Energetic Balance Analysis on small Distilleries with Run / Alcohol Conjugated in the South Brazil Region

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Abstract

The aim of this paper is to analyze the energetic efficiency in systems of run/alcohol conjugated production, due to the great potential use of this process in micro distilleries that take place in the south of the country towards the production of run, but they can also be adapted to the production of alcohol combustible, aiming the energetic support of these properties. Hence, there is the need to accomplish an energetic balance on this kind of process. The aim of this balance is to find out an equilibrium point between energetic efficiency (consume/production relationship) and a greater economic profit. The balance was accomplished, analyzing the agricultural and industrial sectors, adapted to the south country production reality. In the agricultural sector energetic balance the necessary operations were done to obtain the raw material taking into account its combustible consume (situation 1), mechanization level and energy consumed to the production of the equipment, (situation 2) fertilizers, suppliments and defensives (situation 3) in a system with manual harvest without the utilization of the sugar cane straw.
In the industrial sector analysis, the electric power consume was considered, besides considering the bagasse burning as an energy consumed in the distillery process as well (situation 1). The energy spent with buildings and equipments was taken into consideration, as well as the energy consumed for the equipment production (situation 3) process suppliments (situation 4). Through the relation ºGL (% alcohol in volume) / kcal, a relationship between alcoholic graduation and energy consumed was established. Nevertheless this value had a variation, according to the proportion alcohol / run, as well as the quantity of alcohol produced and excess of bagasse in a curvature presenting the following points: 100/0, 80/20, 60/40, 40/60, 20/80, 0/100 in alcohol 92.9º GL and run % to 44.9º GL.

The curvature equilibrium point between energetic efficiency and economic return was the one where the proportion alcohol/ run was 60/40, where the efficiency losses in relation to production/ consume were 28.32% and the losses in terms of economic return were 30.17%. It is worth quoting that this is a generic point and should be adapted according to each different case according to its productive system and costs analysis. In short, the system of alcohol / run conjugated production is now an energetic and economic alternative to the rural properties which need both a product as a profit alternative, as an energetic source to the own property.

Keywords: Energetic efficiency, alcohol, run

Introduction

This study has as objective main to analyze the energy balance in a system of conjugated production alcohol / run, with intention to find the point where the enery availability and the economic income are balanced. As they exist in the south of Brazil, many units directed for production and processing of the sugar cane in the form of run, exist with this an enormous potential of these properties to generate its proper energy through the alcohol production. Alcohol this, that could be produced through the implantation of attached equipment or adaptations in the used destillers, aiming at with this, to produce as much run how much alcohol. Thus, these properties would be at the same time generating income through the production of run, and energy through the alcohol, aiming at its energetic and economic sustainable. For this analysis was effected this study with intention to point which where these variable enter in balance, considering the ratio of run and of alcohol produced for ton of sugar cane. With this, these properties will have to make use of tools to towards its production thus aiming at its balance, adjust a general system for each situation. Thus, properties that present minor mechanization or minor external use of suppliments and fertilizers as its system of culture, also present a lesser energy consumption in its agricultural sector, or properties that they use the bagasse and the straw of the sugar cane in its industrial sector, present greater energetic availability in this sector. By this, a generic balance based on publications was used, techniques adapted for the reality of production of the south of the country, considering the energy consumed in the agricultural sector and the industrial sector. Beyond the energy generated in the process, as the ratio of production in % of alcohol for % of run. The importance of this study and to provide to a form or a tool for better use of energy in this form of production, being able the same one to be a good energetic option for small agricultural properties. Thus, the produced alcohol can be used in engines of internal combustion of vehicles or same in electric generating, transforming the contained energy into the alcohol in electricity for internal use. Thus presenting, an excellent energetic option, mainly for the small agricultural property that still does not make use of electric energy through transmission nets. With this, the analysis based on an general balance is of great importance, not excusing to the individual analysis for better adjustment of the ratios of production of alcohol and run, for each practical property on the basis of its of process and its system of culture. Thus, will be presented in this work the energetic availability and economic of vary production situations, based on one same balance, having as variable the energy consumed and generated in the process of destillation, in agreement the ratio alcohol / run produced in each situation of process.

Materials and Methods

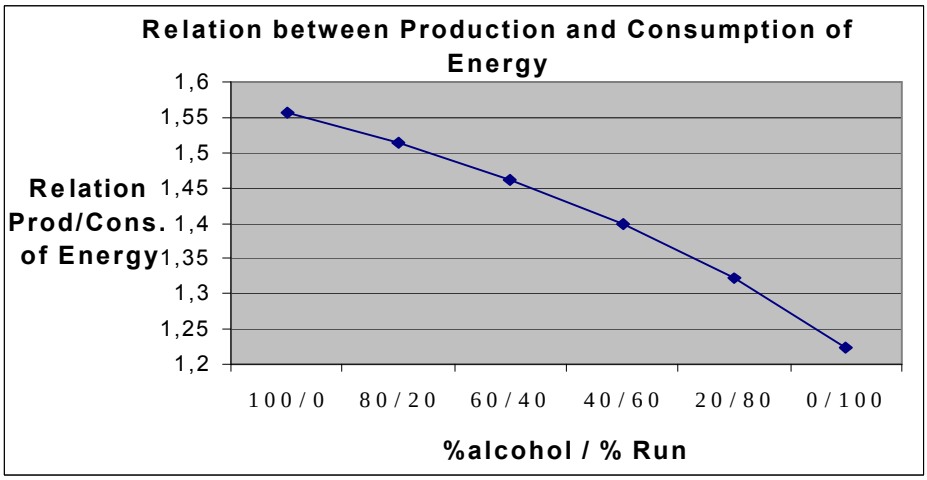
With objective to find the break-even point between energetic availability, (relation production consumption) and greater economic income .This energetic balances had been effected, analyzing the agricultural an industrial sector, adapted the reality of production of the south of the country. In the energetic balance of the agricultural sector the necessary operations for atainmente of raw material had been analyzed, considering its fuel consumption (situation 1), level of mechanization and energy consumed for the production of the equipment (situation 2), suppliments, fertilizers and defensives (situation 3). For situation 1 (combustible), the consumptions of energy to fuels (diesel fuel) can be computed in the energy value of diesel fuel (179 235 Warmth = 9 kcal/l + 2 kcal/l for production, transport and processing (situation 2) 11 414 kcal/l), in agreement CTC(1985). For situation 3 it was considered the energetic value of fertilizers and defensives and its respective amounts for

production of 1 ton of sugar cane, with basis of calculation in a production of 60 tons of sugar cane/ha year. The analysis of the sector "' industrial", was considered the consumption of external electric energy, beyond to consider as consumption energetic, the energy consumed in the destillation through the burning of the bagasse (situation 1). The energy was taken in consideration also spends with constructions and equipment (situation 2), energy consumed for the production of the equipment (situation 3) and suppliments of process (situation 4). A relation between alcoholic graduation and consumed energy was established. Through this relation (kcal/ºGL), the values corresponding the energetic availability, economic income, ratio alcohol / run, as well as the amount of produced alcohol and exceeding bagasse, had been related with the following points: 100/0, 80/20, 60/40 40/60, 20/80, 0/100 in % of alcohol 92.9 ºGL and % of run 44.9ºGL. The generated energy was calculated in agreement the Warmth of the alcohol and the Bagasse that had been respectively, 5952 Kcal/Kg of alcohol in agreement Penido Filho (1981) y 1672.4Kcal/Kg of Bagasse in agreement Mello.G (2001).

Results and Discussions

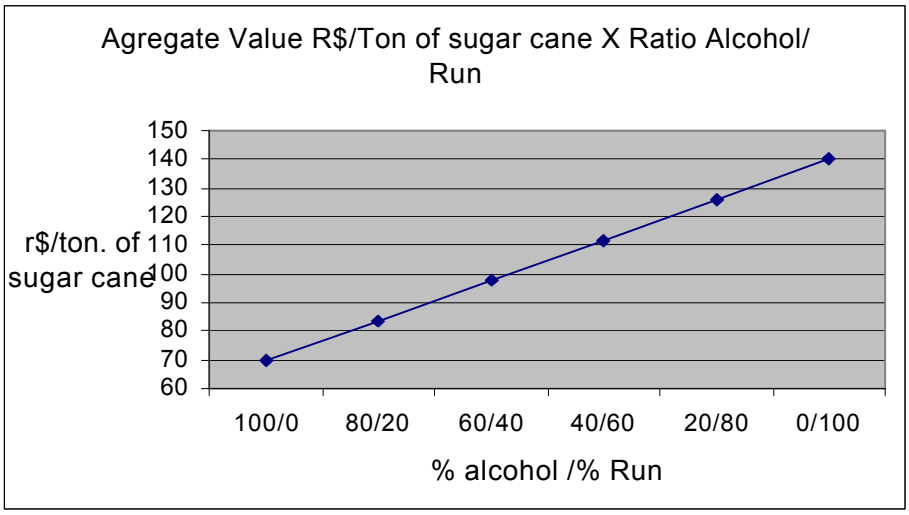
As analysis of the presented results, notices that how much bigger the energetic availability, minor is the economic return, and oppose also it is true. For better analysis and discussions the results will be presented in the graphs separately with its removed values of respective energy balances, as the ratio alcohol / run produced in each situation.

GRAPH 1-Relation between Production and Consumption of Energy



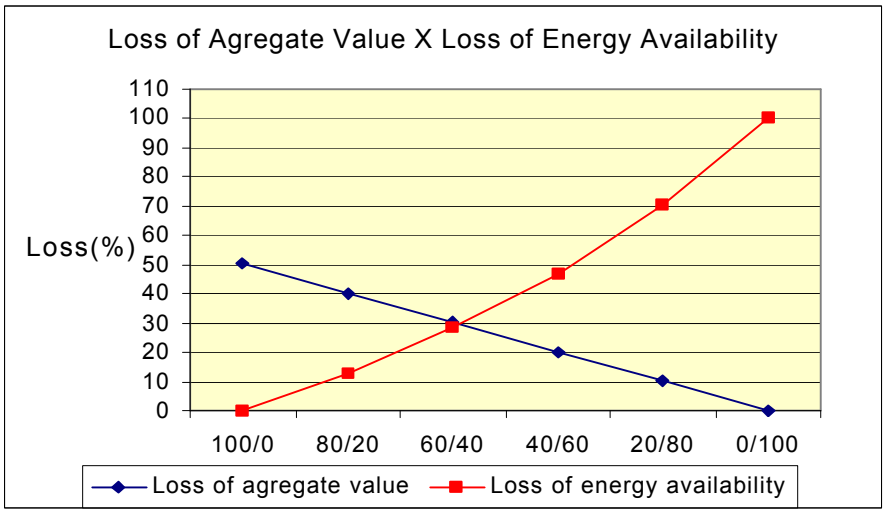
In analysis if verifies the relation between production and consumption of energy in the system, thus in agreement the ratio of alcohol produced for the ratio of run produced if has a greater or minor amount of energy generated in form of alcohol and consumed energy (suppliments energy). Thus, if it verifies that how much bigger alcohol production, bigger the efficiency between the relation production consumption, presented in graph 1. When the production of alcohol and zero the only available energy is the exceeding bagasse (total of energy consumed with the burning of the bagasse in the destillation less the energy consumed with the produced bagasse total).

GRAPH 2- aggregate Value r$/Ton of sugar cane X Ratio alcohol/run



In analysis to graph 2 if note that the results of aggregate value vary in a straight line, proportional the amount of run produced. Thus, as the price of run is 75% greater to the price of the alcohol, how much bigger the produced amount of run, bigger the value added for ton of processed sugar cane. As the curve of energetic availability; relation production / consumption is inverse the variation of economic return, is necessary to find the break-even point between the economic income and energy availability.

GRAPH 3- Loss of aggregate Value X Loss of Energy Availability



In analysis, the graph 3 was constructed aiming at to analyze the losses of energetic availability and aggregate value to the product, to have possibility of analysis of the break-even point enters the losses of the two variable. Thus, to improve the availability exist losses in aggregate value and to increase the aggregate value ha losses in availability in the system. The break-even point of the curve between energy availability and economic return were the point where the ratio alcohol / run was of 60/40, where the losses of availability with regard to production / consumption had been of 28.32% , and the losses in terms of economic return

had been of 30.17%. Is important to cite, that this point is a generic point, having to be adapted for each case in agreement its productive system and its analysis of costs.

Conclusions

In analysis to the results gotten through the respective balances demonstrated in graphs 1,2 and 3 if conclude so that the system of conjugated production alcohol / run, presents a balance between energetic availability (energy production/energy consumption) and economic return in the system. The ratio to be produced of alcohol and run is of 60% of alcohol and 40% of run. It is important to cite, that this result is generic having to be adapted for each case as its productive system, its method of process, its analysis of costs and its main necessity. This form of production at the same time makes possible the attainment of a product as income source and a power plant for the property, being extremely advantageous is interesting, mainly for properties that access does not have the electric energy and that they need a product as alternative of income in such a way, as of an energy source for the proper property. Is important to cite that as the main necessity, the ratio of production can be changed. Without problem, if exist a bigger necessity of energy production of that economic return, the ratio of to be produced alcohol production can be bigger, as well as the the opposite also is true. Thus, a system was considered approximately working with 70% oft the efficiency such a way energy as economically, with losses of availability with regard to production / consumption of 28.32% and loss of economic return of 30.17%. Thus, if it concludes that the system of conjugated production alcohol / run if presents as it joins energetic and economic alternative for agricultural properties. Without problem, the produced alcohol can be used in combustion engines moving schemes and equipment or generating, transforming the contained energy into the alcohol in electricity for use in the property and run used as commercial product, providing alternative of income for agricultural properties. Thus presenting a tool for assist it in the sustainable of the agricultural productive systems of size small .

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