Effects of Weed and Grass Control on the Establishment of *Fraxinus excelsior L.*

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Summary

Fraxinus excelsior L. was planted at Johnstown Castle, Co. Wexford in a loam to clay loam soil which had previously been used for intensive beef production. Weed control, using glyphosate, was practised on part of the site for three consecutive years, the rest remained untreated.

A marked increase in tree height and quality occurred in the treated plots. It is suggested that vegetation competing for moisture, rather than nutrients, was the main reason for the poor growth in the control plots.

Introduction

Ireland has approximately half the livestock numbers that it's grassland is capable of carrying (Lee and Diamond, 1972). Because of E.C. restrictions it is unlikely that, in the forseeable future, there will be sufficient livestock to utilise the existing grassland efficiently. It is therefore critical that alternatives to grassland be found. The climate and soils are such that tillage crops are unlikely to provide a viable alternative land use on a national scale. At the moment 6.5% of Irish land is under forestry (Fitzsimmons, 1987) and this percentage is rising at a rate of 0.25% per year.

Since the foundation of the State forestry has, by and large, been confined to the poorer soil types. The introduction of grants and premia by the Government to the private sector has vitalised interest in forestry among farmers and the choice of land available for tree planting has widened significantly. There is a considerable interest now in planting broadleaves on good quality lowland, that was heretofore used for intensive grassland agriculture (Culleton and Bulfin, 1990).

Competition by grasses and herbaceous weeds in young plantations can seriously reduce the survival and early growth of the trees and lead to an extended establishment period. Grasses, especially, can compete vigorously for light, nutrients and in the lowlands and drier uplands, for water (Williamson and Lane, 1989). Weed control is therefore recognised as highly desirable in the establishment of newly planted trees (Davies, 1987). Soil moisture deficits become greater under grass and weeds than under bare

Figure 1. Difference between treated and control plots are readily distinguished. Glyphosate treated plots on right.

ground because a vegetated cover can loose moisture more rapidly and for a longer time before soil moisture potential limits transpiration. Relatively little moisture evaporates from bare soil before a layer of dry soil forms, restricting further evaporation loses (Marshall and Holmes, 1979).

Insley (1988) suggested weed control under broadleaves is required for a longer period than for conifers because of their slower establishment phase. Roberts and Chancellor (1986) reported on the large number of seeds normally present in the soil of intensively managed lowland soils. There is a need to quantify the effects of weedgrass control on the establishment phase of hardwood trees on fertile lowland sites.

Material and Methods

Twelve hundred saplings of *Fraxinus excelsior* were planted on an imperfectly drained loam to clay loam soil at Johnstown Castle, Co. Wexford in April 1989. A description of the trees at planting is given in Table 1. The land had previously been used for intensive beef production from grass, using up to 200 kg N/ha, and carrying a stocking rate of 2000 kg/ha of stock at turn-out in spring. The sward prior to planting consisted primarily of *Lolium perenne*. The P and K levels were 12 and 150 mg/kg, respectively. Soil pH was 6.7. The entire sward was burnt off completely three weeks before planting with glyphosate.

The trees were planted at a 2m spacing within and between rows. There were 40 rows of 30 trees per row. Complete weed control was maintained in the first 20 trees of each row, by spraying with glyphosate three times per year, in late April, mid June and late September in 1989, 1990 and 1991. In the last 10 trees per row there was no weed control and there were no other differences between treatment of soil or trees subsequently. In November 1991, tree mortality and tree performance were assessed in both treatments. Each tree was also graded into good, medium or poor quality. This was determined by eye and was based on a combination of factors i.e. presence/absence of apical bud, tree shape and general appearance of healthy growth. Leaf samples from the middle of the crown of a range of trees in each treatment were collected in July 1991 and analysed from N, P, K, Ca and Mg as outlined by Byrne (1979).

Table 1: Description of Saplings Planted in April, 1989.

	Height(cm)	Width(mm)	Quality
Mean (S.D.)	73 (20.4)	9.7 (1.88)	42% good
Minimum	26	49	52% medium
Maximum	170	16.0	8% poor

Results and Discussion

While every effort was made to plant trees that were uniform in appearance there were differences in height, width and grade in trees at planting (Table 1). Complete weed control was maintained, although at each spraying operation a different species of weed tended to appear. The constant spraying insured that these weeds were not growing sufficiently long to compete with the trees for light, nutrients or water. This observation of constant and severe weed infestation on highly fertile ex-agricultural land has been reported previously by Roberts and Chancellor (1986).

In the no weed control plots grasses, rather than weeds, were the dominant species present. *Lolium perenne* and *Agrostis tenius* returned rapidly after the spraying prior to planting and grew vigorously in each growing season. Small numbers of broadleaved weeds, mainly *Rumex* species were also present. The effects of this luxurious grass growth severely restricted the performance of the trees. Mortality in trees was higher than in the complete weed control plots (Table 2). It was observed that the tall grass tended to pull down the saplings to an almost horizontal position, from which several were unable to recover. Minimal weed control, like trampling around each tree could lesson these problems. The effects

of grass growth on tree growth and width were enormous. The trees in the no weed control plots were 34% and 37% of the heights and widths respectively in the complete weed control trees. It was observed over the three year period that there were considerable amounts of apical bud death and dieback in the no weed control plots. It was also observed that after the weeds had choked the young saplings new growth came in the following year from an auxiliary bud near ground level. While many plants survived, the quality of the surviving trees were very much reduced (Table 3). Moffat and Williamson (1991) agreed in that they reported that tree establishment was seriously compromised unless weed control was practiced on lowland fertile sites.

Table 2: The accumulated effects of weed control in *Fraxinus excelsior* growth after three growing seasons.

	Complete Weed Control	No Weed Control
Moratality%	4	15
Height(cm)		
Mean (S.D.)	220 (31)	75 (26)
Minimum	95	18
Maximum	320	135
Width(mm) at 30cm		
Mean (S.D.)	27 (5)	10 (4)
Minimum	12	5
Maximum	38	18

Table 3: Quality of trees in weed control and no weed control plots (percentage of total monitored).

	Good Quality	Medium Quality	Poor Quality
Complete Weed Control	30	40	30
No Weed Control	2	30	68

The reasons for the difference between treatments is not immediately apparent. The chemical composition of leaves harvested in July, 1991 from both treatments is given in Table 4. While there was some evidence of lower mineral content in the no weed control trees, the differences were not large. It is difficult to imagine growth being retarded by nutrient deficiency in such high fertility soils.

Table 4: Chemical composition (g/kg) of leaves of *F. excelsior* taken in July 1991.

	N	P	K	Ca	Mg
Complete Weed Control	3.0	.23	.82	1.7	.79
No Weed Control	2.6	.20	.74	1.4	.74

Marshall and Holmes (1979 and Tabbush (1984) reported that drought can restrict tree growth and suggested that trees in bare soils will suffer less drought stress whenever evaporation exceeds rainfall during the summer. Table 5 summarises data on rainfall and soil moisture deficits during the growing seasons on 1989, 1990 and 1991. There was a severe soil moisture deficit for most of the establishment year. There was also low rainfall in 1990. This suggests that lack of moisture may have been the main reason for the lack of growth in the no weed control plots.

Table 5: Climatic parameters in 1989, '90 and '91.

	1989		1990		1991	
	Rain (mm/day)	S.M.D. (mm)	Rain (mm/day)	S.M.D. (mm)	Rain (mm/day)	S.M.D. (mm)
April	4.1	0.8	0.7	30.8	3.0	11.7
May	0.2	51.8	1.2	72.1	0.4	48.3
June	2.1	77.5	27	59.6	3.1	62.5
July	0.7	91.1	1.4	49.7	2.1	62.9
August	2.5	78.0	1.3	82.9	0.9	62.9
September	1.2	58.2	1.3	78.2	3.8	73.9

The results from this trial, suggests that weed control is vital for the rapid establishment of *Fraxinus excelsior*. A trial that was planted in 1990 at Johnstown Castle is examining degree of weed control in more detail. The results after the first season's growth suggests that weed control in the immediate environs of the tree may result in better growth rates than either no weed control or complete weed control. Results of this trial will be published in more detail in due course.

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