

Assessment of Firewood Supply Chains from Hardwood First Thinnings – a result of the COFORD Forest Energy Programme

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Introduction 1: COFORD Forest Energy Programme 2006 - 2009

Objective: Investigate cost-effective supply chains of marketable firewood and woodchip from farm forestry first thinnings.

Overview

- Describe roundwood harvesting systems applied to hardwood first thinning sites
- Investigate productivity of firewood supply chains
- Quantify the harvested volume from hardwood thinnings
- Recommendations

Introduction 2: Summary of Methods Trialled

Operation	Method
Harvesting:	Chainsaw
	Harvester
Extraction:	Forwarder
	Tractor & Grapple
	ATV & Arch
	ATV & Trailer
	Horse & Arch
	Horse & Trailer
Firewood Processing:	Hakke Pilke "Hawk"
	Posch Cross-cutter
	Bilke
	Sawbench

Thinning with Chainsaw



Thinning with Harvester



Log presentation for Forwarder Extraction



Forwarder Extraction



Tractor & Grapple



Log presentation for Tractor & Grapple



Log presentation for ATV or Horse



Horse & Trailer Extraction



Horse & Arch Extraction



Bilke Firewood Processor



Hakke Pilke “Hawk” Firewood Processor



Methods 1: Fieldwork & Data Analysis

Work Task	Work Method
Thinning Control:	Line & selection thinning, c. 33% stem removal, crop marked according to Teagasc guidelines
Site Description & Standing Volume:	GPS survey & sample measurement plots
Harvested Volume:	Sample log volumes & log counts
Operation Time Studies:	Contractors employed Stop watches & field computers (SIWORKS3) Cycle level time studies
Productivity Analysis:	Production Hour => Productive Time & Unproductive Allowance Production Cost => Production Hour & Contractor Hourly Rate

Methods 2: Productivity & Hourly Rate Assumptions

Operation	Method	Unproductive Time Allowance	Hourly Rate
		(% Productive Time)	(€/pmh)
Harvesting:	Chainsaw operator	50	25
	Harvester	30	110
Extraction:	Forwarder	30	90
	ATV (with timber arch or trailer)	50	30
	Horse (with timber arch or trailer)	50	30
	Tractor and grapple	30	40
Firewood Processing:	Chainsaw and log bench	50	25
	Hakke Pilke "Hawk" & 2 operators	50	60
	Posch cross-cutter, tractor & 2 operators	50	75
	Bilke, tractor & 1 operator	50	50

Results 1: Site Descriptions

Site	No. Plots	Species	Site Area	Age	Stocking	Mean dbh	Top Height	Yield Class
			ha	year	stems/ha	cm	m	
Dovea	4	ash	4.05	13	3155	9	10.5	12
Manseragh	4	ash/sycamore	5.4	12	2022	10	9.8	10
Mullinavat	4	ash	5.5	14	2588	10	8.8	8
Stradbally	2	ash	1.9	14	2065	11	12.5	12

Results 2: Harvesting by Chainsaw & Harvester

Fell Method		Chainsaw	Harvester
No. Cycles		1630	1990
Total/Tree	mins	2.8	0.59
Trees/pmh		21	102
Vol./tree	m ³	0.028	0.015
Vol./hr	m ³	0.59	1.57
Hourly Rate	€/hr	€25.00	€110.00
Cost/m ³	€/m ³	€42.51	€70.07

Result 3: Variation in Chainsaw Productivity

Site		Dovea		Manseragh			Mullinavat		Stradbally	
Total/Tree	mins	1.99	2.13	1.92	2.09	2.8	1.76	2.73	4.65	5.54
Trees/pmh		30	28	31	29	21	34	22	13	11
Vol./tree	m ³	0.034	0.025	0.023	0.026	0.025	0.018	0.018	0.033	0.049
Vol./hr	m ³	1.012	0.692	0.727	0.746	0.529	0.612	0.4	0.431	0.536
Hourly Rate	€/hr	€25.00	€25.00	€25.00	€25.00	€25.00	€25.00	€25.00	€25.00	€25.00
Cost/m ³	€/m ³	€24.70	€36.12	€34.39	€33.49	€47.23	€40.82	€62.56	€57.94	€46.68

Results 4: Forwarder and Small Scale Extraction Methods

Extraction Method	Forwarder	Tractor & Grapple	ATV & Arch	Horse & Trailer	ATV & Trailer	Horse & Arch
No. Cycles	34	36	76	34	16	39
Extraction Distance (m)	383	80	168	226	225	275
Total Time/Load	48.4	6.83	9.94	27.82	32.45	24.81
Loads/hr	1.24	8.79	6.0	2.16	1.85	2.42
Vol./load	3.43	0.21	0.11	0.296	0.328	0.191
Vol./hr	4.25	1.843	0.67	0.639	0.606	0.462
Hourly Rate	€90.00	€40.00	€30.00	€30.00	€30.00	€30.00
Cost/m ³	€21.15	€21.70	€44.91	€46.93	€49.47	€64.98

Results 5: Roundwood Cost to Roadside

Harvesting	Extraction	Harvesting Cost	Extraction Cost	Total Cost
Chainsaw	Forwarder	€42.51	€21.15	€63.67
Chainsaw	Tractor & Grapple	€42.51	€21.70	€64.21
Chainsaw	Horse & Trailer	€42.51	€46.93	€89.44
Chainsaw	ATV & Arch	€42.51	€47.67	€90.18
Harvester	Forwarder	€70.07	€21.15	€91.22
Chainsaw	ATV & Trailer	€42.51	€49.47	€91.98
Chainsaw	Horse & Arch	€42.51	€64.98	€107.49

Results 6: Production Cost of Firewood Processing

Processor	Cycles	Vol./hr	Hourly Rate	Cost/m ³
		m ³ /hr	€/hr	€/m ³
Bilke	222	2.39	€50.00	€21.79
Saw bench	289	0.485	€25.00	€52.11
Posch Cross-cutter	76	0.74	€75.00	€101.49
Hakke Pilke "Hawk"	373	0.435	€60.00	€151.76

Results 7: Harvested Roundwood Volume at Roadside

Site		Mullinavat	Manseragh
Treated Area	ha	5.5	5.4
No. Logs		5893	5138
Log Volume	m ³	0.017	0.017
Total volume	m ³	99	86
Volume per ha	m ³ /ha	18	15

Results 8: Assortment Impact on Harvested Volume

Assortment	Dovea (m ³ /ha)	Manseragh (m ³ /ha)	Mullinavat (m ³ /ha)	Stradbally (m ³ /ha)
7cm & 3m	24	15	18	23
7cm pole	28	18	22	26
	118%	117%	133%	113%
5cm pole	38	23	28	33
	158%	150%	156%	143%

Conclusions

- Chainsaw harvesting
 - Further harvester trial on larger mean tree volume
- Extraction dependent on site area
 - Forwarder and tractor & grapple
- Firewood production
 - Processor productivity dependent on mean log volume
- Harvested volume low
 - Small mean tree volume & assortment losses