

Variations of Carbon Content Among Oil Palm Organs in North Sumatra Conditions: Implication for Carbon Stock Estimation at Plantation Scale

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ABSTRACT

Most of the models which convert the standing biomass to equivalent carbon stock are depending upon the choice of a good estimation of the carbon content of oil palm biomass. Most of the time, rates comprised between 40 % and 45 % are used assumptionally. In order to examine the validity of such rates, an important set of carbon content analyses (920) were performed on dry matter samples collected in Aek Pancur (Indonesian Oil Palm Research Institute, 3°30' N, 98°48' E ; 25 m above sea level) on *Deli X La Mé* material (LM007T x DA 128D clonal material, MK60) between 2003 and 2004. Sampling was done on 10 trees, respectively on the above part (leaflets, rachis, petiole, trunk) and below root system (roots I,II and III+IV) as well as reproductive parts (fruits, bud, stall, spikelets). Carbon composition of bulk organic matter was determined (at the same time with ^{13}C composition) using an NA-1500 elemental analyzer (Carlo-Erba, Milan, Italy) coupled to an isotope ratio mass spectrometer (VG Optima, Micromass, Villeurbanne, France). Then results were double with, in one hand, the carbon composition in % of the sample and, in other hand, the delta ^{13}C (already published Lamade et al., 2009). Important variations were observed in leaflets, rachis and petiole depending on the leaf rank and also among all organs as trunks and roots. For leaflets, a maximum was quoted at leaf rank 3 ($47.4 \% \pm 0.2$ n = 20) and a minimum at leaf rank 57 ($41.8 \% \pm 0.7$, n= 7) with a total average of $45.2 \% \pm 0.03$ (n= 479). For the rachis and petioles, carbon content is lower than for leaflets with an average of $41.2 \% \pm 0.2$ (n=84) for rachis and $41.8 \% \pm 0.3$ (n=55) for petioles . Trunk dry matter showed an average of $40.8 \% \pm 0.3$ (n= 35) and roots $42.08 \% \pm 1.06$ (n= 14). The new total average can be estimated at 41.8 % (including all ponderations for vegetative parts), when it is 45.7 % for reproductive parts. The carbon content of fruits is highly related to their maturation stages : $43 \% \pm 0.6$ (n=28) the first month after anthesis until $57 \% \pm 2.7$ (n=9).at maturation stage. As a consequence of these observed rates, our new estimation for *Deli x La Mé* material in North Sumatra conditions will be equal to 25.4 t C ha^{-1} of standing biomass for the vegetative part and 6.5 t C ha^{-1} for the reproductive one. Then the difference from our former rate of 45%, will be around 2 t of C per ha. It is not that much, but if calculation is done over 100 000 ha, this make a difference of $2 * 10^5 \text{ t of C}$ which is not negligible. In conclusion,

such analyses must be done more frequently for different planting materials and different ecologies to get adequate carbon stock for oil palm.