THE EFFECT OF DIFFERENT HARVESTING DATES ON SHELF LIFE OF EGGPLANT (*Solanum melongena*)

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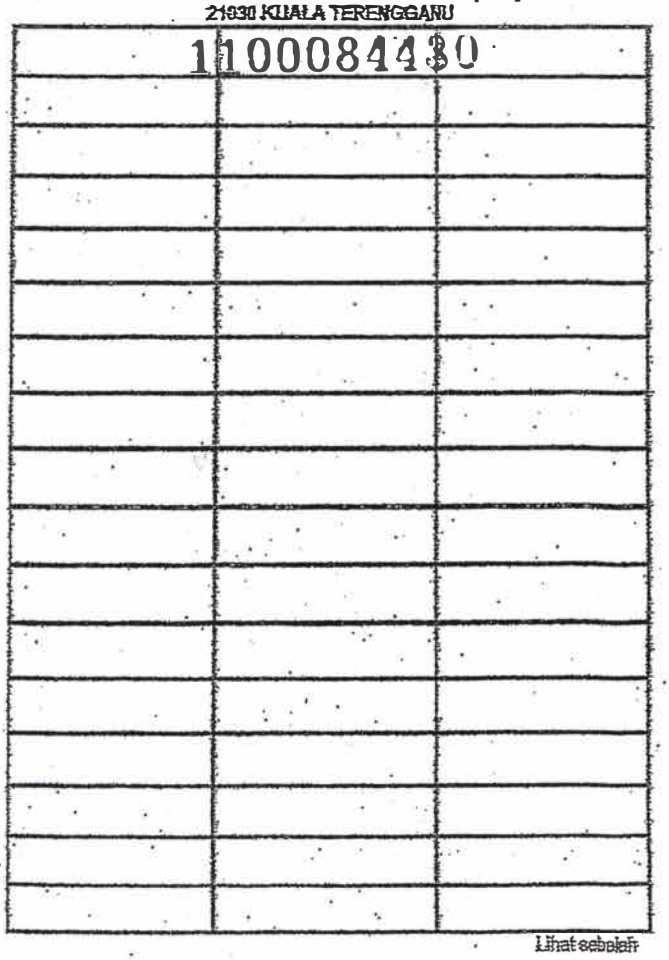

THE EFFECT OF DIFFERENT HARVESTING DATES ON SHELF LIFE OF EGGPLANT (*Solanum molengena*)

By
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Research Report submitted in partial fulfillment of
the requirements for the the degree of
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DEPARTMENT OF AGROTECHNOLOGY
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ENDORSEMENT

The project report entitle The **Effect Of Different Harvesting Dates On Shelf Life of Eggplant (*Solanum molengena*)** by **Siti Faridah Hamdillah** Matric No**. UK 16337** 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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DECLARATION

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

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ABSTRACT

This study was conducted to determine the effect of different harvesting date on the shelf life of eggplant (*Solanum molengena*). Eggplant trees were planted with fertigation system at Green House, Department of Agrotechnology, and University Malaysia Terengganu. The entire samples ware tagged after flower bud emerged and harvested at three different times where the first harvesting dare was (25 days after tagging), second harvesting date (30 after tagging) and third harvesting date (35 days after tagging). After harvesting, all the samples were evaluated with physical and chemical analysis of firmness, skin color, vitamin C, pH, and total soluble solid (TSS) every 3 days over a storage at ambient for 9 days. The fruit of the first harvesting date contained high sugar compared to the second and the third harvesting. The higher content of vitamin C was obtained in the third harvesting date followed by second harvesting date and first harvesting date. The pH value of three harvesting dates showed an increase trend from day 0 until day 9 during storage (24 ± 0.2^{0}C). The firmness was higher in the first harvesting date compared to the second and third harvesting dates. The high value of firmness also related to the shiny skin color of eggplant. From the results, the best quality of eggplant was found when the fruits were harvested at 25 days after tagging (flower bud emerged). This stage had high total soluble solid, shiny skin and flesh firmness

ABSTRAK

Kajian ini telah dijalankan untuk menentukan waktu penuaian terhadap jangka hayat terung (*Solanum molengena*). Pokok terung ditanam secara fertigasi di Makmal Tanaman Lepas Tuai, Fakulti Agroteknologi dan Sains Makanan, Universiti Malaysia Terengganu. Semua sample di tanda selepas kudup bunga keluar dan di tuai sebanyak tiga kali iaitu tuaian pertama (25 hari selepas ditanda), tuaian kedua (30 hari selepas ditanda) dan tuaian ketiga (35 hari selepas ditanda). Selepas dituai semua sample dianalisis dari segi fizikal dan kimia termasuk kandungan vitamin C, gula, pH, kekerasan dan warna kulit. Buah pada hasil tuaian pertama mempunyai kandungan gula yang tinggi berbanding tuaian kedua dan tuaian ketiga. Kandungan vitamin C tinggi pada hasil tuaian ketiga berbanding tuaian kedua dan pertama. Nilai pH pada ketiga-tiga hasil tuaian menunjukkan menurunan dari hari 1 hingga hari ke semasa penyimpanan.($(24\pm0.2^{0}C)$. Nilai kekerasan pada hasil pertama tuaian lebih tinggi berbanding tuaian kedua dan ketiga. Nilai kekerasan yang tinggi membuktikan bahawa kulit buah terung pada hasil tuaian pertama lebih berkilat. Hasil daripada kajian saya, kualiti buah yang baik adalah pada hasil tuaian pertama iaitu 25 hari selepas kudup bunga keluar. Pada hasil tuaian ini, buah terung mempunyai kandungan gula yang tinggi, kulit yang bersinar dan kekerasan isi yang baik untuk penyimpanan.

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LIST OF ABBREVIATONS

^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

1.1 Background of study

Eggplant prefers a sunny location, a long growing season, and fertile, well-drained soil for best yields. The eggplant, aubergine, or brinjal (*Solanum melongena*), is a plant of the family *Solanaceae* (also known as the nightshades) and genus *Solanum*. The fruit is a pendant berry; whish can be ovoid to oblong in shape. Most cultivar are dark purple, although white, yellow and variegated varieties are grown. Aubergine is classified as a non-climacteric fruit and will freeze at about -1.0 to 0.7°C (Wright 1942) or -0.94 to 0.78°C (Weichmann 1987). Inaba *et al.* (1989) found that there was increased respiration in response to ethylene at 100 µl litre $^{-1}$ for 24 hour at 20- 35°C, but the effect was much reduced at lower temperature.

2.1 Problem statement

Many farmers harvesting their crop at not suitable time means the crop is still not mature. The shelf life of produce was short and not suitable for export in long distance. It is so important to determine the optimum of harvesting date to make sure the produce will be able to eaten for long period.

1.3 Significant of study

The study can help farmers to harvest the produce at the suitable time to prolong the shelf life and to make sure the produce is still fresh during transportation. This study include research about pre-harvest factor which is divided into two that is control and uncontrolled. The result of this study can help farmer to harvest their crop at the optimum stage of maturity and obtaining the best final eating quality.

1.4 Objective

The objective of this study is to determine the:-

1. Shelf life of eggplant based on the harvesting date
2. Optimum harvesting date of eggplant that the most retain the longer period of shelf life under ambient condition.

CHAPTER 2

LITERATURE REVIEW

2.1 *Solanum molengena*

It is an annual crop cultivated all over India as one of the principal vegetables. The fruit are available practically throughout the year. The unripe fruit are used a vegetable alone or with potatoes and tomatoes or in curries. The fruits are employed as a cure for toothache. It is also an excellent remedy for those suffering from liver complaints.

It's green leaves are the main source of antiscorbutic Vitamin C. according to the Aykroyd (1941) 100 grams of edible fruit contain 91.5 g water, 6.4 g carbohydrates, 1.3 g protein, 0.3 g fat and 0.5 g mineral matter. The quality of a crop at harvest can have a major effect on its postharvest life. There are numerous factors involved and these factors frequently interact, giving complex interrelationships.

In tree crops, fruit produced on the same tree and harvested at the same time may behave differently during marketing or when stored. Medlicott *et al.* (1987a) showed that early maturing mangoes tended to have better quality and postharvest characteristic than those that matured later. Late-harvested Braeburn apples were more susceptible to flesh and core browning (Rabus and Streif 2000).

2.2 Experimental factors

There are several experimental factors which can be controlled such as light, water, and nutrient such as fertilizer whereas for the pre-harvest factor which cannot be controlled such as temperature.

2.3 Pre-harvest factor

There are several factor of pre-harvest which is very important to determine the quality of produce. Pre-harvest factor will determine the development of trees. There are a few of preharvest factors on postharvest life and one of this factors is harvesting date which is very important to maintain the shelf life of produce.

The shelf life is the length of time a product may be stored without becoming unsuitable for use or consumption. According to Linke, Kläring (1974) yield component and quality parameters at the date of harvest are the key areas of interest in preharvest investigation

2.4 Postharvest handling of Eggplant

The stage of development of vegetables when harvested affects the quality of the product reaching the consumers. In some vegetables, such as the bean and pea, optimum quality are reached well in advance of full maturity and then deteriorates, although yield continues to increase. Factors determining the harvest date include the genetic constitution of the vegetable variety, the planting date, and environmental conditions during the growing season. Successive harvest dates may be obtained

either by planting varieties having different maturity dates or by changing the sequence of planting dates of one particular variety.

According to the Drost, (2005), eggplant is generally harvested when fruits are full size, have a glossy sheen, and are 6 to 8 inches long. Fruits that are firm, plump and fully colored, with smooth skin have the best flavor and quality. The fruit are harvested when they are reach a size that the market requires, but if this is delayed too long they can become seedy a, dull and fibrous (Pantastico 2004). Use a knife or pruning shears to cut the stem when harvesting rather than twisting off the fruits.

Wear gloves, as eggplant has small prickly thorns on the stems and under the leaves. Pick fruits as they mature. Mature eggplant will store for 7 days if held at 50-55°F. Fruits are subject to chilling injury if refrigerated. Over mature fruits are dull colored, soft, seedy, and taste bitter. Eggplant is not suitable for canning or drying, but can be frozen.

2.5 Fertigation

Common advantages of fertigation, is the application of fertilizers through an irrigation system, include considerable savings in the labor and energy costs of application, chemicals are already in solution form and thus immediately available to the plants throughout the root zone, flexibility in irrigation timing makes it easier to schedule fertilization, soil compaction is minimized by avoiding heavy equipment traffic through the field and small doses of chemical are applied when needed, reducing leaching of water-soluble nutrients during periods of excessive rainfall or over-irrigation (Burt et al. 1998, Boman and Obreza 2002).

CHAPTER 3

MATERIALS & METHODOLOGY

This study was conducted at the Green House of Postharvest Laboratory, Department Agrotechnology, and University Malaysia Terengganu.

3.1 Materials

Set of fertigation systems, glassware, pH meter, refractometer, texture analyzer, chromameter. Seed material which used in this study was bought from the shop supplied by Leckat Corporation Sdn. Bhd under trademark 'Green World'and the seed were F1 hybrid round eggplant no. 311.

3.1.1 Chemical reagents

0.1 N sodium hydroxid, 2, 6-dichloroindophenol, distilled water

3.2 Method

3.2.1 Seed Germination and Plant Fertigation

The seed were soaked in H_20 for 24 hours. Each seed were kept in a hole of seeding traying contain peat moss. After two weeks, each seedling was transferred into the cup. After 2 weeks in the cups, each seedling was transferred into fertigation set. The fertilizer was mixed with water. Solution of fertilizer was applied thought the system of fertigation using pump electric timer.

Table 3.1: The schedule of the fertilizer application in the fertigation system.

WEEK	TIME	FREQUENCY (PER DAY)	DAY	MINT	EC (Electron Conductivity)
1	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	4 – 5	1 – 7	4	1.4 – 1.6
2	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	8 – 14	5	1.6 – 2.0
3	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	15 – 21	5	2.0 – 2.4
4	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	22 – 28	5	2.5 – 2.6
5	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	29 – 35	5	2.6 – 2.7
6	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	36 – 42	5	2.6 – 2.7
7	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	43 – 49	5	2.6 – 2.7
8	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	50 – 56	6	2.6 – 2.7
9	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	57 – 63	6	2.7 – 2.8
10	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	64 – 70	6	2.7 – 2.8
11	7.30am, 9.30am, 11.30am, 1.30pm, 3.30pm, 5.30pm	6	71 – 77	6	2.7 – 2.8

3.2.2. Tagging

The process of tagging was started after the flower bud emerged. The eggplant was harvested at the following time of maturity. The entire sample was brought to laboratory and the physical and chemical characteristics were measured.

Figure 3.1: Process of tagging

3.2.3 Chemical and physical analyses

There were several chemical analyses involved which are vitamin C, pH, Total Soluble Solid (TSS) and for physical analyses which are texture, and skin color.

3.3 Determination of vitamin C

Chemical and reagent used is 3% metaphosphoric acid i.e 15 gm HPO3 in + 0.4653 gm ethylendiaminetetraacetic acid disodium salt (EDTA) in 500 ml distilled water or 60 gm HPO3 + 1.8612 gm EDTA in 2 liter distilled water, 0.05 gm 2,6-dichloroindophenol + 0.042 gm NaHCO3 in 150 ml hot distilled water – the chemical solution allowed to cool and let it cool and dilute to 200 ml 0.1 gm Standard ascorbic acid was weight and makeup with 3% HPO3 into 200 ml volumetric flask.

3.3.1. Procedures

The sample was grilled with grinder machine. 10 gram of sample was adding with 20 ml 3% HPO3 makeup to 100 volumetric flasks with distilled water. After that, the solution was filtered using filter paper. 5 ml of sample was take and added with 5 ml HPO3. Then the sample was titrated with indophenol dye until the color changed from white to light pink.

Formula:

1. Standard Ascorbic Acid

Volume of titre = x ml

X ml titre of dye =2.5 mg vitamin C (5 ml standard)

Hence 1 ml =2.5 /x mg vitamin C

2. Ascorbic Acid formula:

$$\text{Percentage of ascorbic acid} = \text{mean titre} * \text{Standard Factor} * \text{Dilution } (100/5) \frac{100\%}{\text{Initial Weight}}$$

3.4 Determination of °brix (TSS)

Each replicate was analyzed using the refractometer (model ATAGO RR-1) for determined the total soluble solid (TSS). This refractometer is bases on light refraction form one medium to another medium. The eggplant flesh was blended to obtain a homogenous sample. This analysis was done to determine how much the total soluble solid in the sample.

The sample was grinded until it's become homogemous. Then, distilled water was dropped into the lens for calibration. After get obtain the reading, dry up the distilled water using clean tissue paper. Place a dropped of sample on the lens. The value was taking and repeats the same procedure.

3.5 Determination of pH

Determination of pH was done using pH meter. After grinding the sample, take 5 gram and put into beaker. Place the pH probe into the sample. Take the reading.

3.6 Determination of texture

The texture of the eggplant flesh was evaluated using Texture Analyzer (TA.XT PLUS). The probe used was P/2N needle stainless. Texture analyses were done on the sample to determine its degree of texture flexibility of a particular sample. If the texture of a particular sample was soft, therefore it can be concluded that only small amount of force are required to penetrate the sample. If the sample is more firm, more force is required to penetrate the sample.

Figure 3.2: Determination of firmness using texture analyzer

3.7 Determination of L*, a*, b* values using Chroma Colorimeter

The external skin color for eggplant was evaluated using colorimeter (Chromameter model CR-200, Minolta). In this color space, L* indicates lightness and a* and b* are the chromaticity coordinates. Lightness, L* is corresponding to the vertical axis with the range from 0 to 100 that is black to white. Whereas, the value represented a color range from green to red which is values are -60 to +60. If the higher values of b* indicated a greater intensity of yellow color.

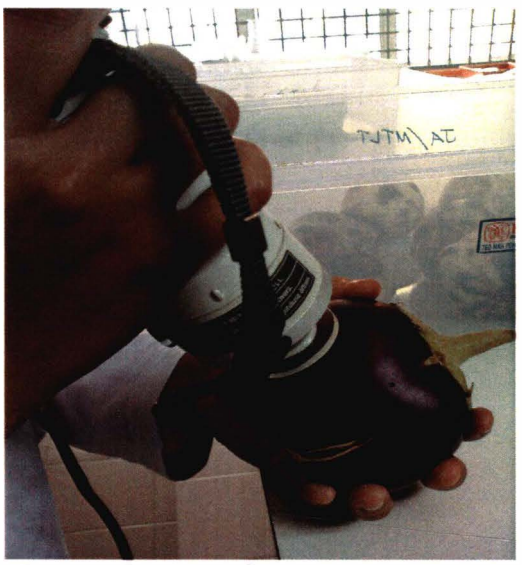

Figure 3.3: Determination of skin color using chromameter

CHAPTER 4

RESULT AND DISCUSSION

4.1 Total Soluble Solid (TSS)

Figure 4.1 showed that the total soluble solid of eggplants consistent reading between three different harvesting times. For second and third harvesting, the value of total soluble solid showed consistent value from day 0 until day 9 except for day 0 in second harvesting where the value was higher than third harvesting. The higher value of total soluble solid was observed in the first harvesting. Based on the result, it showed that fruits harvested in the first harvesting date contain high sugar compared to the second and the third harvestings. This indicated that carbohydrate content in first harvesting date was higher than the second and third harvesting dates.

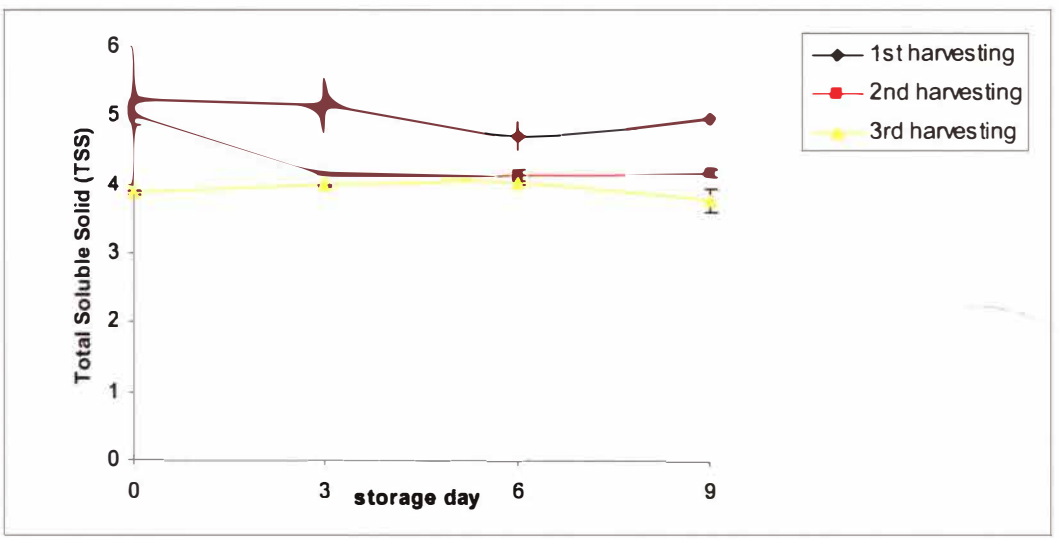

Figure 4.1: The changes of total soluble solid value from different harvesting dates of eggplant (*Solanum molengena*) stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

According to Chen *et al,.* (2006) the time of harvest significantly influence the carbohydrate contents in fruit and vegetable where the respiration rate increase during postharvest storage time at ambient temperature. An increase in respiration enhances the consumption of sugar as substrate for several metabolic processes. The first substrate used during respiration is sugar. A close relationship between respiration and sugar levels was noticed in peaches during storage. Total soluble solid (TSS) of the first harvesting was significantly ($P< 0.05$) higher than the second and third harvestings. (APPENDIX A)

4.2 Vitamin C

Figure 4.2 showed the value of vitamin C in different time of harvesting. For third harvesting the value of vitamin C was decreased from day 0 until day 3, then increase from day 3 until day 9. While for the second harvesting the value increase consistently from day 0 until day 9. The value of vitamin C in first harvesting was obviously consistent from day 0 until day 3, increased in day 6 but decreased again in day 9. The higher content of vitamin C was found in the third harvesting date followed by the second harvesting and the first harvesting. Since the eggplant was stored at ambient temperature for 9 days, the composition of vitamin C increased with storage period.

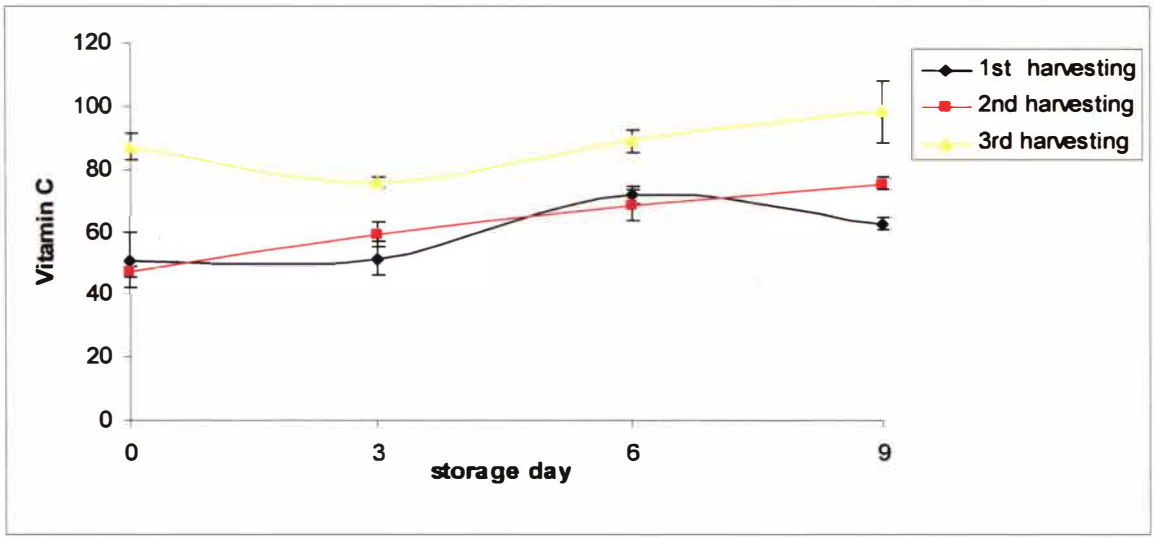

Figure 4.2: The changes of vitamin C from different harvesting dates of eggplant (*Solanum molengena*) stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

Eggplant is rich in vitamins A, B and C. Eggplants are rich in Calcium, Phosphorous, β-carotene and Potasium and also serves as an excellent source of vitamin C, iron, niacin and folate. Besides, eggplant also contains folic acids. There was significantly ($P<0.05$) higher Vitamin C in the third harvesting compared to the first and second harvestings. (APPENDIX B)

4.3 pH

Figure 4.3 showed pH value of eggplant in three different harvesting times stored from day 0 until day 9. The pH value was high in the first harvesting followed by the third harvesting and the second harvesting. For the first harvesting pH decreased consistently from day 0 until day 9. In second harvesting, the pH value was high and also decreasing until day 9.

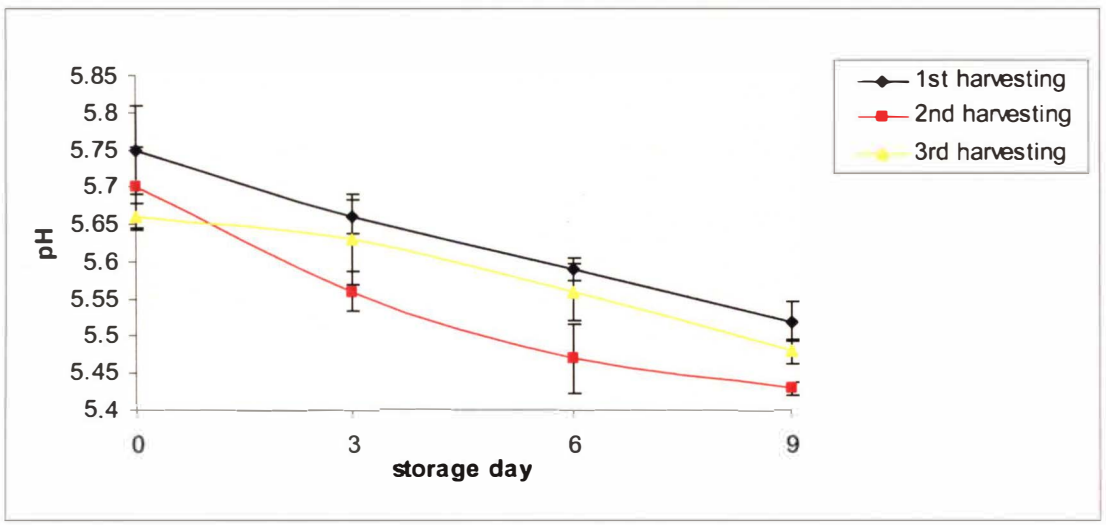

Figure 4.3: The changes of pH value in different harvesting date of eggplant (*Solanum molengena*) which stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

On the first day of evaluation, pH analysis for the third harvesting showed a slight decreased in pH from day 0 until day 3 but the value decreased consistently from day 3 until day 9. The pH value of eggplant decreases gradually during storage at ambient. The acidity increased through the biochemical changes within the fruit during storage. These observations are in accordance with findings of Khalid in (1974) who found that pH value of apple juice increased during storage intervals..

This increase in acidity and decrease in pH has been observed by Khalid *et al.*, (1991) and Wright and Kader (1997). There. There was no significant difference ($P>0.05$) in pH value over three harvesting dates. (APPENDIX C)

4.4 Firmness

According to the figure 4.4, the firmness value was higher in first harvesting compared to second and third harvesting. For the second and third harvesting, the firmness was almost the same from the beginning to the end of analysis which is from day 0 until day 9. Overall, the fruit firmness increased with storage period except for the second harvesting. Eggplant contains high amount of fiber that may cause the texture became firm.

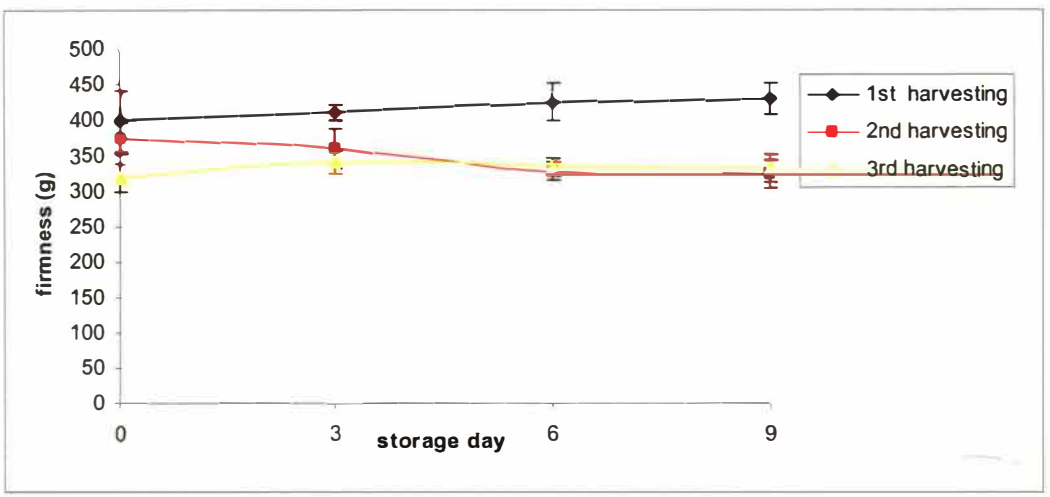

Figure 4.4: The changes of firmness from different harvesting dates of eggplant (*Solanum molengena*) stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

Although the exact biochemical mechanism have not yet been fully established, it is believed that softening is largely due to the breakdown of starch and other non-pectic polysaccharides in the pulp, thereby reducing cellular rigidity (Lizada *et al.*

1990). The changes in texture was due to the breakdown of starch to form sugar since starch granules could have a structural function in the cells and also the breakdown of the cell walls due to the solublization of pectic substances and even the breakdown of cellulose. (Thompson , 2003). There was no significant difference (P>0.05) in firmness values among all the three harvesting dates.

(APPENDIX D)

4. 5 L* value of skin color

Figure 4.5 showed the value of L* (lightness) of eggplant for the first harvest was almost the same from day 0 until day 9. While for second harvesting the value of L* decreased from day 0 until day 3 then increased from day 6 until day 9. For the third harvesting, the value of L* was increased form day 0 until day 3, decreased on day 6 and increased again on day 9.

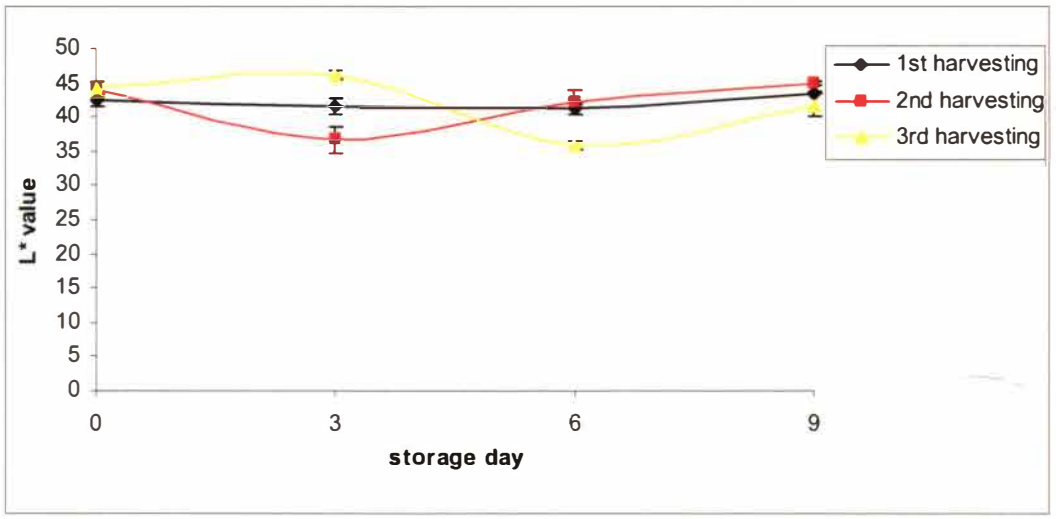

Figure 4.5: The changes of L* value are different harvesting dates of eggplant (*Solanum molengena*) stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

Generally the L* value (lightness) indicated lighter color where the color of fruit changed as chlorophyll pigment started to deteriorate and β-carotene production was initialized and at maximum (Chiesa *et al.*, 1998). There was significant difference ($P<0.05$) in L* value in first and second harvesting dates. (APPENDIX E)

4.6 a* value of skin color

Figure 4.6 showed the value of a* for skin color of eggplant in three harvesting times. For the first harvesting date, the a* value was lower compared to the other two harvestings dates. The higher value of a* was observed in the third harvesting followed by the second harvesting. On the a* axis, positive values indicated the amount of red, while negative values indicated the amount of green.

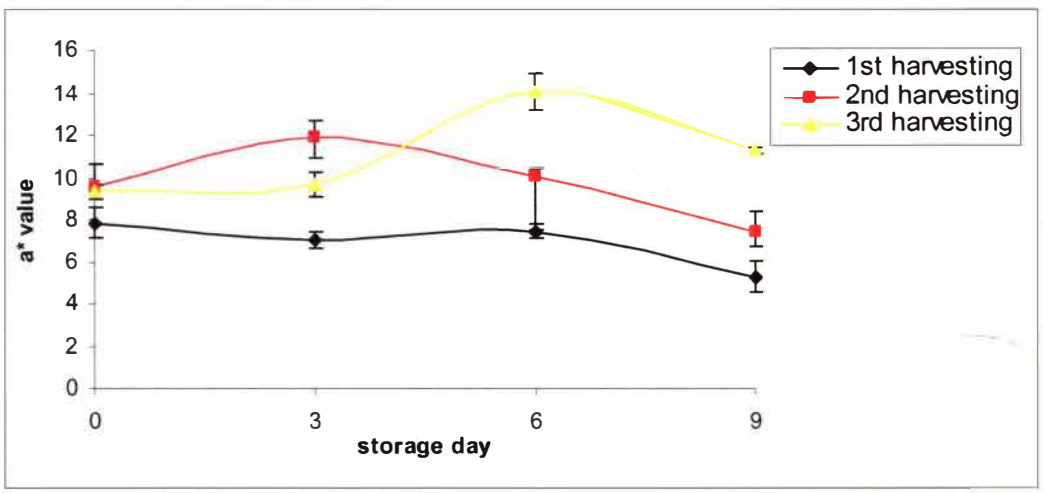

Figure 4.6: The changes of a* value are different harvesting dates of eggplant (*Solanum molengena*) stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

The graph showed all positive value, which means there was no green color of skin in eggplant from day 0 until day 9 in all the three harvestings dates. Skin color was normally used for fruit and vegetables where skin color changes occur as the fruit ripens or matures, but in some fruits there is no observation of color changes during maturation. The pigment of chlorophyll in eggplant after matures will reduce until become dark purple color when matures. The changes in color of ripening fruit are associated with the breakdown of chlorophylls with carotenoid levels remaining relatively constant (Seymour 1985; Montenegro 1988). There was significant difference ($P<0.05$) in a* value between the second and third harvesting dates.

4.7 b* value of skin color

Figure 4.7 demonstrate the b* value in first, second and third harvestings times of eggplant. On the b* axis, yellow is positive and blue is negative. For both color axes, zero is neutral grey. Based on the graph, there is a negative b* value in three harvesting times. The value of b* is not consistent either in the first harvesting, second harvesting and third harvesting from day 0 until day 9 which indicated that all the eggplant skin were not yellow in color.

The increase value of b* indicated the fruit changes into dark blue. Anthocyanins give red, purple and blue color to many fruit and vegetables, cereals and flowers. The stability of anthocyanins depends on the pH and the chelation of metal ions. (Paliyath *et.,al* 2008)

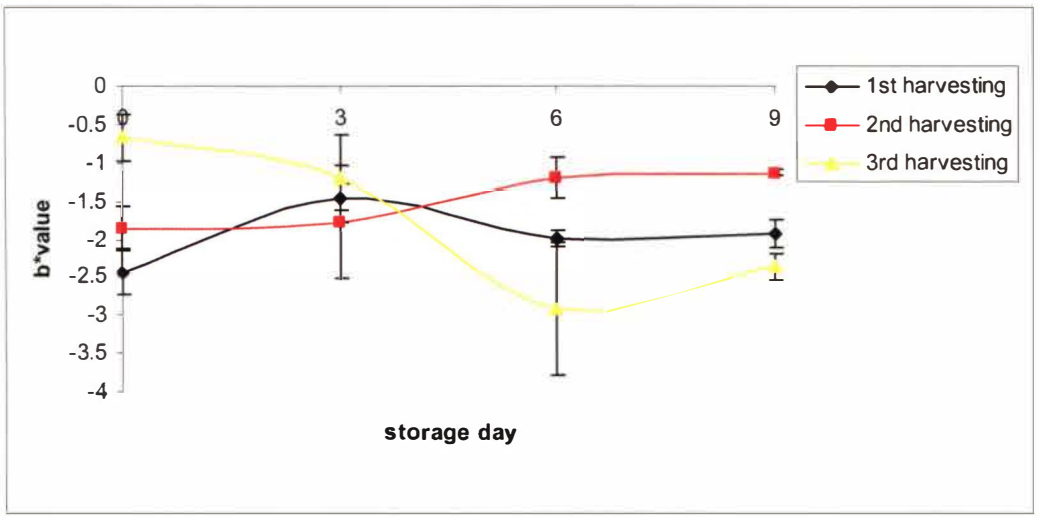

Figure 4.7: The changes of b* value are different harvesting date of eggplant (*Solanum molengena*) stored at ambient temperature 24±0.2^{0}C. The vertical bars indicate the standard error

They are stable under acidic condition and are rapidly broken down under neutral condition. Environmental factors such as light and temperature effect anthocyanins accumulation in fruit. There was significant difference ($P<0.05$) in b* values among the three harvesting dates.

CHAPTER 5

CONCLUSION

Among the three harvesting dates, first harvesting showed the best quality in shelf life. The fruit from the first harvesting contain high amount of vitamin C and sugar content even if stored at ambient temperature (± 25^0C) for 9 days. The fresh and fairly hard texture of eggplant in first harvesting date proved that its can be stored for longer period of time even in ambient temperature. pH value of eggplant in first harvesting showed lower acidity which means can be eaten even stored for 9 days under ambient temperature. The skin color of eggplant in first harvesting was so shiny with darker purple compared second and third harvesting date. With the shining of skin color, its will intriguing buyer during sell and display vegetables in market. Its can concluded that the first harvesting times is the best harvesting time because it is provide good quality in shelf life of eggplant during storage in ambient temperature.

RECOMMENDATION

Longer storage period (extent the storage of eggplant until 20 days). Studies on the storage quality (shelf life) at the optimum storage temperature of eggplant which 6-8^0C. . More parameters are done such as fibre, anthocyanin contents and so on.

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APPENDIX A: Means of Vitamin C in three different harvesting date of eggplant (*Solanum molengena*) during storage period at ambient temperature. (24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	5.0000± 0.127845^{b}	5.1267±0.398344^{b}	4.5567±0.203415^{a}	5.0367±0.069841^{c}
2nd	5.0000± 0.141774^{b}	3.8967±0.078599^{a}	4.1333±0.088757^{a}	4.1667±0.061734^{b}
3rd	3.8767±0.039299^{a}	4.0133±0.008819^{a}	4.0367±0.031798^{a}	3.6767±0.169542^{a}

APPENDIX B: Means of TSS in three different harvesting date of eggplant *(Solanum molengena*) during storage period at ambient temperature. (24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	51.0033±8.455851^{a}	50.3367±5.161202^{a}	79.1800±3.027546^{a}	59.687±1.804497^{a}
2nd	47.3833±1.883484^{a}	63.0700±3.939657^{ab}	72.0867±4.953592^{ab}	77.833±1.771349^{ab}
3rd	87.1933±4.207867^{b}	72.2700±1.713369^{b}	93.4033±3.858576^{c}	101.790±9.668526^{b}

Means within columns with same letters are not significantly different (P>0.05)
Means within columns with different letters are significantly different (P<0.05)

APPENDIX C: Means of firmness in three different harvesting date of eggplant (*Solanum molengena*) during storage period at ambient temperature. (24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	399.600±43.30117^a	415.060±12.23459^a	430.760±26.34337^b	432.007±22.49483^b
2nd	375.997±22.17099^a	356.953±27.35484^a	318.147±12.43786^a	322.330±19.69015^a
3rd	319.560±19.8556^a	348.473±16.66652^a	333.073±13.29413^a	332.597±19.14618^a

APPENDIX D: Means pH value of in three different harvesting date of eggplant *(Solanum molengena*) during storage period at ambient temperature. (24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	5.7467±0.058405^a	5.6333±0.023333^a	5.5600±0.015275^a	5.5000±0.026458^a
2nd	5.6967±0.054874^a	5.5200±0.026458^a	5.4367±0.047022^a	5.4233±0.008819^a
3rd	5.6567±0.018559^a	5.6200±0.061101^a	5.5433±0.061101^a	5.4500±0.01732^a

Means within columns with same letters are not significantly different (P>0.05)
Means within columns with different letters are significantly different (P<0.05)

APPENDIX E: Means L* value of in three different harvesting date of eggplant *(Solanum molengena)* during storage period at ambient temperature. (24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	42.4067±0.974771^a	42.6767±1.186119^b	40.7533±0.775056^b	44.1800±0.131149^a
2nd	43.9033±1.143173^a	34.2333±1.900477^a	43.9900±1.929223^b	45.8533±0.396709^a
3rd	44.3100±0.816721^a	46.6567±0.680106^b	32.3133±0.585273^a	43.5633±1.637929^a

APPENDIX F: Means a* value of in three different harvesting date of eggplant *(Solanum molengena)* during storage period at ambient temperature(24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	-2.4300±0.300056^a	-1.1267±0.172948^a	-2.1733±0.103494^{ab}	-1.9100±0.1823^a
2nd	-1.8633±0.28591^{ab}	-1.7467±0.73994^a	-1.0100±0.265141^b	-1.1000±0.045826^b
3rd	-.6667±0.308887^b	-1.3800±0.570731^a	-3.4833±0.880423^a	-2.1933±0.161898^a

Means within columns with same letters are not significantly different (P>0.05)
Means within columns with different letters are significantly different (P<0.05)

APPENDIX F: Means b* value of in three different harvesting date of eggplant *(Solanum molengena)* during storage period at ambient temperature (24±0.2^{0}C)

Harvesting	Storage (day)			
	0	3	6	9
1st	7.8333±0.707445^a	6.7567±0.392697^a	7.5800±0.363456^a	4.5667±0.745438^a
2nd	9.5200±1.103917^a	12.6700±0.759759^b	9.4833±0.394307^{ab}	6.5733±0.933994^b
3rd	9.3200±0.55003^a	9.8033±0.973932^{ab}	15.4833±2.533781^b	10.3767±0.753488^c

Means within columns with same letters are not significantly different (P>0.05)
Means within columns with different letters are significantly different (P<0.05)

APPENDIX H: Raw data on Total Soluble Solid (TSS)

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	5.27	5.52	4.93	4.9
	4.94	4.33	4.23	5.13
	4.79	5.53	4.51	5.08
2	5.27	4.05	4.31	4.26
	4.94	3.79	4.03	4.19
	4.79	3.85	4.06	4.05
3	3.80	4.01	4.01	3.88
	3.90	4.00	4.10	3.34
	3.93	4.03	4.00	3.81

APPENDIX I: Raw data on vitamin C

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	34.99	42.24	81.83	56.53
	54.30	48.84	82.57	59.75
	63.72	59.93	73.14	62.78
2	51.07	70.85	62.35	76.86
	46.21	60.26	75.37	81.27
	44.87	58.10	78.54	75.37
3	95.36	68.87	87.52	120.97
	81.35	74.34	100.67	90.07
	84.87	73.60	92.02	94.33

APPENDIX J: Raw data of pH

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	5.80	5.67	5.59	5.55
	5.81	5.64	5.54	5.49
	5.63	5.59	5.55	5.46
2	5.79	5.57	5.53	5.44
	5.70	5.48	5.38	5.41
	5.60	5.51	5.4	5.42
3	5.67	5.66	5.54	5.48
	5.68	5.70	5.61	5.45
	5.62	5.50	5.48	5.42

APPENDIX K: Raw data of firmness

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	351.79	393.15	381.96	395.76
	486.04	416.58	437.96	427.05
	360.97	435.45	472.36	473.21
2	397.57	306.8	308.83	292.64
	331.66	363.1	342.78	314.77
	398.76	400.96	302.83	359.58
3	281.25	326.75	340.79	294.45
	329.66	337.44	351.25	348.78
	347.77	381.23	307.18	354.56

APPENDIX L: Raw data of L* value in skin color

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	40.88	44.09	42.14	43.92
	42.12	43.62	39.46	44.28
	44.22	40.32	40.66	44.34
2	45.89	33.75	40.26	46.24
	43.89	37.74	46.71	46.26
	41.93	31.21	45.0	45.06
3	42.81	45.33	33.16	41.38
	45.62	47.58	32.59	42.54
	44.50	47.06	31.19	46.77

APPENDIX M: Raw data of a* value in skin color

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	6.50	7.48	8.07	5.63
	8.09	6.66	7.80	4.94
	8.91	6.13	6.87	3.13
2	11.22	11.24	9.26	8.41
	9.89	13.83	10.25	5.95
	7.45	12.94	8.94	5.36
3	9.88	10.66	14.47	11.69
	9.86	7.860	20.29	9.08o
	8.22	10.89	11.69	10.36

APPENDIX N: Raw data of b* value in skin color

Harvesting dates	Storage period			
	Day 0	Day 3	Day 6	Day 9
1	-1.84	-1.46	-2.06	-2.14
	-2.82	-1.04	-2.38	-2.04
	-2.63	-0.88	-2.08	-1.55
2	-2.35	-1.42	-0.48	-1.04
	-1.88	-0.66	-1.29	-1.19
	-1.36	-3.16	-1.26	-1.07
3	-0.48	-1.9	-2.71	-2.50
	-0.25	-0.24	-5.24	-2.13
	-1.27	-2.00	-2.50	-1.95

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THE EFFECT OF DIFFERENT HARVESTING DATES ON SHELF LIFE OF EGGPLANT (SOLANUM MELONGENA) - SITI FARIDAH BINTI HAMDILLAH