

**EFFECTS OF SILICON NUTRIENT ON MELON
(*Cucumis melo* cv. Melon Manis Terengganu)
GROWTH AND POWDERY MILDEW
(*Podosphaera xanthii*) INCIDENCE**

CHONG SOK LENG

**MASTER OF SCIENCE
UNIVERSITI MALAYSIA TERENGGANU**

2021

**EFFECTS OF SILICON NUTRIENT ON MELON
(*Cucumis melo* cv. Melon Manis Terengganu)
GROWTH AND POWDERY MILDEW
(*Podosphaera xanthii*) INCIDENCE**

CHONG SOK LENG

**Thesis Submitted in Fulfilment of the Requirements
for the Degree of Master of Science in the Faculty of
Fisheries and Food Science
Universiti Malaysia Terengganu**

2021

Dedicated this thesis to:

My supervisors,

Siti Nordahliawate Binti Mohamed Sidique, Ph.D and Xiaolei Jin, Ph.D.

My beloved mother, siblings and other family members.

For all their dedication, sacrifice and endless love.

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the degree of Master of Science

EFFECTS OF SILICON NUTRIENT ON MELON (*Cucumis melo* cv. Melon Manis Terengganu) GROWTH AND POWDERY MILDEW (*Podosphaera xanthii*) INCIDENCE

CHONG SOK LENG

2021

Main supervisor : Siti Nordahliawate Binti Mohamed Sidique, PhD

Faculty : Faculty of Fisheries and Food Science

Plant diseases, including powdery mildew are common biotic stresses affecting melon cultivation. Several studies have reported that silicon (Si) is effective in controlling plant diseases. However, there is still a lack of silicon studies highlighting the effectiveness of silicic acid (liquid form of silicon) on plant growth and disease control. Cucurbits are Si intermediate-accumulator, where highly soluble Si (e.g. silicic acid) is needed for efficient transport into the plant system. Therefore, the Si nutrient has a potential to improve melon plant growth and development, while also reducing the most common fungal diseases of melons such as powdery mildew. There were three objectives in this study; firstly to determine the effects of Si nutrient towards melon growth; secondly to determine the potential of Si nutrient in delaying powdery mildew disease on melon and; thirdly to understand the impact of Si application on the uptake and accumulation of other nutrient elements in melon (leaves and roots). A randomized complete block design (RCBD) was adopted for the experimental plot design that were conducted in selected greenhouses by using melon cv. melon manis Terengganu (MMT) as tested plant samples. Different Si treatments of: 0.1% Si (v/v); 0.5% Si (v/v); 1.0% Si (v/v); and 1.5% Si (v/v) were applied weekly through soil drenching and foliar spraying. Throughout this study, melon plant growth and development, powdery mildew disease (at field, *in vitro* and *in planta* experiments), fruit quality and nutrient uptake were analysed. This study confirmed the ability of melon plants (cv. MMT) to

uptake Si. The two lowest concentrations of Si [0.1% Si (v/v) and 0.5% Si (v/v)] by root application obviously enhanced the plant height, chlorophyll contents, and the number of female flowers and fruit buds produced. The highest tested Si concentration [1.5% Si (v/v)] by root application also enhanced plant biomass and root development. The Si-treated melon fruits (by root application) had greater fruit mass, were sweeter (fruit brix) and showed reduced fruit rot. All Si treatments were observed to be able to control powdery mildew and even the minimum Si concentration [0.1% Si (v/v)] was observed to significantly reduce the occurrence of powdery mildew during the favourable monsoon season [disease incidence (57%) and disease severity (6%)] compared to control plants (84% disease incidence with 14% disease severity). This study also suggests for the application of fungicides when two conditions occur: a temperature of 25°C to 29°C with a humidity of > 85%; and leaves covered with < 5% powdery mildew. The uptake of other plant nutrients such as K, P, Mg, Mn and B were increased together with Si uptake, whereas heavy metals such as Pb were less taken up by plants. Therefore, Si will benefit MMT plants when provided via a root application in a gradual manner, from lower to higher concentrations, depending on the plant growth phase.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

**KESAN NUTRIEN SILIKON TERHADAP PERTUMBUHAN MELON
(*Cucumis melo* cv. Melon Manis Terengganu) DAN INSIDEN KULAPUK
BERDEBU (*Podosphaera xanthii*)**

CHONG SOK LENG

2021

Penyelia utama : Siti Nordahliawate Binti Mohamed Sidique, PhD

Fakulti : Fakulti Perikanan dan Sains Makanan

Penyakit tanaman termasuk kulapuk berdebu adalah salah satu faktor umum di bawah kesan stres biotik terhadap tanaman melon. Beberapa kajian telah melaporkan bahawa silikon (Si) berkesan dalam mengawal penyakit tanaman. Namun begitu, kajian silikon yang menekankan keberkesanan asid silikat (silikon dalam bentuk cecair) terhadap pertumbuhan tanaman dan kawalan penyakit adalah masih terhad. Tanaman cucurbit adalah diperingkat pertengahan kemampuan mengambil Si di mana dengan kadar larutan yang tinggi (cth: asid silikat) diperlukan untuk pengangkutan yang efisien ke dalam sistem tanaman. Oleh itu, nutrien Si berpotensi bagi meningkatkan pertumbuhan dan perkembangan tanaman yang seterusnya membantu mengurangkan penyakit kulat melon yang utama seperti kulapuk berdebu. Terdapat tiga objektif dalam kajian ini; pertama untuk mengetahui kesan nutrien Si terhadap pertumbuhan melon; kedua untuk menentukan potensi nutrien Si dalam mengurangkan penyakit kulapuk berdebu pada melon dan; ketiga untuk memahami kesan penggunaan Si terhadap pengambilan dan pengumpulan unsur nutrien lain oleh tanaman melon (daun dan akar). Reka bentuk plot eksperimen bagi rumah hijau yang terpilih adalah di dalam reka bentuk blok lengkap secara rawak (RCBD) dengan menanam melon cv. melon manis Terengganu (MMT). Rawatan Si yang berbeza; 0.1% Si (v/v), 0.5% Si (v/v), 1.0% Si (v/v) dan 1.5% Si (v/v) digunakan secara mingguan melalui penyiraman terus ke tanah dan penyemburan daun. Sepanjang kajian ini, pertumbuhan dan

perkembangan tanaman, perkembangan penyakit kulapuk berdebu (di rumah hijau serta eksperimen *in vitro* dan *in planta*), kualiti buah dan pengambilan nutrien oleh tanaman telah dianalisis. Kajian ini telah mengesahkan kemampuan tanaman melon (cv. MMT) untuk mengambil Si. Kepekatan terendah Si [0.1% Si (v/v) dan 0.5% Si (v/v)] melalui aplikasi akar jelas menunjukkan peningkatan ketinggian tanaman, kandungan klorofil serta penghasilan bunga betina dan tunas buah. Kepekatan Si yang lebih tinggi [1.5% Si (v/v)] melalui aplikasi akar juga meningkatkan biomass tumbuhan dan perkembangan akar. Buah melon yang dirawat Si (melalui aplikasi akar) turut mempunyai jisim buah yang lebih berat, lebih manis (brix buah) dan mengurangkan busuk buah. Semua rawatan Si telah diperhatikan dapat mengawal kulapuk berdebu walaupun dengan kepekatan Si minimum [0.1% Si (v/v)] pada musim tengkujuh yang merupakan keadaan optimum untuk pertumbuhan kulapuk berdebu [insiden penyakit (57%) dengan keparahan penyakit (6 %) berbanding tanaman kawalan (84% insiden penyakit dengan 14% keparahan penyakit)]. Kajian ini juga mencadangkan penggunaan fungisid apabila dua keadaan muncul; suhu (25°C to 29°C) dengan kelembapan (> 85%) dan daun diliputi dengan <5% kulapuk berdebu. Nutrien tumbuhan seperti K, P, Mg, Mn dan B telah meningkat bersamaan dengan pengambilan Si oleh tanaman manakal elemen beracun seperti Pb kurang diangkut oleh tanaman. Si boleh memberi kebaikan kepada tanaman melon melalui aplikasi akar, secara beransuran dari kepekatan yang rendah ke yang lebih tinggi bergantung fasa pertumbuhan tanaman.