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Homogeneous Management Zones: An Approach to Improve Agricultural Efficiency of Sugar Cane Cultivated in Marginal Lands

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Abstract

More efficient farming and land use systems are mandatory in a world where the demand for food, fiber and fuel is constantly rising. This demand required an increment in area dedicated for agricultural production, forcing the inclusion of marginal areas in production systems. As an optimal approach, non-food agricultural production should focus on marginal land to avoid competition with food crops (and impact food security). However, marginal areas usually have limitations which in aggregate can severely constrain production. Brazil actually cultivates more than 9 million hectares with sugar cane (with a considerable share of marginal areas), resulting in a total production of 600 million tons, of which 50 % are used for ethanol production, generating an immense amount of residues. The correct management of these residues is also of economic and environmental importance.

The objective of this work was to establish an approach to manage field variability on a site-specific basis, optimising the agronomic practices and agricultural efficiency using residues of sugar cane for bioethanol cultivated on marginal land in Brazil.

The homogeneous management zones (HMZ) were defined as sub-regions of a field with a relatively homogeneous combination of yield-limiting factors (such as low pH, soil organic matter, high bulk density, etc.). Instead of focusing in the maximum agricultural output (yield) of a HMZ, this approach aimed to rationalize the agronomic management to obtain the highest efficiency out of this area. As a result, for example, in areas limited by water availability (because of the soil texture or compaction) an over fertilisation not necessarily increased the output, but increased costs and caused pollution. The HMZ approach, in this case, reduces the amount of fertiliser applied in such area and balances the amount of residues to be applied, just to allow the best possible output considering the limitations. An important feature is that the HMZ approach was focused on the use of residues of ethanol production (especially filter cake), aiming to close the nutrient cycle for this crop.

Keywords: Crop residues, ethanol, filter cake, land use, natural resources management, precision farming, *Saccharum officinarum*, yield