

UNIVERSITI TEKNOLOGI MARA

**ANALYSIS OF PALM
MORPHOLOGY IN RELATION TO
YIELD AND NUTRIENT
COMPONENTS OF SUGAR PALM
(*Arenga pinnata*) GROWN UNDER
MANAGED SYSTEM**

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ABSTRACT

The sugar palm (*Arenga pinnata*) is a multipurpose palm species which is commonly known for its sap and currently is one of the economic sources in rural societies particularly in region of Southeast Asia. While research on economically-important yield of this species are progressing over the years, study on growth performance and physiology is still scarce and neglected. The objective of this study was to analyze quantitatively morphological characteristics and yield parameters of *A. pinnata* grown under proper domestication. General palm growth, reproductive morphological characteristics and nutrient composition in leaf, soil and sap were quantified and analyzed with the overall sap yield and quality. The study was conducted in sugar palm plantation of Balong River Eco Resort and Plantation which located in Tawau, Sabah from March 2015 until April 2016. Sixty individual palms with age ranging 6-7 years and at reproductive stage were selected for assessment of growth and reproductive morphological characteristics. Male inflorescence morphological parameters were measured prior to sap tapping where during the tapping period, sap yield and Brix value were sampled on every alternate day for a three-week duration to get the average total sap and nutrient composition for each individual palm. Nutrient analyses were carried out on leaf and sap samples of thirty palms used for inflorescence study, and selected soil samples to represent fertility status of the experimental sampling area. Descriptive analyses were carried on various parameters studied followed by correlation and regression analyses on various parameters relationships. There were strong relationships between various palm morphological parameters and inflorescence characteristics, as well as between various reproductive morphological characteristics of male and female inflorescence. Significant relationship between male inflorescence parameters with average sap volume/day were identified such as average rachilla length ($r^2 = 0.47^{***}$) and total rachillae number ($r^2 = 0.35^{**}$). Nutrients such as P, K and Mg were identified as important in overall palm nutritional metabolism where significant relationships existed within leaf, soil and sap samples. Sap nutrient composition significantly affected by the leaf Mg/Ca and K/Mg ratios, as well as soil N/P ratio. This study also found that the emergence of the first inflorescence consistently found on the second leaf from the apex with the first inflorescence is always female. The successive leaves below the first inflorescence are always paired with an inflorescence as it emerged basipetally during reproductive stage. The significant relationships between some parameters of male inflorescence and average sap volume/day showed the potential of these parameters to be indicators of sap yield. The establishment of various relationships of selected morphological and nutrient parameters of *A. pinnata* improved the understanding on its growth performance and how it can influence sap yield and overall productivity.

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CHAPTER ONE

INTRODUCTION

1.1 Background Study

1.1.1 *Arenga* spp.

The genus *Arenga* belongs to palm family *Arecaceae* (*Palmae*) which includes in the phylum of *Angiospermae* (flowering plants) (Uhl and Dransfield, 2008). It consists of small to medium-sized palms with varying stem structures from shrub to cluster and a few species with solitary stem. The distribution of *Arenga* spp. stretched from north regions of South China, India until Australia where the most diversity is located in Southeast Asia (Dransfield and Moge, 1984; Uhl and Dransfield, 1987). *Arenga* spp. thrive in various environments such as lowland rain forest, deciduous forest, secondary forest, mountain range forest as well as limestone outcrop, near villages and open area. While most can be found below 800 m at sea level, some species can survive at 2200 m elevation. *Arenga* spp are known as an economically important species due to their multipurpose uses such as *A. pinnata* and *A. westerhoutii* (Pongsattayapipat and Barfod, (2009). Various parts of the palms can provide community with material sources that can be used such as leaves of *A. westerhoutii* and *A. longicarpa* for traditional house construction and other craftsmanship. Among the species, *A. pinnata* was the most well known for its sap production and classified as one of the major sap-producing palm trees utilized by mankind.

1.1.2 *Arenga pinnata*: The Multipurpose Palm

Commonly known as sugar palm, *A. pinnata* has been locally known with various names depending on localities. Such names include; aren, ejow, gomuti (Indonesia), kabung (Malaysia), kaong (Philippines), zuckerpalme (Germany) and various other names by specific ethnic groups of respected countries. The common name derived from its most important product which is the sweet sap. As it can be produced all year-round, the saps can be a source of invigorating juice especially during dry season. Saps can be further processed to obtain jaggery, toddy, crystal and