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Analysis of weather impacts on oil palm productivity

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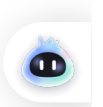
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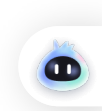
Oil palm is the major source of vegetable oil in the world and Indonesia and Malaysia are the main palm oil producing countries. Its fresh fruit bunch (FFB) yield refers to the quantity of fresh fruit bunches harvested from oil palm trees. There is limited knowledge on the factors accounting for variation in FFB yield. This study investigated relationships between weather factors with FFB yield and its components using data obtained from study site Pahang Malaysia. The database included weather variables and yield records for 35 years, portraying a wide range of yield and environmental conditions. We used average monthly and annual values to detect temporal variations in yield associated with weather based on average rainfall, maximum temperature, minimum rainfall and number of rainy days per month. It is found that water stress was the key factor accounting for temporal variation in oil palm yield. Our analysis also highlights the importance of frequent rainfall as a stress factor in oil palm, with this study being the first to demonstrate the negative relationship between yield and rainfall frequency. Meteorological anomalies during the drought period did not exhibit major impact on yield which indicated significance of







appropriate irrigation strategy. These findings extend current knowledge about sources of variation in oil palm yield, providing useful information to describe oil palm production in context of environment and improve oil palm production by mitigating negative weather impacts on yield. Moreover, it can facilitate oil palm modeling and timely forecasting.

Topics

[Biofuels](#), [Hydrology](#), [Knowledge](#)



REFERENCES

1. Khatun, R., et al, *Sustainable oil palm industry: The possibilities. Renewable and Sustainable Energy Reviews*, 2017. 76: p. 608-619.
<https://doi.org/10.1016/j.rser.2017.03.077> 
[Google Scholar](#) [Crossref](#) 
2. Murphy, D.J., K. Goggin, and R.R.M. Paterson, *Oil palm in the 2020s and beyond: challenges and solutions. CABI Agriculture and Bioscience*, 2021. 2(1): p. 1-22.
<https://doi.org/10.1186/s43170-021-00058-3> 
[Google Scholar](#) [Crossref](#) 
3. Beyer, R.M., et al, *The environmental impacts of palm oil and its alternatives. Biorxiv*, 2020: p. 2020.02. 16.951301.
[Google Scholar](#)
4. Jackson, T., et al, *Learning to love the world's most hated crop. Journal of Oil Palm Research*, 2019. 31(September): p. 331-347.
[Google Scholar](#)
5. Abubakar, A., M.Y. Ishak, and A.A. Makmom, *Impacts of and adaptation to climate change on the oil palm in Malaysia: a systematic review. Environmental Science and Pollution Research*, 2021. 28(39): p. 54339-54361.
<https://doi.org/10.1007/s11356-021-15890-3> 
[Google Scholar](#) [Crossref](#)  [PubMed](#)
6. Parsons, S., S. Raikova, and C.J. Chuck, *The viability and desirability of replacing palm oil. Nature Sustainability*, 2020.

3(6): p. 412-418.

<https://doi.org/10.1038/s41893-020-0487-8> 

[Google Scholar](#) [Crossref](#) 

7. Monzon, J.P., et al, *Influence of weather and endogenous cycles on spatiotemporal yield variation in oil palm.*


Agricultural and Forest Meteorology, 2022. 314: p. 108789.

<https://doi.org/10.1016/j.agrformet.2021.108789> 

[Google Scholar](#) [Crossref](#) 

8. Khan, N., et al, *Prediction of oil palm yield using machine learning in the perspective of fluctuating weather and soil moisture conditions: evaluation of a generic workflow.* *Plants*, 2022. 11(13): p. 1697.

<https://doi.org/10.3390/plants11131697> 

[Google Scholar](#) [Crossref](#)  [PubMed](#)

9. Chiarawipa, R., K. Thongna, and S. Sdoodee, *Assessing impact of weather variability and changing climate on oil-palm yield in major growing regions of southern Thailand.* *Journal of Agrometeorology*, 2020. 22(3): p. 274-284.

<https://doi.org/10.54386/jam.v22i3.189> 

[Google Scholar](#) [Crossref](#) 

10. Khan, N., et al *Environment-Based Oil Palm Yield Prediction Using K-Nearest Neighbour Regression.* in 2022 IEEE International Conference on Artificial Intelligence in Engineering and Technology (IICAET). 2022. IEEE.

[Google Scholar](#) [Crossref](#) 

11. Corcoran, J. and R. Zahnow, *Weather and crime: a systematic review of the empirical literature.* *Crime Science*, 2022. 11(1): p. 1-13.

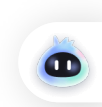
<https://doi.org/10.1186/s40163-022-00179-8> 

[Google Scholar](#) [Crossref](#)  [PubMed](#)

12. Abubakar, A., et al, *What does modelling tells us on the influence of certain weather parameters on oil palm production in Peninsular Malaysia.* *Indian Journal of Agricultural Research*, 2023. 57(1): p. 73-78.


[Google Scholar](#)

13. Promchote, P., et al, *Boosting Thailand's palm oil yield with advanced seasonal predictions.* *Environmental Research*



Letters, 2023.

[Google Scholar](#)

14. Islam, M.M., A.A. Amir, and R.A. Begum, *Community awareness towards coastal hazard and adaptation strategies in Pahang coast of Malaysia*. *Natural Hazards*, 2021. 107: p. 1593-1620. <https://doi.org/10.1007/s11069-021-04648-2> 

[Google Scholar](#) [Crossref](#) 

15. Jaafar, H.Z. and M.A. Ashraf, *1 Climate, Ecosystem. Soils of Malaysia*, 2017: p. 1.

[Google Scholar](#)

16. Sodhi, N.S., B.W. Brook, and C.J. Bradshaw, *Tropical conservation biology*. 2013: John Wiley & Sons.

[Google Scholar](#)

17. Tukimat, N.N.A., et al, *Evaluation of climate variability performances using statistical climate models*. *Sains Malaysiana*, 2018. 47(1): p. 77-84.

<https://doi.org/10.17576/jsm-2018-4701-09> 

[Google Scholar](#) [Crossref](#) 

18. Foong, S.Z., et al, *Input–output optimisation model for sustainable oil palm plantation development*. *Sustainable Production and Consumption*, 2019. 17: p. 31-46.

<https://doi.org/10.1016/j.spc.2018.08.010> 

[Google Scholar](#) [Crossref](#) 

19. Park, J.-I., J. Park, and K.-S. Kim, *Fast and accurate desnowing algorithm for LiDAR point clouds*. *IEEE Access*, 2020. 8: p. 160202-160212.

<https://doi.org/10.1109/ACCESS.2020.3020266> 

[Google Scholar](#) [Crossref](#) 

20. Carreño, A., I. Inza, and J.A. Lozano, *Analyzing rare event, anomaly, novelty and outlier detection terms under the supervised classification framework*. *Artificial Intelligence Review*, 2020. 53: p. 3575-3594.

<https://doi.org/10.1007/s10462-019-09771-y> 

[Google Scholar](#) [Crossref](#) 

21. Othman, M., et al *Tropical deforestation monitoring using NDVI from MODIS satellite: A case study in Pahang*,



Malaysia. in IOP Conference Series: Earth and Environmental Science. 2018. IOP Publishing.

22. Cedric, L.S., et al, *Crops yield prediction based on machine learning models: Case of West African countries*. *Smart Agricultural Technology*, 2022. 2: p. 100049.

<https://doi.org/10.1016/j.atech.2022.100049> 

[Google Scholar](#) [Crossref](#) 

23. Rashid, M., et al, *A comprehensive review of crop yield prediction using machine learning approaches with special emphasis on palm oil yield prediction*. *IEEE access*, 2021. 9: p. 63406-63439.

<https://doi.org/10.1109/ACCESS.2021.3075159> 

[Google Scholar](#) [Crossref](#) 

24. Rodthong, W., et al, *Factors influencing the intensity of adoption of the roundtable on sustainable palm oil practices by smallholder farmers in Thailand*. *Environmental Management*, 2020. 66: p. 377-394.

<https://doi.org/10.1007/s00267-020-01323-3> 

[Google Scholar](#) [Crossref](#)  [PubMed](#)

25. Khatiwada, D., C. Palmén, and S. Silveira, *Evaluating the palm oil demand in Indonesia: production trends, yields, and emerging issues*. *Biofuels*, 2021. 12(2): p. 135-147.

<https://doi.org/10.1080/17597269.2018.1461520> 

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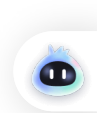
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