite trend during 1996 and 1997 seasons. 5- Fruits of all treatments that reached the end of storage period in a good physical condition were able to maintain their marketing ability for 4 days after storage except control and hot water treated fruits stored at 13°C as they showed no shelf life ability. In addition, Alphonse mango fruits could be stored for longer periods, by immersion either vapor Gard or 'borax solution and storage under goC these treatments increasing its ability to be successful in marketing. Generally, it could be safely concluded from the present work that the following bases and procedures must be taken into consideration and recommended for a safe storage and marketing of such perishable fruits "Alphonse mango fruits" under the same condition of El-Kanater, Kalubia, Governorate. a. First fruit harvesting must be done at marking "135 day from full bloom", fruit pulp colour became light yellow and fruit flesh firmness became 19.13 and 19.60 lb/inch', b- Immersion in borax or Vapor-Gard preceding 9 days ambient storage for local marketing. c- Immersion in borax or Vapor-Gard before refrigerated storage at 8 °C & 90% R. H. for day with the exporting purpose.