

Project number: 5933
Funding source: Teagasc

Date: July, 2017
Project dates: Jan 2010 – Dec 2016

Thinning maximises revenue in farm forest plantations



Key external stakeholders:

Farm forest owners; Forest managers, Forest Industry.

Practical implications for stakeholders:

- Where possible thinning should be considered as it results in more profitable forest enterprises
- Thinning should be considered earlier in the life cycle of a forest as it provides the opportunity for trees to develop into more profitable products.
- A series of practical guidelines have been developed to assist private forest owners.
- Increasing the intensity of thinning offers the potential for farm forest owners to increase value of their crop and to reduce rotation length

Practical guidelines including a ready reckoner and the types of trees and volume to remove in thinning operations have been developed which should serve to guide farm forest who are considering thinning their plantation. Teagasc can make a valuable contribution to the farm forest sector by the promotion of best practice through its advisory and KTE initiatives to assist in national timber mobilisation efforts.

Main results:

The key results were:

- For best results thinning should be practiced on time when the crop has fully occupied the site when trees have reached 15 to 16 cm in diameter and between 10 and 12 m in height.
- It is recommended to use basal area or volume to control thinning rather than stem numbers.
- Thinning affords a significant improvement in stem quality (e.g. straightness) and provides an opportunity to increase diameter and volume, provided inferior quality trees are removed.
- Increasing the thinning intensity offers the potential to increase the revenue generated from thinnings, when typically, pulpwood represents 60 to 70% of volume.
- The benefit of intensifying thinning becomes apparent at second thinning, with the proportion of pallet wood increasing to 60 to 65% of volume compared to 30% with light thinning.
- Timber quality is greatly enhanced by thinning, the greatest increase occurs in the heaviest thinning, where 76% of the volume has 3 m+ straight stem, lighter treatments show smaller increases.

- It should be possible to grow to a merchantable size of 0.7 to 0.8 m³ in 30 years on most sites if protocols are followed.
- Delaying thinning is counter-productive, with reduced diameter increment, and the risk of windthrow increasing.

Opportunity / Benefit:

The All Ireland roundwood forecast (COFORD, 2016) estimates significant increases in the production capacity of Ireland's private forests; this can only be achieved by adequate (appropriate) thinning of the resource. There are now increasing demands for timber volume assortments which traditionally were used in the manufacture of wood panels and fencing materials and an increasing demand for local wood assortments to facilitate investment decisions on new or expanded production facilities. This research hopes to strengthen core forest management competencies in the farm forestry sector through expert research and technology transfer. This research serves to develop practical guidelines which will assist in the development of best thinning practice, serving to assist growers in managing their plantations in order to maximise their profitability. It is hoped that many farmers will see the benefits of thinning when appropriate, and that technology adoption will lead to an increased in thinning practice, leading ultimately to an increase in output from the farm forest sector. The outputs of this research will provide tools and information for Knowledge Transfer initiatives and assist in the development of the sector through increased forest management ultimately leading to increased volume output. It is envisaged that expertise will be developed and maintained in the area of forest growth and yield.

Collaborating Institutions:

Teagasc project team:

Dr Niall Farrelly, Matt O' Grady, John Casey, Liam Kelly

External collaborators:

Mr Vivian Kenny, The Forestry Company, Society of Irish Foresters, Irish Timber Growers Assoc. Private forest owners.

1. Project background:

Forestry is a long term business, with approximately 30 years required to produce a crop of timber suitable for sawmilling on productive soils. Since 1980 over 280,000 ha of Private afforestation has been planted with a sizeable proportion approaching first thinning. Many farmers have conifer crops approaching thinning stage which require urgent attention to maximize the value of the resource. Therefore it is important to increase awareness among farmers of the benefits of thinning and forest management to increase the output from the sector and ensure greater profitability to rural communities. To assist forest management the development of practical tools and information on best practice are being developed. The impact will result in an intensification of appropriate thinning practice and ensure increased timber mobilization efforts.

2. Questions addressed by the project:

- Compare the impact of first thinning treatments on various crop parameters
- Assess the longer term impact of thinning on crop development
- Evaluate the usefulness of using volume to regulate thinning
- Evaluate differences in log assortments and financial returns from different thinning treatments
- Assess the impact of thinning on timber quality and rotation length

3. The experimental studies:

A thinning experimental trial was established in Frenchpark, Co. Roscommon in 2010 to observe the effect of different thinning intensities on volume production in the Sitka spruce crop. When the trial was established, the crop had a top height of 11 m, with a mean diameter at breast height (dbh) of 16.4 cm, and a volume of 200 m³ha⁻¹. Four different thinning treatments (Table 1) were assigned to the crop as follows:

1. Control – leave crop unthinned,
2. Grade B – Remove dying, suppressed, forked and subdominant trees, approx., 51 m³/ha
3. Grade C – As per light treatment but include some co-dominant trees, approx. 62 m³/ha.
4. Grade D – As per medium treatment but more co-dominant and competing trees, approx. 73 m³/ha

The first thinning commenced in 2010 and followed a line (1 in 7) and selective thinning removing dead, dying and inferior quality stems and improving the quality of the remaining crop to prescribed treatment (Table 1). A second thinning took place in 2016 focussing on the removal of inferior quality stems until a reference basal area was

reached for each treatment (Table 2). For both thinning treatments the net volume assortments and value of thinnings were derived. The value of thinnings was €6/m³ for pulp and €16/m³ for pallet, no sawlog was produced in either thinning. Total volume production was calculated in 2016 as standing volume plus thinnings to observe if differences existed between treatments. An assessment of timber quality was also performed to observe if treatments had any effect on log straightness.

Table 1: Summary of main crop details with volume removed and revenue after first thinning treatments

Treatment	Age (yrs)	Top HT (m)	Stems (Ha)	Dbh (cm)	Ba/ha (m ² /Ha)	Vol (m ³)	Vol Remain (m ³ /ha)	Vol Remove (m ³ /ha)	Net Vol Pul/Pal	Revenue €/Ha
Unthinned	15	11.8	2133	16.2	44	0.10	211			
Grade B	15	11.4	1500	17.2	35	0.11	168	51	28/17	475
Grade C	15	10.5	1230	17.7	30	0.12	148	62	34/20	564
Grade D	15	11.3	1015	18.5	27	0.13	134	73	44/19	616

Table 2: Summary of main crop details with volume removed and revenue after second thinning treatments

Treatment	Age (yrs)	Top HT (m)	Stems (Ha)	Dbh (cm)	Ba/ha (m ² /Ha)	Vol (m ³)	Vol Remain (m ³ /ha)	Vol Remove (m ³ /ha)	Net Vol Pul/Pal	Revenue €/Ha
Unthinned	21	17.2	1990	19.9	62	0.23	452			
Grade B	21	16.7	1163	23.2	49	0.34	386	40	25/10	334
Grade C	21	16.3	938	23.9	42	0.36	338	61	22/31	691
Grade D	21	16.9	791	24.9	38	0.40	311	62	19/35	748

4. Main results:

- The majority of the volume at first thinning was pulpwood; ranging from 61% to 70% from light to heavy treatments owing to removal of poorer trees in heavier thinning treatments.
- Total revenue at first thinning increased from €475/ha for light thinning to €616/ha for heavy thinning with no revenue produced for the no thinning treatment.
- Timber quality was greatly enhanced by first and second thinning with the greatest proportion of the trees (by volume) with 3 m or more straight stems in the grade D treatment.
- Crop attributes (e.g. mean dbh, mean volume) were increased with thinning intensity with the greatest increases occurring in the Grade D treatment.
- The proportion of pallet at second thinning increased with thinning intensity from 29% in the grade A treatment to 65% in the grade D treatment resulting in an increase in revenue from €334/ha to €748/ha.
- Total revenue from first and second thinning was greatest in the Grade D treatment at €1364/ha, compared to €1254/ha in the Grade C thinning and €808/ha in the Grade B thinning.
- The Grade D treatment which has larger trees and a higher proportion of trees with straighter stems will have a shorter rotation period, likely to be the most lucrative option.

Table 3: Total volume, revenue and quantity of 3 and 5 m logs after first & second thinning by thinning treatments

Treatment	Vol Remain (m ³ /ha)	Vol Removed (m ³ /ha)	Total Vol production (m ³ /ha)	Combined revenue €/ha	Log volume > 5 m length	Logs volume > 3 m length
Unthinned	481	0	481		13	69
Grade B	416	91	508	809	20	73
Grade C	368	123	490	1255	27	78
Grade D	339	135	474	1364	34	78

5. Opportunity/Benefit:

Results of this project have provided research-based evidence on the importance of prompt forest management to realise investment decisions. Results of this study indicate that increasing the intensity of thinning can increase timber quality and profitability of the thinning operations themselves and increase the value of the remaining crop which can be expected to yield the bulk of the financial return. It is clear from this research that thinning, where possible (appropriate) should be promoted and encouraged. The choice of thinning grade may depend on local or personal circumstances, but results from the research presented here clearly indicate that increased thinning intensity can increase returns from thinning, improve timber quality and result in shorter more profitable rotations. Such trials and information are beneficial in which to demonstrate best practice to industry.

6. Dissemination:

Main publications:

Dhubháin, A., Maguire, K., and Farrelly, N. The suitability of the private forest estate for thinning. *Irish Forestry* 67 (1&2) 2010.

Farrelly, N. 2014. Adding value in the forest. How good silvicultural practice can optimise the forest resource. *In* proceedings of what shall we do with the timber? Opportunities for Irish wood and wood products. National Forestry Conference, Enfield, Co. Meath, Friday, 6th June 2014.

Krajnc, L., Farrelly, N., Harte, A.M. 2016. Mechanical characterization of green Sitka spruce logs. Civil Engineering Research in Ireland, CER16, August 2016, Galway Ireland.

Popular publications:

Farrelly, N. 2012. The practice of thinning forest crops. *Forest and Energy Review*, Vol 2, No. 1.

Teagasc, 2013. Forest thinning in Conifers. Teagasc Farm Forestry Series No. 10. Teagasc Forestry Dev. Dept., Athenry, Co. Galway.

Teagasc 2016. The thinning Ready Reckoner-Getting Ready for thinning. Available at https://www.teagasc.ie/media/website/crops/forestry/advice/Teagasc_thinning_ready_reckoner.pdf

Youtube:

Is my conifer forest ready for thinning? Check with the ready reckoner:

<https://www.youtube.com/watch?v=98EHaf6KBc>

Notable field events:

2012. Joint Teagasc/ITGA field day. Thinning experiments in Sitka spruce, Moyvore, Co. Westmeath, 6th July

2013. Joint Teagasc/SIF field day. Thinning in fast growing Sitka spruce, Frenchpark, Co. Roscommon, 19th April

2015. Joint Teagasc/Forest Service field day. First and second thinning in Sitka spruce, Kilbrin, Co. Cork, 20th October.

7. Compiled by: Niall Farrelly