



INTRODUCTION

Energy crops can be categorised into two main groups; bio-mass crops that can be combusted to produce heat and power, and bio-fuel crops that can be fermented to produce alcohols, methane and hydrogen.

This factsheet provides an overview of the energy crops that are, or could be, grown in Wales.

BIO-MASS CROPS

In the context of energy, the term “bio-mass” crop usually refers to crops which are used in their solid form for energy generation, rather than crops that have been processed into a liquid fuel (known as bio-fuel)

Miscanthus (often referred to as Elephant Grass) is a perennial species that produces woody stems similar to bamboo which can be harvested on an annual basis. It originates in east Asia but has been found to adapt well to the UK’s maritime climate. Miscanthus can be planted as a rhizome which then produces green shoots each spring. It is harvested annually in late winter / early spring, either by mower/baler or by forage harvester. It is not well suited to marginal land, high altitudes or exposed sites. The harvested material has a relatively high mineral content which is not suited to all biomass boilers. The crop should last for at least 15 years, with average yields of 14odt/ha.

IBERS is responsible for the national miscanthus breeding programme. Plant breeders are looking to develop new varieties to provide improved yield and combustion quality and also to widen the genetic base of miscanthus in the UK to protect against pest and diseases.

Short rotation coppice (SRC) willow can be established from unrooted cuttings. Standard practice is to plant 15,000 cuttings per ha in rows that are spaced to accommodate harvesting with maize harvester and trailers. The crop is cut back a year after planting to encourage tillering, and is then harvested every three years. Crops are expected to last for 20 years, with average annual yields of around 10odt/ha. Because of the mechanised harvesting the crop requires flat, well drained land.

IBERS leads the Willow for Wales project consortium to demonstrate the potential of SRC willow as a renewable energy source across Wales. The project is in its final year and crops on seven commercial farms will be harvested this autumn. Scientists are evaluating the performance of different willow varieties at different altitudes to assess suitability to Welsh conditions. Collections of local genetic material from across Wales have been included in trials to assess the performance of local provenance willow.

Short rotation forestry (SRF) is receiving increasing levels of interest as a production system for wood to be used in energy generation. For SRF a site is planted with fast growing tree species which are harvested at a diameter at breast height (130cm) of 10 – 20 cm. Several native species are suitable including birch, ash, alder and poplar as well as non-native



eucalyptus species. Depending on the species, the trees are harvested after 8 - 20 years. In this system, the high productivity of a young plantation is used to produce trees with a better wood:bark ratio than with SRC. Issues concerning bio-diversity impact and water uptake are currently being looked at. Especially with Eucalyptus species which are known for their high water uptake.

Wales' oldest energy crop is of course **wood** from conventional woods and forestry. Both hard - and softwood species can be used when seasoned properly. Using the wood for heat production is generally the most effective way to obtain energy from it, rather than trying to convert it into electricity or a liquid biofuel. Firewood is an ideal use for thinnings and cleanings when bringing old farm woodlands back into management. Freshly cut wood contains a lot of water – probably half of the weight will be water. Once wood has been seasoned for approx. one year, it will dry out to about 20% moisture. In energy terms, that means on a weight for weight basis, seasoned wood has around 75% more energy than green wood. So careful planning ahead and seasoning is necessary to obtain the best energy value from the wood. In these days of carbon consciousness, it is worth bearing in mind that using locally grown wood to displace fossil fuels greatly reduces carbon emissions.

BIO-FUEL CROPS

Conventional bio-fuel crops are processed from crops like oil seed rape (for bio-diesel) or the grains of cereals like wheat or of corn (for bio-ethanol). There are serious concerns about the energy balances of these crops and also concerns about the use of “food” crops for energy production.

An alternative methodology for producing bio-fuels is to use woody plant material as the feedstock. These fuels are known as ‘second generation’ bio-fuels. Researchers at IBERS are exploring ways of efficiently converting perennial crops that are high in lignin and cellulose (e.g. SRC willow and miscanthus), into bio-ethanol.

Another area of interest is the use of grass as a feedstock. Farmers in Wales have a long history of producing excellent grass crops. Grass is something that can be grown cheaply and simply across most of Wales. It has the added advantages of being a crop that farmers are familiar with, and it doesn't require any special machinery for harvesting. IBERS is looking at several ways of fermenting grass to produce alcohols, methane and even hydrogen. By using a perennial crop that can be grown on marginal land with minimal inputs, scientists hope to develop grass as the energy crop of the future.

Depending on the nature of bio-fuel crops, the conversion to bio-ethanol can be less efficient than their usage for direct combustion. Whereas readily fermented carbohydrates such as sucrose in sugar cane make it easier to utilise, structural carbohydrates occurring in grasses and miscanthus are more difficult to convert. To overcome this problem, scientists are looking for methods to make lignocellulose more accessible for the micro-organisms which are suitable for fermentation to obtain more energy from the plants.