UNIVERSITY OF IDAHO
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AND RANGE SCIENCES

SCOTCH PINE CHRISTMAS TREES FOR NORTHERN IDAHO PLANTATIONS
AN EVALUATION OF FOURTEEN VARIETIES[1]

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SUMMARY

Fourteen strains of Scotch pine were evaluated in regard to characteristics associated with Christmas tree quality. Two northern Idaho plantations served as experimental sites, observations in each being made over a six-year growing period. Because seedling survival was poor on one of the sites, actual data presented are from a single plantation. Similar trends, however, appeared to be equally evident at the second location.

Based on the work reported here, only three strains of Scotch pine can be unreservedly recommended to Idaho growers. These are: (1) Spanish Burgos (preferred), (2) Spanish Segovia, and (3) Polish Riga. A minimum of cultural operations are required to produce quality Christmas trees from these strains. Two French strains, although better than the average, were rated below the three strains listed. Mainly because of excessive growth rates, the cost of developing acceptable trees from many of the other strains investigated makes their selection unwise.

Future seedings of Scotch pine at the University of Idaho Clarke McNary Nursery will be of the Spanish Burgos strain exclusively.

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An Evaluation of Fourteen Varieties[1]

by H. Loewenstein and F. H. Pitkin[2]

INTRODUCTION

Production and marketing of Christmas trees from northern Idaho have rapidly expanded in recent years. Most of the trees involved have been 'wild,' i.e., they have been cut from the native forest. As in other parts of the country, this pattern is gradually shifting to a plantation type of operation.

Scotch pine *(Pinus sylvestris)* has become by far the leading species of Christmas tree sold in the United States, accounting for almost 30% of the market. Scotch pine is not yet grown extensively in Idaho, but consumer demand makes it likely that large acreages will be devoted to this species as more and more plantations are established within the state.

The seed source utilized is of tremendous importance when Scotch pine is to be planted. Trees grown from seed of one source may be excellent specimens at harvest time; those grown from a second source may have such poor form and color as to be unmarketable. Those grown from one source may need a minimum of cultural treatment; those from a second may require economically unfeasible effort to produce saleable trees. Complicating the choice of seed source is the fact that seed from a source proved superior in one geographic area may produce inferior Christmas trees when used in another locality.

The work reported below was undertaken to find a seed source or sources that would produce high quality Christmas trees with little or no cultural operations under environmental conditions generally prevailing in northern Idaho.

METHODS

Seed from 14 geographic varieties (proveniences) of Scotch pine were obtained from commercial dealers in 1959 (Table 1). These seeds were sown at the nursery ,and the resulting seedlings were raised in the beds for two years. The two-year-old seedlings were field planted at two locations in northern Idaho during the spring of 1962. One site was located on a terrace bordering the south side of the Clearwater River about 10 miles west of Orofino. Precipitation in the area is esti-

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[1] Published with the approval of the Director, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

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mated to be approximately 23 inches annually. Soil in the planting area has silt loam texture and a Ph of 6.0. The second plot was located within the Rathdrum prairie, about 15 miles northwest of Coeur d'Alene. During the course of the study the most intensive observations were made on the Clearwater River site. The results enumerated in this paper, therefore, are based on data collected from that particular area. Examinations of the Rathdrum Prairie site indicated that trends established on the main study area were equally evident there.

Table 1. Sources of Scotch Pine seed used in the experiment.

Austria—1,000'—1600' elevation
Austria—3300'—4000' elevation
Belgium—Lowlands Strain 1
Belgium—Lowlands Strain 2
Canada
Czechoslovakia
France—D'Auvergne Strain 1
France—D'Auvergne Strain 2
Poland—Strain 1
Poland—East Prussian Strain
Poland—Riga Strain
Scotland
Spain—Burgos Province—3,000'—4800' elevation
Spain, Segovia Province—3500'—4000' elevation

Fifty seedlings per seed source were hand planted on each of the two sites, in replicates of 25. Both areas were clean cultivated prior to the planting operation. Supplemental irrigation and periodic weed control during the year of establishment enhanced survival on the Clearwater site. These operations could not be performed on the Rathdrum plot, and as a consequence seedling survival was relatively poor.

In an effort to stimulate survival and early growth, a fertilizer pellet (composition-24% nitrogen, 2.6% phosphorus) was placed in the planting hole of the first 13 seedlings of each 25 tree replicate.

During the summer of 1964, cultural treatments were initiated. Operations included leader pruning, basal pruning, and shearing of laterals for form improvement. These treatments were applied to 9 of the 14 proveniences involved in the study, being judged unnecessary on the remaining 5, (except for pruning to a satisfactory basal whorl). In order to ascertain the effect of time of cultural treatment on subsequent development, half the trees within the varieties involved were treated on July 1, while the remainder were treated late in the growing

season, on August 29. Two trees within each replicate received no treatment, serving as controls.

In 1965 it became necessary to shear individuals of the five sources which were not involved in the 1964 cultural operations. Additionally, the trees of the other nine varieties again required cultural treatments (same as pattern in 1964). In 1965, all cultural operations were performed on July 8.

Data concerning growth and quality factors were obtained yearly from 1962, the year of planting, through 1966. After measurements and evaluations were made in the fall of the latter year, selected wholesale buyers were allowed to mark and remove trees from the experimental site. In order to determine buyer preference, a record of each tree so removed was maintained.

RESULTS AND DISCUSSION

Fertilization

The placement of fertilizer pellets in the planting holes had no apparent beneficial effects. Survival of non-fertilized seedlings equalled that of treated specimens. Height measurements made after the first and subsequent growing seasons failed to reveal any stimulation resulting from the fertilization treatment. Analyses of foliage for nutrient content, carried out after the first growing season, showed that fertilized and unfertilized tissue did not differ significantly in percentage of nitrogen, phosphorus, or potassium. It should also be stressed that no improvement in foliar color resulted from use of the fertilizer pellets.

Lack of response to fertilizer was experienced in this experiment on both the Rathdrum (unirrigated) and Clearwater (irrigated) plots. The negative results obtained on the latter site are particularly worthy of note. If beneficial effects cannot be obtained in situations where soil moisture conditions are excellent, it is doubtful whether a grower can expect any response where supplemental applications of water are not feasible. Scotch pine is a species which is generally believed to have low requirements for nutrients, and based on results of this study the particular seed source involved is not a factor which affects these requirements.

Christmas tree farmers sometimes find that their Scotch pine seedlings produce foliage of an undesirable pale green or yellowish green color. From experience with farm crops or certain other tree species they quite logically believe that fertilization, especially with nitrogen, will deepen the needle color.

Unfortunately, however, foliage color of Scotch pine is largely a genetic character. Only in rare situations on extremely poor soils will fertilization intensify the greenness of needles. The best answer to the color problem lies in the proper choice of seed source for the plantation. Further discussion of this point will be found in the section of this paper entitled **Color.**

Height Growth

Many characteristics of Scotch pine vary with seed source. None of these variations, perhaps, are more striking than the variation associated with height growth. Rapidity of height growth can be controlled by cultural practices, such as tip pruning. However, use of an inherently slow-growing variety of pine will reduce the necessity of such operations, thus concurrently reducing costs. Then too, certain cultural techniques may result in undesirable "bird-nests" on upper whorls because an excessive number of buds develop into lateral branches. More comment on this factor will be found in a later section.

Average height of trees on the Clearwater site which never received cultural treatments and those which did is shown graphically in Figure 1. Data were collected in the fall of 1966 and thus represent five years of growth.

Cultural operations produced trees ranging in average height from 76 inches for the Polish strain 1 source down to 62.5 inches for the specimens grown from seed obtained in Canada. Comparison with trees of each source which were untreated were quite revealing. Control trees from the Polish Strain 1 source average 115 inches in height, for example, and those developed from Canadian seed, 93.5 inches. Such specimens were elongating at a much too rapid pace (more than 2 feet per year in some instances) for Christmas tree purposes. In contrast, control trees of certain other races (e.g. Spanish Segovia and Burgos, Riga) were not appreciably taller (or were even shorter) than specimens which were cultured. As a general rule, the strains which Figure 1 indicates had appreciable differences in height of control and cultured specimens should not be chosen as Christmas tree growing stock. Highest cost would be involved in managing these, and even though height growth was retarded, the quality of the final product could well be unsatisfactory.

Little variation was noted in the growth rate within a strain during the entire course of the experiment. Control trees which were tallest in 1966 had in each of the previous years consistently maintained growth rates high enough to damage form. On the other hand, control trees which were relatively short in 1966 had at no time previously exhibited an excessively high growth rate.

Density

Consumer preference has generally been for Scotch pine specimens exhibiting a marked degree of foliar density. Such a condition may be brought about by shearing, an operation which will stimulate branching and subsequent needle production. The strain of pine used, however, is also reflected in the foliar development. One seed source may produce trees with a much more dense, compact branching habit than another, thus markedly reducing the necessity to shear. Such differences were noted with the varieties examined in this study, as detailed below.

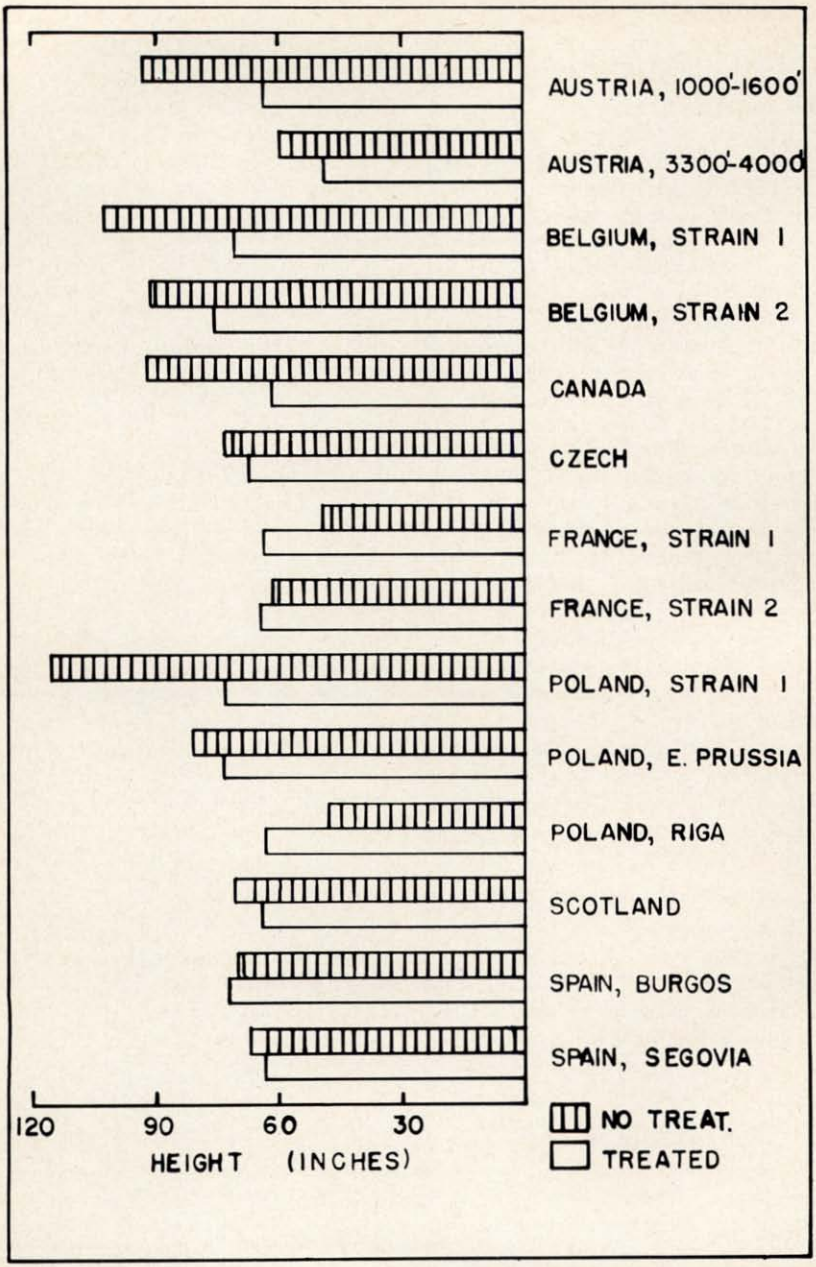

Figure 1.—Average height of cultured and uncultured trees from various strains of Scotch pine. Measurements were made six years after planting, in the autumn of 1966, on the Clearwater experimental plot near Orofino, Idaho. Treatment of the Spanish, French, and Polish Riga strains was minimal and occurred only in 1965; cultural treatment of the others was intensive and occurred both in 1964 and 1965.

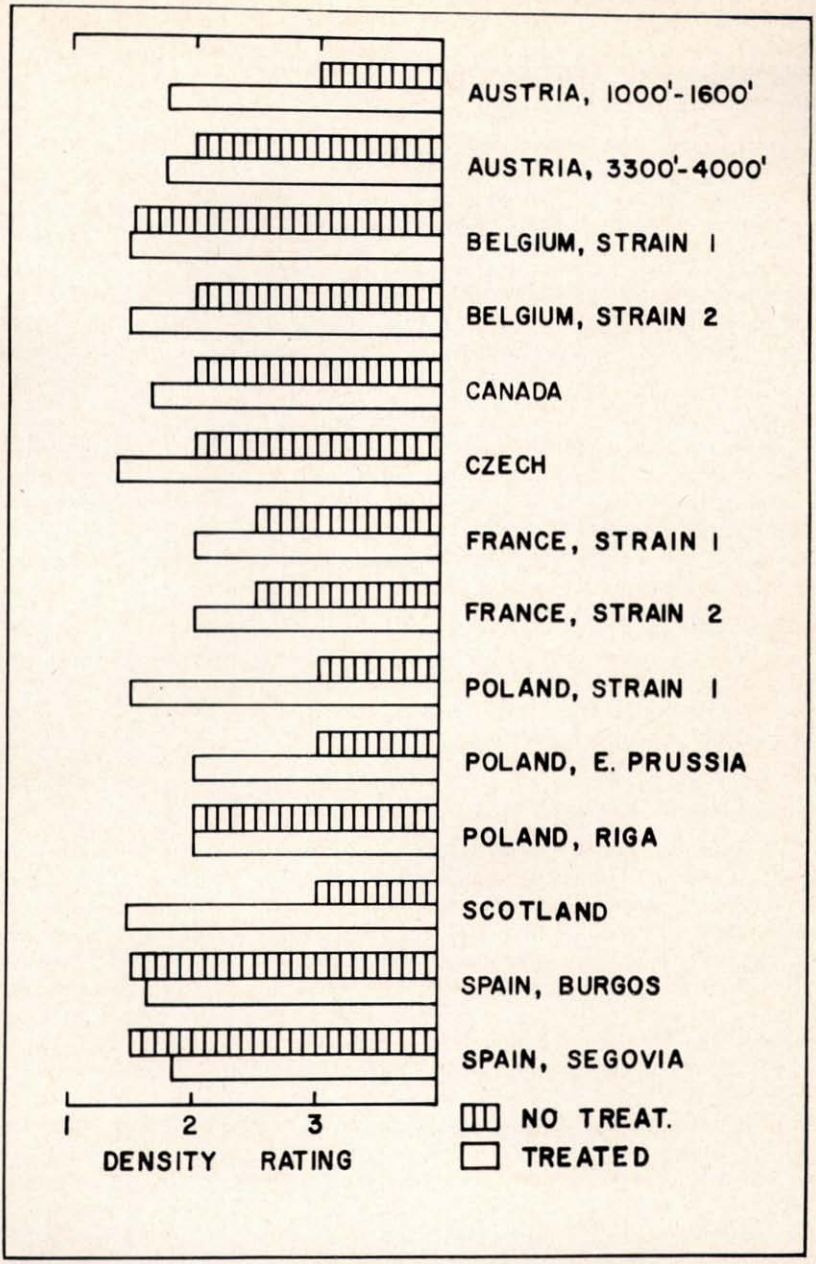

Figure 2.—Average foliar density rating of cultured and uncultured trees from various strains of Scotch pine. Measurements were made six years after planting, in the autumn of 1966, on the Clearwater experimental plot near Orofino, Idaho. The lower the rating value, the more dense the foliage. Treatment of the Spanish, French, and Polish Riga strains was minimal and occurred only in 1965; cultural treatment of the others was intensive and occurred both in 1964 and 1965.

Foliage density was estimated on the basis of sparse, medium, or full, these being given numerical values of 3, 2, and 1 respectively for averaging purposes. The same two observers, working as a team, made all of the density estimations.

Four strains (Austria, 1,000'–1,600', Poland Strain 1, East Prussia, and Scotland) were represented by control trees with density ratings of 3 (Figure 2). In all four instances cultural activities, primarily shearing of laterals, improved density ratings to at least 2.

The trees from many of the other proveniences, however, bore acceptably dense foliage on controls. The two Spanish strains, Burgos and Segovia, and one Belgium source were particularly outstanding in this regard. Shearing operations required were minimal with these three strains.

Some change was noted in density ratings of control trees between evaluations made in 1963 and 1966. For example, the Austria 1,000'--1,600' strain had a foliar density of 1 (full) in 1963, but for controls this rating had fallen to 3 (sparse) by 1966. This deterioration in quality is clearly correlated with the high annual height growth rate of trees from this source, this factor resulting in long internodes between whorls of branches.

Thus the state of foliar density two or three years after planting is unreliable as an indicator of the amount of culture work which will be necessary to produce trees with satisfactory foliar density at harvest time. Strains with inherently rapid growth rates should be avoided, regardless of early appearance.

Needle Length

Considerable genetic variation is found in the length of needles produced by Scotch pine. As consumers have been found to generally prefer trees bearing relatively short needles, the grower must be concerned with this factor when selecting a particular strain for his plantation. Figure 3 graphically presents comparisons of needle length of the fourteen varieties involved, as observed on (1) foliage developed during the year of harvest (1966), and (2) foliage developed and measured in 1963. Because needle length did not seem to be affected by cultural treatment, data from controls are not plotted. In 1966, needle length ranged from 1.45 inches for the seed source from an elevation of 3,300-4,000 feet in Austria, up to 2.1 inches for the source obtained from East Prussia. It would appear from these results that little practical difference exists in the needle length of any of the proveniences examined. However, a consideration of the 1963 measurements indicates otherwise. Here differences between sources are much greater, suggesting that the effect of variation in climate or other environmental factors may be reflected to a greater degree in one race than in another. For example, one Belgium strain produced needles averaging 2.85 inches long in 1963, compared to 2.05 inches in 1966. On the other hand, the Riga source showed almost no difference in length of needles produced during the two years.

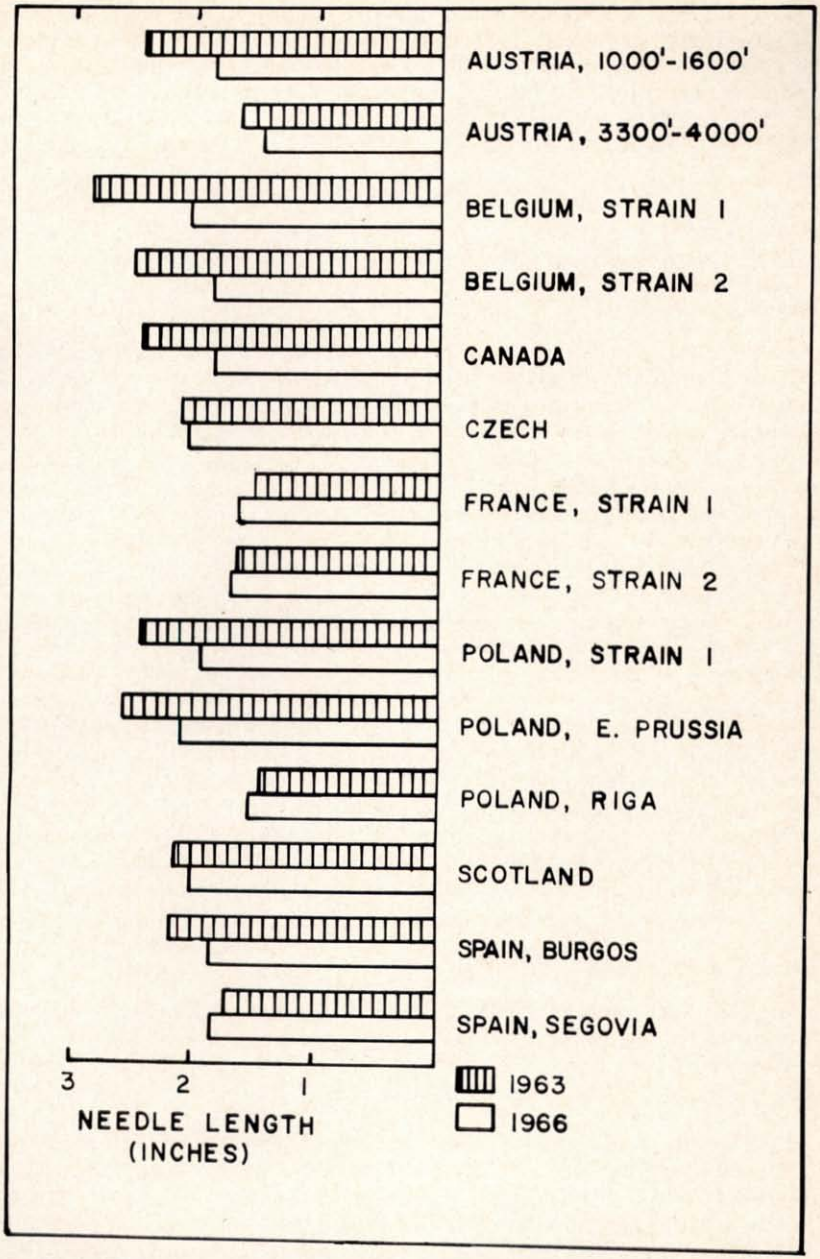

Figure 3.—Average needle length of cultured and uncultured trees from various strains of Scotch pine. Measurements were made six years after planting, in the autumn of 1966, on the Clearwater experimental plot near Orofino, Idaho. Treatment of the Spanish, French, and Polish Riga strains was minimal and occurred only in 1965; cultural treatment of the others was intensive and occurred both in 1964 and 1965.

Two factors should therefore be taken into account when selecting a strain which will exhibit desirable needle length—the actual size of the average needle and the consistency exhibited in maintaining that size in needles produced in different years. On the basis of the work reported here, the two French strains, the one from Austria (3,300' – 4,000'), the Spanish Segovia and the Polish Riga strains appear good choices. It must be remembered, however, that needle length is but one factor in the complex of factors which affect the desirability of a particular race.

Color

As mentioned earlier (in the section concerning fertilization), the color of Scotch pine foliage is largely controlled by genetic traits, although some climatic effects can also be noted. While an occasional individual specimen will vary, most trees within a particular strain will exhibit a similarity of needle coloration. Thus certain strains will consistently exhibit a yellowish appearance, making them unfit for Christmas tree purposes unless an artificial colorant is utilized. This technique, of course, increases cost. Other strains may show poorer color one year than another, under the influence of climate. In 1966, foliage color was judged shortly before harvest, as acceptable coloration early in the growing season does not necessarily mean acceptable coloration later. Munsell Color Charts for Plant Tissue were used to aid in the evaluation.

Color differences among the fourteen strains under observation were quite small in 1966. No provenience investigated, therefore, would have been eliminated from consideration on the basis of the color factor alone. In other years, however, variation among the strains was more marked with several exhibiting very pale coloration in the autumn. Fortunately, the races which were judged best in other attributes involving quality did not show this tendency to vary in color from year to year.

Cultural Techniques

In 1964 and again in 1965, leaders were pruned on trees representing nine of the races involved in the experiments. Because of their relatively slow growth rates, the two Spanish, the two French, and the Riga sources did not receive this treatment.

Leader pruning generally proved detrimental to the quality of the trees. This practice was used in an attempt to correct for the very rapid growth of many strains, but two deleterious effects negated its value. First of all, new leader growth developed from one of the numerous adventitious buds which formed on the side of the old leader, below the cut, and in most cases, a pronounced crook or 'dogleg' was produced as the new twig elongated and gradually turned upward. In an attempt to ascertain if the angle of the cut made in pruning the original leader would influence the tendency for crooks to form, several different angles were utilized. On some specimens, the leader was severed

in a horizontal plane, on others it was cut on an angle of either 45° or 70° in reference to the horizontal. Some reduction of severity of crookedness was noted when the cut was made at the steep angle of 70°, but the defect was still quite noticeable. Where the cut was made horizontally, double leaders frequently occurred.

A second negative effect on quality was also related to the adventitious buds below the cut. These buds developed in such profusion that upon their elongation into a whorl of lateral branches a pronounced 'birds-nest' appearance was created. When treatment was made late in the growing season there was some decrease in bud formation as compared to results found when tips were pruned earlier, but appearance was still unsatisfactory. Removal of many of the branches in these whorls was necessary and on a commercial basis this operation would add considerably to costs.

In contrast to tip pruning, basal pruning did not adversely affect the form of the trees, and it is quite possible to reduce leader growth through use of this latter technique. However, the amount of basal pruning required to achieve the goal is an important consideration. With many of the strains investigated, it appeared that an inordinate number of lower branches would have to be removed in order to retard height growth enough to make tip pruning unnecessary. Such excessive pruning would be unsatisfactory from the standpoints of both cost of production and size of marketable trees. Here again, the superiority of the relatively slow growing strains such as those from Spain becomes evident.

Some shearing was judged to be unavoidable regardless of provenience. The amount needed varied markedly between strains and to some extent between individuals belonging to the same strain.

Most of the races required shearing in 1964 and again in 1965. In many instances the practice was utilized to increase the density of foliage. In other situations the individual had acceptable foliar density, but shearing was needed to improve form. The natural density and form of the Spanish, French, and Riga proveniences were such that shearing was only executed in 1965.

Stem Form

The quality of Scotch pine Christmas trees is sometimes impaired by stem crookedness, a factor which is often genetically controlled. The stem form of trees involved in this study, however, was judged satisfactory regardless of the particular provenience observed.

Grade

In the fall of 1966, shortly before harvest, all trees involved in the experiment were graded by two evaluators working as a team. These quality grades reflected the total impact of all the aspects of appearance cited earlier in this paper. A grade of 1 represented a premium or top quality Christmas tree, a grade of 2 an average but acceptable

specimen, while a grade of 3 indicated poor individuals which would be difficult to market.

Control specimens from the different races showed wide variation in grade. Those from certain strains (e.g. Poland Strain 1, Austria 1,000'–1,600', Scotland) received the poor grade of 3, for example while the two Spanish strains and the source from Riga produced controls that had average grades of 1.5. This wide difference in grades was greatly narrowed by treatment.

If only the trees subjected to some degree of cultural treatment are considered, the average grades ranged from 2 for the Canadian strain to 1.4 for the Spanish Segovia source. It was thus possible to develop acceptable or better products from the great majority of these Scotch pine, regardless of specific seed source. Practical considerations, however, rule out the use of most of the proveniences examined. First, with many of the strains, rather drastic tip pruning was necessary to reduce growth rate. This alone would be a costly procedure. Secondly, as emphasized earlier, tip pruning resulted in undesirable side effects, which could only be corrected by considerably more cultural work.

On the basis of all factors involved then, only three of the fourteen strains of Scotch pine tested can be highly recommended to Idaho growers. These are listed in order of preference, as follows:

1. SPAIN, BURGOS PROVINCE. 3,000'–4,800' ELEVATION
2. SPAIN, SEGOVIA PROVINCE. 3,500'–4,000' ELEVATION
3. POLAND RIGA STRAIN.

The two French strains also appeared satisfactory, but overall quality of trees was judged to be under that of the sources listed above.

As a result of the study reported here, the Clarke-McNary nursery at the University of Idaho is now supplying Scotch pine seedlings of the Spanish Burgos strain exclusively. Seed from all three of the preferred sources are available from commercial seed dealers.

One further comment should be made. Some trees which normally would be considered unmarketable may actually have considerable value to particular wholesale buyers. This fact was observed at the conclusion of this experiment, when several wholesalers marked and harvested the crop according to their own desires. Most of the trees from the superior strains listed above were taken, but so were a quantity of the larger, less densely foliated specimens, some having relatively poor form. The buyer planned to flock these, and with this treatment they might well be attractive to certain consumers.

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