



Replacing fallow by cover crops: economic sustainability

José Luis Gabriel (1,2), Alberto Garrido (2), Miguel Quemada (2,3)

(1) Dpt. Environmental sciences (ELI-e), Earth and Life Institute, Université Catholique de Louvain, Croix du Sud 2 bte L7.05.02, 1348 Louvain-la-Neuve, Belgium, (jose.gabriel@uclouvain.be), (2) Research Centre for the Management of Agricultural and Environmental Risks (CEIGRAM), Technical University of Madrid, Ciudad Universitaria, Campos de Prácticas, 28040 Madrid, Spain., (3) Dpt. of Plant Production, Escuela Técnica Superior de Ingenieros Agrónomos, Avda. Complutense s/n, Technical University of Madrid, 28040 Madrid, Spain.

Replacing fallow by cover crops in intensive fertilized systems has been demonstrated as an efficient tool for reducing nitrate leaching. However, despite the evident environmental services provided and the range of agronomic benefits documented in the literature, farmers' adoption of this new technology is still limited because they are either unwilling or unable, although adoption reluctance is frequently rooted in low economic profitability, low water se efficiency or poor knowledge. Economic analyses permit a comparison between the profit that farmers obtain from agricultural products and the cost of adopting specific agricultural techniques.

The goal of this study was to evaluate the economic impact of replacing the usual winter fallow with cover crops (barley (*Hordeum vulgare* L., cv. Vanessa), vetch (*Vicia villosa* L., cv. Vereda) and rapeseed (*Brassica napus* L., cv. Licapo)) in irrigated maize systems and variable Mediterranean weather conditions using stochastic Monte-Carlo simulations of key farms' financial performance indicators.

The three scenarios studied for each cover crop were: i) just leaving the cover crop residue in the ground, ii) leaving the cover crop residue but reduce following maize fertilization according to the N available from the previous cover crop and iii) selling the cover crop residue for animal feeding. All the scenarios were compared with respect to a typical maize–fallow rotation. With observed data from six different years and in various field trials, looking for different weather conditions, probability distribution functions of maize yield, cover crop biomass production and N fertilizer saving was fitted. Based in statistical sources maize grain price, different forage prices and the cost of fertilizer were fitted to probability distribution functions too.

As result, introducing a cover crop involved extra costs with respect to fallow as the initial investment, because new seed, herbicide or extra field operations. Additional costs varied from 28 to 73 € ha⁻¹ but, results suggest that barley and vetch as cover crops increases maize yields, being a strategy that stochastically dominates the fallow.

In this case, even without selling residue and without fertilizer reduction, vetch treatment increased the benefits with respect to the fallow in almost two out of three years and barley treatment did so in one year out of two. When biomass was sold as forage, benefits increase in 80% of the years for the vetch and in 70% of years for the barley with respect to the fallow. However, rapeseed was not a good cover crop for the Mediterranean region because poorly adaptation to the weather conditions. Then, cover crops can lead to increase of economical benefits improving environmental conditions at the same time.

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