Organic tree propagation under Welsh nursery conditions

David Frost and Aldwyn Clarke
ADAS Pwllpeiran

Organic Centre Wales

Aberystwyth

June 2007

Published by Organic Centre Wales
P: Institute of Rural Sciences, University of Wales Aberystwyth, Ceredigion, SY23 3AL.
T: 01970 622248.
E: organic@aber.ac.uk.
W: www.organic.aber.ac.uk

Background

The demand for organically raised tree and hedging plants had been reported from organic farmers in Tir Gofal, as well as within the landscaping industry.

Although there are a number of plant raising nurseries producing organically raised plants for vegetable and fruit production, there are no tree nurseries producing to organic standards. Nursery tree growers were concerned that there was currently too little known about the performance of tree seedlings in organic substrates (e.g. in root-trainers), nor about the nutrient supply to seedlings under organic regimes, nor about diseases control (especially fungal diseases such as mildew).

Composts

Five different composts types were trialed:

1. **Ystwyth nursery mix**
   The nursery's own mixture containing peat based compost mixed with vermiculite in a prill form and a pelleted slow release fertilizer

2. **Peat based**
   West Riding's seed and cutting compost, based on Moorland Gold reclaimed peat carrying the Soil Association symbol.

3. **Peat free based**
   Fertile Fibre coir based compost is blended and packaged in the UK and is certified by the Soil Association. Its coir comes only from organically grow coconut trees: Certification of the organic produce is entirely done by international agencies accredited to the International Federation of Organic Agriculture Movements (IFOAM).

4. **Wood chip based**
   This woodchip based compost was sourced from Pontbren. The compost was produced when mixed hard woodchip had been used as bedding material under sheep and composted outdoors for 2 years. The compost was sieved through a 12mm sieve to remove larger pieces of woodchip, which would have caused problems in filling the cells and air pockets within the cells after filling.

   Pontbren is a sustainable farming initiative being pioneered by farmers in the Pontbren catchment near Llanfair Caereinion, mid-Wales.

5. Organically certified green waste based

This compost was produced on a Soil Association certified organic holding by composting horticultural and agricultural waste. Its intended use was as a nutrient source for the production of tomatoes and cucumbers by soil incorporation. The compost was sieved through a 12mm sieve to remove larger pieces of materials and stones, which would have caused problems in filling the cells and air pockets within the cells after filling.

		Compost Type				
Determination	**Units**	**Ystwyth Mix**	**Peat based**	**Peat free**	**Woodchip compost**	**Green waste**
PH		5.9	6.8	6.9	7.4	8.6
Conductivity	µS@20°c	281 (1)	794 (6)	677 (5)	230 (1)	2700 (9)
Phosphorus	mg/l	72 (7)	26 (4)	24 (4)	83 (8)	126 (9)
Potassium	mg/l	165 (3)	605 (6)	594 (6)	246 (4)	4280 (9)
Magnesium	mg/l	27 (4)	12 (2)	11 (2)	43 (5)	52 (6)
Mineral Nitrogen	mg/l	175	170	115	59	355
Nitrate as N	mg/l	81.4 (4)	<6.0 (0)	<6.0 (0)	59.7 (3)	351 (7)
Ammonia as N	mg/l	94 (2)	170 (4)	115 (3)	1 (0)	4 (0)
Calcium	mg/l	39.6	38.3	7.4	65.0	81.9
Sodium	mg/l	29.2	271.0	263.0	83.6	1120.0
Chloride	mg/l	39.6	364.8	315.4	43.3	2940.0
Sulphur	mg/l	95.0	502.0	414.0	12.2	335.0
Boron	mg/l	0.12	<0.10	0.40	0.29	0.70
Copper	mg/l	0.13	<0.10	<0.10	0.14	0.99
Manganese	mg/l	0.13	0.19	<0.10	0.10	0.98
Zinc	mg/l	0.47	0.20	0.17	0.32	0.85
Iron	mg/l	0.79	0.98	1.18	0.53	4.96

Growing systems

Each compost was evaluated under two different growing systems:-

Root trainer system consists of a 32 cell tray with each cell measuring 120mm deep and 40mmx 40mm. Each cell is seeded (see methods) and the resultant plants grow for the first season within the cell.

3 trays used for each treatment.

Ridged cell system consists of a 67 cell tray with each tray measuring 85mm deep and 34mm in diameter. Each cell is seeded (see methods) and the resultant plants are grown within the whole cell has been occupied by root growth. Once root growth has reached the desirable level the plants are transplanted into prepared beds outdoors.

2 trays used for each treatment.

Tree species

Three of the most commonly used hedging plants Hawthorn, Hazel and Blackthorn were used to assess the potential suitability of the composts. Local provenance seed collected by Coed Ystwyth Trees staff ensured that only seeds collected from healthy typically formed trees were used.

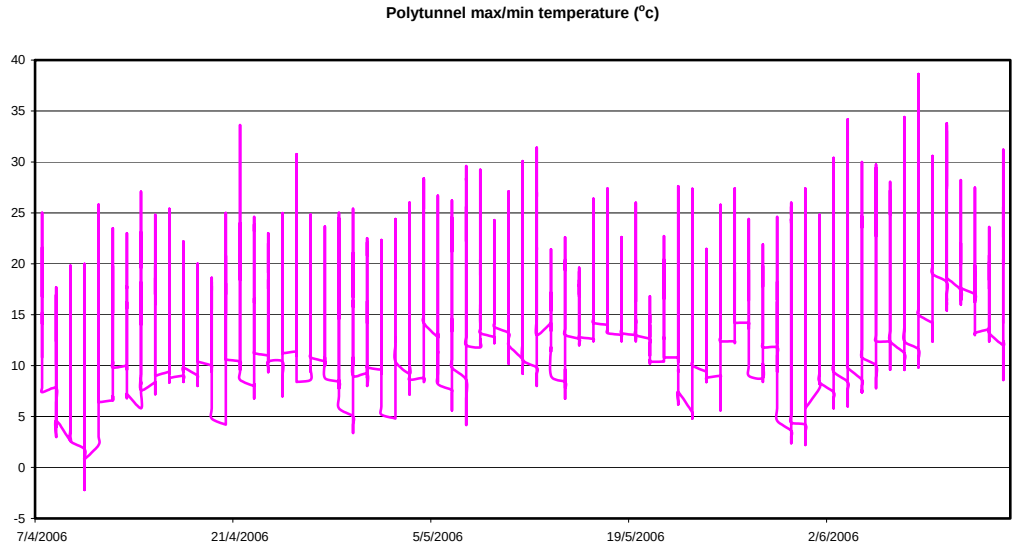
Methods

Sowing cells and seedling husbandry

For each compost type labelled trays were completely filled with compost to within half an inch of the upper surface of the cell. Seeds were then placed into each of the cells and once each cell was seeded, compost was added to fill the cells completely. The compost was slightly compacted and further compost added to fill any voids ensuring each cell was completely full of compost. All filled trays were watered using a watering can fitted with a rose until the compost of all

trays were moist. Once completed all trays were stored on benches within a polytunnel.

Species	Sowing date	Number of seeds per cell
Hawthorn	5 April 2006	5
Hazel	6 April 2006	1
Blackthorn	5 May 2006	2



In line with normal nursery practise seedlings from cells containing multiple seedlings were transplanted into empty cells *(after the germination assessments had been carried out)*

Planting out

Hawthorn and hazel plants were hardened off outside during late May with the later planted blackthorn hardened off in early June.

Once hardened off plants growing in:-

1. Root trainers were sited on raised benches outdoors offering some shelter from strong winds and partial shade for a short period mid afternoon.
2. Ridged cells were hand transplanted in a grid formation into prepared soil beds outdoors during mid June (Layout Appendix I). Spacing between plants varied between species Hawthorn planted 3inches apart, Hazel 4inches and Blackthorn around 5inches.

Site details

Coed Ystwyth Trees nursery is situated at Pontrhydygroes, Cwmystwyth, Ceredigion. The 1ha site lay's within the former walled garden of the Hafod Estate and a variety of hedging plants and other ornamental trees/shrubs are produced by Messrs John and Ursula Rainbow. Although the site is not certified Organic it has been run for a number of years using environmentally sensitive methods where possible.

Ridged cell bed		
	Mg/l	**Index**
Phoshorus	51	4
Potassium	147	2-
Magnesium	92	2

The soil on site is a clay/loam (Seris – Rheidol) with the ridged cell bed having a pH of 6.0.

Hazel in root trainers on raised benches

Transplanting Hazel ridged cell seedlings

Nutrients

Product		Organic Use
Fertile Fibre NU GRO	Highly soluble feed made from fish derivatives containing no mammalian products. 8% Nitrogen 7.8% Phosphorus 7.2% Potassium	Restricted

Rooster	Rooster Pelleted Manure is manufactured from local sources of non-battery poultry manure. 4.5% Nitrogen 3% Phosphorus 3% Potassium	Restricted

Nu Gro applied by knapsack at 5 ml per 10 litre of water to plants growing in root trainers. The first application being applied at half rate when the plants had hardened off and further full rate applications at 6-7 week intervals throughout the season.

Rooster applied at 300g/m^2 to prepared lining out soil beds and incorporated to a depth of 2-3 inches.

Pest, disease and weed control

During the germination phase, no whitefly (Trialeurodes vaporariorum) were found in the yellow sticky traps used to monitor flying insect pests within the poly tunnel.

Watering levels were controlled to allow adequate moisture for germination but not excessively wet that Sciarid (Fungus Gnats) larvae were a problem.

Hazel seed predation by small rodents was an unexpected problem, only one or two seeds were taken. They effected all treatments, but seemed to effect woodchip cells in particular. Any missing seeds were replaced.

- Vine weevil (Otiorrhynchus sulcatus)

Good nursery husbandry ensures that vine weevil damage is kept to an absolute minimum and no evidence of damage was seen. However Steinernema kraussei nematodes (Grubsure from Defenders Ltd) were applied at the recommended rate in early June to both root trainer and ridged cells. With a second application at the recommended rate applied mid October to root trainer cells.

- Aphids

During early July a few trays of Hazel and Hawthorn growing in root trainer cells were infested with a small number of aphids (not identified to species). This infestation was successfully controlled by a single application of a soft soap product ORGANIC PEST CONTROL purchased from Chase Organics. This 1 litre ready to use spray gun was ideal to deal with this small scale out break. However with this small container it would be fairly expensive and labour intensive to treat a larger area.

- Mildew

The sheltered position and micro-climate within the walled garden of the nursery provide ideal conditions for mildew. With the site also being in a high rainfall area repeated applications would be required to give adequate control of mildew. The first signs of mildew were first seen on the hawthorn in early July and was treated using Vitax Yellow Sulphur powder in a puffer pack. Although Yellow sulphur powder controlled the mildew, uniform application was very difficult and very labour intensive to treat a relatively small number of plants. A further application of sulphur powder was made some 10 days later before switching to Sulphur Plant.

Sulphur Plant (Chase Organics) is a wetable sulphur powder suitable for application with a knapsack sprayer. To aide plant growth and reduce any effects from repeated applications of sulphur, each tank mix contained Chase SM3 seaweed extract. Repeated applications every 10-14 days depending on weather conditions of wetable sulphur plus SM3 ensured effective control of mildew.

- Weeds

During the germination phase of the study a large number of various weeds were found in the Green Waste compost and a small number of grass weeds found and removed from the West Ridings Peat compost. The other composts were fairly weed free and no action was needed.

Weeding was not necessary on any plots within the transplanted beds. However weeds were a problem throughout the season within the root trainer grown plants. A fairly large number of weeds we seen and removed by hand from the root trainer cell containing West Riding's compost. Weeds included grasses, rushes, nettles, thistles and a number of smaller broad leaf weeds.

Assessments

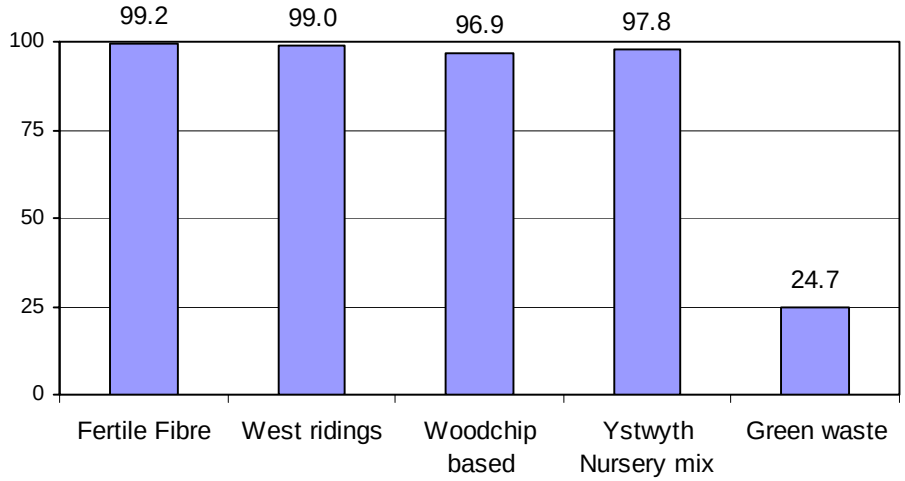
Germination	The presence or absence of seedlings were recorded for each cell
Root development	During the transplanting of seedlings from ridged cells into the prepared beds, visual assessments were made of the root structure and extent of root growth within the cells.
Plant height	Plant heights were measured initally using a graduated sward stick and steel ruler subsequently. Heights were recorded as the distance from the compost surface to the uppermost leaf.
Plant girth	Stem girths were measured using a plastic Vernier calipers and taken at the stem's base i.e at compost surface.

Results

Germination

Seeds sown in the Woodchip compost were the first to emerge followed a day or so later by those sown in Ystwyth mix. Emergence was seen a day later in Fertile Fibre and West Ridings with no emergence in the Green Waste compost for a further 3 or 4 days.

% Germination



Due to very poor germination rates and subsequent poor growth of hawthorn, hazel and blackthorn seedlings a decision was made to remove the Green Waste produced compost from the trial at this stage.

Hawthorn seedlings sown in Green Waste produced compost

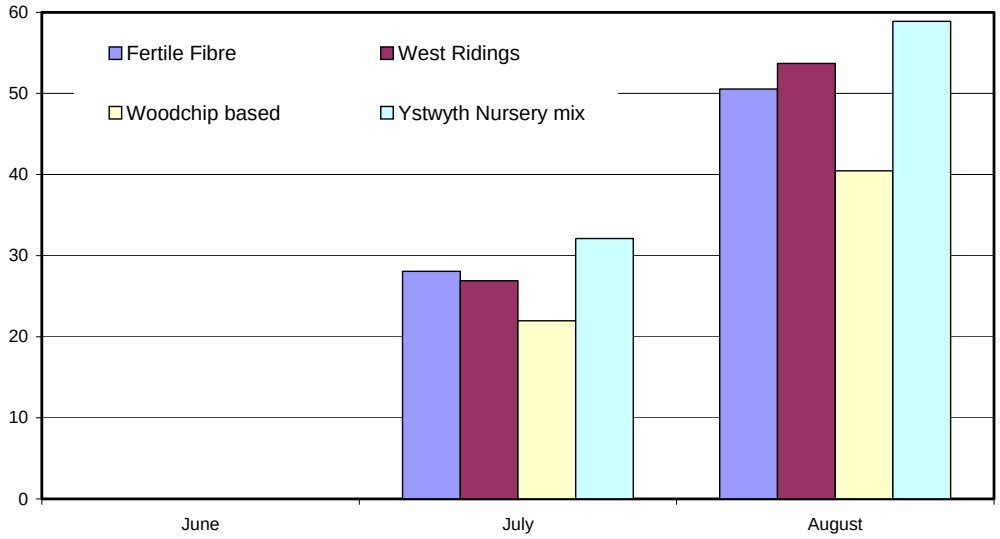
Hawthorn seedlings sown in other compost types

Root development

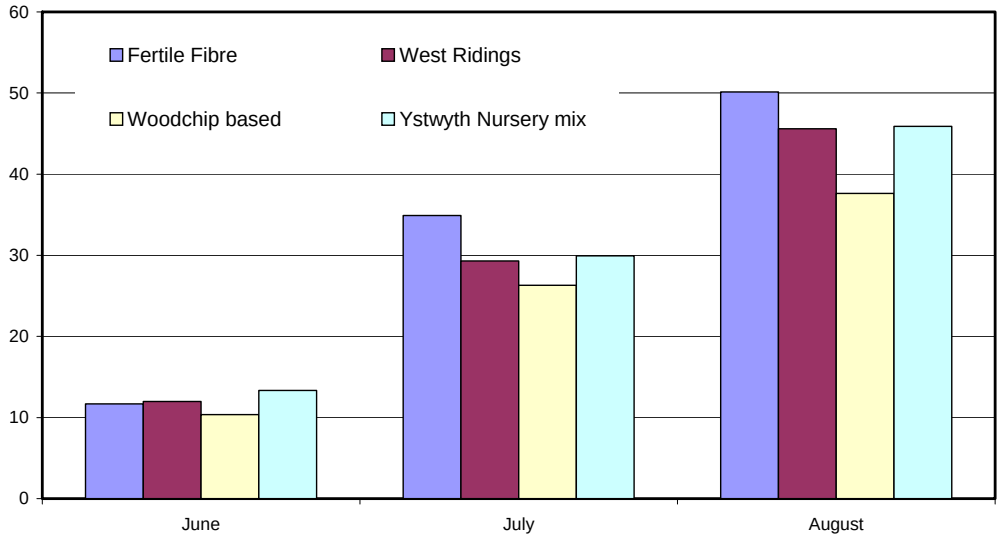
Fertile Fibre	Roots well developed with a good mix of strong vertical roots and a large number of lateral roots. Very firm root plugs, which held its form during planting.	
West Ridings		Nice firm root plug, slightly fewer vertical roots than Fertile Fibre but a greater number of lateral roots. Root plug held its shape very well.
Ystwyth Mix	Roots slightly less well developed than Fertile Fibre and West Ridings. Root plugs a little fragile with a tendency to crumble during transplanting.	
Woodchip		Least well developed root system. Although a good mix of fairly strong vertical and lateral roots in most cells the roots had not filled the whole cell. Root plugs very crumbly.

Plant heights

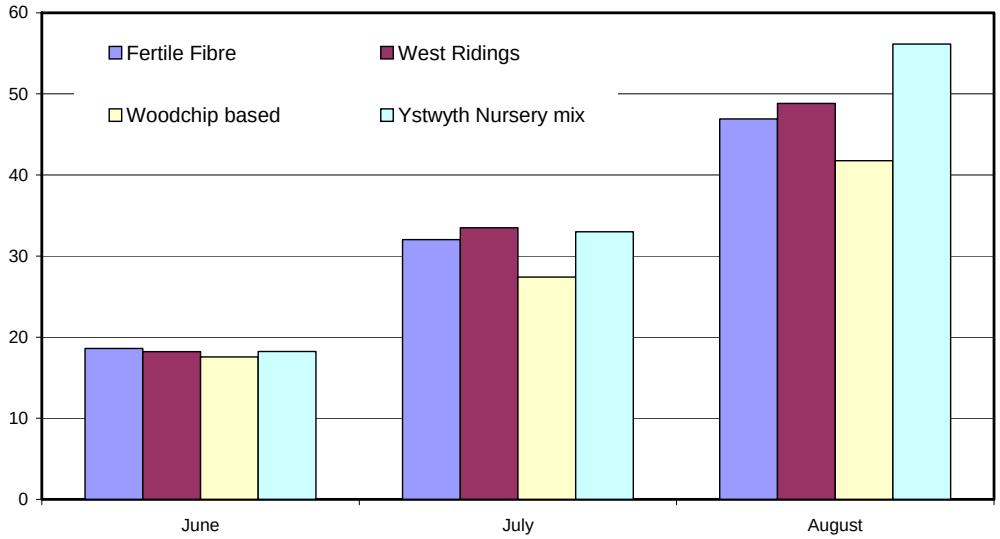
Average Height (cm) of Blackthorn grown in root trainers



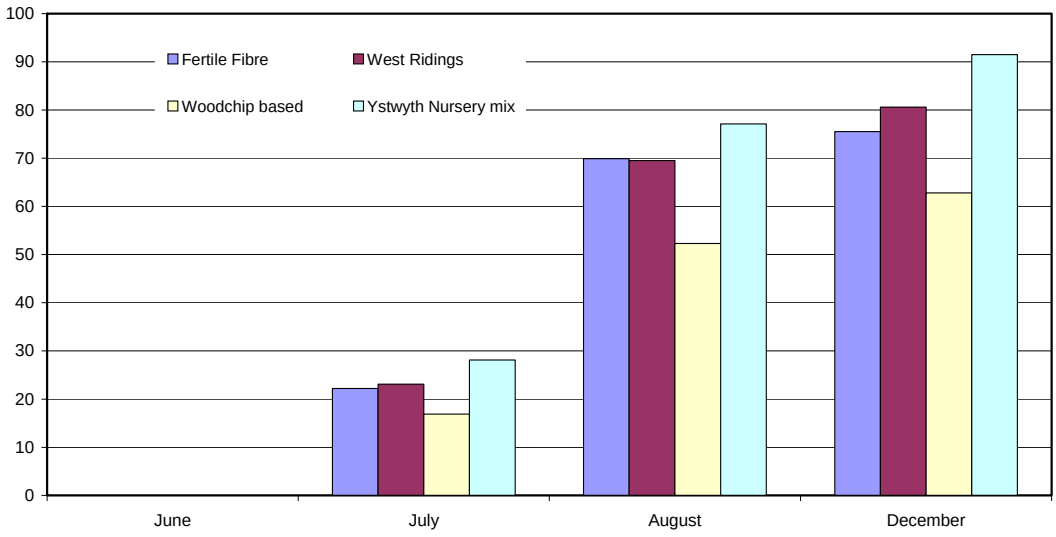
Average Height (cm) of Hawthorn grown in root trainers



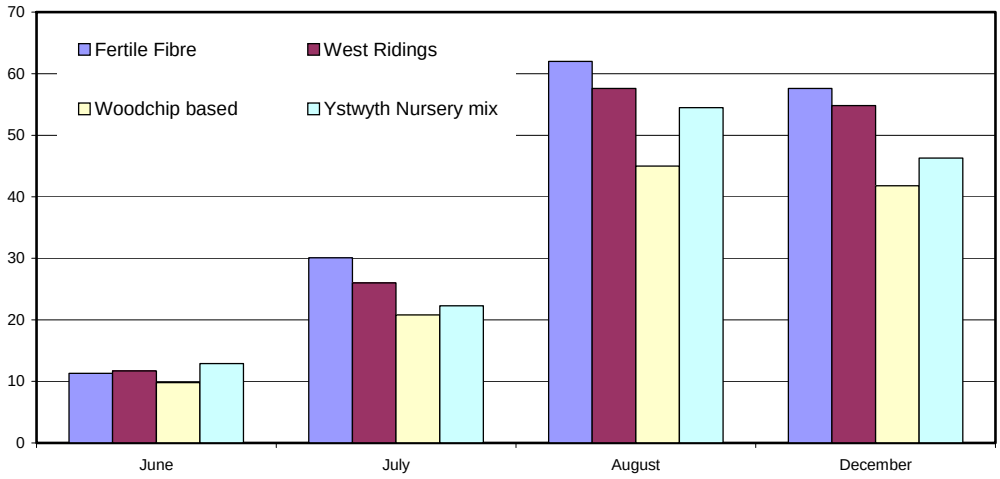
Average Height (cm) of Hazel grown in root trainers



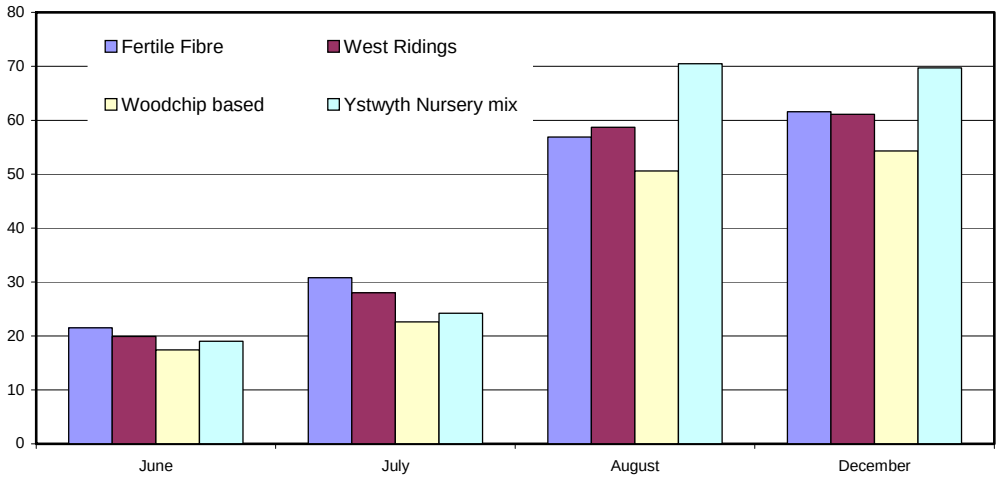
Average Height (cm) of Blackthorn grown from ridged cells



Average Height (cm) of Hawthorn grown from ridged cells



Average Height (cm) of Hazel grown from ridged cells



Stem Girths

Table of means for root trainer grown plants (December 2006)

Species	Compost	Height (Cm)	Collar diameter (mm)	Ratio ht/dia
Blackthorn	Fertile Fibre	38.0	4.2	90.3
	West Ridings	40.0	4.0	97.9
	Woodchip	31.6	3.5	91.8
	Ystwyth Mix	46.0	4.2	113.8
Hawthorn	Fertile Fibre	42.1	5.0	84.2
	West Ridings	37.3	4.9	71.9
	Woodchip	32.1	4.4	70.7
	Ystwyth Mix	39.5	5.0	80.8
Hazel	Fertile Fibre	39.8	5.3	75.1
	West Ridings	43.6	5.5	81.7
	Woodchip	32.5	4.5	74.4
	Ystwyth Mix	45.6	5.2	89.9

Table of means for ridged cell (bare rooted) grown plants (January 2007)

Species	Compost	Height (Cm)	Collar diameter (mm)	Ratio ht/dia
Blackthorn	Fertile Fibre	75.5	4.9	145.5
	West Ridings	80.6	4.5	176.7
	Woodchip	62.8	4.3	140.9
	Ystwyth Mix	91.5	5.7	177.0
Hawthorn	Fertile Fibre	57.6	4.6	132.1
	West Ridings	54.8	5.1	114.4
	Woodchip	41.8	4.6	87.1
	Ystwyth Mix	46.3	4.7	95.1
Hazel	Fertile Fibre	61.6	6.6	96.3
	West Ridings	61.1	7.5	79.8
	Woodchip	54.3	6.4	97.0
	Ystwyth Mix	69.7	7.5	97.7

Revenue potential

Plant heights were assessed after all the leaves had been shed and plants grouped according to the nurseries standard size categories.

Table 1 shows the potential revenue generated from a total of 96 root trainer cells initially sown.

Blackthorn	**No of plants**		**Cost/plant (pence)**		
Compost	**20-40cm**	**40-60cm**	**20-40cm**	**40-60cm**	**Revenue**
Fertile fibre	50	39	30	34	£28.26
Peat based	35	48	30	34	£26.82
Woodchip	81	8	30	34	£27.02
Ystwyth Mix	16	73	30	34	£29.62

Hawthorn	**No of plants**		**Cost/plant (pence)**		
Compost	**20-39cm**	**40-60 cm**	**20-39cm**	**40-60 cm**	**Revenue**
Fertile fibre	32	58	29	32	£27.84
Peat based	49	45	29	32	£28.61
Woodchip	77	16	29	32	£27.45
Ystwyth Mix	49	47	29	32	£29.25

Hazel	**No of plants**		**Cost/plant (pence)**		
Compost	**30-40cm**	**40-60cm**	**30-40cm**	**40-60cm**	**Revenue**
Fertile fibre	29	53	36	39	£31.11
Peat based	18	72	36	39	£34.56
Woodchip	53	18	36	39	£26.10
Ystwyth Mix	12	67	36	39	£30.45

Table 2 shows the potential revenue generated from a total of 134 ridged cells initially sown.

Blackthorn	**No of plants**			**Cost/plant (pence)**			
Compost	**20-40cm**	**40-60cm**	**60-80cm**	**20-40cm**	**40-60cm**	**60-80cm**	**Revenue**
Fertile Fibre	3	27	80	18	21	26	£ 27.01
West Ridings	2	14	89	18	21	26	£ 26.44
Woodchip	13	39	71	18	21	26	£ 28.99
Ystwyth Mix	3	9	111	18	21	26	£ 31.29

Hawthorn	**No of plants**			**Cost/plant (pence)**			
Compost	**20-40cm**	**40-60cm**	**60-80cm**	**20-40cm**	**40-60cm**	**60-80cm**	**Revenue**
Fertile Fibre	5	66	61	16	18	20	£ 24.88
West Ridings	9	80	44	16	18	20	£ 24.64
Woodchip	49	76	5	16	18	20	£ 22.52
Ystwyth Mix	35	82	11	16	18	20	£ 22.56

Hazel	**No of plants**			**Cost/plant (pence)**			
Compost	**20-40cm**	**40-60cm**	**60-80cm**	**20-40cm**	**40-60cm**	**60-80cm**	**Revenue**
Fertile Fibre	11	36	77	28	32	34	£ 40.78
West Ridings	8	45	64	28	32	34	£ 38.40
Woodchip	19	49	48	28	32	34	£ 37.32
Ystwyth Mix	6	26	94	28	32	34	£ 41.96

Farmers' views

Findings from a survey on the use of organically grown hedgerow plants

Objectives and Methods

- A small market survey to establish the demand for organically grown trees among organic farmers and growers in Wales
- Telephone survey of 21 organic farmers who are also in Tir Gofal

Survey Findings

- 14 of the 21 farmers interviewed said they buy hedgerow plants every year
- 12 respondents said they *think* they buy local provenance seedlings, but were not sure
- Respondents use a wide variety of tree species when planting hedgerows

Species planted by farmers (n = 21)

- Hawthorn 13
- Blackthorn 12
- Hazel 11
- Ash 5
- Holly 4
- Rose 3
- F. Maple 4
- Oak 3
- Mountain Ash 2
- Alder 2
- Gorse 1
- Silver birch 1
- Chestnut 1
- Wild plum 1
- Beech 1

Interest in organically grown plants

1. Would you would buy organic hedge plants?

- No 2
- Yes 14
- Don't know 5

2. Would you pay a premium?

- Yes 14
- How much? 10% - 50% (average 15%-25%)

Appendix I

Tree Nursery 2006

Glasshouse

Hawthorn	Non Trial	
Hawthorn	Pontbren	149-150
Hawthorn	Fertile Fibre	134-135
Hawthorn	Moorlands	139-140
Hazel	Pontbren	169-170
Hazel	Fertile Fibre	159-160
Hazel	Moorlands	164-165
Blachthorn	Pontbren	184-185
Blachthorn	Fertile Fibre	194-195
Blachthorn	Moorlands	189-190
Blachthorn	Ystwyth Mix	W983-984
Hazel	Ystwyth Mix	179-180
Hawthorn	Ystwyth Mix	154-155