UNIVERSITI TEKNOLOGI MARA

A QUANTITATIVE ANALYSIS OF THE GROWTH PERFORMANCE AND THAUMATIN CONTENT OF *Thaumatococcus daniellii* GROWN UNDER DIFFERENT IRRADIANCE AND FERTILIZER LEVELS

NURUL HIDAYAH BINTI MOHD KHAIRLANI

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Nurul Hidayah Binti Mohd Khairlani
Student I.D. No.	:	2012205324
Programme	:	Doctor of Philosophy (Agronomy) – AT990
Faculty	:	Plantation and Agrotechnology
Thesis Title	:	A quantitative analysis of the growth performance and thaumatin content of *Thaumatococcus daniellii* grown under different irradiance and fertilizer levels
Signature of Student	:	 ……..
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ABSTRACT

Thaumatococcus daniellii is a rhizomatous monocotyledonous, perennial herb species of the Marantaceae family and Zingeberales order. The fruit aril contains thaumatin, a sweet protein with a sweetness intensity of about 1600 - 3000 times than sucrose and is extensively employed as a natural sweetener. The species has a potential to be an important future economic crop if the proper husbandry can be established and cultivated under proper agronomic practices. This study was carried out at the Botanical Garden, Shah Alam, Malaysia, from July 2014 to February 2017. Seedlings were raised from rhizomes and grown on the field using a randomized complete block design with four treatments and three replications. The treatments consisted of combinations of two irradiance and two fertilizer levels, which were designated as high irradiance (moderate shade) with either low (H Irr_L Fer) or high fertilizer (H Irr_H Fer) and low irradiance (heavy shade) with either low (L Irr_L Fer) or high fertilizer (L Irr_L Fer). The high irradiance treatment referred to plants grown on the forest floor, which received photosynthetically active radiance (PAR) transmission ratio in the range of 30 to 50% diurnally. The low irradiance treatment was achieved by growing plants under shade house covered with black polyethylene netting reducing irradiance further to 10 to 20% of PAR transmission ratio diurnally. A total of 560 plants were planted in the field. The sampling plants consisted of 128 plants with the rest were used as border plants or guard row. In general, irradiance was the main factor affecting the growth of *T. daniellii*. The high irradiance had significantly increased the overall growth, biomass production, partitioning parameters and starts to produce fruits at 390 DAT. The potassium was the highest amount of nutrient taken up by the plant followed by N and P for both vegetative and reproductive stages. High irradiance was significantly increased the thickness of leaf lamina and epidermis layer. Two to three layer of palisade was found under high irradiance treatments and area of each pulvinus, petiole, rhizome and root was increased. Number of vascular bundle and stomata also increased under high irradiance treatments. Phenologically, the species had eight principal growth stages, which included bud and leaf development, formation of side tillering, petiole elongation, emergence of synflorescence, flowering, fruit development and fruit maturity. Both irradiance and fertilizer levels affected certain phenological stages; with leaf, tiller, synflorescence, and fruit strongly influenced by irradiance levels. Highest thaumatin content was found under H Irr_H Fer at the value of 6.4 mg and yield of thaumatin at value of 24% of the total of crude thaumatin. This study provided a detailed basic knowledge on the science of the *T. daniellii* based on the crop development vis-à-vis growth and environmental requirements. This will pave the way for attainment of an efficient crop agronomic practice.

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