Fact Sheet
TILLAGE No. 3

Teagasc
Agriculture and Food Development Authority

# Willow

TILLAGE SPECIALISTS 2010

## Introduction

Willow can produce large quantities of renewable "green" energy without harming the environment. Growing willow for energy contributes to sustainable development in rural communities. Willow yields a fuel that can be stored until needed, and then used to generate heat and electricity. Ireland has an obligation under the Kyoto Protocol to reduce greenhouse gas emissions by 13 per cent above 1990 levels by 2012.

## Site selection

Most agricultural soils with pH in the range 5.0-7.0 will produce satisfactory coppice growth. However, light sandy soils particularly in drier areas will have a problem with moisture availability and highly organic or peaty soils should be avoided as initial weed control, which is vital, will be extremely difficult. Medium to heavy clay-loams with good aeration and moisture retention are ideal although they must be capable of allowing a minimum cultivation depth of 200-250mm to facilitate mechanical planting. Boggy sites are not suitable as this can hamper harvesting, which is carried out in the winter.

Willow coppice requires more water for its growth than any other conventional agricultural crop and hence requires a good moisture retentive soil. Areas with an annual rainfall of 900-1,100mm are best or areas where the crop has access to ground water. The crop can tolerate occasional inundation but this may have implications for harvesting.

## Site preparation

Willow should be planted in an excellent seedbed as there is little chance of rectifying problems when the crop is sown. Plough pans, which can develop under tillage systems, should be removed by sub-soiling before planting. Aim to establish a consolidated seedbed with a fine tilth. It is generally recommended that a power harrow be used prior to planting to achieve the desired seedbed. Willow is very palatable to rabbits, hares and deer.

Fencing should be completed before the crop is planted where a problem is anticipated. Fencing is the best method of controlling rabbits. There is usually no need for further control when the willow plantation is established.

## Establishment

It is strongly recommended that all perennial broad leafed and grass weeds be controlled with Glyphosate prior to sowing. Control of these weeds after the crop is planted can be very difficult and expensive.

Plantations are sown with 15,000 cuttings per hectare. The cuttings are sown in a spacing structure similar to maize, in a twin row arrangement. This twin row spacing allows machinery to pass through the crop. The spacings are generally 0.75m between the rows and 1.5m in between twin rows with a spacing of 0.6 m between the cuttings.

The cost of establishment is high at approximately €2,900/ha. Support is available through the BioEnergy Scheme administered by the Department of Agriculture, Fisheries & Food.

## Nutrition

To ensure correct crop nutrition, it is essential to have a recent soil analysis report before planting. Consult a recent soil report to identity the soils available: phosphorus (P), potassium (K) and magnesium (Mg). Where soils are low (Index 1) in P & K at planting time an organic source of P & K should be incorporated into the seedbed. Nutrient advice can be summarized as follows.

| Soil Index | Nitrogen (N) Kg/ha | Phosphorus (P) (kg/ha) | Potassium (K) (kg/ha) |
|---|---|---|---|
| 1 | 130 | 34 | 155 |
| 2 | 100 | 24 | 135 |
| 3 | 75 | 0 | 120 |
| 4 | 40 | 0 | 0 |

Opportunities also exist for growers to charge a gate fee for spreading waste materials like brewery waste and sewage sludge on their willow plantations. Further information is available in the Teagasc Nutrient Guidance for Energy Crops spreadsheet.

## Harvesting and yields

Harvesting is carried out from December to April and whilst the root system of the growing coppice will support the harvesting and extraction equipment on the coppice site, hard access is required to the site. Slopes in excess of 13 per cent will be difficult for harvesting machinery particularly in wet conditions and should be avoided.
The first harvest will usually commence early in years three to four after planting. Yields will vary depending on the land quality but the crop is generally harvested every two years. Harvesting can be accomplished by either harvesting and chipping in one operation or harvesting the willow entire, then stacking and chipping at a later date. Harvesting and chipping is completed with grass forage equipment with an adapted header. These chips are blown directly into trailers and transported from the site for storage/drying. Willow harvested by this method contains 50 per cent moisture content and will need drying before burning. Harvesting the willow entire and stacking the material in the field has the advantage of letting the willow reduce in moisture content before chipping.

## Economics

The establishment grant provides 50 per cent grant aid towards the cost of establishment. However, with the grant a payback period of seven years is anticipated. Government help is needed to develop the infrastructure around biomass supply chains. It is a brand new market and the general public, including our big heat utilisers, need to be made aware of the benefits of switching to biomass.
Local market access is vital as the bulk density of the crop is low and the crop becomes unprofitable when high transport costs are incurred. The best economic return is for groups of farmers to develop local markets. Supply of these markets (schools, hotels and more) can be organised by the farmer groups and payment for the chips paid directly to the groups through either a payment per tonne of chip or per unit of heat used. Additional income may also be derived from charging a gate fee for spreading wastes e.g., brewery wastes.

## Pests and diseases

A wide range of insects and fungal pathogens can live in willow. However, many of these pathogens and insects will not harm willow and only enhance the bio-diversity of the plantation, due to the plentiful supply of the food. Rust (melampsora) is the major disease of willow. A severe attack can reduce yields by 40 per cent and in some cases kill willow plants. Rust can change populations over two to three years and a resistant variety of willow can become susceptible over that period of time. It is therefore essential that all plantations are sown with at least five to six different willow varieties to prevent a devastating attack of rust. The blue and brassy willow beetle can cause some problems but populations are generally low. Control is possible but it can be difficult due to the structure of an advanced willow plantation.

## Crop management

The growth in the first year after planting can be as much as 1.5-2.0m high. This growth is cut back to ground level in the winter to encourage more shoots to grow (coppicing). Generally four to eight stems will start to grow in the second year. Growth in the second year can be as high as 2-2.5m and a final height of 8m can be expected at harvest.

**Key Points**

- Spray Glyphosate four weeks prior to planting (Roundup 3l/ha)
- Plough to 20cm 14 days after glyphosate
- Power harrow, lift stones, level land
- Plant willow at 15,000 cuttings with mechanised planter
- Give ground a light rolling after planting
- Spray with 3 l/Stomp/ha within 14 days of planting
- Walk plants regularly checking for rabbit or leatherjacket damage

Further information on herbicide use can be obtained in the Teagasc Willow Weed Control factsheet.

**Further information:**

**Department of Agriculture & Food**
**www.agriculture.gov.ie**
**(look under schemes/other schemes/Bioenergy Scheme)**

**Barry Caslin, Teagasc. barry.caslin@teagasc.ie**
**John Finnan, Teagasc. john.finnan@teagasc.ie**

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