CLOVER PLUGS-A "SLOW RELEASE" NITROGEN SOURCE ESTABLISHED WITH SEEDLINGS AT TIME OF PLANTING

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Nitrogen-fixing plants have long been used to amend nitrogen deficient forest soils in Europe (1). Their use in North American forestry has been more limited, confined mainly to nursery cover crops. However, an optimistic review of the potential of nitrogen-fixing in coastal British Columbia (2), coupled with escalating commercial fertilizer costs stimulated MacMillan Bloedel Limited to initiate field trials,

Broadcast Trials

In 1973, birdsfoot trefoil (Lotus corniculatus), Alsike clover (Trifolium hydridium), red clover (Trifolium pratense) and white clover (Trifolium repens) were sown on recently clearcut lands on southern Vancouver Island. Trials were expanded to include hairy vetch (Vicia villosa), biannual lupine (Lupinus angustifolia) and purple pea (Lathyrus nevadensis) in 1974.

Results of these trials were discouraging. After one growing season, the only surviving plants were located on exposed mineral soil. Apparently disturbance of the organic layer during high-lead logging was insufficient to provide a seedbed suitable for germination or early establishment of germinants. Since the cost of preparing seedbeds for broadcast sowing is prohibitive, alternative means of establishing legumes are needed

Greenhouse Establishment

In the spring of 1975 I began experimenting with a method that appears to have definite possibilities In March I sowed innoculated white clover seed into 200 styroblock-8 containers, 100 filled with only potting mix and 100 containing 1-0 Douglas-fir seedlings averaging 12.5 cm in height. A block of 100 seedlings without clover was used as control.

The clover germinated quickly and grew well in the greenhouse environment (natural photoperiod and approximately 20° C days and 10° C nights). After 2 months the clover averaged 7.5 cm in height. Roots were well nodulated.

Seedling foliage and soils, sampled at 2 months after sowing with clover and from controls with only seedlings, were analyzed for total nitrogen concentration. No differences were apparent in either soil or foliage, perhaps because 2 months may be insufficient time for the clover to fix nitrogen in excess of its own requirements. Also, since absolute nitrogen contents were not determined, the possibility of a dilution effect from growth of seedlings with clover could not be checked.

Figure 1. *Clover-fir plug after outplanting on a road* cut bank, *May 29, 1975.*

Field Checking

On May 29, 1975, 2 months after sowing the clover, the plugs were planted on a relatively sterile road-fill and cutbank (figure 1). Such sites are typically difficult to regenerate with conifers; surviving seedlings are usually slow growing, chlorotic, and are frequently damaged by upslope debris and by movement of soil away from their roots. Establishment of legumes by direct seeding is greatly impeded by loss of seed and/or young plants by erosion.

Figure 2 shows a seedlingclover plug on August 9, 1975. All clover and seedlings survived. The clover has spread very readily, but none of the seedlings were overtopped. The clover flowered and set seed in 1975,'so I expect even further colonization of the site by clover in 1976. It is encouraging that seedlings growing with clover were less chlorotic and appeared more vigorous than the control seedlings after the first growing season. Their relative performances will be measured after 1976 growth has ceased.

Figure 3 illustrates the growth, vigor, and spread of the clover. Similar planting probably at closer spacing (e.g., 1 m x 1 m) could prove valuable in establishing clover or other cover crops to stabilize steep road-fills, cutbanks, slides, etc.

Advantages

Results of this first trial suggest the following advantages of Douglas-fir-clover plugs:

1. Earlier plug confirmation. Clover roots help hold the plug together resulting in a firm, plantable plug sooner.

2. The rapid spread of clover shoots protects the soil surface around the seedling, reducing surface erosion. Clover roots also grow readily into the surrounding soil, helping to anchor the plug.

3. Release of fixed-nitrogen should ultimately result in increased seedling growth.

Figure 2. *Clover-fir plugs on August 9, 1975. Notice clover blooms.*

4. The clover foliage will provide some shade for the seedling, reducing temperatures in the critical root-collar zone.

Disadvantages

Potential disadvantages include:

1. Increased competition for light, moisture, and nutrients other than nitrogen. The first can be minimized by scheduling sowing dates to permit the seedling to maintain a dominant position. From greenhouse experience, Douglas-fir appears to be more drought resistant than clover. Competition for nutrients remains to be assessed. However, seedlings may be helped when nutrients are recycled from clover litter.
2. Increased seedling damage by browsers attracted by the clover.

Figure 3. *Clover-fir plug (foreground) and clover plugs* at *mid-slope on* a *road-fill* August 9, *1975,*

Continued Research

the results of this small, initial trial have encouraged me to conduct more extensive research in 1976. In addition to white clover, birdsfoot trefoil will also

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be sown in Douglas-fir styroblock-8 plugs. Replicated outplantings will be established on a wider range of sites including thick duff, compacted landings, disturbed mineral soil, and more road-fills and slides. Systematic sampling for foliar nutrient analyses is, also contemplated.

I encourage you to try this promising approach. I would appreciate hearing of your experiences with legumes in general and containerized trials in particular.

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Number of cotyledons per seedling averaged 9.8. One of the lots had a range of 7 to 12, but most of them ranged from 8 to 11.

Our recommendations for storage and pretreatment of chilgoza pine seeds are as follows:
1. Long-term storage (after air drying at room temperature) should be approximately -10" C.
2. After subfreezing storage, test a small sample for vitality by comparing germination of stratified versus unstratified seed. 3. If germination is reduced by stratification, sow seedlot from frozen storage without pretreatment.

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