Maize seeding (Baptiste Drouet)

# Strip till to improve maize establishment (France)

Strip till

## DESCRIPTION

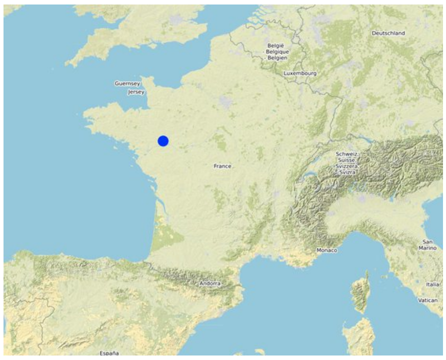
**Strip tillage to plant maize: a way to reduce soil disturbance and secure maize establishment.**

The region of Pays de Loire in Western France has a temperate climate with warm summers and mild winters. The region has many rural areas, dedicated mostly to agriculture, with large economic centres and conurbations (e.g. the Nantes area). The strip till technology is applied to te same area on a dairy farm in Pays de Loire (La Pouëze), which implements a form of conservation agriculture. Fields have not been ploughed for 9 years, and direct seeding of cover crops (i.e. clover seeded cover for green mulch, weed control and nitrogen fixation) and winter crops (economic cash crop) has been used for 4 years. Crop rotation is practiced on a 2 year rotation between spring maize and winter wheat.
Strip till is a conservation system that uses minimum tillage. It combines the soil drying and warming benefits of conventional tillage with the soil-protecting advantages of no-till by disturbing only the portion of the soil that is to be seeded. Strip till has been developed as an alternative to conventional tillage to prepare the soil before planting maize. It targets tillage on the line to be seeded: on 10 to 20 cm wide strips, at a depth of 10 to 30 cm. Strip till is harder to use in clayey and lumpy soil.
Strip till protects roots and facilitates crop establishment by creating higher soil porosity and seed line warming. As strip till does not disturb the inter-row, soil disturbance is minimized leading to:
-Improved production
-Reduced land degradation
-Beneficial economic impact

Initial investment costs are limited to purchasing the specialised strip till machine, which is about Euro 14,000. Benefits of strip till include:
- Increased: crop production, farm income, water drainage, nutrient cycling, soil organic matter carbon, vegetation cover, beneficial soil species, and habitat diversity
- Reduced: risk of production failure, workload/time, fuel, surface water runoff, evaporation, soil crusting, soil compaction, impact on soil life, and weed emergence

The compilation of this SLM is a part of the European Interreg project FABulous Farmers which aims to reduce the reliance on external inputs by encouraging the use of methods and interventions that increase the farm’s Functional AgroBiodiversity (FAB). Visit www.fabulousfarmers.eu and www.nweurope.eu/Fabulous-Farmers for more information.

## LOCATION



**Location:** La Pouëze, Pays de Loire, France

**No. of Technology sites analysed:** single site

**Geo-reference of selected sites**
- -0.80407, 47.56584
- -0.80407, 47.56584

**Spread of the Technology:** evenly spread over an area (0.3 km²)

**In a permanently protected area?:** No

**Date of implementation:** 2015

**Type of introduction**
- [ ] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [x] through projects/ external interventions

Strip till (Marie-Line Faure)

Strip till in cover crop (Baptiste Drouet)

## CLASSIFICATION OF THE TECHNOLOGY

### Main purpose

- [x] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact

### Land use

Land use mixed within the same land unit: No

**Cropland**

- Annual cropping: cereals - maize

Number of growing seasons per year: 1
Is intercropping practiced? Yes
Is crop rotation practiced? Yes

### Water supply

- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

### Purpose related to land degradation

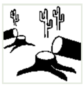
- [ ] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

### Degradation addressed

**soil erosion by water** - Wt: loss of topsoil/ surface erosion

**chemical soil deterioration** - Cn: fertility decline and reduced organic matter content (not caused by erosion

**physical soil deterioration** - Pc: compaction

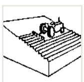


**biological degradation** - Bl: loss of soil life

### SLM group

- rotational systems (crop rotation, fallows, shifting cultivation)
- minimal soil disturbance

### SLM measures



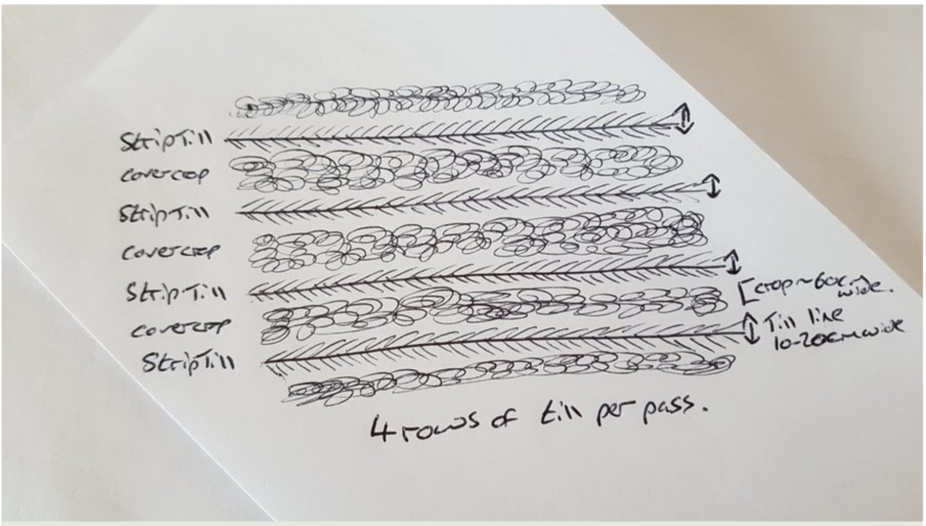
**agronomic measures** - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility, A3: Soil surface treatment

## TECHNICAL DRAWING

### Technical specifications

The strip till is a machine equipped with:
- 4 teeth permitting soil tillage at a soil depths between 10 cm and 30 cm
- 4 pairs discs to crumble the soil between 10 cm and 20 cm depth for preparation of the seedbed

Between each till line cover crops can be allowed to remain but may be cut back to near soil level to reduce competition with crop seeds.
Technology was applied on 30ha of maize plantation in regular row planting formation.



Author: Alan Rabdourne

## ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

**Calculation of inputs and costs**

- Costs are calculated: per Technology area (size and area unit: **30 ha**; conversion factor to one hectare: **1 ha = 1 ha = 2.47 acres**)
- Currency used for cost calculation: **€**
- Exchange rate (to USD): 1 USD = 0.9 €
- Average wage cost of hired labour per day: 120

**Most important factors affecting the costs**

The initial investment to buy the strip till is high, but its cost by passage is lower than ploughing or other simplified techniques of implantation.

**Establishment activities**

1. Purchase of strip till plough (Timing/ frequency: one-off purchase in 2015)
2. Cutting cover crop (Timing/ frequency: pre-planting crop seed)
3. Strip till and seeding (Timing/ frequency: Crop planting)

**Establishment inputs and costs (per 30 ha)**

| Specify input | Unit | Quantity | Costs per Unit (€) | Total costs per input (€) | % of costs borne by land users |
|---|---|---|---|---|---|
| **Labour** | | | | | |
| Cover crop cutting | day | 1.0 | 120.0 | 120.0 | 100.0 |
| Strip till & seeding | day | 1.5 | 120.0 | 180.0 | 100.0 |
| **Equipment** | | | | | |
| Strip till | per till | 1.0 | 14000.0 | 14000.0 | 100.0 |
| Tractor (inc fuel) | day | 2.5 | 50.0 | 125.0 | 100.0 |
| **Total costs for establishment of the Technology** | | | | **14'425.0** | |
| *Total costs for establishment of the Technology in USD* | | | | *16'027.78* | |

**Maintenance activities**

1. Strip till run (Timing/ frequency: Annual)
2. Cover crop management (Timing/ frequency: Annual)

**Maintenance inputs and costs (per 30 ha)**

| Specify input | Unit | Quantity | Costs per Unit (€) | Total costs per input (€) | % of costs borne by land users |
|---|---|---|---|---|---|
| **Labour** | | | | | |
| Cutting cover crop | day | 1.0 | 120.0 | 120.0 | 100.0 |
| Strip till & seeding | day | 1.5 | 120.0 | 180.0 | 100.0 |
| **Equipment** | | | | | |
| Strip till maintanance | per item | 1.0 | 100.0 | 100.0 | 100.0 |
| Tractor (inc fuel) | day | 2.5 | 50.0 | 125.0 | 100.0 |
| **Total costs for maintenance of the Technology** | | | | **525.0** | |
| *Total costs for maintenance of the Technology in USD* | | | | *583.33* | |

## NATURAL ENVIRONMENT

**Average annual rainfall**

- ☐ < 250 mm
- ☐ 251-500 mm
- ✓ 501-750 mm
- ☐ 751-1,000 mm

**Agro-climatic zone**

- ☐ humid
- ✓ sub-humid
- ☐ semi-arid
- ☐ arid

**Specifications on climate**

Average annual rainfall in mm: 650.0
Mild and rainy winter, hot dry summers (lately)
Name of the meteorological station: Beaucouzé meteorological station

- 1,001-1,500 mm
- 1,501-2,000 mm
- 2,001-3,000 mm
- 3,001-4,000 mm
- > 4,000 mm

**Slope**
- ✓ flat (0-2%)
- gentle (3-5%)
- moderate (6-10%)
- rolling (11-15%)
- hilly (16-30%)
- steep (31-60%)
- very steep (>60%)

**Landforms**
- ✓ plateau/plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

**Altitude**
- ✓ 0-100 m a.s.l.
- 101-500 m a.s.l.
- 501-1,000 m a.s.l.
- 1,001-1,500 m a.s.l.
- 1,501-2,000 m a.s.l.
- 2,001-2,500 m a.s.l.
- 2,501-3,000 m a.s.l.
- 3,001-4,000 m a.s.l.
- > 4,000 m a.s.l.

**Technology is applied in**
- convex situations
- concave situations
- ✓ not relevant

**Soil depth**
- very shallow (0-20 cm)
- shallow (21-50 cm)
- ✓ moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

**Soil texture (topsoil)**
- coarse/ light (sandy)
- ✓ medium (loamy, silty)
- fine/ heavy (clay)

**Soil texture (> 20 cm below surface)**
- coarse/ light (sandy)
- ✓ medium (loamy, silty)
- fine/ heavy (clay)

**Topsoil organic matter content**
- high (>3%)
- ✓ medium (1-3%)
- low (<1%)

**Groundwater table**
- on surface
- ✓ < 5 m
- 5-50 m
- > 50 m

**Availability of surface water**
- excess
- good
- ✓ medium
- poor/ none

**Water quality (untreated)**
- good drinking water
- poor drinking water (treatment required)
- ✓ for agricultural use only (irrigation)
- unusable

*Water quality refers to: both ground and surface water*

**Is salinity a problem?**
- Yes
- ✓ No

**Occurrence of flooding**
- Yes
- ✓ No

**Species diversity**
- high
- ✓ medium
- low

**Habitat diversity**
- high
- ✓ medium
- low

## CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

**Market orientation**
- subsistence (self-supply)
- mixed (subsistence/ commercial)
- ✓ commercial/ market

**Off-farm income**
- less than 10% of all income
- ✓ 10-50% of all income
- > 50% of all income

**Relative level of wealth**
- very poor
- poor
- average
- ✓ rich
- very rich

**Level of mechanization**
- manual work
- animal traction
- ✓ mechanized/ motorized

**Sedentary or nomadic**
- ✓ Sedentary
- Semi-nomadic
- Nomadic

**Individuals or groups**
- ✓ individual/ household
- groups/ community
- cooperative
- employee (company, government)

**Gender**
- women
- ✓ men

**Age**
- children
- youth
- ✓ middle-aged
- elderly

**Area used per household**
- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2-5 ha
- 5-15 ha
- ✓ 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

**Scale**
- small-scale
- ✓ medium-scale
- large-scale

**Land ownership**
- state
- company
- communal/ village
- group
- individual, not titled
- ✓ individual, titled

**Land use rights**
- open access (unorganized)
- communal (organized)
- ✓ leased
- individual

**Water use rights**
- open access (unorganized)
- communal (organized)
- leased
- ✓ individual

**Access to services and infrastructure**

| | poor | | | | good |
|---|---|---|---|---|---|
| health | poor | | | ✓ | good |
| education | poor | | | ✓ | good |
| technical assistance | poor | | | ✓ | good |
| employment (e.g. off-farm) | poor | | | ✓ | good |
| markets | poor | | | ✓ | good |
| energy | poor | | | ✓ | good |
| roads and transport | poor | | | ✓ | good |
| drinking water and sanitation | poor | | | ✓ | good |
| financial services | poor | | | ✓ | good |

## IMPACTS

### Socio-economic impacts

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crop production | decreased | | | | | | ✓ | | increased | Efficiency increased in production due to benefit of quicker tillage and benefits of interseedin with cover crops. |
| risk of production failure | increased | | | | ✓ | | | | decreased | No change in risk. |
| expenses on agricultural inputs | increased | | | | | | ✓ | | decreased | Reduced tillage reduces costs |
| farm income | decreased | | | | | | ✓ | | increased | Reduced costs leads to greater profit margin |
| workload | increased | | | | | | ✓ | | decreased | Significant reduction in the frequency of tool changeover. |

### Socio-cultural impacts

### Ecological impacts

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| surface runoff | increased | | | | | | ✓ | | decreased | Due to reduced soil disturbance |
| excess water drainage | reduced | | | | | | ✓ | | improved | Reduced passages across field, reduces compaction and improves soil water drainage. |
| evaporation | increased | | | | | | ✓ | | decreased | reduced soil disturbance results in less evaporation |
| soil moisture | decreased | | | | ✓ | | | | increased | No change |
| soil cover | reduced | | | | | | ✓ | | improved | Reduced disturbance and compaction improves soil cover |
| soil loss | increased | | | | | | ✓ | | decreased | Reduced soil disturbance limits soil loss |
| soil crusting/ sealing | increased | | | | | | ✓ | | reduced | Persistance of cover srop and reduced soil disturbance reduces soil cursting potential |
| soil compaction | increased | | | | | | ✓ | | reduced | Less passages across the field with less equipment use reduces compaction. |
| soil organic matter/ below ground C | decreased | | | | | | ✓ | | increased | Reduced soil disturbance allows for improved organic matter development |
| vegetation cover | decreased | | | | | | ✓ | | increased | Cover cropping persistence with inter-seeding in strips |
| biomass/ above ground C | decreased | | | | | | ✓ | | increased | Cover cropping persistence with inter-seeding in strips |
| beneficial species (predators, earthworms, pollinators) | decreased | | | | | | ✓ | | increased | Cover cropping mix encourages increased beneficial species |
| habitat diversity | decreased | | | | | | ✓ | | increased | Cover cropping mix encourages increased habitat diversity |

### Off-site impacts

## COST-BENEFIT ANALYSIS

### Benefits compared with establishment costs

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Short-term returns | very negative | | | | | | | ✓ | very positive |
| Long-term returns | very negative | | | | | | ✓ | | very positive |

### Benefits compared with maintenance costs

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Short-term returns | very negative | | | | | | | ✓ | very positive |
| Long-term returns | very negative | | | | | | ✓ | | very positive |

## CLIMATE CHANGE

### Gradual climate change

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| annual temperature increase | not well at all | | | | ✓ | | very well |
| annual rainfall decrease | not well at all | | | | | ✓ | very well |

## ADOPTION AND ADAPTATION

**Percentage of land users in the area who have adopted the Technology**
- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%

**Of all those who have adopted the Technology, how many have done so without receiving material incentives?**
- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

**Has the Technology been modified recently to adapt to changing conditions?**
- [ ] Yes
- [x] No

**To which changing conditions?**
- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

## CONCLUSIONS AND LESSONS LEARNT

**Strengths: land user's view**
- Reduced soil compaction for maize implantation
- Reduced drying of the soil that reduces the negative impact on soil biology
- Makes it possible to locate fertilizer inputs

**Strengths: compiler's or other key resource person's view**
- Reduced soil compaction
- Reduced drying of the soil
- Improved soil health and stability

**Weaknesses/ disadvantages/ risks: land user's view** → how to overcome
- Challenging in a lumpy or clayey soil → Take longer to process and implement
- Complexity of tool settings → The settings are the same once selected

**Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view** → how to overcome
- Challenging in a lumpy or clayey soil → Take longer to process and implement

## REFERENCES

**Compiler**
Alan Radbourne

**Reviewer**
William Critchley
Rima Mekdaschi Studer

**Date of documentation**: Feb. 12, 2020

**Last update**: May 17, 2021

**Resource persons**
Marie-Line Faure - co-compiler
Denis Colineau - land user
Baptiste Drouet - co-compiler

**Full description in the WOCAT database**
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5676/

**Linked SLM data**
n.a.

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