



***IRRIGATION POTENTIAL BASED ON CROP WATER REQUIREMENT AND  
TIME SCHEDULING FOR SPINACH GROWN IN COCOPEAT***

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**A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia,  
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## CERTIFICATION PAGE

This project report entitled “**Irrigation Potential Based On Crop Water Requirement And Time Scheduling For Spinach Grown In Cocopeat**” is prepared by Nurul Sahirah Binti Saroni and submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Agricultural Science.

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## ABSTRACT

Water is a major issue in agriculture because of limited water sources. Over or excessive irrigation of water to plants will affect plant respiration as the roots cannot take in gases. On the contrary, shortage of water due to under irrigation will lead to water stress. By knowing the actual crop water requirement and time scheduling irrigation, plant damage can be reduced and thus, yield and cost efficiency can increase. Spinach is one of the leafy vegetable that is very sensitive to water. Small changes in water application to spinach can be detected from its growth performance. Thus, an irrigation potential was affected by different amount of water application on spinach to observe its growth. The objective of this experiment was to determine the actual amount of water required for spinach grown in cocopeat based on crop water requirement and time scheduling in order to avoid over or under irrigation. This study was conducted in the shade house, Field 15 at Faculty Agriculture, UPM. There were three treatments of irrigation tested, common irrigation practice, crop water requirement irrigation and time scheduling irrigation. The experimental design for this experiment was RCBD with 4 blocks (replications) for each treatment and each experimental plot had 10 spinach plants. CROPWAT 8.0 software was used to calculate reference evapotranspiration for the determination of crop water requirement. Data collections include plant height, leaf length, and number of leaves, root length, canopy diameter and fresh weight of the spinach. The effect of irrigation on these spinach performances was analyzed with Statistically Analysis System (SAS). The result for this study showed no significant difference among the treatments for all the growth parameters tested except for plant height at 14 days after transplanting. The insignificant difference was hypothesized to be contributed by that cocopeat medium used in this study that had provided satisfactory

available water for the spinach growth regardless different amounts of irrigation water applied.



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## ABSTRAK

Air adalah merupakan isu utama dalam pertanian kerana sumber air yang ada semakin terhad. Pengairan yang berlebihan kepada tumbuh-tumbuhan akan menjejaskan pengudaraan tumbuhan kerana akar tidak boleh mengambil gas. Sebaliknya, kekurangan air disebabkan oleh pengairan akan membawa kepada tekanan air. Dengan mengetahui keperluan air tanaman sebenar dan penjadualan pengairan, kerosakan tumbuhan boleh dikurangkan dan hasil serta kecekapan kos boleh di tingkatkan. Bayam adalah merupakan salah satu sayur - sayuran yang sangat sensitif terhadap air. Perubahan kecil dalam aplikasi air untuk bayam boleh dikesan dari prestasi pertumbuhannya. Oleh itu, potensi pengairan boleh terjejas oleh pelbagai penggunaan air pada bayam untuk melihat pertumbuhannya. Objektif percubaan ini adalah untuk menentukan jumlah air sebenar yang diperlukan oleh bayam yang ditanam di dalam cocopeat berdasarkan keperluan air tanaman dan penjadualan masa bagi mengelakkan air lebih atau di bawah pengairan. Kajian ini dijalankan di rumah teduhan, Ladang 15 di Fakulti Pertanian, UPM. Terdapat tiga rawatan pengairan yang diuji iaitu amalan pengairan biasa, pengairan keperluan air tanaman dan pengairan penjadualan masa. Reka bentuk eksperimen untuk eksperimen ini adalah RCBD dengan 4 blok (replikasi) untuk setiap rawatan dan setiap plot eksperimen mempunyai 10 tumbuhan bayam. Perisian. CROPWAT 8.0 digunakan untuk mengira evapotranspirasi rujukan untuk menentukan keperluan air tanaman. Koleksi data yang dikumpul termasuklah ketinggian tumbuhan, panjang daun, dan jumlah daun, panjang akar, diameter kanopi dan berat segar bayam. Kesan pengairan pada perkembangan bayam ini dianalisis dengan Sistem Analisis Statistik (SAS). Hasil kajian ini menunjukkan tiada perbezaan yang ketara antara rawatan untuk semua parameter pertumbuhan yang diuji kecuali untuk ketinggian tumbuhan



pada 14 hari selepas pemindahan. Perbezaan yang yang tidak sekata telah dihipotesiskan dengan menganggap bahawa medium cocopeat yang digunakan dalam kajian ini telah menyediakan air yang secukupnya untuk pertumbuhan bayam tanpa mengira jumlah air pengairan yang berlainan.



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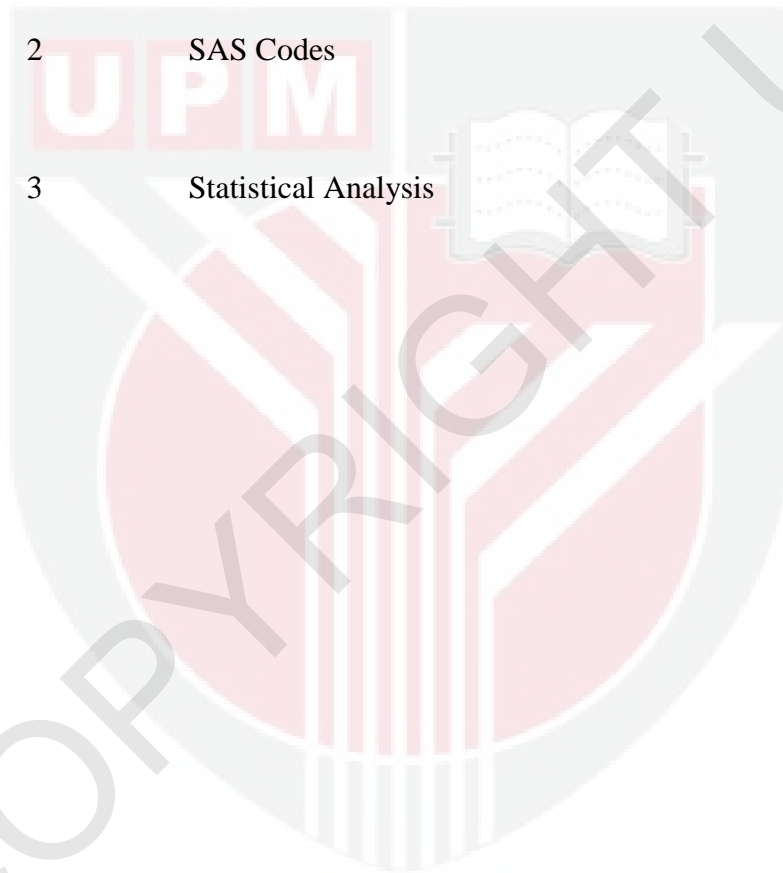
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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

In Malaysia, sources of water become the major issues in agriculture because limited sources of water available (Siwar et al., 2009). In agriculture, plant should be irrigated with the actual amount of water needed to ensure that the plant can grow well and save the cost for irrigation. Kumar and Sahu (2013) stated that the properly irrigation management can reduce irrigation water requirement and increase the yield.

Over irrigation or excessive water can affect plant respiration as the roots cannot take in gases. Under irrigation or water deficit, the plants will lead to the water stress. Flexas et al. (2006) and Chaves et al. (2009) reported that water stress can immediately affect the photosynthesis of the plant by reducing the carbon dioxide intake since the stomata is close. Therefore, by knowing the actual crop water requirement and time to irrigate, the plant damage can be reduced, increase cost efficiency and yield.

In agriculture, there are many leafy vegetables that are essential in our life for nutrient and vitamins. One of the leafy vegetables that is rich with vitamin, mineral and antioxidant is spinach. However, it is one a leafy vegetable that is very sensitive to water. A small change of water application to the spinach can be detected through the observation within one growing period.

Thus, managing water requirement for spinach is very important because it can affect its production yield. Like Bennett and Harm (2011) stated that there are relationship between the crop yield and water supply in the field that depend on the sensitivity of the crops. The optimum or deficit water supply to the crop will affect the increasing or decreasing of the production yield. Then, managing water requirement to the crop is very important to the yield and also able to save the irrigation cost.

## 1.2 Problem Statement

Nowadays, farmer's irrigation practice without knowing the actual amount of water from crop water requirement of spinach may lead to over or under irrigation. Consequently, over or under irrigation to the plant may lead to the water stress and give results in the burst head on the spinach wilting. Besides that, it also disrupts the plant growth which reduces leaf area, stem height, chlorophyll content, and root development. Thus, excess or deficit of water given to spinach may result in plant damage that will decrease yield.

Waskiewicz et al. (2016) stated that the good quality of the irrigation will lead to the good yield. Therefore, applying the actual amount of water can avoid wastage of the water in the field by over irrigation and prevent under irrigation. The productivity of the yield also can be increased when the plant have enough amount of the water. Thus, suitable irrigation practice in the field or farm will affect the result in the yield that produced.



### 1.3 Objectives

The main objective of this study was determine the actual amount of water that is required for spinach from its crop water requirement and time scheduling that precisely apply water according to the plant needs without over or under irrigation.



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