UNIVERSITI PUTRA MALAYSIA

EFFECT OF STORAGE TEMPERATURE ON THE POSTHARVEST QUALITY AND SHELF LIFE OF GINGER *Zingiber officinale* RHIZOME

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EFFECT OF STORAGE TEMPERATURE ON THE POSTHARVEST QUALITY AND SHELF LIFE OF GINGER *Zingiber officinale* RHIZOME

By

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CERTIFICATION FORM

This project entitled **Effect of Storage Temperature on The Postharvest Quality and Shelf Life of Ginger *Zingiber officinale* Rhizome** is prepared by **Nur Athirah binti Shaharudin** and submitted to the Faculty of Agriculture in fulfillment of the PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Horticultural Science.

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ABSTRACT

Zingiber officinale, commonly known as ginger, is significantly important in the spice trade industry because of its high medicinal importance. Its shelf-life and quality is governed by storage temperature and time. The present study pertains to biochemical changes in ginger rhizome during storage. The objective of this study was to determine the effect of storage temperature on the postharvest quality and shelf life of ginger rhizome. The rhizomes were stored at three different temperature: room temperature (RT) (24 ± 1°C); low temperature (LT) (12 ± 1°C); and chilling temperature (CT) (5 ± 1°C) with three replicates of ± 300 g for each experimental unit. The experimental design was completely randomized design (CRD) with three replicates. The data samples were analyzed at different time intervals: weekly on the first month and every two weeks on the second month and third month, which were analyzed on day 0, 7, 14, 21, 28, 42, 56, 70 and 84. Temperature did affect weight, total soluble solids, pH, acidity and microbial growth of ginger rhizomes when stored at different temperatures. There were significant changes in weight loss, total soluble solids, pH and microbial growth. However, there was no significant changes observed in titratable acidity. Shrivelling and sprouting are the limiting factor for further storage at RT, and the high percentage of water loss was responsible for commercially rejection levels of shrivelling. Rhizomes exhibited chilling injury symptoms as water-soaked lesions with tissue softening, browning, extreme water loss and failure to sprout at the chilling temperature (CT) and rapid deterioration of physical, and physiological properties at RT. Low temperature minimized the

biochemical changes and doubled the shelf-life of ginger influenced by temperature and storage time.

ABSTRAK

Zingiber officinale, biasanya dikenali sebagai halia, adalah sangat penting dalam industri perdagangan rempah dan mempunyai kepentingan perubatan yang tinggi. Jangka hayat dan kualitinya dikawal oleh suhu penyimpanan dan masa. Kajian ini adalah berkaitan dengan perubahan biokimia dalam rizom halia semasa penyimpanan. Objektif kajian ini adalah untuk menentukan kesan suhu penyimpanan terhadap kualiti lepas tuai dan jangka hayat rizom halia. Rizom disimpan pada tiga suhu yang berbeza: suhu bilik (RT) (24 ± 1 ° C); suhu rendah (LT) (12 ± 1 ° C); suhu penyejukan (CT) (5 ± 1 ° C) dengan tiga replikasi ± 300 g bagi setiap unit uji kaji. Reka bentuk eksperimen adalah reka bentuk rawak sepenuhnya (CRD) dengan tiga replikasi. Sampel data dianalisis pada selang masa yang berbeza: setiap minggu pada bulan pertama dan setiap dua minggu pada bulan kedua dan bulan ketiga, yang dijalankan pada hari 0, 7, 14, 21, 28, 42, 56, 70 dan 84. Suhu penyimpanan tidak menjejaskan nilai kehilangan berat, jumlah pepejal larut (TSS), pH, keasidan tertitrat dan pertumbuhan mikrob pada rizom halia disimpan pada suhu yang berbeza. Terdapat perubahan ketara dalam kehilangan berat, jumlah pepejal larut, pH dan pertumbuhan mikrob. Walau bagaimanapun, tiada perubahan ketara diperhatikan dalam keasidan tertitrat. Pengecutan dan percambahan adalah faktor yang mengehadkan untuk penyimpanan lanjut di suhu bilik, dan peratusan kehilangan air yang tinggi bertanggungjawab dalam penolakan dalam peringkat komersial. Dalam julat suhu, rizom dipamerkan kesan kecederaan dingin dengan pelembutan tisu, pemerangan, kehilangan air yang melampau dan kegagalan bercambah pada suhu yang paling rendah (CT) dan kemerosotan pesat fizikal dan fisiologi di RT. Suhu

rendah mengurangkan perubahan biokimia dan menggandakan jangka hayat, yang dipengaruhi oleh suhu penyimpanan dan masa.

CHAPTER 1

1 INTRODUCTION

1.1 General introduction

Ginger (*Zingiber officinale* Rosc.) is the underground stem of a herbaceous perennial herbs. It has been cultivated mostly for its rhizomes. Ginger is significantly important in the spice trade industry. It is sold as fresh or, more frequently, in dried form. Ginger is used widely as a spice, pickles, candies and as medicinal herb. It can be grown in many countries but it does best in tropical environment (Ravindran & Nirmal Babu, 2005).

Biological activities and therapeutic effects such as antigastritic and antiulcerative actions, antioxidant and anti-inflammatory effects, antibacterial actions, immunomodulatory effects, and increasing peripheral body temperature have been reported (Yang, et al., 1992.; Masuda & Jitoe, 1994; Sheo, 1999; Ryu & Kim, 2004; Fujisawa, et al., 2005). The use of ginger rhizome is widespread and growing in the health food industry because of recognized health-stimulating properties and medicinal effects.

The largest producers of ginger in the world are India, China and Nepal. In terms of production, Malaysia is one of the largest producer in the world among countries that produced ginger. The production of ginger in Malaysia in 2012 is 9,017 tons

(FAOSTAT, 2014). Since the demand for ginger increases, ginger grower has increasingly keen to expand ginger cultivation to meet market demand.

However, the expansion of ginger industry is limited due to short postharvest life, prone to postharvest diseases and chilling injury. Harvested fresh ginger rhizomes are chilling and drying sensitive and have poor storability (Jeong, Lee, et al.,1998). Loss of quality occurs rapidly because of sprouting, shrivelling, changes in chemical composition, physiological breakdown and microbial growth (Mukherjee, et al., 1995; Paull, et al., 1988).

Various postharvest treatment methods are applied to increase the biological stability and to extend the shelf life of products (Geetha & Thirumaran, 2010). Storage temperature storage is one of the most important factor that can affect postharvest shelf life of ginger rhizomes. Postharvest losses of vegetables have been estimated to be as high as 25 – 50% due to poor postharvest handling and storage temperature management (Nunes & Emond, 2003). Postharvest deterioration of ginger includes physiological loss of water, and shrivelling followed by sprouting.

Root vegetables are also susceptible to high water loss, a major limitation for postharvest storage (Burton, 1982), and various bacteria and fungi that are present in the soil that cause decay during storage (Brecht, 2003). Proper practices such as optimum storage environment are required for ginger to avoid deteriorations, primarily due to decay and softening acceleration.

Because of high medicinal properties and its importance in the food industry, there is a need to retain quality after harvest. The purpose of this study, therefore, is to determine optimum storage temperature for maintaining high quality of ginger rhizomes with slight biochemical changes. The effects of storage temperature and duration on postharvest quality characteristics of ginger rhizomes are investigated.

1.2 General objective

- To investigate the postharvest quality changes in ginger rhizomes due to various storage temperatures and durations
- To evaluate the effect of different storage temperatures on microbial growth of ginger rhizome

1.3 Hypothesis

This study investigated the hypothesis that within the range of temperatures, boundaries between the lower end of chilling injury and upper end of sprouting would decrease postharvest quality and shelf-life of ginger rhizomes. The optimum temperature that maintain postharvest quality and shelf-life of ginger rhizomes would be at low temperature, range of 12 °C.

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