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INRA

PHENOPALM, a phenological model for oil palm based on individual internal trophic level at tree scale

Lamade E.[1], Setiyo Indra E.[2], Sinaga K.[3], Permana R.[4], Barthod S.[1,2] & Listia E.[2]
CIRAD

PHENOPALM is a simulation model of phenological development of oil palm (leaf emission rate, inflorescence cycles, anthesis, maturation rate and harvesting bunches, pruning leaves...) at tree scale. From two important phenological observations set of data, one from Ivory Cost (Research Station of La Mé) on LM2T x DA10D, the second one from North Sumatra (Marihat Research Station) on Deli X La Me material as well as on Deli x Yangambi, a kern module has been elaborated, MODPHEN (object-oriented programming in Delphi 7.0 environment) which generate for each oil palm tree units composed by one leaf (including leaflets, rachis and petiole), and its respective inflorescence axilled. Incrementation is achieved by a thermic time in ° days. This « kernel » is completed by a daily carbon balance between carbon supply and demand from development and needs of all growing organs. A simple carbon supply module (MOD-SIMPALM) allows to estimate daily the ratio supply/demand and to calculate an internal trophic level (Ic) which conducts each step of the phenological development and influences inflorescence sexualisation, abortion. In the last version of PHENOPALM, a water balance module (MOD-WATERPALM) is completing the software as well as competition effect between individual palm trees for light and nitrogen absorption (MOD-N-LIGHTPALM). This last module is still under development. The software is running over a period of 8000 days (even more), has been parameterised for all materials studied, in West Africa and South East Asia, which have different sensitivities for photoperiod, temperature and water stress. The model is able to give at tree scale, yield, inflorescence cycles (F, M, A) as well as the prediction of each phenological events date (date of each rank 1, anthesis, maturation and harvest). Water balance and carbon balance at plantation scale could be also easily output. An important meteorological database (12 stations Africa/Asia) under 30 years periods as well as production data are completing the software which lead to formulate strength hypotheses on seasonal and inter-annual variations observed. A clear pertinence of this tool could be seen also thorough the global warming effect on the future land use of this tree-planted ecosystem.

Mots-clés: oil Palm, phenology, model, trophic level, carbon balance, water balance, tree scale

PHENOPALM

"a phenological model for oil palm at tree scale based on internal trophic level".

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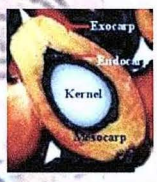
Software output

The outputs presented here illustate only possibilities and are susceptible to give others results depending on parameters and factors inputs.



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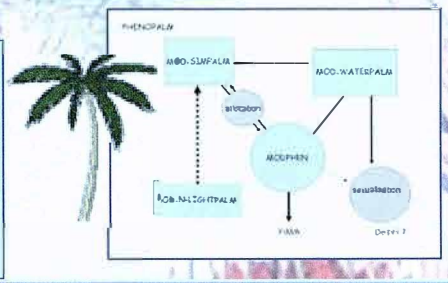
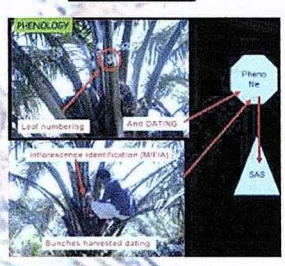
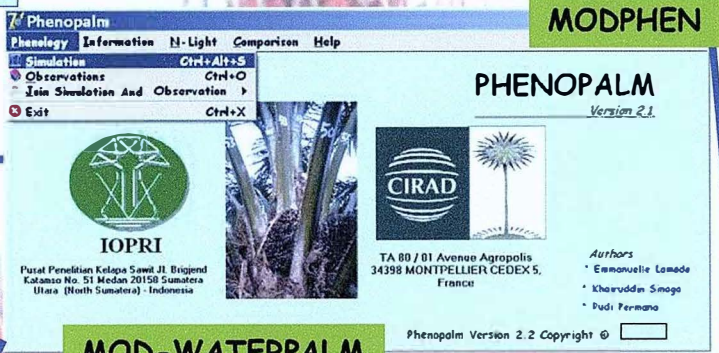
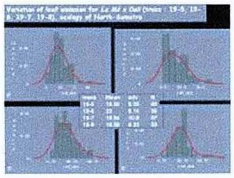
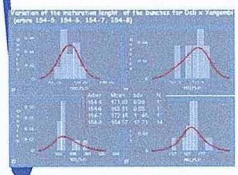




MODPHEN

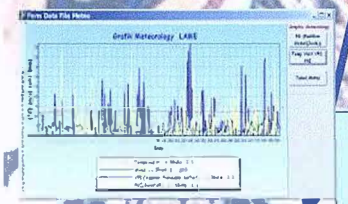


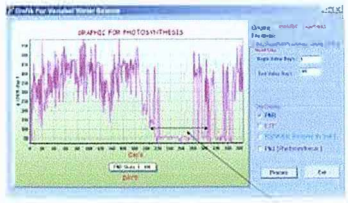




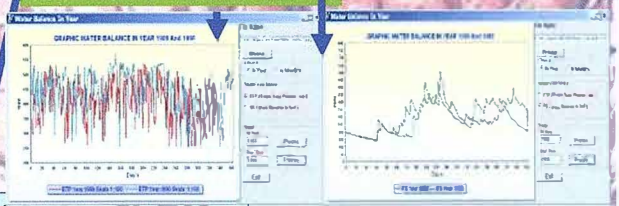
MOD-SIMPALM

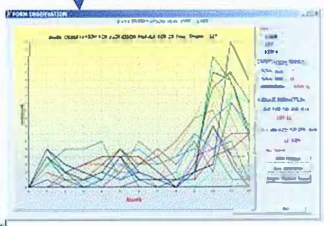
This « kernel » is completed by a daily carbon balance between carbon supply and demand from development and needs of all growing organs. A simple carbon supply module (MOD-SIMPALM) allows to estimate daily the ratio supply/demand and to calculate an internal trophic level (Ic) which conducts each step of the phenological development.





MOD-WATERPALM





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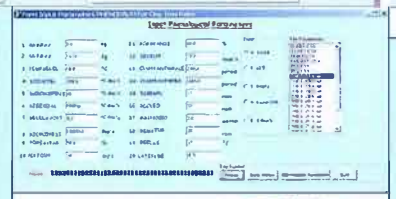

Water balance and carbon balance at plantation scale could be also easily output. An important meteorological database (12 stations Africa/Asia) under 30 years periods as well as production data are completing the software which lead to formulate strength hypotheses on seasonal and inter-annual variations observed. A clear pertinence of this tool could be seen also thorough the global warming effect on the future land use of this tree-planted ecosystem. This software will be distributed to planters.