



# Combining organic livestock and bioenergy production

A novel trial integrating willow and alder short rotation coppice and cattle

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## Why combine livestock and energy production?

Agricultural land is subject to many competing demands: for increased food production to meet the needs of a growing world population; for bioenergy production from biomass crops such as short rotation coppice (SRC) to meet renewable energy targets; and the demand for agricultural land to protect the environment including soil, water and air quality, reducing climate change, and supporting biodiversity.

Agroforestry has the potential to help to meet these conflicting demands by integrating energy production from short rotation coppice and livestock production, without compromising the environment.



Applying woodchip for weed control Ref: Jo Smith, ORC



Cattle and short rotation coppice. Ref: Jo Smith, ORC

## Design and establishment of the system

Trees were planted in north/south rows with 24 m of pasture between tree rows in spring 2011. Willow (*Salix viminalis*) was chosen as it has a dual use as both a productive bioenergy source and a livestock fodder.

Common alder (*Alnus glutinosa*) was also planted as it coppices well and it fixes nitrogen, which may be useful for organic systems. However, its value as a fodder crop was unknown. Trials comparing different weed control approaches found that woodchip mulch can perform as well as fabric mulches. Further, as it can be sourced on-farm or from local tree surgeons for free, it provides a good approach to weed control in organic systems. Tree establishment rates were initially low due to dry spring weather in the first two years, and there was a high level of replanting, particularly of the willow. Trees were cut to a height of 10 cm after one year to encourage multiple branching and a silage cut was taken from the alleys once or twice a year for the first four years, with cattle first introduced in the fifth year. In the sixth year, the pasture was ploughed in and oats grown for whole-crop silage before re-seeding with a diverse pasture mix.



Cutting for silage Ref: Jo Smith, ORC

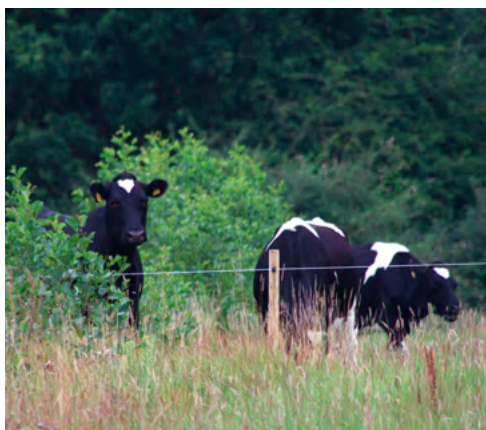
## Advantages

The key advantages of the system are self-sufficiency for the farmer in energy production, combined with shelter and shade for cattle and the provision of alternative feed resources.

Other advantages include, improvements to soil organic matter, support for farmland biodiversity, and the substitution of fossil fuel with renewable energy.



Coppiced alder drying in field before chipping. Ref: Jo Smith, ORC



Browsing trial. Ref: Jo Smith, ORC



Cultivating the alleys. Ref: Jo Smith, ORC

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November 2017

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## Woodchip and pasture production

The trees were first harvested after five years. Alder yields were on average 160 kg/100 m (30% moisture content) or 663 kg/ha of agroforestry, while average willow yields at this first coppice were just under 8 kg/100 m or 32 kg/ha of agroforestry. It appears that the willow is not well suited to the site. With hindsight, other species of willow may have been a better choice. For example, white willow, (*Salix alba*) which has been planted in nearby hedges, has survived and grown very well. Yields of the pasture were monitored over the first five years, and no significant impacts were found, suggesting that in the initial years of establishment, competition between the trees and grass was minimal.

## Tree and livestock interactions

A browsing trial found that cattle have a preference for willow over alder. However, after a few days, the cattle also started browsing the alder trees, suggesting that as they become more familiar with browsing tree leaves, their acceptability of different species increased. The use of trees to provide cattle fodder is likely to conflict with the production of woodchip for bio-energy, although one possibility would be to allow the cattle access to the trees in the months leading up to harvest in order to strip the leaves. Cattle will also take branches up to 10 mm in diameter, but this is unlikely to make much difference to the woodchip yield. Otherwise, tree fodder may have a role to play when grass is in short supply, e.g. during summer droughts, when any loss in woodchip yield would be compensated by avoiding the expense of buying in forage. Using a single strand electric fence was sufficient to protect the trees from the cattle, while allowing them to reach grass in the understorey of the tree row.

## Further information

Caslin B et al. (2015). Short Rotation Coppice Willow. Best Practice Guidelines. TEAGASC and AFBI Publication. <https://www.agriculture.gov.ie/media/migration/ruralenvironment/environment/bioenergyscheme/TeagascCoppiceWillowGuidelines260315.pdf>  
Smith J, Gerrard C (2014). System Report: Agroforestry for Ruminants in England. AGFORWARD Report.