EFFECTIVENESS OF VINEGAR AND SUCROSE IN ROOM TEMPERATURE ON THE VASE LIFE OF POSTHARVEST ROSES

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ABSTRACT

The objective of this study was to evaluate the effect of vinegar and sucrose as a potential floral preservative that can extend the vase life of postharvest roses at room temperature (25 ± 5^0C). The tested treatments were distilled water (control), 0.5% of vinegar, 1.0% of vinegar, 2% of sucrose, 4% of sucrose, 2% of sucrose and 0.5% of vinegar, 4% of sucrose and 0.5% of vinegar, 2% of sucrose and 1.0% of vinegar, and 4% of sucrose and 1.0% of vinegar. The treatments were arranged according to Complete Randomized Design (CRD). Five replicates were prepared for each treatment and replicates were stored in room temperature (25 ± 5^0C). The water loss and vase life data of the cut roses were observed and recorded daily. The bacteria was cultured on the 7^{th} day of experiment. Day 7 was selected as a control day. The data on water loss was compared across the treatments using SPSS software by performing One-way ANOVA. The results suggested that vinegar and sucrose significantly affected the vase life of cut roses ($p<0.05$). Treatments with 2% of sucrose and 0.5% of vinegar was the best treatment to extent the vase life of the cut roses at room temperature (25 ± 5^0C) to 20 days without existence of bacteria .

KEBERKESANAN CUKA DAN SUKROSA DALAM SUHU BILIK TERHADAP JANGKA HAYAT BUNGA KERATAN ROS

ABSTRAK

Kajian ini dijalankan untuk mengetahui kesan keberkesanan cuka dan sukrosa sebagai pengawet bunga yang bagus dalam suhu bilik terhadap jangka hayat bunga keratan ros. Rawatan-rawatan yang dikaji adalah air suling, 0.5% cuka, 1.0% cuka, 2% sukrosa, 4% sukrosa, 2% sukrosa dengan 0.5% cuka, 4% sukrosa dengan 0.5% cuka, 2% sukrosa dengan 1.0% cuka, dan 4% of sukrosa dengan 1.0% cuka. Semua rawatan disusun mengikut Rekabentuk Rawak Lengkap (CRD). Setiap rawatan direplikasi sebanyak lima kali dan disimpan di suhu bilik (25±5 ^{0}C). Jangka hayat dan kuantiti air yang hilang diperhatikan setiap hari dan data tersebut dicatatkan. Pengkulturan bakteria dilakukan pada hari ketujuh kajian. Hari ketujuh dipilih sebagai hari kawalan. Data kehilangan kuantiti air dianalisis dengan menggunakan perisian SPSS (analisis ANOVA Satu-hala). Keputusan yang diperolehi mencadangkan keratan bunga ros yang dirawat dengan 2% sukrosa + 0.5% cuka, merupakan rawatan yang terbaik dimana keratan bunga ros mencapai jangka hayat selama 20 hari pada suhu bilik (25±5 ^{0}C), ($p<0.05$) tanpa kehadiran bakteria.

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ANOVA	Analysis of Variance
BA	benzyladenine
Chl	Chlorophyll
ClO_2	Chlorine dioxide
DDMH	dimethyl-thydanton
HQC	hydroxyquinoline citrare
PCD	Programmed Cell Death
PGR	Plant Growth Regulator
RH	Relative Humidity
RM	Ringgit Malaysia
SSA	School of Sustainable Agriculture
STS	Silver thiosulfate
UMS	Universiti Malaysia Sabah
SPSS	Statistical Package for Social Science

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Rose is a perennial flower shrub or vine of the genus *Rosa*, within the family Rosaceae, that contains over 100 species and comes in a variety of colours. The species form a group of erect shrubs, and climbing or trailing plants, with stems that are often armed with sharp prickles. Most are native to Asia, with smaller numbers of species native to Europe, North America, and northwest Africa. Natives, cultivars and hybrids are all widely grown for their beauty and fragrance. There are many types of roses. They are, wild roses, old garden roses like, Alba, Gallica, Damask, Moss, Potland, Hybrid Musk, and modern garden roses like, Hybrid tea, Pernetiana, Polyantha, and landscape roses

Rose, a universally celebrated flower, has been used as a garden plant since the dawn of civilization. Rose is a symbol of perfection, elegance, romance and love. It was called "The Queen of Flowers" firstly by Greek poetess in her "Ode to the Rose" (Muhammad *et al.*, 1996). Roses (*Rosa hybirida*) belong to family Rosaceae and Genus *Rosa* which contains more than 150 species and 1400 cultivars (Synge, 1971). Rose enjoys superiority over all other flowers being extensively used for decorative purposes and is prized for its delicate nature, beauty, charm and aroma. Rose is recognized for their high economic value, which are used in agro-based industry especially in cosmetics and perfumes. Additionally, roses play a vital role in the manufacturing of various products of medicinal and nutritional importance. However, the main idea of rose plant cultivation is to get the cut flowers, which greatly deals with the floricultural business (Butt, 2003).

Cut flowers are parts of plants, characteristically including the blooms or "inflorescences" and some attached plant materials, but not including roots and soil. Fresh cut flowers are highly perishable because they maintain only limited life-supporting processes by taking water up through their stems. The United States is the third-largest producer of cut flowers in the world; production was valued at $424 million in 2001, down from $472 million in 1997. Almost all domestic production serves the U.S. market, which has seen increasing demand for cut flowers since the late 1980s. The United States has one of the most diverse cut flower markets, with all types of fresh flowers arriving from all over the world. Roses are the leading fresh cut flower produced and consumed in the United States (based on value) and, in 2001, accounted for almost 30 percent of fresh cut flower shipments. Fresh cut flowers are used for decorative purposes such as vase arrangements and bouquets at formal events; designs for weddings; gifts on occasions such as Mother's Day, Valentine's Day, in times of illness, and at holidays such as Christmas and Easter; corsages and boutonnieres; and informal displays to beautify homes and public places (Joanna Bonarriva, 2003).

The cut flower industry in Malaysia is a relatively recent development compared to other agricultural enterprises. From its rather humble origins as a hobby industry, the cut flower industry in Malaysia has developed into a very viable commercial enterprise with the most marked growth in the mid-Eighties. In fact it has shown such tremendous growth in the last decade that production has increased tenfold and export twelve-fold in response to local and foreign demands. The trend is expected to continue in the future with growing affluence of the local population and that of the developed countries as well as improved market opportunities. The cut flower market consists of three important components which are temperate flowers, orchids and other lowland flowers. In general, the area of cultivation of cut flowers in Malaysia is determined by the climate and topography of the land. For instance, highlands such as the Cameron Highlands are the major growing areas of temperate flowers. Other cut flowers adapt better to the hot humid conditions in the lowlands with orchids constituting the major share of the production (Jong *et al.,* 2000).

In the National Agriculture Policy (1992-2010) and the Seventh Malaysia Plan (1996-2000), cut flowers have been identified as a priority group of crops with good potential to meet the growing domestic and international demand and to generate higher income for producers. It has been estimated that at least 1,000 farmers are involved in the floriculture industry that contributed RM 370 million to the economy in 1995. Orchids contributed 40 percent of total value of production, followed by temperate cut flowers (33 percent) and ornamental plants (27 percent) (Jong *et al.,* 2000).

Although the contribution of cut flowers to the total of Malaysian exports is not significant, the annual growth rate over the last year was 24%. If the forecast of 10% annual growth rate of floriculture production holds true for the 7th Malaysia Plan period (1996-2000), the floriculture industry will enjoy the highest annual growth rate compared to other major commodities including rubber and palm oil over the same period (Mohd. Ridzuan *et al.,* 2000).

It is clearly stated that, nowadays cut flowers especially cut roses are very demanding. Among horticultural crops, cut flowers and other ornamentals have perhaps the highest value and are the most perishable. Their high respiration rates, rapid deterioration, and susceptibility to damage require the utmost care to maintain quality during postharvest handling. In postharvest handling, the most important thing that we must consider is, the preservative solution or floral preservative that we placed the cut flowers. The use of preservative solution is considered a common practice for the storage of floral stems. These treatments allow to control ethylene synthesis, pathogen development, maintenance of hydric and respiration balance, to contribute to colour conservation, floral buttons induction and latter to complete their development (Halevy and Mayak, 1981). For these reasons, many floral preservative contain germicides, ethylene synthesis inhibitors, growth regulators, some mineral compounds, and carbohydrates that are essential to extend the vase life of cut flowers (Halevy and Mayak, 1981). In my research I used commercial vinegar and sucrose as preservative solution to extend the vase life of cut roses.

1.2 Problem Statements

There are many factors involved in keeping good quality of cut flowers, but the most important factors are appropriate storage temperature, flower preservatives, ethylene inhibitor, and inhibitor of microorganisms (Scott *et al.,* 1994). Floral preservatives are very important to increase the vase life and maintain good quality of cut rose flowers (Roberts *et al.,* 1993). Growers and florists do not give much attention on this matter because floral preservatives are expensive and not easily available in the market. To overcome this problem, they (especially florists) need flower preservatives that are easily available and cheaper.

1.3 Justification

This study has been designed to evaluate the effectiveness of vinegar and sucrose in room temperature on the vase life of postharvest roses which has potential to be good flower preservative. This is one of the initiative to replace the expensive flower preservative in the market where vinegar and sucrose can be flower preservative which is economical and easily available. The importance of this study is to suggest a good flower preservative (vinegar + sucrose) where florists and growers can prepare by their own with simple steps without spending much money.

1.4 Objective

The objective of this study is:

I. To evaluate the effect of vinegar and sucrose as a potential flower preservative that can extend the vase life of postharvest roses at room temperature.

1.5 Hypotheses

H_0 = There are no significant differences in the effect of vinegar and sucrose on postharvest roses in room temperature.

H_1 = There are significant differences in the effect of vinegar and sucrose on postharvest roses in room temperature.

CHAPTER 2

LITERATURE REVIEW

2.1 Taxonomy of Rose Flower

Roses for the longest time have enjoyed the honour of being the most popular flowers in the world. The reason for popularity of the rose flower may be its wide variety in terms of colour, size, fragrance and other attributes. There are many types of rose flowers. They are, Alba, Gallica, Damask, hybrid tea roses, hybrid musk, floribunda and more. Flowers may be solitary or panicled. Many native species have five petals and numerous stamens. The ovary is inferior and develops into fleshy fruit or hip, which can become colourful yellow to red when ripe (Dole and Wilkins, 2005). Figure 2.1 shows picture of a fresh cut rose flower. Below are the scientific classification of rose:

Kingdom	: Plantae
Division	: Magnoliophyta
Class	: Magnoliopsida
Order	: Rosales
Family	: Rosaceae
Subfamily	: Rosoideae
Genus	: Rosa

(Source: http://en.wikipedia.org/wiki/Rose)

Figure 2.1 Fresh cut rose flower

Source: http://www.google.com.my/imglanding/rose

Bar = 1 cm

2.2 History of Rose Flower

The rose apparently originated in Central Asia about 60 to 70 million years ago, during the Eocene epoch, and spread over the entire Northern Hemisphere. Early civilizations, including the Chinese, the Egyptians, the Phoenicians, the Greeks, and the Romans, appreciated roses and grew them widely as long as five thousand years ago.

About 500 B.C. Confucius wrote of roses growing in the Imperial Gardens and noted that the library of the Chinese emperor contained hundreds of books about roses. It is said that the rose gardeners of the Han dynasty (207 B.C.-A.D. 220) were so obsessed with these flowers that their parks threatened to engulf land needed for producing food, and that the emperor ordered some rose gardens plowed under.

The oldest rose identified today is *Rosa gallica*, also known as the French rose, which once bloomed wild throughout central and southern Europe and western Asia, and still survives there. Although the exact origin of *Rosa gallica* is unknown, traces of it appear as early as the twelfth century B.C., when the Persians considered it a symbol of love (Bose and Yadav, 1989).

2.2.1 Roses in the Ancient World

Descending from *Rosa gallica* is *Rosa damascena*, the damask rose, whose well-known fragrance has been part of rose history since the rose first appeared in about 900 B.C. About 50 B.C. a North African variant called *Rosa damascena semperflorens*, the 'Autumn Damask', thrilled the Romans because it bloomed twice a year - a trait previously unknown to them. The 'Autumn Damask', which has been traced back to at least the fifth century B.C., is believed to be a cross between *Rosa gallica* and *Rosa moschata*, the musk rose. Until European merchants discovered the tea and China roses in the Orient many centuries later, this rose would be the only repeat bloomer known to the Western world.

Another important early rose was *Rosa alba*, the 'White Rose of York'. Made famous as the emblem of the House of York during the fifteenth-century Wars of the Roses, this five-petal rose is actually far older, dating to before the second century A.D. It probably originated in the Caucasus and travelled west by way of Greece and Rome. *Rosa alba* and its relatives, known as albas, are believed to have descended from some combination of *Rosa gallica*, *Rosa damascena*, *Rosa canina*, and *Rosa corymbifera*.

The early Phoenicians, Greeks, and Romans all grew and traded in roses, which they brought with them as they travelled and conquered. As a result, roses spread throughout the Middle East and elsewhere in the Mediterranean.

The Greek scientist and writer Theophrastus, cataloging roses known about 300 B.C., described their flowers as having anywhere from five to one hundred petals. He was the first known detailed botanical description of a rose. Alexander the Great, king of Macedonia around this time, grew roses in his garden and is credited for introducing cultivated roses into Europe. He may have had something to do with rose growing in Egypt, too.

In ancient Rome patricians tended rose gardens at their homes, and public rose gardens were a favourite place to pass a summer afternoon. Records show that there were two thousand public gardens in Rome before its fall in A.D. 476. The poet and satirist Horace complained about the short sightedness of the Roman government for allowing rose gardens to be planted where the land should have been used for wheat fields and orchards (http://mirrorofisis.freeyellow.com).

2.3 Postharvest Consideration for Roses

Problem of the cut rose flower begin at harvest; if cut too early, the rose may contain little store food. Generally rose should be cut at the stage which the flowers will continue to develop for the final consumer. There are two short-term problems of the cut rose; water loss increases at harvest and water moves into the leaves from the stems where air enters the stem base. The first problem causes wilting while the second one limits the rate of water uptake when the flowers are placed in the water. Hydration of cut flowers in deep ,which is the harvest water problem can be solved by adding acidifier to the water (Durkin, 1980).

2.3.1 Quality of Cut Flower

Fresh flowers and ornamental plants differ from edible and other agricultural products because edible and other agricultural products will be consumed or processed within few days after harvest. But, fresh flowers are expected to maintain their aesthetic value as long as possible. Quality in horticultural products is assessed by the relative value of several characteristics which considered together, will determine the acceptability of the product to the buyer and the customers (Nelson, 2003).

2.3.2 Light

Light can influence postharvest performance of roses. Cut roses exposed to constant light or 12 hours of light per day lost 5 times more water than roses kept in darkness (Halevy and Mayak, 1981). This, it is thought, was due to stomatal opening caused by the light. Light intensity directly influences the efficiency of photosynthesis, which determines the carbohydrate contents of the cut flowers. Petal colour is also affected by shading or low light intensity, and thus depends on the availability of carbohydrates in surrounding tissues, resulting in tissue blueing in the presence of low light intensities. Low light intensity greatly reduces plant and consequently flower quality due to leaf and flower abscission (Cushman *et al.,* 1994).

2.3.3 Temperature

Temperature is the most important factor that cause damages to cut flowers. Cut flowers have shown that flowers are often exposed to damaging in high temperatures (Maxie *et al.,* 1974). The suitable temperature for most perishable horticultural commodities to last longer is near at 0 ^{0}C, where low temperatures reduce both metabolic processes and microbial growth rate and germination (Van Doorn and de Witte, 1991). Poor temperature management during transport of cut flowers is largely the result of inadequate pre-cooling and transport under non-refrigerated conditions. Several researchers have shown the negative effects of improper storage temperatures on vase life of a range of cut flowers (Cevallos and Reid, 2001).

Since temperature is the major factor affecting the cut flower life, emphasis is laid on cool temperature. Cooling is essential in order to reduce the metabolic changes such as enzyme activity, and to slow down the maturation of flower or foliage. The cooling period required for flowers is generally depends upon difference between the temperature of flowers and the room temperature, quantity of flowers to be cooled, species of flowers and efficiency of the refrigeration (Teixera da silva, 2003).

The optimum temperature depends on the species, cultivar, and the stage of maturity, production environment and duration of storage (Wills, 2007). Temperature, relative humidity, air composition and air circulation in storage environment influence the postharvest lasting quality of cut flower (Dole and Wilkin, 2005).

2.3.4 Water Stress

Water stress, has a detrimental effect on cut flowers, causing wilting that ends their vase life. Three factors are involved in maintaining a balance of water in the cut flower. They are uptake and transport of water, loss of water through stomates or transpiration, and retention of water by plant tissues. Uptake and transport of water can be inhibited by several factors. Microbial growth, and some metabolites produced by these bacteria, can block the xylem in the lower part of the stem. The bacteria suspected to be the biggest problems are *Pseudomonas sp.* and members of the enterobacteriaceae found in tap water (van Doorn and de Witte, 1997).

Loss of water, through stomates and transpiration, will cause wilting if this loss exceeds water uptake. Cut roses kept in the light lost five times more water than those kept in the dark because the stomates were open in the light (Halevy and Mayak, 1981). The ability of plant tissues to hold water is affected by osmotic potential and by membrane integrity. Sugar added to vase water of cut flowers prolongs flower life by helping to maintain the osmotic potential in the plant tissue and by adding metabolic fuel.

Water balance is a major factor determining quality and longevity of cut flowers. It is influenced by water uptake and transpiration, being the balance between these two processes (Teixera da silva, 2003). When the amount of transpiration exceeds the volume of water uptake, water deficit and wilting develop (Halevy and Mayak, 1981). Low water uptake is often due to occlusions located mainly in the basal stem end (He *et al.,* 2006), and microbes are a common cause of stem end blockage (van Doorn, 1997). Many agents have been used in cut flower vase solutions to extend vase life by improving water uptake. These include silver nitrate (Fujino *et al.,* 1983), aluminum sulphate (Ichimura and Shimizu-Yumoto, 2007) and 8-hydroxyquinoline

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