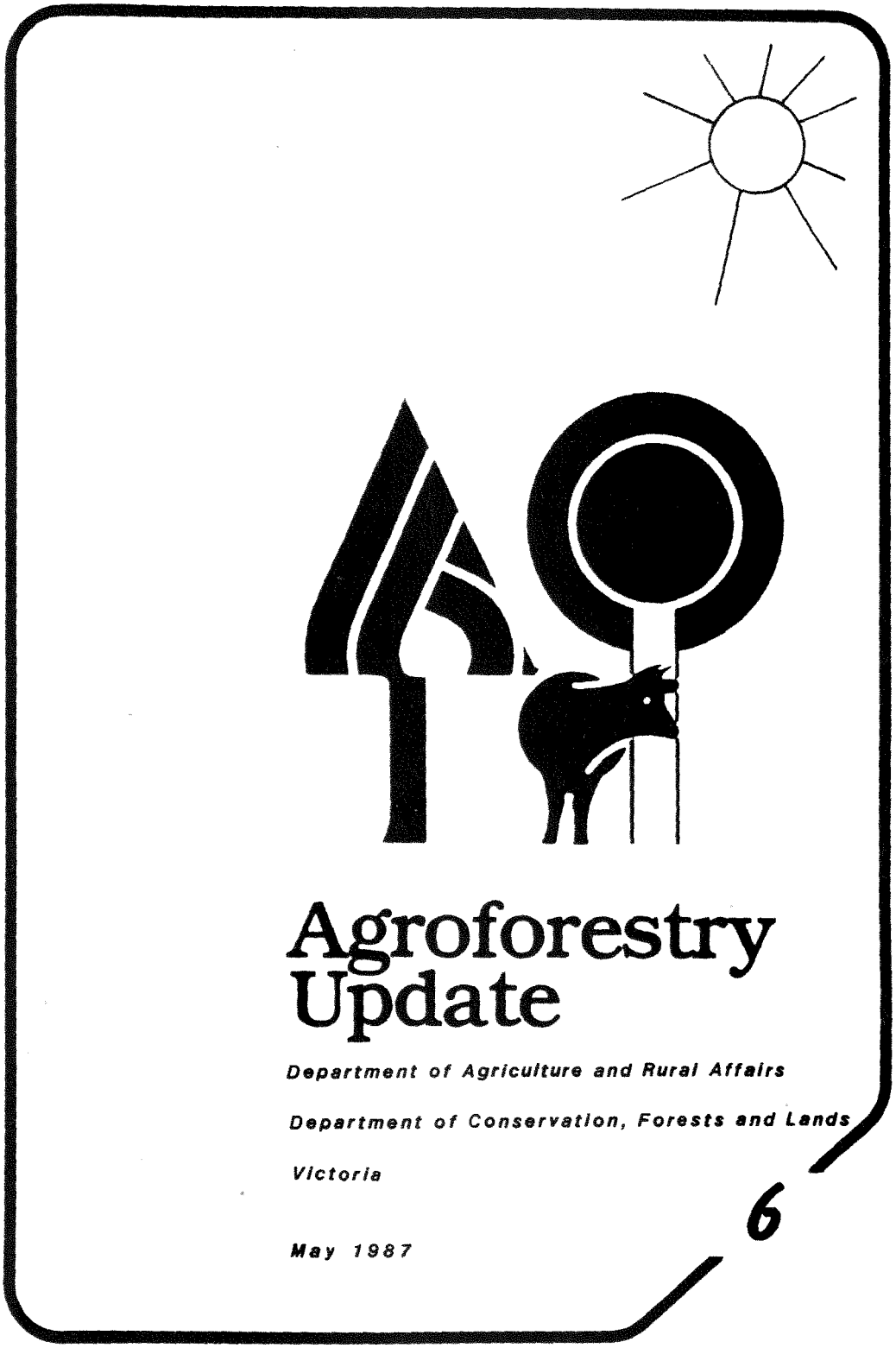
THE LAST & FINAL VICTORIAN



Agroforestry Update

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Agroforestry Update An occasional newsletter for agroforestry practitioners, research workers and extension specialists

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Editors: Ian Hamer
Department of Agriculture and Rural Affairs
166 Wellington Parade
East Melbourne, Victoria, 3002
Telephone: (03) 651 7712

Rob Youl and Brad Lynch
Land Protection Division
Department of Conservation Forests and Lands
250 Victoria Parade
East Melbourne, Victoria, 3002
Telephone: (03) 651 4667

Typist: Linda Gebar,
Land Protection Division

Printer: David Rooke,
Land Protection Division

EDITORIAL

There have been several contributions this time and the editors have combed the literature to complete the issue. We apologise for the delay in this final Victorian edition - promised for the New Year but postponed because we have been overworked-and send our best wishes to Richard Moore and Geoff Anderson in Western Australia. We feel sure that, unlike us, they'll get each number out on time. Who will be next after WA? We suspect Queensland where the enthusiastic Gary Bacon and others are looking at the many tropical possibilities of combining trees and farming. This seems very reasonable since most of the literature on agroforestry emanates from Asian, African and Latin American sources.

* * *

The Australian workshop on agroforestry, held in Western Australia in October 1986, indicated that CALM has progressed far. Of great interest were the good growth of clover in pasture trials (with CSIRO) under pines, and the joint activities with the Department of Agriculture on public land and with committed farmers on freehold land. An inescapable impression is the size of the salinity problem - not that Victorians should be complacent about their own difficulties in this area.

The amount of effort by the organisers to make the workshop a great success, and the good working relationship between CALM and CSIRO, were also very obvious.

* * *

It is a satisfying time for people involved with rural treegrowing. In every state, very worthwhile things are happening as interest grows and grows in revegetating strategic portions of our farms to improve the environment and raise agricultural productivity. The editors believe that the possibility of also earning money directly from sales of tree produce should always be considered when planning treegrowing. After all, if people can make money from trees, they have the best possible incentive to plant many more.

* * *

The editors thank all the people who have helped us during the last three years. We are particularly pleased with the co-operation that exists between Australian and New Zealand agroforesters.

TODDLER TREES - THE YOUNG EUCALYPT PROGRAM

A convincing case can be made that Australian foresters have neglected the eucalypts in favour of radiata pine - meanwhile the rest of the tropical and temperate world is using eucalypts as widely as it can.

It seems we are starting to redress our neglect at last. CSIRO (Divisions of Chemical and Wood Technology, and of Forest Research), DCFL Victoria and the Tasmanian Forestry Commission, and the timber industry have pooled finance and staff to embark upon a major study of eucalypt regrowth forests. The project also signals that, after two hundred years of forestry, utilising of mature logs is almost finished in Australia. The results will most certainly be important for agroforestry.

Some of the projects are:

Thinning and harvesting

The initial phase of this project involves the introduction and study of new technologies for thinning young stands. Both non-commercial and commercial thinning systems will be explored to establish the effect of stand variables on productivity. Future work will also examine the clearfelling of young stands. A forest classification system based on stand and terrain factors will be developed alongside these studies so that the results can be generalised to other sites.

Project Leader: Bob McCormack, CSIRO Forest Research, Canberra

Stand damage

Thinning can be expected to cause some damage to the roots and stems of a proportion of the remaining trees. Changed patterns of branch shed may also influence the occurrence of defect. The research will involve a comparative analysis of the development of decay and discolouration in thinned and unthinned stands and establish whether new thinning technologies can reduce the incidence and severity of damage. The project will include an economic analysis of timber losses.

Project Leader: Glen Kile, CSIRO Forest Research, Hobart

Growth response

This project is designed to predict the growth of young stands of Eucalyptus regnans at different spacings, and how they will respond to different thinning treatments. The prediction will require new relationships to be established between crown characteristics, competition between trees, and tree growth. The results will be used to extend STANDISM, an existing growth forecasting model, so that it can be used in younger stands.

Project Leader: Phil West, CSIRO Forest Research, Hobart

Debarking

This project investigates alternative technologies for removing the bark from small diameter, fibrous-barked eucalypts. The absence of a suitable process remains a major constraint to the use of early thinnings. Several harvesting/debarking/transport systems are being compared to identify those debarking processes worthy of research and development. Initial studies will involve short experiments on readily available equipment, including debarking by drum, modified softwood harvesting equipment and possibly vibration.

Project Leader: Robin Wingate-Hill, CSIRO Forest Research, Canberra

Sawn timber production

Available market research information will be used to predict the sawn products likely to have high total sales and high prices per cubic metre. The problems likely to prevent young, fast-grown eucalypts supplying these markets will then be examined. Existing drying, sawing and finishing facilities will be assessed and at the same time a computer model of drying, sawing and finishing processes will be built to relate log specification to log value.

Project Leader: Gary Waugh, CSIRO Chemical and Wood Technology, Melbourne

Pulping

Kraft pulping studies will be conducted on samples of E regnans and E obliqua between 7-10 and 70 years of age, as well as samples of the old growth forest from southern Tasmania. Trees from the younger age group will also be pulped with bark included, to simulate the situation where bark removal from small wood is prohibitively expensive. The technical results will be used to calculate dollar values of pulpwood relative to woodchip export prices where these values are known.

Project Leader: Frank Phillips, CSIRO Chemical and Wood Technology, Melbourne

Resources and markets

This is a project to assess the extent and potential of the regrowth forest. It involves the collation of existing information on forest areas and likely markets for wood products.

Project Leaders: Geoff Gartside, CSIRO Chemical and Wood Technology, Melbourne

Kim Wells, CSIRO Forest Research, Hobart

(Readers will note that Kim Wells, formerly of Canberra, is now working in Hobart.)

SEEDAID
DATELINE: HARARE

Hugh Stewart, a DCFL forester on loan to Australian Development Assistance Bureau in Zimbabwe, was invited by the Ethiopian Ministry of Agriculture to assist in the design of a research program to evaluate Australian tree species for community forestry. A large consignment of seed from over sixty species was provided for this program by ADAB as part of the Tree Seeds for Developing Countries Project.

Hugh was in Ethiopia from 5 - 29 October 1986. Apart from developing a research plan, he held a five-day workshop on research methodology for forestry staff, and spent ten days in the field in order to appraise the existing program of research.

The field trip was by far the highlight (Hugh's diary records):

We arrived in Addis Ababa soon after 1 pm. So ended over 3,000 kilometres through rural Ethiopia in ten enthralling days. I was privileged to have undertaken the journey - hard going as it was. In such a fleeting glimpse of the country, it is easy to form general impressions, though difficult to fairly comment on a society that has descended directly from an ancient kingdom whose origin was perhaps a thousand years before Christ.

Many things, however, will be vivid memories: the dignity and overwhelming hospitality of the people; their fierce desire to retain their individualism and identity; the distinctive food, especially the dishes eaten communally out of beautifully woven wicker baskets; the fabulous coffee; the no-star hotels; the heat of the equatorial sun; and the intensity of life along the main routes in the central highlands - a procession of people and animals, seemingly going about their business as if time was standing still.

But above all, I realised how wrong my preconceptions of the country were. The images presented by the mass media show only the tragic side of Ethiopia - the periodic famine that is mainly restricted to the northern provinces of the country. My trip was to the heart of Ethiopia - the central plateau - where the vast majority of people lives on well watered and reasonably fertile land, eking out a traditional living from subsistence agriculture. Though I recognise that I saw the country at its best, without doubt, my lasting impression will be: How green it was.

CHINA JOINS ITCI

Geoff Wilson reports from Melbourne:

The People's Republic of China has joined the International Tree Crops Institute.

Thirty Chinese agroforestry scientists are ITCI China's foundation members, following the Ministry of Forestry's approval of a non-government organisation being set up to participate in ITCI.

Mr Wang Shiji, the Deputy Director of the Research Institute of Forestry of the Chinese Academy of Forestry, is the first ITCI China Director. Mr Zhu Hao-hua is the Executive Director. China's leading paulownia research scientist, he visited Australia in 1986.

China is of special interest to ITCI because some twenty million hectares have been planted already to agroforestry regimes. More than half a million hectares of this involves paulownia agroforestry, using the forest net principle, where climatic modification has now been proven.

In some areas the forest net system, using poplars and paulownia, has led to a threefold increase in the food output per hectare, plus a big bonus in timber and fuelwood for sale. Another bonus has been leaf fodder for the planned expansion of livestock industries in China.

A visit to Australia by seven Chinese agroforestry research scientists is planned for late 1987, following a visit last October by a party of three.

A reciprocal visit by eleven treegrowers (seven Australians, three Americans and one Indian), is planned for August - September 1987, when the party will visit Shandong and Anhui Provinces in northeastern China.

This is being organised by ITCI Australia. Further exchanges are being planned for 1988.

By the way, ITCI Australia is accepting members at present. Contact Geoff Wilson, Executive Director, at P O Box 283, Caulfield South, Victoria, 3162 (telephone: 03 523 5025). The joining fee and annual subscription are each $25.

AGROFORESTRY RESEARCH AND DEVELOPMENT IN VICTORIA

John Kellas, Peter Baldwin and Stuart Margetts write from Victoria:

Since the inaugural meeting of the interdepartmental working group on agroforestry, the Victorian Departments of Conservation, Forests and Lands (DCFL) and Agriculture and Rural Affairs (DARA) have implemented the series of agroforestry trials proposed at that meeting, using funds provided by the State 150th Anniversary Board. To maintain this research program and satisfy public demand for information on agroforestry, DARA has appointed Peter Baldwin as its agroforesty specialist, based at Hamilton. The Land Protection Division of DCFL continues to provide agroforestry extension services through Rob Youl and Steven Burke, while the research aspects are the responsibility of the Research Section of Public Lands and Forests Division. These latter duties were transferred to John Kellas after Hugh Stewart was seconded by the Australian Development Assistance Bureau to Zimbabwe.

General community interest in rural trees has continued to increase through volunteer organisations, private schemes such as the Potter Farmland Plan, Federal and State Government initiatives through the CEP, other government schemes and through farming groups. The Victorian Farmers Federation (VFF - formerly the Victorian Farmers and Graziers Association) has continued to expand the number of farm tree groups throughout Victoria. The thirty-five or so groups, in addition to DARA and DCFL, hold regular field days to promote treegrowing on farms.

The VFF held a workshop last year on joint ventures, attended by representatives of Government, the timber and paper industries and the agricultural community. Subsequently a seminar was conducted by the Australian Forest Development Institute on attracting investment to agroforestry, and very recently DARA and DCFL held a seminar titled "Towards profitable agroforestry for Victorian farms" that attracted well over one hundred and fifty landowners and other interested people.

Government policies

As part of its corporate strategy, DCFL recognises the importance of private forestry and timber production; the department provides advice on the establishment and maintenance of agroforestry on private land and places a high priority on agroforestry research. In addition, the strategy proposes to accelerate treegrowing programs on farms to assist in reducing land degradation, reversing tree decline and improving productivity and landscape values.

More recently, the Government's Timber Industry Strategy has been released, providing specific commitments to assist landowners with agroforestry. The strategy states that:

- DCFL and DARA will, jointly, continue to establish agroforestry research projects directed at determining the costs and benefits of a wide range of agroforestry combinations.

- DCFL will establish commercial agroforestry operations on suitable Crown land.

- A system will be developed to provide farmers with authoritative information to enable them to evaluate agroforestry in terms of the economic viability of various agroforestry combinations, management practices, financial management systems and marketing campaigns.

- DCFL will provide increased technical advice and assistance to farmers who wish to undertake agroforestry schemes.

Complementary strategies are likely to be developed within DARA following that department's reorganisation.

Research

As stated above, DARA and DCFL have completed the establishment of six agroforesty projects across Victoria. (See Agroforestry Update 5.)

The future

Continued public awareness and education should make rural trees in general, and agroforestry in particular, important topics for landholders and those concerned with aesthetic values. The strategies developed by the Government through DARA and DCFL should provide a strong scientific basis to properly evaluate the economic impact of the agroforestry combinations. However, the intangible benefits (aesthetics, reversal of land degradation and the provision of habitat) may not be calculable in either the short or long term.

Finally John, Peter and Stuart have supplied this data:

Percentage of trees with bark damage to main stems following browsing by sheep, Carngham 1986

Treatment stems/ha	Damage Class# 0	1	2	3	4
			Percentage		
100 (8m x 12m)	35	33	23	9	0
277 (4m x 9m)	63	19	10	6	2
277 (5 rows with 10 row gap)	50	14	17	14	5
1650	74	13	8	3	2

\# Damage classes

0 - no damage

1 - limited bark removed, no sapwood exposed

2 - 0-10cm of bark removed, sapwood exposed

3 - 10-30cm of bark removed, sapwood exposed

4 - 30cm of bark removed, sapwood exposed

AN AUSTRALIAN AGRARIAN REVOLUTION

Bernadine Atkinson has written excellent articles on trees in 'Town and Country Farmer'. Publishers Glenn and Shirley Hurley have allowed us to publish these. The editors have selected firstly part of a piece that appeared in the Summer 1985 issue that seemed to us to include some interesting ideas:

Australia is on the brink of a revolution in long-term land management as trees are incorporated into agriculture, because this represents a shift from intensive monospecific broadacre farming - a practice that appears profitable in the short-term, but in the long-term is highly exploitative.

World market instability and competition leave the farming community with no option but to ensure that Australian produce is available on a reliable and sustainable basis. On top of this we must develop new markets for both our staple produce and new products. Harnessing the potential of trees on private property will help to alleviate the pressures the farming sector must confront if it is to remain viable in the latter stages of the twentieth century. Diversifying into trees can be a farmer's insurance policy.

Some countries are well ahead of us in the treeing revolution. In America an estimated four million private landowners collectively own sixty per cent of the nation's commercial forest. The law in some Scandinavian countries forbids any reduction in the proportion of forest on private land; a farmer may selectively log or clearfell in his forest, but must reafforest an equivalent area.

In Australia, our history of sustained private forestry is not strong, but we do have the 'Aussie battler', the chap from the bush who is renowned universally for being innovative and efficient. Today if the 'battler' is not pioneering interesting and economical farm tree industries, he's at least implementing the results of experiments conducted in Australia and New Zealand and benefiting from the experience of some leading treegrowers.

The seed orchard

Seed production potential can be realised within a decade and can be incorporated into any shelterbelt design.

A New Zealand experiment growing Eucalyptus fraxinoides harnesses this potential nicely. The windward row was lopped to provide a dense lower storey that prevented windthrow of the tall trees and significantly increased the shelter. The stunted growth made seed harvest easy and profitable. (The current market value of Eucalyptus fraxinoides in New Zealand is $350 per kg.)

In Australia the price today for eucalypt seed varies from $110 to $165 per kg; acacia seeds sell from 1 to 9 cents each.

If you're keen to incorporate seed production into your shelterbelt, eucalypts in particular should be planted with a view to maximising the proportion of outcrossed seed. Trees that are isolated, or flower out of phase, produce a crop of seed with limited genetic diversity and less vigour. Marketing any native seed requires the seed provenance to be known - where it came from and the trees' growth, form and habitat. The potential market is good, both within Australia, as farmers turn to growing trees using direct-seeding techniques, and internationally, as we have tree species to suit most of the world's habitats.

Already sixty-seven countries grow the eucalypt and other Australian natives commercially. Unless we satisfy the international demand with Australian-produced seed, we may find other countries developing this potential. However, we do have an unbeatable advantage with the wealth of the natural gene pool readily accessible; this will ensure the successful marketing of Australian seed. Roy Pullen from the CSIRO Division of Plant Industry, cautions that though there may be wonderful profits to be realised from seed production, there is also the potential for the market to fall away suddenly with overproduction of seed. However, the enterprising are the only people who will realise any market value.

Other short-term production possibilities that can be incorporated into the shelterbelt can include the production of flowers and nuts for florists. The humble honey bee, through its pollinating activity, is known to improve the yield of flax, lucerne, clovers, lupins, rape, sunflower and many other crops. Valuable oil can be produced from the distillation of the leaves of Eucalyptus viridis, Eucalyptus sieroxylon, Eucalyptus citridora, Eucalyptus globulus and Eucalyptus polybractea to name just a few.

The medium term

The return to slow-combustion stoves for home heating and cooking provides a sustainable market for fuelwood. Some enterprising suppliers saw, split and wrap wood in plastic-covered bundles and sell these in supermarkets. The current market value for firewood varies from forty dollars (for bulk wood), to two hundred and fifty dollars a tonne (for small packets of wood). A shelterbelt designed for fuelwood harvest can also be a source of posts and poles - creating self-sufficiency on the farm and another saleable product. Including these options into your shelterbelt design may require a high density stocking to produce a large volume of timber made up of small trees. High-density stocking allows for selective logging over an extended period, thus the shelterbelt value can be maintained.

Long-term potential

The highest economic returns will always be for timber - logs with a diameter greater than 300mm. This real timber value accrues from twenty years onwards. Today, logging contractors can justify the expense of relocation if there are more than fifty straight, high-quality logs ready for milling. Here too, advances in technology indicate processing logs on-site will provide employment for private contractors and farming syndicates.

One extraordinary example of the profitability a shelterbelt planned for timber production can bring to the farm is provided by a New Zealand case. A row of radiata pine was planted behind a dense windward row of western red cedar.

The pines were pruned, and when harvested at twenty-two years, some of the logs proved to be veneer quality. This harvest averaged a value of twenty-two thousand dollars per kilometre and the trees over the twenty-two years had provided shelter that enhanced the farm's production by an estimated sixty thousand dollars. Other shelterbelts on New Zealand's Canterbury Plains are currently valued at between six and twenty-two thousand dollars per kilometre.

The tragic 'Ash Wednesday' fires at Mt Macedon left one profitable harvest. One hundred years ago, botanist Baron von Mueller had planted Californian redwoods, larch, spruce, cedars and oaks. Some of these trees had standing values of many thousands of dollars; some of the air-dried speciality timbers had quoted values of two and a half thousand dollars per cubic metre (Australian Forest Grower, September 1984). This type of market is long-term and particularly lucrative, but the value of any timber-producing plantation can be realised in a shorter period.

In Australia, our traditional supplies of hardwood are being replaced by smaller logs and softwoods - there is a tragic shortage of fancy timbers both here and in other parts of the world. The growing of furniture-grade, high-quality timber is certainly an attractive economic alternative for the multipurpose management of the farm shelterbelt.

In conclusion, one cannot stress enough the importance of sound planning in shelterbelt establishment. It can mean the difference between the satisfaction of a job well done or the heartbreak of wasted time.

It is also worth remembering that most innovations in farm forestry have to be experiments. We won't know of their success until it comes time to harvest the seed, pick the fruit or mill the timber; but one thing is sure, today's ocker-knockers and mockers won't be riding the crest of any waves! Trees on farms will bring decent returns for the far-sighted farmer.

WHITHER THOUGH GOEST: CUTTINGS OR SEEDLINGS?

Geoff Brann, a very keen agroforester from Te Puke, which is north of Rotorua, tells of his recent experiences:

With three seasons of planting radiata pine cuttings behind us, we thought it interesting to discuss some of the advantages and pitfalls that are starting to show up with cuttings, as they are much sought after at the moment. I must emphasise that this is purely a layman's observation and in an agroforestry situation only (grazed with stock as soon as practicable). We do not have large areas or numbers involved.

In 1983, we planted five hundred cuttings taken from five-year-old trees, at 8m x 8m final spacings. Each tree was planted by screefing and a properly dug hole - one person digging, the other planting - one days work. The trees were then released with Caraguard at the end of September - October during the optimum grass-growth period. Only one releasing was necessary. The area was part of a main stock access, so stock went through regularly with no hassles.

The following year, 1984, the trees were very spindly with few branches and lots of adventitious shoots, and tended to be top heavy and require some of the few branches to be removed to prevent toppling. Had these been seedlings, our past experience would have had us with lambs, and maybe ewes, grazing lightly but in this case it was definitely not on, and we were starting to have doubts about these strange-looking trees.

Now, eighteen months later, January 1986, after a wet warm growing season, we have stripped the adventitious shoots and lightened the branches, and the trees look really good, although there is a very big variation in heights, from 1.5m to 4m. However, their biggest drawback is the tender, smooth bark that cuttings have, and whilst our sheep are used to pine trees, we are finding we just cannot graze hard or even tidy up these blocks as the animals just bite chunks out of the bark. As yet, we have had no stripping but only because we are not game to leave them too long.

Perhaps the major mistake in this situation would seem to be that the parent trees from which the cuttings were taken were too old or mature at five years.

The 1984 planting involved five hundred cuttings, this time from three-to four-year-old parent trees with the same planting and releasing. Eighteen months later, these trees had much better growth and form. At this stage we are drifting lambs in and out; so far there has been no damage, but at the same time the lambs are not doing much with the rough feed, whereas with seedlings we would generally have the pasture under control again.

The 1985 planting involved one thousand cuttings from two- to three-year-old parents. These were given the same treatment and six months later they are by far the best-looking trees for growth. However, amongst these cuttings we planted twenty '268' tube-grown seedlings, which at this stage look to be heading everything off, which will make us rethink the 1986 plantings.

Advantages of cuttings

In summary, the advantages of cuttings to us are:

- light branches that grow out at right angles resulting in low pruning and silvicultural costs
- each tree planted properly should be perfect, so only the final crop spacing need be planted initially and if the odd one does blow over - so what?
- no taper

Disadvantages of cuttings

There are several drawbacks:

- slower growth rate, but this may not be so if cuttings are taken from two-year-old parent trees
- cones appear on the main trunk at an early age; this is not serious in the butt log as they can be taken off at pruning but it is a problem in the second and third unpruned logs
- timber quality is as yet unknown
- palatability to stock is high and this must be the most serious matter as far as farmers are concerned; we don't know yet how long it will be before the bark thickens up

Alternatives

An alternative may be some of the improved New Zealand seedlings when they become available in any number, which may be a year or two away yet.

(Since this article appeared in 'New Zealand Tree Grower', Geoff has achieved excellent grass control with mob-grazing 1500 ewes 'crammed' (his words) on to 3 ha of final-spaced two-year-old and three-year-old radiata pine for about two hours daily, taking care not to rush the sheep or they would trample the trees. Geoff thinks that only full sheep, that is sheep with full bellies, will start chewing trees.)

EXPERIENCE IS THE BEST TEACHER

Bernadine Atkinson's second article indicates the progress being made with direct seeding:

Everyone knows you don't plant tree seedlings in summer! Why not? It is too dry and hot, of course! Funny how the voice of experience can contradict even the most widely believed principles.

Bill Weatherly and his family have been planting trees earnestly since the early 1980s and, prior to that time, spasmodically for generations on the family property, 'Blythvale'.

The change from casual tree planting was triggered by the aftermath of the devastating 1977 Streatham fires and the ensuing realisation of the value of shelter to stock. Many of the old plantations on 'Blythvale' were killed in the fires that almost totally destroyed the township of Streatham. The Weatherlys were lucky their family home was not burnt, a fact Bill attributes to the fire-retardant properties of an old pepper tree close to the house.

But when all protective tree cover has gone, it is easy to see and feel the effects of the wind and weather.

Surveying stock on a motorbike over winter and summer, as a sensible economic ploy rather than being ensconced in the temperature-controlled cabin of a utility, makes one very much aware of the extremes of climate. And if humans suffer, Bill says spare a thought to consider the stock that remain outside, night and day, without respite.

'All that energy they're using to maintain body heat, is absolutely wasted as far as I'm concerned', Bill said.

Amongst all the arguments in favour of shelterbelt establishment, from the increase in land value to priceless conservation and habitat values, Bill's experience shows there is an overriding pragmatic consideration...economics! A mob of cattle was divided into two and the only variable in treatment was shelter: the cows that had been sheltered brought home an extra $2,500 and they'd eaten only half the hay required by the unsheltered mob. Bill argues that the same effect can be seen with sheep, although not quite so clearly.

So the Weatherly family began planting trees as an adjunct to their already busy farming calendar. Their experience has taught many valuable lessons.

Evolution of techniques

Two methods of tree establishment are used at 'Blythvale' - planting seedlings and direct seeding - a hybrid system which over the last few years has had an outstanding establishment success.
This success, Bill believes, can be attributed to the elimination of weed competition. Even trees planted in the middle of summer thrive, after they've been watered in, if there is no weed competition.

'We used to have trouble with weeds when using the ploughing method - we'd be providing a terrific seedbed for corkscrew, capeweed and annual grasses. Forest extension officers advised us to spray and rip. This combination made a tremendous difference in the success of tree planting at Blythvale', Bill said.

When planting seedlings, the Weatherlys use tree guards. These reduce evaporation stress, so the young trees are able to make better use of available soil moisture. They also protect young trees from hares and create a stable micro-climate.

Traditionally, tree planting at Blythvale was carried out in the wet cold months, but, more through accident than design, planting projects were delayed until summer. Surprisingly, these have been almost one hundred per cent effective.

The essential prerequisite is that the soil must be weed-free, the plants must be given an initial thorough watering and plastic tree guards used. Bill says the trees are not watered again until the autumn break, and with this method he has had a 99 per cent success rate. 'Certainly I won't ever be going back to planting in the winter months!' Bill Weatherly vows.

Since the early 1980s the Weatherly family has been experimenting with direct seeding as a method of establishing trees.

'Direct seeding is the obvious answer if you want to cover a lot of country in a short time - but we've again found it only works if there is adequate weed control'.

In one day, Bill and his family were able to plant a twenty-metre strip, four kilometres long, with six rows seeded.

To beat the weeds, the Weatherlys spray the strip intended for planting in spring, in an effort to prevent seed set. The following year, the plot is sprayed at least one other time to kill any residual weeds that may have germinated. Then, in the spring of that year, they direct-seed into a rip line. The plantation has therefore required one years preparation before seed could be broadcast.

The seed is mixed with bran and given a fertilizer coating. It is then spread through a conventional drill or hand broadcast at a rate of 100 gms of seed per kilometre.

Using this method, one tree has grown every metre. Bill believes he could have used one-sixth of the amount of seed and still produced a conventional plantation.

Bill concentrates on replanting native trees. 'We know they'll grow well in this country, and they have the greatest conservation value', he says.

He collects most of the seed himself, and suggests one should take seed only from the trees and shrubs that show a desired form. 'When the seed is available, it is worth collecting a lot because seeds are produced at a different rate each year. It is important to label the seed and date the collection. Put the seed in a dry spot and spread them to prevent mould. Then try and remember to keep the mice and insects out of your storage area!'

More insights

There have been other hard-learnt lessons in relation to tree planting at 'Blythvale'. The Weatherlys discovered that the young plantations grown closest to established trees were the least affected by bird and insect pests. The further from established native vegetation, the greater the battering they received from disease and insects.

Bill Weatherly also believes that the popular three-row plantation is inadequate.

'They're not worth putting in if thirty years later you've got a moth-eaten collection of trees that's not viable as a shelterbelt and is continually being knocked back by the wind, dieback and insect pests.'

An effective plantation width should come close to being twenty metres wide. 'A lot of us are a bit mean with the width of ground we give over to trees. You put the fence down and think "Oh Crikey, I could run a lot of sheep on that!", but if you sit down and work it out, one kilometre, twenty metres wide, is only two hectares.'

Bill bases this judgement on the old sugar gum plantations of Western Victoria that are still in good order; most of these are more than twenty metres wide.

All the shelterbelt plantations on 'Blythvale' are fenced, even after they've become established.

By using native trees and shrubs and permanent fences, the Weatherlys hope to create self-sustaining plant communities; a habitat that will support birds and mammals, which in turn will help maintain the trees and control the insect pests. In an effort to fulfil this aim, Bill and his family have tried to have something flowering in the plantation all year round - to provide a twelve-month supply of food for the honeyeaters and nectar-eating wasps.

Benefits such as fodder for stock and a timber supply are not primary considerations at present in the Weatherly tree planting projects. However, Bill says his approach to re-establishing native trees does not exclude these benefits becoming available in the future.

Back to basics

And back to the original question - Why plant trees? Bill answers; 'There are a lot of people who say "yes, we need more trees" or "I'd like to plant trees, but I can't really afford it" or "I'll do it when I can afford to", and that's fair enough. But if you look back over the last fifteen years in farming, we've had one bad turn after another. At each downturn, we scrap more development programs and restrict ourselves to a fortress economy. An each time we do this, we find we're a lot worse off because though we've saved a few bob, our farm has gone backwards. One doesn't have to elaborate on the evidence for this - pasture decline, salinity and reduced stock carrying capacity.'

'Planting trees is not as expensive as it may seem, particularly if you fence off the plantations, then you have them for all time. One has worthwhile shelter in ten years, and some shelter in three to four years. At the risk of appearing glib, I have to say it comes down to a case of not whether we can afford to put trees in, it's a case of whether we can afford not to! The long-term penalty for not doing the job properly is probably far greater than the immediate penalty for doing it.'

'I think there's an attitude involved in tree planting or any other improvement you can make on a farm: either you flog the place to death and go for every cent you can get, or you can say, "This country has got to be here for a long time". To quote a notable Western Victorian (Malcom Fraser, I think), "You don't inherit the land from your parent, you borrow it from your children"'.

BYE BYE, MS AMERCIAN PLY

RADIATA CUTTINGS PRODUCE INCREASED VENEER

David Spencer, CSIRO Forest Research, Canberra provided this piece:

My recent study looked at the question of whether cuttings of radiata pine would produce more timber of higher quality than seedlings of the same age.

A mill study sampled material from a 36-year-old stand of cuttings and adjacent seedlings planted at the same time and from the same ultimate seed source as the cutting material. The cuttings had been taken from six-year-old seedlings of good vigour, stem form and branching.

The cuttings produced in total 106% more face-grade veneer sheets (grades A, B and C) than the seedlings. The overall yield in volume of veneer was 43 per cent greater for the cuttings.

Sawn timber log volumes and recovery results show 8 per cent greater volume yield of final products for the cuttings compared with seedlings.

Total volume of logs harvested and merchantable product produced from the sample shows the cuttings yielding more merchantable volume than the seedlings in each operation.

Results of the study, which used cuttings from trees selected at a low intensity, demonstrate that substantial gains in recovered volume and quality of timber product can be achieved by using cuttings rather than seedling stock.

FODDER PHYLLAS: TREERIFFIC TUCKER

Tim Vercoe, CSIRO Forest Research, Canberra is doing research on native trees that are suitable for fodder:

Trees and shrubs offer several advantages as sources of fodder for livestock. They are less susceptible than pastures to seasonal variation in moisture availability and temperature, and to fire, and they offer other benefits such as better establishment and maintenance in dry environments than pastures. They are also capable of providing vital food supplies to stock at critical times of the year.

In this study, twenty-two Australian tropical and sub-tropical species, including fourteen acacias, were screened for fodder potential. Fourteen of the twenty two have been recommended for further study.

WHAT'LL RESULT WHEN WE REALLY GET TO WORK ON OUR ACACIAS?

Lex Thompson of CSIRO Canberra works on breeding trees for salinised land. Australia has many acacia species with exciting potential for planting on saline or alkaline sites for production of fuelwood, fodder and other purposes in hot, dry parts of the world:

The factors constraining the planting of acacias - lack of information on suitable species and scarcity of seed - have been largely overcome.

Information on the species is being gathered far more rapidly now than ever before in the face of an urgent need to reclaim and use marginal lands throughout the world. For example, an Australian acacia is the basis for a $US27 million FAO project to supply the 500,000 tonnes of charcoal needed each year by the African city by the turn of the centuryof Kinzono in Zaire.
Research on sub-tropical acacias of potential value, funded by the National Biotechnology Program, has identified eight species as having the most promise: Acacia ampliceps*, A. cuspidifolia, A. ligulata*, A. maconochieana* A. salicina* A. sclerosperma, A. stenophylla* and A. victoriae. (Species marked thus*, and A. auriculiformis, have been identified as having great potential for surviving high concentrations of salt, and growing well at moderate concentrations.)

Work on the acacias has been motivated by an acute world-wide need to dramatically increase the scale of revegetation for fuelwood, fodder production, soil conservation and shelter in dry climates.

At least 120 acacia species dominate Australia's extensive tropical and sub-tropical dry zone, which equates to those areas of the world experiencing acute fuelwood shortages. Many of the dry-zone acacias have promise for planting on harsh sites, including saline/alkaline soils.

Their potential uses include:

- wood production, especially fuelwood (firewood and charcoal) and round timber (posts and small poles)
- fodder, shade and shelter for animals
- human food reserves during famine (their seeds can be easily prepared for long-term storage)

Some species have potential for rehabilitating degraded saline areas through:

- protection, shading and mulching of surface soil (their low foliar salt concentrations avoid recycling salt to the soil surface)

- soil binding, especially root-suckering species
- soil improvement and nitrogen fixation
- lowering saline water tables (species that coppice following harvesting may rapidly recover leaf area and transpirational capacity)

REMEMBER: THE NEW EDITORS OF 'AGROFORESTRY UPDATE' ARE:

GEOFF ANDERSON
CSIRO
DIVISION OF ANIMAL PRODUCTION
PRIVATE BAG
WEMBLEY WA 6014
(PH: 09 387 0237)

RICHARD MOORE
CALM (RESEARCH SECTION)
QUEENS STREET
BUSSELTON WA 6820
(PH: 097 52 1677)

SEND YOUR ARTICLES TO THEM FROM NOW ON. NUMBERS 7, 8, 9 AND 10 ARE ON THE WAY, BUT THEY NEED YOU! WHAT ABOUT TROPICAL AUSTRALIA? WE HAVEN'T HEARD FROM YOU YET! TROPICAL LASSITUDE? CANE TOADS ATE YOUR BRAHMAN CALVES? GYMPIE BUSH HOSPITALISED YOUR T/A? PHYTOPHTHORA KILLED YOUR SLASH PINES? THE EDITORS OF THIS ISSUE DON'T REMEMBER A TASMANIAN ARTICLE EVER EITHER! GET YOUR COUSIN TO WRITE ONE IF YOU'RE TOO BUSY SNIPING AT THE GREENIES OR DYEING MULLET SO THAT IT LOOKS LIKE EXPORT CRAYFISH. AND AS FOR THE PREMIER STATE: APART FROM KNOWING ABOUT FRANCIS CLARKE'S ACTIVITIES, THERE'S BEEN NOWT.

ON THE OTHER HAND, THE KIWIS HAVE BEEN VERY HELPFUL - THANKS LADS!

WHERE THE PELICAN BUILDS ITS NEST

Rod Bird of Hamilton, Victoria outlines his latest work on treegrowing on the basalt plains:

Species assessment

We have little data on species suitability for the laterised tablelands or volcanic plains, particularly when grown on pasture in relatively open density. A comparative study of a wide range of species from different genera would be extremely useful, particularly if a diversity of sites was covered. Of course provenance is also very important and must be documented.

The species are selected primarily for timber. Our aim is to assess the practicability of producing timber from a wide range of contenders. Other considerations, such as suitability for honey or pollen, for shelter, or salty sites, were noted when including a given species in the project. Salt-tolerant species were tested at two sites with incipient salting.

Tree spacing and pasture production

Since the trees will be planted on pasture land we wish to discover how different species affect pasture growth at varying espacement. We will also assess the effect of tree spacing on timber production. We have a conventional design for P. radiata at Carngham, with sheep grazing among the trees at different spacings. This is very resource-demanding, however, and is not deemed appropriate for Hamilton. Rather, we will use a systematic design (see Huxley 1983) that minimises space requirements and is analysed by regression. The design is very useful for preliminary investigations, particularly of a comparative nature, where many species and density combiations are to be tested.

Timber production from shelterbelts

Though a major source of timber from farms in New Zealand, this practice has been completely overlooked in Australia. Indeed, even the planned management and utilisation of timber plantations is virtually non-existent. There is considerable scope for examining the great number of possible combinations of species and row designs that could be used for dryland or irrigation areas. In all cases the aim is to produce timber while simultaneously producing and maintaining shelter for livestock, pastures or crops.

Our work aims to demonstrate, in a small way, a few design possibilities, together with the necessary management procedures, and should provide estimates of potential timber production.

CLAN MACMONTEREY - A GROUP APPROACH TO TIMBER PRODUCTION

John Aitken of Havelock North, Hawkes Bay, author of the very interesting late 1970s report 'Family - Based Agroforestry', supplied these notes:

The grand plan for Tuki Tuki is to plant one hundred hectares every year for twenty-five years thus creating a sustained yield forest. The wood will be processed by the Tuki Tuki Timber Company. This combination of agriculture and forestry will have a major impact on the standard of living of the participating families.

The Aitkens will have ten per cent of the forest (250 ha), the Ormonds' twenty per cent, and the Neilsons' forty per cent. At year four, we are well ahead of our afforestation target and have seventy per cent of the estimated landbank agreed to in principle.

We are always reviewing both the ultimate objective and the means of achieving it. This is particularly the case since the 1985 Budget. We expect to survive Rogernomics* by adherence to a set of principles we have identified over the last eighteen years as fundamental to successful farm forestry. (* After Roger Douglas, the NZ Minister of Finance.)

The principles

Principles	Value to families	Value to joint venture partners	Collective value
Land ownership	1	3	4
Landuse	2	4	3
Finance	3	2	2
Marketing	4	1	1
Organisation	5	5	5
Management	6	6	6

Land ownership

Landowners are motivated towards forest ownership by the promise of dollops of dough (DOD). DOD makes possible the equal division of an owner's estate as well as continued family ownership for generations to come. Shade, shelter, aesthetics and soil conservation are acceptable pluses providing they do not create extra costs or detract from the DOD objective.

Landowners must be encouraged to become competent in making decisions on overall forest policy. They should be given preference when work opportunities come up, but in our experience they seldom exercise the option. The important point is that they have some say in who works on their land.

Landuse

Land allocated for planting must be uneconomic for grazing but highly profitable for forestry. It should be within sixty km of the processing point and carry tractorable slopes with known potential for high growth rate.

Planting profitable pasture land is the prerogative of the rich or the stupid.

Finance

All finance must come from another source. Just as a farmer cannot afford to forego income by planting good pastoral land he cannot afford a twenty-five year investment period (few people can!).

The Groome Joint Venture recognises that farmers want to own forests but cannot finance the first rotation, whereas sawmillers are prepared to pay the costs providing they get access to the whole resource.

The Forestry Rights Registration Act 1984 enables a landowner to allow another party to register on the title a right to trees growing on the landowner's land. The Act protects our investor, Odlins Tree Farms Ltd, and has much wider application for family forestry.

Marketing

Marketing is the most important landowner advantage arising from our joint venture. Our product objective is clearwood for the North Island Odlin-Winstone retail outlets. As individual landowners, neither Aitken, Ormond or Neilson would have the courage to adopt the Fenton/Sutton/Knowles low-stocking regimes. On our own we would lack the element of compulsion necessary for disciplined long-term planning. We are comfortable however with the idea that if our investor partner is to get a return on its investment so will we.

Organisation

Our organisation is a straight lift from Finland. In that country, Forest Management Associations cater for all those who have DOD expectations from local forestry. Participation in the Tuki Tuki scheme is limited to landowners, beneficiaries, Odlins and our consultants. This loose association has brought about a high degree of co-operation between landowners and the forest company, which is unusual and is considered by some commentators as traitorous. Unrepentant, we believe that progressive development depends on a group of landowners putting attractive investment opportunities in front of its investment partner. Our experience is that this attitude improves the revenue potential for farmers as well.

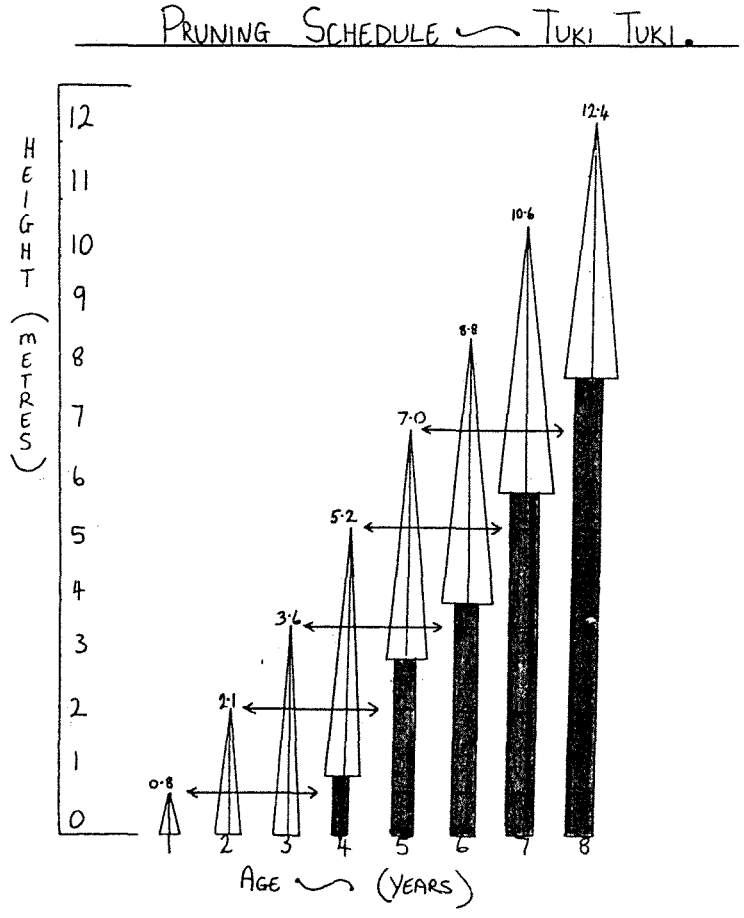
In order of importance, the organisation ranks marketing first, followed by finance, land organisation and management last. This is in stark contrast to conventional farm forestry wisdom, which generally reverses the order.

Management

We are, at year nine, developing a management system that promises perhaps to cut costs in half and increase revenue by forty per cent. The potential revenue is close to $40,000 at year twenty-five: the IRR is eighteen per cent. The key is early identification of individual trees with high production potential; then direct silvicultural costs at those trees.

That management is given lowest priority does not mean that it is unimportant. What it does mean is that the best management in the world is of no value if the other principles have not been put in place.

The pruning schedule illustrated below shows first the year-by-year height target we must achieve to be on course for the high revenues referred to above. It shows the relationship between tree height and pruned height three years later. It shows how the green crown on our trees remains constant. It explains how we achieve a constant defect core and how we can predict key computer input data three years earlier than conventional forestry.



A CHEMICAL COMPLEX FOR EVERY PRIVATE PLANTATION - WHY DON'T WE UTILISE THE COMPLEX CHEMICALS IN PINE NEEDLES?

David Cooper, PO Box 148, Mansfield, Victoria, 3722 (telephone no: (057) 77 0561), has long been interested in full utilisation of his plantation. He is pursuing three approaches to the harvesting and treatment of both bulk slash and separated pine needles:

Composting

David employed the Jean Pain method to compost slash, which requires large stacks and abundant water. He found that fermentation commenced very soon after which the temperature rose for three days, then suddenly declined. Has anyone else had a go at this? What is the inhibitor? David has heard that there is a bacterial additive that enables the process to continue.

When there's MUKA there's brass!

Russian foresters dry pine needles and put them through a hammermill (are they cut with a sickle too?). This produces a fodder called muka which is equivalent to lucerne in protein content. Frequently it is utilised in feedlots; a common proportion is ten per cent muka in the feedlot mixture.

Organic chemistry

Pine needles contain chlorophyll-carotene - in Russia two hundred and fifty tonnes of this paste are produced annually, as are vitamin products, organic salts, oils and waxes. In Germany, a green extract from pine needles is widely used as a bath oil. Is there a possibility that chemicals can be extracted on farms? By steam or alcohol distillation? Can plantation owners add value to their most basic and abundant product - pine needles?

David's major reference is the book 'Organic Chemicals from Biomass' (edited by Goldstein and published by DRC Press in 1981) - chapter 11 on foliage is written by George M Barton.

HOW TO MANAGE AN AREA THAT YOU HAVE FENCED AND REGENERATED TO CONTROL EROSION

Don Nicholls writes from the red gum country around Gringegalgona, Victoria:

My eroded gullies have been closed to stock since 1979 when I approached the Soil Conservation Authority for advice on obvious accelerated erosion of gullies following introduction of cattle in 1977. The property had previously only run sheep.

The Authority did not agree with my suggestion of a single fence along the gully, and I now realise that this was wise. Staff suggested double fencing of the worst areas. At this time a grant of virtually the cost of material ($800) was available and later thirty cents per tree planted in the area - a well worthwhile incentive.

The fencing is four-wire electric with posts (three inch creosote) every fifty metres with two by one inch hardwood creosote spacers every ten metres. I will not graze the enclosed areas subject to the grant. I have since enclosed other areas, and hope to do more.

The total area enclosed in 1979 was about eight hectares. I estimate that this enclosed area would probably run 5 DSE/ha compared with 9-10 DSE/ha on the uneroded areas of the property.

The material for 2000m of fencing was $800 in 1979. I used 14 gauge in the three bottom wires and 12.5 gauge in the top wire. Strainers were 7" x 5" with horizontal brace and 6" x 4" upright with 1/2" and 3/8" mild steel diagonal brace. This type of endpiece was only used on 90 degree or more acute corners: all other corners were 7" x 5" posts driven at a slight angle to the strain. One of the beauties of this type of fencing as you will know is that the fence can follow the general curve of the creek and so a minimum of country is lost to general grazing. In lots of angles a standard post is sufficient.

The young eucalypts, mainly red gum and manna gum that germinated after enclosure, were in my opinion influenced by the proximity of seed-bearing trees, by the competition, especially shading from grasses, and by the rainfall received.

The first spring saw a host of young eucalypts germinating especially in the eroded creek bed and in salt-affected areas but very few away from the creek. We have since planted there. Away from the creek the grass was too competitive.

This was borne out by the fact that quite often we experienced germination of red gum when we sprayed metre-square areas with Roundup for new plantings.

I suppose that in one hundred years or less some of the red gums will be able to be thinned for timber, but I have not really had this in mind, except for an experimental planting of honey locust for fodder production. At this stage they really haven't done at all well.

I feel that these enclosures could be used for shelter in emergencies, mainly for a few days after shearing in bleak weather, but I am loathe to recommend it as so much damage would be done by overuse. They are of course a terrific harbour for birds (and rabbits and foxes) and shelterbelts for stock as well as controlling the erosion. I am not really sure which will eventually prove to be the biggest advantage of this type of conservation.

PROFIT LOPPING FOR THE CAUSE OF REVEGETATION

In a novel move to encourage more planting of trees in rural areas, the authors of "Tree$ for the Back Paddock" are donating $1 from the sale of each copy of their recently released book to a number of community groups involved in revegetating agricultural land throughout Australia. These groups are ATCV, Warrenbayne - Boho Land Protection Group and Project Branchout in Victoria, Greening Australia in South Australia and Tasmania, Trees on Farms in NSW, TREAT from Yungaburra in Qld and Wickepin Soil Conservation District in WA.

"Tree$ for the Back Paddock" by Nan Oates and Brian Clarke, and published by Goddard and Dobson of Box Hill, Victoria, argues the ecological and economic justification of trees on farms.

As the book comprises around 300 pages, including over 170 illustrations, the authors are anxious not to be accused of contributing to further tree decline through the volume of paper required to print the book. Hence the $1 tree tax!

Trees are one of the long-term keys to the viability of Australian farming. Their removal over the past two centuries is now recognised as a major contributor to problems of widespread importance - salinity and erosion.

As more and more farmers seek to learn about the productive uses of trees and shrubs, the place of farm trees gains greater credibility. This in turn, has greatly expanded the demand for advice and assistance from government agencies and community groups.

"Tree$ for the Back Paddock" is therefore a timely, comprehensive and relevant addition to the growing literature on farm trees. It covers all aspects of establishment, maintenance and management for commercial timber production, agroforestry, shelter, shade, fodder, erosion and salinity control, wildlife and firewood.

Between them, the authors have many years of experience in the preparation and presentation of educational material to the rural community. "Tree$ for the Back Paddock" has a place on the shelves of every farmer, extension officer and educationalist interested and involved in revegetating our rural lands productively and economically.

Recommended retail price is $25 (plus $4 postage and packaging).

Contact: Nan Oates
1 Eildon Street
DONCASTER VIC 3108
(03) 848 4353

or Brian Clarke
(056) 27 8320

DAGS AND SCRAGS

Goddard and Dobson, 486 Station Street, Box Hill, Victoria 3128 (telephone no: (03) 890 4618) have a wide range of books on agroforestry.

Agroforestry in Australia and New Zealand (Reid and Wilson)	$31.00
Growing Carobs in Australia (Esbenshade and Wilson)	$20.00
Tree Crops '84 - Growing Up (edited Oates)	$26.00
Tagasaste - Tree Lucerne (Snook)	$10.00
Tree$ for the Back Paddock (Clark and Oates)	$29.00

(All figures quoted include postage.)

* * *

Hardly a dag or a scrag, but Dr David Bennett, formerly of CALM, has now moved to Muresk Institute of Agriculture, Northam WA 6401 (096) 22 4545, where he is now Wesfarmers Professor of Rural Management. David is also Chairman of Greening Australia (WA).

* * *

DCFL in Victoria is finalising plantation sharefarming schemes in three regions (Central Gippsland, North Eastern [formerly Wangaratta and Wodonga] and Yarram).

* * *

Participants in last years agroforestry workshop in WA enjoyed seeing the 'Forestry Squirrel' in action in a CALM plantation south of Bunbury. This is an hydraulically operated pruning platform designed for agroforests by Crendon Machinery, P O Box 95, Donnybrook WA 6239. Mike and Neville Fry (telephone (097) 31 1502) will be happy to send you more details.

* * *

A proposed plant at Mansfield, Victoria will produce carbon black from hardwood obtained from local forests. Apparently an environmental impact statement must first be prepared. Other good news for growers and farmers in north-eastern Victoria is the advent of the Monsbent plant at Benalla, which is currently taking as much radiata pine pulpwood as it can purchase for the manufacture of high-quality chipboard for furniture manufacture.

* * *

Under the US Freedom of Information Act, it has just been revealed that, in July 1945, Harry Truman approved the following Japanese targets, in order of priority, for atomic bomb attack:

- Hiroshima
- Nagasaki
- Tagasaste

As Harry said afterwards to aides, 'With Tagasaste, the jumbuck stops here!'

* * *

Alan Koehler of FRI, Rotorua, back from his working holiday in Australia, reports that he is currently producing a series of videos on agroforestry. The first, entitled 'Timberbelts', lasts ten minutes and may be purchased for NZ$165. It outlines the concept of timber production from single-row shelterbelts and highlights establishment, species selection and pruning. Other titles in the series will be:

- What is agroforestry? (The NZ scene overall.)
- Trees in pasture (The Tikitere approach with low stocking on established pasture.)
- Forest grazing (Sowing plantations with Maku lotus, grazing management, electric fencing and water supplies.)
- How to repair a stretched gumboot (Safe sex with sheep.)

Contact the Information Officer, FRI, Private Bag, Rotorua, New Zealand, if you wish to buy one of these cassettes.

* * *

Chris Borough, the first co-editor of 'Agroforestry Update', has left CSIRO and taken a position with Fortech, the Canberra consultants.

* * *

The Natural Resources Conservation League still has copies of its excellent December issue of 'Trees and Natural Resources' on agroforestry. Send $2.50 to NRCL, P O Box 105, Springvale, Victoria 3171 for a copy. The new editor, Nan Oates, is doing an excellent job. She has succeeded in wheedling out some very interesting articles from new writers, so there is lots that is fresh and topical.

NZFS Reprint 1801
ODC 266

Timber production from shelterbelts — getting started

Two design and management options

Jeff Tombleson.
Forest Research Institute, Private Bag, Rotorua

Recently when arriving a little early at a friend's farm it became obvious that I had surprised him. As he came out of the vegetable garden, innocently throwing the chainsaw behind the hedge out of my sight, I could see that I had interrupted a job he had intended to have completed well before my appearance. As we greeted each other, he must have sensed I knew what he was up to and confessed everything.

All but a few of last year's proposed shelterbelt planting programme of 10,000 radiata pine seedlings lay clearfelled. After having arrived from the nursery the previous winter they had been heeled in the vegetable garden where they had taken root permanently.

How often do we all return from a farm forestry field day all fired up over some new concept, and rush off and order a few thousand seedlings. Meanwhile, during the busy winter period, farming activities take preference to fencing and getting the area sprayed for planting. Despite the planting season giving way to early summer the seedlings are bunged in the ground anyway. Of course, from that day on we pay the price of poor background research and planning. Visiting members of the forestry and agricultural discussion groups delight in firing a barrage of questions as to why it was planted or managed in that particular way. But in being prepared for this usually critical group a list of plausible excuses is well rehearsed.

Fortunately for my friend, a project initiated in a burst of enthusiasm had not progressed further than purchasing the seedlings and had not developed into an expensive exercise, continuing on for some 25 years.

The idea of preceding the establishment of any tree planting investment with a pilot plot established one year in advance of the main planting venture has a lot of appeal. Experience gained on a small scale can be applied the following year. The application of increased management skills acquired can only result in a project giving a better return on investment, demonstrating the importance of PLANNING and good MANAGEMENT.

While giving my friend a hand to cut and heap the remaining seedlings he suggested that next year's effort would be more successful if I were to provide him with an outline of some design and management options aimed at producing high-quality timber and shelter benefits.

He commented that, in providing him with this outline, he only wanted the main conclusions with no unnecessary historical background or technical jargon. Here was an opportunity to give my outline.

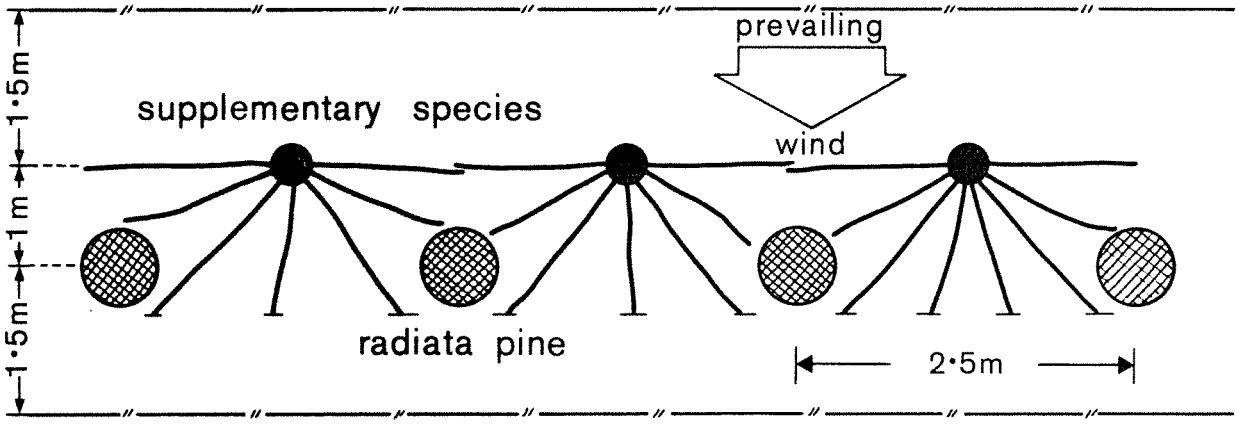
In both the following options radiata pine is considered as the timber producing species.

OPTION ONE

In late winter precision plant one row of radiata pine cuttings at 2.5 m to 3 m spacings. When the trees are 4 m to 5 m tall conventional pruning to half height should start. Diameter growth of trees on farms is rapid, therefore pruning on time to confine the branch stubs to a minimum defect core is important. One method of achieving this is to leave 3 m of crown on each tree. Pruning is carried out annually until all trees have been pruned to a height of 6 m. On a good growth site this might be around age seven. This operation will destroy the bottom shelter, so to compensate, a slower growing or supplementary species is interplanted within the row of radiata pine or planted in a row of its own just offset from the radiata pine. The supplementary species is established in the same year as the radiata pine. In providing bottom shelter in its position under the umbrella of radiata pine branches the function of the supplementary species is sacrificial. The choice is wide and may include species such as *Cryptomeria japonica; Cupressus arizonica; C. macrocarpa,* Leyland cypress; Western Red cedar; and Douglas fir — to name a few.

Single-row, wide spacing, weed control, high-quality tree stocks and electric fencing: a prerequisite for success. OPTION ONE. NZFS photo.

OPTION ONE



Management of the supplementary species is as important as for the primary species (radiata pine). This ensures a desirable permeability is maintained and that branches which spread out over the fence and later the paddock are kept in check. For this, topography permitting, a mechanical horticultural type trimmer applied to both sides is ideal, particularly if the supplemenatry species and the radiata pine are planted in the same row. Where the supplementary species is in a row offset to the row of radiata pine, fan pruning (on one side) may be considered. Fan pruning is a technique where all branches pointing towards the nearest fence are removed with pruners or jack saw, leaving only those branches pointing towards the opposite side of the shelterbelt. In later years the remaining untended side can be mechanically trimmed. Fan pruning, if carried out severely enough (see diagram), has an advantage in that it is permanent, unlike trimming which is expensive and has to be carried out regularly.

The figure shows what the OPTION ONE shelterbelt should look like.

The following is an example only of an establishment and management cost budget for Option One. It is based on the establishment of 400 radiata pine cuttings, and 400 seedlings of a supplementary species per kilometre. All costs include materials and labour.

OPTION ONE BUDGET
(example only)

	1 km
Fencing (permanent electric, one fence only)	$1500
Marking out	30
Spot spraying herbicide	80
Tree stocks (radiata pine cuttings)	60
(supplementary species)	240
Planting	80
Pruning (radiata pine)	680
(supplementary species)	200
Trimming (supplementary species, 1 side twice)	80

Pruned radiata pine, at six years, with slower growing cryptomeria. A design to yield high value timber and shelter benefits. OPTION ONE. NZFS photo.

OPTION TWO

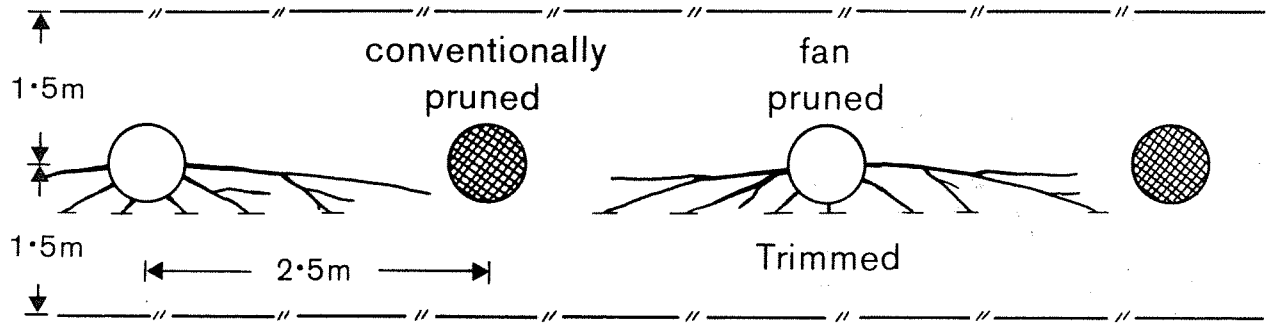
Precision plant one row of radiata pine at 2.5 m to 3 m spacings. When the trees are 4 m to 5 m tall, conventionally prune every alternate tree. In this option the low shelter is provided by the remaining alternate trees which are managed in either of three ways:

(a) MECHANICAL TRIMMING both sides of the shelterbelt. Commencing early and applied regularly is a good method of maintaining the narrowness of the shelterbelt. This treatment depends on the availability of suitable machinery and topography.

(b) FAN PRUNING the remaining alternate trees removing a single quadrant of branches only is a new treatment currently being evaluated. Branches are removed creating a potential clearwood quadrant of 50 to 80% of the tree circumference (see diagram on next page and photo). Branch development on the opposite side of the shelterbelt is kept in check by regular mechanical trimming.

(c) INTERNODE PRUNING the remaining alternate trees might be termed an option for the far-sighted enthusiast. In this technique some whorls of branches are removed leaving single whorls at

OPTION TWO (b)



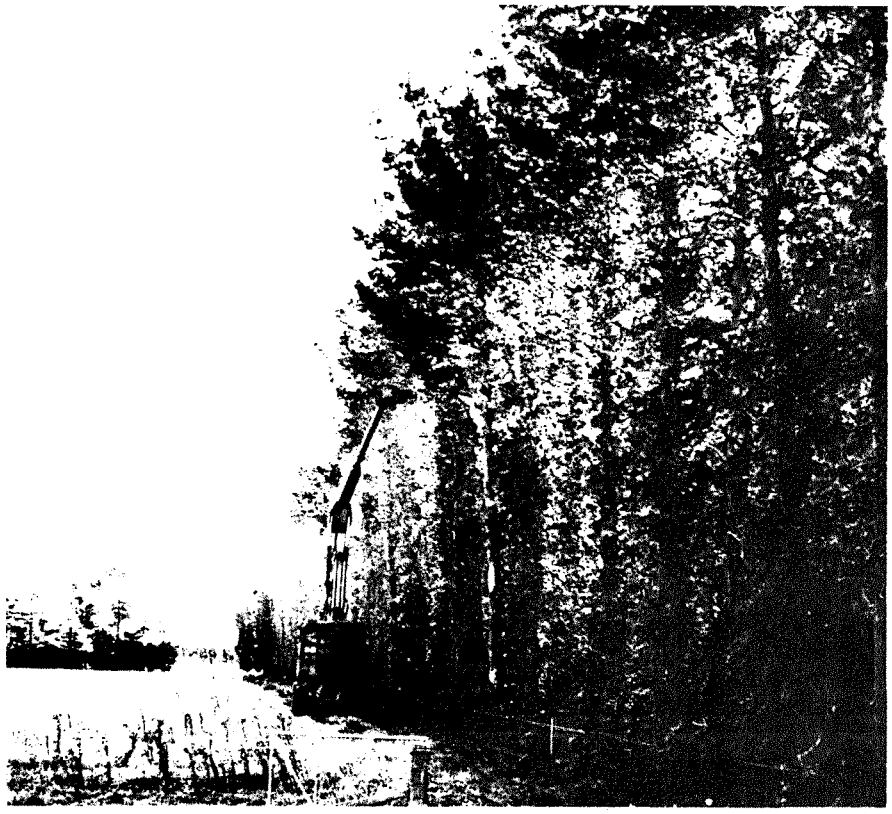
predetermined heights (see photo). The aim is to produce short clear length logs. Upgrading the value of an otherwise untended tree which would produce low-grade timber containing huge intergrown knots that in the future, chances are, no sawmiller will want. Internodes created of the right length, straight, and with defects confined to a small knotty core may be utilised as peeler bolts for the manufacture of plywood veneer. Although in theory the application of internode pruning has great potential in shelterbelts, trees treated in this way have yet to be sawn or peeled and that's another 20 years away yet!

The following is an example of an establishment and management cost budget for OPTION TWO (b).

Every alternate tree is conventionally pruned to 6 m with the remaining trees being fan pruned (60% circumference branches removed). The remaining side is periodically trimmed. It is assumed that a single row of radiata pine has been planted at 2.5 m spacings or an equivalent of 400 trees per kilometre of shelterbelt.

OPTION TWO BUDGET
(example only)

	1 km
Fencing (permanent electric, one fence only)	$1500
Marking out	15
Spot spraying	40
Tree stocks (radiata pine cuttings)	60
Planting	40
Pruning (includes fan pruning)	500
Trimming (1 side 8×)	220



Mechanical trimmers can operate to a height of 15 m. OPTION TWO (a). NZFS photo.

Some further considerations and points of clarification are necessary to ensure the success of the shelterbelt investment.

PRECISION PLANTING is best achieved by marking out the shelterbelt prior to the spraying or planting operation. Cut two lightweight sticks (bamboo) to meet the planting design dimensions. In the example of OPTION TWO one stick is cut to 2.5 m (distance between trees within row) and the other 1.5 m (distance from the shelterbelt to the fence). Using an aerosol paint marker and holding the sticks in an L-shape, marks are made indicating the tree planting position. It is possible for one person using this procedure to mark out the shelterbelt at a walking pace.

GOOD ESTABLISHMENT techniques cannot be over-emphasised. Apply a knockdown and residual herbicide by spot spraying prior to planting. This will ensure bare ground for at least the first growing season. Good planting techniques must also be used to ensure the shelterbelt doesn't topple or blow over in future gales. Planters are often quick to blame tree toppling on high fertility sites and rapid growth rate. Despite this, few trees have been shown to topple when given good ground preparation and proper planting techniques. In many South Island situations, ripping to a depth of 500 mm is essential.

Pruned radiata pine alternating with mechanically trimmed trees. OPTION TWO (a). NZFS photo.

IMPROVED GENETIC MATERIAL. With shelterbelts we are locked into a system of planting the final stocking. Large variations in growth and form of existing radiata pine seedling stock has had to be accepted. However, new developments at the Forest Research Institute have resulted in the identification of genetically superior trees which have better form and growth. Controlled pollination between such trees can be used to produce moderate quantities of seed which will be grown into one- or two-year-old seedlings, each of which can be treated to produce quantities of juvenile cutting material. These cuttings will have better stem form and growth than seedlings of lower genetic quality. The cost of these cuttings will be 2-3 times that of seedlings but the production of more uniform high-quality crop should more than offset this increase. Until these new generation cuttings from control pollinated seed become commercially available, only high-quality seed orchard planting stock should be considered.

WHY RADIATA PINE? No other commercial timber producing species subjected to such a range of soil types, varying rainfall, and extremes of exposure has such a fast and uniform growth rate matching that of radiata pine. The proof of this is to fly over the Canterbury Plains where one sees little else but radiata pine. There is, of course, a place for special purpose species in shelterbelts, e.g., eucalypts, Australian blackwood, *Cupressus macrocarpa*, and *C. lusitanica*. It must be remembered that unlike radiata pine, most of the special purpose species, particularly some of the hardwoods, are site specific and that shelter itself is a primary site requirement for their growth. These species may be best suited to internal shelterbelts.

FENCES are necessary for the protection of the shelterbelt throughout the entire rotation. Profitability of the shelterbelt investment is sensitive to fencing costs. The conventional eight wire and batten fence costing around $4000 a kilometre cannot be justified financially. Cheap and effective electric fencing systems ranging from $500 to $2500 a kilometre are ideal.

Distance between trees and the fence line is important. Distances of 1.5 m for sheep and 2 m for cattle are considered acceptable, without unnecessarily increasing the area of the shelterbelt or risking damage from stock browsing.

WHY SINGLE ROWS AND WIDE SPACING? Historically those considering timber production from shelterbelts planted close-spaced, multiple-row designs (long narrow woodlots or thickets). The objective was to contain branch sizes by suppression. This was achieved on the middle rows at least, but at great expense to individual tree growth and profitability. Unfortunately, the multiple-row design has continued to remain fashionable. One reason might be that some growers have taken their lead from horticulture where wind breaks are a prerequisite to the success of many export crops. The design in terms of timber production and profitability is of no consequence.

However, except in a very few circumstances agricultural shelterbelts are not a prerequisite to farming objectives. Therefore the criteria for their evaluation is surely return on money invested or benefit realised from either the management for timber production and/or agricultural benefits, relative to the costs incurred.

A recently pruned young shelterbelt; alternate fan and conventional pruning. OPTION TWO (b).

Financial evaluation, comparing widely spaced single-row shelterbelts with closely-spaced single or double-rowed shelterbelts, indicates that each produce a similar volume of wood. But by planting all those extra trees in a multiple-row design it costs several times more to establish, prune, harvest, and saw for a similar return. In economic terms when taking into account returns from timber production, traditionally spaced multiple-row shelterbelts or closely-spaced single-row shelterbelts can be very unprofitable.

FURTHER INFORMATION on herbicides, establishment methods, supplementary species choice, application of pruning techniques, or any other matter relating to shelterbelt silviculture can be obtained from your Forest Service Advisory Officer. Their technical ability coupled with your local knowledge make a good partnership.

Alternate internode and conventional pruning. An option for the enthusiast? OPTION TWO (c). NZFS photo.

SUMMARY

Leaning on the top rail of the gate my friend had scribbled all the important points on pages headed NOTES in his stock and station agent's diary. Looking down at the overlay of sketches etched into the dirt it was becoming obvious that sufficient information had been discussed to enable him to choose an option and make a start.

TO CONCLUDE, it must not be overlooked that well-managed shelterbelts are a valuable timber crop in their own right. In getting started whatever option is chosen, management for shelter need not compromise timber quality and returns. This is achieved by wide tree spacing with subsequent early and regular pruning. Only then is effort rewarded with returns of up to $50,000 nett per kilometre of shelterbelt; shelter benefit could even be considered a bonus.

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ODC 266

Switched on agroforestry using radiata pine cuttings protected by electric fencing

A. Koehler, J. Tombleson, V. Paton, Forest Research Institute, Private Bag, Rotorua

A lot of people have been turned off radiata pine agroforestry because of problems with sheep browsing young trees, expensive silviculture, and the sight of good pasture disappearing under pruning and thinning debris. There is a better way! Exciting developments to agroforestry have been initiated by a new generation of cuttings. This involves planting fewer trees, planting in groups to confine debris and simplify selection of final crop trees, and continued grazing of newly planted areas using electric fencing.

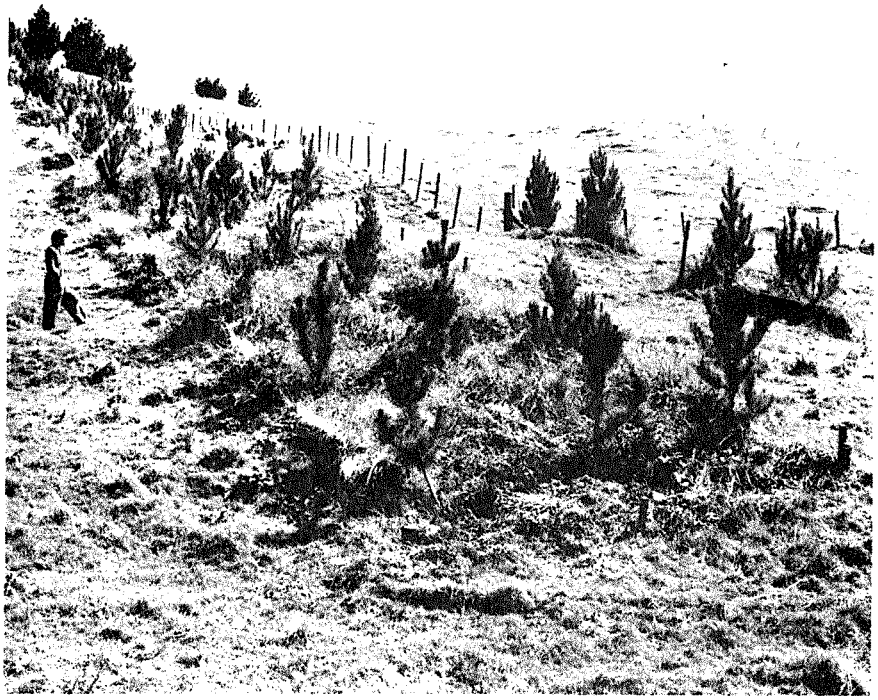
Electric fencing protects palatable cuttings from sheep while still allowing 80% pasture utilization. Photo: NZFS

CUTTINGS

Radiata pine seed of the best genetic material is now becoming available from the Genetics and Tree Improvement breeding programme. To maximize use of this seed, especially from controlled pollinations, methods of vegetative multiplication from seedlings are being developed. The two main options are:

(a) Field cuttings from plantations which have been established with superior seedlots.
(b) Juvenile cuttings propagated from nursery stool beds.

Field cuttings from three- to four-year-old trees have some improved characteristics of form and straightness, but have slower initial stem diameter growth than more juvenile cuttings. The main benefit with cuttings is in the improved genetic quality, particularly when using controlled crosses of the best parents. The term "control" refers to the artificial or control pollination of two trees known to produce superior progeny. To allow nurserymen to gain experience in the new radiata propagation techniques, the Forest Research Institute has released small quantities of improved seed. At present the seed is of open-pollinated origin from the best seed orchard parents. Small quantities of control-pollinated seed will be available soon. Some nurseries are already selling cuttings from both field-collected and nursery stool beds. The sale of this genetically improved planting stock should become more widely available this planting season, including stock from the Forest Research Institute nursery.



Switched on agroforestry: combining cuttings, triple row configurations and electric fencing. Photo: NZFS

With improved genetic material we now have a tree ideally suited to agroforestry and, when combined with early pruning and thinning, it will enable agroforesters to confidently plant as few as two to three times the required number of final-crop stockings, i.e. within the range of 100 to 200 stems per hectare. Correspondingly, establishment, pruning, and thinning costs are reduced.

ADVANTAGES OF PLANTING FEWER TREES PER HECTARE

If trees are grouped, as is possible when planting fewer trees of known quality, a

number of advantages can be gained. These include simplified selection of final crop trees, confinement of pruning and thinning debris to small areas and an increase in the area available for grazing. Between-tree competition is prevented by thinning out neighbours to leave single, well-formed trees at wide spacings.

A final crop of 100 stems per ha equates to one tree per 100 m^2, with even spacing resulting if groups of three trees are planted at 10 m centres. A widely spaced final crop can also be achieved by grouping three rows together and spacing the sets of triple rows 25 m apart. Trees within the triple rows are spaced 1.5 m apart, with 4 m between trees within rows. The three-to-one selection ratio results in two trees out of every group of three being thinned to waste, with final crop trees being spaced approximately 25 x 4 m apart.

ESTABLISHING THE TREES ON PASTURES

There is a choice between spraying before planting using any of a wide range of herbicides, or using selective herbicides after planting. Spraying before planting has the advantage of ensuring the job is completed, and of avoiding herbicide damage to the trees. The trees should be planted into a well cultivated hole, with the roots hanging downwards and not bunched up. Care is needed in handling the young trees to ensure they don't dry out.

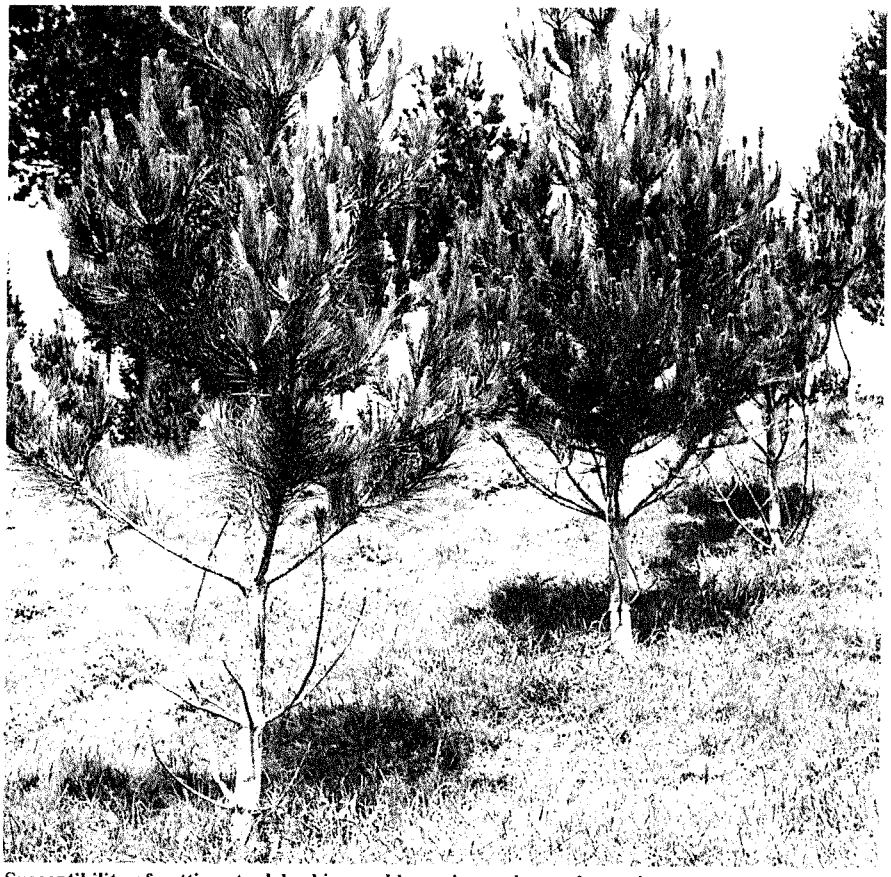
OPTIONS FOR EARLY GRAZING

Current options for grazing newly planted areas are to shut the gate and keep sheep out until the trees are well up out of harm's way, or graze carefully by either set stocking sheep at low numbers or grazing larger numbers for short periods. Changes in pasture composition through leaving pasture to become rank and the obvious loss of grazing revenue make the first option unattractive. The second option requires time and skill on the part of the stock manager and is probably the riskiest option, especially if cuttings are used, as they are reputed to be more prone to browsing.

Protecting individual trees from browsing damage is both uneconomic and impractical when high numbers of trees are planted per hectare. Tree protection becomes viable when there are less trees in total and they are protected in groups rather than individually. With the trees protected, newly planted areas can be grazed as if the trees weren't there. To be successful, the tree protection system needs to be both cheap and effective. A system which fills this role well is the grass fence. The use of a single electric wire to protect young trees from browsing is not a new one; however, the planting of trees in widely spaced groups or multiple rows makes this system practicable on a much larger scale than has previously been possible.

EVALUATION

Two trials were planted in August 1983 using stem cuttings from three- to four-year-old trees. At this time cuttings from controlled pollination were unavailable. One area of 1.5 ha is located at the Tikitere agroforestry research area; the other 1.2 ha area is on Tumunui Trust land just south of Rotorua. Planting configurations being evaluated include single, double, triple rows, and groups, all planted at 300 stems per hectare aiming at a final crop of 100 stems per hectare.



Susceptibility of cuttings to debarking and browsing makes early grazing management critical. Photo: NZFS

In both areas spots 1 m in diameter were sprayed with a glyphosatesimazine mixture two weeks prior to tree planting.

Tree management will involve annual variable lift pruning up to 6 m with two thinnings to waste. First thinning and pruning will be undertaken when the trees are 3 to 4 m tall.

ELECTRIC FENCING SYSTEM

The grass fence system used in the trials was constructed using 1.6 mm-gauge wire supported on half fence battens, insulated by 100 mm insultube insulators. Because only sheep were being grazed, the single wire was positioned 25 to 30 cm off the ground and at a distance of not less than 50 cm out from each tree. Two power sources were tested — a mains-powered energizer at Tikitere and a portable solar rechargeable unit at Tumunui. Both were effective, the portable unit being ideally suited to electrifying small areas where mains power is unavailable.

It is important to follow manufacturers' specifications and use approved electric fencing practices. This ensures that the energizer operates at maximum efficiency, as shorting, caused by grass touching the wire, can result in drainage of power and less effective shock.

The group planting proved the most difficult to fence off due to their distance apart and the need to connect the wire from one group to the next whilst permitting stock to move freely amongst them. The double and triple rows were the easiest to fence, as it was simply a matter of running a wire along each side of the outside rows. On hilly sites planting orientation appears to be an important factor, as sheep prefer to graze along the contour. Planting along the contour also makes fencing easier, as the wire can be strung out along benched stock tracks. The smoother the surface of the paddock the easier the wires are to erect and maintain.

GRAZING MANAGEMENT

Rotational grazing was practised at Tikitere, with approximately 80 hoggets being grazed on a week-in three-weeks-out rotation. At Tumunui a set stocking of 20 mixed-aged ewes was maintained in the planted area for nine out of the first 12 months. Both methods resulted in approximately 80% pasture utilization, with only very isolated cases of stock entering fenced-off areas. Continued grazing resulted in the grass within the fence growing to form a visual barrier to the sheep. As sheep prefer to graze short pasture, the likelihood of stock breaking through the fence was diminished. This effect was more quickly apparent with the more intensive rotational grazing at Tikitere.

DISMANTLING THE FENCE: A cautionary note

The attitude of sheep to young trees can only

be described as unpredictable. **The increased palatability of cuttings provides for a cautionary approach to early grazing.**

Once the trees have grown to a height of 1.5-2 m their terminal buds are well out of reach and the fence can be removed. The majority of the materials used are salvageable and can be reused to protect subsequent plantings. When the fences have been removed the first few grazings should be on quite long pasture, and of short duration, as debarking can occur.

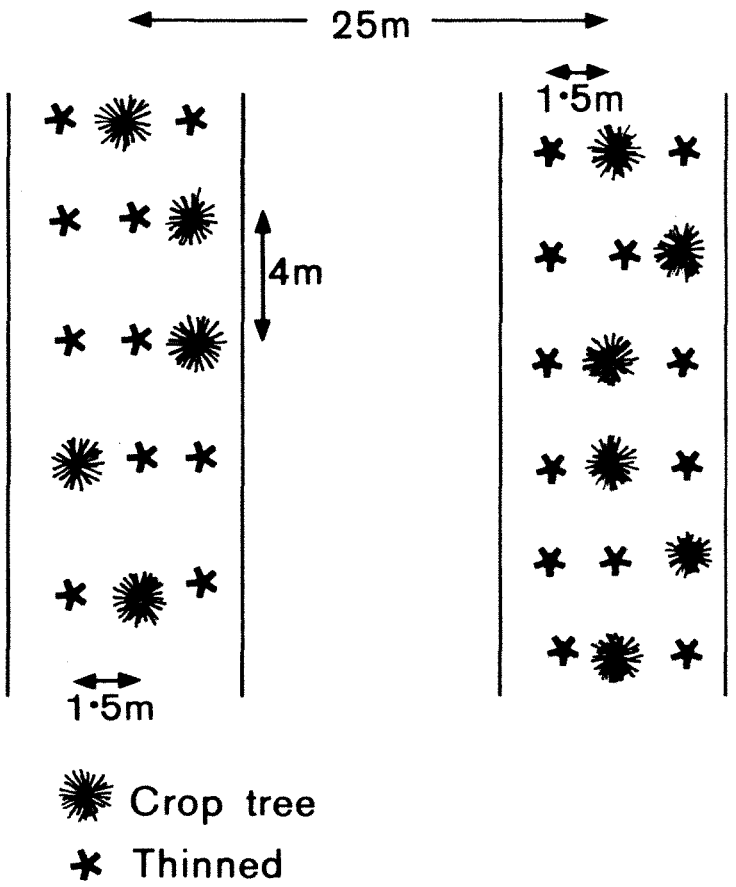
COSTS AND RETURNS

The double and triple row systems were the cheapest to fence off at an approximate cost of $120/ha for materials, excluding the energizer. As each row had to be fenced off individually, the cost of fencing the single rows doubled to approximately $240/ha. The groups, once fenced, took up the least amount of area and cost around $170/ha to $200/ha, depending on whether an underground or overhead system was used to link them. (All costs exclude labour charges.)

For the system to be economic, initial costs should be kept as low as possible and the majority of materials reused. Nett returns are dependent on the number and class of stock used and the duration of grazing. The decision to use the grass fence system should not be based only on the return on the dollars spent. Other less quantifiable benefits such as ease of management and fail-safe grazing are sufficient reasons to make it a worthwhile practice.

TRIPLE ROWS RECOMMENDED

The use of improved genetic material combined with early unrestricted grazing simplifies both grazing and forestry management. The triple row system is recommended, as it incorporates the desirable features of providing a wide area between rows for unrestricted grazing. Selection of trees to be pruned and thinned out is simplified, as trees are managed in discrete groups within the rows and fencing is simply a matter of running a single wire down each side. Triple rows should be spaced 25 m apart, as previously outlined.



A fool-proof planting design: triple row configurations simplify pruning and thinning selection decisions. Photo: NZFS

The increasing availability of improved genetic material from controlled crosses, coupled with tending fewer trees planted in groups protected by electric fencing, provides the opportunity for those previously turned off agroforestry to switch on to a highly profitable, easy care system.

DIRECTORY

The following additions and changes have come in since 'Agroforestry Update 5'.

Send further alterations to:
Richard Moore
CALM (Research Section)
Queens Street
BUSSELTON WA 6280

AUSTRALIAN CAPITAL TERRITORY

Dr Clive Hackett
Ph: 062 46 5842
CSIRO Division of Forest Research
C/- CSIRO Division of Water and Land Resources
GPO Box 1666
CANBERRA ACT 2601

INTERESTS

- Ecophysiological land evaluation
- Ecophysiological plant descriptions

CURRENT PROJECTS

- Evaluation of PNG for subsistence agriculture and smallholder cashcropping
- Application to other problems, especially multi-species problems

QUEENSLAND

Grahame Applegate
Ph: (070) 91 1844
Department of Forestry
PO Box 210
ATHERTON, QLD 4883

INTERESTS

- Research into the interaction of different tree species and pasture in the humid tropics of North Queensland
- Evaluating species suitable for an agroforestry system on the coastal lowlands of North Queenland
- Whole-farm planning of re-vegetation and, after that, whole-catchment planning, especially on the Atherton Tableland

CURRENT PROJECTS

- Monitoring the growth of slash pine in agroforestry systems on the Atherton Tableland
- Monitoring the growth of various eucalypt species at wide spacings on the Tableland
- Evaluating hoop pine in agroforestry on the Tableland
- Evaluating various native and exotic highial hardwoods for use in agroforestry on the North Queensland coast.

SOUTH AUSTRALIA

Peter Bulman
Ph: (085) 32 3344
Native Plant Section
SAWFD
Box 752
MURRAY BRIDGE SA 5253

INTERESTS

- Agroforestry
- Fuelwood
- Fodder trees
- Direct seeding
- Seedling establishment
- Salinity

CURRENT PROJECTS

- Chemicals for weed control when growing native species
- Establishment techniques for 'wet', semi-arid and arid sites
- Establishment techniques on creacking clays
- Chemical weed control for direct-seeded sites
- Agroforestry for salinity control
- Quantitative tolerance of salinity by provenances of red gum and other species
- Amelioration of salted sites
- Assessment of fodder trees
- Alternative species for agroforestry

(Greg Dalton and Bruce Mason are included in the above entry.)

VICTORIA

Bob Piesse
Ph: (03) 859 8353)
Piesse Productivity
1461 Burke Road
EAST KEW VIC 3102

INTERESTS

- Economic control of mammals, insects and birds with electric fields, smells, sound and shocks

CURRENT PROJECTS

- Powered wire-loop protection for individual trees and clumps and its effect on tree growth
- Promoting the Rowley 'No Netting' rabbit fence
- Flood plain fencing, Fitzroy River, WA
- Dog control, Backabuggery station, west of Kalgoorlie, WA
- Anti-giraffe devices, Werribee Park, Victoria

Rob Youl
Ph: (03) 651 4667
Land Protection Division
DCFL
250 Victoria Parade
EAST MELBOURNE VIC 3002

WESTERN AUSTRALIA

Prof David Bennett
Ph: (096) 22 4545
Muresk Institute of Agriculture
NORTHAM WA 6401

NEW ZEALAND

Dudley Franklin
Ph: (03) 51 7099)
Forest Research Centre
PO Box 31-011
ILAM CHRISTCHURCH NZ

INTERESTS

- Silvivulture
- Agroforestry

CURRENT PROJECTS

- Species selection

Leith Knowles
Ph: (073) 47 5899

INTERESTS

- Agroforestry to diversify, and boost economically, landuse in New Zealand's hill country

CURRENT PROJECTS

- Analysis of tree growth in shelterbelts and response to silviculture
- Video films on agroforestry

Alan Koehler
Ph: (073) 47 5899
Forest Research Institute
Private Bag
ROTORUA NEW ZEALAND

INTERESTS

- Silviculture of radiata pine
- Technology transfer

CURRENT PROJECTS

- Nationwide final crop stocking trials
- Development of economic model for agroforestry

Patrick Milne
Ph: (073) 47 5899
Forest Research Institute
Private Bag
ROTORUA NEW ZEALAND

INTERESTS

- Silviculture
- Agroforestry

CURRENT PROJECTS

- Evaluating timber production from shelterbelts

Jeff Tombleson
Ph: (073) 47 5899
Forest Research Institute
Private Bag
ROTORUA NEW ZEALAND

INTERESTS

- Management of shelterbelts for shelter and timber

CURRENT PROJECTS

- Shelterbelt growth analysis
- Comparison of trees grown in plantations and in shelterbelts
- Financial analysis of shelterbelt productivity

Graham West
(073) 47 5899
Forest Research Institute
Private Bag
ROTORUA NEW ZEALAND

INTERESTS

- Forest grazing
- Silviculture of radiata pine

CURRENT PROJECTS

- Effects on tree growth of grazing oversown legumes

- Use of livestock for weed control

- Modelling effects of silviculture on growth of radiata pine

INDONESIA

Ir Made Nitis
Ph: (0361) 23 791
Jurusan Nutrisi dan Makanan Ternak
Fakultas Peternakan
Universata Udayana
Jl Jendral Sudirman
DENPASAR
BALI INDONESIA

(Department of Nutrition and
Tropical Forage Science
Faculty of Animal Husbandry
Udayana University)

INTERESTS

- Integrated farming systems

- Agro-industrial by-product feeds

- Fodder shrubs and trees

- Forage under plantations

CURRENT PROJECTS

- Three-strata forage system: (1) grass/legumes (2) shrub (3) trees; for grazing cattle on Bali (1984-1990)

- Agro-industrial by-products: rumen content and fish waste for non-ruminant feeds (1986-1988)

F D Atkinson Government Printer Melbourne