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Comparative Analysis of Bunch Weight and Fruit-to-Bunch Ratio Between Dura and Tenera Oil Palm Varieties

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Abstract

Oil palm (*Elaeis guineensis* Jacq.), a vital crop in global agriculture known for its high oil yield, predominantly features two fruit types: Dura and Tenera. Despite their economic importance, there's a paucity of research on how these varieties differ in bunch weight and fruit-to-bunch ratio, key factors in optimizing oil palm cultivation and promoting sustainable practices. This study addresses this knowledge gap by examining the influence of Dura and Tenera fruit types on these parameters. We gathered data on bunch weight and fruit-to-bunch percentage from plantations cultivating both varieties. Our findings indicate Dura had a marginally higher mean bunch weight (18.88 kg) compared to Tenera (17.30 kg), and a similar trend was observed in the fruit-to-bunch ratio, with Dura at 73.29% and Tenera at 66.15%. These results suggest that the choice of fruit type should be a consideration in planting strategies. Further investigation is warranted into the genetic and environmental contributors to these observed disparities.

1. Introduction

The global agricultural sector significantly relies on the production of oil palm, a crop pivotal for its high oil yield. The Dura and Tenera varieties, each with unique characteristics, are at the forefront of this cultivation. Previous study emphasizes the crucial differences in oil content and productivity between these varieties, underscoring their economic and environmental impacts [1][2]. This distinction is particularly important as the industry not only caters to a large portion of the global edible oil market but also influences the livelihoods of millions in the developing world [3]. Therefore, understanding the nuances between these types is essential for optimizing cultivation and ensuring sustainable agricultural practices.

While general aspects of oil palm productivity have been extensively studied, focused research on Dura and Tenera types, especially concerning oil content and fruit characteristics, remains limited [4]. This knowledge gap hampers the development of more efficient cultivation techniques and breeding programs. Previous study highlights the necessity for more detailed comparative studies to enhance agricultural outputs and adapt to evolving market demands [5]. Moreover, the environmental impacts of cultivating these varieties at different scales are not fully understood, making targeted research in this area critical. Bridging this gap is key to advancing the industry and ensuring its sustainability.

By examining the specific characteristics and oil content of Dura and Tenera palms, the research aims to influence cultivation methods and boost productivity [6]. It addresses a critical aspect of agricultural science

that aligns with global efforts toward food security and sustainable farming practices [7]. The comparative approach promises to unravel nuances that could lead to more resilient and efficient palm oil production. Ultimately, this research is expected to contribute significantly to both theoretical and practical aspects of agricultural science.

The study is designed with two primary objectives: firstly, to explore the differences in bunch weight, a direct indicator of yield, between Dura and Tenera palm fruit types. This aspect is crucial as it affects the volume of oil production. Secondly, the study aims to analyze the variations in the fruit-to-bunch percentage, which is vital for determining the efficiency of oil extraction. Understanding these parameters is crucial for breed selection and cultivation practices. By achieving these objectives, the study will provide valuable data that can be used to optimize crop yields and enhance the overall efficiency of oil palm production.

2. Methodology

2.1 Study Area

The research was conducted in the Ladang Seed Garden, located within the Pusat Penyelidikan dan Pembangunan FELCRA Berhad in Bota Perak, Malaysia (coordinates: 4°18'43"N 100°58'03"E), as shown in Figure 1. This specific site, known as 'Trial 1', spans an area of 9.15 hectares and offers a representative sample of the region's oil palm cultivation practices.

The area is characterized by its tropical climate, well-distributed rainfall, and fertile soil, making it an ideal location for oil palm research. It has a diverse range of oil palm plantations, including both Dura and Tenera varieties, thus providing a comprehensive and suitable environment for conducting comparative analysis.

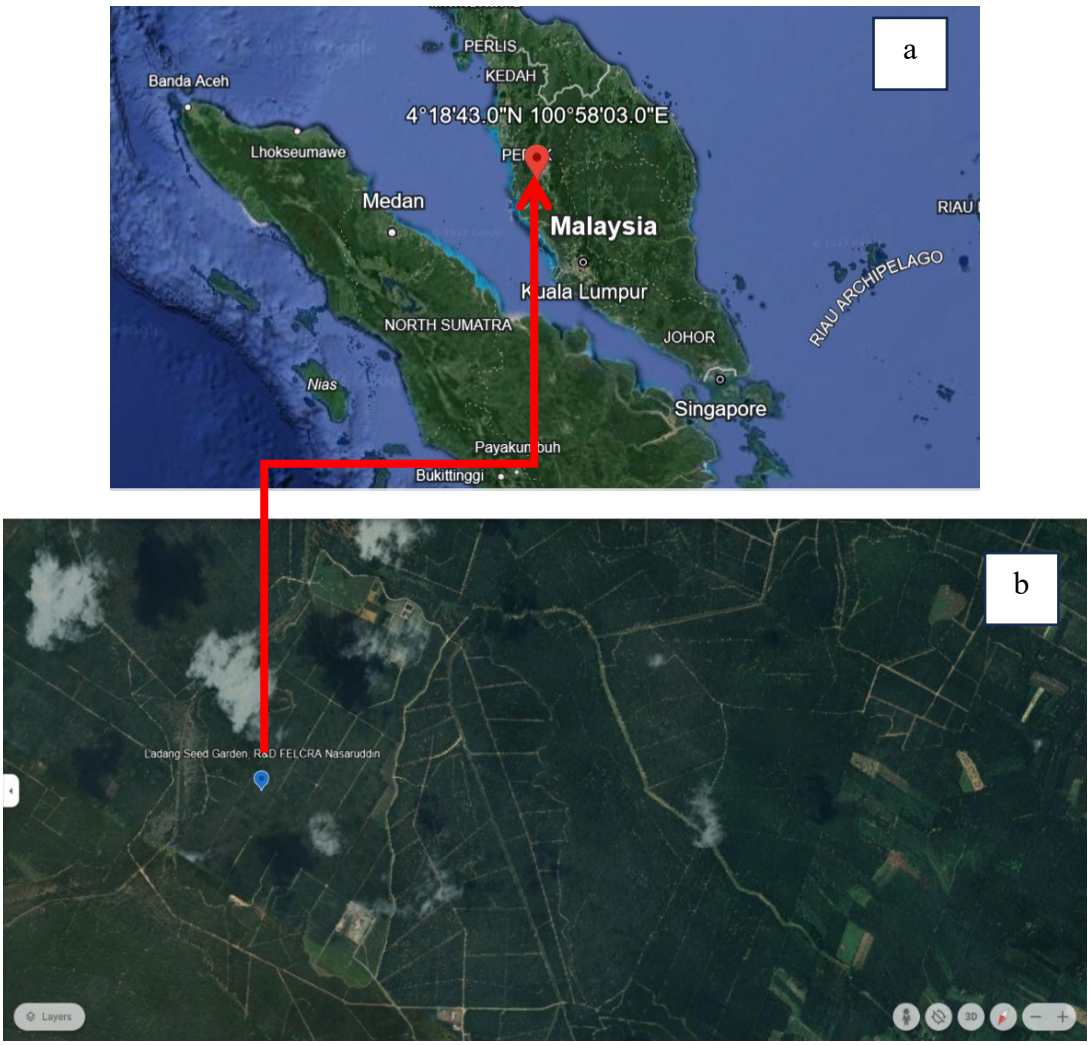

Fig. 1 *Map of peninsular Malaysia (a) and location of study plot Ladang Seed Garden, R&D FELCRA Berhad (blue point) in (b)*

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2.2 Data Collection

For the measurement of bunch weight, we employed a standardized weighing method consistently throughout the year 2018. This approach ensured uniformity and precision in recording the weights of the bunches. As for the fruit-to-bunch ratio, the data was derived through a detailed analysis of fruit bunch components. This method was based on the protocol established by Rao et al. in 1983[8], which underwent a comprehensive review in 2011[9].

The specific formula used to calculate the fruit-to-bunch ratio is as follows:

$$\frac{FFWT + PFWT}{SWT} \times \frac{STKWT}{BWT} \times 100$$

Where:

- FFWT represents the weight of the Fertile Fruit Bunch.
- PFWT denotes the Parthenocarpic Fruit Weight.
- SWT is the weight of the Spikelets.
- STKWT stands for the weight of the Stalk.
- BWT is the total Bunch Weight.

2.3 Data Analysis

Our approach to analyzing the collected data involved an in-depth examination of both the bunch weight and the detailed components of each bunch, with particular emphasis on the fruit-to-bunch ratio. To process and interpret this data, we utilized IBM SPSS Statistics 21, a robust statistical software known for its precision and reliability.

This software facilitated the calculation of both the mean and standard error for the Dura and Tenera oil palm varieties. We then applied an independent T-Test, a statistical method ideal for comparing means between two independent groups, to conduct a thorough comparative analysis.

3. Results and Discussion

Our study, which involved analyzing 288 oil palm trees (230 Dura & 58 Tenera) at the Ladang Seed Garden, FELCRA R&D Nasaruddin, Bota, Perak, revealed nuanced but statistically non-significant differences between the Dura and Tenera varieties. Specifically, the Dura variety exhibited a slightly higher mean bunch weight of 18.88 kilograms compared to the Tenera variety's 17.30 kilograms (Figure 2).

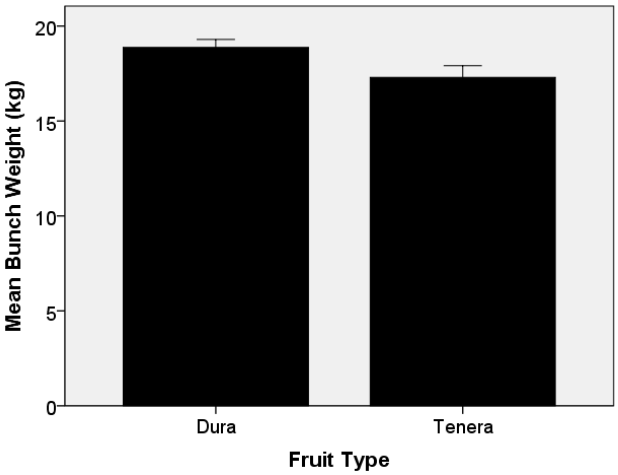

Fig. 2 *Mean bunch weight graph Dura vs Tenera*

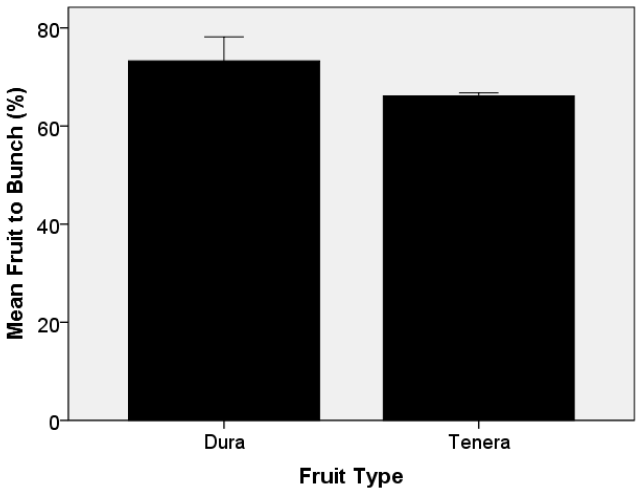

Fig. 3 *Mean fruit to bunch ratio Dura vs Tenera*

In terms of the fruit-to-bunch ratio, Dura palms showed a mean ratio of 73.29%, again marginally higher than Tenera's 66.15% (Figure 3). Although these differences are noticeable, they were not statistically significant, indicating that while these varietal distinctions exist, they may not have substantial impact on overall yield. Supporting our findings, literature in the field aligns with these observations. For instance, studies by Afshin et al. (2011) [10] and others have noted similar trends in bunch weights and fruit-to-bunch ratios between Dura and Tenera varieties [11] [12]. However, as our results suggest, these differences, while present, are not always statistically significant. This highlights the complexity of genetic and environmental factors influencing oil palm characteristics and underscores the need for further research to understand these dynamics fully [13].

3. Conclusion

The comparative study of Dura and Tenera varieties revealed that, in terms of bunch weight and fruit-to-bunch ratio, the differences were not statistically significant. On average, Dura palms exhibited a marginally higher performance in both metrics, but these slight variances did not amount to significant disparities. This finding suggests that while there are observable differences between the varieties, they are not substantial enough to influence major decisions in breeding programs based on these two factors alone. Given the limited scope of our study, which focused primarily on bunch weight and fruit-to-bunch ratio, future research should adopt a more comprehensive approach. It is recommended that subsequent studies include a complete analysis of all components of the oil palm bunch. This holistic perspective is crucial for a more accurate and thorough assessment of oil palm performance. Such in-depth analysis will undoubtedly contribute to the enhancement of breeding programs, leading to improved varieties with optimized characteristics for higher yield and efficiency.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Mohamad Asyraf Hasli, Nadia Mohd Fadzil, Sari Indra Saputra Mohd Arbain,* ***data collection:*** *Mohd Amirulhakim* ***analysis and interpretation of results:*** *Noraini Ruslan;* ***draft manuscript preparation:*** *Mohamad Asyraf Hasli, Najma Syahmin Abdul Halim, Noraini Ruslan, Muhammad Syazwan Shahidan.*

References

[1] Mejouyo P. W. H., Tiaya, E. M., Tagne, N. R. S., Tiwa, S. T., Njeugna, E. (2022) Experimental study of water-sorption and desorption of several varieties of oil palm mesocarp fibers, *Results in Materials, 14,* 100284.

[2] Owolarafe, O., Olabige, M., & Faborode, M. (2007). Physical and mechanical properties of two varieties of fresh oil palm fruit, *Journal of Food Engineering*, *78*, 1228-1232. https://doi.org/10.1016/J.JFOODENG.2005.12.049.

[3] Erinoso, S., Aworinde, D., Teniola, O., & Ojo, S. (2020). Ethnobotany of *Elaeis guineensis* Jacq. and its importance in the household economy of the Ikale and Ilaje of Ondo State, Nigeria. *Ethnobotany Research and Applications*, *20*, 1-16. https://doi.org/10.32859/era.20.42.1-16.

[4] Witjaksono, J., Yaumidin, U. K., Djaenudin, D., Astana, S., Harianja, A. H., Fery, S., Hasibuan, A. M., Khotimah, H., Hidayatina, A., Rusdin, Bungati, Imran, Rusdi, Purba R. (2023) The assessment of fresh fruit bunches supply chain of palm oil independent smallholder farmers in southeast Sulawesi, *Uncertain Supply Chain Management, 11, 941-950.*

[5] Singh, R., Low, E., Ooi, L., Ong-Abdullah, M., Chin, T., Nagappan, J., Nookiah, R., Amiruddin, M., Rosli, R., Manaf, M., Chan, K., Halim, M., Azizi, N., Lakey, N., Smith, S., Budiman, M., Hogan, M., Bacher, B., Brunt, A., Wang, C., Ordway, J., Sambanthamurthi, R., & Martienssen, R. (2013). The oil palm Shell gene controls oil yield and encodes a homologue of SEEDSTICK. *Nature*, 500, 340 - 344. https://doi.org/10.1038/nature12356.

[6] Ooi, L., Low, E., Abdullah, M., Nookiah, R., Ting, N., Nagappan, J., Manaf, M., Chan, K., Halim, M., Azizi, N., Omar, W., Murad, A., Lakey, N., Ordway, J., Favello, A., Budiman, M., Brunt, A., Beil, M., Leininger, M., Jiang, N., Smith, S., Brown, C., Kuek, A., Bahrain, S., Hoynes-O'Connor, A., Nguyen, A., Chaudhari, H., Shah, S., Choo, Y., Sambanthamurthi, R., & Singh, R. (2016). Non-Tenera Contamination and the Economic Impact of SHELL Genetic Testing in the Malaysian Independent Oil Palm Industry. *Frontiers in Plant Science*, 7, 771. https://doi.org/10.3389/fpls.2016.00771.

[7] Sandhu, H. (2021). Bottom-Up Transformation of Agriculture and Food Systems. *Sustainability*, *13(4),* 2171. https://doi.org/10.3390/SU13042171.

[8] V. Rao, A.C. Soh, R. H. V. Corley, C. H. Lee, N. Rajanaidu, Y. P. Tan, C. W. Chin, K. C. Lim, S. T. Tan, T. P. Lee and M. Ngui (1983). A Critical Reexamination of the Method of Bunch Quality Analysis in Oil Palm Breeding. *PORIM Occasional Paper*, *9*, 1 - 28.

[9] Isa, Z. A., Kushairi, A., Mohd Din, A., Suboh, O., Junaidah, J., Noh, A., Choo Kien, W., & Musa, B. (2017). A Critical Re-Examination of the Method of Bunch Analysis in Oil Palm Breeding – An Update. *Journal of Oil Palm Research*, *29(1)*,19-32.

[10] Afshin, K., Endan, J., Harun, H., Ahmad, D., & Saleena, F. (2011). The Relationship between Palm Oil Index Development and Mechanical Properties in the Ripening Process of Tenera Variety Fresh Fruit Bunches. *Research Journal of Applied Sciences, Engineering and Technology*, *3*, 218-226.

[11] Pedapati, A., Mathur, R., Ravichandran, G., Babu, B., & Bhagya, H. (2021). Evaluation of bunch quality components in Dura x Dura progenies of Zambia and Camaroon sources of oil palm germplasm. *Journal of Environmental Biology*, 42, 1567-1577. https://doi.org/10.22438/jeb/42/6/mrn-1813.

[12] Breure, C. (1986). Parent selection for yield and bunch index in the oil palm in West New Britain. *Euphytica, 35*, 65-72. https://doi.org/10.1007/BF00028542.

[13] Luyindula, N., Mantantu, N., Dumortier, F., & Corley, R. (2005). Effects of inbreeding on growth and yield of oil palm. *Euphytica, 143*, 9-17. https://doi.org/10.1007/s10681-005-6735-1.