Impact of ethanol production on water balance in the regions of sugar cane expansion: the Parana River Basin

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Introduction:

Brazil has the highest water availability on the planet, 13.8% of the global average runoff. The hydrographic network is made up of Brazilian rivers navigated in free flowing and waterways created by the pipeline stretches of rivers, and large isolated lake, created by the construction of dams for the sole purpose of generating hydroelectric power, has high moisture conditions in most of national territory and is considered as the densest of the planet. The relationship between demands and availability of water points to the current situation of water use in the country. In relation to this indicator the region of the Parana Basin is in a situation that requires intense management and interventions, mainly due to conflicts of uses, with some rivers showing concerning situation in the region of sugar cane expansion. In the cultivation of sugar cane water is provided primarily by rainfall and by the various waste generated in the production process (treated or not), which are recirculated. Exceptionally, in critical cases of drought, some crops are irrigated with fresh water, drawn from nearby watershed, but this procedure is limited to the distance of the plantations and the irrigation system adopted. Despite this apparently comfortable situation in the region and the non-use of irrigation applied as agricultural techniques to increase crop productivity, it is observed that the Agro-Ecological Zoning of Sugar Cane (ZAE Cane) did not take into account the consequences of land use change in the basin. The ZAE Cane shows that the potential for expansion of sugarcane in the Parana basin should occur mainly on pasture areas. The processes of production of sugarcane as a function of biomass production (tons per hectare) and composition (about 70% of the biomass is water) impact on water balance in the region. However, it is not clear how this land use change impact the environment, being necessary to assess this impact in ensuring a sustainable production of sugar cane in this important basin. Based on this scenario, this paper aims to raise and discuss some basic questions regarding the availability of water for sustainable production of ethanol in the region of the Parana basin.

Results and Conclusions

The issues raised and discussed in this work were: 1 - The water is (or will be) a natural resource, limiting the production of Bioethanol in a sustainable system? The answer to this question is apparently "not" due to the fact that sugarcane is grown in regions where there is water availability, but the formal studies presented at the 4th IPCC report show that there is a strong tendency to occur alterations in this balance with changes in mean annual temperature, which

would increase the water stress requiring crop irrigation in regions where today it is not necessary. 2 - What is the real demand for water (agriculture) to produce ethanol from sugar cane (m^3 GJ^{-1})? In Brazil as in other regions producing Bioethanol from sugar cane a major concern regards the potential impact of water use. To understand this question you need to know in detail the water crop requirement to produce one unit of energy, ready for consumption. 3 - What are the impacts of agriculture and the climate change on water resources? 4 - The practice of agricultural irrigation is feasible to be applied in the new expansion areas with water deficit? What are the benefits (energy, financial and environmental) of implementing this practice? With the expansion of sugar cane cultivation in the Cerrado, in some of its regions, irrigation will be necessary, conducted normally after planting or harvesting time, called "salvage irrigation". If these water applications are not well planned, it can lead to irreversible consequences on biodiversity and conflicts over the use of natural resources. To help answer those questions The Brazilian Bioethanol Science and Technology Laboratory – CTBE held a workshop in 2010 with the participation of researchers engaged to the theme, in which it was possible to draw the following conclusions: The Parana basin presents today favorable conditions for the expansion of sugar cane in a sustainable manner, with annual rainfall adequate in quantity and distribution. However, it was observed that the demand for water is alarming in some areas of the Basin, mainly in the states of Sao Paulo and Goias, limiting the use of surface and subsurface water and restricting installation of new sugar and ethanol projects. Apparently, water demand for ethanol production (m^3.ha^{-1}.year.season) despite high is only slightly above demand of the pasture areas, which means that the impact on land use change should be low, but no studies have been proving that this Basin water availability is sufficient to keep the new pattern of water demand. Irrigation brings significant benefits to the production of sugar cane, especially in areas where the natural distribution of rainfall does not occur properly.

In the Parana river basin there are areas considered suitable by (ZAE Cana), whose water availability is critical in certain periods of the year, requiring investments in irrigation to ensure adequate production of biomass. Finally, there is no doubt that the elaboration of studies for the generation of indicators of water use by sugar cane crop are essential for assessing and certifying the sustainability of biofuels production in the Brazilian river basins, especially in marginal areas to food production.