Weed Control in Australian Pine Plantations

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Weed control has always been an important and expensive part of conifer plantation management in Australia. The subject is assuming even greater importance at the present time because of the trend toward shorter rotation lengths and the need to maximise productivity on a very limited land base.

The principal justification for controlling weed competition is the loss in increment, and therefore financial return, caused by diversion of part of the growth potential of the site into undesirable species. Subsidiary reasons for controlling weeds are to improve pine plant survival under some conditions, to improve access, to reduce physical malformation of the pines and to reduce the fire hazard.

Forestry organisations in Australia spend some $1.2 million annually on weed control. In view of the magnitude of expenditure it is surprising very little economic analysis of the operation has been carried out. In one of the very few such studies published anywhere, Jack (1970) concluded the opportunity cost of removing woody weeds could be as high as $600 per hectare for medium quality sawlog-regime P.radiata in Victoria. He also found there was no opportunity cost of removing herbaceous weeds unless first year survival was less than 50% or more than one year's growth was lost.

There is an urgent need for extension of this work to a wider range of situations. For example it is likely the opportunity cost varies according to distance of a plantation area from the main market. Other related questions on which data are required are (1) how do timing and degree of weed control effect the level of crop response?,
(2) does crop growth following release from competition follow a trend parallel to that for crops still having competition?

Weed Control Techniques

In some favoured areas, such as cleared poor quality forest on the west coastal plain the preplanting ploughing operation provides adequate control of native weeds. In most Australian plantation areas, however, ploughing is not feasible or, as on grassland sites, it is ineffective for control of competition.

The most frequent approach is to use a herbicide for weed control. Table 1 (attached) summarises the position for those organisations whose members replied to the Secretary's circular on the subject. It is seen there is a large measure of agreement as to the type of weedicide and application rate, but some variation in method of application.

In grassland plantings the most frequently used herbicide is a mixture of atrazine and amitrol (Vorox AA), although some simazine is used also. These chemicals give good short-term control of annual broadleaf weeds and grasses, but for the deeper-rooted perennial grasses a translocated weedicide such as Dowpon or Weedozol TL is required. In W.A. Vorox AA has been used quite successfully as an overall spray postplanting to hold back a very vigorous couch/kikuyu/paspalum sward for a period of 3 months in spring. This check to the competition was sufficient to enable an 80 percent first year survival, compared with a virtually 100 percent death without Vorox spraying the previous year.

On sites cleared of native forest, where the principal weeds are native herb and scrub species and Eucalypt regrowth, there is general agreement that, in the preplanting situation, a foliar spray of 2,4,5-T butyl ester is the most useful tool. The only difference of opinion seems to be in the choice of solvent, ie, water or dieselene. The choice may be influenced by whether it improves herbicidal activity in the particular situation, but the use of dieselene increases the difficulty of controlling spray drift because of its lower specific gravity.

For postplanting control of weeds there is some diversity of approach. Coppice is controlled by basal spray or cut stump treatment with 2,4,5-T or Tordon injection or foliar spray, whereas low-volume foliar application of 2,4,5-T is generally used for scrub and herbaceous regrowth. Presumably differences in species susceptibility account for some of these variations.

Because of the risk of damage to the pines, mainly stem kinks and leader death, the postplanting foliar spray operation has to be performed with extreme care. Particular attention has to be paid to recent conditions as they influence bud growth, since some pines, such as P.radiata can be actively growing at any season of the year. The risk of damage is also related to the age of the crop. When one-year old P.radiata is involved less care is necessary as any damage at that age does not have a serious effect on tree stem form. Damage to two and three year

old pines would come at a more serious time in the life of the tree and must be avoided at all costs. In this situation it is safer to revert to basal spraying etc or consider the possibility of between-row cultivation, where this is feasible.

It must also be recognised that any postplanting overall 2,4,5-T spray will have a deleterious effect on pine growth, at least in P.radiata. In an extensive field trial in W.A. very good control of scrub was attained in this way, but the setback to the pines was such there was no growth benefit.

Herbicide Application Techniques

Reference to Table 1 indicates almost all forest organisations in Australia concentrate on overall low-volume spraying, either from the ground or from the air. The change in recent years from high-volume to low-volume techniques is in line with the general trend for mechanisation of forest work and, to some extent, greater cost consciousness. Aerial application is increasing in popularity as it offers the ultimate in productivity and low manpower requirement.

All low-volume methods have the disadvantages of increased danger of vapour or spray drift and require considerable expertise and close attention to weather conditions. Furthermore they are inherently wasteful, a large proportion of the chemical being entirely lost (see Norris 1971). Aerial spraying has its own problems, being not well suited to very steep country and presenting a particular hazard in the case of an emergency dump.

It is logical no organisation should confine itself to one technique only. Each weed control problem should be considered on its merits and the appropriate technique chosen. For example, there is no reason why high volume foliar spraying could not still be used under some circumstances where there might be a vapour drift problem or where the size of the job does not warrant an expensive aerial operation.

Future Trends

Three logical lines of future development present themselves:

(1) Develop new, more efficient chemicals. To the writer's knowledge none are in sight, and since the furore over the suspected hazards of 2,4,5-T we can be sure any new products will have even longer gestation periods than in the past. For the immediate future then, we would appear to have the choice of 2,4,5-T, picloram and the triazines.

(2) Use pre-emergent weedicides in all situations, eg, the triazine group, to prevent any weed growth in the first place. This approach is already under development and is very promising, although it may come under criticism from environmental organisations.

(3) Increase efficiency of currently used herbicides. On personal experience the environmental factor has a large influence on herbicide performance but the way it operates is obscure. There are several aspects which should be followed up such as influence of past growing conditions on plant susceptibility, effect of temperature and relative humidity, etc, at the time of spraying, the influence of different surfactant chemicals and the causes of variation in susceptability between species.

A somewhat different approach to application methods, and one which would seem to offer great promise is the electrostatic sprayer being developed at the University of Hong Kong. Should we advocate financing of this project by, eg, the Australian Weeds Committee, since it has wider prospects than forestry alone?

Moving now to a more personal view of the weed control problem in Australian pine plantations, I cannot help feeling we have become "hooked" on herbicides, to the exclusion of a potentially valuable means of weed control, namely controlled sheep grazing. Certainly there are situations where chemicals offer the only feasible method of controlling weeds, but it seems to me that if there is a possibility of using an alternative technique, the latter should be seriously considered. In the case of sheep grazing there is potential for obtaining weed control at no cost, or even at a profit depending on who owns the sheep, and at the same time making a further contribution to society.

TABLE 1. SUMMARY OF AUSTRALIAN WEED CONTROL PRACTICE

Organisation	Grassland Areas	Cleared Native Forest Pre plant	Cleared Native Forest Post plant
Western Australia	Vorox AA By air, boom or planter 2-3kg/ha	245-T 2-4kg/ha Lo-vol tractor (water) 0.2% hi-vol tractor	Basal spray 245-T 3-4%. Lo-vol 245-T 1kg/ha in water from tractor up to age 1.
South Australia	Vorox AA 3kg/ha Boom or spot or weedazol TL.	245-T 2-3kg/ha Boom, lo-vol or knapsack sometimes 24-D if required.	Cut stump 245-T.
Victoria	Vorox ± weedazol TL 2-3kg/ha Boom sometimes simazine 2kg/ha Boom	245-T 1 kg/ha in diesel by air.	245-T 1kg/ha in diesel by air or basal spray 245-T, or injection Tordon 105, cut stump 245-T.
APM Gippsland	Propazine or Simazine Boom 2-4kg/ha	245-T in diesel 1kg/ha by air.	245-T in water 1kg/ha by air. 245-T basal spray 2% or Tordon 105 injection.
Tasmanian	-	245-T lo-vol mister 2%	Tordon 20K 0.2% in water by mister or Tordon 105 2% injection.