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Science for Environment Policy

Life cycle study demonstrates the long-term costs of everyday crops

The environmental and economic costs of a selection of common crops have been determined by a new study, which hopes to improve agricultural sustainability assessments in Europe. The researchers used life cycle analysis on organically farmed tomatoes and pears, and intensively farmed wheat, apples, and lettuce to show the overall impact of agricultural methods.

Agriculture accounts for 45% of total land use in the EU, and over 30% of total water use. Such large areas mean that any changes to management will have a significant impact on the wider environment. Sustainability in agriculture has been a main item of discussion in the latest reform of the European Common Agricultural Policy for the period 2014–2020.

This study, which was part-funded by the INTERREG IVC programme[1], took place in the Emilia Romagna region of north-east Italy. Using data from a total of 40 farms, the researchers conducted a Life Cycle Analysis on five crops — organically farmed tomatoes and pears, and intensively farmed wheat, apples, and lettuce.

A Life Cycle Analysis attempts to account for all environmental impacts along the production or supply chain of a product, within the boundaries found to be relevant for a particular analysis. In this case, it included considerations such as the diesel used to plough the fields, the water to irrigate the crops, and the petrol to transport the harvested product. Environmental impacts include, amongst others, toxicity for humans, eutrophication, water consumption, and the effects on global warming. Life Cycle Costing also looks at the various inputs and outputs of agricultural production, but is focused on financial impacts. For this study the researchers combined both approaches, quantifying the environmental impacts and financial costs of a single kilogram of freshly harvested produce of each crop.

Overall, the organic farming techniques were found to decrease CO_2 production and the risks of toxic pollution for human health and the environment when compared to standard intensive farming practices. Furthermore, when organically grown tomatoes were compared to results from a separate study from southern Italy which looked at intensively grown tomatoes, the differences were striking: the 'global warming potential' of intensively grown tomatoes — a measure based on greenhouse gas emissions — was 12 times greater.

The researchers drew up a set of 'external' costs for each crop; these attempt to take into account damage to the long-term environmental condition (encompassing aspects such as biodiversity and soil fertility), costs that neither the farmer nor the consumer actually pays for (but which may well impact, for example, soil fertility and hence a farmer's revenue in the future). As a result of the high levels of pesticide and fertiliser used, intensively farmed wheat was estimated to have a high externalised cost of €1.37 per kg, whereas the farming inputs of organically grown tomatoes resulted in externalised costs of €0.03. When these externalised costs are combined with the market prices of the products themselves, they bring a new perspective on the true affordability and sustainability of different farming techniques.

Calculating these costs is a difficult and contentious task, as a result of the wide range of variables involved, but could help to improve agricultural sustainability, the researchers stress. The results emphasise the areas in which resource use could be improved at the local level, but they also lead us to ask bigger questions — how can costs which are not accounted for in current market systems be incorporated?

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1.The 2007-2013 Interregional Co-operation programmes were funded through the European Regional Development Fund, and included the 28 EU Member States plus Norway and Switzerland. http://www.interreg4c.eu/