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Comparative Analysis of Energy Efficiency in Wheat Production in Different Climate Conditions of Europe

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Abstract: This paper presents results concerning energy efficiency of wheat production considered in the context of specific energy input variation in different climatic conditions of Europe as well as case studies on implementation of selected energy saving measures in practice. The source data collected from the six european union (EU) countries represent five agricultural regions of continental Europe and three climates: continental, temperate and Mediterranean. The life cycle assessment (LCA) methodology was applied to analyze the data excluding of pre-farm gate activities. The total primary energy consumption was decomposed into main energy input streams and it was regressed to yield. In order to compare energy efficiency of wheat production across the geographical areas, the data envelopment analysis (DEA) was applied. It was shown that the highest wheat yield (6.7 t/ha to 8.7 t/ha) at the lowest specific energy input (2.08 GJ/t to 2.56 GJ/t) is unique for temperate climate conditions. The yield in continental and Mediterranean climatic conditions is on average lower by 1.3 t/ha and 2.7 t/ha and energy efficiency lower by 14% and 38%, respectively. The case studies have shown that the energy saving activities in wheat production may be universal for the climatic zones or specific for a given geographical location. It was stated that trade-offs between energy, economic, and environmental effects, which are associated with implementation of a given energy saving measure or a set of measures to a great extent depend on the current energy efficiency status of the farm and opportunity for investment, which varies substantially across Europe.

Key words: Wheat, energy efficiency, trade-off analysis.

1. Introduction

Energy from fossils is an essential input of the modern agricultural production. Even if the sectors of energy and agriculture generate a relatively small part of gross value added (GVA) of national economies (in the EU: 3.1% and 1.7%, respectively), they are crucial in fulfilling demands of growing population for energy and agricultural commodities. According to Smil [1], global cultivated area and energy consumption almost doubled during the 20th century. Further increase of arable land and fossil energy consumption (even if limited) may cause detrimental effects to the environment. Therefore, the intensification of agricultural production must be coupled with conservation efforts and orientated on speeding the agronomic advancements that improve

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