Supplementary material 1: Participatory multicriteria analysis of the TCLS designed for the Aveyron River watershed.

Criteria were rated relative to the current situation by stakeholders involved in the TCLS design process. “++” signifies “strongly improved”, “+” signifies “moderately improved”, “0” signifies “no effect” and “-“ signifies “negative impact”.

|  |  |  |  |
| --- | --- | --- | --- |
| Processes | Criteria | Impact of the TCLS designed | Stakeholder comments |
| Nutrient cycling | Balance of N inputs/outputs | ++ | Introduction of legume crops in cropping systems help balance N management. Biogas units in livestock systems could reduce the N leaching that occurs when animal manure is spread. |
| Balance of C inputs/outputs | + | Introduction of perennial crops in cropping systems reduces depletion of soil organic matter. Biogas units in livestock systems could improve the recycling of C from animal manure, reducing methane emissions to the atmosphere. |
| Soil fertility maintenance | Organic manure application | - | The fertilizing value of biogas residues is considered to be lower than that of animal manure. |
|
|
|
| Symbiotic N fixation | ++ | Alfalfa has high symbiotic N-fixation capacities. |
|
| Biological regulation | Diversity of crops at the field level | ++ | Introduction of alfalfa in cropping systems rotated with other crops. |
| Diversity of land use at the landscape level | + | Introduction of alfalfa in a large proportion of agricultural area. |
| Work management | Workload Work quality | 0 | Alfalfa requires less work to cultivate but would be harvested three times a year and require several interventions for initial field drying. |
|
| Social learning and capacity building | Active participation of partners | 0 | Possibility of developing direct relationships between field-crop farmers and livestock farmers, but no obvious effect. |
| Autonomy of farmers | 0 | Alfalfa cultivation and harvest would be managed mainly by the supply chain. |
| Knowledge capitalization | + | Possibility of developing networks to exchange practices and experiences of new cropping systems. |
| Adaptive capacity | + | Alfalfa could be introduced in fields with weed-control problems or a severe decline in fertility. It can be replaced with another crop or kept longer according to the development, yield and quality of cover. |
| Economic viability | Resilience to biophysical and economic risks | + | The reduction in irrigated surface area (some maize replaced by alfalfa) could ensure minimum water availability to the remaining maize area. More generally, crop diversification may mitigate annual variations due to climatic conditions. |
| Optimization of products | + | Supply of alfalfa to livestock farmers may initiate a local label based on the local origin of animal feed. Biogas production in livestock systems would be an added source of income for farmers. |
| Embeddedness of agriculture in the territory | Social acceptability of agriculture | + | Maize monocultures and uniform landscapes have a bad image for citizens and tourists. Conversely, alfalfa requires few chemical inputs and appears more ecological. |
| Contribution to local economic dynamism | + | Alfalfa cultivation, harvest, conditioning and transport could generate local activity and organize new supply chains. |
| Integration in public policies | Contribution to local and global sustainability issues | + | Diversification of crop rotations with alfalfa would reduce pesticide and fertilizer applications, reduce erosion, provide habitats for pollinators and other organisms and reduce the pressure of irrigation on water resources. |
| Support of public policies | + | Crop diversification and introduction of alfalfa could be subsidized by European agricultural policies. Biogas production is also supported with tax refunds and subsidies for investments. |