Guidelines for the management of productive Sitka spruce crops

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Many crops of Sitka spruce planted in the 1990's on out farms are now showing exceptional growth rates, which require earlier management than the crops traditionally planted on more marginal ground. In many cases these crops are suitable for first thinning at 15 years of age, due to the mix of good genetic stock resulting in rapid juvenile growth on favourable sites.

Many farmers who planted Sitka spruce crops since the 1990's can expect shorter rotations with opportunities to achieve a log size of 0.7 to 0.8 m^3 after 30 years. The key ingredients are good forest management and sensible thinning aimed at favouring straight trees that are defect free to grow into larger timber for commercial sawlog (prices range from €60-80 per m^3). Results of a Teagasc research thinning experiment in Frenchpark is now becoming available and has been used to assist in providing guidelines on how to thin and manage highly productive crops of Sitka spruce (yield class 30) with the aim of achieving commercial sawlog production. The research supported by the forestry advisory service aims to support best practice adoption in the management of farm forests. The first step in deciding whether to thin your forests is to familiarise yourself with the thinning operation, there is good advice available from Teagasc about first thinning https://www.teagasc.ie/crops/forestry/advice/timber-harvesting/first-thinning-of-conifer-forests/

As a general rule Sitka spruce crops should be thinned on time where possible as it allows greater flexibility in management. While delaying thinning for 2 or 3 years can be considered for commercial reasons, it reduces the types of operations that can be carried out owing to the vulnerability of trees to windblow, especially on wetter soils. It may be necessary to consider the risk of windblow when considering thinning. Crops on wets soils, especially ion exposed soils should not be thinned. A nice tool which has been developed to assess the probability of windblow in your forest is available from COFORD http://www.coford.ie/toolsservices/windthrow/

First thinning

Start planning for first thinning by assessing the readiness of your crop for thinning by measuring it and by consulting the Teagasc ready reckoner https://www.teagasc.ie/crops/forestry/advice/timber-harvesting/thinning-ready-reckoner/.

Thinning should ideally start when the average diameter at breast height (dbh) is 16 cm or greater, and the number of trees per hectare (ha) greater than 7 cm is at least 2000 per ha.

For many productive crops this will be at 15 growing seasons after planting. Thinning should be delayed by 3 years if the number of trees is lower than 2000 per hectare, until the average dbh increases to 18 cm.

The first thinning operation generally removes 1 line in every 7 planted lines (14.3% of the volume) which allows machinery access to the crop. The line removal reduces the number of stems by approximately 300 per hectare and provides for some pallet wood at first thinning but does little to improve the quality of the crop. Depending on site conditions and crop development the thinning prescription may warrant a light, medium or heavy thinning. Heavy thinning may be required to

remove more volume, where the crop is overstocked, but it requires strict supervision and should not be practiced on exposed locations, wet soils or where stability is a concern. The industry standard is practice, a medium thinning which removes about one third of the volume in first thinning operations. A light thinning removes less volume and may be more suitable for crops where there are stability concerns.

It is important that the thinning operation that takes place between the remaining six lines focuses on removing smaller trees. In addition poor quality trees which are forked, or only have the possibility of producing pulpwood assortments should be removed. Where heavier thinning is warranted, other trees competing with better quality trees may need to be removed to provide for increased growing space. A good thinning is one which increases the dbh of the remaining crop by at least 1 to 2 cm, otherwise the thinning will be considered neutral.

Photo 1: An unthinned plot of Sitka spruce with an assortment of quality classes.

Photo 2: A thinned plots of Sitka spruce, where much of the smaller poorer quality trees have been removed.

A good guideline for first thinning is to retain a set number of stems per hectare. Recommendations on the number of stems has been derived from the Frenchpark experiment which are presented in table 1. A light thinning operation would retain at least 1500 stems per hectare of at least 17 cm in dbh. A medium thinning should retain about 1250 stems per hectare of at least 17 cm and a heavy thinning should leave 1050 stems per hectare with a mean dbh of at least 18 cm. All thinning types should focus on increasing the average dbh by actively removing smaller stems. This will increase the dbh by at least 1.3 cm for medium thinning and by 2 cm for the heavy thinning.

Table 1: Stocking table for Sitka spruce for each thinning type based on results from Frenchpark experiment.

Thinning Type	Volume/Ha removed	Stems/Ha before	Stems/Ha after	DBH (cm) before	DBH (cm) after	Increase in Dbh (cm)	Dbh removed (cm)
Light thinning	50	2199	1526	16.3	17.2	0.8	14.9
Medium thinning	62	2069	1230	16.4	17.6	1.3	14.2
Heavy thinning	73	2091	1049	16.2	18.5	2.3	13.6
No thinning	0	2163	2163	16.2	16.2	0.0	

Volume removal in the Frenchpark experiment ranged from 50 to 73 m^3/ha. While majority of the volume removed at first thinning is pulpwood (60 to 70%). Some palletwood is produced (20 to 30%) from heavier trees on the removed line, where better trees may produce one or two lengths of

palletwood. In terms of financial returns a light thinning may return €450/ha, a medium might be worth, €560/ha and a heavy thinning may be worth €610/ha, owing to a higher volume produced.

Second thinning

Ideally second thinning should take place after 4 or 5 years after first thinning, when the crop is about 20 years of age. The average dbh of the crop should be somewhere between 22 and 24 cm. A rule of thumb is that second thinning should remove one out of every four or five trees depending on the thinning type. Second thinning should aim for a stocking of between 825 to 1200 trees per hectare, and the average tree dbh should increase by at least 1 cm. The Dbh after thinning in Frenchpark ranged from 23 to 25 cm for the different thinning types (Table 2).

Table 2: Stocking table for Sitka spruce for each thinning type based on results from Frenchpark experiment.

Thinning Type	Volume/Ha removed	Stems/Ha after	DBH (cm) before	DBH (cm) after	Increase in Dbh (cm)	Dbh removed (cm)
Light thinning	40	1180	21.8	23.3	1.5	15.6
Medium thinning	60	940	22.9	23.9	1.0	19.2
Heavy thinning	62	825	24.1	24.9	0.7	21.4
No thinning	0	2004	20.0	20.0	0.0	

The volume removed at second thinning can often be lower than that removed than in first thinning. For example in the Frenchpark experiment the volume removed at second thinning was less than the first thinning and varied from 40 to 60 m^3 per hectare (Table 2).The volume assortments at second thinning are highly dependent on the type of first thinning carried out. Where the first thinning was light, the percentage palletwood removed is much lower at 25% of the volume. Where the first thinning was medium or heavy, a higher proportion of palletwood is available to be removed (>50%). The difference is that the medium and heavy thinnings prioritise the removal of pulpwood at first thinning and focus on removing a higher proportion of palletwood. Returns from second thinnings can vary from €330 per hectare for the light thinning, €690 for the medium thinning, to €750 for the heavy thinning. Results from Frenchpark can only serve to illustrate that the value of the second thinning is dependent on the quality and intensity of the first thinning and the ability to remove pulp at first thinning.

Subsequent thinnings and timing of clearfell

After a further 5 years the third thinning should be scheduled. The average dbh of the thinned crop should be in excess of 25cm. By contrast the unthinned plots have an average dbh of just 21 cm. The aim of the third thinning is to reduce stocking by between 10 to 16% and create space for the trees to grow to commercial size. Following on from the first and second thinnings the light thinning should have approximately 1050 stems/ha; the medium thinning 825 stems/ha; and the heavy thinning about 694 stems/ha. It is not necessary to consider any further subsequent thinnings after third thinning as the average tree size is forecasted to reach 0.8 m^3 at 30 years after which time final harvest can take place.

Increase in stem quality a key result of thinning

Thinning when carried out correctly allows the forest owner to divert valuable site resources to better quality trees, resulting in trees of higher value. Results from Frenchpark illustrate the benefit of thinning. Overall there is a significant an increase in the quality of with a greater percentage of straight logs in all the thinning treatments compared to the unthinned plots and as thinning intensity increases so those timber quality. For more heavily thinned plots, over 83% of the stems are capable of achieving at least a valuable 3 m straight log compared to 75% of the stems for the medium thinning and only 56% of stems for the unthinned plots. There is limited potential to influence the quality of trees in unthinned plots (Figure 1).

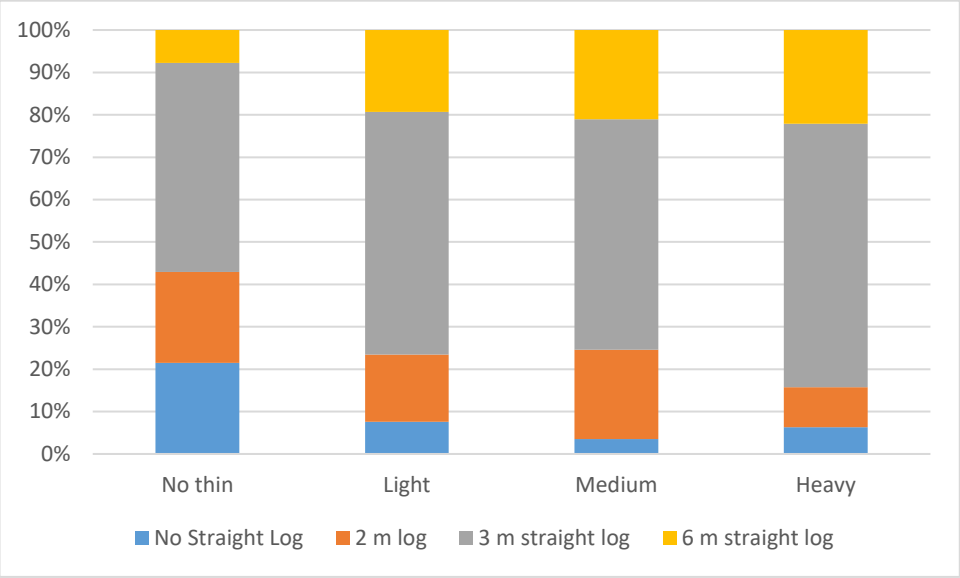

Figure 1: Percentage of straight logs (2, 3 and 6 m) for different thinning regimes after third thinning in Frenchpark.

Overall thinning is a positive and necessary intervention in the forest and if carried out correctly should result in shorter rotations decreasing the time to harvest increased revenue returns for growers. The focus of thinning should be on the retention of trees with good quality traits and the removal of those with less value over the rotation. If one thinks of a forests in terms of products, the pulpwood is the first product to be taken out, then the palletwood is removed in the second and third thinning, leaving the sawlog for final harvest.