

BioEnergy Scheme 2010

Best Practice Manual for SRC Willow



A Best Practice Manual for Growing Short Rotation Coppice Willow under the BioEnergy Scheme



1. Introduction

Under the BioEnergy Scheme, establishment grants are available from the Department of Agriculture, Fisheries & Food to encourage the growing of willow and miscanthus for the production of biomass suitable for use as a renewable source of bioenergy. Further details on the BioEnergy Scheme are available from Biofuels Policy, Department of Agriculture, Fisheries & Food, Kea-Lew Business Park, Mountrath Road, Portlaoise, Co. Laois (bioenergy@agriculture.gov.ie / T. 057-8692231).

This Best Practice Manual sets out the standards and specifications required by the Forest Service of the Department of Agriculture, Fisheries & Food in relation to willow applications submitted under the BioEnergy Scheme 2010. These standards and specifications are in addition to the general terms and conditions of the BioEnergy Scheme.

This manual details best practice regarding the growing of short rotation coppice (SRC) willow to produce woodchip suitable for use as a source of bioenergy. It sets out the critical factors involved in protecting the environment, maximising yield and achieving economic viability. Further reading and useful contacts are included in Appendices A and B.

2. Protection of the environment

All willow applications must be compatible with the protection of the environment. Where environmental issues are identified (e.g. important habitats, water quality, landscape, archaeology), the Forest Service may attach specific conditions to the project approval, following consultation with relevant statutory bodies.

SRC Willow and water quality

Under the willow element of the BioEnergy Scheme, a 10 m wide aquatic buffer zone is required along watercourses that are within or adjoining the site and that are depicted on a 6 inch OS map¹. The purpose of the aquatic buffer zone is to create a strip of natural ground vegetation that will help prevent sedimentation, chemicals and runoff entering the water.

The aquatic buffer zone is to be excluded from all ground preparation activities, planting, herbicide / pesticide application and machine traffic. Apart from the periodic control of excessive woody growth, the aquatic buffer zone is to remain *in situ* and undisturbed throughout the lifetime of the willow plantation.

Forestry Act 1946

In relation to any proposed clearance work prior to planting under the willow element of the BioEnergy Scheme, note that, under the Forestry Act 1946, it is an offence to uproot a tree over ten years old or to cut down any tree unless the owner has obtained permission in the form of a felling license from the Forest Service. Application for a felling license is made on a felling notice form, available from any Garda Station.

¹ On a case-by-case basis and where pre-approved, a 5 m wide aquatic buffer zone may be acceptable on flat stable sites.

3. An overview of growing SRC willow

Willow can be grown on a short rotation coppice system to produce woodchip suitable for use as a source of bioenergy for heat and power generation. This process involves the planting of suitable varieties of willow, followed by the repeated cutting (combined harvest / chipping operation) and resprouting of the crop over a 3- to 4-year cycle, for up to 20-25 years. The woodchip material produced at each harvest is subsequently dried and used for bioenergy.

Establishing, growing and harvesting SRC willow for bioenergy is a highly specialised activity, and potential applicants must be fully aware of the critical factors involved, including protection of the environment, site access, feasible plantation size, efficiencies in layout and design, the costs from establishment to drying and transportation of the woodchip, proximity to market, etc.

4. Site requirements

Growing SRC willow requires high quality fertile agricultural land (former tillage land or improved grassland) capable of being ploughed to a depth greater than 20 cm. Peaty soils are unsuitable, as are soils that dry out quickly or are waterlogged for prolonged periods.

The site must have a low elevation and be moderately sheltered (sites of higher elevations may be suitable, if well-sheltered). To facilitate machine operations and to minimise potential runoff, slope should be minimal (not exceeding 15°).

5. Plantation layout

Proper plantation layout is important in order to optimise operational efficiency throughout establishment and harvesting. Key considerations are as follows:

- ❑ Adopt a rational field layout. Run planting rows along the longest length of the site, and parallel to existing field boundaries and ditches. Avoid running rows across the slope, as this could create a potential for machinery to topple over. Rows should be long enough to maximise machine efficiency, based on the type and capacity of the machine. For example, the trailer accompanying the harvesting machine should reach its capacity at the end of a row, as opposed to halfway down.
- ❑ Ridelines and headlands are required to facilitate machine access and turning. Under the BioEnergy Scheme, up to 10% of the site is allowed as open space. Ridelines are normally 4 m wide, running along at least one side of the plantation. Headlands should be 8 m wide and located at both ends of, and at right angles to, the planting rows. Ridelines and headlands can be permanent, i.e. unplanted and maintained by mowing twice yearly. However, temporary ridelines and headlines that are 'reclaimed' from the crop at the start of each harvest should be used in localised areas of heavy, poorly drained soils, where the *in situ* willow root mass will protect the soil and provide a machine carrying capacity. This approach should also be considered in smaller SRC willow blocks, to minimise disproportionately large unproductive

areas. When using temporary ridelines and headlands, be aware of the risk of tyres being punctured by newly cut stems.

- ❑ Avoid localised areas of wet terrain, which may impede machine traffic and create a potential for soil damage.
- ❑ Hard access to the site is essential, to facilitate machine access and the removal of the harvested material. Gates may need to be widened. The access track should lead to a landing area, where the harvested material can be handled.
- ❑ Maximise the planting area and consolidate planting blocks as far as possible, in order to maximise efficiency and economies of scale. Consider co-ordinating with neighbouring landowners who are also growing SRC willow, with a view to consolidating blocks within a particular area.

6. Ground preparation and vegetation management

At the time of planting, it is crucial that the site is well cultivated, i.e. ploughed to a depth of at least 20 cm (to facilitate the insertion of cutting of 15-20 cm in length) and harrowed, and completely free of competing vegetation. It is also vital that the vegetation-free conditions persist until the crop becomes established. Shortly after planting (within 3-5 days), a pre-emergence residual herbicide is typically applied, in order to secure vegetation-free conditions up until canopy closure, which normally occurs mid-summer.

Spot spraying may be required in localised areas where heavy vegetation emerges, but extreme care must be taken to avoid herbicide contact with willow foliage and stems. Typically, former improved grassland poses a greater challenge regarding vegetation management, compared to former tillage land.

7. Planting material

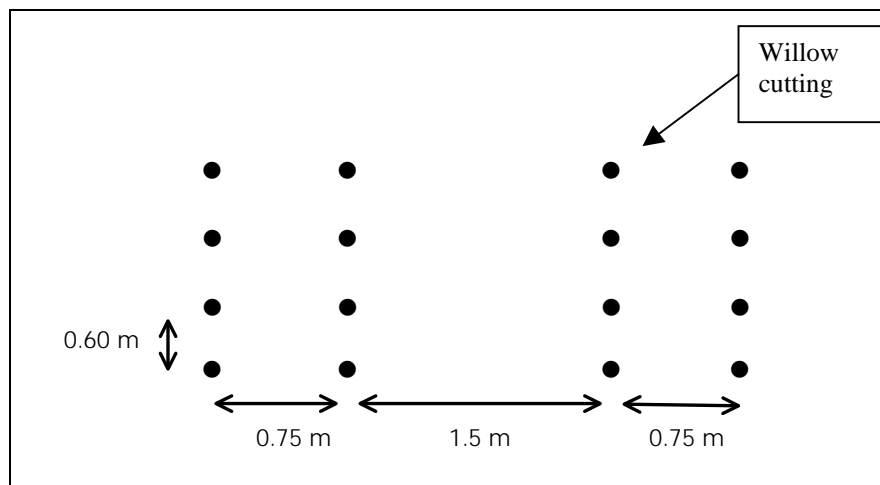
Various varieties of willow have been developed commercially for use in SRC, through intensive breeding programmes (e.g. the separate Swedish Breeding Programmes and European Breeding Programme) aimed at promoting production, resistance to rust and other required characteristics. Such material is typically protected by Plant Variety Rights and sold by specialist suppliers under strict licence to a specific client for a specific use, i.e. for planting on a particular site.

8. Planting

Planting material is supplied in the form of rods that are kept in cold storage right up until planting. Planting is normally carried out from mid-March to the end of May, although earlier and later planting is possible. Planting can be carried out by hand, but is more typically undertaken using a specialised machine, whereby manually-fed rods are mechanically cut, planted and firmed in into the soil. Typically, a single rod produces 10 cuttings.

Under the willow element of the BioEnergy Scheme, a minimum planting density of 15,000 willow cuttings / ha is required. The recommended planting design is as follows (see diagram):

- ❑ twin rows 0.75 m apart and with 1.5 m between each set of twin rows (this gap is designed to accommodate the wheels of machinery such as harvesters);
- ❑ individual plants are spaced 0.60 m along each row.



9. Pest and diseases

Leatherjacket larvae

Leatherjacket larvae pose a threat, particularly on former grassland or long-term set aside. If present, control is required in the form of a suitable insecticide sprayed shortly after planting, typically alongside the pre-emergence residual herbicide application (see above).

Fencing

Normal stock fencing is required to prevent livestock from entering the crop. Such fencing may not be required around the actual willow plantation, if the wider perimeter is already securely fenced.

Rabbit / hare fencing may be needed during the first growing season after planting, during which time the shoots develop. Such protection is not required after this initial establishment period or in subsequent cycles, due to the vigorous nature of the crop. Therefore, where required, consider using temporary rabbit and hare fencing that can be moved and redeployed elsewhere. If using temporary rabbit and hare fencing, a 15 cm outward-facing flap of fencing must be left at the bottom of the fence, and securely pegged down.

Where present in small numbers, deer may cause localised grazing or bark stripping. Such losses can be absorbed by the vigorously growing crop. However, high deer numbers and the likelihood of heavy damage may necessitate deer fencing, or, due to the cost involved, may simply rule out the feasibility of growing SRC willow on that site.

Required fencing specifications are set out in page 53 of the Forest Service *Forestry Schemes Manual* (2003).

Rusts

Melampsora rusts represent a serious threat to SRC willow crops, potentially affecting both productivity and survival. This threat is best countered by the use of willow varieties that have been specifically bred for resistance to this disease. Typically, a mixture of varieties is included in the plantation, to allow adequate yield compensation should individual varieties lose productivity or die out due to increasing disease susceptibility. This measure also increases the genetic diversity within the crop, thereby reducing the selection pressure on the disease organism.

The following apply under the willow element of the BioEnergy Scheme:

- ❑ Only varieties from the Swedish Breeding Programme and the European Breeding Programme are acceptable.
- ❑ Each application must include a minimum of five varieties from either or both of the above breeding programmes.
- ❑ All varieties used must be suited to the Irish climatic conditions.
- ❑ The varieties must be intimately mixed throughout the crop. (In practice, bundles of each variety are loaded onto the planting machine. Rods are taken from each bundle in succession and fed into the machine, to achieve the required intimate mix.)
- ❑ Invoices / receipts for willow planting material must clearly specify the breeding programme involved, the specific varieties supplied, and the quantities supplied under each variety.

10. Cutback

The crop can reach a height of 2.0 metres or more during the first growing season. To initiate the development of multiple shoots, each stem is cut back at its base during the winter of the first year, before bud burst. Cutback is normally carried out using a finger bar mower. The cut itself should be clean and regular. The material 'harvested' at the cutback stage may have limited or no commercial value.

11. Nutrition

The BioEnergy Scheme is focused on high quality fertile agricultural land. This, together with leaf litter recycling and atmospheric nitrogen inputs, generally means that fertiliser application is not required during the lifetime of the crop. In any case, do not apply fertiliser of any type during the first year after planting. This is because the emerging roots will not have developed enough to enable the crop to utilise the additional nutrients.

As a possible by-product of producing woodchip for bioenergy, it may also be appropriate to use the SRC willow crop for the treatment of certain biowaste material. This use lies outside the scope of the BioEnergy Scheme, and it is the responsibility of the applicant to comply fully with all relevant best practice, legislation, regulations and licencing requirements.

12. Harvesting

The first harvest is usually undertaken 4 years after planting, i.e. 3 years after cutback. Subsequent harvests are undertaken thereafter normally on a 3- to 4-year cycle. Harvesting is carried out from November to the end of February, when foliage is

absent and stem moisture content is at its lowest (approximately 55%). Careful planning is required to avoid excessive rutting and soil disturbance, particularly in localised wet areas.

Stools should be cut as close to the ground as possible during each harvest, as this keeps stool height as low as possible throughout the life of the crop. Direct-chip harvesting is typically used, whereby the stems are cut and chipped by the harvester and blown into an accompanying trailer. Whole rod harvesting systems are also becoming increasingly feasible.

The harvesting of SRC willow does not fall under the remit of the 1946 Forestry Act.

In all cases, applicants should aim to achieve a sustainable annual supply of marketable quantities of woodchip, to ensure a sustainable supply to end-users. The potential exists for applicants working on a co-operative basis to stagger applications, to ensure a rolling programme of harvesting from year to year, and a continuity of supply to end-users.

13. Storage, drying and transport of woodchips for bioenergy

Freshly harvested willow woodchip material typically has a moisture content of approximately 55%. Due to fungal activity, fresh green chips stored in piles will heat up rapidly and can begin to deteriorate within a 24-hour period. Therefore, it is vital that the time between harvesting and the commencement of the drying process is minimised. Pre-dried woodchips should be stored under roof or under plastic sheeting, and exposed to a good airflow.

Drying typically involves the use of ventilated floor grain driers. Other methods are available, including low rate aeration. Drying to a moisture content of 30% is satisfactory for use in most modern woodchip burners. However, if it is envisaged that the material will be stored, woodchip needs to be dried to 20% or below, in order to avoid self-heating and deterioration.

Dried woodchips should be stored under roof until collection. Both pre- and post-drying woodchips should be heaped onto a clean waterproof layer, to minimise dirt contamination and rising ground moisture.

Storage, drying and transport all have a major bearing on the economic viability of producing willow woodchips for bioenergy. Proximity to the end-user is vital. Generally, transport distances over 20 km begin to have an adverse effect on the energy balance and the economics of growing the crop.

14. Crop removal

SRC willow crops typically have an economic life of up to 20-25 years. Earlier removal and replacement may make economic sense, if more productive and/or disease-resistant varieties become available.

Land under SRC willow can be converted back to agricultural use without major difficulty. Stools are killed after the final winter harvest, by spraying the young shoots with glyphosate during the following spring. Stools are subsequently broken up by mulching or ploughing-in. The site can then be grassed for the remainder of the year

in preparation for arable cropping the following year. Root degeneration may take longer in the case of a mature coppice system, and stool removal or 2-3 years under grass may be needed before returning to arable cropping.

SRC willow does not fall under the remit of the 1946 Forestry Act, and is therefore not subject to the felling and replanting requirements.

Appendix A

Further Reading

- DEFRA. 2002. Growing Short Rotation Coppice. Best Practice Guidelines for Applicants to DEFRA's Energy Crops Scheme. Department for Environment, Food & Rural Affairs. DEFRA Publications, Admail 6000. London SW1A 2XX, England. www.defra.gov.uk
- Forest Service. 2006. Challenge Fund for Short Rotation Coppice Energy Crops. Information Booklet. Forest Service, Department of Agriculture & Rural Development, Dundonald House, Upper Newtownards Road, Belfast BT4 3SB, Northern Ireland. www.forestserviceni.gov.uk
- Forest Service. 2000. Forestry and Water Quality Guideline. Forest Service, Department of Agriculture, Fisheries & Food, Johnstown Castle Estate. Co. Wexford. LoCall 1890 200 223.
- McCracken, A. 2007. Guidelines for Establishing Short Rotation Coppice in Northern Ireland. Forest Service, Department of Agriculture & Rural Development, Northern Ireland. www.dardni.gov.uk
- Teagasc. 2006. Wood Energy from Farm Forests: A Basic Guide. Teagasc Forestry Development Unit, Mellows Centre, Athenry, Co. Galway. www.teagasc.ie
- Tubby, I. and A. Armstrong. 2002. Establishment and Management of Short Rotation Coppice. Practice Note. Forestry Commission, 231 Corstorphine Road, Edinburgh EH12 7AT. www.forestry.gov.uk

Appendix B

Useful Contacts (listed alphabetically)

Biofuels Policy, Department of Agriculture, Fisheries & Food

Kea-Lew Business Park, Mountrath Road, Portlaoise, Co. Laois

bioenergy@agriculture.gov.ie / Tel. 057-8692231.

COFORD – National Council for Forest Research & Development

Arena House, Arena Road, Sandyford, Dublin 18

www.coford.ie / T. 01-2130725

Department of Communications, Energy & Natural Resources

29-31 Adelaide Road, Dublin 2

www.dcmnr.gov.ie / T. 01-6782000

Environmental Protection Agency (EPA)

PO Box 3000, Johnstown Castle Estate, Co. Wexford

www.epa.ie / T. 053-9160600 / Lo Call 1890 335599

Forest Service of the Department of Agriculture, Fisheries & Food

Johnstown Castle Estate, Co. Wexford

www.agriculture.gov.ie/forests-service / T. 053-9160200 / LoCall 1890 200223

IrBEA - Irish Bioenergy Association

www.irbea.org / contact@irbea.org

Sustainable Energy Ireland

Glasnevin, Dublin 9

www.sei.ie / T. 01-8369080

Teagasc Forestry Development Unit

Teagasc, Mellows Centre, Athenry, Co. Galway

www.teagasc.ie / T. 091-845200

woodenergy.ie

c/o COFORD, Arena House, Arena Road, Sandyford, Dublin 18

www.woodenergy.ie / T. 01-2130725

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