SOLMACC
ORGANIC FARMERS COUNTERING CLIMATE CHANGE

CLIMATE-FRIENDLY PRACTICES ON YOUR FARM

A PRACTICAL MANUAL

Life

Editor and Publisher

Research Institute of Organic Agriculture
Kasseler Straße 1a – 60486 Frankfurt – Germany
Phone: +49 69 7137699-0
Fax +49 69 7137699-9
Info.deutschland@fibl.org
www.fibl.org

Authors: Lin Bautze, Matthias Meier (FiBL), Tereza Maarova (IFOAM EU), Sigrid Griese, Ralf Mack, Martin Hänsel, Stephan Gehrendes (Bioland), Sara Sjöqvist, Oscar Franzen, Niels Andresen (Ekolantbruk), Daniele Fontanive (AIAB)

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FOREWORD

Dear farmers, farm advisors, policymakers,

Dear EU citizens,

Extreme temperatures and weather events during the last springs and summers have left no doubt about the relevance of climate change for the agriculture sector. Climate change is an issue that needs fast, efficient and easy to implement measures that help to reduce agricultural greenhouse gas emissions (GHG) in the European Union and at the same time, help farmers adapt to adverse consequences of unavoidable climate change risks.

Further, other important sustainability goals, such as the protection of biodiversity, healthy water bodies and animal welfare should not be neglected at the cost of a better greenhouse gas emission balance. Between 2013-2018, the project SOLMACC (**S**trategies for **O**rganic- and **L**ow-input-farming to **M**itigate and **A**dapt to **C**limate **C**hange) demonstrated on 12 farms in Italy, Germany, and Sweden that climate-friendly and resilient farming is possible and can provide valuable ecosystem services.

This brochure shows why organic farming has the potential to reduce GHG emissions in the EU and how SOLMACC farmers implemented diverse climate-friendly and resilient farming practices on their farm. Last, but not least, recommendations for farmers and farm advisors are given and further reading materials are presented.

We hope that you enjoy the provided material and wish you an exciting learning experience about climate-friendly and resilient farming practices in the EU!

Cordially,

Your SOLMACC team

Climate Change, Agriculture and the Food System

While climate change has been on the political agenda for many years, few things were achieved for the farmers in the European countryside. With increasing pressure, farmers struggle more and more with harvest losses, damage, and insecurity due to climate change effects and risks. Rising temperatures, extreme weather events and higher pest and disease pressure leave farmers particularly vulnerable if the current agricultural system does not adapt. This is true for farmers all over Europe. Even when, the effects might be more visible in southern countries, like Italy where droughts and heat in the summer months destroy the harvests of whole regions regularly. However, also other countries, like Sweden and Germany which like to count themselves as "climate change winners" suffer under climate change effects. Even when it is argued that the rising temperatures enable the farmers to grow a larger variety of crops for a more extended period, extreme weather events can destroy whole harvests.

At the same time, agricultural production systems contribute significantly to greenhouse gas (GHG) emissions in the European Union. More than 10% of the anthropogenic GHG emissions in the EU derive directly from agricultural production. Additionally, embedded emissions from deforestation abroad for crop and livestock production, food processing, transportation, and waste contribute to an even higher number of total GHG emissions. Internationally, from one third to half of the global GHG emissions derive from the food system.

This share needs to be reduced through a collaborative effort, and organic farming can lead the way. While agriculture is more often seen as part of the problem, it can also be part of the solution. The more farmers apply climate-friendly practices, the more chances we have to prevent dangerous climate change. At the same time, climate-friendly practices must sustain farmers' livelihoods, and a farmer's GHG reductions should not entail a decrease in farm income. Instead the uptake of climate-friendly practices, as part of a more comprehensive sustainability agenda, should be seen as the best way to support farm resilience and to enhance societal expectations of agriculture concerning climate action.

The project SOLMACC (**S**trategies for **O**rganic- and **L**ow-input-farming to **M**itigate and **A**dapt to **C**limate **C**hange) sets out to demonstrate the impact that climate-friendly practices can have. It promotes wider adoption of innovative practices that can contribute to the EU achieving its objectives for climate change mitigation and adaptation in the food and farming sector while considering the economic costs and gains from the practices.

12 motivated organic farmers across Germany, Italy, and Sweden, with four farms in each of the three countries (see Map 1) were part of the SOLMACC demonstration network for climate-friendly and resilient practices. The farmers contributed land, equipment, and labor, and shared their experiences of applying newly-acquired knowledge for climate change mitigation and adaptation in the EU.

Map 1: The 12 SOLMACC demonstration farms

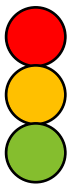
THE SOLMACC DEMONSTRATION FARMS

Each SOLMACC farm applied four agricultural strategies to reduce greenhouse gas emissions; optimized on-farm nutrient management, crop rotations, tillage management and agroforestry. Each practice was evaluated for their climate change mitigation and adaptation potential, as well as their socio-economic and technical feasibility, and associated co-benefits. In this brochure, you will find the description of each farm and the four implemented practices of each farmer.

MITIGATION POTENTIAL

The greenhouse gas mitigation potential is described via a traffic light system. The reduction is described as a percentage change of the initial farm situation. E.g., if the manure was dumped as a manure pile (initial situation), now the farmer composts (improved practice) and thus GHG emissions are reduced by 49 % on average by this practice. For the crop rotation and improved tillage management, GHG emissions were calculated among the whole crop rotation.

The colors indicate the following changes:



Red: GHG emissions were not reduced with the new practice
Yellow: GHG emissions were slightly reduced by minus 1-10%
Green: GHG emissions were significantly reduced with the new practice by more than minus 10 %

ADAPTATION POTENTIAL

Additionally, each practice was validated by the farmers for their climate change adaptation benefits. The two checked boxes indicate the benefit for each practice. For each benefit, one point was given. In total, a maximum of two points was given for the climate change adaptation benefits:

☒**Crop yields**: no change or increase→ one point was given. If yields decreased no point was given.

☒ **Soil parameters** (compaction, humus content, water holding capacity): no change or improvements according to farmer statement→ one point was given. If soil quality declined with the practices, no point was given.

ECONOMIC VIABILITY

Further, the economic viability of the practices was assessed according to the SOLMACC farmers experience within the project duration (2013-2018). A maximum of three points, represented as **€€€**, for the different income and costs factors were given for:

Crop yield changes: if the crop yields did not change or increased → one point was given. If they decreased no point was given.

Operational & input cost changes: if the operational & input costs did not change or decrease → one point was given. If the costs increased no point was given.

Labor costs: if the labor costs did not change or decreased → one point was given. If the costs increased no point was given.

Last, co-benefits associated with the implemented practice are shown, and practical guidelines and experiences of the farmers are shared.

THE SOLMACC FARMS

Johannes Kreppold: New Manure Treatment

Farm Description

The Bioland farm Kreppold lies 500 m above sea level in southern Germany. With an average annual temperature of 7,5°C and a mean annual rainfall of 750 mm, a lot of arable crops are suitable for the farm. On his 120 ha of sandy to loamy soils the farmer Johannes Kreppold cultivates legumes (36 ha), cereals (42 ha), field vegetables (3 ha), green manure/grassland (35 ha) and forest (7 ha). The suckler cow herd (40 GV) adds up to a traditional mixed farming system.

Farmer Statement

"Climate change mitigation and adaptation is the essential topic of our time, and organic farming plays a forerunner role. Through participating in the SOLMACC-Project and the results thereof, I want to gain a feeling for the right balance between reasonable yields and C-sequestration. The results of the project shall be used on my farm for possible improvement."

Nutrient Management

Johannes Kreppold started **composting his farmyard manure together with green residues from his farm** (e.g., hedge cuttings, weeds). Since 2015, he experiments with an innovative anaerobic treatment (Microbial Carbonisation). He spreads the material on some cultures (maize, winter wheat, beetroots) and thus **helps to close on-farm nutrient cycles.**

CO_2-eq. Reduction: **- 49 %**
Composting farmyard manure helps to reduce CH_4 and N_2O emissions, compared to the emissions of a manure pile under anaerobic conditions.
Climate Change Adaptation Benefit: ☒☒

Co-benefits of Composts:

- Reduces the number of viable seeds in the fertilizer as well as soil erosion.
- A stabilized organic matter.

Economic Viability: €
Johannes Kreppold´s experience shows that the compost increased his crop yields. The input, operational and labor costs went up slightly.

Further Information: The mitigation potential refers to a standard composting practice (3 times turning of the material). The MC treatment performed by Johannes Kreppold is a very innovative approach, not tested sufficiently to assess its GHG mitigation potential. However**, this treatment does not require any turning of materials**, which helps to reduce fossil fuel consumption. Nevertheless, further research is needed to get to know the procedure more detailed.

Crop Rotation Management

Johannes Kreppold changed parts of his crop rotation management. He **increased the grain legume production** (soya bean and field beans) from 0% to more than 21% of the arable area. Together with the **forage legume production**, 38% of arable land is cultivated with leguminous crops.

CO_2-eq. Reduction: **- 12 %**
Leguminous crops contribute to N fixation and therefore, reduce the amount of fertilizer needed in the following years.
Climate Change Adaptation Benefit: ☒☒

Co-benefits of Legumes:

- Enhanced crop biodiversity on the arable fields, supporting a more diverse insect fauna.
- Higher soil fertility because of N fixation of legumes.

Economic Viability: €€€
Johannes Kreppold's experience shows that with the changes in his crop rotation management, yields and all associated costs did not change.

Further Information: For drying his soybeans, Johannes Kreppold **utilizes the heat waste of a nearby biogas plant**. Depending on the crop, the drying requires large quantities of energy (fossil fuels). By utilizing the heat waste of renewable energy production for the drying process, further CO_2 emissions can be avoided.

Tillage Management

Johannes Kreppold **reduced the depth of tillage** from 15-20 cm to 10-15 cm for nearly all of his arable crops (except winter wheat).

CO_2-eq. Reduction: **- 12 %**
Reducing the depth of tillage helps to reduce fossil fuel consumption.
Climate Change Adaptation Benefit: ☒☐

Co-benefits of Reduced Tillage:

- Potential increase of organic matter in the top soil.
- Helps to reduce soil erosion.
- Increases water holding capacity.

Economic Viability: €€€
Johannes Kreppold's experience shows that crop yields were maintained and at the same time input/operational and labor costs were reduced. In the long term, higher water retention capacity of the soils is essential to him.

Further Information

To reduce the depth of tillage on his farm, he **constructed special machinery**, adapted to his local soil conditions. Therefore, he could minimize weed pressure and maintain crop yields as before.

Agroforestry

Johannes Kreppold uses parts of the renewable energy source of his forest wood for **substituting fossil fuel based house heating**. Additionally, he planted 1 ha of hedges. The shredded hedges are used as a material for the MC treatment (see above).

CO_2-eq. Reduction: 77 t CO_2 eq. saved by using wood instead of heating oil and 16 – 55 t C/ha sequestered annually in the soil, tree biomass and hedge biomass.
Trees and hedges help to sequester atmospheric carbon into plant biomass and soils. Therefore, they function as a carbon sink.
Climate Change Adaptation Benefit: ☒☐

Co-benefits of Woody Elements:

- Living habitat for diverse animals (biodiversity protection).

Economic Viability: €€€
Johannes Kreppold's experience shows that crop yields were maintained, while input/operational and labor costs did not change with the practice

The MC treatment of farmyard manure

Johannes Kreppold tests a special way of farmyard manure treatment, the microbial carbonization process. For this, he mixes his fresh farmyard manure (around 30-40% mass weight) with materials high in lignin, such as wood chips. The material should be mixed and formed to a trapezoid pile with 1.5 m to 2.5 m in height. The moisture content should be around 50%, which can be best tested if the hands are a little bit moist after the material is touched with light pressure. After the pile is established once, the material is neither turned nor covered. After around 6-8 weeks, the material is ready to be used as a fertilizer. The MC-process offers a good opportunity to integrate wooden waste from the forest and the hedges as a valuable source of C to stabilize N before bringing it to the field. The process can be realized without specialized machinery and with minimum additional effort, both of which make it very feasible.

Pfänder Farm: Innovations on a Stockless Farm

Farm Description

Pfänder farm is a stockless organic farm since 1998. It is located at 560 m above sea level and has an average annual temperature of 7,6°C and a mean annual rainfall of 700-800 mm. Though it is in the neighborhood of the Bioland farm Kreppold the farm's nearly 60 ha of loess clay soils and alluvial soils are managed quite differently. On 54 ha the Pfänder family grows field vegetables, clover grass, cereals. Additionally, 1.5 ha of structural landscape including hedges and forests and 3 ha of permanent grassland belong to the farm.

Farmer Statement

„Even a farm without animal husbandry can grow high-quality food and maintain soil fertility with the farm's own fertilizers." Johannes and Florian Pfänder

Nutrient Management

The farm produces **green compost** from different on-farm sources, such as forage legumes, waste from vegetable processing, straw, and soil from carrot washing. The compost is regularly turned and used as a fertilizer for all fields. Therefore, this **helps to close on-farm nutrient cycles.**

CO_2-eq. Reduction: **- 49 %**

Composting green manure helps to reduce CH_4 and N_2O emissions, compared to the emissions of a residue pile under anaerobic conditions.

Climate Change Adaptation Benefit: ☒☒

Co-benefits of Compost:

- Reduces the number of viable seeds in the fertilizer as well as soil erosion.
- A stabilized organic matter.

Economic Viability: €€

The experiences from the Pfänder farm shows that crop yields increase with the application of compost, while operational/input costs decreased. At the same time, labor costs increased slightly.

Crop Rotation Management

The farm **introduced leguminous crops** at 25% of the total arable land. Before cultivating green manure leys, broad beans, field peas and soya, they cultivated on this area maize (13 ha).

CO_2-eq. Reduction: **- 7 %**

Legume crops contribute to N fixation and therefore, reduce the amount of fertilizer needed in the following years.

Climate Change Adaptation Benefit: ☒☒

Co-benefits of Legumes:

- Enhanced crop biodiversity on the arable fields, supporting a more diverse insect fauna.
- Higher soil fertility because of N fixation of legumes.

Economic Viability: €€€

The experiences from the Pfänder farm shows that yields can be maintained even when growing high-quality vegetables. Operational/input and labor costs did not change.

Tillage Management

The Pfänder farm tested a **no-tillage approach for some crop cultures** (winter wheat, oats, spelt) with a total area of 19 ha. Before SOLMACC, these cultures were tilled annually with a depth of 15-25 cm.

🟡 **CO_2-eq. Reduction**: **- 1 %**
Reducing tillage helps to reduce fossil fuel consumption.
Climate Change Adaptation Benefit: ☒☒

Co-benefits of Reduced Tillage:
- Potential increase of organic matter in the top soil.
- Helps to reduce soil erosion.
- Increases water holding capacity.

Economic Viability: €€€
The experiences from the Pfänder farm shows that crop yields and labor costs did not change with the new practice. At the same time, operational costs decreased.

Agroforestry

Family Pfänder **planted hedges and tree strips** (0.61 ha) and cultivated around 1 ha of forest. Parts of the renewable energy source of their forest wood is used for **substituting fossil fuel based house heating**.

🟢 **CO_2-eq. Reduction: 5.2 t CO_2 eq. saved by using wood instead of heating oil and 5-29 t C/ha sequestered annually in the soil, tree biomass and hedge biomass.**
Trees and hedges help to sequester atmospheric carbon into plant biomass and soils. Therefore, they function as a carbon sink.
Climate Change Adaptation Benefit: ☒☐

Co-benefits of Woody Elements:
- Living habitat for diverse animals (biodiversity protection).

Economic Viability: €
The experience from the Pfänder farm has shown that crop yields did not change.

The in-situ mulching system

One technique used by Bioland Pfänder farm is the in-situ mulch of broad beans in growing field vegetables. The broad beans form a temporary mixed seed. They improve the structure of heavy and often wet soils in spring, suppress weeds and supply nitrogen to the main crop. At the same time, the mechanical hoe can be used without problems.

All machines for the cultivation of field vegetables have a working width of 3 m. With a simple mechanical seed drill with 12.5 cm row spacing, the farmers sow four rows of field beans in 3 to maximum 4 cm placement depth. In between these, there are two empty rows where no beans are sown. Like this 400 kg of the broad bean is sown per ha. The shallow placement depth is essential to ensure that the field bean can be killed reliably with a row tiller later on. In heavy wet soils, the shallow sown bean grows without problems. Two weeks later, when the soil has settled, the farmers plant or sow field vegetables - cabbage, celery, leek, broccoli or cauliflower - in the empty rows. The cultivator hoe along the row of field vegetables is no problem, while the field beans, which are not chopped yet, continue growing. If the broad beans are 20 to 30 cm tall, they are worked into the soil with a Comeb row tiller that is set to 5 to 6 cm working depth, i.e. deeper than the seed placement, so that the seed grain is chopped out as well to make sure that the bean plant is completely killed and sets free its N to fertilize the vegetables. The field bean should not be larger than 40 cm so that the row tiller works smoothly. Depending on the culture and the in-row weed pressure, weeds there are covered with a trailing ridging hiller unit. Like that the weeds are well regulated in all areas Depending on the crop and weed situation, the farmers use the row tiller a second time after a while, sometimes combined with the ridging hiller unit.

Gut Krauscha: Synergies of Adaptation & Biodiversity

Farm Description

On the Bioland farm Gut Krauscha, Hans-Joachim Mautschke manages around 300 ha of land. His main production is cereals (79 ha), clover grass (54 ha) and legumes (26 ha) beside his permanent grassland (120 ha) and more than 11 ha of hedges. With the beginning of the SOLMACC project, he additionally kept around 70 cows but stopped animal husbandry in 2018.

Farmer Statement

"For a farm in the eastern rim of Germany the exchange of experiences is of utmost importance. I want to make use of the changes the project delivers in terms of connections. Hence, it would be important for me to meet my colleagues from Germany but also from Sweden and Italy."

Nutrient Management

The farmer composted the farmyard manure from his 70 cows. The produced compost was spread on the most of his arable fields once per year. Therefore, the compost application helped him **to close on-farm nutrient cycles.**

● **CO_2-eq. Reduction**: **- 49 %**
Composting farmyard manure helps to reduce CH_4 and N_2O emissions, compared to the emissions of a manure pile.
Climate Change Adaptation Benefit: ☒☒

Co-benefits of Compost:

- A stabilized organic matter.
- Helps to reduce soil erosion.

Economic Viability: €
The experience at the Gut Krauscha farm shows that crop yields and operational costs could be maintained with the new practice. At the same time, input and labor costs increased slightly.

Crop Rotation Management

The farmer **introduced grain legumes** (field peas and lupines) on 16% of his arable area. Additionally, he **extended the clover ley cultivation from one to two years** in his crop rotation. By this, 50 % of his arable area is now cultivated with leguminous crops.

● **CO_2-eq. Reduction**: **- 7 %**
Legume crops contribute to N fixation and therefore, reduce the amount of fertilizer needed in the following years. By extending the clover cultivation, practices, such as plowing are done only once every two years instead of every year. This helps to reduce fossil fuel consumption.
Climate Change Adaptation Benefit: ☒☒

Co-benefits of Legumes:

- Enhanced crop biodiversity on the arable fields, supporting a more diverse insect fauna.
- Higher soil fertility because of N fixation of legumes.

Economic Viability: €
The experience at the Gut Krauscha farm has shown that crop yields and operational costs could be maintained with the new practice. At the same time, input and labor costs increased slightly.

Tillage Management

Some cultures were managed **without plowing** (clover, lupine), while for winter wheat and rye the **depth of tillage was reduced** from 20-25 cm to 10-15 cm. In total, on 86% of the fields, tillage was reduced.

● **CO_2-eq. Reduction**: **- 0.1 %**
Reducing tillage helps to reduce fossil fuel consumption.
Climate Change Adaptation Benefit: ☒☒

Co-benefits of Reduced Tillage:

- Potential increase of organic matter in the top soil.
- Helps to reduce soil erosion.
- Increases water holding capacity.

Economic Viability: €
The experience at the Gut Krauscha farm has shown that crop yields and operational costs could be maintained with the new practice. At the same time, input and labor costs increased slightly.

Agroforestry

On the farm around 11 **ha hedges and tree strips were planted**. Part of the woody biomass (as wood chips) is used to **substitute house heating with fossil fuels**.

● **CO_2-eq. Reduction**: **206 t CO_2 eq. saved by using wood instead of heating oil and 107-211 t C/ha sequestered annually in the soil, tree biomass and hedge biomass.**

Trees and hedges help to sequester atmospheric carbon into plant biomass and soils. Therefore, they function as a carbon sink.

Co-benefits of Woody Elements:

- Living habitat for diverse animals (biodiversity protection).

Economic Viability: €€

Operational, input and labor costs did not change with the new practice.

A farmer composts his grassland growth, to fertilize his fields

There are important reasons for preparing compost. On the Bioland farm Gut Krauscha, it is the extensively used grassland, which is also to be cultivated by mowing unless the small herd of suckler cows grazes on it. However, the nutrient-rich clippings were no longer to be mulched uselessly, while on the sandy farmland of more than 200 hectares fertilizers had to be purchased in part. Farmer Mautschke tried to transfer nutrients from grassland to arable land via compost from meadow cuttings. Composts from pure plant material promise a balanced nutrient content. Above all, they provide phosphorus and potassium for arable crops and positive effects through humic substances in the soil. Although compost also produces nitrogen, unlike the other nutrients, only about ten percent of it is effective in terms of yield in annual stages. During composting in triangular rents with a height of about 1.5 m, the rotting of the meadow cuttings was challenging to get going. It did not want to form an earthy, black decomposition product. On other farms in the SOLMACC project, it turned out that grass can only be satisfactorily processed with bovine manure or similar additives. According to technical literature, however, an optimum structure and adequate moisture content of the rotting material and adequate nitrogen in the organic material are sufficient. The visit to the composting plant confirmed the literature references. The compost professionals only mix grass clippings with wood chippings to reach the compost through a suitable substrate structure. That is why they wet the rent. Also, the rents are turned several times a week to bring fresh air to the core of the rent. The entire rotting process should take place aerobically so that neither methane nor other harmful gases are formed. Before the compost is delivered, the composting plants screen the compost to 15 mm and use the coarser structural components, usually wood chippings, one more time.

With regard to the climate balance, the wide C/N ratio and the coarse structure of the starting material are favorable for compost. As a result, only a small amount of ammonia and methane is likely to be emitted in the rotting process. Compost is also a complex fertilizer. Farmer Mautschke is aware, however, that he is only relocating phosphorus and potassium in particular with grassland compost and is not creating new ones. However, nitrogen is also included, which is mainly produced by white clover on grassland. It is precisely this nutrient transfer that relieves some arable land of the task, with the help of legumes to have to collect nitrogen themselves. This allows arable farmers to increase their cereal market share.

Kornkammer Haus Holte: Building a Biogas Cooperation

Farm Description

The cattle loose Bioland farm Kornkammer Haus Holte has an average annual temperature of 8.9°C and a mean annual rainfall of 750-890 mm. On a total of nearly 250 ha with mainly loess soil, he cultivates cereals (143 ha), red clover and legumes (54 ha), potatoes (32 ha), permanent grassland (15 ha) and hedges (6 ha).

Farmer Statement

"Through participating in the SOLMACC-Project I hope to find a better adapted management in my plant production. Moreover, the measurements and assessments of the climate relevance of my farm are exiting as well."

Nutrient Management

A cooperation between the farmer and a biogas plant producer was established. The biogas plant received the first cut of the clover grass ley in exchange for biogas slurry. The slurry was brought back to the oat and potato fields and therefore used as a fertilizer to **closer on-farm nutrient cycles.**

CO_2-eq. Reduction: **- 1.3 %**
The application of biogas slurry helps to reduce fertilizer application in the following years. Further, less GHG emissions are emitted when clover-grass leys are cut and carried, instead of mulched in the fields. Last, biogas production helps to reduce fossil fuel emissions for energy and heat production.
Climate Change Adaptation Benefit: ☒☒

Economic Viability: €€€
The experience of the farmers shows that crop yields increased with the practice, while operational/input costs and labor costs decreased.

Crop Rotation Management

The farm **introduced leguminous crops.** Red clover is produced for the biogas plant instead of cultivating maize on the same are (39 ha). Additionally, grain legumes (field beans) were cultivated instead of winter wheat. By this, the area cultivated with leguminous crops increased by 23%.

CO_2 Reduction: **+ 2 %, due to an increase in organic fertilizer usage**
Legume crops contribute to N fixation.

Co-benefits of Legumes:
- Enhanced crop biodiversity on the arable fields, supporting a more diverse insect fauna.
- Higher soil fertility because of N fixation of legumes.

Tillage Management

Red clover, winter wheat, and spelt are **cultivated ploughless**. Additionally, a ploughless cultivation of potato was tested on 32 ha. Last, the farmer **reduced the depth of tillage** from 20-25 cm to 5-10 cm in oat fields.

CO_2-eq. Reduction: **- 9 %**
Reducing tillage helps to reduce fossil fuel consumption.

Co-benefits of Reduced Tillage:
- Potential increase of organic matter in the top soil.
- Helps to reduce soil erosion.
- Increases water holding capacity.

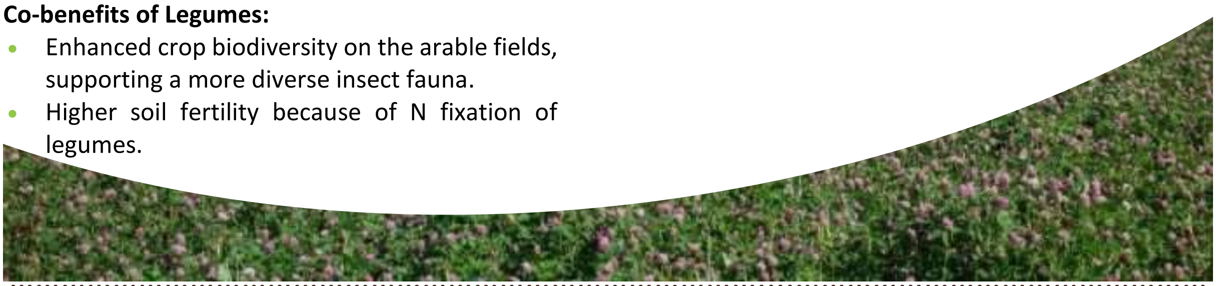
Agroforestry

The farm **planted around 3 ha of hedges and tree strips** on their fields. Along with the already existing diverse hedges and trees, around 6 ha are used as boundaries for the arable fields.

CO_2 Reduction: **Around 45-153 t C/ha are sequestered annually in soil, tree biomass and hedge biomass.**

Trees and hedges help to sequester atmospheric carbon into plant biomass and soils. Therefore, they function as a carbon sink.

Co-benefits of Woody Elements:
- Living habitat for diverse animals (biodiversity protection).



Establishing a Biogas Cooperation

The establishment of a biogas cooperation requires particular attention to implement the specific guidelines in each region correctly. The Bioland enterprise Kornkammer Haus Holte in North Rhine-Westphalia has successfully realized cooperation with a local biogas plant.

Using this successful cooperation as an example, a summary of experience can be given according to which organic farms in North Rhine-Westphalia can enter into similar cooperation. It should be noted that the guidelines of the Bioland Association differentiate between two types of biogas plants. One speaks of **ecogas plants** if a biogas plant belongs to an organic farm and is operated according to the Bioland guidelines**. Agrogas plants** are biogas plants that are operated by conventional companies in accordance with the Bioland Directive.

Basic regulations for cooperation with agrogas plants

- Agrogas plants on Bioland farms are possible if cultivated according to Bioland guidelines
- Bioland farms that cooperate with agrogas plants must take back the quantities of nutrients that have also been added to the plant beforehand. This is only possible in NRW in the form of clover grass and manure (this procedure is tolerated until new regulations in the area of biogas plants are made with the revision of the EU ECO-Regulation).
- The organic farm must prove that it is economically unreasonable for it to contribute to an ecogas plant from which fermentation residues are exclusively or predominantly (>50 %) spread on organic land. The following applies to the proof of this unreasonableness:
    1. If a distance of more than 30 km from the plant to a biogas plant with a share > 50 % of organic substrates is defined (ecogas plant).
    2. A suitable map shall be used to show which ecogas plants (>50 % organic substrate) are available over a distance of 30 km.
- All fermentation materials must be listed in Annex 10.1 (Guideline p. 47) Approved soil improvers and fertilizers as well as substrate components.
- If substrates from non-organic production are used as co-ferments, e.g., maize, in agrogas plants, these must not have been treated with pickling agents from the active substance group of neonicotinoids.
- No GMOs are allowed
- The conformity of these fermentation materials must be documented with proper proof (form Biogas control body).
- The delivery of fermentation residues to organic farms that have not previously delivered clover grass or manure to this plant is not permitted.
- The delivery of fermentation residues to conventional farms is still permissible.