

Hybrid poplar and oak along drainage ditches

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Why plant poplars?

The Padana Plain in Italy is characterised by intensive agriculture. Cereals are the most common crop, and hybrid poplar (*Populus x euroamericana*) is the most common cultivated tree species for timber production. Intercropping poplar trees with arable crops is now recognized as a modern form of Smart Agriculture, due to the efficient use of site resources (light, nutrients and water) by canopies and root distribution.

The Common Agricultural Policy-Rural Development Plans 2014-2020 currently support the establishment of agroforestry systems in Europe, with direct grants encouraging tree inter-planting with arable crops. In Italy, the current CAP (2014-2020), measure 8.2, promotes these systems in Veneto, Umbria, Basilicata, Marche and Puglia regions.

With the objective of increasing the economic value of the farm through product diversification, linear tree systems, combining different woody species are encouraged by public administrations to enhance productivity and environmental benefits (carbon sequestration, biodiversity preservation, soil erosion control, soil and water quality). Farmers, as well as local people and tourists, appreciate their environmental and aesthetic value.



Soybean and alfalfa within hybrid poplar in an alley cropping system. Ref: Paris 2016

Where and how to plant poplar trees at low planting density for timber quality

Hybrid poplars are fast growing trees, best suited for cultivation on deep alluvial soils, with permanent groundwater (1-1.5 m below soil surface). Low-lying and flat alluvial soils, with frequent drainage ditches, (at a spacing of about 30-35 m) can be easily used for the establishment of alley cropping systems, by planting trees along one side of the drainage ditch, thereby optimizing the use of reclaimed lands. In each row, hybrid poplar trees are the principal woody species. They are planted for their fast growth at an intra-row spacing of 7-10 m. These may be alternated with other hardwood species, like pedunculate oak (*Quercus robur*). This is an endemic species in many areas of Europe. It is hygrophilous, produces a very high quality timber, and has a lower growth rate compared to hybrid poplars.

Hybrid poplars are planted using 3 m long rods, provided by specialized nurseries, with selected planting material. Rods are planted into deep holes, drilled using machinery or a manually operated motorized drilling device. Oak is planted using containerized seedlings. Care should be taken to use local germoplasm of pedunculate oak with appropriate certification. After tree establishment, localized weed control is required, along with occasional irrigation at times of prolonged drought. Formative pruning is necessary for good quality timber production.



Hybrid poplar and pedunculate oak in an alley cropping system. Ref: Paris, 2016

Advantages

- Producing a second crop of wood (for plywood, packaging and chips) in between the arable crop facilitates product diversification and increases the productivity per unit of land.
- Improved microclimatic conditions within alley cropping systems benefit the arable crop at little additional cost.
- Tree hedgerows have the ability to shelter crops and soils from extreme weather events induced by climate change.
- Crop diversification can protect the farmer from complete crop failure.



Measuring solar radiation distribution across a 3 year-old tree alley with hemispherical photos. Crop shading by trees was almost nil. Ref: Paris, 2016

Tree yield

Hybrid poplars are fast growing trees reaching a harvestable diameter at breast height of 35 cm in 8-16 years, depending on site conditions. In 2017, poplars had a final value of between 40-50 € per tree. Simulations show that agroforestry trees, with low planting density, should have larger volumes than those grown in plantations.

Crop yield.

Crop yields are expected to be impacted, only slightly, if at all, by tree shading for the first years. Simulations show that crop yields should start significantly to decrease (approx. 70% of sole crop) approaching six years, which is half-way through the trees rotation (Graves et al. 2007).

Pests and diseases

Hybrid poplars, under intensive cultivation, are vulnerable to a range of pests and diseases, attacking leaves (e.g. *Melampsora*, *Marssonina*), root systems (*Armillaria*, *Rosellina*) and trunks (with wood borers e.g. *Saperda*, *Cossus*, *Crypthorhynchus*). For each specific site, it is important to refer to technical consultants. Canopy spraying should be avoided as this can lead to possible drift over intercrops. It is also recommended to use new resistant clones (Coaloea et al. 2016). Major trunk damage caused by wood borers, can be controlled by early spring spraying.

Labour, harvesting and marketing

Annual tree pruning is essential for producing high quality timber such as plywood). In agroforestry systems, with low planting density, the tree canopy should cover two thirds of the total height. Manual tools reaching high branches can be easily used. For intercrops, no additional labour is required due to tree rows. The maintenance of the ditches (mowing and modelling) is done from the open side. Wood of hybrid poplar is an important commodity, with many industrial uses.

Further information

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At tree maturity, the crown height does not hinder the use of machinery for crop cultivation. Ref: Paris, 2017

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