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LIFTING TIMES FOR LARCH ESTABLISHMENT, by Helen McKay and Bobby Howes

Abstract

We have summarized six experiments planted between 1990 and 1992 in which bare-rooted larch were lifted at intervals through the winter and either cold-stored at +1°C until April or planted directly on second-rotation cultivated sites on the North Yorkshire Moors. Based on these experiments, the strategies giving maximum survival and height growth are:

- direct planting of larch lifted during the last two weeks in October and during March; and
- cold-storage of stock lifted between mid-November and mid-March with planting in early April.

Larch should be undercut and wrenched.

Introduction

1. In recent years survival of larch after planting on restock sites has been unsatisfactory, with surveys showing losses of up to 50%. Tabbush (1988a) estimated the discounted cost of 60% survival rather than 100% initial survival as £350 per hectare (1987; includes cost of beating up, weeding, reduction in felling revenue and delay in revenue). Larch, traditionally, have been recognised as species that are sensitive to cold storage and difficult to establish. Aldhous (1964, 1972) concluded, on the basis of experiments with Japanese larch seedlings, that larch was not suitable for long-term cold storage (two-year-old stock was not examined).

2. This Note outlines the results of a series of experiments set up to investigate the effect on larch performance of the time of lifting for both cold-storage and direct planting. In all cases the plants were two-year-old, bare-root stock from Wykeham nursery; they were stored in black and white polythene bags in a direct cold-store at +1°C, and planting sites were cultivated, second-rotation sites in the North Yorkshire Moors. The majority of experiments used undercut and wrenched Japanese larch, sometimes in comparison with transplant stock. Hybrid larch (Japanese x European) was studied in a few experiments.

Experimental outlines and results

Cold-storage

3. Undercuts and transplants of Japanese larch were lifted on nine occasions between October 1989 and March 1990 and cold-stored until 4 April. Survival and height increment were assessed after two growing seasons. The practice of undercutting and wrenching improved survival (see Figure 1). Storage of undercut stock in early October resulted in poor survival and growth but storage from mid-October onwards gave satisfactory survival (> 80%) and height growth. Undercuts lifted in mid-November and January had survivals of 93–94%. The survival of transplants was generally poor (< 50%) and was > 80% on only one occasion (early January).

4. Undercut Japanese larch were lifted on eight occasions the following year (13 November 1990 to 12 March 1991) and planted on 5 April after cold-storage. The results confirm that excellent survival of Japanese larch was possible following storage on a wide range of dates (see Table 1).

5. Japanese and hybrid larch undercuts were lifted for cold-storage on eight occasions between 29 October 1991 and 17 March 1992. Hybrid larch had slightly greater overall survival (83% vs 77% of Japanese larch) but poorer height growth (7.7 cm vs 10.7 cm) (see Table 2). Hybrid larch had satisfactory survival generally but mortality was > 20% when it was stored on 10 December and 4 February. Survival of Japanese larch varied from 65 to 90% but was greater than 80% on 12 November, 7 January and 3 March.

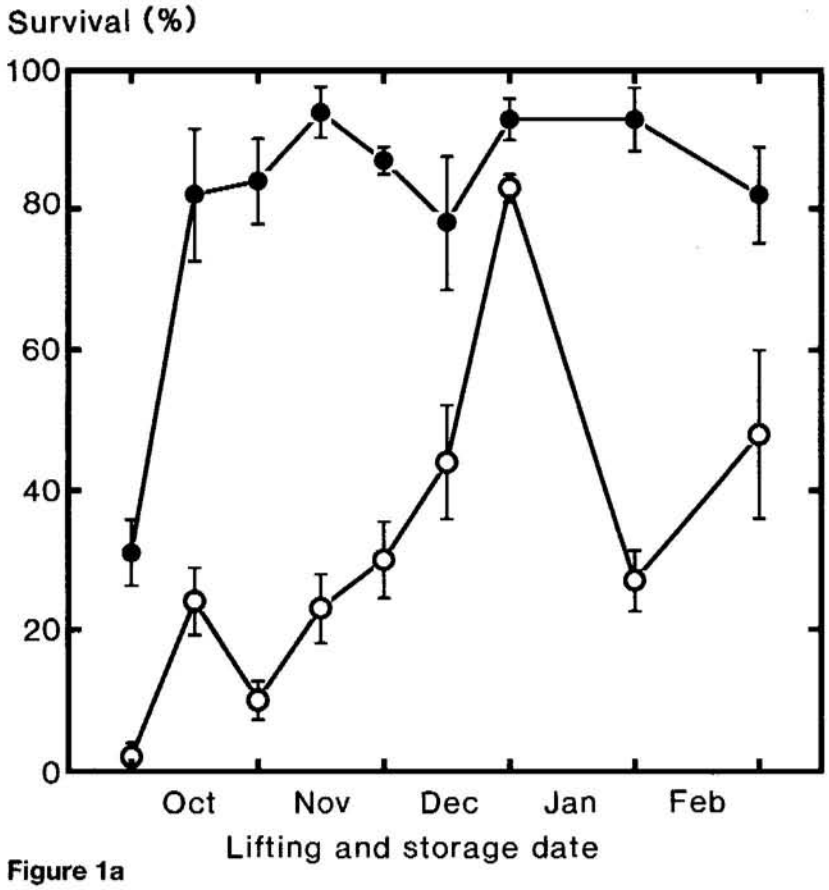

Figure 1a

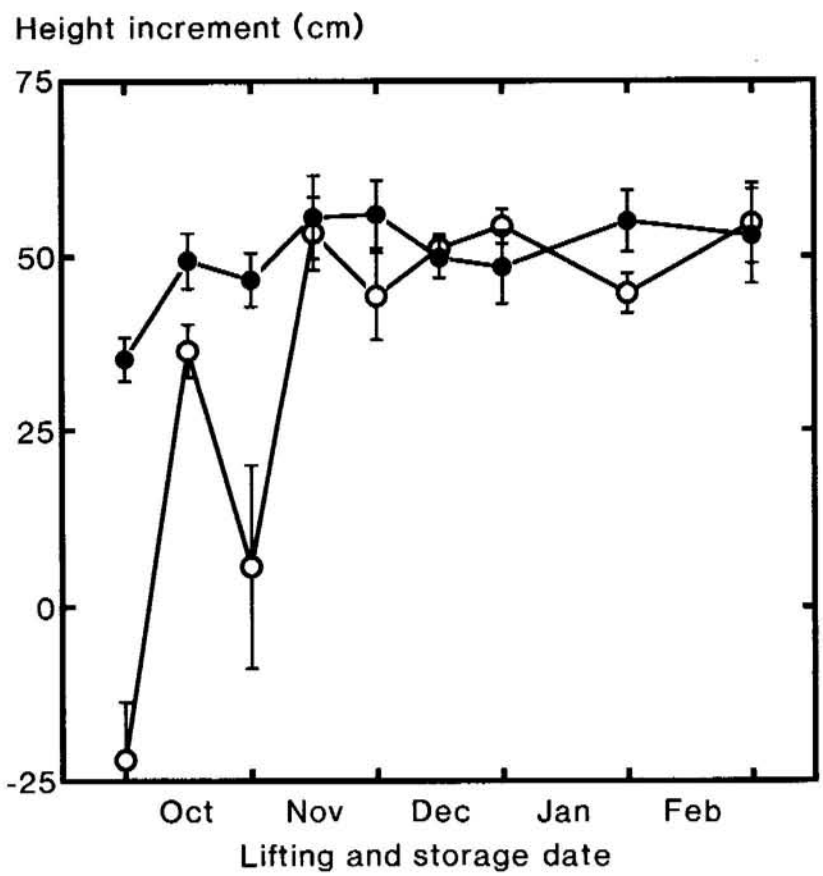

Figure 1b

Figure 1: Survival (a) and height increment after two growing seasons (b) of Japanese larch undercuts (●) and transplants (○) cold stored at intervals during the winter and planted in April, 1990. Vertical bars represent ±1 standard error.

Table 1. Survival and height of Japanese larch planted on 5 April 1991 after two years, following cold-storage at +1°C beginning on different lifting dates

Assessment	Lifting and storage								
	13 Nov	27 Nov	11 Dec	2 Jan	15 Jan	29 Jan	26 Feb	12 Mar	SED
Survival (%)	93	92	92	95	89	95	95	96	4.0
Height (cm)	119	110	115	118	107	110	106	126	7.1

Notes: Height at planting averaged over all dates was 38 cm.
SED is the standard error of the difference of means.

Table 2. Survival and growth of Japanese and hybrid larch planted on 4 April 1992 after one year, following cold-storage at +1°C beginning on different lifting dates

Species	Assessement	Lifting and storage date										
		29 Oct	12 Nov	26 Nov	10 Dec	7 Jan	4 Feb	3 Mar	17 Mar	SED		
										1	2	3
Japanese larch	Survival (%)	65.0	85.0	77.0	68.0	83.0	78.0	90.0	73.0	3.6	6.7	9.6
	Height increment (cm)	8.3	8.2	10.6	11.9	9.5	8.2	13.6	15.5	0.7	1.8	2.5
	Diameter increment (mm)	2.1	2.0	2.5	3.1	2.4	2.2	2.9	2.9	0.2	0.4	0.5
Hybrid larch	Survival (%)	82.0	81.0	90.0	76.0	85.0	78.0	90.0	80.0	3.6	6.7	9.6
	Height increment (cm)	4.9	7.8	7.7	6.0	8.5	8.9	9.1	8.6	0.7	1.8	2.5
	Diameter increment (mm)	1.9	2.1	2.0	2.3	2.1	2.2	2.5	2.3	0.2	0.4	0.5

Notes: SED – standard error of the difference of means:
of 1 – species
of 2 – lifts
of 3 – lifts and species

6. Japanese larch from Wykeham production nursery were compared with research stock; the undercutting and wrench regimes possible in the production nursery are less intensive, i.e. involve less frequent root disturbance, than those used to raise research stock. Plants were lifted on three occasions (12 November 1991, 7 January and 17 March 1992) and planted on 14 May and 8 June after extended cold-storage. First year survival of plants from both regimes was good (87%) on all lifting dates even after seven months' cold-storage, and there were no significant differences between stock types, lifting dates or planting dates.

Direct planting

7. In 1990, undercut Japanese larch were lifted and planted within 24 hours, at fortnightly intervals from 4 September until 11 December. Survival of stock lifted in early September was poor (see Table 3).

Table 3. Survival and growth of Japanese larch after two years when lifted and planted directly (1990)

Assessment	Lifting date								
	4 Sep	18 Sep	2 Oct	16 Oct	30 Oct	13 Nov	27 Nov	11 Dec	SED
Survival (%)	34	58	92	100	93	94	73	86	14
Height increment (cm)	77	79	93	90	81	70	57	68	14
Diameter increment (mm)	10	9	12	12	11	11	10	12	1.5

Note: SED is the standard error of the difference of means.

However survival improved during the month to reach excellent levels in October and early November with 100% survival in mid-October. There was a slight decrease in survival of stock lifted in late November and December. Maximum height growth occurred in stock lifted in October.

8. The following year, undercut Japanese and hybrid larch were lifted on 11 dates between 1 October 1991 and 31 March 1992 for direct planting. On all occasions except 31 March, hybrid larch had slightly better survival than Japanese larch, although the difference was only significant on the first lifting date (see Figure 2). The survival of both larches followed a double peak pattern. In early October survival was poor but increased sharply during the month reaching > 90% in late October. Survival decreased during November and remained at 60 - 70% during December, January and February. The second period giving satisfactory survival was in March.

Cold-storage vs direct planting

9. Cold-storage and direct planting can be compared in two series of parallel experiments. In both 1990 and 1991–92, plants were taken from the same nursery bed and either planted immediately or cold-stored for planting in April on an adjacent site. Over most of the winter, survival of cold-stored larch was better than that of directly planted stock but, in October and mid-March, freshly-lifted stock had greater survival than cold-stored stock.

Discussion

10. The double peak pattern of larch survival following direct planting matched its cycle of root growth potential (RGP) (McKay, in preparation). Hybrid larch transplants had a similar RGP cycle with high values in autumn and spring and lower values in winter (Mason et al., 1990). The RGP pattern of larch differed from that of evergreen conifers, which have high RGP in winter with a single peak between December and February (Ritchie and Dunlap, 1980; Tabbush, 1988b; McKay and Mason, 1991). During December, January and February, regeneration of larch roots was extremely slow, even in favourable growing conditions and even though the root system was undamaged (as indicated by root electrolyte leakage and triphenyl tetrazolium chloride tests). Consequently, larch planted in mid-winter were dependent on their existing root system, with almost no new roots to provide anchorage and supply water and nutrients until March.

11. Larch raised by precision sowing, undercutting and wrenching were able to tolerate storage at +1°C for five months with satisfactory second-year survival and growth. Stock could be lifted on a wide range of dates (mid-November until March) for planting in early April with satisfactory results. Other experiments suggest that long-term storage of larch is best between mid-November and January (McKay, 1993). These exact levels of survival cannot be expected on all sites in all years.

12. Transplants had poorer survival and growth than undercuts – this is attributed mainly to the poor development of their fibrous root system but also to the slightly poorer quality of fine roots (McKay, 1992).

13. The survival of cold-stored stock was generally better than that of directly-planted stock except when RGP was at its maximum (mid-October and mid-March).

14. Direct planting in autumn, though possible, has risks attached. The time associated with satisfactory survival may be limited to a few weeks (e.g. in 1991–92) and the exact timing may vary from year to year. Furthermore, the width and timing of the autumn peak may vary from nursery to nursery, and the optimal time for lifting at the nursery need not coincide with the most suitable time for planting in the field.

Conclusions

15. Cold-storage of Japanese and hybrid larch at +1°C gave satisfactory survival rates when lifted to storage on a wide range of dates (mid-November, possibly October, to March) for planting in April. Survivals after one growing season of > 90% were possible when stock was planted in May and June following storage beginning in November to early March.

16. Satisfactory survival of directly-planted stock was possible in October and March, but survival and growth were significantly poorer in the intervening months. The optimal planting time in October was variable from year to year.

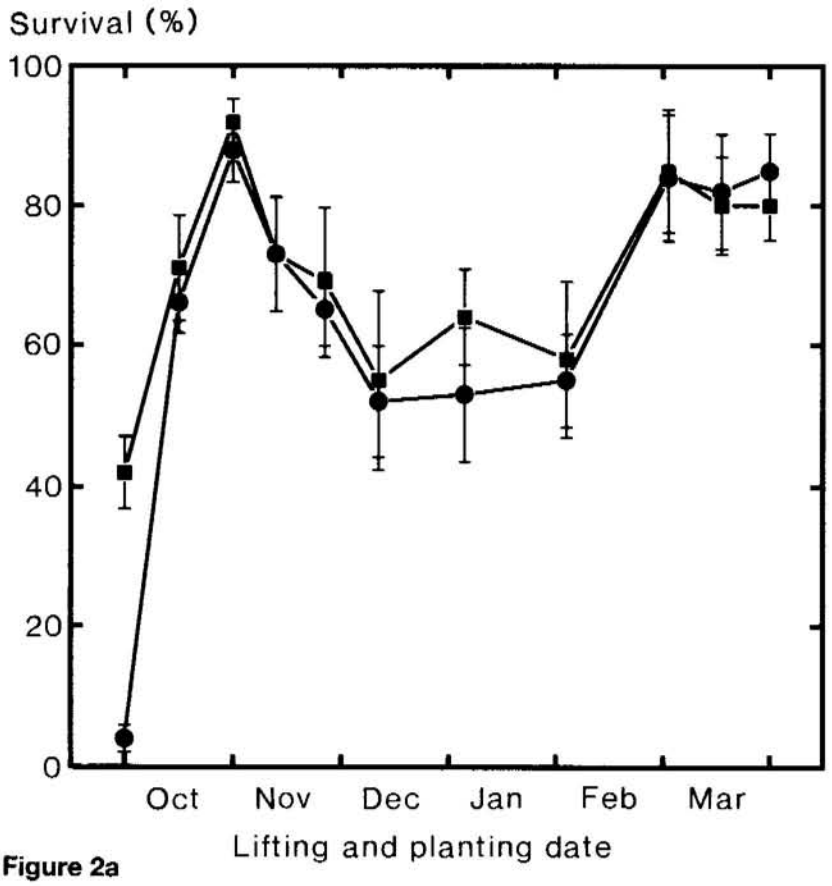

Figure 2a

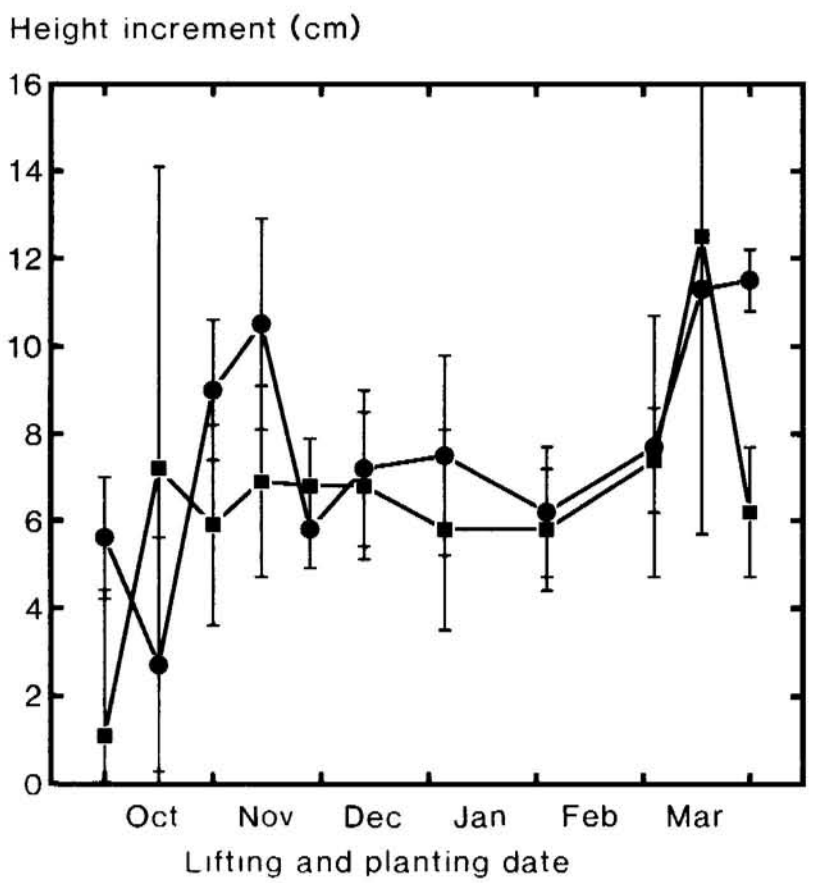

Figure 2b

Figure 2: Survival (a) and height increment (b) after one growing season of Japanese larch (●) and hybrid larch (■) undercuts planted at intervals during the winter of 1991–92. Vertical bars represent ±1 standard error.

17. Undercutting and wrenching improved the performance of larch and is therefore recommended.

18. Hybrid larch had a slightly better survival than Japanese larch in both cold-storage and fresh lift experiments.

Acknowledgements

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