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HIGHLIGHT

Diversification of breeding systems offers keys to adaptation for the future

It is widely accepted that polyculture-livestock systems should outperform specialized production systems in terms of input savings, and could thus provide a sustainable alternative to specialization. To date, however, little research has been conducted to test this hypothesis, using real data. This study partly fills this gap by using an innovative analytical framework, the Cross Production Boundary Model, which has not been used yet in this field. This analytical framework makes it possible to evaluate the efficiency of mixed farms compared to space-based farms. We find that a large majority of the mixed dairy-crop farms (72%) in our sample have input diseconomies (they use more inputs per unit of farm product than specialized farms). We also note that for our sample of French farms, the virtuous concept of mixed crop/beef cattle-meat farming (looping of the C and N cycles, lower input use per unit produced, lower environmental impact) comes up against structural and socio-economic realities, mainly with regard to farm size and public subsidies.

In the context of agro-ecological transition, mixed crop-livestock production systems are often presented as a sustainable alternative to specialized production systems. It is commonly accepted that these systems should perform better than specialized production systems in terms of input savings through, for example, (i) the use of a given production factor for different production workshops and (ii) the use of herd effluents to fertilize crop production (reduction in the use of chemical fertilizers).
To date, however, little research has been conducted to test the hypothesis that mixed crop-livestock systems provide input savings.

We tested this hypothesis using an innovative analytical framework that, to our knowledge, has not been used yet in this stream of literature. Specifically, we used the standard cross-frontier frontier model to obtain an aggregate (synthetic) measure of input savings by situating the efficiency of diversified systems production technologies relative to specialized systems technologies. The major methodological advantage of this framework is that it allows for the comparison of two different production technologies (Growitsch and Wetzel, 2009). Beyond an analysis of total input use in agriculture, it is particularly interesting to obtain additional information on the potential savings for each input separately. Thus, we have proposed an extension of the standard cross-boundary model to perform this type of analysis.

Legend: Polyculture-livestock farming system integrating crop fields, meadows, pastures, and hedgerows.

The standard cross-boundary model and our extension of it were applied to a sample of 825 observations on 247 French dairy cattle farms involving a more or less large field crop workshop. The results of the standard cross-boundary method indicate that 72% of the mixed farms present input diseconomies. This suggests that mixed production technology is largely dominated by specialized technology in terms of input savings. The results of our cross border model indicate that on average mixed farms have input diseconomies for each of their inputs. However, we found that almost one-quarter of the mixed farms achieve input savings on the use of labour, synthetic fertilizers and pesticides. In examining potential reasons for the presence of input diseconomies (savings) in our sample of mixed farms, we find that government subsidies and farm size are negatively associated with the likelihood of observing input savings.

Learn more:

Minviel, J.J., Veysset, P. (2020). Are there economies of inputs in mixed crop-livestock farming systems? A cross-frontier approach applied to French dairy-grain farms**.** *Applied Economics.* https://doi.org/10.1080/00036846.2020.1856324

Bibliographical references:

Growitsch, C., Wetzel, H. (2009). Testing for Economies of Scope in European Railways: An Efficiency Analysis. *Journal of Transport Economics and Policy* 43 (1):1-24.

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