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CROPS IN THEIR JUVENILE PHASE MEMORIZE AND LIMIT FOR LIFE THEIR RESPIRATIONAL AND CARBON-USE EFFICIENCY, WHICH ARE BASICALLY MODULATED BY A FALSE SIGNAL OF METABOLIC OXIDATIVE PERTURBATION FROM EXPOSURE TO OZONE

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Current modeling attempts often tend to apply a threshold value for ozone, underestimate the yield suppressing effect of ground level ozone, overestimate 'the feeding effect' of CO_2 and apply traditional Q_{10} temperature responses derived from short term (hours) measurements in mature organisms. To elucidate the actual and future yield gap and the dynamics of the land-carbon reservoir, an updated vision and consequent approach are put forward as to how temperature, ground level ozone and CO_2 interactively modulate carbon sequestration and yield-outcome. The presented study combines field observations with phytotron tests on ozone modulated epigenetic memory effects and yield. The results show the threshold value of mitochondrial alternative oxidative pathway (AOX) respiration relative to total dark respiration (TDR) during early ontogeny in both C3 and C4 crops to be fixed for life. When crops are exposed to ozone in their early ontogeny, the minimum daily accumulated [AOX/TDR] and consequently TDR become proportionally and permanently up-regulated. The presented study shows (1) the end of a paradigm: extra atmospheric CO_2 doesn´t feed crops' yield, but basically acts as ozone 'detox', (2) the CUE paradox: although variable, crops Carbon Use Efficiency tends to be fixed and, as opposed to short term changes, long term temperature change little interferes with CUE but principally affects crop yield by interfering with the crop cycle duration and (3) the CUE paradox explained: crops in their juvenile phase memorize and limit for life their respirational and carbon use efficiency which is basically modulated by exposure to ozone. It is further concluded that ground level ozone generates *a false signal of oxidative metabolic perturbation*. No threshold or 'safe value' for ozone exposure applies. Yield is basically modulated by ground level ozone as opposed to atmospheric CO_2. Broadening the scope from crops to earth's vegetation in general and considering the doubled ground level ozone and 40% atmospheric CO_2 increase since the onset of the industrial revolution, we postulate atmospheric CO_2 to be increasing principally due to the consequences of anthropogenic emissions of ozone precursors on crops and vegetation in general instead of due to the anthropogenic CO_2 emissions directly. Commissioned by the Dutch ministry of Economy, Agriculture and Innovation (EL&I), this study has been peer reviewed by the Wageningen University and Research Centre (WUR), is integral part of the theme 6 contribution to the INGC project "Responding to Climate Change in Mozambique" and was the opening presentation of the 10th African Crop Science Society Conference held in Maputo, Mozambique.

Key words: Yield, Ozone, Memory, [Alternative oxidative pathway] Respiration, Carbon balance.