Profit from Rhododendron Control

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Acknowledgements

Studies commissioned by:

Beddgelert Rhododendron Management Group

Presentation:

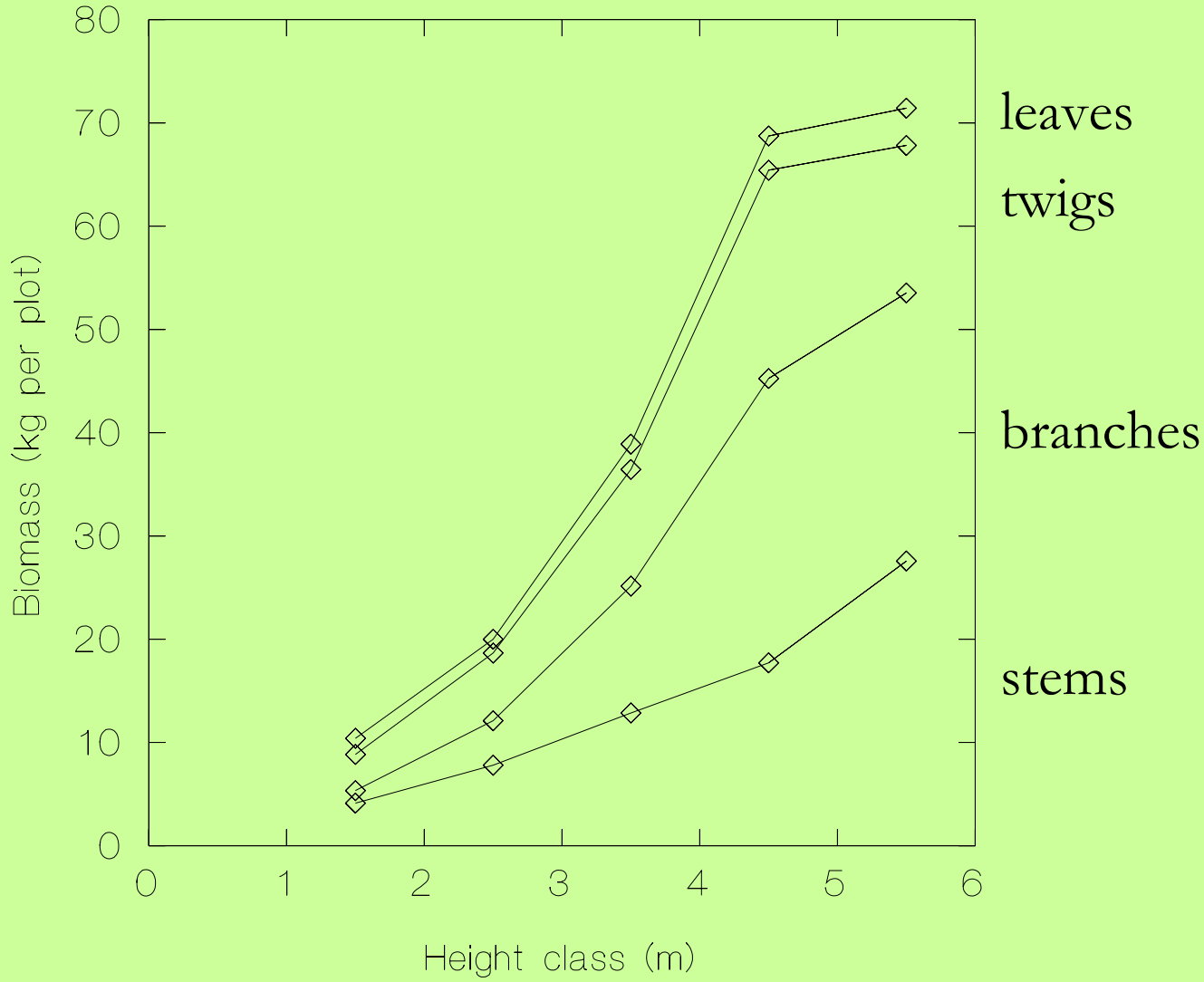
Potential commercial products

- Charcoal
- Mulch
- Biofuel
- Foliage
- Phytochemical extraction
- Crafts

Biomass sampling design

- Stratified for open and shaded sites
- Random sampling from transect lines
- 2 x 2 m plots through the full height of the bushes
- Wood, branches, twigs and leaves weighted green on site
- Sub-sampled for dry weight determination

Open sites - biomass



Comparative yields

Material	Size	Volume $m^3\ ha^{-1}$
Open Rhododendron	> 2 cm d	66 – 264
	> 5 cm d	35 – 137
Conifer thinnings	> 7 cm d	3 – 44
Conifer main crop	> 7 cm d	238 – 656

Clearance costs

Operation		Pick seedlings	Spray	Cut & spray	Manual cut	Stem injection
Bush size		< 0.5 m	< 1 m	1-2 m	> 2 m	> 5 cm d
% site cover	< 20	15	18-75		1,800	13,000
	20-49	400	120-150	566	2,500	
	> 50			1,000-2,600	2,500-5,500	

Contractor survey – 14 questionnaires - 36 job details

Comparative harvesting costs

Costs (£) per m^3	Rhododendron		Forestry	
	2-3 m tall 39 m^3ha^{-1}	> 3 m tall 105 m^3ha^{-1}	thinnings 50 m^3ha^{-1}	felling 450 m^3ha^{-1}
Easy site	80	30	12	7
Difficult site	207	77	23	18

Costs of chipping

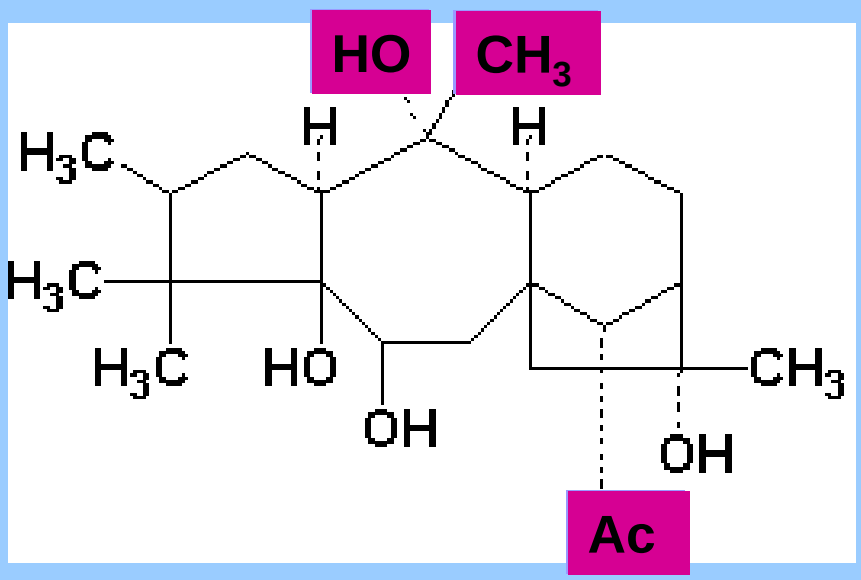
- Extraction costs from £30 per m^3
- Chipping costs as much as £29 per m^3
- Costs of haulage £4 per m^3
- Economic threshold for haulage 50 miles from source
- Total cost = c. £63 per m^3 delivered

Conclusions

- Rhododendron volumes per ha are ¼ of those from forestry final fellings
- Manual clearance costs as a basis for harvesting not competitive with forestry operations
- It is likely that even mechanised clearance will be more expensive than forestry operations because of lower available volumes

Toxic compounds

The main ones are Grayanotoxin I and III

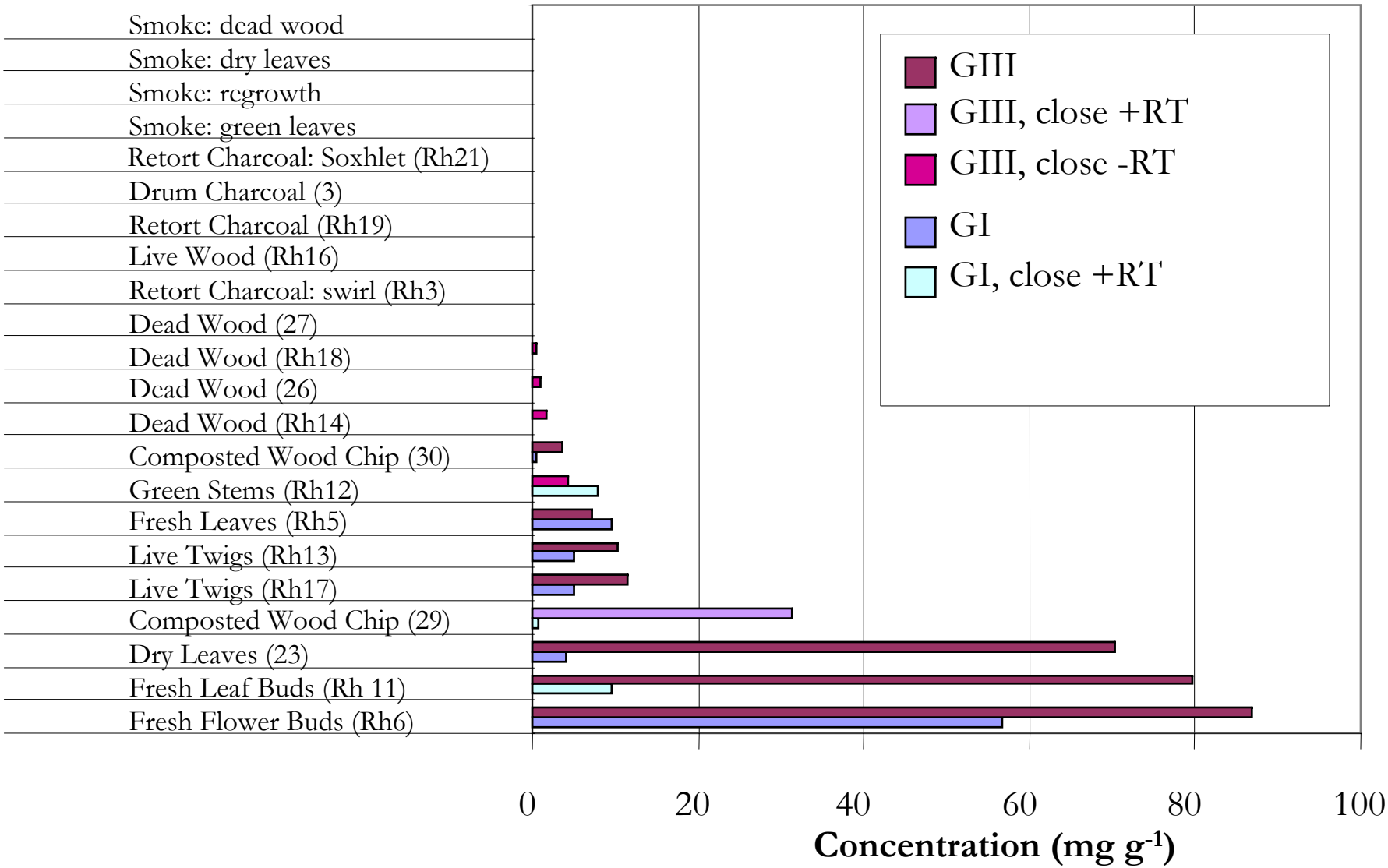


Type	R_1	R_2	R_1R_2	R_3
GI	OH	CH_3		H
GII			$=CH_2$	H
GIII	OH	CH_3		Ac

Analysis for Grayanotoxins I & III

- Gas Chromatography gave reasonable certainty for the toxin GIII but was less reliable for GI

Grayanotoxins GI and GIII



Toxicity: Green material

- Most found in FRESH, GREEN material (flower buds, leaf buds and dry leaves)
- Substantial quantities of the toxins GI and GIII found here are consistent with an antifeedant role

Toxicity: Wood and charcoal

- The dead wood itself contains *only* traces
- Live wood *only* contains traces
- The amounts detected in charcoal are, at best (or worst), traces

Toxicity: Smoke

- **No grayanotoxins or very little in SMOKE but GC traces complex, with many peaks**

Calorific value, bomb calorimetry

Material	Calorific value (kJ g^{-1})
Rhododendron plant parts:	
Air-dried wood	21.85
Freshly cut wood	24.79
Air-dried leaves	20.90
Green leaves (oven dried)	20.96
Green leaves (not oven-dried)	8.98
Green stems (not oven-dried)	9.88
charcoal: Single drum	28.14
charcoal: Retort	34.85
Douglas fir wood	24.39

Mulch study
Suitability as a mulch and rate of biodegradation of chips, leaves, wood and roots

Mulch: weed suppression properties

- Does rhododendron mulch have an allelopathic effect?
- If so then rhododendron chip could have a competitive advantage over other mulches

Method

- White clover planted in John Innes compost overlaid with differing depths of mulch
- Chipped rhododendron wood, leaves and roots tested separately and together as a ‘pooled’ mulch
- Compared to commercially available mulches and a ‘control’ of inert plastic spheres
- Every day the number of seeds that germinated through the mulch layer was recorded

Mulch suitability, results

- Significantly fewer seeds germinated under a mulch of shredded rhododendron leaves when compared to the inert control
- Shredded rhododendron leaves performed at least as well as commercial mulches
- 'Pooled' rhododendron chip performed better than rhododendron wood chip

Implications

- Presence of rhododendron leaves improves the weed suppressing performance of the mulch
- Supports theory that phytochemicals in the leaves are active
- This implies that green material should not be separated from woody material if resource to be used as a mulch – reducing costs

Decomposition study

- Done to examine persistence of **mulch**
- "litter bags" and wood blocks buried in soil for 25 and 100 days at high temperature and humidity
- Decay assessed by weight loss (%)

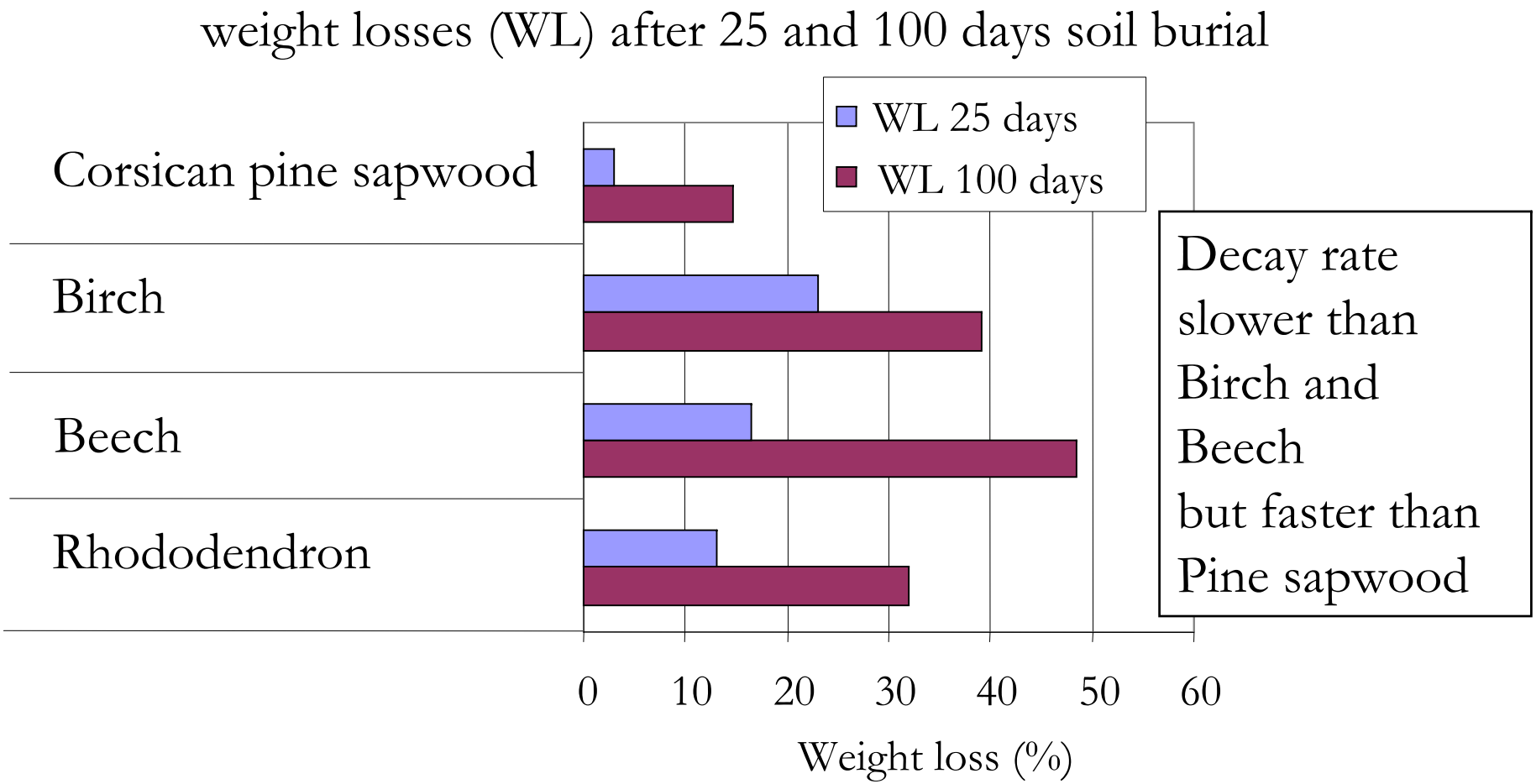
Materials decomposed

Litter bags	**Wood blocks**
Filter Paper	Rhododendron
Birch Leaves	Beech
Rh fine roots	Birch
Rh fresh green leaves	Corsican pine sapwood
Commercial chip, not Rh	
Old weathered Rh leaves	
Composted chip, not Rh	
Rh wood chips and leaves	
Rh wood chips	

Decomposition study (bag)

- Rh mulch initially decays at a slightly slower rate than other mulches but greater decay was seen with prolonged exposure
- This should provide an ideal mulch material
- The leaves decay rapidly when exposed within the soil. This is probably much faster than in the leaf litter layer
- The roots initially decayed rapidly but showed some recalcitrance at the later stages of decay

Decomposition study, wood blocks



Decomposition study, wood blocks

- Rh wood blocks not particularly durable for construction purposes or for the manufacture of composites like chipboard, OSB or MDF

Phytochemicals from *Rhododendron* spp.

- Desk study
- Very little done on *R. ponticum* since 1960s
- Other species more widely studied, *R. dauricum* and *R. latoucheae, R. adamsii*, *R. ellipticum, R. ferrugineum, R. molle, R. simsii*

Pesticidal	Anti-bacterial
HIV	Anti-oxidants
Yeasts, fungi	Expectorant
Cardiac stimulants	Pigments
Anti-cancer	

Foliage

Muir of Ord

- 250 ha – owned by FE
- Coppiced 8 yrs ago
- 25% of stems harvested each year
- Transported to Glasgow for sale
- Sold to the Netherlands
- Cash in hand for workers
- Operator sells ~200,000 stems per week

Killarney

- Private land
- Mostly open and semi-sheltered sites
- 1 million stems harvested each year
- Sold into UK market via van Geest

Gailty Mountains

- ~ 1200 hectares owned by Coillte Teoranta
- Mostly sheltered sites, some open ground
- Sold into the UK through van Geest
- Piece rate system (per bundle)
- Majority pickers are Ukrainian
- Small team of local people (supervisors/managers)

Important site considerations

- Reasonable density of bushes
- Not too steep
- Close to road/track
- Shaded or sheltered sites preferred

Parts used

- Straight, 60 cm long shoots with perfect, regular leaves
- Stems with closed, perfect flower buds

Season

- August to May

Rhododendron control ?

- Prefer to work on coppice bushes
- Usually only ~ 25% of stems harvested
- Bushes maintained at ~ 2 m height
- Harvested bushes flower but at reduced rates
- One company does control in exchange for harvesting rights

Ecomonics

PICKERS

- 90 p per bunch of 20 stems
- Income of £500-600 a week

WHOLESALERS

- Prices ~ 10p stem
- Large volume sales are profitable
- Demand growing

MARKETS

- All companies interested in sourcing from new areas
- Main UK buyer says there is room for another supplier
- Value addition (wreaths) is possible

Turnery

- Good to turn – similar to Hornbeam
- Very white and holds colour well
- No nasty smells or irritations

Markets for chip

Biofuels market

- Customers pay 3 p per kW h^{-1}
- North Wales biofuel company prepared to p
- I try waste
- No quality premium

NOT ECONOMIC

Rh chip ~ £59 m^3 for material at roadside

Wood chip mulch market

- Local contractor selling chip for £21 per m^3 (cost price)
- H[illegible]50 p[illegible]

NOT ECONOMIC

Rh chip production cost ~ £63 per m^3

Charcoal

Larger scale manufacturers require:

- **straight 60 cm lengths 7-15 cm diameter**
- **in loads of 3.5 m^3**
- **FSC certified**

Small scale production not economic unless a significant price premium or very local markets can be assured

Best opportunities for income in northern Snowdonia

1. Foliage production
2. Souvenirs / crafts
3. Mulch
4. Biomass
5. Charcoal
6. Phytochemicals