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Investigating the energy pattern of tomato production in Khorasan Razavi province

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Introduction

While the world's population is growing, agricultural production is still based on the use of limited and non-renewable resources. In addition to the scarcity of resources, their continuous using over the long term, causes the widespread pollution, loss of soil fertility and low agricultural production capacity, eventually. The main causes of the increase in energy consumption include the increase of world population, limited arable land, low price of fuel and fertilizer and noted increased levels of human life. Attention to limited resources and adverse effects resulting from the appropriate use of different energy sources on human health and the environment, has been required examining the energy consumption patterns and the flows of energy in the agricultural sector. Checking the share of input and output energy in different agricultural ecosystems, with attention to the type of product and the type of materials used in production, can help to identifying defects and play a fundamental role in the sustainable production, optimization of economic system, maintaining reserves of fossil fuels and mitigate air pollution. With this approach, in this present study energy consumption and energy indices for tomato production in Khorasan Razavi were studied.

Materials and Methods

The energy efficiency of units was analyzed using the stochastic frontier technique (SFA). Energy inputs from two perspectives have also been divided. In the first view of energy inputs, including inputs that have a direct energy (DE) and indirect energy (IDE). The second approach as well includes inputs that have renewable energy (RE) and non renewable energy (NRE).The data for this study was collected through interviews and completing 156 questionnaires using two-stage random sampling from tomato producer of Khorasan Razavi province in 2012.

Results and Discussion

The results showed that the energy consumption for tomato production in Khorasan razavi province of Iran were 43.2 GJ ha^{-1}. Water for Irrigation was attributed the greatest share of energy inputs (30%). The average amount of diesel fuel consumption was 152 lha^{-1}, Human resources and machinery were 987 h ha^{-1} and 44.6 h ha^{-1} respectively. The average amount of water needed for irrigation was 12596 m^3 ha^{-1}. Average energy output of the system was determined to be 35.3 $GJha^{-1}$. The share of different forms of energy inputs such as direct energy was 53.9%, indirect energy was46.1renewable energy was 50.5, and renewable energy was49.5%. According to the results, the share of indirect energy was higher than direct energy and the share of renewable energy was higher than renewable energy. Also the result of the study revealed that energy productivity and efficiency in the investigated units were 0.68 and $0.82MJha^{-1}$, respectively. The results show that the Cobb-Douglas function to calculate the efficiency has more consistency and adaptation with the data. In other words, Cobb-Douglas function is superior to the translog function. Average of technical efficiency was calculated 57%.

Conclusions

The results indicated that although a significant percentage of the investigated farms are inefficient, farmers with higher acreage have favorable energy consumption and technical efficiency of these farms was higher than that the other ones. Considering the obtained results, the main drawback associated with the technical efficiency of energy use and production of tomato in Khorasan Razavi is inappropriate use of inputs due to

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mismanagement, lack of information and also the small size of the farms. Based on the results the better management in the use of inputs and the enlargement of the size of agricultural land can improve energy efficiency in the region. Also, for improving the measures of energy flows in growing tomatoes, determining the appropriate amount of fertilizer (particularly phosphates) to grow tomatoes, conducting classes and printing the brochures for farmers to implement correct procedures in the use of inputs and the use of machines, correction of the system to reduce water consumption and cultivation of new varieties of tomato seeds in the region are recommended.

Keywords: Energy productivity, Energy ratio, Renewable energy, Tomato