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New model developed to optimise management of irrigation

Under water restrictions, farmers will achieve the optimal balance of income and efficient water use if they combine the planting of crops that require little water with the planting of more profitable crops that need more water, according to research.

In areas of irrigated farmland, water supply is becoming increasingly scarce, particularly in regions that suffer droughts and have experienced increased levels of irrigation, such as in the Mediterranean. Decision support systems (DSS), based on scientifically informed models, can help farmers decide which crops to grow and how best to use their limited supply of water to optimise their resources in these conditions. DSSs for irrigation have been widely studied, but few have been built that balance both agronomic and economic aspects.

Co-financed by the European Social Fund, the researchers developed a model to inform farming decisions on water use and crop choice and help improve the sustainability of irrigation at a farm level.

The model optimises economic cost whilst considering estimates on crop yields under different levels of water availability. It was applied to a farm-sized area in Southern Spain to explore the best combination of water use and crop choice that maximised economic profit under four possible scenarios. The scenarios were: the current situation of crop price and Common Agricultural Policy[1] (CAP) subsidies; a free market orientated situation with no CAP subsidies; a scenario based on principles of the EU Water Framework Directive[2] (WFD), which suggests water price increases, and a scenario with crop price increases.

From the results, it appears that policies which encourage changes in cropping patterns will encourage more water savings than policies that increase water prices. The model indicates that CAP subsidies ensure the profitability of certain crops, such as cotton, which would otherwise phase out under the market-orientated scenario. However, current CAP subsidies tend to favour crops with high water demands, such as maize, which could increase the risk of water shortages under conditions of climatic uncertainty.

According to the model, when water availability is high, increased water prices do not encourage water savings or crop changes. When there are water restrictions, the model suggests that the best economic strategy is to combine crops that use little water, such as sunflower, with more profitable crops with high water use, such as maize.

The study also estimated that communication delays by the local water authority on the level of water allocation could lead to maximum losses by the farm of €300 per hectare. This further emphasises the need for quick, efficient and transparent decision making by water authorities and the potential role for DSSs, such as that considered in this study.

1. See: http://ec.europa.eu/agriculture/capexplained/index_en.htm
2. See: http://ec.europa.eu/environment/water/water-framework/index_en.html

Source: Garcia-Vila, M. & Fereres, E. (2012) Combining the simulation crop model AquaCrop with an economic model for the optimization of irrigation management at farm level. *European Journal of Agronomy.* 36:21-31.

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