GRADE IN SAWN TIMBER AND ROUND PRODUCTS OF *PINUS RADIATA*.

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1. SUMMARY

Clear wood of New Zealand grown *Pinus radiata* has excellent physical properties which commend it for a very wide range of uses. Sawn timber from the unthinned and unpruned stands now being felled, however, yields too high a proportion of low grades. The capacity of the species to yield a large volume of good quality wood in a given time suggests that pruning of butt logs is economically justifiable and nationally essential to meet domestic needs for high utility clear timber and peeler logs in the near future. If stands can be managed on longer rotations, there are notable advantages to be gained also from heartwood and from an all round increase in density

2. INTRODUCTION

I had hoped that the aspect of the general theme which is introduced in this paper would have been bolstered up by a discussion of the basic properties of *P. radiata* timber as determined by heredity, site, and silvicultural treatment. A large mass of work has still to be carried out before a comprehensive analysis of these relationships can be presented. It may be equally contended that comment on the grade relationships is somewhat premature. Scant attention is paid for instance to :

(a) Branching habit and size of laterals as affected by spacing.

(b) Conditions conducive to heartwood development.

This paper simply presents ideas upon grades of timber and round products which *should* be yielded by the forests. From a brief discussion of the properties of the timber, it passes on to grades produced, and produceable in tended forests.

Untended stands of *P. radiata* being milled today fall far short of giving us in correct proportions, the grades of timber which we need for many of our important uses. It is probably equally true to say that the timber cannot be regarded as a good and satisfactory alternative to Northern European and North American softwoods at present used in some of our more important potential export markets. There have to be balanced supplies of good grades to go with the lower grades, before those markets can contemplate severing connections with the North Hemisphere sawn softwoods trade.

The sawn product requires to be criticised also for its relative "youth". There is a notable degree of unbalance in its basic qualities which must be considered in conjunction with the defects ; both features are characteristics of youth (in trees).

3. PRINCIPAL PROPERTIES OF *P. RADIATA* TIMBER

I think there is still scant appreciation of the remarkable *potential* qualities of *P. radiata* timber. The word "potential" must be emphasised in view of the preceding and subsequent comments. Briefly, the main features of *P. radiata* timber are :—

Assets : Timber moderately light and even textured, with consequent ease of seasoning, sawing, machining and finishing, and nailing ; moderately soft but even-wearing ; taking natural finish well—and with good natural decorative qualities of the much sought-after blonde type ; with good painting qualities (subject to reservations relating to knots and "slash" grain). The average strength properties of clear timber are good, especially in the seasoned condition, but the wood is not tough. Heartwood is not susceptible to sapstain or to *Anobium* attack and has moderate durability above ground ; its low initial moisture content and a very useful measure of dimensional stability are, in contrast to the undesirably high moisture content of sapwood and its ready absorptiveness for moisture after seasoning.

Liabilities : In the main forest areas on the pumice lands knots are large and branches usually occur in whorls of seven, eight, or more, which occupy most of the cross-section of the log in young trees and constitute a serious mechanical weakness in round products (poles, posts and props) and in sawn timber from the central rings. The wood in the central rings is of low density, apart from any subsequent resin deposition when heartwood forms, has significant shrinkage along the grain and is weak. The gradient in density from the first to the tenth (or later) ring is steep, although the later-formed wood is fairly even in density, texture, shrinkage properties and strength. Pith is large and often wanders.

It will be noted that the main faults are linked with young wood whether it be the central zone or butt logs or the small diameter "head" logs. Grading can be the key to sorting of the sawn product, but use requirements cannot be subordinated to the whim of the forest grower.

Timber cut from young trees with a very small heartwood zone has the problems attendant upon closely-spaced large laterals, warp resulting from the extreme variation in shrinkage and density variation with consequent strength variation in the wood apart from effect of defects. Small diameter logs mean curvature of growth rings in sawn timber and some boards show prominent slash grain which leads to painting problems. The timber has a high initial moisture content, is liable to sapstain severely and to rot rapidly if poorly handled or subject to damp conditions in service, and is sometimes attacked by *Anobium*. It is also liable to pick up moisture readily after seasoning. with consequent poor dimensional stability unless properly protected by coatings. These are,I think, sufficient

to indicate that considerable problems must be faced in the use of timber from young stands. It is not much use talking about good mean values for strength, density and shrinkage, if we then have to qualify our statements by quoting the large degree of variability.

4. GRADES

Primary requirements of the main groups of grades are :—

A. Framing grades are graded for strength and ability to season satisfactorily without serious warping. Large single or grouped defects are most undesirable.

B. Board grades for full length use, must season and machine satisfactorily without serious degrade, must remain straight, take a good finish and have adequate strength. In weatherboarding a further requirement is, that all the defects be watertight and that the knots should not be large or located on the lower exposed edge.

C. Board grades for "cutting" are graded for their capacity to yield clear lengths for a multitude of manufactured products without excessive waste. Large defects at infrequent intervals are admissible.

D. Box grades for box manufacture without excessive wastage or for serviceable boxing, sarking, etc.

E. Structural grades to which stress figures may be applied for roof trusses, columns and bridges. Sleepers fall into a slightly different category.

It is scarcely practicable for me to discuss the so-called "multinodal" and "uninodal" tree forms, but the fact cannot be overlooked that for sawn grades for framing, some board sizes for full length uses, and for structural sizes, it is highly desirable to have small numerous dispersed defects, rather than large knots, or groups of knots. There seems to be little that we can do about untended stands due for early felling, but in other stands to be thinned, the advantages of multinodal form will no doubt be recognised. In propagation in the future also this feature should receive consideration. For round products produced as thinnings the multinodal form has many advantages in regard to strength. The tree form which yields timber with large knots and groups of knots at infrequent intervals is very useful for factory work requiring clear cuttings of high quality.

As to the common defects themselvs, some comments seem timely:

(a) Intergrown knots affect strength, warping during seasoning and machining. Large knots mean much grain distortion and one looks for cross grain in the vicinity of all large knots. Large knots are more prone to check and cause

problems in painting of exterior woodwork; a crack in a paint film is likely to develop over such a check.

(b) In the slightly older age classes, the encased knot is a very bad problem inadmissible in such items as flooring and weatherboarding and restricted in size below intergrown knots in framing. In actual fact the encased knot is one which is more easily assessed for its effect upon strength than the intergrown knot, because there is simply a slight grain deviation around the stub as distinct from grain distortion.

(c) Cone stem holes are a serious feature in board grades. A tree form which shed its cones from the trunk would be desirable.

(d) Pith and low density are commented upon elsewhere.

The crux of the position is that grade determines whether the timber can in practice be used for the host of uses for which it is, by virtue of its good physical and mechanical properties, considered suitable. The fact that *P. radiata* is being marketed in a series of grades covering the needs of a wide range of uses, does not mean that a balanced production of those grades is being achieved.

5. THE WIDER OBJECTIVES

It may be asked "What silvicultural practices are economically justifiable in view of the existing diversity of grades and uses with the products of unmanaged forests?' The simple answer is that production is weighted heavily in favour of low grades but, more than that, *we would look far before we could find a tree species as capable as P. radiata of forming a very large amount of excellent quality wood substance in a given period of years, and our need for such wood is urgent.* The corollary to that is, that the maximum return would be obtained from silvicultural operations insofar as they affect the final crop rather than the thinnings. As for the thinnings, the uses for good round products and saw logs are restricted by their poor grade. Groundwood pulp is the hopeful outlet.

The alternative to such treatment is not a pleasant one as it will perpetuate the present difficulties in marketing a large volume of low grade timber. In trees 30 years of age or more we are faced with a growing proportion of pieces with encased knots. Unfortunately, the dead branches may remain attached to spoil the potentially excellent product of fifteen or more years of mature growth. In long rotation trees one can probably afford to wait for the dead branches to fall off, but with fast trees the penalty is obvious.

From the butt logs of the properly managed forests there could be a very different range of grades and products from those obtained today from untended stands :—

(a) Peelers in standard lathe lengths to yield veneers in the hooppine class as distinct from our short clears or knotty billets.

(b) Sawn clears at least equal in value to clear rimu to provide :

  (i) Natural finish interior woodwork, e.g. mouldings, architraves, skirting, panelling, interior joinery and those furniture parts which are not easily secured from Factory grade.

  (ii) Exterior joinery, weatherboarding, fascia boards and other exterior woodwork from preservative-treated sapwood. Modern sealers and coatings may be used to counter its moisture absorptiveness.

(c) Framing and other general untility timber permitting defects from the central core with its significant proportion of resinous heartwood to give the much sought after natural durability.

Briefly, my first main theme re-stated is "*When it is possible to grow wood as rapidly as is the case with P. radiata, the maximum return is to be obtained from silvicultural operation.*" Clear grades of *P. radiata* are first class finishing lines. On the Pacific Coast of U.S.A. I think it is correct to say that the pines are the cream of the forest crop with their even texture—ease of sawing, seasoning and machining—high qualities for finishing, combined with natural attractiveness in colour and lustre—and good wearing and painting characteristics. I suggest that our *P. radiata* in managed forests could possess the same advantages over Douglas fir, redwood and cedar which the western pines have in U.S.A. Douglas fir is of course a remarkable constructional timber, but the grades required for *most* construction need not be clear and prices for constructional timber are always lower than for finishing. In New Zealand too our Douglas fir is likely to be the general utility wood rather than a finishing timber and the needs for clear timber for ladders, scaffold poles and suchlike are not very great. It is however apparent, that natural round thinnings from Douglas fir are a far more easily marketed item than thinnings from *P. radiata*. I suggest that peeler logs of *P. radiata* may also command a higher price than Douglas fir, because of the same qualities noted in regard to sawn timber. From *P. radiata* stands there will still be low-priced grades for box-making and other lines intermediate in quality between these and the finishing lines, and a mass of material for pulping too.

The comparison made between Douglas fir and *P. radiata* does not purport to do full justice to the former timber. It seems to me that some essential timber needs during the next few decades can be met only by immediate attention to the fast-growing *P. radiata*. There are other exotic conifers, superior to *P. radiata* in evenness of texture, earlier formation of durable heartwood and other qualities

in the same way that Douglas fir and larch are superior in most strength properties, which will, I hope, figure more prominently in the timber market in the future.

My second main theme is :—*There are notable advantages to be achieved by allowing forests to grow to* 50 *or more years in age :*

(a) An all round increase in average density of wood. Low density core becomes reduced to much smaller proportion of the sawn product. Variability becomes very insignificant.

(b) Less curvature in growth rings in sawn timber—hence less warp.

(c) Significant proportion of heartwood in logs to give resinous stability to the low density corewood, a useful degree of natural durability to building timbers, and improved hardness and compressive strength. Stability means retarded shrinkage and swelling with atmospheric changes with seasoned wood in service, and far less tendency for warping during seasoning.

(d) Obvious advantage of no sapstain troubles and a low initial moisture content which reduces the time lapse from log to finished product for all heartwood stock.

What abont the troublesome core wood ? I should like to think it was possible to reduce the core to a small diameter, but it seems to me that wide rings are inevitable in the wood close to the pith if the rapidity of height and diameter growth are to be maintained. The close spacing of trees to achieve a small core may defeat its own object as my own limited experience with closely-spaced stands has been that trees are notable for their overall low density in the suppressed crown class. Something the same may be said about the large pith, although wandering pith especially is a very bad feature. In large diameter saw logs, one would feel more inclined to accept the central wood and pith in much the same way that a similar core is accepted in many hardwoods.

6. SUMMING UP

It is suggested that *P. radiata* is a very versatile timber My objective has been to show that its versatility can be very much enhanced by management with specific aims :—

(a) To ensure a continuing supply of clear peeler logs in standard lathe lengths.

(b) To ensure that there are adequate supplies of clear grade boards for exterior woodwork to be painted, for a proportion of interior decorative woodwork and mouldings.

(c) Production of larger diameter logs for many of needs for sawn timber to get the advantage of heartwood and of

higher and less variable density in the great bulk of the timber (which at the same time reduces the low density defective core timber to a percentage which may easily be absorbed in the less exacting uses). Fifty years or more for final crop trees may be envisaged.

Can we afford *not* to prune and thin the stands when the resultant products of such treatment appreciate in value to the extent that may be expected with this species.

If it is practicable to envisage pruning of a proportion of trees in a stand which will be removed as thinnings there is a limited market for natural rounds. But they will no doubt still possess the disadvantage of low strength inherent in the low density core. Other species have obvious advantages when items such as poles are considered. One of them is the desirability of getting a high retention of preservative in the outer layers without having to go to excessive absorptions ; resistant heartwood is an obvious advantage there.

Finally, there must be the thought that whatever silvicultural treatment is given to *P. radiata* it will not rate higher than second or third choice for many wood uses. One falls easily into the trap of thinking, just because we have a lot of *P. radiata*, that the wood technologist is morally obliged to adapt the timber or methods so that it may suit all needs. That is unhealthy ! It may not be untimely to suggest that the Institute should accept its responsibility as the professional body concerned with forestry in the wide sense, for pointing out that national timber needs can be met only by having a range of timbers.

ANALYSIS OF THE GROWTH MEASUREMENTS OF YOUNG PINUS RADIATA D. DON.

I. AN INTRODUCTORY ACCOUNT OF THREE OBSERVATION PLOTS AT ATHENREE, BAY OF PLENTY

By C. S. BARKER

In March 1949 it was becoming apparent that precise information on the growth of young *Pinus radiata* was lacking, at least as regards Athenree. During 1948 some plots had been established in what were then 6 and 12 years old trees. On reflecting on the information derived from these plots at that age, it became clear that they would yield only some *conventional* information beginning at the age of 6 and 12 years respectively. The chances were that much valuable information and perhaps the most important data had been irrecoverably lost previous to these measurements. On further reflection it