UNIVERSITI PUTRA MALAYSIA

EFFECT OF PACLOBUTRAZOL ON GROWTH PERFORMANCE AND YIELD OF ROSELLE (*Hibiscus sabdariffa* L.)

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EFFECT OF PACLOBUTRAZOL ON GROWTH PERFORMANCE AND YIELD OF ROSELLE (*Hibiscus sabdariffa* L.)

By

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A project thesis submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science

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CERTIFICATION

This project report entitled "Effect of paclobutrazol on growth performance and yield of roselle (*Hibiscus sabdariffa* L.)" by Nabila Huda Binti Buyamin submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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TABLE OF CONTENT **PAGE**

List of tables:

List of Figures

List of Plates

List of Appendices

ABSTRACT

This research was conducted to investigate the effect of different concentration of paclobutrazol on growth performance and yield of roselle (*Hibiscus Sabdariffa* L.). The study was done under controlled environmental structure (CES) at Universiti Putra Malaysia, Serdang, Selangor. The experiment consisted of three concentration of paclobutrazol, T0- 0 ppm, T1- 100 ppm and T2- 200 ppm paclobutrazol. Soil media 2:2:1 was used as the planting media. The total numbers of plants are 60. Each treatment was replicated 4 times with 5 single plants in each treatment. The experimental design was Completely Randomized Design (CRD). Data on growth parameters (plant height, number of branches, total leaf area, internode length, fresh and dry weight of shoot and root and chlorophyll content) were collected from each treatment.

For final harvest, yield analysis of fruit number, fruit fresh weight, weight of fresh calyx, weight of dry calyx, total soluble solid (TSS), ascorbic acid content and tissue analysis NPK content for shoot and root were taken from each plant. Data were analysed statistically by using Analysis of Variance (ANOVA) and mean comparison among treatments was performed using LSD test at probability 0.05. There were significant difference on data growth and yield parameters. For data growth parameter, the plants that applied with paclobutrazol showed lower growth compared to controlled plant. Meanwhile the yield in treatment 1 (100 ppm), for fruit number fruit number showed no significant different compared to controlled plant growth.

Moreover, this study showed that plants that applied with paclobutrazol give greater total soluble solids value compared to controlled plants. While ascorbic acid content did not give any significant difference.

As conclusion, there were differences in plant growth and nutrient uptake ability between controlled and both treatments. Since the treatment 1 (100 ppm) plant achieved same number of fruit compared to controlled plants, it is better to use 100 ppm paclobutrazol treatment applied to plants because to provide better resistance to lodging without loss of fruit yields and save labour costs for maintaining the plants.

ABSTRAK

Kajian ini telah dijalankan bertujuan untuk mengkaji kesan perbezaan kepekatan paclobutrazol ke atas pertumbuhan pokok roselle (*Hibiscus sabdariffa* L.) dan hasilnya. Kajian ini telah dilakukan di bawah Sistem Perlindungan Hujan (SPH) di Universiti Putra Malaysia, Serdang, Selangor.

Eksperimen ini terdiri daripada tiga kepekatan paclobutrazol yang berbeza iaitu T0- 0 ppm, T1-100 ppm dan T2-200 ppm. Campuran tanah 2:2:1 digunakan sebagai media tanaman. Jumlah keseluruhan pokok adalah 60. Setiap rawatan direplikasi sebanyak empat kali dengan lima pokok pada setiap rawatan. Rekabentuk eksperimen ialah Rekabentuk Rawak Lengkap (RRL)

Data parameter pertumbuhan (tinggi pokok, bilangan dahan, jumlah keluasan daun,panjang internode, berat segar dan kering bagi pucuk dan akar dan kandungan klorofil) telah diambil dari setiap sampel rawatan bagi setiap dua minggu. Bagi tuaian yang terakhir, parameter dan analisis hasil (bilangan buah, berat segar buah, berat segar dan kering kaliks, jumlah pepejal larut (TSS), kandungan asid askorbik dan nutrient analisis bagi Nitrogen, Fosforus, Kalium untuk pucuk dan akar telah diambil dari setiap pokok. Data telah dianalisis secara statistik menggunakan LSD ujian pada kebarangkalian 0.05.

Terdapat perbezaan yang signifikan terhadap data bagi pertumbuhan pokok dan hasil buah. Dari segi pertumbuhan, pokok yang disembur paclobutrazol menunjukkan pertumbuhan

perlahan berbanding pokok kawalan. Selain itu, bilangan buah setiap pokok yang disembur 100 ppm paclobutrazol menunjukkan tiada perbezaan dengan pokok kawalan.

Tambahan lagi, kajian ini menunjukkan penggunaan paclobutrazol meningkatkan jumlah pepejal larut pada buah berbanding kawalan. Manakala kandungan asid askorbik tidak memberi apa-apa perbezaan yang signifikan.

Kesimpulannya, ada perbezaan pada pertumbuhan pokok dan keupayaan pengambilan nutrient antara kedua-dua rawatan dengan kawalan. Oleh kerana pokok rawatan 1 (100 ppm) memperoleh hasil yang sama dengan pokok kawalan,adalah lebih baik untuk menggunakan rawatan 100 ppm paclobutrazol kepada pokok roselle untuk menyediakan rintangan yang lebih baik terhadap rebah tanpa kehilangan hasil buah dan juga dapat menjimatkan kos buruh untuk menjaga pokok.

CHAPTER 1

INTRODUCTION

Roselle commonly known as *Hibiscus sabdariffa* L. from a Malvaceae family and native from a tropical region of Africa (Omobuwojo *et al*., 2000; McClintock and El Tahir, 2004). The others name of roselle are 'Asam Kumbang', 'Asam Susur', and 'Asam Paya'. Roselle is an annual shrub that has been commonly grown as an ornamental by based on its decorative flowers and red coloured stems (Morton, 1987). Recently, roselle has received increase due to its multi-functional attributes. Roselle can be utilized as a natural source of food colorants, pharmaceuticals and cosmetics (Mazza and Miniati, 1993).

Roselle is grown as a leafy vegetable and the calyces are also consumed as a juice extracted (Schippers, 2000). For high quality purposes, the calyx must be processed within 12 hours after harvesting and for a longer storage, the calyx must be kept in freezer below zero degrees. The calyces or petals of the flower are widely used to prepare an herbal drink, cold and warm beverages, and for making jams and jellies (Abu-Tarboush *et al*., 1997; Rao, 1996; Tsai *et al*., 2002). The calyces have a lot of benefit because of its have high content of anthocyanins and organic acids (Hong and Wrostlad, 1990; Gomez-Leyva *et al*., 2008)

The plants have been brought from India and it is a new commercial plant in Malaysia. Early 1990s, these plants were introduced and have been promoted by the Department of Agriculture in Terengganu. In 1993, roselle was replaced tobacco as cash crop plant on bris soil in Terengganu. Therefore, Terengganu was to be the first and the largest producer of

roselle, but nowadays the production has spread to other states too. There are three species of roselle in Malaysia which are 'Wild Red' roselle, 'Red' roselle and 'Yellow' roselle. 'Red' Roselle (UMKL Variety) and Red UKM Variety are recommended for commercial growing (Hosnan, 2009). In late 1990, roselle recently had been commercially grown in Johore (District of Mersing) and mostly was grown on bris soil. From 2000 to 2008, 246 hectares of land used to plant this commercial plant and had produced about 424.7 metric tons of calyces (Hosnan, 2009).

The current production of this plant in Malaysia is about 240 tonnes annually (Halimatul *et al*., 2007). Roselle plant is one of the new products and future industry for development in the Third National Agricultural Policy (NAP) (Harizamrry, 2008). Ministry of Agriculture and Agro-based Industry Council had enforced roselle Industries Council of Malaysia chaired by the Director General, Department of Agriculture for the implementation of the National Strategic Plan Roselle Industry in 2002 (Harizamrry, 2008). Forteen companies from several states had involved in product process of roselle and Malaysia has the best roselle in the world.

Roselle can be considered as medicinal plant. Its extracts became a basic material in medicine, the food and cosmetic industries due to the world's return to nature (Omer *et al*. 1997; Shalan *et al*. 2001). Nowadays, consumer awareness is on the rise for herbal medicines as the preventive health and alternative supplements and remedies. The World Health Organization estimates four billion people use some form of herbal medicine, and the European market alone is currently worth about RM25 billion. It is with this potential in mind that Malaysia's herbal industry has been identified as one of the agriculture Entry Point

Projects (EPPs) under the National Key Economic Areas (NKEAs) in the Economic Transformation Program (ETP). Its target: a gross income of RM3.25 billion by 2020. Roselle is one of the herbs that have been prioritized to be undertaken in this project.

Roselle is an annual herbaceous plant that can grow to a maximum height about 2-3m long and lasts about 6–7 months in the field. Thus, the long height of roselle plant make difficult for grower to manage it. Growers face problem when roselle plant keep growing and fruiting heavily and plant lodging due to heavy rain and strong wind in the field. Lodging is a common problem in most cereals and various other crops. It can reduce yields, quality of production and mechanical harvesting efficiency (Kono, 1995). The use of chemical paclobutrazol (PBZ) could possibly be one way to remedy the problems.

PBZ is one of plant growth retardants that acts by inhibiting activity of ent kaurene oxidize, which catalyses the sequential oxidation of kaurene to ent kaurenoic acid in the early step of the biosynthetic pathway of gibberellin acid (Evans *et al*. 1999). Plants treated with PBZ usually showed reduction in growth (Fletcher *et al*. 2000, Rademacher, 2000). Reduced plant height and leaf area of *Syzygium campanulatum* and *Lilium* sp. were reported following treatment with PBZ (Ahmad *et al*. 2007, Francescangeli *et al*. 2007). However, the specific study on the effectiveness of PBZ on roselle under local condition has not been established. Therefore, the present study was conducted with the following objectives:

1) To characterize the effects of PBZ on growth performance and yield of roselle.
2) To determine the optimum concentration of PBZ for effective retardation without loss of calyces yield.

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