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EFFICIENT FERTIGATION FOR IMPROVEMENT OF YIELD AND QUALITY OF CHILLI PRODUCTION IN SOILLESS CULTURE UNDER PROTECTED CULTIVATION

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By

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EFFICIENT FERTIGATION FOR IMPROVEMENT OF YIELD AND QUALITY OF CHILLI PRODUCTION IN SOILLESS CULTURE UNDER PROTECTED CULTIVATION

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Chilli (*Capsicum annum* L.) is an important vegetable crop in Malaysia and cultivated commercially in fertigation system. In 2011, Malaysia produced 32 780 metric tons of chillies with growing area at 2,559 ha. Nutrient and media are essential inputs that required for plant development. In fertigation system, fertilizer is supplied in nutrient solution form and been efficiently utilized. Thus, main objective of this study is to determine fertigation approaches that lead to efficiency for fertigation management. The studies were carried out on chilli plants grown under simple rain shelter structures in lowland of Malaysia. In the studied, plants were grown in three different media combinations (100% coconut coir dust (CD) as based media; 80 % CD + 20 % empty fruit bunch (EFB) compost and 70 % CD + 30% EFB as additive to the basic CD media with four different formulation. All those formulations used two different quantities of 400ml and 700ml fertilizer concentration.

This study found that Copper Formulation and 400ml concentration resulted in a higher growth and yield of chilli plants (justify results). From this study, the suitable conductivity for chilli cultivation was investigated in the following trial. The study involved the use of different electrical conductivity (EC) of Copper Formulation. In this study, plants were subjected to 1.5 and 2.0 dS/m. The experiment was conducted in a CRD with three replications. The results indicated that Cooper Formulation with EC 2.0 dS/m. In conclusion, efficient fertigation can be achieved by cultivation chilli plants in CD mixtures with 30% EFB compost with 2.0 dS/m EC of Copper Formulations. Higher growth and yield performances were attributed by utilizing additive soilless substrate resulted in better growth and yield of plant. Proper managements of electron conductivity and nutrient application are vital to achieve cost effective production.

Abstrak tesis yang dikemukan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains Pertanian

KECEKAPAN MENGGUNAKAN SISTEM FERTIGASI DAPAT MENINGKATKAN HASIL & KUALITI TANAMAN CILI TANPA MENGGUNAKAN TANAH DI DALAM RUMAH HIJAU

Oleh

Siti Suliza Binti Salamat

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Cili adalah antara tanaman sayuran yang penting di Malaysia dan ditanam secara komersil menggunakan system fertigasi. Pada tahun 2011, Malaysia dapat mengeluarkan hasil tanaman cili sebanyak 32 780 dengan keluasan tanah 2,229 hektar. Nutrien dan media adalah elemen penting untuk menanam pokok untuk penetuan hasil tanaman. Sistem pembajaan diberikan kepada tanaman dalam bentuk cairan secara cekap. Dalam pada masa yang sama lebihan zat makanan dan media yang berlebihan akan menyebabkan pencemaran alam. Pemberian nutrien yang berlebihan akan mengalir ke sistem pengairan menyebabkan pencemaran berlaku dan menjadi penyebab kehadiran serangan penyakit. Walau bagaimanapun penggunaan nutrien dan media tanaman untuk pertanian adalah keperluan dalam penanaman tanaman. Pada masa yang sama berlaku pembaziran penggunaan sekap kelapa selepas penggunaannya dan menyebabkan berlakunya longgokan sekap padi. Objektif kajian ini dilaksanakan untuk memperolehi sistem penananaman terbaik berdasarkan keperluan nutrien untuk pokok dan kawalan serangga perosak untuk mengurangkan kos tanaman dalam sistem fertigasi. Kajian in Kajian penanaman cili ini dijalankan di bawah rumah teduhan yang ringkas tanah rendah di Malaysia. Kajian menggunakan seratus peratus sabut kelapa, media kedua 80 peratus sekap kelapa dan 20 peratus tandan kelapa kosong dan media ketiga 70 peratus sekam kelapa dan 30 peratus tandan kelapa kosong. Media yang digunakan pada kajian ketiga ini adalah sekam padi 100% dan sekam padi:tandan kelapa kosong 70%:30%. Pada masa yang sama menggunakan empat jenis formulasi yang berbeza iaitu Copper Formulasi, Bennoit Formulasi, Copper Modify Formulasi dan Local Formulasi menggunakan perbezaan kuantiti 400ml dan 700ml kepekatan baja.

Kajian ini mendapati bahawa Formulasi Copper dan jumlah isipadu larutan 400ml menunjukkan perkembangan dan hasil cili yang tinggi berbanding dengan rawatan yang lain. (boleh tambah dengan menunjukkan kenapa pertumbuhan dan hasil pokok lebih tinggi cth. Media mempunyai pH dan EC yang baik dibandingkan dgn media ain atau kecekapan dari segi pengambilan nutrient). Kajian menggunakan dua elektron kekonduksian iaitu 1.5 dan 2.0. Kajian yang dibuat menggunakan

kajian secara rawak menggunakan tiga replikasi. Kajian mendapati Copper Formulasi dengan elektron kekonduksian dengan 2.0 adalah kombinasi terbaik. Kesimpulannya fertigasi cekap boleh dicapai oleh penanaman pokok cili dalam campuran CD dengan kompos kelapa sawit 30% menggunaakan elektron kekonduksian 2.0 menggunakan Copper Formulasi. Pertumbuhan yang lebih tinggi dan pengeluaran hasil adalah disebabkan dengan menggunakan substrat tambahan menyebabkan pertumbuhan yang lebih baik dan hasil tumbuhan. Pengurusan yang betul kekonduksian elektron dan aplikasi nutrien adalah penting untuk mencapai pengeluaran kos efektif.

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I certify that a Thesis Examination Committee has met on 20 February 2013 to conduct the final examination of Siti Suliza Salamat on her thesis entitled " Efficient Fertigation For Improvement Of Yield And Quality Of Chilli Production In Soilless Culture Under Protected Cultivation" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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LIST OF ABBREVIATIONS

AAS	Atomic Absorption Spectrophotometer
ANOVA	Analysis of Variance
CD	Coconut Coir Dust
BRH	Burnt Rice Husk
VERMI	Vermicompost
EFB	Empty Fruit Bunches
CRD	Complete Randomized Design
DAT	Days after Transplanting
EC	Electrical Conductivity
SAS	Statistical Analysis System
TPU	Taman Pertanian Universiti

CHAPTER 1

INTRODUCTION

Chilli is one of the most important vegetables in Malaysia. In recent years, the Malaysian production of vegetables especially chilli using greenhouses has experiencing accelerated growth. In 2011, production area of chilli reached up to 2,933 ha and the production of chilli reached around 32 780 tones which are 2, 559 tones higher than the production in 2010 (Anonymous, 2011). The attraction and demand for chilli have dramatically increased and showed major economic significance which is shown as it is getting higher year by year in the Malaysia.

Most of the greenhouses are soilless culture with automatic control of freshwater, fertilizers, soilless media and climate systems. The direct delivery of fertilizers through drip irrigation to demands the use of soluble fertilizers and pumping and injection systems to introduce the fertilizers directly into the irrigation system. Fertigation allows an accurate and uniform application of nutrients to the wet area, where the active roots are concentrated. Water and fertilizer are critical input in soilless culture. The advantage fertigation provides an excellent opportunity to maximize yield and efficiency use fertilizer in the same times minimizing fertilizer application and save cost to grower on the fertilizer invested. Advantage of fertigation are amount, timing and concentration of fertilizer applied are easily controlled. Every grower need supply both input everyday to the plants through irrigation system for plant get enough nutrient (Ismail, 2000). Flexibility, cost effectiveness, and the potential for improved seasonal fertilizer application efficiency are advantages of fertigation over traditional fertilizer application methods. However increasing price of fertilizer very year, will promote greater problem to grower because of high cost of chilli production.

Soilless medium is commonly used in horticulture for growing seedling, plant propagation and production of vegetables because of capacity to hold water. The common substrates used are coconut coir dust due to high physical and chemical stability chemical. There has been an increasing usage of coconut coir dust as growing media for cultivation of high value vegetable in Malaysia as soilless culture media. Grower are increasingly growing vegetables and crop in soilless growing medium which have great advantage of enabling grower to control the root environment more precisely and economically than in soil. Soilless substrate has lack of the microbial diversity and biological “buffering” that found in natural soil bag. Crop production in soilless culture systems requires an adequate supply of all the elements essential for plant growth very well.

Fertigation is assisted with irrigation with fertilizer that dissolved in the water at concentration which (Leith and Oki, 2008). In order to sustain and better crop performance and yield plant need high and appropriate supplying of macro and micro-nutrient. . Fertilizer is well known as the highest variable costs item in the crop production budget. However, when increase global fertilizer price is raised and fluctuated, it will promote greater problem to the grower and affect the chilli production. Besides the fluctuation of fertilizer price, another problem needs to be overcome is poor management of fertilizer and water by grower.

The main objective of the present study is to establish efficient fertigation for production of chilli in coconut coir dust soilless culture. To achieve efficient fertigation, the study had also established the following specific objectives;

- to characterize the effect different of media mixture
- to determine the effect of different nutrient formulation
- to determine the optimum Electron Conductivity (EC) levels

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