WILLOW SHORT ROTATION COPPICE:  
Is it commercially viable?

Introduction

For more than a decade the UK government has supported the development of energy crop production on agricultural land, however, the level of uptake by UK farmers has so far been low. At present, high grain prices and a reluctance to change cropping patterns limit farmer’s uptake of willow Short Rotation Coppice (SRC). Significantly higher wood chip prices are likely to be needed if willow is to be able to compete with conventional arable crops. Price trends in world agricultural commodity markets and changes to the current support for renewable energy will be important in determining any future expansion of willow area. This article summarises and updates the findings of a recent study into the commercial viability of energy and other non-food crops in Scotland undertaken by SAC with funding from the Scottish Government.

The two main perennial energy crops to have become established commercially in the UK are willow Short Rotation Coppice (SRC) and the giant grass miscanthus. Scotland’s cooler climate does not favour miscanthus a C4 species leaving willow SRC as the most viable option.

The Short Rotation Coppice system utilises fast growing tree species repeatedly cut back (coppiced) and harvested at regular intervals through the crops lifespan of 15 to 20 years. Several species are potentially suitable but to date the most successful species in northern Europe has been willow. The commercialisation of willow coppice developed in Sweden in the early 1990’s when around 15,000ha were planted and this is where much of the breeding and technology has been developed. Willow SRC has been planted commercially in the UK since the mid 1990’s concentrated near the failed ARBRE power station project in Yorkshire. More recently an increase in plantings has occurred across the UK although so far the scale has been limited. In Great Britain the area planted to date is estimated at around 2,800ha based on recent figures. There have also been plantings in Northern Ireland.

In Scotland the area of willow SRC currently planted under grant aid is estimated at 225ha with applications for a further 809ha in the pipeline. To meet the expected demand for the two main power plants being built in Scotland and some additional co-firing would require an estimated area of up to 30,000ha of willow plantings in Scotland by 2010. The current rate of planting therefore falls well short of this projected demand despite almost a decade of low returns for conventional agriculture. In the last year sharply higher grain prices have greatly improved the prospects for conventional arable crops and the economics of willow do not currently appear favourable for most Scottish arable farmers. Where does the crop fit in and what is its future agricultural potential?

Willow Production

Willow is a perennial biomass crop grown principally for energy production with additional potential for the biofiltration of waste water and sewage sludge. Yields are measured in Oven Dried Tonnes (odt) adjusted to zero per cent moisture although in practice the crop averages around 55% moisture at harvest. Like other crops the best yields are achieved on sheltered, fertile sites which can be readily cultivated though it will grow on a wide range of soils. Yield potential in commercial situations is variable but can range between 6 and 12 odt/ha. Figures from existing commercial sites in England and Ireland suggest that average yields of around 8odt/ha are representative of plantations using older cultivars. Where the latest cultivars are employed commercial yields closer to 10odt/ha may be achieved according to a recent study of willow SRC crops in northern England. A major uncertainty for Scottish farmers considering the crop is the lack of local commercial yield data due to the limited area of the crop at present.

The crop is established by planting cuttings in the spring using specialised planting equipment. The first year of establishment requires effective weed and pest control. After the first year the crop is cut back to ground level to encourage coppicing and then it takes three years of growth before the first harvest in year four. The crop can then be cut every 3 years for the next 15 to 20 years. Annual maintenance requirements are generally low though fertilising and some weeding will be required after each harvest.
Markets and Contracts

The main market to date has been to supply woodchip for co-firing in coal fired power stations supported by the Renewables Obligation. This legislation requires that a minimum proportion of UK electricity sales are met from renewable sources. In Scotland there are currently two large commercial operators offering long-term contracts for the purchase of woodchip. Renewable Fuels Ltd offer contracts based on supplying the EON power plant presently being commissioned at Lockerbie. Scottish Biofuels are offering contracts to supply the proposed Westfield power plant in Glenrothes. Current contracts for woodchip are around £31/odt ex-farm leaving between £21/odt and £23/odt after harvesting charges. Both companies offer 10 year fixed price contracts index linked to the Retail Price Index. Another operator, Rural Generation Ltd from Northern Ireland, has also recently entered the Scottish market in conjunction with Oran Group.

Grants and Subsidies

Willow SRC is classified as an agricultural crop and will not affect the eligibility of land under the Single Farm Payment scheme. It is also currently eligible for the EU Energy Crop Scheme at 44 euro/ha (£30/ha) if grown on conventional agricultural land. It can also be grown on set aside but will not then attract support under the Energy Crop Scheme.

A planting grant of £1,000/ha was available under the Scottish Forestry Grant Scheme but this scheme closed to new applicants in December 2006. However land owners can still access the grant by entering into a contract with one of the two existing operators: Scottish Biofuels or Renewable Fuels Limited as long as planting is completed by May 2008. A new planting scheme is expected to be included in the Scottish Rural Development Programme.

Farm Economics of Willow production

For most farmers the decision of whether or not to plant any crop hinges on how profitable it will be relative to other land uses and its effect on existing enterprises. With the advent of decoupling this decision is largely unconnected with subsidy since the Single Farm Payment will be paid irrespective of the cropping choices made. In this study a comparison was made between the profitability of willow SRC and a conventional arable rotation.

Comparisons were made using enterprise margins rather than gross or net margins. Enterprise margins in this study have been determined as follows:

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\text{ENTERPRISE MARGIN} = \text{CROP OUTPUT} - \text{CROP COSTS}
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\text{CROP OUTPUT} = \text{market return} \times \text{yield} \times \text{price} + \text{crop related subsidy payments}
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\text{CROP COSTS} = \text{variable costs, contract charges and cropping related fixed costs}
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\text{EXCLUDED} = \text{land related costs such as rent, borrowings on land, land maintenance costs and land related returns including the Single Farm Payment}
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When comparing willow SRC with conventional arable crops the issue is complicated by the perennial nature of the willow crop. The four year delay before the first harvest has significant cash flow and interest charge implications for a typical arable farm business. This issue is not readily accounted for in a gross margin analysis and neither is the fact that willow has a very different fixed cost profile to combinable crops. For this reason a discounted cash flow analysis was carried out to compare the relative benefit in today’s monetary terms of planting willow SRC compared to continuing with arable cropping. Net Present Values (NPV) were calculated for the 16 year life of the crop. From this annual enterprise margins or Annual Equivalent Values (AEV’s) were derived to allow comparison with the arable rotation. Full details are contained in the report.

The willow SRC crop cycle starts with the relatively costly establishment phase however the planting grant of £1,000 ha is expected to cover most of these costs. There then follows a period of four years before the first harvest with maintenance costs and no income apart from Energy Aid Payment on eligible land. At harvest the net standing values achieved on the farm are dependant on harvesting and transport costs, moisture content and delivered price to the end user. Once harvesting commences the average enterprise margin for the crop was estimated at £116/ha/yr over the assumed 16 year life cycle.

These returns are highly dependant on both yield and price as illustrated by the sensitivity analysis in Table 1. A £5/t change in wood chip price leads to a £34/ha change in enterprise margin while a 1t/ha change in yield results in an £18/ha change in enterprise margin. Sites that are high yielding for willow are also likely to be high yielding for other crops. Therefore changes to the price of wood chip have the greatest bearing on the competitiveness of willow SRC relative to other crops. New higher yielding willow varieties will also improve the crop’s competitiveness.
Table 1: Impact of yield and price on willow SRC enterprise margins

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In order to compare willow SRC with arable cropping another simple farm cash flow model was constructed using estimates of standard costs and returns for a typical arable rotation over the same 16 year investment time frame. From this the enterprise margin for the arable rotation was estimated in March this year at £162/ha/yr based on forward grain prices for harvest 2007. This compares favourably with the willow SRC enterprise margin of £116/ha/yr. Since then tightening world grain stocks and poor harvest results have helped push grain prices £50/t higher and raised estimated arable enterprise margins to over £300/ha. Obviously at present grain prices willow SRC is not a realistic competitor on arable land.

However, it must be recognised that high grain prices make conventional arable cropping appear especially profitable at the present time whilst only a year ago the picture was very different. Based on average grain price for the five year period 2002 to 2006 the enterprise margin for the arable rotation was estimated at just £67/ha.

If grain prices do remain elevated then willow SRC is likely to have difficulty in competing for land without a matching rise in the woodchip price. The current optimism over biofuels and positive prospects for grains and oilseeds prices are major reasons why arable farmers are less likely to switch to alternative crops at present. However, high prices are likely to encourage an increase in global grain production and a possible future fall in prices whilst future reform of the CAP could reduce the level of EU cereal market support.

It is possible that willow SRC could compete more effectively with some livestock enterprises, which have not benefited from the same level of price gains as arable crops. However willow SRC is currently unable to deliver the same returns as short term lets along with the added benefits of future cropping flexibility.

For farm businesses without retained labour and machinery and on certain land classes willow SRC could become competitive again if grain prices fell especially for those farmers seeking a low input and relatively stable income stream.

For most farm businesses however willow SRC remains unattractive due to the long-term commitment required, loss of cropping flexibility, limited market outlets and an incompatibility with existing farm cost structures. It is telling that even when returns from arable production were low uptake of willow SRC by Scottish farmers remained low. To overcome these issues and achieve large scale plantings willow SRC returns would have to significantly exceed those obtainable in conventional arable systems.

This could most readily be achieved by an increase in the price for wood chip. As Table 1 shows a £9/t rise in woodchip prices to £40/odt would increase enterprise margins by 50%. Higher prices could come from a general rise in the commodity market for wood fuel or where the farmer is able to develop value added local markets selling heat directly to the consumer. Additional revenues could also be generated from gate fees for the disposal of sewage sludge.

Future Prospects

The main market driver for willow SRC to date has been the Renewables Obligation under which all renewable energy technologies receive the same support equivalent to one Renewable Obligation Certificate (ROC) for every Mega watt hour (MWh) of power produced. This support has been more effective in developing lower cost technologies such as wind, landfill gas and co-firing of regular biomass such as palm meal. It has been less effective at supporting higher cost technologies such as off shore wind and the use of purpose grown energy crops such as willow SRC.

The recent government Energy White Paper introduced a number of proposals to rectify this. Foremost of these is the proposal to band Renewable Obligation Certificates (ROCs) to give differential support depending on energy type and technology. Under these proposals energy crops would continue to receive 1.0 ROC/MWh if burned in a dedicated biomass power plant with or without Combined Heat and Power (CHP). At the same time this proposal would lower support for non-energy crop biomass to just 0.25 ROC/MWh for co-firing, 1.5 ROC/MWh if burned in a dedicated biomass plant and 2.0 ROC/MWh with CHP. These proposals remain under consultation and the final outcome remains uncertain.

If government support for energy crops is raised significantly then energy companies may be able to raise...
their woodchip prices high enough to encourage farmers to plant willow SRC on a larger scale. The question is can these energy markets afford to pay the same as markets for food and liquid biofuels such as ethanol made from wheat? Avoiding direct competition with prime arable land will therefore remain a key priority in encouraging a sustainable increase in willow SRC production. Other energy crops such as grasses that are more compatible with existing farming systems may also prove more attractive to farmers.

It is not just the absolute level of price that can be achieved today that is important to the farmer but also how much flexibility he will have in the future both in terms of the number of buyers but also in terms of price. Currently most energy companies are seeking to secure woodchip on long term fixed price contracts linked to the RPI providing security to both buyer and supplier. Rightly or wrongly however, many farmers are more concerned about the danger of missing out on any future rise in the spot market than they are about securing a stable long-term price. The appeal of willow SRC to farmers could therefore be widened by introducing more flexible and transparent contracts perhaps based on the grain or energy futures markets.

Reform of the CAP will also continue to influence the competitiveness of energy crops particularly plans for set aside. At present energy crops can be grown on set aside land providing additional income without direct competition with conventional arable crops, which cannot be grown there. This season the EU are proposing a temporary reduction in the EU set aside rate to 0% to counter current shortfalls in grain supply. The EU have published their proposals for the 2008 CAP “Health Check” and these include plans for the abolition of set aside in order for the EU to meet its biofuels production targets and the ending of the Energy Crop Scheme. A wide range of other EU proposals including commitments to reach 10% biofuels in road fuel by 2020 will also continue to influence the uptake of willow SRC and other energy crops.