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"Utilisation of diversity in land use systems:
Sustainable and organic approaches to meet human needs"

Exploring Land Use Systems in Rural Settlements, Upper Egypt: Combining Biophysical Possibilities and Socioeconomic Goals

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Abstract

The ambitious project of desert land reclamation in Upper Egypt is only possible if settlers can develop a sustainable agriculture, with effective water saving allocation schemes. According to the Lake Nasser Development Project (LNDP) the total Nile water requirements for irrigation will reach 41 billion m^3 yr^{-1} once all on-going land reclamation projects are completed. The drinking and industrial water requirements in the medium term will reach 10 billion m^3 yr^{-1}. The volume evaporating from the Nile is estimated as of 1.3 billion m^3 yr^{-1}, being the total allocation of water for Egypt 55.109 m^3 yr^{-1}, around 3 billion m^3 yr^{-1} will still be available. According to this figures, it is imperative that the water allocation in the new lands be as efficient as possible. Another important aspect is the environmental fragility of the region around the Lake Nasser, the use of agricultural inputs like fertilisers and biocides should be minimised or even avoided. Alternative land use systems are needed, which achieve higher yields and returns to water ensuring zero nutrient depletion of soils and no environmental damage. The desert reclaimed lands have mineral rich soils that need a supply of organic matter through manure, in order to improve their fertility, water retention and structural quality. There is still a very poor integration of the livestock activities and agriculture (fodder cultivation and husbandry), despite the advantages for improvement of poor soils organic matter content and also for families self-sufficiency in food. The objective of this land use study is to explore solutions for the above problems searching for organic cropping alternatives that are simultaneous biodiversity enhancing, through the implementation of an integrated bio-economic farm model. The model aims to combine linear programming techniques with agronomy-based crop growth simulation models like CropSyst. The inclusion of agronomy-based models enlarges the flexibility and exploratory power of the model. It allows the exploration of more efficient and sustainable land use systems, e.g. systems that are constrained for zero-soil nutrient depletion and zero environmental emissions, e.g. nutrient balancing.

Keywords: CropSyst, linear programming, optimisation

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