DaLeA – permanent living mulch in arable farming in Germany

Year of issue

2025

Summary

EIP-AGRI Operational Group “DaLeA” tested a clover-based permanent living mulch interplanted with arable main crops to suppress weeds, regulate soil temperature, retain water and minimise tillage, while assessing feasibility, transferability and economics across three years and three sites.

Photo Gallery



Location

50.444852, 7.901969

Sector

Agriculture

Installation Date

2019-2023

Implementation status

Completed

Contact

Agrarbüro Mittermeier

Overview

Location of the project

DaLeA pilot site in Rhineland, Germany (Rhineland-Palatinate).

Country

Germany

NUTS2 Code

Rheinhessen-Pfalz

Sponge measures implemented in the case study

Mulching

Cover crops

Minimum tillage

Objectives

Suppress weeds
Regulate soil temperature and reduce heat stress
Retain water and improve erosion control
Minimise tillage and inputs, reduce nutrient losses
Assess feasibility, transferability and economics

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
Farmers	Agrarbüro Mittermeier	Implementation	Coordination, on-farm trials	Responsible
Research institute / University	Institute of Applied Plant Nutrition, University of Göttingen	Monitoring	research on evapotranspiration and CO_2 exchange	Supporting

Site Information

Climate Zone

Cool temperate moist

Precipitation

737.00 mm

Temperature (°C)

10.00 °C

Elevation range

265

Vegetation class

Crops and clover

WFD Ecological status

Moderate

WFD Chemical status

Failing to achieve good

Water quality status

Nitrate leaching during rainfall events was a recurring problem in the region; the living mulch acted as a nitrogen buffer and reduced leaching in trials.

Design and Implementation

Project scale

Micro

Project scale specifications

Field-scale trials on multiple private farms in Rhineland-Palatinate

Project area

12 ha

Principles

Permanent clover living mulch as continuous cover
Lower external inputs and greenhouse gas footprint
Nitrogen cycling: leveraging clover fixation and reducing fertiliser demand
Soil temperature moderation and water retention
Erosion control
On-farm exact trials and knowledge transfer via field days and website

Favourable preconditions

Region normally has sufficient rainfall; effects in dry regions need study
Thermal moderation observed with mulch; drone thermal imagery showed cooler mulched zones than bare soil
Gas-exchange and ET measurements indicated less crop heat stress and net water savings despite added transpiration surface
Constraints noted: winter hardiness issues in freezing events, challenges for heavy erosion-prone crops like potatoes, summer crops harder to integrate; maize workable but water management still an issue
Where a prior cover crop existed, initial soil structure differences were not observed at that timepoint

Financing

Total cost

304685.00 €

Financing authorities

Authority name	Type of funding	Comments	Financing share
European Union	EU-funds: Cohesion and regional development funds	€300,000	98 %
Ministry for Economic Affairs, Transport, Agriculture and Viticulture Rhineland-Palatinate (MWVLW)	National funds	€4,685	2 %

Compensations

Non

Policy and Governance

Policy description

Facing erosion and water stress issues, this project is a test and research site, with demonstrator value.

Land ownership

Private farms participating (one large full-time farm and one part-time farm explicitly mentioned).

Policy targets

Erosion Control

Target remarks

Soil health and biodiversity gains
Lower inputs and emissions
Water retention and erosion control
Reduced nutrient losses
Comparable profitability to conventional systems

Pressure remarks

Excessive reliance on chemical inputs
Soil erosion and biodiversity decline
Nutrient losses and climate stress on crops

Part of a wider plan

Non

Public consultation

Oui

Consultation activities

Activity stage	Activity type	Comments
Other	Annual field days targeting agricultural stakeholders	Up to 300 farmers participated. Ongoing presentations to advisory circles in Germany and abroad.
Other	Project website and social media	maintained for dissemination

Has contractual arrangements

Non

Impacts and Monitoring

Monitoring System

Monitoring parameters

Around 24 field trials per year; between 10 and 40 exact trials annually depending on research focus
Master’s theses on nitrogen dynamics and water infiltration
On-farm measurements of evapotranspiration and CO_2 exchange using canopy chambers during main-crop season
Drone biomass and thermal imaging
Rain-simulator demonstrations for erosion and runoff understanding

Maintenance

Maintenance requirements

Management research on controlling clover vertical growth when competition or genetic background caused excessive upward growth (tools or chemicals tested); no routine maintenance schedule reported.

Impact Assessment Methodology

Biophysical impact assessment method

Comparison of living-mulch vs conventional variants across three years and three locations with rotating crops
Field measurements of infiltration, ET and gas exchange, yield and quality (protein)
Economic comparison of inputs and contribution margin

Socio-economic Impacts

Direct benefits

Yield gap vs conventional reduced from about 30–40 percent in year 1 (ecological farming baseline) to 10–14 percent in year 3
Contribution margin roughly comparable to conventional due to lower inputs of diesel, fertiliser and water
Knowledge exchange through large field days and international presentations

Biophysical impacts: Hydrology

Information on retained water

Higher infiltration rates measured in plots with established clover stand
Cooling of soil surface in mulched areas observed by drone thermal imaging
Less crop heat stress recorded with living mulch; net water savings despite evapotranspiration considerations
Improved water retention and erosion control reported

Biophysical impacts: Biodiversity

Information on improved biodiversity

Enhanced soil health and biodiversity conservation reported with living mulch system (no quantitative indices provided).

Biophysical impacts: Water & Soil Quality

Information on water quality overall

Reduced nitrogen leaching in rainfall events in living-mulch treatment
Lower nutrient losses overall reported in nitrogen reduction experiment

Biophysical impacts: Others

Other biophysical impacts changes

Lower greenhouse gas emissions via reduced and more efficient use of production resources.

Lessons Learned

Key lessons

Evaluate at farm level; site-specific adaptation is essential
Weather variability and farm-specific approaches require flexibility
Continuous learning with scientific partners produced practical and statistically meaningful results

Barriers

Barrier type	Barrier role	Comments
Other	Main barrier	Time to optimise system performance (about three years to reach near-working system)

Drivers

Driver type	Driver role	Comments
Legal obligations	Main driver	Need to meet European Green Deal goals and address soil degradation, erosion and high input dependency
Organisation committed to it	Secondary driver	Practitioner-led initiative supported by RDP Measure 16 cooperation

Success factors

Success factor type	Success factor role	Comments
Successful coordination between authorities	Main factor	Strong practitioner–researcher network and transparent communication, including sharing setbacks
Communication activities	Secondary factor	High-quality outreach via field days, demonstrations and bilingual website

Cost effectiveness

Contribution margin roughly comparable to conventional due to reduced diesel, fertiliser and water inputs.

Transferability

Method is transferable but requires local adaptation; impacts in drier regions should be specifically studied before adoption.

Sources

Sources

DaLeA – permanent living mulch in arable farming (EU CAP Network good practice page)

DaLeA – permanent living mulch in arable farming (EU CAP Network Good Practice Report, PDF)

Agricultural and Rural Inspiration Awards – ARIA 2024 brochure (EN)

DaLeA project website (EN)

“IAPN supports research in ‘DaLeA – Permanent living mulch in agriculture’ project” (news post)

Dalea – Permanent living mulch in agriculture (DaLeA) project registry entry (FISA online)

Map of Living Labs and Lighthouses