**TECHNICAL NOTE 17/96**

Forest Research
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TECHNICAL DEVELOPMENT BRANCH

# ESTABLISHMENT AND MAINTENANCE OF A WOODFUEL RESOURCE


## Summary

This Technical Note is the second in a series of three which provide information on growing a dedicated fuel supply in the form of single stemmed plantations.

A poplar plantation which will provide the domestic heating requirement for farm buildings can be established at low cost on a small area of land (Plate 1).

Modern enclosed heating systems can be as efficient as oil fired systems and properly seasoned wood is competitive with oil in terms of cost. Modern woodfuel burners are reasonably compact up to the *c*. 50 kilowatt-hour (kWh)[1] size (Plate 2) and will accept either logs or chips.

The advantages of a woodfuel resource, which is grown on the farm, are that it:

- Is not susceptible to market price fluctuations.
- Is entirely under the control of the user.
- Is not subject to Fuel VAT charges.
- Is reliable and carbon neutral.
- Provides the opportunity to produce a product for local sales.
- Provides additional benefits for sporting, shelter and amenity.

All the operations, to grow and harvest, can be carried out by suitably trained 'on-farm' labour and farm equipment, or by hiring in local forestry contractors.


Plate 1

Poplar Stems

## The System

Short Rotation Forestry (SRF) involves growing poplar over rotations of *c*. 8 to 15 years, depending on yield performance. Management concentrates on promoting maximum volume on single stems. The yield potential for a poplar stand planted at 3.0 m spacing, with a Yield Class[2] of 18 is shown in Table 1.

1 Kilowatt-hour, also commonly abbreviated to kW.

2 Yield Class is an expression of the growth rates in terms of maximum mean annual increment per year - $m^3$/ha/yr.

Table 1

Potential Yields from Poplar SRF at 3.0 m x 3.0 m Spacing
at Different Clearfell Ages

| Felling Age (Yrs) | Stems | Diameter at 1.3 m (cm) | Volume ($m^3$/ha) | Estimated tonnes/ha at 35% Moisture Content |
|---|---|---|---|---|
| YIELD CLASS 18 | | | | |
| 5 | 1074 | 11.9 | 45 | 33 |
| 10 | 1031 | 20.5 | 220 | 159 |
| 15 | 984 | 26.8 | 457 | 331 |

SRF is not restricted to 3.0 m x 3.0 m spacing but there is little reliable yield data for alternative spacings and thinning intensities. Row spacing can be set to suit mechanised maintenance operations, such as weeding. This operation can be carried out by All Terrain Cycle based spraying systems if spacings of less than 3.0 m are used.

There are poplar clones to suit most conditions met in the UK[3]. Detailed information on growth performance of a variety of poplar clones is currently being investigated by Forest Research Silviculture Branch. Poplar should be established on the better grades of land to get the best returns. Deep, base rich, loamy soils in a sheltered location with a summer water table not higher than 1.0 m, are the preferred site types.

Poplar plantations should be established in the spring on soils prepared to a good arable crop standard. Frost will damage new growth so early planting and frost hollows should be avoided. Rods or 'setts' of *c*. 1.2 m are purchased from a specialist nursery and inserted to a depth of 45 cm, tip uppermost, if necessary into a hole prepared by a planting spike. Rabbit or hare guards may be necessary, although fencing would be cost effective for large areas. Good weed control is essential, a post-planting spray in years 1 to 3 is recommended. Care must be taken to avoid damaging growth during the spraying operation through careful herbicide selection and by directing spray from the boom or knapsack. If poplars are grown partly for saw or peeler logs, removal of side buds and at a later stage pruning, will be necessary. A range of information is available as guidance on suitable methods.

Plate 2

Heating System


The rotation of an SRF crop will be dictated by annual demand of the heating system and the growth rates achieved.

Other tree species can be grown on this system but their yield cannot match correctly sited and managed poplar. The potential yield from poplar and other broadleaved species on SRF and alternative growing systems is illustrated in Table 2.

3 Forestry Commission (1990), Bulletin 92, Poplars for Wood Production and Amenity.

Table 2

Indicative Yields for 5 Silvicultural Systems at Alternative Felling Ages

| Age (yrs) | Poplar SRF | Broad-leaved SRF | Broad-leaved High Forest | Sweet Chestnut Coppice | Poplar High Forest |
|---|---|---|---|---|---|
| | Felling Volume ($m^3$/ha) | | | Thinning Volume ($m^3$/ha) | |
| 5 | 33 | – | – | – | – |
| 6 | – | – | – | – | 34 |
| 10 | 220 | – | – | – | – |
| 15 | 457 | 37 | 15 | – | 95 |
| 20 | 686 | 80 | 28 | 190 | – |

SRF has a distinct advantage over Short Rotation Coppice (SRC) in that all harvesting operations can be carried out using conventional methods and equipment. No capital intensive investment in complex harvesting equipment is necessary. At the end of the first rotation the cut stumps can be allowed to regrow. At the end of the next growing season, the multiple shoots can be singled out, on the stools, to leave the strongest to grow on for the next rotation.

The disadvantage of SRF is the time until the system yields its first cut. A 30 kWh burner might only require 40 tonnes/year and this could possibly be produced from existing woodland on the farm, or a neighbouring farm, until the SRF crop is ready.

The area of woodland required to meet interim demand could be as much as 14 ha over 10 years if it is a well managed single stem plantation, less if it has been under thinned in the past. Alternatively *c*. 1.5 ha of well stocked, coppice woodland could be clearfelled over the same period.

## Poplar High Forest for Sawlog Timber

Poplars can be grown on a high forest system to yield a cash crop of high value sawlogs and veneer logs. Woodfuel can be obtained from this crop when thinnings are taken at set periods throughout the rotation in order to maximise development of selected stems. However, a much greater land area will be required for a regular annual woodfuel supply. The crop also requires a higher level of management through regular pruning, to ensure that quality logs are produced. The timing and intensity of thinnings can be varied to either maximise the volumes removed or provide an even flow of timber. Current yield data is based on one, non-selective thinning, and needs to be extended to evaluate other options, such as selective thinning.

## Grant Support

Growing poplar on a high forest system attracts grant aid through the Woodland Grant Scheme (WGS) and Farm Woodland Premium Scheme (FWPS). The existing grant packages are summarised in Table 3, but as grant regimes change from time to time the latest position should be confirmed through any local Forestry Commission office. Woodland can be planted on set-aside land, although there are no additional payments beyond the FWPS.

Table 3

Summary of Grant Aid for Woodland Establishment

| Category | Forestry Commission Woodland Grant Scheme | Ministry of Agriculture, Fisheries & Food, Farm Woodland Premium Scheme |
|---|---|---|
| Planting Grant Broadleaved Woodland < 10 ha | £1350/ha | none |
| Planting Grant Broadleaved Woodland > 10 ha | £1050/ha | none |
| Land Type Supplements | £600/ha Better Land Supplement | £250/ha/yr for arable/improved land grassland outside less favoured areas (LFA) |
| | | £190/ha/yr for arable/improved land in disadvantaged areas of LFAs |
| | | £130/ha/yr for arable/improved land in severely disadvantaged areas of LFAs |
| | | £60 for unimproved land in LFAs - all categories |
| Community Woodland Supplement | £950/ha for woodlands within 5 miles of a village/town where there are few woodlands open for informal public access | none |
| **Total Grant Aid Available/ha** | **£1650 – £1950/ha (£2 600 – £2900/ha with Community Supplement)** | **£1950 – £3750/ha on arable/improved grassland £900/ha on unimproved grassland** |

## Land Area Required

If grown purely as a domestic woodfuel resource, an indication of the quantity of land required to provide a self sustaining supply using the **SRF system** is given in Table 4.

Table 4

Annual Land Requirement for an SRF Poplar Crop

| Energy Requirement (kWh) | Fuel Requirement (tonnes/year) | Rotation Length (years) | Annual Land Requirement (ha/yr) |
|---|---|---|---|
| | | | Yield Class 18 |
| 30 – 50 | 40 – 70 | 5 | 1.2 – 2.1 |
| | | 10 | 0.3 – 0.4 |
| 50 – 200 | 70 –280 | 5 | 2.1 – 8.5 |
| | | 10 | 0.4 – 1.8 |
| 200 – 1 000 | 280 – 1 404 | 5 | 8.5 – 43 |
| | | 10 | 1.8 – 9 |

A 30 kWh heating system will require *c*. 40 tonnes a year, which could be obtained from a total area of 3.0 ha on a 10 year rotation. If the fuel is produced from a **high forest poplar** crop, as much as 12 ha of land will be required in total.

The information relating to the larger burner sizes (>50 kWh) will be relevant to larger estate farm complexes with domestic and office space, or businesses with a heat requirement such as for poly tunnels. The figures illustrate the potential to grow fuel for sale into a local firewood/heating market.

## Establishment Costs

All establishment and maintenance operations for SRF and high forest systems can be done by 'on-farm' labour. However, the costs quoted in Table 5 for SRF assume use of contract labour.

Apart from planting and fitting rabbit/hare guards, all the operations are standard mechanised farm systems.

The establishment of a high forest poplar crop differs from SRF in that pruning of side branches will be required at regular intervals throughout the life of the crop. Pruning is an essential operation if quality logs are to be produced. This could increase the cost of establishment to £1700/ha, in total, over 20 years.

The grant support package available for high forest poplar covers all establishment costs.

## Conclusions

A self-sustaining woodfuel resource for a 30 kWh heating system can be established on as little as 3.0 ha, if grown on a 10 year rotation. This should cost *c*. £1090/ha to establish, excluding farm overheads and land value charges, but including all labour charges. Establishment grants of up to £2900/ha are available.

The cost of woodfuel produced through SRF should make it directly competitive with oil. The woodfuel supply is directly under the control of the grower/user and free from the market fluctuations which can affect oil prices.

Poplar SRF can provide additional benefits by providing shelter and increasing the sporting and amenity value of the land.

A high forest system of poplar, grown for sawlogs, will cost around £1700/ha to establish and maintain. Current grant support can cover the cost of establishing a poplar high forest system which will provide a cash return in 30 years, equivalent to the returns from grazing the same land.

Tree crops can be planted on set-aside land.

More detailed yield modelling is required to evaluate alternative thinning timings and intensities.

Table 5

Establishment and Maintenance Costs for a Poplar SRF System

| Year | Operation | Work Output (ha/shr) | Materials | Cost (£/ha) |
|---|---|---|---|---|
| 0 | Ploughing | 0.75 | | 33.60 |
| | Harrowing | 1.00 | | 23.00 |
| | Planting | 0.12 | 1.2 m setts @ 50p ea<br>Labour @ 4p ea | 594.00 |
| | Spraying – overall | 3.75 | Cyanazine @ 5 litre/ha @ £10/litre | 56.00 |
| | Protection | 0.06 | 75 cm hare guards @ 17p each | 310.00 |
| 1 | Spraying – band (0.375 ha nett) | 1.60 | Cyanazine | 25.00 |
| 2 | Spraying – band | 3.17 | Glyphosate @ 2 litre/ha @ £9/litre | 24.00 |
| **Total cost of establishment (£)** | | | | 1065.60 |

Work Outputs are given in Standard Hours, which include allowances for rest and other work


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