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REPORT ON A VISIT TO NEW ZEALAND

under the Research Officers' Exchange Scheme

by

F. H. McKINNELL

April 23 to May 18, 1974

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23 April - 18 May 1974

The main part of this visit to New Zealand was spent at the Forest Research Institute in Rotorua and was concentrated on seeing aspects of establishment and silviculture of Pinus radiata. The report which follows gives a day by day account of the tour.

The outstanding impression of the visit was the sheer size of the pine afforestation in New Zealand. To some degree, at a forest such as Kaingaroa the vast, monotonous tracts of dark green pine were overpowering and I can now see why some people object to large scale pine planting on aesthetic grounds.

I had not previously appreciated the large number of risks associated with growing pine in New Zealand, such as wind damage, frost, disease and insect pests. Nor had I realised the effect poplar rust has on ornamental plantings. Most poplars grown in W.A. including P. nigra have no future at all as the rust must reach us eventually.

The Forest Research Institute is a most impressive organisation which clearly demonstrates the great benefits to be gained from integration of the forestry and forest products research organisations. One can only envy their foresight in this regard.

I wish to thank all those at the F.R.I., at Kaingaroa and at Eyrewell who made my visit such an interesting and enjoyable one, and especially Mr. Geoff Chavasse, who had the task of organising the programme, without knowing when I would arrive!

Tuesday 23 April

Nursery and seedling quality problems J. van Dorsser and M. Menzies.

Inspected demonstration weedicide trials. These were of interest since the chemicals used have not been tested in W.A. Propazine is very effective against a wide range of broadleaf weeds and annual grasses at rates of about 1kg/ha. If it is necessary to control summer grass chlorthal may be used at the same time at 9kg/ha. This treatment may be used either pre-emergence or post-emergence. For eucalypts, there can be damage by propazine when used at levels of 0.6kg/ha and above.

Other chemicals of value under certain conditions are nitrofen (for both pine and eucalypts), diphenamid and choramben.

A great deal of work has been done here on root pruning in P. radiata. There seem to be two reasons for this operation. Firstly they are unable to confine their planting to the short optimum season as we do, and secondly, well root-pruned stock are less liable to toppling, which is a serious problem on many sites. Since toppling appears to be a problem on some sites in the Sunkland this approach could well have relevance for W.A.

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Grafting P. radiata has more or less been discontinued because of the problem of graft incompatibility. Propagation of desirable genotypes is now done almost entirely by rooted cuttings. It is of interest to note a reliable method of obtaining cuttings from old trees has been evolved.

Trevor Faulds has a very good technique for grafting eucalypts which has been used on about 15 species including delegatensis, regnans, saligna, botryoides, grandis, ficifolia and leucoxylon. Most species give about 80% take and the scions can come from trees of any age. This technique would seem to hold great promise for production of early yielding eucalypt seed orchards. I was shown an E. ficifolia 18 months after grafting bearing very heavy fruit and an E. leucoxylon graft four years old which was a mass of flowers. This might well be what we have been looking for for a karri seed orchard and propagation of pink flowering marri, canker-resistant E. ficifolia and a reliable source of tuart seed.

Wednesday 24th April

Grazing/forestry L. Knowles.

Inspected Tikitere experimental site. This is a farm of about 200 ha on very variable topography used for a large scale trial aimed at evaluating a grazing/forestry enterprise under two intensities of grazing and at five levels of pine final stocking. The planting rows were marked out by pre-spraying the lines three pints of paraquat and 3 lb. of simazine per sprayed acre, using a Land Rover unit. The rows are spaced 14 feet apart to permit hay to be cut between the rows in much the same way as we have done in W.P. 15/73. Pine final crop levels will be 0, 20, 40, 80, and 160 stems per acre and they were planted at five times that stocking, to be reduced by thinning to waste. The design is replicated on flat country, on rolling country and on very steep sites. A very similar experiment has been established using E. delegatensis, the intention being to prune this just as they would P. radiata.

Then inspected a small area of private pine plantation at Ellis and Burnand's mill near Litchfield. The pine was planted 13 years ago at 8' x 6' and thinned more or less on our Sil 70 schedule, the last thinning to 80 stems per acre being carried out in 1970. All trees have been pruned to a height of 36 feet and a good cover of grass has come in underneath. This stand is a good illustration of the type of stand where there can be no real conflict of interests, and much benefit to both pines and livestock from a combination of grazing and forestry.

Near this plot is an area of 23 year old plantation of several species mostly planted at quite wide spacing (about 12' x 12'), in several rows. The most interesting parts are some E. delegatensis which are now up to about 24 inches in diameter. Some are limby but some are not, indicating wide early spacing in eucalypts does not necessarily lead to excessive branchiness. The radiata in this section is on the most exposed outside position but, due to pruning being carried up to about 50 feet from the ground, have produced millable logs in this situation.

A brief visit was paid to a N.Z.F's plantation at Waratah, to a 13 year old area converted to something like the Ellis and Burnand plot above, but on a much larger area. Pruning slash and tops had been successfully cleaned up using a Yeomans Tritter. Observation here would indicate it is necessary to prune to at least 24 feet to obtain satisfactory grass development. If this approach becomes more popular it may be worth developing strains of pasture plants more tolerant of shading.

An inspection was then made of a most impressive demonstration of an integrated grazing/forestry enterprise on a farm recently purchased by the Ellis and Burnand mill. Pines were planted at 14' x 6' in June 1973 into previously sprayed strips (where trafficable) or spots, using the same weedicide mix as at Tikitere. All the tractor country had had the grass cut for hay in December 1973, mainly to induce clover dominance in the pasture. Where the weedicide had been sprayed the new pasture was 100% clover. The ready availability of the clover is apparently essential for prevention of grazing damage to the pines.

Early in April 1974 the pines were 1 - 4 feet in height, with pasture about 1 foot in height. Grazing had been in progress about two weeks when the trial was seen and the sheep had already made a great impact on the pasture. The sheep used were six month old newly weaned lambs. They were at a stage in life when they were growing rapidly - of the order of 2 lb. live weight gain per week. Stocking rate was 6 sheep to the acre. After an extensive search no evidence of damage to the pines could be found, although the sheep were eating down the clover hard up against the pine seedlings.

The obvious success of the technique here encourages an extension of the work already carried along these lines in W.A.

Thursday 25 April Anzac Day Holiday.

Friday 26 April

Weed control with chemicals. D. Preest and G. Chavasse.

Inspected weedicide field trial at Kaingaroa, testing several chemicals applied post planting to P. radiata, Douglas Fir and Euc. delegatensis. A chemical not yet seen in W.A. known as Caroguard is giving promising results. It has a good knock down as well as a residual action against grasses and herbaceous weeds. Radiata appears to tolerate Caroguard at levels up to 12 kg/ha.

Adjacent to this trial is a large area of P72 P. radiata sprayed 9/73 with ½ gal/ac. of weedazol TL and 4 lb. a.e./ac. of atrazine (80%) in 30 gallons of water per acre from a boom spray. At the time of inspection the ground was completely bare, and with no detectable damage to the pines.

Inspected bracken spraying trials testing Tandex, glyphosate, Asulam and 4-CPA. Of these Tandex and glyphosate show the greatest promise. Radiata appears to tolerate small amounts of glyphosate. With Tandex inconsistent effects are observed, pines sometimes being stimulated and sometimes killed.

Monday 29 April

Pathology, J. Gilmour

Saw N.Z.F.S. film on the Dothistroma problem and discussed pathology problems in general with John Gilmour. Present thinking is that aerial application of cuprous oxide for control of Dothistroma will be required four times during a rotation of radiata pine, each operation costing $2.50 per acre. Inspected examples of terminal crook disease at the F.R.I. nursery. This is a serious disease at the nursery stage, not being a killer of seedlings but causing stunting of growth for about 12 months. The fungus is not affected by the copper-based sprays used for control of Dothistroma. The most effective (but not entirely satisfactory) mixture at present is captan + phenyl mercuric chloride (PMC). For safety reasons it is desirable to find a replacement for the PMC but no effective substitute has yet been found.

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Discussed work with S. Chou where he has shown that Diplodia pinea can be a primary pathogen on P. radiata under suitable conditions. It is usually first noticed as a spring dieback of the terminal 30 cm or so of leaders and lateral shoots. This results in stem crooking and shoot malformations but there is considerable indivual tree variation in response.

Entomology

P. Alma, R. Zondag

Inspected facilities for entomological research and had general discussion of insect problems with Zondag and Alma. The main insect problem on P. radiata in New Zealand is Hylastes, but this is a problem mainly of second rotation areas where a build up in population is encouraged by the large amount of logging slash. Concern was expressed at the potential for damage of a new insect arrival, the bark beetle Hylurgus. It ringbarks small trees at the root collar in a similar way to Hylastes. Ips grandicolis has not yet been found in N.Z.

An interesting point is that, in spite of the successful establishment of several predators, Sirex is not yet a thing of the past and it has recently been seen to attack radiata pine which had been thinned to 100 s.p.a. This is in marked contrast to its previous pattern of attack in N.Z.

Tree Physiology

D. Rook

Inspected the recently built F.R.I. controlled environment facilities and discussed work by Rook on root wrenching and the need for more work on the physiology of the seedling. It is of interest to note the general direction of work in this field with parallel work proposed for the Canberra F.R.I. by K. Cremer.

Tuesday 30 April

Silviculture J. Tustin, R. James

The first visit of the day was to a cattle grazing trial under P68 P. radiata at Rotoehu forest. This is an operational trial in an area where there is a heavy undergrowth of bracken and several native shrub species. Part of the area now running cattle had been thinned to waste six months previously but the cattle had made a marked difference in the height of the slash and bracken. I see no reason why we should not immediately introduce a policy of grazing cattle in all stands thinned to waste. Under our conditions it would be undesirable to have the cattle in the plantation during the fire season but grazing during winter and spring would result in a marked improvement in accessibility for high pruning and a reduction in competition and fire hazard.

Inspected a demonstration thinning trial in compartment 128, also in a P68 area. This area had been thinned at age 4, when the ground cover was mostly bracken. Grazing with cattle has been carried on, when feed was available, since that time. The ground cover, except on the steeper parts which are avoided by the stock, is now pasture only and the slash has virtually disappeared. Control areas adjacent to the trial carried very dense bracken and some other scrub species, presenting a problem in access for marking for height pruning and future thinning operations.

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The trial itself demonstrates three variations on the theme of "Fentonian" thinning as follows:

REGIME	1	2	3
Intermediate yield	grazing only	(i) grazing (ii) 70 spa posts at PMH 55'	(i) grazing (ii) 70 spa pulp PMH 75'
Final crop	80 spa sawlogs	80 spa sawlogs	80 spa sawlogs

We then moved on to Tarawera Forest, owned by Tasman Forest Products Ltd. to see an F.R.I. thinning experiment aimed at providing the data necessary for evaluation of the feasibility and cost of production of framing grade logs and groundwood pulpwood.

This experiment and the one previously mentioned at Rotoehu are good examples of a different philosophy of thinning research from that usually adopted in Australia. Here thinning research appears very much product oriented, whereas Australian research generally concentrates on exploring the growth patterns of the log produced. The New Zealand approach may produce data of more immediate value but the trials run the risk of being rendered obsolete by technological developments in the wood processing industry.

An interesting feature of this experiment is the plot layout. The plots are of an interlocking hexagonal shape, with 0.15 acre measured plot each with a 0.3 acre surround. It is located on a scoria soil close to Mt. Tarawera itself and this very uniform soil is ideal for this type of work since site variation is very slight.

Wednesday 1 May

P. radiata nutrition G. Will

Maramarua Forest - established pre-war on "kauri gumland" soil. Phosphate deficiency is a characteristic of the area although it is not as severe as at Riverhead. The old stands look very like the old stands at Grimwade and Margaret River. Foliar P levels in deficient areas are in the range 0.08 - 0.09 per cent, whereas 0.13 - 0.14 is considered optimum.

The current establishment technique on second rotation areas is to make a spot application of superphosphate at 4-6oz. per tree at planting. As soon as the trees have dominated the scrub a further 10 cwt. per acre is applied from aircraft. In fact 5 cwt. per acre is sufficient but 10 cwt. is used to ensure the application rate does not fall below 5 due to haphazard aerial application. I was surprised at the opinion expressed by several foresters in New Zealand that it is just not possible to get even application of superphosphate from aircraft, as this is not consistent with our own experience at Wanneroo. A feature of Maramarua, also noticed elsewhere, is the slight attention given to weed control. Even if the competitive effect of weeds is not so great in New Zealand due to the good summer rainfall the weeds still pose considerable problems in access.

Riverhead Forest - another plantation with the original plantings made during the depression era. The soils hare are more severely deficient in P and in addition pose formidable physical obstacles to good pine growth. Most of the original plantings on the upper slopes just stagnated and eventually died due to P deficiency. The soils consist of 3-6 inches of topsoil overlying a deep, pale, very compact clay. When dry they are very hard with massive blocky structure. When wet they very quickly become (and remain) saturated resulting in

very poor aeration. If P. radiata can stay healthy on this inhospitable site we need have no worries about the species in the Sunkland. The amazing thing is that with liberal applications of superphosphate it not only thrives but brings about a dramatic improvement in soil physical properties.

I was shown a fertiliser trial laid out in 1952 where the treatment had changed the stand from failed to moderate productivity. Soils under the control area were still very wet with massive, blocky structure whereas under healthy pine it was a friable, crumby structure with obvious vastly greater general biological activity. The water table has been lowered considerably - by an average of $2\frac{1}{2}$ feet in all seasons of the year. To see this was very encouraging to one used to seeing P. radiata portrayed as a "soil destroyer". If this whole mythology of soil improving and soil destroying trees actually does hold water it is clear the true picture is not as simple as some would have us believe.

Thursday 2nd May

Woodhill G. Will and R. Gadgi

This is a coastal sandy area somewhat similar to Myalup and McLarty but the soil is not an old leached sand as we have, but a recent brown sand, with a high total P content of 500-600 ppm. Not all of this, however, is available to the pines as I saw several young stands which appeared to be deficient in this element.

Plantings began here in the 30's as a protection measure but have produced most attractive and productive stands. The well-proven establishment technique is as follows:

(1) Plant marram grass to stabilise the dunes.

(2) Seed in lupins (Lupinus arboreus) to build up soil N content; this is an essential precursor to pine planting. Without it pines do not thrive.

(3) Crush lupins after 2 years or so and plant pines. After the crushing residual lupin seed, which persists in the soil for 10 years or more, germinates readily and forms an understorey, but this is rapidly shaded out by the pines.

I came to Woodhill hoping to see a system where the stand is managed to maintain a pine - lupin mixture. In fact this is not done at Woodhill. When pines are thinned below a certain level the lupins appear to regenerate at any stage in the life of the stand. How long it persists depends on the degree of thinning and subsequent crown development. No conscious attempt is made to maintain the mixture. Although somewhat disappointing from this aspect it was still of great interest to see how effective a relatively short period of lupin culture can be in raising soil N levels. I am more than ever convinced we need to make lupin or some other nitrogen-fixing plant an integral part of the pine plantation ecosystem on very poor soils.

It is of interest to note the nitrogen comes into the system not only in the root nodules but in the above ground parts of the plant which is 3 - 4 percent N by oven dry weight.

Friday 3 May

Seed extraction, grading and seed sowing. G.W. Hedderwick

Inspected the Rotorua and seed extraction facilities where most of the radiata seed for N.Z. is processed.

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Hedderwick has developed an ingenious seed grader which can grade pine seed into, e.g. four grades. The device works on the principle that the plan area of a seed is closely correlated with its weight. The grades can readily be adjusted to suit the requirements of different species. There seem to be a few minor bugs to be sorted out but the device now has the support of the N.Z. Invention Development Authority. It is intended to have it built and marketed by the Lotus company.

In nurseries the Stanhay seeder is now pretty well standard equipment. Although it is the best available it is still not ideal. Hedderwick tried to improve the design but concluded this is not possible. There is a strong feeling that greater precision of sowing is necessary to take full advantage of expensive seed orchard seed and of the latest thinking on root pruning which involves vertical root pruning on four sides of the seedling. Hedderwick has developed a prototype precision seed sower using vacuum pick-up of individual seeds, and it seems highly successful. This unit is also being further developed to the commercial stage by the Lotus organisation.

Soils and Nutrition D.S. Jackson

General discussion of pine nutrition and moisture use problems in New Zealand and W.A. Jackson recommends a portable neutron probe, the Wallingford Model 225, which is very reliable and easy to use. He has a computer programme designed to process raw data from the probe and perform two types of statistical analysis on them.

An inspection was made of the experimental area at the FRI containing lysimeters and new sites in preparation for an intensive programme of root studies. Jackson uses only clonal material for his work as he has found vast differences between randomly chosen clones in respect of such fundamental characteristics as transpiration rate. For example one clone transpires 50% faster than the average of eight other clones when grown under identical conditions.

Saturday 4 May

Site preparation and machine planting. I. Page

Discussed the role and performance of heavyweight rollers for site preparation. There are no Marden (U.S.A.) rollers in N.Z. but Page has seen them working in South Carolina. Suitable only for small sized material up to about 5 cm diameter, but do a very good job in the right conditions.

There is some scope in N.Z. for gravity rollers. They have a rather unique situation with very steep country which is reverted farmland covered in dense scrub 6 - 10 m in height. A large dozer of Cat D8 size on the ridge top controls the 8 ton steel roller by twin winches each holding about 300 m of cable. Several contractors have had a go at this producing in the process some weird and wonderful machines.

Shear blades are used to some extent on tractor country. There are two types used - the FLECO V - type blade and the ROME K - G straight blade. Both do a good job in the right conditions with an impressive degree of splitting of the felled trees. However, since the root systems are undisturbed the method would have no application in W.A.

In respect of planting machines there has been a search for a better type of machine to replace the LOWTHER - type units generally used today. The Lowther planter has a number of shortcomings in design and does not do a good enough job of planting, as it is very easy to get deformed root systems, leading to toppling of the plant.

The "Lotus" planter is a N.Z. designed and made machine with some very good points, such as its trailing arm suspension (much better than three-point linkage) and its chisel type plough. The Mark II unit costs approximately $N.Z.3,200. It has recently been tested by Page on a clean cut pine area, with quite good results when carried on a D4 size dozer equipped with a light V-blade to sweep the larger debris out of the way. Some further development is still required but the unit is regarded as almost operational by staff at Kaingaroa for use in cut over pine areas.

Another type of machine, and a most interesting one, is a copy of the U.S.F.S. "Forest land planter" made up recently in N.Z. by a small town mechanic. It apparently worked very well first try and its outstanding feature is an automatic planting and spacing device. The operator sits upright all the time, thus eliminating the back strain inevitable in the Lowther or Lotus designs. He just places the plants into "hands" on an endless chain which move them down into a furrow, dropping them at precisely the right depth and spacing. In practice it is a little inflexible since it cannot be stopped for obstructions, but this could easily be rectified with a foot operated clutch or brake. According to Page the unit does a beautifully uniform job of planting and the operator greatly prefers it to the Lowther.

A further variant on this theme was seen in a leaflet recently received at the F.R.I. from a firm called K.F. Rath in Austria. They are making an intermittent type of planter which provides for cultivation of the soil only in the vicinity of the plant site. This clearly would be an advantage in cut over country.

A combination of the best features of the "Lotus and "Forestland" planters would, I am sure, provide a machine we could use in our second rotation pines, Sunkland, and perhaps in the Karri forest as well. I would strongly recommend we construct no more planters of the Lowther type and try to develop a new design along the lines indicated above. I have photographs and drawings which I am sure would be sufficient to enable a successful machine to be built.

Monday May 6

Tasman Pulp and Paper Co., Kawerau. Te Teko Nursery. J. Gleed.

This is the best organised, most efficient nursery I have seen, producing 10 million seedlings annually at a price of $10.00 per 1,000 to external customers. It is highly mechanised, with beds some 400 metres in length by 12 rows in width. Beds are formed up about 25 cm above the general level of the nursery to facilitate root pruning. The site is perfectly flat with a free draining soil. Some problems have been experienced with Phytophthora cinnamomi and Fusarium, but these have been controlled by fumigation with Methyl Bromide and Chloropicrin at a cost of $450 per acre.

As with all the N.Z. nurseries I saw, weed control was very good and intensive root pruning was prescribed. Weed control was maintained by application of 2 pints of Paraquat and 2 lb. propazine per acre as a pregermination spray, with further post emergent propazine at 2 - 4 lb. per acre during the growing season. Terminal crook disease was controlled by weekly sprayings of Captan (2 lb. per acre) and PMC (1 lb. per acre). The sprayer tanks were cleaned by flushing out into a sump containing activated charcoal. It is of interest that this disease is believed to have entered the nursery on the clothing of a visitor from an infected nursery 100 miles away.

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Dothistroma infection was prevented by bi-monthly spraying with Cuprox at 2 lb. per acre.

No count of plants is carried out in the lifting season. If a customer wants the plants counted he is obliged to pay an extra $2.00 per 1000.

T.P.O. Forest Operations Tarawera Forest

E. Manketlow

Inspected current planting operations. T.P.P. will use planting machines on 30° downhill runs and 19° uphill runs. Use planting machines wherever possible - the unit seen was an Allis Chalmers HD 16 pulling two parallelogram-linkage mounted Lowther machines. Establishment is very cheap due to the light scrub cover on the area. The soils are quite fertile, being Scoria from the 1886 eruption of nearly Mt. Tarawera. Some of the scrub areas are killed prior to crushing by aerial application of a desiccant mixture. The mixture used is 12 gallons/acre of a brew containing 10 lb. sodium chlorate, 3 pints 245T and 2 pints 24D dissolved in water, sometimes with a little diesel to improve foliar penetration. It is of interest to note T.P.P. are very keen on aerial application and favour helicopters over fixed wing aircraft.

A feature of T.P.P. operations in the use of contract gangs to carry out most forest operations - planting, weed control, clearing, thinning to waste and pruning (where this is done). The aim is to have only about 30 percent of the labour force on wages. Contracts are generally offered to men who have worked for them before and who are known to be reliable.

Tuesday May 7

Forest Products Division F.R.I. J.M. Harris

General discussion of work in progress at the wood quality section. Recent work indicates that P. radiata branch size is a poorly heritable feature. For improved sawn timber grade return it seems an increase in wood density is more desirable, and density is known to be quite highly heritable. An increase in wood density of 10 percent is calculated to be better than halving branch size from 5 cm to 2.5 cm diameter.

Pinus taeda has very poor wood properties in N.Z. No latewood at all is formed until about 10 years of age, resulting in very low average density. There are also problems with resin and bark products. We should check out this aspect on W.A. grown P. taeda before planting any more of it.

Other recent work has examined the effect of the "new silviculture" regimes on wood properties. As my own work in this field had indicated, growth rate per se has little or no influence on wood properties. However there is a change in overall density due purely to the increased proportion of corewood in the tree. Calculations show that for a 25 inch DBH final crop tree a 25 year rotation will mean an 8 percent lower average density than will a 35 year rotation. This has led to the suggestion that progeny trial evaluation should include checking the rate of increase in wood density from the pith outward for the first 10 or so rings.

I. Hutchinson, Wood properties/particle board

Wood density is not considered to be of any importance in manufacture of particle board from P. radiata. Some plants in N.Z. use peeler cores. This confirms my comments that Cullitys' complaints in this regard for pine at Nannup are unfounded. On the other hand wood moisture content is recognised to be a most important factor.

Wednesday May 8

Kaingaroa Forest, Establishment. Lloyd Evans

Inspected establishment practices in the southern part of this huge (370,000 acre) forest. Natural regeneration is still used to a small extent but less and less every year. However natural regen is a problem in the replanted areas and some work has been done on methods of eradicating it. Burning only seems to promote germination of pine although repeated burning may be useful. Some success has been obtained with spraying with a mixture consisting of 3 lb. 24D and 10 lb. sodium chlorate in 30 gallons of water per acre.

There appear to be more risks associated with pine establishment in N.Z. than in W.A. Toppling by wind is a severe problem - I saw areas of 50 acres or so where every tree was tipped 30-40° from vertical. Frost is a major problem in some years. An unseasonal frost in February this year caused widespread damage in P72 and P73 pine was completely killed by this February frost.

In new plantings the trend is toward more thorough site preparation by deep ploughing with a "Super Giant" plough with 30 inch discs.

In the second rotation areas, consisting of some 12,000 acres annually the site preparation was by comparison rather poor. To begin with, there was an immense accumulation of logging slash. It is generally agreed that 25 percent of the standing volume is wasted for one reason or another. The slash is usually not burnt due to the difficulty of getting sufficiently dry material and good burning weather in time to fit into the re-establishment programme. Most clear felled areas are windrowed but the heaps are not burnt. All the windrowing I saw was extremely poorly done, with never less than a 3 foot heap of topsoil under the slash. Often the soil heap was over 6 feet in height. I was told rake blades were used in the operation, but on the only machine we could find doing the job the blade was a normal solid one with short "teeth" welded to the lower cutting edge, and this seems to be the local definition of a rake blade. In view of the fact that on these young soils (pumice) nearly all the soil nitrogen is in the top 5 cm of the soil profile, I cannot accept the proposition that there is no decline in productivity of P. radiata in the second rotation at Kaingaroa at least.

An interesting feature of Kaingaroa is the administrative organisation which closely resembles that proposed for the W.A. Chipwood area. In conversation with several staff members at Kaingaroa I gained the impression that:

a) This type of organisation does improve efficiency of each of the functional sections.

b) There is a real danger of lack of communication or personality clashes between sections.

c) There is a real danger individuals are kept too long in one section so they are unable to appreciate the overall aims of the organisation.

d) There is a certain loss of job satisfaction from over-specialisation.

Thursday 9 May Kaingaroa

Silviculture, P. Beaumont, N. Williams.

Inspected examples of the current silvicultural regime which could be classed as a moderate multi-thinning regime, where the

aim seems to be to grow framing grade timber. At present "Fentonian" regimes are regarded with some misgivings and there is concern that such an approach to silviculture results in coarser branching above the pruned zone. I was shown one trial area which had been managed on a regime very close to our Sil. 70 regime (for a seed production area) and there did appear to be some increase in average branch size. I have a copy of a report on a study of logs taken from part of this area and it would appear on this site there was a significant increase in average branch size in the zone 40 - 60 feet above the ground. However, similar, but younger trials on other sites do not appear to have had the same problem, so the question is not yet resolved.

With regard to thinning to waste and pruning operations I was impressed by the methods used for control and payment of contractors (who do most of this work). Rates are set by a specialised group located at Kaingaroa who really know their stuff. Such decentralised control of ratesetting offers the ultimate in flexibility to meet changing situations. On the whole I think their contractors are very fairly treated and the whole approach is one we could well examine closely with a view to adopting it here when feasible.

Friday 10 May

Production Thinning Kaingaroa

I was interested to see techniques used for production thinning and was surprised to see only conventional machinery being used, but being used to their limits. First thinning was being carried out at much the same stand height and to much the same intensity as we would. The optimum team for this operation is 5 men as follows:

1 man on log skidder, C - 5 Tree Farmer preferred
1 man on loader - rubber tyred type
1 faller
2 trimmers who can assist the faller if necessary

A team of this size can cut 400,000 cubic feet per year at a cost on landing of about 12 cents per cubic foot. By contrast clear felling cost is 6c or less per cubic foot. The price quoted here is for the logs trimmed to length and sorted on the landing into mill logs, pulp logs, etc.

Some smaller operators were trying to use light weight 4-wheel drive agricultural tractors for skidding but they are too unreliable. They are also dangerous - I saw one almost turn over as I stopped at one site.

All thinning except fence post operations are long-log operations, even when small tractors are used.

Fence post operations are always done for that product alone, no attempt being made to incorporate a baulk-log type of operation with them. The whole tree goes into fence posts of one type or another. Butt logs go into strainers, mid logs are sawn down the middle and used as half-rounds and the upper logs used as rounds.

As a result of seeing one of these operations I believe we must introduce immediate changes to our own fence post production. The first thing is that Koppers must be compelled to take half-rounds for fence posts. In N.Z. half-rounds are in fact preferred by farmers to the full-rounds as they are easier to line up and easier to staple into. I also saw quarter-rounds being cut at one point but this is done only when the stand has grown beyond the optimum size for a post thinning. Debarking and drying of posts is done as we are proposing to do in the forest. The second thing is that the standard of straightness required by

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Koppers is too high. I looked at fence post stacks at several sites in N.Z. and the picture was always the same. Perhaps what Koppers need is some competition.

Waipa State Sawmill

Inspected the fence post and pole yard, mainly to see the different types of debarker used. The yard has several types of barker itself and held examples of debarking by all available types of machine.

SEARLE unit, costs $8000, peels 800/day but rides over the branch nodes.

HURRICANE, costs $4000, peels 900/day, produces a well rounded product but cutter knives expensive to maintain, lasting only 1-2 hours before resharpening.

SKILLINGS, costs $4,500, peels 1200/day, does a reasonably good job.

MORBARK, costs $8000, peels 2000/day, does the best job of all units seen in N.Z. also the most reliable unit available. I have seen one of these operating in the field at Kaingaroa and can vouch for its high rate of production and very high quality product.

CUNDEY, costs $2000 or so, only a semi-manual machine which can peel 400/day.

Waipa were just commencing site preparation for a new Morbark machine designed to be used for both posts and large poles up to 15 inches in diameter. I have passed a brochure on the Morbark to Mr. Sclater.

Monday 13 - Thursday 16 May

Attended conference of N.Z. Institute of Foresters at New Plymouth.

Friday 17 May

Travelled to Christchurch.

Saturday 18 May

Eyrewell Forest, J. Balneaves, M. Potter

My main interst at Eyrewell was to see the conditions under which widescale windthrow had occurred in recent years (as much as 3,000 acres in a single night) and to see what measures are being taken to minimise the risks of this happening again in the replanted areas.

The soil is not conducive to good root penetration, being a very stoney loam at the surface with heavier textured layers beneath. The area is almost dead flat, so thinning has been carried out by taking vehicles almost to the stump. This in combination with the characteristics of the soil has resulted in further soil compaction, thus making re-establishment difficult and further increasing the risk of wind damage. Some benefit appears to have been gained by the use of felling patterns designed to reduce wind strength in the vicinity of the older stands but all old stands are very much at risk whatever is done. One wonders whether the soil compaction we have observed at Grimwade along the extraction rows might not have a similar effect to that observed at Eyrewell.

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For re-establishment the obvious course of action is to deep rip and this has been done in recent years but it is too early to say whether this has solved the problem. Most second rotation areas are windrowed, and as at Kaingaroa there is a great deal of topsoil shifted into the windrows. Normally the area is broadcast burnt before windrowing, then windrowed with large dozers of the Cat D8 - D9 class, aiming to remove most stumps, then ripped and planted using a Lowther type planting machine.

Some problems are being experienced with poor rooting patterns in machine planted areas. The plants are located on the rip lines and the roots tend to grow along the lines only, resulting in poor stability. Poor machine planting has also been a problem, mainly due to trying to plant at too fast a rate, so that the roots go into the hole in a "swept-back" configuration which again results in poor stability as they continue to grow in this way.

A promising approach to improve root development was seen in a direct seeding trial. The area had been clear filled about 4 years previously, broadcast burnt and then ripped only at about 2 metre intervals by a Cat D9 with one 1.3 m length ripper. A machine of that size has no difficulty in smashing through pine stumps 18 inches in diameter. I suspect we might have to use machines of this size at Grimwade in our second rotation areas if we are to obtain any worthwhile degree of cultivation before replanting.

The direct seeding has had mixed success as there are problems in ensuring correct depth of sowing, nevertheless, where it had succeeded, root growth seemed to be much less influenced by the ripping lines than with planted stock.

Tree stability in intermediate-aged stands is being promoted by heavy early thinning, aided by a buoyant fence post market.

Saturday 18 May

2.30 p.m. Depart for Sydney.