



Trees and crops: making the most of the space

Managing the tree understorey for increased food production and biodiversity

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Why manage the understorey?

In many agroforestry systems, the area between the trees and under the tree canopy is an overlooked and underutilised space. Unmanaged, this can create problems with weed control. This space can be put to productive use through planting crops that are adapted to shady conditions. In addition, when managed correctly, the tree understorey can be a resource for biodiversity, providing a habitat for beneficial insects and a food resource for crop pollinators.

Understorey crop and management options for horticultural agroforestry systems can include cut flowers, rhubarb and globe artichokes. These are all crops which thrive in the shade and can be sold alongside other produce. The understorey can also be sown with wild flowers, with species chosen to attract pollinators and provide habitat for beneficial predators.



Daffodils in flower, April 2016 Ref: Organic Research Centre



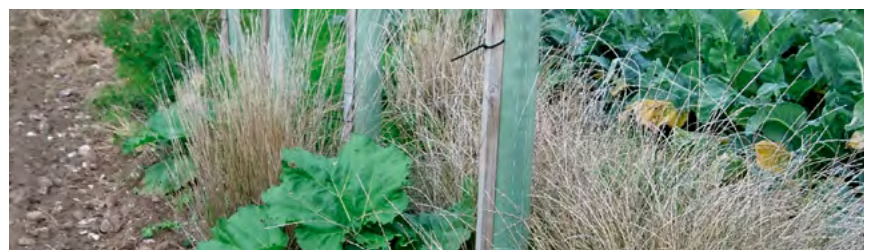
Silvoarable system at Tolhurst Organics, June 2015 Ref: Organic Research Centre

Understorey crop options: what works?

Different approaches to understorey management have been trialled at an organic farm in southern England. The farmer, Iain Tolhurst, has planted a mixture of trees for fruit, timber and coppice products in single rows. Tree species are: apples (18 varieties); field maple (*Acer campestre*); white-beam (*Sorbus aria*); Italian alder (*Alnus cordata*); oak (*Quercus robur*); black birch (*Betula lenta*); hornbeam (*Carpinus betulus*); wild cherry (*Prunus avium*). There are 20 m cropping alleys between where vegetables are grown as part of an organic rotation. The alley width was chosen to fit with the farm irrigation system, and tree rows oriented north/south. The system is still young. Trees were planted into existing ground vegetation in March 2015, and woodchip mulch was applied around each tree to reduce weed competition.

In December 2015, the understoreys of two tree rows were planted with daffodil bulbs (*Narcissus sp.*) with groups of 70 bulbs between each tree. In March 2016, rhubarb crowns were planted into another row; 90 crowns in total over the 150m row. The first saleable harvest of a small number of daffodils was in spring 2016, with the first main crop in spring 2017. Full production of rhubarb is expected in 2019. Ten species of cut flowers were sown in modules in spring 2016 and planted out in summer 2016. Globe artichokes grown from seed were planted in another tree row in late summer 2016, with the first crop likely to be in 2018.

The daffodils and the globe artichokes have been planted into rows sown with a diverse legume and herb mix for pollinators. In one tree row, the understorey has been left as a long-term beetle bank with perennial grasses and tall herbs to provide overwinter habitats for pest predators. Other options for understorey crops are shade-tolerant culinary herb species or species with pharmaceutical properties, such as Melissa.



Rhubarb establishing in the understorey, Sept 2016 Ref: Organic Research Centre



Advantages

Growing additional crops in the tree understorey makes more efficient use of all available land and should increase the overall productivity of the farm. Fifteen percent of total vegetable cropping land was lost to plant the new agroforestry system trees at Iain's farm. Cropping the understorey helps to lessen the impact of taking land out of direct vegetable production.

Perennial crops, such as rhubarb and daffodils, require minimal management following establishment. In addition, active management of the understorey will help to control weed species, which may otherwise cause a problem in the vegetable cropping alleys. Understorey management can also improve resources for biodiversity on farm, helping control pests naturally and increase the presence of pollinators. Daffodils flower early in the spring, therefore supporting pollinators early in the season.



Crop irrigation between the tree rows.
Ref: Organic Research Centre

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Wild flowers in the tree understorey. Ref: Organic Research Centre

Yields, establishment and management

Economic data for the different understorey options are being collected. This includes data on the establishment and management costs of the trees and understorey crops, as well as data on vegetable production within the alleys. It is still too early in the trial to have accurate yield data for the understorey crops. Both rhubarb and daffodil crops provide a harvest early in the season, therefore providing an income boost at a time of year when it is most needed. Ongoing management is minimal with a woodchip mulch for weed control applied around the trees in years one and two. As the plants age, yields will decline and both the daffodils and rhubarb will eventually need replacing. Most rhubarb plants will produce good yields of high quality rhubarb for at least four years, while daffodils can last much longer, although it is likely that some varieties will need replacing as shade increases. Good crop management and control of perennial weeds can extend the life of the plants.

There is the possibility that the understorey crops will compete for water and nutrients, to the detriment of the trees. Tree growth measurements across all rows will allow this to be monitored as the understorey crops establish. There may also be some competition with vegetable crops in the alleys, although it will be difficult to separate out the effects of the trees and understorey crops.

Biodiversity: pest and weed control

The diversity of plant species and ground dwelling invertebrates in the different tree rows is being monitored as the different understorey crops establish and grow through to cropping. In 2015, prior to planting the understorey crops, the long-term beetle bank showed the highest plant species diversity and the three rows sown with a legume and herb mix showed the highest invertebrate abundance.

Further information

Crawford M (2010). Creating a Forest Garden. ISBN 978-1-900322-62-1.
Factsheet on rhubarb production from the Agroforestry Research Trust: <https://www.agroforestry.co.uk/product/factsheet-f37-rhubarb/>
Tolhurst Organic Farm website: <http://www.tolhurstorganic.co.uk/>