
Sustainable farm system management considering economic and environmental attitudes

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Both increasing competition for water among farmers and chemical pollution due to current agricultural practices have led to unsustainability in the Kamfirooz region in the Province of Fars, Iran. The effects of management practice need to be analysed so that we do not veer from a sustainable path for the future. The suggested model combines a biophysical model (WinEPIC) and a mathematical programming model of farmers' economic behaviour with game theory to provide a more realistic representation of economic agri-environmental attitudes. This article investigated the optimal solutions for the conflicting objectives between the two relevant players, namely farmers and the community. The results indicated that it is possible to manage sustainable agricultural systems and the protection of resources by applying the appropriate management practices.

Keywords: bioeconomic modelling; game theory; sustainability; chemical pollution; water loss

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1. Introduction

The lack of water markets and the low price of water have resulted in a higher withdrawal of water resources such that there is a negative balance in most Iranian watersheds and among sub-areas (Zibaei, 2007). So, motivating farmers to use water resources more rationally is a necessity.

On the other hand, the subsidization of chemicals, especially fertilizers, to support more agricultural production has been a major factor in spreading pollution to the environment. In particular, fertilizers contain nutrients such as nitrates and phosphates and have the potential to pollute surface and groundwater and influence ecosystem and human health.

However, the assessment of economic and environmental indicators in agriculture is a multidimensional problem that requires bioeconomic modelling to

adopt various insights from different sciences. Farmers attempt to maximize their economic benefits while the community aims to minimize the environmental effects of agricultural activities. Several studies have been carried out with respect to integrating biophysical information with economic models (O'Shea and Wade, 2009; Sattler *et al.*, 2010; Schuler and Sattler, 2010).

The study area is Kamfirooz, a sub-area of the Doroodzan watershed in Fars Province (Fig. 1). One of the most important arguments for the selection of this area was the availability of data and information from previous studies.

Flood irrigation rice cropping is the dominant crop pattern in the region. In addition to encouraging policies to produce more crops, drought has caused farmers to place greater pressure on regional water resources. To overcome the shortage of water, farmers

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