

INFORMATION NOTE

ODW 10.01



FOREST GROUND PREPARATION

Introduction

This Information Note is one of a series that has been produced as a guide to effective tree protection and good weed control operations that are necessary to establish and maintain a successful woodland.

Outdoor Workshops (ODW) are a Technical Development Branch (TDB) initiative designed to offer practical advice to practical people through presentation, demonstration and user guidance. The ODW programme will involve repeating trials and introducing new systems throughout Great Britain so that a wide range of sites, systems and practitioners can be included.

Information has been gathered from equipment and method trials based at a number of locations. This information must be taken as indicative only. Variation could be expected for other operations where factors such as terrain, product specification or operator efficiency differ

General

Ground preparation (Plate 1) is undertaken on new planting and restocking sites to aid tree establishment. Usually it involves some form of cultivation although this is not always the case (eg brash raking or weed control on brown earth sites). However, cultivation is generally recommended as best practice for establishment of trees on all soil types. Ground preparation operations include dealing with harvesting residues, pre-establishment weed control and soil manipulation for drainage, to break up pans and for cultivation. It is a generally accepted principle that the objectives of ground preparation should be achieved with minimal site disturbance.

This Information Note should be read in conjunction with FC Bulletin 119 (Cultivation of soils for forestry), FC Research Information Note 288 (Cultivation of lowland sites for new woodland establishment) and FC Guidelines, *Forest and Soil Conservation*.

Plate 1

Excavator Mounding



Principles and Benefits

Principles: Ground preparation is undertaken to aid efficient and economical tree establishment. The key principles are:

- To establish a formal system on the ground including where necessary removing obstacles. This improves the effectiveness of establishment and subsequent maintenance operations.
- To improve survival and growth of young trees by manipulating localised site characteristics.

Benefits: The benefits of ground preparation are shown in Table 1.

Table 1

Benefits of Ground Preparation

Operational	Silvicultural
Management of residues enabling whole area to be planted (restock sites). Imposes site discipline allowing correct spacing and stocking. Improved site access.	Improved soil temperature regime. Improved localised drainage (around the planting position). Improved moisture availability (on dry sites). Increased soil aeration. Faster nutrient mineralisation. Reduced soil compaction. Reduced weed competition. Improved survival and growth.

Ground preparation may also provide longer term benefits:

- Cultivation to improve rooting depth and crop stability.
- Harvesting benefits as a result of improved site discipline

Treatments, Methods and Machines

Options: Ground preparation treatment, method and machine options are shown in Table 2.

Selection: A number of factors should be considered when selecting ground preparation treatments, methods and machines (Table 3).

Table 2

Ground Preparation Options

Operation	Treatment	Method	Machine
Cultivation	Scarification	Disc trenching Screefing	Disc trencher Patch scarifier, excavator
	Subsurface Treatments	Moling Subsoiling Ripping	Continuous moulder/moler, moler/D6 Subsoiler/D7, subsoiler/tractor >200 hp Winged ripper/D7
	Mounding	Continuous Spot Trench	Continuous moulder Excavator Excavator
	Ploughing	Deep tine Shallow tine Complete Agricultural	Deep forest plough/D6 Shallow forest plough/D4 or D6 Any plough Modified agricultural plough/tractor
Residue Organisation	Residue Organisation	Windrowing Rearrangement Piling	Excavator, tractor/blade, continuous moulder Disc trencher Excavator, tractor/rake or blade
	Residue reduction	Burning Flailing	Excavator, tractor/blade Tractor/flail
Weeding	Chemical	Spot Band Total	Knapsack, drench gun Knapsack, drench gun, tractor/sprayer Tractor/sprayer, aerial/sprayer
	Mechanical	Spot Strip Total	Clearing saw Clearing saw, tractor/mower, tractor/flail Tractor/mower, tractor/flail
	Manual	Spot Band	Hand tools Hand tools

Table 3

Considering System, Method and Machine Selection

Consider	Factor	Notes
Constraints	Environmental	Refer to Forest Water Guidelines, UK Forest Standard and UKWAS
	Archaeological	Refer to Forest Archaeological Guidelines
	Recreational	Refer to Forest Recreation Guidelines
	Conservation	Refer to Forest Conservation Guidelines
Silvicultural	Planting stock	Consider species moisture and frost tolerance etc, and physical elements such as size
	Soil type	Identify soil type from soil maps, important to identify local variation by digging rapid soil pits
Operational	Size of area	All will affect system, method and machine choice. Consider brush raking and drainage requirements etc On sites with complex soil patterns may need to compromise method
	Terrain	
	Machine availability	
	Access	
	Costs vs. benefits	
	Residues	
Other operations		

Timing: The timing of ground preparation operations is crucial to ensure silvicultural benefits are maximised while environmental impact is minimised. The following guidance notes summarise the key considerations when planning operations.

General

- Ground preparation should be undertaken during dryer periods (spring, summer or autumn) - in very wet weather there is potential to:
 - Seriously increase erosion and water run-off.
 - Damage soil structure.
- There may also be potential to damage soil structure in very dry weather - drought conditions.
- Sites with potential weed problems can be considered for cultivation during the autumn. This will minimise weed colonisation before planting.
- Generally leave at least 2 months before planting to allow cultivation to settle.
- Rapid restocking can be useful to pre-empt anticipated weed problems, but consider the point above.

- Brash will degrade over time making it easier to handle and also making cultivation easier.
- On restock sites where severe weevil damage is anticipated (e.g. ex lodgepole pine) a period of fallow (e.g. 5 years) may be useful to allow the weevil populations to decrease before planting.
- Harvesting programmes should be considered but should not compromise the environmental soundness of ground preparation operations.

Specific

- Moling operations are only effective in dry conditions.

Outline Prescriptions

Ground preparation prescriptions are generally dictated by soil type. However, some operations such as brash management may be required regardless. General prescriptions for each soil type are shown in Table 4 based on the recommendations in FC Bulletin 119.

Table 4

Ground Preparation Prescriptions

Soil Type	Objective	Best Practice	Acceptable Alternative
Brown earths	To create a weed free planting site, to avoid activating the soil seed bank, to provide frost protection especially on flat inland sites with grassy sward and to impose a discipline on the site	Shallow scarification Shallow mounding	Shallow agricultural ploughing for improved grassland Weed control only on freely draining sites
Podzols	To achieve a light surface mixing of soil and humus, to break up the compacted horizon or hardpan and provide weed suppression.	Spaced tine ploughing	Deep scarification Shallow agricultural ploughing for lowland podzols Scarification for restock sites
Ironpan soils	To aerate and mix the organic horizon and also to extensively disrupt the compacted horizon and ironpan	Mounding and ripping Spaced tine ploughing Deep scarification (if ironpan is weak or discontinuous)	Mounding or scarification (restock sites that have previously been subsoiled only)
Gley soils (inc surface water gleys and peaty gleys)	To provide a raised planting position and lower water table if possible, creating conditions for symmetrical rooting. Weed suppression and frost protection are also important	Mounding/moling for relatively stone free soils with a loamy texture Mounding/subsoiling for other soils.	Mounding alone is acceptable if slope < 3° or if a restock site Note: An open drainage system is usually required on these soils.
Deep peats	To provide a raised planting position and lower the water table if possible	Shallow spaced ploughing Mounding (restock sites only)	Drain mounding Mounding Note: An open drainage system is usually required on these soils.

Output and Cost

Outputs for any ground preparation operation are subject to site conditions. In particular the effect of the following should be considered:

- *Terrain* - Difficult terrain with obstacles will reduce outputs. Steep sites will restrict machines such as scarifiers and continuous mowers to 1 way working which will also reduce outputs.
- *Brash type and density* - Dense or poorly presented brash will reduce outputs.
- *Stumps* - The presence of stumps will restrict the performance of some machines, especially those which rely on continuous machine movement for cultivation.

- *Run length* - Short runs will reduce outputs for most machines.
- *Ground preparation intensity* - The intensity to which cultivation is required (spacing etc) will affect output per hectare.

Existing Technical Development Branch output and cost data is shown in Table 5. All outputs are shown as hectares/Standard Hour (ha/shr). A shr includes allowances for rest and other work such as refuelling. The table also shows typical machine hourly charges.

Table 5
Existing Output and Cost Data

Machine	Method	Output (ha/shr)	Cost (£/ha)	TDB Report	Notes
Excavator	Brash rake	0.13 - 0.18	120 - 170	R21/91	Upland clearfell conifer site, 21 tonne excavator @ £22/hr.
	Brash rake and mound	0.08 - 0.1	220 - 275		Output depends on % brash cover.
	Brash rake	0.13	130	TN 37/98	Lowland broadleaved clear fell site, 14 tonne excavator @ £17/hr.
	Hinge mound	0.10	170		Output depends on % brash cover.
	Ditch mound	0.107	205	R14/91	Upland clearfell conifer site, 21 tonne excavator @ £22/hr
Wheeled Digger	Brash rake	0.102	154	R14/91	Lowland broadleaved clear fell site, JCB Sitemaster @
	Hinge mound	0.05	310		£15.63/hr.
Mini-digger	Brash rake	0.072	225	R14/91	Lowland broadleaved clear fell site, 3 tonne excavator @ £16.25/hr.
	Hinge mound	0.037	440		
Walking Excavator (steep sites)	Brash rake and mound	0.05 - 0.12	250 - 600	R15/91 & R2/93	Upland clear fell conifer site, 24%-82% slope, approx. 7 tonne excavator @ £30/hr.
	Brash rake and screef	0.04 - 0.08	375 - 750	R19/93	
	Mound	0.05	720	TN3/94	
Purpose Built Scarifier	Scarify	0.23 - 0.81	40 - 140	R6/93	Upland conifer restock site, slope 15%-35%. Donaren 280 @ £32/hr. Lower outputs indicate 1 way working and dense brash cover requiring 2 passes.
Forestry/ Farm Tractor with Basic Attachments	Brash rake and scarify	0.08 - 0.13	120 - 200	R21/93	Lowland conifer restock site, slopes up to 50%, County tractor with TTS 10 scarifier or similar @ £16/hr. Lower outputs indicate 1 way working and dense brash cover
	Scarify	0.16 - 0.37	100 - 40	NA	requiring 2 passes.
	Windrowing	0.13 - 0.18	80 - 110	R21/93	County tractor with logging blade @ £14/hr or logging blade and plough @ £15/hr or Ulvaforest sprayer @ £16/hr. On a lowland conifer site, slopes up to 50% with heavy bracken. For ploughing higher outputs are for 2 way working.
	Windrow and plough	0.06 - 0.11	140 - 250		
	Chemical weeding	0.088	180		
	Flailing strips	0.04 - 0.06	600 - 900	TN 37/98	Lowland broadleaved clear fell, Unimog with flail @ £37.50/hr.
	Flailing windrows	0.17 - 0.28	130 - 220		Lower outputs for 2 passes - 1 way working.

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Technical Development Branch

Develops, evaluates and promotes safe and efficient equipment and methods of work, maintains output information and provides advice on forest operations