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A policy relevant assessment of the environmental impacts of organic farming

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Introduction

Originally, organic farming was a sector of agriculture that developed to a large extent independently of governmental influence. Since the late 1980s, however, direct governmental influence has increased and there is at present no EU-country which does not directly promote organic farming through agri-political measures (see Lampkin et al.1999). The most important reason given for the political support of organic farming is its positive environmental effects. As environmental goods are public goods, they are supplied in less than optimal quantities. Therefore, in order to achieve an optimal economic solution, government intervention is justified. This line of argumentation can also be applied to the example of organic farming, where an environmentally friendly production system receives financial support. This assertion is of course only tenable, if organic farming demonstrates fewer negative environmental effects than its counterpart, conventional farming. In addition, this raises the question, whether organic farming is indeed the most efficient way to produce the desired public goods; a question von Alvensleben (1998) answered in the negative when he stated: "There are farming systems that can achieve the desired environmental goals more cost-effectively than organic farming."

The methodological challenge

In order to create a comprehensive, European-wide information base, a written survey of experts was carried out in 18 European countries (the 15 EU-countries plus Norway, Switzerland and the Czech Republic). By means of a structured questionnaire, the experts were instructed to provide an English synthesis of the respective national literature about the environmental relevance of organic farming. The reviewed literature displays a multitude of methodological approaches. In many cases only a few countries presented studies of important indicators and mostly these did not differentiate according to farm type, making a differentiation of the environmental effects of organic farming according to country, region or type of system impossible. Although there are numerous studies available, the total quality, extent and comparability of the information is of a very diverse nature. Thus a quantitative assessment was not appropriate. Therefore, the decision was made to carry out a qualitative multicriteria analysis and present each step with the utmost transparency to allow the readers to form their own, perhaps differing opinions. A detailed description of the methodological approaches is beyond the scope of this contribution and can be found in Stolze et al. (2000). The actual methodological challenge of this study is characterised by five questions.

Which systems will be compared?

The obvious system with which to compare the environmental effects of organic farming is conventional farming. However, the term conventional farming encompasses a very broad spectrum: a) the system as typically found in practice, b) integrated farming, and c) with regards to the quality of environmental management, expanded integrated farming. Similarly, one can differentiate systems within organic farming: a) organic farming, as it is commonly encountered in practice, b) organic farming of top-quality enterprises with the best possible management practices, and c) the best realisable organic farming, including specific agri-environmental measures. It is evident that the result of a comparison between organic and conventional farming depends on which of the given sub-systems are compared. The selected scientific studies are not easily brought into the outlined structural scheme, however, we assume that in most cases systems typically found in practice were compared.

Which assessment scale will be applied?

In principle, it would be conceivable to compare the different land use systems on an absolute scale according to their fulfilment of criteria. This would allow quantification by achievement of these criteria. However, such a procedure would make it necessary to determine target levels on an absolute scale for all indicators used. In

view of the fact that there are good economic and scientific reasons why such target levels of each indicator should differentiate strongly by region, and in view of the problematic data situation, it was deemed necessary to directly compare organic with conventional farming. The following will ascertain whether organic farming ranks much better (++), better (+), equal (0), worse (-), or much worse (--) than conventional farming with regard to the specific environmental indicators. In doing so, a relative system comparison will be undertaken, rather than a comparison of systems according to an absolute target level. The hypothesis states that there is no difference between the environmental effects of organic and conventional farming. This hypothesis will be accepted, if there is clear evidence that no difference between farming systems exists or reliable information for this is not available. Only if the reviewed literature unequivocally verifies a difference between organic and conventional systems, such is stated.

Area-related or product-related comparison?
When relating environmental effects of different farming systems according to land area, it can lead to other conclusions than if one relates these environmental effects to the unit of manufactured product. This has agri-political implications which will be further discussed at the end. The majority of investigated comparative studies relate the environmental effects of organic farming to land area while relatively few studies have attempted to compare the environmental effects per unit of manufactured product. Therefore, for pragmatic reasons, a comparison of environmental effects will be carried out per hectare of land area.

Which indicators will be applied?
The assessment is based on the OECD indicator system (1997). In several places simplifications have been made – and where it appeared appropriate – also modifications. As Table 1 shows, we differentiate the indicator categories: Ecosystem, Soil, Ground and Surface Water, Climate and Air, as well as Farm Input and Output. These categories are specified through additional indicators. At the indicator level, the first step of literature assessment was completed.

How will the indicators be aggregated?
In view of the imprecise data basis, a quantitative approach did not appear appropriate to aggregate the assessment of each indicator. In the results table, we display the aggregated results based on the authors' subjective expert opinion.

Results of the system comparison
In Table 1, the results of the comparison of organic and conventional farming systems are shown in the form of indicators. This portrayal not only takes into account the authors' summarising assessment of the indicators, but also specifies the subjective confidence interval. This again reminds the reader that the subject area is hampered by the shortage of precise information. The subjective confidence interval should mark in which area, based on the literature reviewed, it appears conceivable for a deviation from the end results.

Relevance of the system comparison results for agri-environmental politics
In absence of further interpretation, the comparison of organic and conventional farming by means of different scientific indicators does not present an immediate contribution to the agri-environmental political assessment of organic farming. In this section, it should become clear which questions can be answered with the preceding comparison and where the limits of interpretability of the system comparison lie.

The environmentalists' question: How would an expansion of the proportion of land under organic farming (e.g. doubling) influence the environmental situation?
With this question, it is assumed that the total agricultural area does not change, instead the proportion of organically farmed land increases. This question can clearly be answered with the system comparison as a basis: organic farming performs equally in some indicator categories and better than conventional farming in others. Thus, the question is answered as follows: an increase in the proportion of organically cultivated land would lead to an improvement of the environmental situation.

For each indicator organic farming is ranked at least equal to conventional farming, in many cases it performs better or much better. In two cases, the subjective confidence interval reaches into the area which possibly allows conventional farming to appear as the preferred system. Examining the aggregation level of the indicator categories, the picture becomes more uniform. With the exception of climate and air, organic farming performs better than conventional farming in all categories.
A summarising assessment of all indicator categories was not carried out in the table and however the result is clear: organic farming is, in an area-related comparison, more environmentally friendly than conventional

farming. This result confirms one of the basic assumptions of the political promotion of organic farming, as discussed in the introduction.

Table 1. Detailed assessment of organic farming's impact on the environment compared to conventional farming

Indicators	++	+	o	–	– –
Ecosystem		×			
Floral diversity		×			
Faunal diversity		×			
Habitat diversity			×		
Landscape			×		
Soil			×		
Soil organic matter			×		
Biological activity	×				
Structure			×		
Erosion			×		
Ground and surface water			×		
Nitrate leaching			×		
Pesticides	×				
Climate and air			×		
CO_2			×		
N_2O			×		
CH_4			×		
NH_3			×		
Pesticides	×				
Farm input and output			×		
Nutrient use			×		
Water use			×		
Energy use			×		

Legend: Organic farming performs
++ much better, + better, o the same, – worse, – – much worse
than conventional farming

× Subjective confidence interval of the final assessment marked with ×

Source: Stolze et al. (2000)

The question of "Food Security Provision": How would a proportional increase in organic farming affect the environment, if the same amount of food were produced as in the starting situation?
This question assumes a political decision in which the proportion of organic farming is increased without decreasing the amount of food production. Under the current conditions of EU-agricultural policy, this scenario is not relevant although conceivable in the future. In this case, the lower yields of organic farming play an important role. The positive environmental effect from additional land converted to organic farming is not the total effect on the environment, because in this scenario the total cultivated area is expanded. If this expansion is connected to negative environmental effects, then these must be compared with the positive effects of the additional area converted to organic farming. In the situation of a food shortage, it would be relevant to know the environmental effects of both land use systems per production unit. As this information is not available for most indicators, this question cannot be answered at present. From a scientific point of view, this may be unfortunate, but for practical agricultural policy the question is not politically relevant under the current conditions of the EU.

The economists' question: Which is the most cost-effective way to attain a politically defined environmental standard, and what is the extent of organic farming in this solution?

This question cannot be answered based on the indicator comparison because costs are not discussed. Naturally, the question is politically highly relevant. Even if an empirical answer does not appear possible at the moment, a number of plausible considerations are feasible.

When economists ask the above question, they frequently assume that organic farming, as a strictly defined system, only accidentally coincides with the targeted levels society sets for environmental indicators. In several areas organic farming will remain behind the targeted level, in others it will surpass it. As a consequence, this would mean that with a combination of several measures aiming at improving parts of the conventional system the targeted level could be attained more precisely and as a whole more cost-effectively. This point of view follows the Tinbergen-Rule of economic theory, which states that the number of political instruments should at least be equal to the number of the goal dimensions (Ahrens und Lippert 1994). This is theoretically correct, if a number of prerequisites are met: that the environmental indicators are measurable and their measurements do not incur costs, that the interactions between the different environmental indicators can be described quantitatively, and that the transaction costs of a multitude of political instruments are zero or negligible. But reality departs from these assumptions. The measurement of environmental indicators can incur considerable costs, understanding of the interactions between the different environmental indicators is limited, and the administration of very detailed agri-environmental political measures can also be expensive (Falconer and Whitby 1999).

Thus, for policy formulation it is useful to rely on indicators that are simple to measure and on political instruments that are relatively straightforward to administer. Organic farming, as such, can be viewed as an environmental indicator. From a theoretical point of view, the costs of missing the targeted level which could be connected with organic farming must be set against the transaction cost savings which can be achieved through organic farming when compared with a detailed policy development improving conventional farming on a step by step basis. Only if the costs of missing the targeted levels of environmental performance are greater than the saved transaction costs is the implementation of detailed agri-environmental political instruments worthwhile. In practice, organic farming in its operation as an agri-environmental political instrument has minimal transaction costs, because the actual control of the farming system is carried out within the scope of certification in order to make it possible for separate marketing of the products at higher prices.

Based on the results, we conclude that if very specific environmental goals are to be achieved through an agri-environmental political instrument, ones that apply to only one environmental dimension, then more specific measures than those of organic farming are probably more appropriate. Organic farming is well suited for an improvement of the condition of a greater number of environmental indicators. In this case, one can assume that the saved transaction costs, which are connected with the promotion of organic farming (compared to a very detailed solution), are greater than the cost of missing the environmental target level.

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References

Ahrens, H. and Lippert, C. (1994). Tinbergen-Regel und Agrarpolitik. In: Hagedorn, K., Isermeyer, F., Rost, D. und Weber, A. (Editors), Gesellschaftliche Forderungen an die Landwirtschaft. Schriftenreihe der Gesellschaft für Wirtschafts- und Sozialforschung des Landbaues e.V., Münster-Hiltrup, Bd 20, 151-160.

Alvensleben, von R. (1998): Ökologischer Landbau: ein umweltpolitisches Leitbild? Agrarwirtschaft Bd 47 (10) 381-382.

Falconer, K. and Whitby, M. (1999). The invisible cost of scheme implementation and administration. In: Huylenbroeck, van G. and Whitby, M. (Editors), Countryside Stewardship: Farmers, Policies and Markets. Pergamon Press, Amsterdam, 67-88.

Lampkin, N., Foster, C., Padel, S. und Midmore, P. (1999). The policy and regulatory environment for organic farming in Europe. Organic farming in Europe: Economics and Policy, Volume 1. Universität Hohenheim; Stuttgart-Hohenheim, 166 pp.

OECD (1997). Environmental Indicators for Agriculture. Paris, 62 pp.

Stolze, M., Piorr, A., Häring, A. und Dabbert, S. (2000). The environmental impacts of organic farming in Europe. Organic Farming in Europe: Economics and Policy, Volume 6. Universität Hohenheim; Stuttgart-Hohenheim, 127 pp.