HOW MUCH TRASH TO REMOVAL FROM SUGARCANE FIELD TO PRODUCE BIOENERGY?

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Introduction

Since late '90s with the advancement of sugarcane mechanical harvesting without pre-burning, a substantial portion of the biomass (tops, green leaves and dry leaves) started to be left on the soil surface. At first, the most common practice was windrowing and burning this biomass. More recently, substantial number of companies began to consider alternative uses for these considerable amount of residues (trash), ranging from 10 to 30 Mg ha^{-1} dry matter. Due to new possibilities for industrial use of biomass for electricity and, in the near future, to second generation ethanol production, the use of biomass has become quite attractive. While maintenance of straw in the field brings clear benefits to the sugarcane production, such as protection against soil erosion, reduction in variation of soil temperature by protection from direct radiation, increasing the biological activity, better water infiltration; greater availability of water due to reduced evapotranspiration and better control of weeds (Rossetto et al., 2010); it also has some disadvantages, such as increased incidence of pests that may affect the sugarcane quality; reduced productivity resulting from delayed sprouting; fire risk and difficulty of performing mechanical cultivation during the growing period. Given all these positive and negative aspects of the maintenance of residues in the field, the natural response that is also accepted by most researchers in this area is that the best option would be a partial recovery of this material for industrial use. However, the question about how much of these residues can be removed from the sugarcane field still needs an answer with scientific basis, and, also if the practice will have cost effective. Therefore, this paper aims to present a sustainable option for partial removal of residues produced during the green harvest of sugarcane based on biometrics and nutrition data generated by Franco (2008) with one of the main varieties of sugarcane in Brazil (SP81-3250), during plant cane crop cycle at sugarcane fields located in the São Paulo State, Brazil. At the end of the plant cane cycle (June 2006) samples were taken in order to quantify the dry matter of the plant components. The harvest of the aerial part was held on 3 meters of cane row; in this sampling sugarcane plants were separated into stalks, dry leaves and tops and, after weighing, the samples were chopped in forage chopper machine, sub sampled to determine moisture after drying process in a forced air at 65 ^{o}C, then ground in a knife mill. Samples were then subsequently analyzed according its macronutrients and micronutrients. With the results of dry matter of the cane plant component, and its corresponding nutrient concentrations, it was obtained the accumulation of nutrients in sugarcane.

Results and Conclusions

The yield was 142 Mg ha^{-1}. The results of distribution of dry matter production showed that stalks accounted for 72% of total biomass (35.0 Mg ha^{-1}); dried leaves accounted for 18% of total biomass (9.0 Mg ha^{-1}); and tops were 10% of the total (4.6 Mg ha^{-1}). In nutritional terms, the tops showed the highest levels of N, K, P, S, Cu and Zn, while Ca, Mg, B, Fe and Mn were higher in dry leaves. With the exception of K, the stalks showed the lowest nutrients levels. From the agronomic point of view, the use of part of crop residues in the field could reduce the fertilizers application rate, depending on the rate of residues mineralization, which would increase the sustainability of the sugarcane production, based on the amount of nutrients present in each compartment of the plant. At the CTBE, preliminary simulation studies of alternative use of sugarcane residues for bioenergy production, has been chosen that 50% of the biomass of dry leaves and tops could be used in the industrial process, regardless of the quality of each of the compartments: tops or dry leafs. Based on analysis of the field work results from Franco (2008) can be inferred that the choice of the amount of residues to be used in the industrial process should not be simply based on percentages, considering that plant parts differ in composition of nutrients, moisture and biomass. Based on the enormous difference in the tops and dry leafs moisture of the tops, there are big impacts these residues combustion. Based on this great distinction between the two sugarcane residues compartments, it can be recommended that only the dried leaves should be taken to the industrial process. The recommendation identified is the partial removal of 66% of residues produced during sugarcane harvest. This is justified because dry leaves have lower impurities and a higher calorific value, while the tops have higher moisture (7 times more than the dry leaves) and higher ash amount. From the agronomic point of view, about 60% of N and K present in the sugarcane residues would be recycled, even with the removal of 66% of the dry matter of the residues due to high values of N and K in the tops. In this division, about 5 Mg ha^{-1} of biomass would remain on the soil after sugarcane harvesting, with seven times more moisture than the dry leaves. It can aid the regrows of the ratoons in adverse times; significant amount of N and K is return to the field, and smaller amount of trash on the stump could facilitate cultivation and reduce the pests incidence. From the standpoint of agricultural engineering, the choice of the quantity of residues to be used in the industrial process by compartment could facilitate the design of better equipment, such as better performance of the harvester´s pneumatic cleaning/separation system which decreases sugarcane losses and fuel consumption. In addition, Life Cycle Assessment results showed that environmental indicators of the entire chain of sugarcane industrialization are better because more nutrients are recycled and less mineral fertilizers are used in the agricultural phase. At the industrial phase more lignocellulosic material is available to be converted into electricity and/or ethanol per unit area. Additionally, lower environmental impacts at the transport phase are also observed due to a material´s transport with lower moisture content.

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