

DOC 1. Impianti Sasse Rami – 1. Tree Plantations in Sasse Rami

Varietal Selection, Protection, and Pruning

Welcome to Ceregnano!

The municipality of Ceregnano is home to the pilot and demonstration farm “Sasse Rami” managed by Veneto Agricoltura.

The farm consists of two separate land areas, one to the east (Sasse) and one to the west (Rami) of the town of Ceregnano, covering a total area of 214 hectares, with an agricultural area of about 190 hectares primarily cultivated with arable crops following a sustainable agriculture itinerary.

Italy: An Agroforestry Nation

For centuries, millions of hectares in Italy were cultivated as agroforestry systems, and all stakeholders (farmers, technicians, researchers) were aware of a fundamental fact:
Together is better than alone!

This marriage was only dissolved in the second half of the last century.

The Rediscovery of Agroforestry

As in other parts of Europe, in recent decades, there has been a gradual rediscovery of out-of-forest and agroforestry systems in Italy.

The Scientific Foundations of New Knowledge

Websites of the main European research projects on agroforestry:

- SAFE: Silvoarable Agroforestry For Europe; www.1.montpellier.inra.fr/safe
 - AGFORWARD: AGroFORestry that Will Advance Rural Development; www.agforward.eu
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Poplar in Agroforestry Systems

Poplar has long been cultivated in agroforestry systems (riparian poplar cultivation), and Italy has a solid technical-scientific documentation on the cultivation of poplar in rows.

Today, many research projects on this topic are underway in Europe.

Objectives

General Objectives:

- Increase the organic matter in soils, which have become impoverished, and enhance the carbon sequestration capacity of the soil.
- Improve wood production.
- Enhance environmental and landscape quality.

Specific Objectives:

- Evaluate the performance of MSA clones.
 - Assess the behavior of clones in an agroforestry context.
 - Evaluate the effects on associated agricultural crops.
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The Site at Ceregnano

- Average elevation between 0.5 – 1 meter above sea level.
 - 12 plots arranged in the flat Ferrarese style, oriented NNE-SSO, 38-42 meters wide, and varying in length from 100 to 260 meters, bordered by drainage ditches.
 - Alluvial soils with medium texture (clay-loam, silty, sandy at the surface, sandy-loam at depth), with good fertility and permeability, moderately alkaline pH, and an active lime content of 3%.
 - Water table at an average depth of 1.5 – 2.0 meters.
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Poplars in MSA 2018

Trial A:

Full-field poplar plantation dedicated to clonal comparison trials.

Trial B:

Silvoarable system in which the same plot hosts a planned association of tree species (poplar rows) with annual agricultural crops (corn – soy – wheat).

Clone Name | Genetic Origin

1. Aleramo | *Populus x canadensis*
2. Tucano | *Populus x canadensis*
3. Diva | *Populus x canadensis*
4. Senna | *Populus x canadensis*
5. Moncalvo | *Populus x canadensis*
6. Mombello | *Populus x canadensis*
7. Brenta | *Populus x canadensis*
8. Moleto | *Populus x canadensis*
9. Lena | *Populus deltoides*
10. BL Costanzo | *Populus x canadensis*
11. Taro | *P. x Canadensis x P. x generosa*
12. Lux | *Populus deltoides*
13. Soligo | *Populus x canadensis*
14. Mella | *Populus x canadensis*

- 15. Dvina | *Populus deltoides*
 - 16. PLF – BC1 | *Populus x canadensis*
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Clone Comparison Field and Agroforestry Rows

Planting of Saplings

Trial Site A: Clonal field

- Area: 1.8 hectares.
 - Experimental setup: randomized block design with equal area (42 plots of 324 m²) with 3 replications for each poplar clone used.
 - Each plot contains 9 plants, totaling 378 individuals; an additional 72 poplars of different clones were planted around the perimeter.
 - Planting layout: regular square with 6 x 6 meter spacing.
 - Density: 250-270 plants/hectare.
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Trial Site B: Agroforestry Rows

- Poplar rows planted along the edge of 9 drainage ditches (on one side only), spaced 35-40 meters apart, with a total length of 1460 linear meters.
 - Trees are spaced 6 meters apart within the row, totaling 243 plants, equivalent to a density of about 30 plants/hectare.
 - The area between the tree rows is used for crop rotation as per the farm's cultivation plan.
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Pruning

2020: Start of experimental trial on hybrid Paulownia clones.

Clone Comparison Field:

- 6 clones
 - Plots of 3x3 plants, repeated 3 times.
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Provenance Comparison Field

In spring 2021, the establishment of a comparison field began among 11 different provenances of Paulownia belonging to 3 different species:

- **P. tomentosa**
- **P. elongata**
- **P. fortunei**

- Plus the “Italia” selection of *P. tomentosa*.
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Monzambano (MN)

- On private land of about 3 hectares.
 - Year of planting: Spring 1999.
 - Year of utilization: April 2020.
 - 3 species: *P. tomentosa*, *P. elongata*, *P. fortunei*, totaling 17 different provenances (from different areas of China with varying environmental conditions).
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2021: Start of the establishment of a collection field with 11 Chinese provenances of *Paulownia* (Monzambano) + clone Cotevisa2.

Collection Field of Provenances

Agroforestry Rows:

- 2 rows with provenances.
 - 1 row with clones.
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- 2 agroforestry rows with *Paulownia* clones.
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Poplars 2022 in Rami:

Clonal field + agroforestry rows.

Clonal Field

Agroforestry Rows

December 2021: Pollarding of poplars with the collaboration of CNR-IBE of Sesto Fiorentino (FI).

DOC 2. Agroforestry

General Objectives:

- Increase the organic matter in soils, which have become impoverished, and enhance the carbon sequestration capacity of the soil.
- Increase biodiversity.
- Improve wood production.
- Enhance environmental and landscape quality.

Specific Objectives:

- Evaluate the performance of MSA clones.
 - Assess the behavior of clones in an agroforestry context.
 - Evaluate the effects on associated agricultural crops.
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Poplars in Sasse

Clone Name | Genetic Origin

1. Aleramo | *Populus x canadensis*
2. Tucano | *Populus x canadensis*
3. Diva | *Populus x canadensis*
4. Senna | *Populus x canadensis*
5. Moncalvo | *Populus x canadensis*
6. Mombello | *Populus x canadensis*
7. Brenta | *Populus x canadensis*
8. Moletto | *Populus x canadensis*
9. Lena | *Populus deltoides*
10. BL Costanzo | *Populus x canadensis*
11. Taro | *P. x Canadensis x P. x generosa*
12. Lux | *Populus deltoides*
13. Soligo | *Populus x canadensis*
14. Mella | *Populus x canadensis*
15. Dvina | *Populus deltoides*
16. PLF – BC1 | *Populus x canadensis*
17. PLF – BC2 | *Populus x canadensis*
18. PLF – BC3 | *Populus x canadensis*
19. NND | *Populus x canadensis*

20. T I-214 (Control) | Populus x canadensis

Clone Comparison Field and Agroforestry Rows

Trial Site B: Agroforestry Rows

- Poplar rows planted along the edge of 9 drainage ditches (on one side only), spaced about 35-40 meters apart, with a total length of 1460 linear meters.
 - Trees are spaced 6 meters apart within the row, totaling 243 plants, equivalent to a density of about 30 plants/hectare.
 - The area between the tree rows is used for crop rotation as per the farm's cultivation plan (wheat, soybeans, corn).
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Wheat Grain Yield and Protein Content

Grain Yield | Grain Quality

- No yield losses.
- Arkeos +14%, LG Ayrton +4% vs. Control.
- Higher yields at distance H (tree height).
- Significant increase in protein content.
- Arkeos +2.1, LG Ayrton +0.9 vs. Control.
- Higher protein content at $\frac{1}{2}H$ distance.

Biscuit Wheat Arkeos:

- More advantaged by the presence of trees compared to bread wheat.
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Main Results on Soybeans

Chlorophyll Content | Grain Yield

- Increased leaf greenness closer to the tree row.
- No significant differences between clones.
- Significant yield reduction near the row (-31%).
- Yields similar to control at H distance.
- Increased isoflavone content near the row (especially at H distance).

Poplar-Soybean Association: Soybeans (Year 2020)

From the poplar perspective:

- Greater growth compared to the same clones in open fields.
- Requires two rounds of formative pruning due to regrowth.
- Pruning activities need to be synchronized with agricultural crops; it's not always possible to prune.
- Technological characteristics of the wood...
- Attention to spacing between tree rows; too close causes ovalization.

The same clones in Agroforestry, compared to the clonal field, have the following increased diameters:

- Tucano: +18.3%
 - Moncalvo: +12.8%
 - Aleramo: +10.9%
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Poplar Wood Demand: 2.3 million cubic meters

Italy's Production: 700,000 cubic meters

80% of poplar wood is imported.

Price is continuously increasing.

Poplars in Rami

Location of Poplar Tree Plantations in the Agricultural Area of Rami

Plantation established in February 2022 with one-year-old saplings.

Plantation established in February 2022, later removed and replanted in February 2023 with one-year-old saplings.

Paulownia: Ongoing Trials

2020: Start of experimental trial on hybrid clones of Paulownia.

Clonal field:

- 6 clones
 - Plots of 3x3 plants, repeated 3 times
 - Coppicing
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COMPARISON FIELD BETWEEN PROVENANCES

In spring 2021, the establishment of a comparison field began among 11 different provenances of Paulownia belonging to 3 different species:

- Tomentosa
- Elongata
- Fortunei
- Plus the Italy variety.

Agroforestry Rows:

- 2 rows with provenances
- 1 row with clones

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2 agroforestry rows with Paulownia clones.
