

INNOVATIVE SOLUTION FOR SUGARCANE STRAW RECOVERY

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Introduction

Brazil is a major sugarcane (*Saccharum officinarum* L.) producer and its production more than doubled over the last decades to meet global bioenergy demands for reducing crude oil dependency and mitigating climate change. With the progressive shift from a burned to a non-burned harvest system, most of the straw presently retained on the soil surface has become economically viable feedstock for bioenergy production. Nowadays, mechanical harvesting in South Region has reached 97 % of the crop area. As a consequence of burning restrictions, the straw (sugarcane byproducts), composed by sugarcane green tops (40 %) and dry leaves (60 %), is abundantly available in the field. Considering the Center-South Region (with a production equivalent to 567 million tonnes of sugarcane per year, which corresponds to more than 90 % of Brazilian sugarcane production) the amount of straw produced would be higher than 70 million tonnes (dry basis). This biomass has been considered strategic for the production of 2G ethanol. However, the exploitation of straw potential is still limited due to some challenges related to its agricultural harvesting, and to its ecological roles (soil erosion prevention, soil fertilization, etc.).

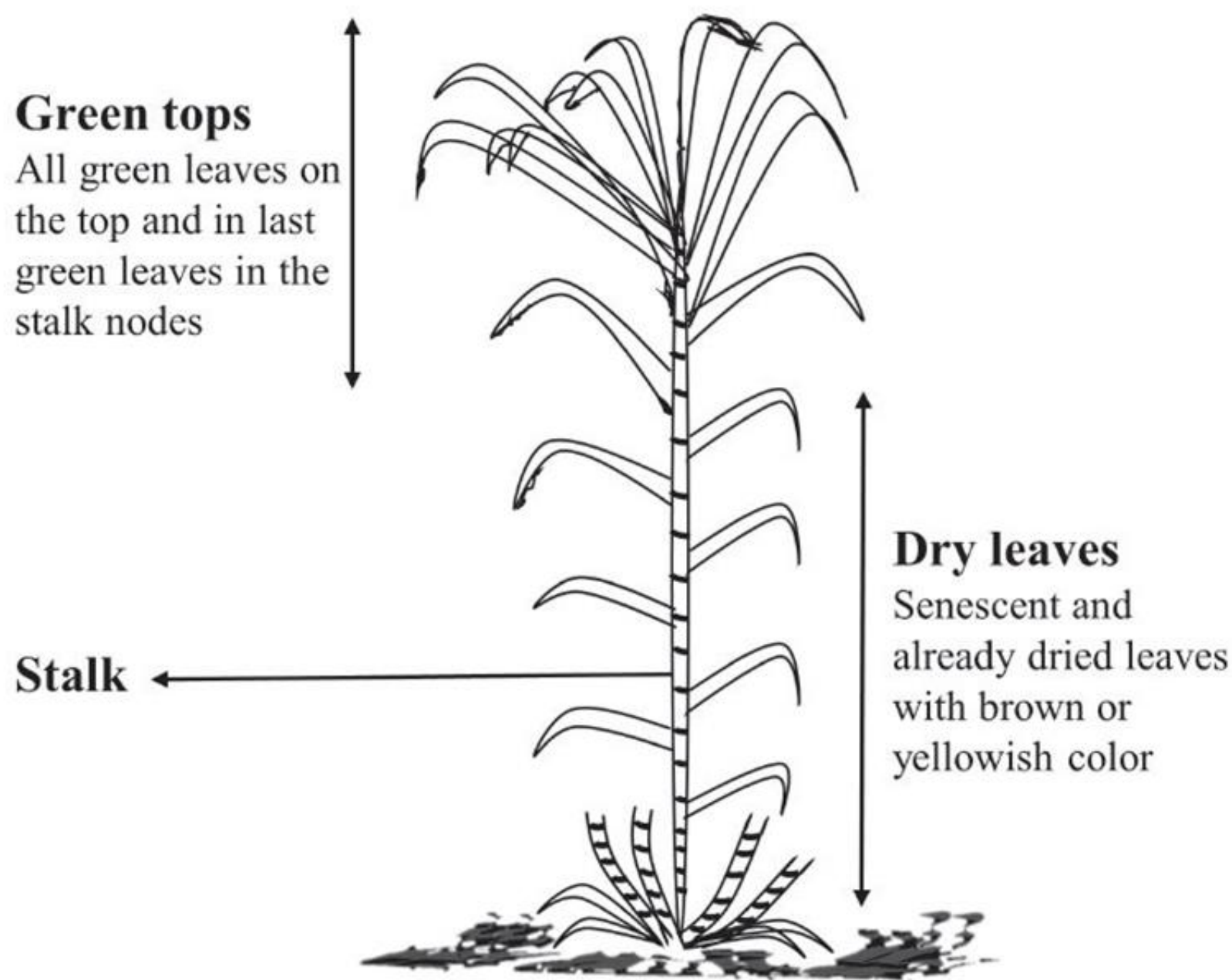


Problems and limits of the actual harvesting system

About 10-14 tonnes of straw per hectare are discharged from the machine into the field. Therefore, the biomass is windrowed and baled. Only half of the biomass is baled (5-7 t ha⁻¹) in order to maintain soil fertility, to avoid soil erosion and to decrease the ash content of the harvested biomass. The applied system however do not permit the selection from dry leaves and top leaves. After baling, the bales are concentrated in piles in the field from where they are transported to the storage center.

Bottlenecks of the sugarcane applied harvesting system:

- Do not select dry leaves from top leaves
- Harvest a great amount of soil moved by the windrover and collected by the baler, also due to low levelling of soil;
- Windrowing teeth and baler pick up teeth can damage the roots (resprouting problems);
- Compaction of soil due to multiple passages (windrowing, baler, bales collection)



Dry leaves represented 60 % of the straw, but green tops contained about 70 % of the total N, P, and K content. Green tops also had six times higher moisture and greater chlorine content which decreased the mill process efficiency. In turn, dry leaves had higher lignin, cellulose, and hemicelluloses content, and greater heating value (gross: 17.3 MJ kg⁻¹; net: 15.6 MJ kg⁻¹). It is preferable to use dry leaves for bioenergy production while leaving green tops on the field for nutrient, for recycling, soil erosion, soil temperature and water content, soil bulk density and soil carbon stock control. Maintaining large volumes of straw could moreover increase pests, result in accidental fires and elevate N₂O emissions from cane fields.

Continuous merger

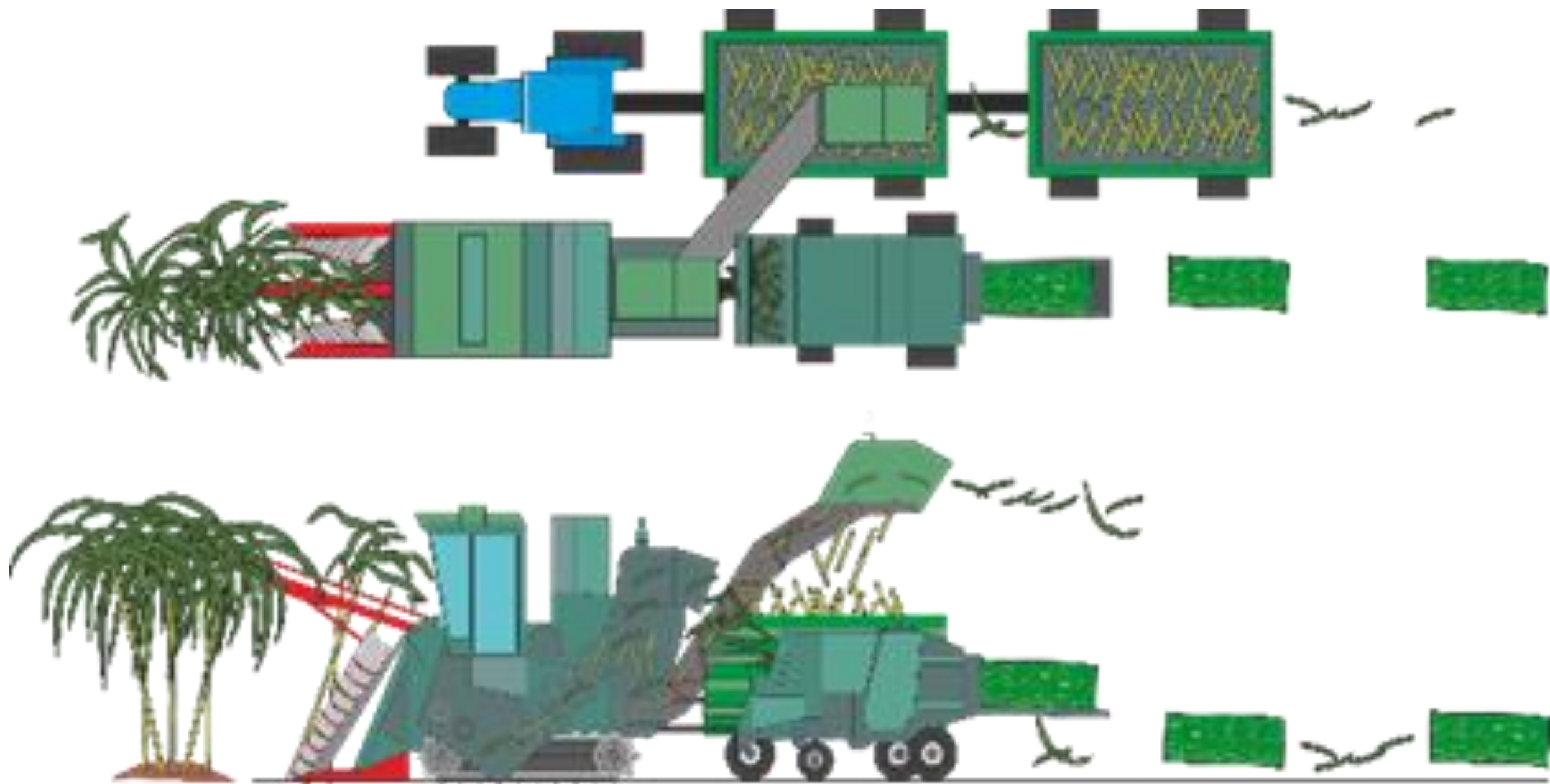


The main difference compared to free wheel rakes is represented by the pick-up system: the rake lifts the crop in order to transport it on a conveyor belt, whereas traditional rakes drag the crop on the ground up to the windrow. This difference leads to:

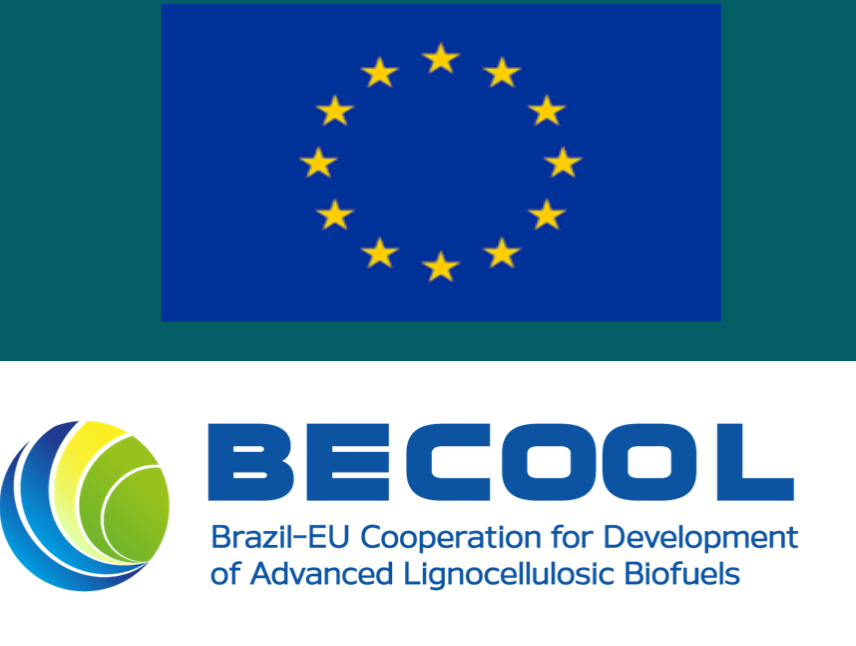
- Less damages on sugarcane root.
- Less ash content in the biomass.

Solutions proposed by CREA

Direct collection by the harvester



A big baler without pick up and feeded directly by the discharge system of the sugar cane harvester that is blowing the dry leaves will be towed by the harvesting machine. The top leaves discharged by the topper and the straw discharged from the second fan will be directed into the soil, as normally happens. This approach will not collect any soil and stone, will decrease the field traffic and the damage of the roots by avoiding the windrowing and pick up for baling operations.



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