Enhancing biodiversity in French crop production systems: Cost-benefit analyses of five measures

The overall objective of EcoStack is to develop and support ecologically, economically and socially sustainable crop production via enhancement of ecosystem services provision and protection of functional biodiversity.

Introduction and context

A loss of biodiversity in agricultural landscapes has been observed in the last decades. To counterbalance the negative effects of some conventional agriculture practices, the maintenance of semi-natural landscape elements such as hedgerows, vegetation strips, flower strips or fallow land, is promoted and funded by the European Union as Agro-Environmental and Climatic Measures and the new Eco-schemes. Semi-natural habitats have the potential to support ecosystem services by providing a wide range of food resources, habitats for numerous species, biological control, pollination and soil conservation.

However, the implementation of these landscape elements could lead to additional costs such as the purchase of specific machinery or additional farmer workload. This Isara (France) study with the support of the Julius Kühn Institute (Germany) aims to determine the costs and benefits of several measures enhancing functional biodiversity in order to determine whether or not they are viable for farmers.

Methodology

Research issue

Five measures were chosen according their practicability and their effectiveness concerning protection and support of biodiversity.
Three off-crop measures:

- hedges (lines of shrubs and small trees planted between fields or along the sides of roads),
- flowering strips (agricultural areas sown with seed mixtures of annual wild or cultivated plants),
- grassy margins (field margins or strips with sown or natural vegetation dominated by grasses and herbs).

Two in-crop measures:

- cultivar mixtures (combination of different cultivars of one crop in the same field),
- direct seeding (without tillage) into a previous cover crop.

Are they viable for farmers, in terms of implementation costs and income benefits?

Methodology

The study was conducted in France in 2021 and included farms specializing in arable crops or have mixed crop-livestock systems. The main crops grown were wheat, maize, barley, and rapeseed. The average farm size was 127 ha. Data on the costs and benefits of the measures were obtained from interviews with farmers, the Hunting Federation, and the Chamber of Agriculture, which support farmers in implementing some of these measures.

To understand the incentives that affect farmer decision making, each cost-benefit analysis for 10 years was conducted for 100 linear meters for off-crop measures and 1 ha for in-crop measures. The costs (in Euro) include machinery, workload and fuel costs calculated for a 150 ha farm. For in-crop measures, the result presented is the difference from the costs of the respective conventional practice.

Data and results

The table shows the measures and the result of the costs-benefit analysis.

Off-crop measures costs		Benefits from the farmers' point of view	Drawbacks from the farmers' point of view
Grassy margins	**37 €**	keep a pesticide free zone around; cover a less productive area; regular strip maintenance prevents weed seeds from spreading into the field	Farmers do not observe effects of grass strips on yield, diseases nor pests
Flowering strips	**163 €**	user-friendly spaces; improve pollination	not "convenient" because they cannot be maintained as grass strips
Hedgerows	**676 €**	windbreak effect; creation of separation and biodiversity increase	cost and maintenance time
In-crop measures costs		**Benefits from the farmers' point of view**	**Drawbacks from the farmers' point of view**
Direct seeding under living mulch	**-49 €**	improve the quality of the soil by increasing the quantity of organic matter, to reduce the workload and to reduce the quantity of inputs	high demand for chemical herbicides; lack of suitable equipment
Cultivar mixture	**0 €**	stable yields; better resistance to diseases and pests	not allowed under contracts with the cooperatives; need to mix the seed every year to control the proportion of each cultivar

Conclusion

Main findings

For **off-crop measures**, costs increase as diversity increases in terms of species and vegetation layers. Grassy margins are a less costly measure, but provide less diversity due to the number of species in seed mixes. Flowering strips are more costly, but also provide more species diversity. Hedgerows are the most cost intensive measure, but provide three strata of trees, shrubs, and grasses, and thus also high species and micro-habitat diversity.

For **in-crop practices**, cultivar mixtures do not add cost or benefit compared to conventional cultivation of pure varieties. Direct seeding, on the other hand, decreases the cost per hectare, as tillage associated costs are avoided.

Farmers statements for implementation

The willingness of farmers to apply the five targeted measures varies. The most important statements of the farmers about these measures are:

- Off-crop measures require systemic changes at the farm scale.
- Hedgerows are expensive to plant, despite significant subsidies from different stakeholders. Moreover, they are already present in most farms.
- Flower strips are not appealing to farmers. They could replace grassy strips, but are more expensive.
- Cultivar mixtures are difficult to implement due to current grain market legislation.
- Direct seeding is interesting in terms of costs, but farmers have to completely rethink their cropping system and make high investments.

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Visit our web site to be informed : www.ecostack-h2020.eu

EcoStack

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