Tropentag, September 17-19, 2018, Ghent

"Global food security and food safety:
The role of universities"

Global Warming Potential of Rice-based Cropping Systems in North of Iran

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Abstract

Agriculture activity is considered to be one of the main sources of greenhouse gas emission and plays an important role in global warming and climate change. Rice is an important crop in north of Iran and its production is highly connected to intensive application of chemical inputs. Therefore, introducing a cropping pattern for efficient use of energy resources in rice fields has been receiving a great interest in achieving sustainable management systems. In this study we aimed to evaluate global warming potential (GWP) of four rice-based cropping systems with different rotation in Mazandaran province, Iran. The comparative analysis was conducted taking into account four rice-based cropping systems being, single rice which followed by fallow (SR), double rice (DR), rice+faba bean (RF) and rice+wheat (RW). A total of 180 farmers field, 45 from each system, were surveyed by face-to-face interview using structured questionnaire during 2016–2017 growing season. All direct (diesel fuel, electricity, and labour) and indirect energy inputs (machinery, fertilisers, pesticides, seeds) data were converted into energy by using the respective energy co-efficient equivalents. The results revealed that the sequences of total energy input were DR > RW > RF > SR among cropping systems, respectively. Energy consumption in SR reduced approximately by more than 40 % as compared to DR. GWP for DR system (1660 kg CO_2 equiv.ha^{-1}) was 100 % higher than the SR (820 kg CO_2 equiv.ha^{-1}). GWP for other RF and RW were 1124 and 1422 kg CO_2 equiv.ha^{-1} respectively. The GWP per ton crop yield in DR system was highest by the amount of 191 kg CO_2 equiv. The lowest GWP per ton crop yield obtained in RF system resulted in 135 kg CO_2 equiv. followed by RW and SR systems. The highest share of GWP was attributed to fuel consumption ranging 73–80 % in different systems. The second factor for global warming potential was observed for fertiliser application resulted in 11, 15, 17 and 19 % for RF, DR, SR and RW systems, respectively. In conclusion, increased energy input in rice cultivation is not always necessary to get higher output energy in the rice-based cropping systems in north of Iran. A significant reduction in chemical fertilisers can be achieved also with putting legume crops in rotation with rice to realise high yields and high energy efficiency together with low environmental impacts for rice-based cropping systems.

Keywords: Green house gasses, rice cultivation

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