SITE PREPARATION TECHNIQUES FOR SOFTWOODS IN AUSTRALIA

by:

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The purpose of site preparation is to create favourable microsites for the successful establishment and subsequent growth of forest tree seedlings.

In Australia site preparation techniques may include one or more of the following methods; manual, mechanical, chemical or controlled natural processes (as burning).

Understanding the basic intent of each site preparation method and the appropriate site preparation methods in the sequence of forest operations will ensure that a successful commercial crop is produced.

The sequence of forest operations in P.radiata plantations is:

Clearfelling Extraction	0-2 years
Site preparation & establishment Growth	3-10 years
Maintenance Thinning	11-30 years
Clearfalling	

Although there is a great integration of silviculture and harvesting techniques in the forest operations of P.radiata plantations, to-day's economic constraints often lead to an overemphasis on production and short term costs as related to site preparation, rather than the biological requirements for seedling survival and maximum growth.

It takes some years before the biological/economical results of planting operations can be assessed and compared to the technical/economical results in logging operations which can practically be assessed in a short period.

Have you as a manager, responsible for plantation establishment, pre determined the minimum quality of microsite that you are willing to accept within acceptable cost limitations?

Five years from now, would the results of your efforts be a healthy vigorously growing stand or an unacceptable forest slum?

Site Preparation Techniques

In Australia, four types of site preparation techniques based on the end result are recognised. Table 1 compares each technique in relation to the following factors:

Equipment type; production rate; microsite quality; microsite spacing; slash treatment; drawbar pull; mobility; manipulation required by operator; planting access and effect on tree growth.

H. Bax used similar criteria to compare site preparation techniques in Canada.

(a) Manual

Cultivation of the soil is done by a mattock (pick), or shovel, removing the turf layer and then cultivating the soil below for a depth of 25 to 40 centimetres. Planting and subsequent weedicide and fertiliser applications are done by hand. In Australia these methods are reserved for areas which are too steep (over 20 degrees slope) for mechanical cultivation.

Examples of this can be seen in the Strzeleckis in S.E. Victoria or at Myrtleford in N.E. Victoria.

(b) Mechanical

Seven primary classifications of site preparation equipment can be identified.

1. Patch Scarification

The scarifiers in this class are designed to produce intermittent patches of exposed mineral soil. The intermittent scalping action can be produced mechanically via chain driven mattock wheels as in the Bracke Scarifier or through hydraulics as in the Leno Scarifier.

A Bracke Scarifier has recently been introduced into South Australia.

2. Furrow Scarification

Furrow scarification creates continuous furrows in one or more parallel rows. Often, long narrow patches are produced rather than continuous furrows due to the slash, stumps and racks present on sites. The single furrows do not exceed one metre in width.

Discs

Disc trenchers cut furrows with toothed discs which are placed at an angle to the direction of travel. The more angled the disc, the wider the furrow. For example, the TTS disc trencher, single or double fire ploughs commonly use serrated or smooth discs.

Multiple arranged discs (Rome) completely till the soil across the whole surface. Examples can be seen in the Mt. Gambier region, S.A.

Front Mounted Attachment

Front mounted on the prime mover blade, the teeth or rakes are designed to create parallel furrows whose width and depth are controlled by the height of the blade held over the forest floor, e.g. Youngs teeth, blades rakes.

3. Blading or Raking

A ditched or bladed area is produced across the soil surface usually with a pronounced windrowing effect. Little or no mixing occurs except in the windrow. It is more than one metre in width. The equipment is designed to cut, shear or pull out competing vegetation, slash or stumps.

Examples are - V blades
Shear blade
C & H plough
Marttinni plough

This technique is little used in Australia.

4. Ploughing

Scarification devices which incorporate the use of a mould board which cuts into a section of soil vertically and overturns that section of soil.

An example is the agricultural plough such as Conner Shea.

5. Crushing, Chopping, Mulching, Discing

Equipment primarily designed to treat the existing vegetation present on a cutover site. The vegetation and debris can be shredded, cut, crushed, chopped or disced and to varying degrees may be incorporated into the soil.

Examples include the Marden Chopper Roller in Southern Victoria and the Hydro Ax seen in South Australia.

6. Mounding

These scarifiers are designed to provide individual elevated microsistes consisting of a mixture of soil and organic matter. In Australia they are used to incorporate organic matter into the soil profile, provide drainage on wet sites, and reduce erosion. Mounds are placed at approximately three metre intervals, aligned to the topography (1 to 2 degree fall to facilitate drainage). The tops of the mounds are 30 to 50 centimetres above ground level, which

allows the soil in the mounds to drain freely.

7. Ripping

On heavy soils, compacted sites or steep areas, deep ripping is beneficial. Deep ripping along planting lines on the contour will minimise erosion, trap moisture, shatter hard pans if they are within 40 to 80 centimetres of the surface and this will improve drainage of the sites and improve wind firmness. 'Wings' have been fitted to the tip of the ripper shanks to increase the shatter zone which in turn provides more soil for tree roots to explore. Some rippers have had bedding discs attached to the ripper. These bedding attachments cultivate the top twenty centimetres of the ripline removing air pockets and providing a better site for the initial establishment of the seedling.

Examples of ripping can be seen in the Strzeleckis in southern Victoria.

(c) Chemical

Depending on the grass spectrum, pasture sites being afforested are applied with weedicide to remove grass competition. Weedicides can be applied by hand held spray guns or tractor mounted or trailer towed spray units.

Cultivation of the site can be done before or after chemical treatment.

Examples of this technique can be seen in Southern Victoria on pasture sites where areas are ripped then weedicide applied prior to planting.

(d) Controlled Natural Processes

Burning of slash

On very steep slopes (over 20 degrees) an intense slash burn in the autumn following logging is carried out. This is followed by hand planting.

Examples of this can be seen at Myrtleford in N.E. Victoria.

Fallow/Grazing

Ideally if land can be allowed to fallow after clearfalling to allow slash to break down, grazing animals such as goats can be introduced to control other vegetation.

Examples of this can be seen in Southern, Victoria.

Cultivation is normally carried out prior to planting.

DISCUSSIONS

The sites on which Pinus radiata plantations are established in Australia are in the south east, and south and south west. Soils range from sands to clay loams, often of only moderate fertility by agricultural standards, and the average rainfall may be less than 800mm per annum. These areas are characterised by summer drought, high solar radiation, high air temperatures and low atmospheric humidities.

Of the many forest soil characteristics, organic matter content is one of the most important for plantation establishment. Organic matter improves soil structure, increases soil porosity and aeration and most importantly for sandy soils increases the moisture holding capacity and ability to hold and exchange nutrients.

In agriculture in Australia the result of our blind acceptance of overseas technology has in fact led to a severe deterioration in the fertility of many of our soils in little more than 100 years. In spite of this we have still only a passing interest in massive and continuing soil erosion (wind and water), while we have little interest in the rapid development of infertility due to compaction, lack of nutrients and salinity.

Many people think that our yields are retarded due to rainfall but this is not true. Even with adequate water our plant yields do not equate with those obtained in Europe and America.

If we apply the corollary to our yields from forest sites unless we employ the best soil management techniques, lower productivity of our forest lands must occur. Techniques which remove organic matter off site such as windrowing of slash; scalping of top soil (displacement of top soil along the planting row) and burning of slash, with the subsequent loss of nutrients will have such a marked effect on subsequent tree growth that growth rates may be more than halved.

Rapidly, the international wood trade is becoming dependent on plantation forestry or second growth natural forest for its wood supply. Insufficient provision is being made for reafforestation for a continued wood supply. The consequence of this inadequate reinvestment is becoming apparent and we may see a desperate situation developing in communities dependent on the forest based industries.

Foresters must employ the best site preparation techniques which will increase the productivity of our forest land such that investment will be directed back into the forest estate.

Harvesting machinery must be designed which will allow the best site preparation techniques to be practised. This implies working along the contour, mulching the slash on site and cutting stumps level with the ground surface. This last requirement will require

wood using industries to develop equipment capable of handling the butt flare which will be present on the first and therefore the biggest log from each tree.

REFERENCES

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Bax, H. RPF Design use and maintenance of site preparation equipment. Canadian Forest Industries, July, 1985.

Ezell, A.W. and Arbour, S.J. Long term effects of scalping on Organic Matter Content of Sandy Forest Soils. Tree Planter Notes Vol. 36 No. 3, 1985 US Dept of Agr Forest Service.

Site Preparation Techniques	Manual	Mechanical								Chemical	Burning
Equipment Type	Pick/ Mattock	Patch Bracke Scarifier	Furrow TTS Disc Trencher	Furrow Multiple Disc Rome	Blading/Raking V Blake	Ploughing C&H Plough	Crushing Marden Chopper Roller	Mounding Rome bedding plough	Ripping		
Production Rate	0.08ha/hr	0.7ha/man hr 0.9ha/machine hour	0.85ha/man hour 1.10ha/ machine hr		0.19ha/man hr 0.35ha/machine hour	0.20ha/man hour 0.41ha/ machine hr	0.85ha/man hour 1.04ha/ machine hr	0.73ha/ man hr 0.86ha/ machine hr	0.27ha/man hr 0/55ha/ machine hr	0.6ha/man hr 1.29ha/ machine hr	
Microsite Quality (Cultivation effect)	Operator Sensitive Shallow Cultivation	Mineral soil exposed. No cultivation	Bears mineral soil furrows created width variable	Complete till of soil surface if no slash	Poor. No cultivation effect	No cultivation effect only exposes mineral soil	No Cultivation effect	Excellent Cultivation	Excellent especially if wing & bedding discs attached	No Cultivation at all	No cultivation at all
Microsite Spacing	Operator Sensitive	Good	Good Length variable		Nil	Good.	Nil	Good	Good	Good	Nil
If second rotation slash treatment	Nil	Windrowing of slash	Slash location effects furrow quality	Little tillage effect if slash over whole area	Pronounced windrowing effect	Poor if slash present	Complete maceration of slash	Complete incorporation of slash & top soil layers	Able to cultivate beneath slash	No effect	Complete removal off site.
Drawbar pull	N/A	Skidder 140HP	Skidder 140HP	Medium to large skidder	D7 track type machine 150-200HP	D7 type 150-200HP	D8 type 300HP	D7 type 150-200HP	D7/D8 type 200-300HP	Small tractor 90-120HP	Nil
Mobility	N/A	Highly mobile	Mobile if provision made for lifting	Mobile if provision made for lifting	Portable	Fair	Poor	Good	Good	Good	Nil
Manipulation required by operator	Operator sensitive	Independent other than forward speed and maintenance	Relatively independent of operator	Relatively independent of operator	Operator sensitive	Close monitoring by operator	Little	Relatively independent	Operator sensitive	Very operator sensitive	Nil
Planting Access	N/A	Hindered due to slash accumulation	Fair	Fair	Poor	Good	Poor	Good	Depends on slash quantity	Depends on slash quantity	Good
Effect on Growth Rate	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Improved	Improved	Need cultivation treatment as well to capture all benefits	Degrade site quality
Location	Gippsland Victoria	South Australia	Not in Australia	South Australia	Not common in Aust.	Not in Australia	Rennick Victoria	Gippsland Victoria	Gippsland Victoria	Gippsland Victoria	Myrtleford NE Victoria