EFFECT OF DIFFERENT HARVESTING DATES ON SHELF-LIFE OF MUSKMELON, *Cucumis melo*

SARIMAH BINTI ARIFFIN

FACULTY OF BIOTECHNOLOGY AND FOOD SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

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The effects of different harvesting dates on shelf lif of muskmelon (Cucumes melo) / Sarimah Ariffin.

THE EFFECT OF DIFFERENT HARVESTING DATES ON SHELF LIFE OF MUSKMELON (*Cucumis melo*)

By
Sarimah binti Ariffin

Research Report submitted in partial fulfillment of
the requirements for the the degree of
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ENDORSEMENT

The project report entitle **The Effect Of Different Harvesting Dates On Shelf Life of Muskmelon (*Cucumis melo*)** by **Sarimah binti Ariffin** Matric No. **UK 16121** has been reviewed and corrections have been made according to the recommendations by examiners. This report is submitted to the Department of Agrotechnology in partial fulfillment of the requirement of the degree of Bachelor of Science Agrotechnology (Postharvest Technology), Faculty of Agrotechnology and Food Science, Universiti Malaysia Terengganu.

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(PROF. MADYA DR. SAYED MOHD ZAIN S. HASAN)
Main supervisor

PROF. MADYA DR. SAYED MOHD ZAIN S. HASAN
Dekan
Fakulti Agroteknologi Dan Sains Makanan
Universiti Malaysia Terengganu
21030 Kuala Terengganu

Date: 25 APRIL 2010

DECLARATION

I hereby declare that the work in this thesis is my own except for quotation and summaries which have been duly acknowledged.

Signature : 

Name : Sarimah binti Ariffin

Matric Number : UK 16121

Date : 25 APRIL 2010

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ABSTRACT

This study was conducted to investigate the effects of harvesting dates on shelf life of muskmelon (*cucumis melo*) in laboratory study. The harvesting dates for muskmelon are refer to 65 days one week before actual date, 75 days was the age of muskmelon after transplanting and the third harvesting was 80 days. After harvested, it was stored at ambient temperature 25^0C for 9 days. The parameters that been used for this experiment were ph, Total Soluble Solid (TSS), color changes of flesh, firmness flesh of muskmelon and vitamin C content. The second and third harvesting had a higher value of TSS which means it contain higher amount of sugar than the first harvesting. Second and third harvesting showed that the values of vitamin C were decreased after storage. The second harvesting and third harvesting also had consistently the value of pH. . The third harvesting showed the texture of fruits had softer. It is because fruits harvested at third harvesting over mature and soften progressively during ripening. The lightness (L value) decreased slightly in muskmelon as maturity was increased. Muskmelon became darker in color. Result indicated that the second harvesting is the best harvested because it contain high value of vitamin C and sugar. It also have the good quality of shelf life .

ABSTARAK

Kajian ini di jalankan bagi mengkaji kesan waktu penuaian ke atas jangka hayat muskmelon *(cucumis melo)*. Waktu penuaian muskmelon merujuk kepada 75 hari selepas pemindahan pokok dikenali sebagai waktu biasa penuaian, 65 hari merujuk kepada seminggu sebelum waktu biasa penuaian ditentukan sebagai penuaian pertama dan 80 hari adalah penuaian ketiga. Muskmelon yang dipetik telah disimpan pada suhu bilik 25^0C selama 9 hari. Dalam eksperimen yang telah dijalankan ini, pepejal terlarut (gula), perubahan warna pada isi, kekerasan isi muskmelon dan juga kadungan vitamin C. Penuaian kedua dan ketiga menunjukkan nilai TSS yang tingi kerana kandungan gula yang tinggi berbanding penuaian pertama. Penuaian kedua dan ketiga menunjukkan penurunan vitamin C selepas penyimpanan. Penuaian kedua dan ketiga juga mununjukkan nilai pH yang kosisten. Kekerasan pada buah menunjukkan buah penuaian ketiga menjadi lembut. Ini kerana buah yang dituai pada waktu ini, terlebih masak dan perkembangan semasa pemasakan. Kecerahan pada muskmelon menurun dengan sedikit jika kematangan naik menyebankan muskmelon menjadi gelap. Keputusan ini menunjukkan penuaian kedua adalah yang terbaik kerana mempunyai kandungan vitamin C and gula yang tinggi. Ia juga menunjukkan kualiti yang baik untuk jangka hayat.

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LIST OF ABBREVIATION

^0C	:	Degree celcius
%	:	Percent
$NaHCO_3$	:	Sodium hydroxide carbonate
L	:	Liter
Ml	:	Mililiter
TSS	:	Total Soluble Solid
HPO3	:	Metaphosphoric acid

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CHAPTER 1

INTRODUCTION

Cucumis melo commonly known as muskmelon, rockmelon or cantaloupe belonging to the family cucurbitaceae or cucubit family. Melon is the fourth largest produced fruits by weight production in the world (18,000,000 tons) behind orange, banana, and grape. According to the Aguayo and other, 2004, melon production was third in USA with 1,320,850 tons, behind China at 5,806,384 tons and Turkeys at 1,800,000 tons. The word cantaloupe is often used especially in the USA to describe the netted melon or muskmelon (*Cucumis melo var. reticulates).*

Muskmelons are relatively perishable fleshy fruits. The shelf life of fruits mature are full slip at the fruits is less than 10 days at 21^0C. During this period, the quality of fruits are changes dramatically. Many researches have investigated the condition muskmelon fruits such as growth, development, maturing and senescence. Characterization changes in vitamins, carbohydrates, protein and texture have been used as criteria for developing post harvest handling guidelines.

Determinations of optimum harvesting dates are the major factor to prolong the shelf life of fruits. It is because the quality of fruits is influences from the pre-harvest factors such as harvesting date. Generally the different harvesting dates of fruits also affect the quality likes sugar content, vitamin C firmness and so on. The harvesting date of crops depends on the maturity, color and marketing demand.

The harvesting date can influence the quality of crop during storage. If harvesting date are early, the shelf life of fruits are prolong but low quality. If the fruits harvest late, the shelf life of crop maybe short and over mature. So these studies

are designed to determine the best harvesting dates for muskmelon to prolong the shelf life during storage at ambient temperature.

1.1 Significance of study

There is still no published work on the harvesting dates for muskmelon grown the fertigation set. This study was conducted to evaluate the effect of harvesting dates that suitable to prolong the shelf life of muskmelon (*Cucumis melo*) for marketing either local or international at ambient temperature.

1.2 Objective

The objective of this study is to investigate the harvesting dates of muskmelon to get the best optimum shelf life of muskmelon (*cucumis melo*) based on the harvesting dates.

CHAPTER 2

LITERATURE REVIEW

2.1 Muskmelon

Muskmelon or cantaloupe *(Cucumis melo)* is a member of the Cucurbitaceae or cucubits family. Squash, cucumber and watermelon are including in cucurbits family. They are originated in different part of the world and presently had naturalized locally as one of important crop in Malaysia. Cantaloupe have originated in Africa and in the USA, muskmelon are classified into two major categories which is eastern and western types. Muskmelon is prone to chilling injury when stored at temperature less than 2°C for several days. Chilling injury sensitively decreases as melon maturity and ripeness increase.

As cantaloupe matures on the vines, the fruit begins to separate at the abscission layer where the stem attaches at the fruits. The maturity level is determined by the degree of separation and called slip. Therefore, if the abscission layer is ½ detached, then the maturity level is called1/2 slip. If the muskmelon is ¾ detached, then it is called ¾ slip. A good indicator of full ripeness and harvest time is partial to complete separation. In USA ¾ to full slip is the maturity level for commercial practice of harvesting muskmelon. (Beaulieu and other, 2004).

There are a large number of muskmelon *(Cucumis melo,* L.) cultivars. Work done on different cultivars has shown that there are marked differences in growth patterns and ripening phsyiology of muskmelon. There are obvious differences in color, flavor and shape. In addition, the quality of one cultivar can vary with locality (pratt,

1971;Yamaguchi *et al., 1977)* . According to cv. Hara Madhu study about fruit development in muskmelon showed that optimum fruit quality occurred 28 - 30 days after flowering (Srinivas et al., 1983). However, Bianco and Pratt (1977) found that fruits of muskmelon (cv. Honey Dew and Powdery Mildew Resistant No. 4S) rapidly accumulated sugars between 28 and 42 days after anthesis and suggested that early harvest of muskmelon would lead to loss of quality.

2.2 Climatic requirement

It can grow well in hot and dry climate where temperature varies from 22°C to 26°C. bright sunny days with high temperatures and low relative humidity are best to produce sweet fruits with less foliar diseases. High humidity during its growing period may delay ripening and increase the incidence of foliage diseases. It is very susceptible to frost.

2.3 Irrigation and drainage

During its growing period, the crop required heavy amount of moisture. Therefore till fruits set, the crop should be irrigated at the interval of 7-8 days. It is better to irrigate the crop only in furrows. It helps to avoid foliage diseases and reduces the quantity of water. Excess water is always harmful to the crops, hence excess water should be drained out immediately to avoid the spread of foliage disease. Irrigation should be stopped when fruits start ripening.

forms allowing the melon to separate from the vine, leaving no stem tissue attached to the fruits.

Unfortunately melons harvested at full slip have a short storage life. Muskmelon harvested prior to full are not as high in sugar and flavor but have longer storage potential. To ensure a shelf life of up 2 weeks, a compromise has to be made between harvest dates. Some study have shown that sugar accumulate in muskmelon 32 days after flowering and continue until maturity. Harvesting approximately 36 days after flowering may be good compromise between maximum flavor and storage potential. Typically full slip is 42 days after flowering.

2.5 Preparation for market

Fruits should be kept in cool place after harvesting and dust should be removed by cloth or washing in running water. Damaged, diseased and under sized fruits should be sorted out and sound ones taken to the market in baskets by suitable transport.

2.4 Harvesting

The growing period muskmelon depends on the variety used. It normally takes 70- 85 days after sowing to maturity. The fruit is best consumed 2 or 3 days after harvesting. The fruits fully ripened on the vine should be harvested to obtain best quality. Over ripened fruits do not get good price in the market. Varieties may differ in certain characters to indicate the maturity. There are various ways of determination maturity. Following are main indication the maturity of fruits.

2.4.1 Aroma

Ripened fruits usually emit a nutty pleasant flavor

2.4.2 Softening of the rind

The softening of rind can be observed by pressing the fruits with the fingers. There is change is rind colors, generally from green to light green or yellowish depending on the varieties. Shining surface of the rind is also indication of ripening.

2.4.3 Change in TSS

The TSS of ripened fruits is much more than that of unripened fruits. The TSS of ripened fruits varies from 10 to 18 percent depending upon the variety. Commercial cultivars have only a 2-3 week shelf life depending on cultivar and harvesting stage (Kader, 1992). Muskmelon is harvested at fully maturity slip have a high in sugar, and have a good flavor and aroma. At full slip an abscission layer

CHAPTER 3

METHODOLOGY

3.1 Method

3.1.1 Seed germination and fertigation planting

The seeds were soaked for 24 hours and then each seeds were kept in the hole of seedling tray containing peat moss. Seeds were sprayed for two times per days for maintain humidity about 60 – 80%. Two days after sowing the seedling started to germinate on third day and straight growing until day ten. After two week, the seeds were transferred to polybag of in fertigation set.

3.1.2 Irrigation and fertilizer

The water and fertilizer were applied bu using timer. The water irrigation and fertilizer was doing at the same time because all the fertilizer in liquid. The solution of fertilizer was applied thought the system of fertigation using electric timer. In this study, the fertilizer that been used was set A and set B. This is the examples of materials in fertilizer set A and set B: Set A: calcium nitrate, ferum, ammonium nitrate and kalium nitrate. Set B: kalium nitrate, kalium sulfate, magnesium nitrate, mono kalium phosphorus, mangan, zinc, cuprum, ammonium molybdenum and solubor. Solution for set A and set B must be separated in different container to avoid the chemical reaction. A 50ml solution from set A and set B is added into the 10 liter

of water before irrigation. The rates of irrigation depend on the age of plants. The process of fertilizer application was conduct with timer.

3.1.3 Tagging

The male flowers were open flower after two weeks are transplants and female was open flower after three weeks. The female flowers were starting from the fulling development until flower became ready to harvest. The yields (fruits) at the following time of maturity were harvested and the samples were stored in ambient temperature 25°C. It is analyzed for its chemical and physical characteristics, postharvest properties were measured for 10 days.

3.1.4 Harvesting date

The fruits were harvested by cutting the fruit stalk and then kept in the plastic bag, brought to the laboratory post harvest. The fruits were immediately tasted, measured according to the following parameters. They are vitamin C, Total Soluble Solid (TSS), pH, color changes and firmness. Three harvesting dates for muskmelon were harvested at 3 times. Muskmelon was harvested at 65 days one week before actual date, 75 days was the age of muskmelon after transplanting and the third harvesting was 80 days.

3.2 Materials

a. Set of fertigation, tunnel, seed, tray, ruler, glassware, knife, scraper, pen, filter paper and burret also digital refractometer,

b. 0.1 N sodium hydroxid, 3% metaphosphoric acid, Indophenol dye, distilled water

3,3 Fruit Analysis

The harvested were conducted at three different dates of maturity. The physical properties were measured at every harvesting fruits at four different times. Samples of muskmelons were taken from each treatment for fruits analysis. Data for all the storage at ambient temperature treatments were recorded every 3 days for 9 days. The first analysis is firmness. A texture analyzer, Model of TA.XT. Plus Texture Analyzer (Stable Micro system, Vienna Court, Lammas road, Godalming, from England) with the data analysis software package Texture Expert for Windows was used to measure the surface firmness of muskmelon during storage. 5mm diameter cylinder stainless probe (P/5) was used to determine the firmness. The physical analysis was measured by color of the skin muskmelon used using colorimeters (MINOTA colorimeters series 200). The analysis followed by chemical analysis that pH determination, total soluble solid (TSS) and vitamin C analysis. Each fruits were three reading taken in order to take an average.

3.3.1 Chemical Analysis

Chemical analysis that been used was determination of ascorbic acid. Most of the fruits are contained a lot of vitamin, especially vitamin C. Hence, muskmelon fruits also not included. So the indicator, indophenols dye was used to indicate the ascorbic acid which contains in the muskmelon fruit through the titration. The titration was titrated the indophenols into the samples which had been filtered drop by drop until the sample change to the pink color. Before proceed this titration, the chemicals need prepared first that was:

- Indophenol dye
- Metaphosphoric acid (HPO3)

a. Indophenols dye

Dissolve 0.042 gm of sodium hydroxide carbonate (NaHCO3) in the 150 ml hot distilled water and than solution was cooled. After that, 0.1 grams of indophenols dye was dissolved with sodium hydroxide carbonate solution. Solution was diluted with distilled water and make up to 500ml. solution was shake and leave it for overnight and filtered it before used.

b. 3% metaphosphoric acid

30 grams 'stick' metaphosphoric acid was weight and dissolved the 'stick' with 200ml distilled water and stir. 'stick' metaphosphoric acid was entire dissolved, solution was pour into 1L volumetric flask and make up to 1000nl with distilled water.

c. Procedures

Samples were blend and 10 grams of samples were weight. 20 ml 3% HPO3 was added and make up to 100 volumetric flasks with 3% HPO3. Filter by filter paper and filter one more time by filter paper. Take 10 ml of filtrate into 50 ml conical flask. Titrate against indophenols dye via burrette until the color of solution changes to the pink color. The reading was recorded.

3.3.2 Method of TSS determination

Total soluble solid (TSS) refer to molecules that are truly soluble in an aqueous samples. Experimentally, it is frequently determine used refrectometer (model ATAGO RR-1). This refractometer was bases on light refraction form one medium to another medium. The muskmelon flesh was blend which cut off to small pieces to homogenized by blander. Then drop of distilled water into the lens for calibration. After reading was obtained, dry up the distilled water using clean tissue paper. Samples were placed on the lens. Values of reading were recorded and clean up the lens, and repeat the same procedure for another sample.

3.3.3 Method of pH determination

The most common way was to measured pH, which is the negative logarithm of the hydrogen ion concentration. The pH range in aqueous solutions is 0 – 14 where values in the range 0-7 indicate acid, and 7-14 indicated base. With very few exceptions, foods are acidic based on this scale. Indeed, foods are referred to as weakly acidic, acidic or strongly acidic depending on their pH.

Determination of pH was done using pH meter. Sample was grinded and spout of pH meter was soaked into the samples. The reading was taken for each sample.

3.4 Statistical Analysis and Experimental Design

Analysis of variance (ANOVA) was used to determine the effect of different harvesting dates on shelf life muskmelon. For the result, the mean values were calculated. The experimental data obtained were analyzed statistically by one way variance (ANOVA). Tukey and Post Hoc's test was used to describe means at the 0.05 significance level. The statistical analysis of the experimental data was done using SPSS 16.0 with 3 harvesting dates and 5 treatments and triplicates.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Determination of Total Soluble Solid (TSS)

Generally the total soluble solid of muskmelon shows a decreasing after storage. However in figure 1, it shows that the first harvesting is consistent values from day 0 until day 9 except for second harvesting and third harvesting. Based on the result, the second and third harvesting had a higher value which means it contain higher amount of sugar than the first harvesting. But they showed lower values from day 0 until day 9 after storage.

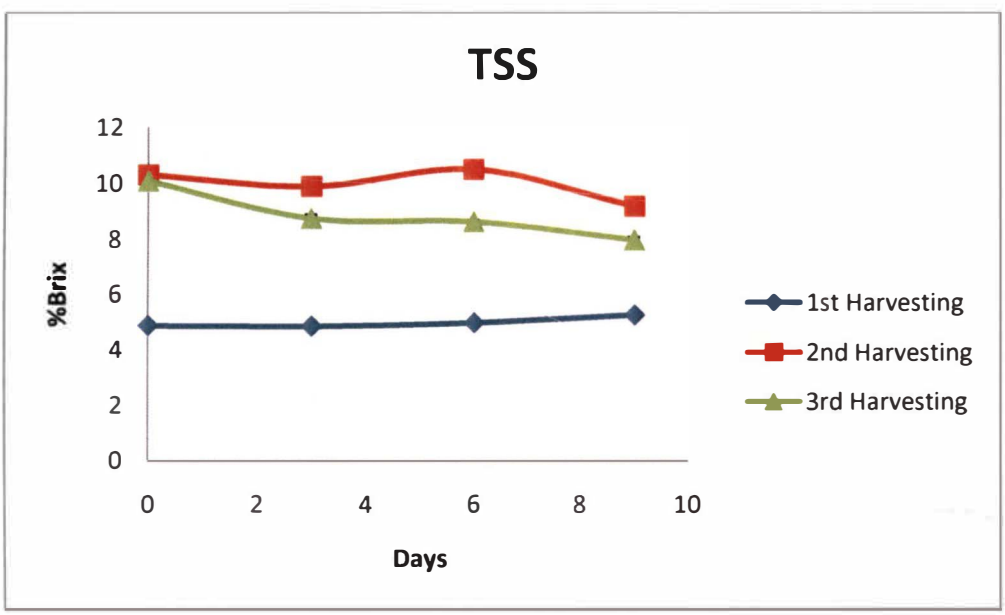

Figure 4.1: The changes of total soluble solid value in different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error.

It was observed that there was a slight decrease in total soluble solids and total sugars when muskmelons were stored. The decrease in total sugars may be attributed

to the utilization of sugars, mainly as glucose for respiration because the first substrate used during respiration is sugar. A close relationship between respiration and sugar levels was noticed in peaches during storage (Chen et al., 2006). Muskmelons do not have the facility for synthesizing sugars during storage because they do not have starch reserves (Bianco and Pratt, 1977). Total soluble solid (TSS) of second harvesting was significant different for the third harvesting ($P < 0.05$) (APPENDIX A)

4.2 Determination of pH

Figure 4.2 showed that the first harvesting, second harvesting and third harvesting had consistently the value of pH. The second harvesting showed the fruits had that highest value compared to the first and the third harvesting. For all the harvesting dates showed the value level of from 0 to 9 days.

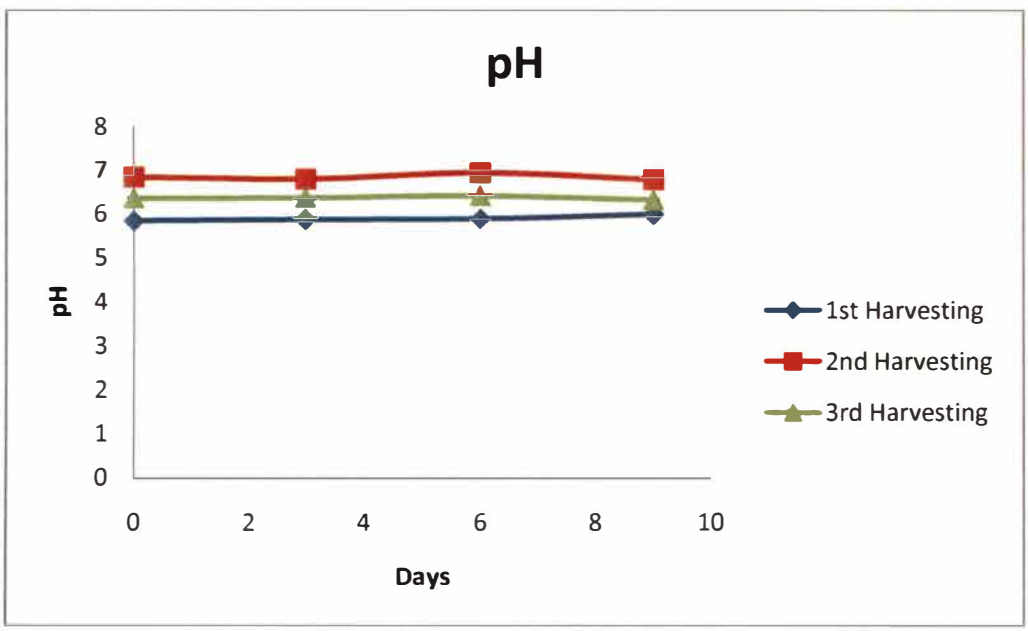

Figure 4.2: The changes of pH value in different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

According to Mutton et al (1981), the value of pH for the fruits did not change appreciably during storage. The indicating that the melon pH value range had did not acquire a sour taste during storage. Previous workers have indicated that it is rare to have truly sour melon (Mutton *et al 1981).* The value of pH for the second harvesting was significant different for the third harvesting ($P< 0.05$) (APPENDIX B)

4.3 Determination of vitamin C

Vitamin C is one of the indispensable components of nutrition in fruits. Figure 4.3 showed were different increased from day 0 to days 9. The value for the first harvesting indicated increased day 0 to day 6 but decreased in day 9. Second and third harvesting showed that the values of vitamin C were decreased after storage. The higher content vitamin C was observed and recorded second harvesting followed by first harvesting and third harvesting. The value of vitamin C of second harvesting was significant different ($P< 0.05$) (APPENDIX C)

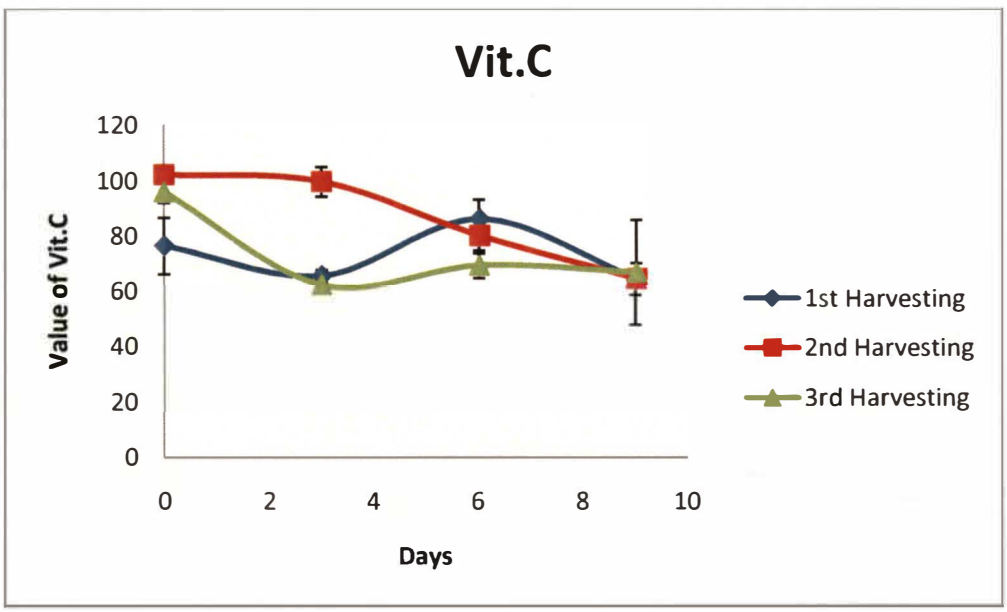

Figure 4.3: The changes of vitamin C different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

4.4 Determination of L value

Figure 4.4 showed the value of L* (lightness) for the color of flesh muskmelon in first harvesting was highest from day 0 to day 6 but decreased for the day 9. The second harvesting showed the change in value was consistent. However the third harvesting was increased for day 9.

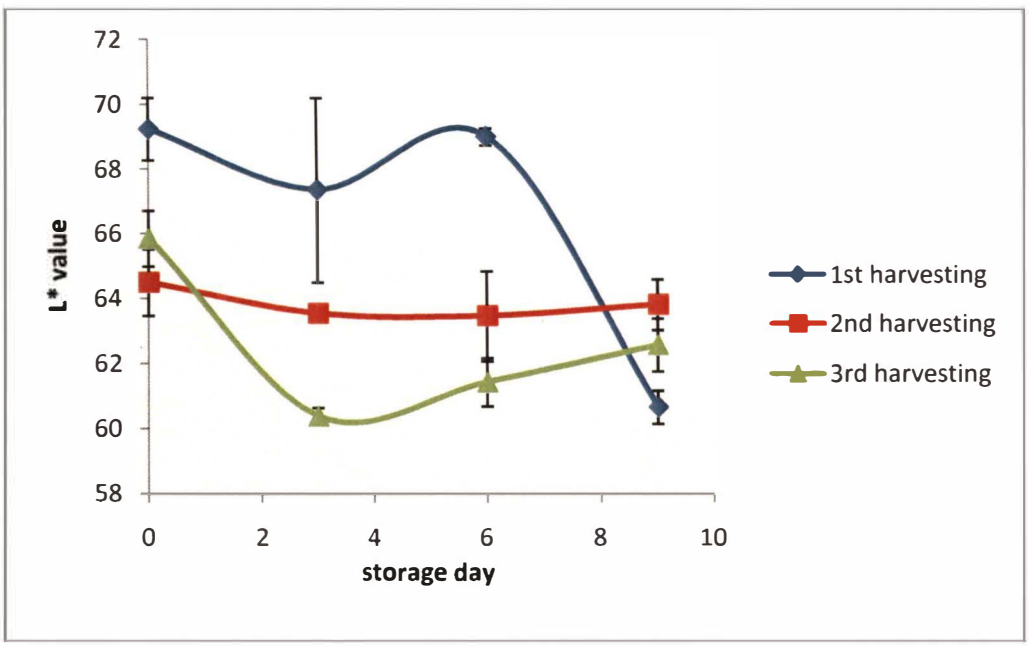

Figure 4.4: The changes of L* value of different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

The observation muskmelons color observation was change reasonable since beta carotein was increased during development and ripening of melon (Pratt 1971: Laster and Dunlap 1985). L * value indicates lighter color. Actually, the lightness (L value) decreased slightly in muskmelon as maturity is increased. Muskmelon became darker in color. In studies sowed that color of fruit changed as chlorophyll pigment start to deteriorate and beta carotein production was initialized and at maximum. (Chiesa *et al.,* 1998). The L* value for first harvesting was significant different ($P< 0.05$) (APPENDIX)

4.4 Determination of firmness

Figure 4.5 showed the firmness of the muskmelon during storage. The firmness (g) value is higher in first harvesting followed by second harvesting and third harvesting. Firmness for the first harvesting and second harvesting was consistent with the storage period. The third harvesting showed the texture of fruits had softer as showed in the second and first harvesting.

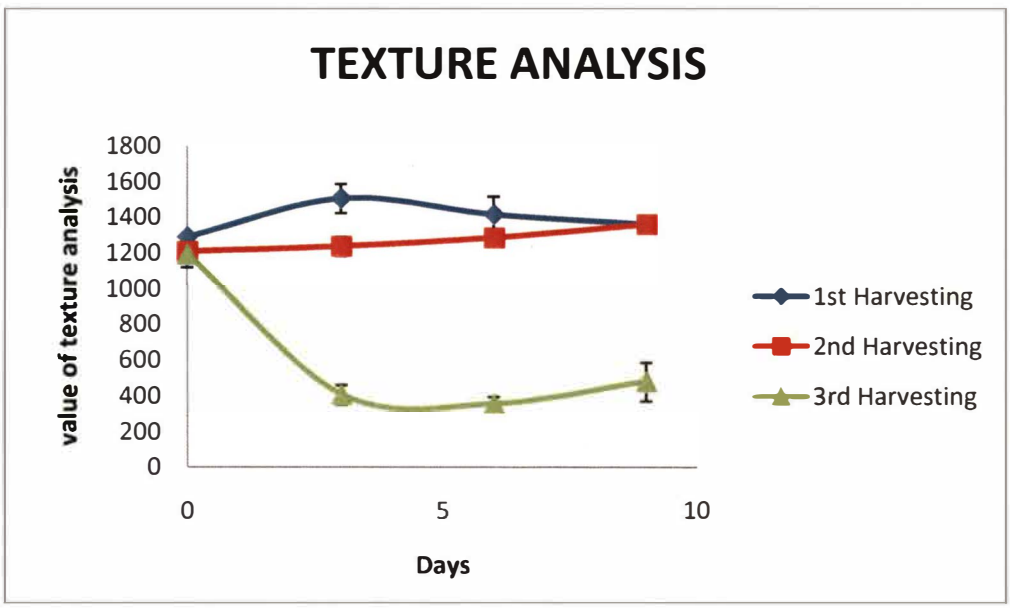

Figure 4.5: The changes of firmness value of different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

Muskmelons normally soften progressively during ripening. During storage, the breakdown of polymeric carbohydrates, especially pectic substances and hemicelluloses, weakens the middle lamella and the cohesive forces binding the cells together. In addition to polymer size, loss of moisture during storage causes the cells to be more flacid, hence the fruit gives way to deformations more easily than turgid cells. The firmness value for first harvesting was significant different for the second harvesting ($P< 0.05$) (APPENDIX E).

4.6 Determination of a value

The value of a* refers to redness to greenness. Positive values indicate an amount of red color, while negative values the amount of green. The value a* for the first harvesting was lower than the second and third harvesting. The second and the third harvesting showed the similar value of a*.

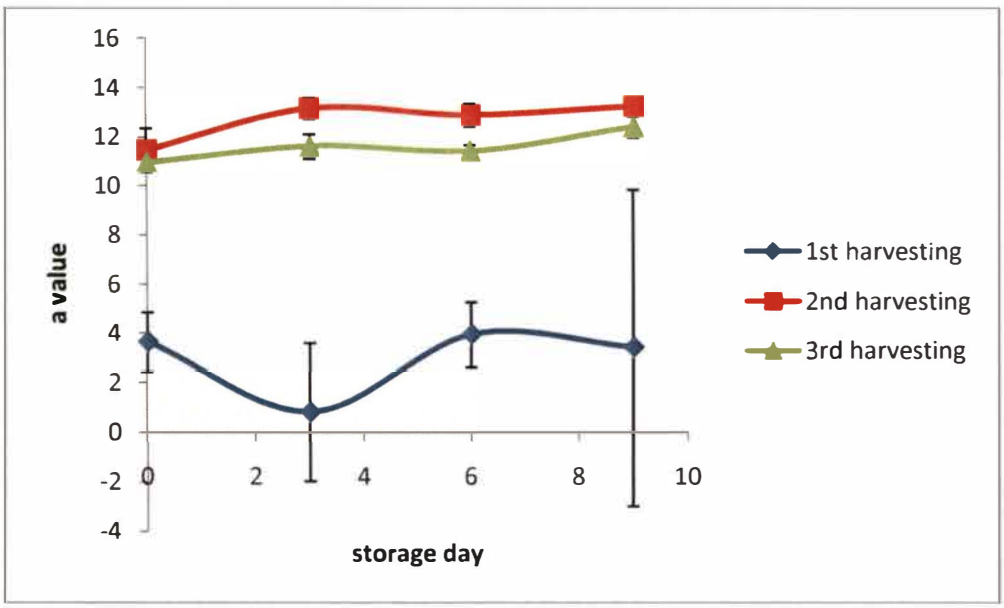

Figure 4.6: The changes of a* value of different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

The graph showed the value of first harvesting was negative which means the fruits had slightly green color on flesh. The fruit for the second and third harvesting showed the higher positive value than first harvesting. Fruits color changes can involve combination of chlorophyll breakdown and the synthesis and degradation of carotenoids and phenolic pigments such as anthocyanins (Lancaster *et al.*, 1997).

Fruits flesh characteristics are important for processed as well as whole fresh fruit. Increased nitrogen fertilization of peaches can result in improved 'a', 'b' and chroma values for fruit puree (more intense yellow colour) and higher sensory rating

(Olienyk et al., 1997). The a* value for second harvesting was significant different for the third harvesting ($P < 0.05$) (APPENDIX F).

4.7 Determination of b* value

Figure 4.7 showed the color changes for the b* value for the three harvesting. Positive b* value indicated the yellow and blue color is negative indicates. The change yellowness b* value at three harvesting were consistent. The b* value determine as yellow – blue character in the absence of red or green components. The orange hue in orange melons is primarily due to high concentrations of beta carotene (Lester and Eischen, 1996; Robertson and Decker-Walters, 1999). The b* value for second harvesting was significant different for the third harvesting ($P< 0.05$) (APPENDIX G

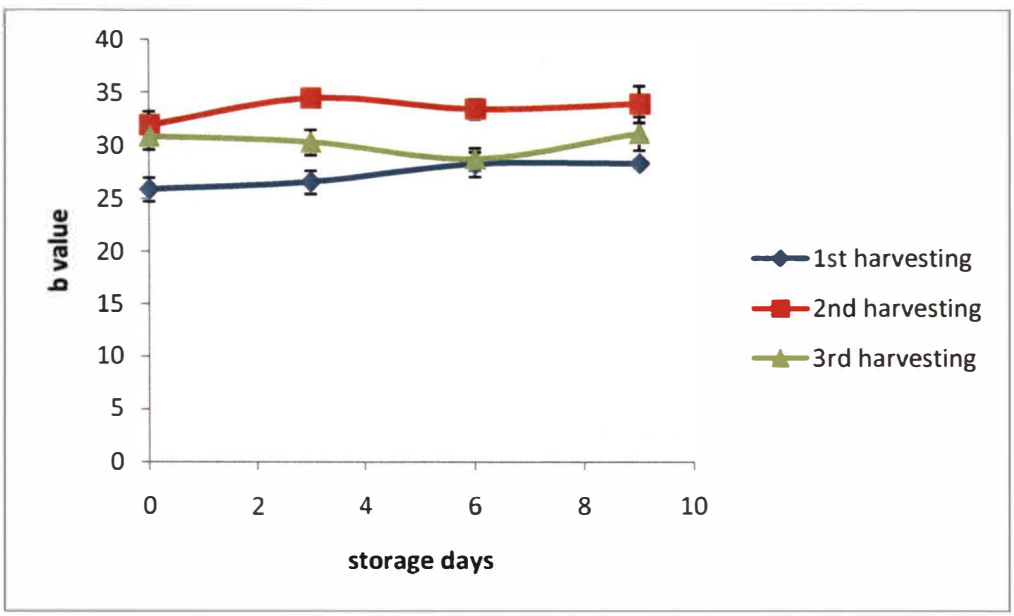

Figure 4.7: The changes of b* value of different harvesting date of muskmelon (*cucumis melo*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

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CHAPTER 5

CONCLUSION

5.1 Conclusion

Results experiment indicated that the second harvesting is the best harvested. Therefore the best harvesting is to pick the muskmelon. The results indicated that even if the fruits stored for 10 days, it did not led any significant changes. Muskmelon has a good flavor and aroma after harvested three or four day. But longer storage period can effect the fruit due to the decrease of vitamin C and sugar content.

5.2 Recommendation for further study

It is recommended future studies that carried out the effect of harvesting dates on shelf life of fruits at two different conditions ie: stored at ambient temperature 25^0C and 6- 8^0C. Thus it is very important to have more research on harvesting date for other commercial fruits.

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APPENDIX A: Means of Total Soluble Solid (TSS) at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	4.863±0.074652 [a]	4.838±0.068845[a]	4.963±0.055434 [a]	5.225±0.059512[a]
2nd	10.262±0.124791[b]	9.837±0.246961[c]	10.450±0.259808[c]	9.125±0.112731[c]
3rd	10.025±0.085391[b]	8.700±0.147196[b]	9.250±0.06455[b]	7.925±0.110868[b]

APPENDIX B: Means of pH value at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	5.828± 0.046075 [a]	5.862±0.031983[a]	5.882±0.030653[a]	5.9900±0.092556[a]
2nd	6.842± 0.044977 [c]	6.800±0.023094[c]	6.945±0.055[c]	6.7875±0.17158[b]
3rd	6.345±0.027234 [b]	6.538±0.01652[b]	6.4100±0.028577[b]	6.3225±0.024958[a]

APPENDIX C: Means of vitamin C at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	76.455± 10.13602 [a]	65.622±2.277599[a]	85.935±7.032056[a]	64.508±5.720123[a]
2nd	101.898± 2.493225 [b]	99.360±5.327152[b]	80.040±5.286418[a]	64.508±5.720123[a]
3rd	95.657±3.847535[a]	62.317±2.765896[a]	69.318±4.477695[a]	66.790±18.93311[a]

APPENDIX D: Means of L*value at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	69.228± 0.962214 [a]	67.342±2.852605[b]	69.003±0.263356[b]	68.145±0.509665[b]
2nd	66.480± 1.030809 [a]	63.812±0.234996[a]	62.465±1.387291[a]	63.798±0.783724[a]
3rd	65.607±0.860759[a]	60.365±0.265879[a]	61.422±0.741905[a]	61.980±0.807941[a]

APPENDIX E: Means of firmness (gram) at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	1.285± 16.93209 [a]	1.502±81.62173[c]	1.411±103.0819[b]	1.356±45.3528[b]
2nd	1.202± 44.80695 [a]	1.232±53.7484[b]	1.287±17.69363[b]	1.356±45.3528[b]
3rd	1.186±69.52873[a]	404.580±54.8071[a]	352.403±40.92373[a]	477.028±107.9875[a]

APPENDIX F: Means of a* value at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	3.628±1.208011 [a]	0.848±2.785601[a]	3.945±1.316526 [a]	22.045±6.408604[a]
2nd	10.100±0.86978 [b]	12.675±0.408768[b]	13.590±0.446632[b]	13.238±0.339743[a]

3rd	11.132±0.41594[b]	11.615±0.489396[b]	11.430±0.251893[b]	12.638±0.411367[a]

APPENDIX G: Means of b* value at three different harvested of muskmelon *(cucumis melo)* during storage period at ambient temperature ($24^0 \pm 0.2^0$C)

Harvesting	Storage (day)			
	0	3	6	9
1st	25.793±1.106951[a]	26.495±1.085123[a]	28.182±1.163252[a]	28.24±0.415792[a]
2nd	31.855±1.310779[b]	33.370±0.408768[b]	35.682±0.926385[b]	33.865±1.727216[b]
3rd	32.767±1.220761[b]	30.245±1.203914[a]	28.670±1.052006[a]	30.390±1.586951[a]

Raw Data

APPENDIX H: Total soluble solid (TSS)

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	4.9	4.9	5.0	5.3
	5.0	5.0	4.8	5.35
	4.65	4.75	5.0	5.1
	4.9	4.7	5.05	5.15
2	10.6	9.25	10.3	9.4
	10.0	9.9	10.7	8.85
	10.2	10.45	9.8	9.15
	10.25	9.75	11.0	9.1
3	10.2	8.4	9.4	8.2
	10.0	8.5	9.3	7.8
	9.8	9.0	9.1	7.7
	10.1	8.9	9.2	8.0

APPENDIX I: pH

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	5.96	5.9	5.97	5.84
	5.82	5.79	5.88	5.84
	5.77	5.93	5.84	6.06
	5.76	5.83	5.84	6.22
2	6.93	6.84	6.85	7.25
	6.77	6.84	7.05	6.79
	6.76	6.76	6.85	6.43
	6.91	6.76	7.03	6.68
3	6.37	6.32	6.41	6.28
	6.41	6.35	6.44	6.33
	6.3	6.36	6.46	6.29
	6.3	6.4	6.33	6.39

APPENDIX J: Firmness

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	1321.67	1373.65	1681.75	1487.96
	1302.12	1373.56	1447.95	1294.39
	1272.1	1549.05	1312.57	1340.77
	1244.55	1713.57	1203.27	1299.06
2	1095.8	1339.05	1334.02	1487.96
	1179.59	1193.57	1254.8	1294.39
	1310.81	1295.07	1265.49	1340.77
	1223.74	1098.76	1293.81	1299.06
3	1277.67	464.029	474.825	725.834
	1248.3	342.536	307.553	309.635
	1237.716	525.582	306.922	589.122
	978.509	286.171	320.312	283.519

APPENDIX K: Vitamin C

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	62.18	61.99	71.6	47.69
	86.04	66.89	100.21	71.87
	100.32	71.53	76.37	71.57
	57.28	62.08	95.56	66.9
2	100.22	86.15	66.88	47.69
	95.62	105.08	86.04	71.87
	105.27	95.85	76.53	71.57
	106.48	110.36	90.71	66.9
3	86.07	67.04	57.52	47.93
	104.92	67.18	76.42	47.88
	95.87	57.59	76.14	47.76
	95.77	57.46	67.19	123.58

APPENDIX L: L*value

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	67.82	60.23	68.28	67.55
	67.58	66.14	69.33	67.19
	69.82	73.85	68.95	69.49
	71.69	69.15	69.45	68.35
2	69.33	64.48	65.24	62.59
	65.21	63.52	64.26	63.01
	64.75	63.45	61.11	63.51
	66.63	63.8	59.25	66.08
3	67.41	59.81	63.25	60.31
	65.25	60.81	61.11	61.44
	66.38	60.01	61.67	62.01
	63.39	60.83	59.66	64.16

APPENDIX M: a* value

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	5.94	7.27	1.87	2.85
	4.9	3.65	3.21	28.76
	3.27	-2.91	2.9	29.13
	0.4	-4.62	7.8	27.44
2	7.56	11.47	13.33	12.93
	11.51	13.13	13.78	13.03
	10.66	12.87	12.55	13.3
	10.67	13.23	14.7	13.69
3	11.63	11.44	11.2	11.55
	11.72	12.85	10.83	13.27
	9.93	11.7	11.8	13.28
	11.33	10.47	11.89	12.45

APPENDIX N: b* value

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	25.87	27.88	25.41	27.63
	28.37	28.74	27.99	28.76
	22.96	24.14	28.23	29.13
	25.97	25.22	31.10	27.44
2	35.62	31.85	34.75	31.31
	31.14	34.40	34.35	32.04
	31.13	33.37	35.22	35.25
	29.53	33.86	38.41	36.87
3	34.02	27.07	28.04	26.13
	35.38	32.91	26.01	33.8
	31.84	30.7	30.76	30.61
	29.83	30.3	29.87	31.02

CURRICULUM VITAE

Name	: Sarimah binti Ariffin
Permanent Address	: A-1435 Kampung Banggol, Mengabang Telipot; 21030 Kuala Terengganu Terengganu Darul Imam.
Telephone Number	: 013-9058517
E-mail	: sarimah_ariff@yahoo.com
Date of Birth	: 07 Ogos 1986
Place of Birth	: Hospital Besar Kuala Terengganu
Nationality	: Malaysian
Race	: Malay
Gender	: Female
Religion	: Islam

Educational Background :

2007 – 2009 Universiti Malaysia Terengganu

2004 – 2007 Kolej Universiti Sains dan Teknologi Malaysia

2003 - Sekolah Menengah Kebangsaan Kompleks Mengabang Telipot

1993 – 1998 Sekolah Kebangsaan Mengabang Telipot

Awards:

Dis 2005/2006	Dean Least Diploma In Fisheries
July 2006/2007	Dean Least Diploma In Fisheries
Dis 2006/2007	Dean Least Diploma In Fisheries

EFFECTS OF DIFFERENT HARVESTING DATES ON SHELF-LIFE OF MUSKMELON, CUCUMIS MELO - SARIMAH BINTI ARIFFIN