THE PRODUCTION OF HIGH GRADE SOFTWOOD TIMBER IN IRELAND

By T. Clear.

Our Timber is Abominably Knotty.

In the production of coniferous timber rate of growth and freedom from knots are considered the most important factors influencing quality. While deals and boards from home-grown spruce, pine and larch have been sawn equal, and very often superior, to the best imported, it must be admitted that the bulk of our softwood timber is abominably knotty. Now apart from rot, knots are the most serious of all wood defects. They render the wood unsuitable for fine sawing and, being so much harder than normal tissue, cause severe wear on saws, cutters and planing machines. The distorted grain around large knots renders hand working difficult and in addition, results in a considerable loss in strength. There is a growing belief that the production of clean timber is no longer of great importance, as the development of pulp, Kraft paper, fibreboard and other like products provide a ready market for lowgrade timber. This is far from being the case. There is greater waste in the " cooking " of knotty timber, greater wear and tear of cutting and grinding machinery and, in many ways, knotty timber is less suitable as a raw material for any of those products. Furthermore the price obtainable for pulpwood is not nearly so attractive as that obtainable for lumber, and other developments in the line of laminated wood seem to indicate that there will be a growing demand for clean timber of large sizes.

How Knots are Caused.

Knots in timber are caused, as every forester knows, by the occlusion of side branches in the bole of the tree. As practically every tree produces side branches it is impossible to get a completely knot-free bole. The important thing, however, is to have as little of the stem affected by knots as possible and to see to it that those knots which do occur are small ones. Degrade due to large knots affects a relatively much greater area than small knots. The aim, therefore, should be (*a*) to have the minimum number of side branches formed on the boles of the trees, (*b*) to prevent these side branches that do form from becoming too large, (*c*) to eliminate them as soon as possible after they cease to be of use in helping to form timber.

The quantity of side branches produced by a tree is largely a matter of species, strain and environment. Some trees are bushy in habit and produce large numbers of side buds, while others produce long internodes free of buds. Among the softwoods, pines are prone to produce bushy forms, with stoutly developing side branches, while spruces, larches and firs are more finely branched. Again rate of growth is important. Rapid growth means long shoots free from buds, while slow growth means a concentration of buds and leads to bush formation. The type of growth, however, can be greatly influenced by proper light control.

THE LIGHT FACTOR AND KNOT CONTROL.

Initiation of growth in the bud of the leading shoot or side shoots depends largely on the amount of illumination of the bud. In poorly illuminated buds growth activity is late or may not start at all. If the quality of light to the side branches is reduced, the buds open slowly and late. Cambial activity is late also. The nutrition of the branch is smaller and this keeps the growth of the branch down to a minimum and it eventually dies. Thus, we see that knot control can be obtained by the timely removal, or reduction of the quantity and quality of the sunlight reaching the buds and foliage of the side branches.

Let us consider the means of controlling side light at the disposal of the tree grower. By judiciously leaving scattered standards of the old crop, or selected small-crowned scrub trees a good deal of side light control can be obtained. It is important, however, that the main or leading bud receive sufficient light to stimulate it to maximum growth. It is possible by this means to get maximum leading shoot development and minimum side branch development. The most important means of controlling side light and, through it, branch development in young crops is, however, by means of the young trees themselves. Close planting and fast even growth are the most powerful factors in branch suppression. When leading shoots are open to the full strength of light they are stimulated earlier than the partially shaded side buds. Thus grass and weeds, and the shade of the neighbouring trees all help in reducing side branch development at a critical stage. It is therefore, unwise to clean over thoroughly. Branch suppression is best achieved then in young plantations by close planting, judicious cleaning but, most important of all, by even and rapid growth in the crop as a whole. Any condition that leads to irregular growth, be it bad planting, poor plants, unsuitable mixtures or rapid changes in site quality, prevents the optimum control of light and tends to poor quality timber growth.

THE IMPORTANCE OF RING WIDTH CONTROL.

Bound up closely with the problem of knot control is the question of ring width control. Fast grown but immature trees of Douglas fir and Sitka spruce have begun to come on the market and are advertised as suitable as boxwood, structural and other timbers and are eagerly bought up in these times of scarcity. Bulk alone seems to be the criterion by which a tree is judged in the forest. After conversion these timbers are criticised because of their rapid growth and lack of strength and are said to compare very unfavourably with imported timber of the same species. The trade has been long accustomed to handling timber from the virgin forests of Northern Europe and America where growth is exceedingly slow and where trees are felled at a great age. For joinery work slow-grown, fine-ringed timber has many valuable attributes, notably ease of working and stability after making up. Due to our mild climate trees enjoy a longer growing season here than in the far orth. This is extremely important as it enables us not alone to

grow a wide variety of timber trees but also to produce timber of large dimensions on a very much shorter rotation. This is an advantage that we cannot afford to relinquish lightly nor indeed, is it necessary greatly to increase our rotations in order to produce timber of reasonably high quality.

If wood cells (or tracheids) were all of uniform dimensions wood structure would appear homogenous and, more important still, there would be no variation in quality between slow grown and fast grown timber. The seasonal changes in northern latitudes, however, exert a marked effect on the cells produced. In the beginning of the growing season, in coniferous timber, the wood cells are large in diameter and thin-walled whereas the cells in the outer portion of the ring are smaller and thicker-walled. The wood formed in summer being composed of thick-walled fibres with comparatively small cavities, is denser and harder than the wood formed at the beginning of the growth period. As the dense layer of summer wood abutts on the more open tissue of the following spring a marked contrast is produced and thus, in conifers especially, the annual rings are sharply defined. Unfortunately the proportion of summer wood to spring wood is not constant but falls off considerably in fast grown or wide ringed timber with the result that the total amount of summerwood is less in the fast grown than in the slow grown. In softwoods which possess heavy summerwood, e.g., Douglas fir and larch, there is an optimum rate of growth for strength, and moderately fast grown timber of these species contains more heavy summerwood than very slow grown or very fast grown timber. Thus in grading softwoods for structural purposes it is usual to specify that there shall not be less than six rings per inch or not more than twenty. With spruces, firs and hemlocks, i.e., species with relatively inconspicuous summerwood, generally speaking, the narrower the growth rings the stronger the timber of these species. Scots pine is intermediate between these two types of softwoods. It can be taken then that the difference in strength variation for timbers having a ring growth over 6 rings to the inch is not of great practical importance. A clean board of Douglas fir or pine with 6 rings to the inch is probably stronger than a knotty one with 16 rings to the inch. Now a growth rate of mature softwood in this country of between 6 to 20 rings to the inch is the rule rather than the exception. Why then are our local timbers criticised because of their too rapid growth and structural weakness ?

The reason is not far to seek. If we could compare the rings on a butt of a home grown larch, Douglas fir or Scots pine with similar species from virgin forest the following difference might be apparent. In our timber the fastest rate of growth, i.e., the widest rings, appear in the centre where one or two rings to the inch is not unusual. After which the rings gradually decrease in width until a stage is reached when there may be 20 or more to the inch with the tendency all the time for the rings to get narrower. On the " virgin " butt the centre rings are fairly narrow, sometimes very narrow, and they increase gradually or remain constant in width. A full width board cut from the former is much inferior to one cut from the latter not only in appearance and strength but also in seasoning properties.

The wide ringed centre will tend to shrink at a much greater rate and to a much greater degree, particularly longitudinally than the outer narrow ringed portion and splitting, twisting and warping can scarcely be avoided. Skilful sawing might overcome this but would be costly as compared with straight-forward sawing methods.

Immature Wood is Poor in Quality.

Another serious defect of our timber is its relative immaturity. This applies not only to the timber from young trees but to that sawn from middle-aged trees as well, particularly fast grown trees. We are accustomed to hear that our Douglas fir and Sitka spruce timber is not of the same nature as that imported. The same criticism was applied earlier to Scots pine and Norway spruce. In fact at the beginning of the present century the only Irish coniferous timber upon which any value was placed was larch. Scots pine and spruce were considered as weeds in the woods and could be purchased at a nominal figure. There must be some foundation for this persistently poor opinion of the strength qualities of Irish timber. Experiments in many countries have shown that most coniferous timber is low in density and strength during the early years of the stem's growth. This is explained by the fact that the wood cells produced during the early years of the tree's life are smaller in size, and have less wall material—especially those formed towards the end of the season's growth—than the corresponding mature tracheides which are formed later on. The average size of tracheides met with in the succeeding annual growth rings gets larger and larger and it is only in the twentieth year or thereabouts that the full sized tracheides begin to be produced. There is relatively less difference in density or strength between moderately wide-ringed or narrow-ringed wood when the tree is out of its " teens." Any coniferous timber which is composed largely of wood cells produced during the first 20 years of the tree's growth is likely to be low in density and cellulose content, i.e., light and brittle and generally of inferior quality either for sawing or pulping.

The type of growth common in forest plantations is not conducive to good quality production. Wide spacing and rich soil give trees a quick start after planting out and allow extremely rapid growth until the thicket stage is reached when root and crown competition causes increasingly rapid diminution of diameter growth. It is usual then to keep the crop as close as possible to try and clean away the coarse branches which have developed—this at a time when the more desirable mature cells are beginning to be thrown off by mother cells of the cambial layer. The aim rather should be to check diameter growth or reduce ring width as far as possible in the beginning and from the thicket stage or small pole stage to seek to maintain or increase ring width. Gradually increasing breadth of the annual rings at this stage means optimum quality and optimum yield in value. Decreasing breadth on the other hand means a loss. What can be done in practice to attain this desirable type of growth ?

THE " HALF-SHADE " TREE.

While the development of a tree is strongly affected by hereditary qualities nevertheless even with good stock quite a lot depends on the environment and the treatment. With Scots pine for example, close planting on light sandy soils or part shade from tall standards results, by the thicket stage, with good varieties especially, in a crop of tall slim trees, with weak side branches. The stronger the height growth or as is sometimes said, the more " drawn up " the trees, the fewer, weaker and more horizontal are the side branches. These small branches die early while the tree is still of small girth and are easily cast off by ever growing pressure exerted by the expanding bole, or they can be cheaply pruned away. On the other hand on the richer loams and peats pines are often planted because they are easier to establish than spruces or hardwoods or because they are useful in nursing the spruces or hardwoods on such sites. Under such conditions the pines are often widely spaced and the result is coarse growth, the side branches growing at the expense of the leader, and this free grown crop by the approach of the thicket stage is composed of squat trees with abnormally long and thick side branches set at an acute angle to the main stem. The period of " bush " formation extends for 15 years or more, short, thick-stemmed, heavily and acutely branched trees being everywhere in evidence. Only early and expensive pruning can save such a crop from developing into a stand of low quality timber trees. If neglected at this stage no treatment will be of any avail. With the passing of years the coarse branches may be hidden but on the saw bench the soft spongy heart and the coarse spiky knots will be revealed and receive all the publicity the irate sawmiller can command ! Very often in pure stands the rate of development of the planted trees is not quite even or, due to planting failures, a large proportion of the crop has been introduced in beeting operations. These backward trees are under the influence of their more forward neighbours and here we see one of the most important factors of branch suppression at work; by ever reducing the quality of the side light while not interfering unduly with the top light the coarse forward trees reduce the vigour of the side branches and increase the rate of leader growth on the smaller trees, producing a slender fine horizontally-branched type, referred to by continental silviculturists as the " half-shade " tree. These *élite* trees are a feature of our thicket pine stands and often constitute a large part of the crop. Unfortunately by the time treatment is normally forthcoming most of them are dead or hopelessly suppressed and are removed in the first cleaning operation. Nor is this " half-shade " tree confined to pine crops. It is met with perhaps more often in Douglas fir stands than in any other. Indeed a thinning treatment which concentrates on the removal of the coarse dominants with a view to forming a final crop of " half-shade " trees, or co-dominants as they are sometimes called, is recommended for Douglas fir.

I saw some fine examples of this form of treatment at Glenmalure and Glendalough and the effect is really gratifying. It is strange that similar treatment is not applied to pure pine woods or

mixtures. Probably Douglas fir, being a partial shade-bearer, stands over-shading much better than pine and so the fine-branched survive in the crop and stand out in sharp contrast to the coarse " wolves " at the time of the opening brashing and call out for relief.

With all tree crops strong height growth from the beginning and even growth over the whole stand is the best and cheapest method of producing narrow-ringed cores and light side branches. Unfortunately in newly planted areas in this country uneven growth in young stands is the rule rather than the exception. The rapid variation in soil and surface vegetation which is a feature of our afforestable land is one of the chief causes of this undesirable state of affairs. There are, however, many stands of very poor quality where, owing to bad planting, neglected cleaning, damage by frost or rabbits, patchy crops have been allowed to develop beyond the stage when beeting up can be of much avail. Even where beeting up has been done extensively the more advanced trees are allowed to suppress the later introductions although these may be of very promising quality owing to the " half shade " position they enjoy. It is advisable to live-prune in such cases. Most foresters are afraid of live pruning because of the danger of wood-rotting fungi getting in. But, as far as can be ascertained, there is little danger of infection—in the case of pines especially.

Despite all that is written about the value of mixtures, an extensive tour of Irish plantations is sufficient to convince one that successful mixtures are the exception rather than the rule and that pure crops are much easier to manage for the production of good quality timber. Scots pine/Norway spruce is now a popular mixture on cut-away bog and is perhaps a good mixture if one aims at getting a crop of spruce. The pine, however, is very vigorous from the start and the spruce very liable to check. Unless the forester is prepared to live prune, or cut back the pine ruthlessly there is a very real danger of poor coarse crops on such ground. It is difficult to select mixtures which are of even growth rates in the early and critical years and most of the headaches experienced in the treatment of mixed crops result from uneven rates of growth. Very often the less desirable trees or species in the mixture tend to become dominant. For instance, the removal of coarse Japanese larch and contorta pine from over badly suppressed but promising trees of Norway and Sitka spruce has become an urgent necessity in many forests. It would be interesting to have records of all such mixtures as eventually they may be more troublesome to handle and less successful than pure crops even on difficult sites. It may be possible by means of soil cultivation and manuring to get crops to start away immediately after planting and to produce that desirable even growth and this may be less expensive than managing crops where the essential nurse trees are liable to get out of hand.

The Value of Early Pruning.

It appears then that the first stage in the life of a plantation is really very important as it is during this stage between planting and first thinning that the foundation of the timber crop is laid. It is in

those early years that the quality grade of the crop is largely determined. There are many crops, however, in which for a variety of causes, such as uneven growth and wide planting, canopy does not close rapidly. In such stands artificial pruning is essential for the production of clean wood. Even after early suppression the side branches of some species persist for many years and are occluded in the wood as dry or dead knots, and thus the advantages of close spacing are minimised. There is a growing body of evidence to show that good results can be got by relatively wide spacing followed by early pruning. For pruning to be successful it must be done while the core of the tree is still small, say up to 4″ in diameter. A more important factor still is that the growth rate after pruning should be rapid. The typical half shade tree has many qualities that lend themselves to successful pruning. Thin side branches and long internodes make for cheap pruning while the narrow girth guarantees the maximum addition of knot-free increment provided the tree is given ample room for growth after pruning. Pruning is worth while on good soil even though the trees have grown somewhat coarse but it is important that it be carried out early. Early pruning involves the cutting of live branches and many foresters avoid early pruning on this account. It is no unusual sight to see pines and firs being pruned when they are 6″ or more in diameter and when girth increment is rapidly falling off. From all accounts, it appears that the removal of some whorls of live branches has little effect on the growth of the trees particularly if these branches are already partially shaded. The most efficient portion of the crown for the assimilation of sunlight and the formation of wood is the upper portion and by far the most of the assimilation is done by the newly formed needles in the case of spruces and by last year's needles in the case of pine. There can, therefore, be no excuse for delayed pruning.

Thinning and Quality Increment.

Having obtained the maximum amount of branch suppression in the thicket and small pole stage the important thing subsequently is to achieve the maximum addition of valuable timber by a proper grade of thinning. It is very disconcerting for a young forester to hear the many and conflicting views on this important problem. To judge from discussions at our Society's excursions it is largely a case of one guess being as good as another. If in those controversies which arise there were some unanimity as to the final object in view, it should be possible, I think, to get a great deal of agreement on many forestry problems. Of course there is no rule of thumb or set prescription for dealing with silvicultural matters and each stand must be considered in the light of its particular stage of development or condition, but as a rule there can be only one technique that will achieve the desired objective. The greatest complications arise when conditions in the crop are abnormal, for example when the crop is being ravaged by insect or fungus pests or where there has been extensive snow or wind damage. For normal stands the guiding principle in thinning should be to help the best and *largest* trees

rather than to remove the bad. The *élite* trees of the stand must be given the opportunity of putting on the maximum girth increment. The main factor affecting girth increment is the size of the assimilating crown surface. This can be measured by reference to crown length and maximum breadth. Trees with the greatest length of crown react most efficiently to thinning and as these are found as a rule among the dominants it is important that they be given every chance. If we are satisfied that steady or increasing ring width is desirable, regular, light to moderate thinnings at 3 to 5 year intervals, depending on the rate of growth, should give the desired result. It should be remembered that an early or untimely heavy thinning may have very bad results on the timber quality of the second log length. The branches will then have a considerable period of growth before suppression sets in again and no further cleaning will result.

In this short discussion I have of necessity ignored many important factors affecting the production of merchantable timber. The importance of source of origin of seed is appreciated by everyone dealing with the raising of crops and is of, perhaps, greater concern to the forester than any other. Unfortunately it is all too apparent that too little attention has been paid to this matter in the past and it is only natural to suspect that the poor growth of many of our plantations is due to the penny wise policy of using cheap unselected seed.

The raising of physiologically balanced nursery stock is also of fundamental importance. Trees grown on exhausted nursery soils are affected in more than height growth and root development. Lack of potash, for example, may influence the frost resisting qualities of planting stock and therefore affect establishment on frosty sites.

It can be appreciated that the raising of good quality timber under present Irish conditions is not an easy task. Unlike his *vis-à-vis* in countries with long established forests and an older tradition of silviculture, the forester here is dealing with new and untried species and mixtures and is very often poorly informed of the soil or climatic conditions with which he has to contend. Under such conditions the finer arts of silviculture may tend to be neglected. There is a natural preoccupation with the manifold problems associated with the creating of forests on bare ground. It does not pay, however, to neglect or forget the major objective of all forestry endeavour, the creation of a store of *merchantable* raw material for the wood-using industries of the country.

Ireland has always been able to import its timber requirements at reasonable prices in normal times and to select species and grades of hardwoods and softwoods to meet the varied requirements of the trade. The stoppage of imports during the war turned the attention of the sawmilling, woodworking and building trades to our own forests as a source of supply. While the supplies of timber forthcoming have been of inestimable value during the past few years the fact that much of the material coming on the market has been of poor quality has fostered or kept alive the prejudice that exists against most local products. It is of the utmost importance

to the future of forestry that this widespread prejudice against homegrown softwoods be combated by every means. It is hoped that locally grown softwoods will play an increasingly important part in the general timber economy of the country. Large areas of pine, spruce and larch are being planted and eventually a " forest estate " capable of meeting all our requirements can be built up. This is the objective of forest policy here and it is the task of the forester to see that this objective is attained. Unless the products of the forests are bought and utilized there can be no stability in forestry. They will not be bought and utilized unless they are serviceable and economic. The timber grower must recognise the defects of his products and must seek to eliminate them as far as is possible. The future of the forestry industry in Ireland lies to a large extent in the hands of those who wield the axe, saw and marking scribe.

FASHIONS IN FORESTRY.

1778. FORBES (FRANCIS) Gent., in *The Improvement of Waste Lands* published in London in 1778.

There is a vulgar saying " A poplar will buy a horse before an oak will buy a saddle."

1790. A COUNTRY GENTLEMAN in *Essays on Agriculture and Planting founded on experiments made in Ireland,* published in Dublin in 1790.

There is a saying in England that an elm would buy a horse before an oak would buy a saddle.

1839. J. MAIN in *The Forest Planter and Pruner's Assistant,* being a practical treatise on the management of the native and exotic Forest trees commonly cultivated in Great Britain. London, 1839.

A Lincolnshire proverb declares that " a willow will be worth a horse before an oak will be worth a saddle."

1851. JAMES BROWN in *The Forester.* 2nd edition. 1851.

There is an old saying among foresters—and it is indeed a true one—that " a larch will buy a horse before an oak will buy a saddle."

Contributed by M. L. ANDERSON.