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Preliminary analysis of effects of scale, mechanization and technological level in sugarcane biorefineries

Chagas, MF[1,2]; Jesus, CDF[1]; Cavalett, O[1]; Leite, JGDB[3]; Bonomi, A[1,2]; Leal, MRLV[1]; Cortez, LAB[3,4].

[1]Laboratório Nacional de Ciência e Tecnologia do Bioetanol, CNPEM, Campinas, SP
[2]Faculdade de Engenharia Química, Unicamp, Campinas, SP
[3]Núcleo Interdisciplinar de Planejamento Energético, Unicamp, Campinas, SP[4]Faculdade de Engenharia Agrícola, Unicamp, Campinas, SP

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The main factors affecting sustainability of sugarcane biorefineries are the mechanization level of the sugarcane agricultural production system and the scale and technological level of the industrial plants. In this work a preliminary analysis of the impact of the choices made with respect to these key aspects of the Brazilian sugarcane sector are presented and discussed.

Production of sugarcane was studied under manual and mechanized systems, considering the effects of industrial scale in required areas for sugarcane culture and its spatial distribution. In the industrial sector, autonomous distilleries with low and high milling capacity, as well as a micro-scale plant were considered. Apart from micro-distilleries, basic and optimized industrial technological levels were considered for low and high capacity plants, respectively. Techno-economic parameters, as the sugarcane production cost and internal rate of return, were selected to measure the impacts of these variables.

Results showed that considering larger distilleries, sugarcane will need to be cultivated in more distant areas, increasing mean transport distances and consequently sugarcane production costs. By adopting a mechanized scenario of sugarcane production, it was observed a reduction on manual operation costs while more jobs were created for mechanized operations. Even though, increasing mechanization level in agricultural sector required more investments, it decreased the sugarcane production costs due to reduction in labor intensity. For the industrial sector, results indicated that the economy of scale for investments favors larger and optimized distilleries, which presented better economic results. Low process yields leads to unfavorable economic results for micro-distilleries. Micro-scale plants have viability only under very specific context, applicability, and market prices.

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