

PLANT A HOLLY ORCHARD

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IMPORTANCE OF HOLLY

HISTORICALLY A CHRISTMAS DECORATION

Holly is a very important evergreen. The glossy leaves and clusters of bright red berries have been closely associated with the festivities of Christmas for centuries. The praises of this beautiful green are sung in song and legend, poem, proverb and superstitious tales of old.

The origin of the name Holly is lost in antiquity, but some of our early writers called it the Holy Tree, and there is good reason to believe that it was the holly bough that made up the crown of thorns the persecutors of Jesus pressed upon his brow. An old legend declares that the holly first sprang up under the footsteps of Christ, when he trod the earth, and its thorny leaves and scarlet berries, like drops of blood, have been thought to be symbolical of the Savior's sufferings, for which reason the tree is called "Christ's Thorn" in the languages of the northern countries of Europe.

Christmas decorations are sometimes supposed to be derived from a custom of the Romans, of sending boughs, accompanied by other gifts, to their friends during the festival of the Saturnalia--a custom the early Christians adopted. (The Saturnalia commencing about a week before Christmas.) The custom has also been supposed to be derived from the Druids, who decorated huts with evergreens during winter as an abode for the sylvan spirits. What-

ever the source of the custom, however, it has been adopted by Christian Church and Home, and is as deeply rooted in our modern times as either in pagan or early Christian days.(1)

NATIVE STOCK DISAPPEARING

The native holly (*Ilex opaca*) is rapidly disappearing. This holly formerly had a natural distribution from Massachusetts to Missouri and south to Florida and Texas. Destructive harvesting has practically eliminated the species in the region from Massachusetts to central New Jersey, except where it occurs on protected properties, and promises to denude the wild places of this growth in a very few years unless legislation, which will probably be enacted, prohibits the promiscuous cutting that now goes on.

Although this American holly (*Ilex Opaca*) is very attractive in its native environment, and lends great beauty to the hills and valleys where it grows, yet, as cut holly, it is much inferior and in no way to be compared in beauty with the stiff, glossy, vivid green of the English holly, and cannot compete successfully on the markets except at a much lower price. (2)

DEMAND EXCEEDS THE SUPPLY

Only by growing Holly in commercial plantings can we hope to have an enduring and adequate supply of this traditional evergreen. There is a tremendous potential market awaiting Holly growers of Oregon and Washington. This market is possibly 100 times greater than the present

supply. The past few years many holly trees have been planted. When all of these trees are in full bearing they will not supply enough cut Holly at Christmas time to meet the demand of any one of the large cities of the nation. There is an American market eager for the annual crop that can be cut from 100,000 to 150,000 Holly trees.

PART II.

DESCRIPTION OF COMMERCIAL HOLLIES

Although there are more than three hundred varieties of holly listed by various horticultural writers and a great many have decorative value as specimen trees for the garden, it is only the European Holly "Ilex aquifolium" that can be considered when putting in a commercial planting for the Christmas trade. But the aquifolium varieties are numerous, and we must again limit ourselves to consider only the two of these varieties that produce in paying quantities the product that the Christmas market wants.

"One of these is the common English Holly, and the other which has been developed by selection from this, is what is variously known in the Pacific Northwest as the Select English Holly (French Strain), or Blue-stemmed English Holly.

The Select or French strain of English holly is bisexual, having both male and female blossoms on the same tree; it always produces a thick foliage and an abundance of bright red berries; the foliage is heavy and weighs about a third more than does that of the common English variety. Furthermore the French strain, compared with the common English, is a much more vigorous grower and yields a considerably larger annual harvest; its leaves are larger and of a deeper green; its berries are larger, more firm and never ripen too early; it keeps longer after being cut;

ships better; is more attractive and for the past number of years has been bringing a price on the eastern markets that is about 30% to 50% higher." (3)

Quoting from a Western Washington Experiment Station Circular on the culture of Christmas Holly, "Only the Dutch, common English, and Select (French) English are common in the Northwest. Commercially it cannot be profitable to plant any but the best trees of the Select varieties. The blue-stemmed and green-stemmed strains appear to be equally desirable to the trade. The Select English trees are vigorous growers, have berries which are large and bright red and leaves that are thick, glossy, curly, and dark green." (2)

To dispute Falco's statement that the Select or French strain of English is bisexual, many authorities on holly state that English hollies are dioecious, that is, male and female flowers are found on separate plants. The female produces the berries and the male supplies the pollen for fertilization of the female flowers which produce these berries. They recommend about one male tree for every ten female trees.

Falco, on the other hand, backs up his statement with his orchard at Wilsonville, Oregon, and states that the Select or French strain of English Holly is the result of many years of experimentation on common English holly in France. The first trees were brought to the United States about 25 years ago.

GROWING THE HOLLY

SELECTION OF LAND

Climatic conditions are ideal west of the Cascade Mountains to the Pacific Ocean from the Canadian border to a point about 30 miles south of Eugene, Oregon, and for about 50 miles inland as far South as Eureka, California. Outside of this territory the summers are too hot and winters too cold for successful commercial growth. Plantings should not be attempted at elevations greater than 1200 feet above sea level.

Any of the soils in Western Oregon and Western Washington, providing they are well drained, will grow good Holly. Soils of the Willamette, Olympic, Melbourne, Powell, Amity and Aiken Series are excellent for this purpose. Large well grown trees are to be found on the shallow soil that covers the rocky bluffs at Oregon City. The flat lands of the Willamette Valley will produce as good growth as the hill lands, but in seasons of late April frosts, when the trees are in bloom, the hill lands or river frontage that provide air drainage will probably give the best crop of berries. The soil must be fertile and kept fertile, and should be of a texture that is retentive of moisture. The deep sandy or gravelly loams that are fairly strongly acid, are the best for a commercial planting.

PLANTING

The preparation of soil is a much disputed question

and there is no set rule that will fit all cases. The land should be ploughed, disked and harrowed as for any crop. If the soil is particularly unfertile it may be advisable to plant a cover crop and apply fertilizer to be described later in this paper.

If the soil is in a good state of fertility, holes 18" to 24" in diameter and about 24" deep should be dug where trees are to be planted and the top 8" of soil removed, put in one pile and the bottom soil in another pile. Next fill the hole to within 6" of the top with top soil taken from convenient spots within shovel length of the hole after which this top soil should be left to settle for 2 or 3 days before setting the tree.

Trees that are 10 to 15 inches in height are about the best size to plant. They are usually sold "balled and burlapped" and securely bound with binder twine, and should be planted just the way they are bought. The trees should be set just deep enough to let one-inch of burlap show above ground. Before filling in soil around the root ball a couple of handfuls of raw bone meal should be sprinkled on the pile of soil that was first removed from the hole and this soil and bone meal shoveled in around root ball and the soil pressed firm by lightly tramping around the tree. After the tree is planted the surplus soil that was removed from the bottom of the hole should be used to replace the top soil that was used to fill in the lower part of the hole.

Spacing of the trees is a point for much disagreement among holly growers. Some say to plant 10 to 15 feet apart, while others advocate not closer than 25 feet. Holly trees need plenty of room to grow and thrive, thus if planted 10 to 15 feet apart, they should be thinned out to about 25 feet when they become about 10 to 12 years of age.

CARING FOR THE TREES

After the planting is finished, set a stake at each tree and fasten tree securely to it to prevent whipping in the wind. A flat cotton material is best for this purpose as twine or cord might cut into bark of the tree.

The most important work after planting and during the first few years to come is the conservation of moisture. We have in the Pacific Northwest an average annual rainfall of 36 to 40 inches which soaks into the soil in the rainy season and is drawn back to the atmosphere again during the summer. If the surface of the soil is allowed to bake and crack the moisture will be rapidly evaporated. To guard against this the soil should be kept loose and pulverized to a depth of one to one and one-half inches forming what is called a dust mulch, which forms a seal between the evaporating power of the sun and the reservoir of moisture in the soil.

The top inch of soil around tree can be loosened with a scuffle hoe, or ordinary garden hoe. If cow manure is available, a mulch of one or two inches thick in a circle

24 inches in diameter around tree will be to the tree's advantage. This mulch is not essential but it will help to hold moisture and put the soil around the young tree in better condition.

If the planting has been done in the fall of the year, nothing more need now be done until early spring when the top soil around the tree should again be loosened and weeds around the tree destroyed. After the last rains in the spring, probably in late April or May, the planting should again be disked and harrowed after which the ground should be gone over with a good weeder through the summer to keep a dust mulch and destroy weeds.

"Little is known of the particular plant food requirements of holly, especially trees in bearing. The manures are always safe fertilizers. Six to 10 tons of manure supplemented by 400 to 500 pounds of superphosphate or bone meal should keep the trees growing in thrifty condition. The manure and superphosphate may be applied to the cover crop in the fall or may be scattered before the spring plowing. In case commercial fertilizer is used, one analyzing 3 to 6% nitrogen, 8 to 10% phosphoric acid, and 4 to 7% potash should give satisfactory results if applied early in the spring at the rate of 1 to 2 pounds per tree depending on the size and needs of the trees." (2)

In late August the land should be seeded for a cover crop with 40 pounds of vetch and 70 to 80 pounds of Rosen Rye per acre. It should be drilled in between the trees and

not so close to the trees that it will have to be worked out by hand labor. In early May the crop should be ploughed or disked under as green manure.

The growing and turning under of annual cover crop will greatly improve the fertility of the soil and this fertility will assure the grower of excellent harvests of cut Holly when the trees are old enough to crop. Further than this it costs little or nothing to provide this cover crop as our Federal Government, in its soil conservation program, pays so much an acre for seeding and for turning the crop under in some areas.

Although Holly is not very susceptible to diseases, sometimes it is infected and if disease is not soon controlled it may become serious. About the only diseases of Holly, their description, and control suggestions are outlined by W. D. Edwards and Don C. Mote on "Insect Pests of Holly" which follows:

"Holly Scale, Aspidiotus britannicus Newstead.

Infestations of this scale on holly ruins decorative value for Christmas trade. The scale also attacks English laurel and box as well as holly.

Control Suggestions. Most satisfactory is an oil emulsion spray at strength of 3 gallons of oil to 97 gallons of water. Oil specifications recommended are: Viscosity of 75 seconds Saybolt and sulfonation test not less than 85. These specifications are to be found in commercial "summer" oil emulsions. Spray applied in early spring shortly before buds open. While all of the foliage should be sprayed, special effort should be made to hit lower part of tree where most scales are found and upon both sides of leaves.

Appearance of Holly Scales: Female scale cover is round or slightly oval and about $\frac{3}{32}$ inch in diameter, while male is oval and about same length but little more than one-half as wide. In color they are brown with a faint yellow cast.

Soft Brown Scale, Coccus hesperidum Linn.

This scale occasionally heavily infests holly but may be distinguished by its greater size and lack of the protective scale covering.

Control suggestions. Same as for holly scale.

Oblique-banded Leaf-roller, Archips rosaceana (Harris).

Has caused severe damage in Oregon by webbing leaves together and feeding within this protection.

Control Suggestions. A spring spray as suggested for Holly scale assists in control. In cases of severe infestation spray with lead arsenate at rate of 3 lbs. to 100 gallons of water or apply a dust of lead arsenate 1 lb. to 9 lbs. of hydrated lime during late July to kill newly-hatched worms.

Appearance of Worms: The larvae reach a length of about 1 inch at maturity; are green with pale spots at base of body hairs, and have brown or black heads. When disturbed, they wriggle violently and may fall to the ground or suspend themselves by a silken thread.

Holly Bud Moth, Rhopobota naevana (Hubor) var. ilicifoliana.

A major pest of holly in British Columbia. Reared from holly in Oregon in 1935.

Injury is similar to that of Oblique-banded Leaf-roller.

Control Suggestions: A spray should be applied in spring when new terminal leaves start to grow before newly-hatched larvae web leaves. Two sprays about 10 days apart are necessary.

Spray formula:

Water	3 gallons
Nicotine Sulfate	
40%	1 ounce
Whale oil soap	4 ounces
Lead Arsenate	3 ounces

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As larvae usually pupate in the debris under the trees, this material should be raked and burned in early July before moths emerge.

Appearance of Worms: The young worms are first greenish-white with a black head but darken as they grow, becoming a dull grey-green with a jet black head at maturity. Mature worms are about $\frac{1}{2}$ inch long never becoming as large as the Oblique-banded Leaf-Roller, though they behave similarly when disturbed.

Holly Leaf Miner, Phytomyza illicicola Loew.

This insect has also been reported to occur in Oregon. Damage is caused by mining within the leaf resulting in winding deadened areas.

Control Suggestions: No control for maggots within the leaves has been developed. Dusting the holly trees during the flight period of the adult flies is suggested with a 2% nicotine-lime dust which may be secured commercially or mixed as follows:

Hydrated lime 10 lbs. - screen to prevent lumps.
Nicotine Sulfate (40%) $\frac{1}{2}$ lb. or $\frac{1}{2}$ pint.

Mix in a tight barrel mounted to allow turning or simply by rolling on ground for five minutes. Smooth stones may be used to facilitate mixing.

This dust should be applied at weekly intervals through May and until the middle of June.

Appearance of Injury: Damage just noticeable in August and consists of a red spot or linear mine. Later the mines become larger and are deadened. (4)

"With young trees the necessary pruning consists of keeping the tree to one stem, cutting out all suckers and subordinating all side limbs to the main leader.

After a tree comes into bearing, it is usually sufficient to remove all dead or crossing limbs and to keep the limbs thinned out so the tree can bear fruit throughout its

top. As the tree attains a height of 15 or 16 feet they are headed back so as to force out the lower side limbs. The main limbs and their larger branches should never be headed back. This practice ruins many holly trees for future production." (2)

PROPAGATION OF HOLLY

When one plans on starting a Holly Orchard, there are various ways of obtaining stock to plant. Probably the simplest is to buy the young trees from a nursery. In which case, he should know something about the way in which the trees were grown. On the other hand he may want to grow his own stock from the first, or if not, maybe he will later on to enlarge the size of his orchard. Whatever the case may be, he will want to know something about propagation of holly. The following paragraphs have been taken from a paper on "propagation of Holly" by W. P. Duruz, Professor of Pomology at Oregon State College.

Seeds

It is a curious fact that the sexes of holly do not come true from seed. About one-half will be male and one-half female. There will also be great variation in shape of plants, form and color of leaves and fruit, hardness, and other factors. However, if one is not particular, or if growing for understock, seeds can be used for growing holly plants cheaply. Wild seedlings may be obtained in some sections and if they can be taken while small, before they have established themselves too firmly, so that their root systems can be preserved, they can be transplanted and used for individuals or root stocks. While it may appear to save time, it is doubtful if wild seedlings are to be preferred to those from known source grown under proper conditions.

The best practice is to obtain the seed from vigorous, healthy trees in the late fall when the seeds are thoroughly mature. By macerating the fruit, the seeds can be separated

and the pulp washed out. The good seeds will sink and thus can be collected. Planting can be done in the fall or spring, using flats, of compost, leaf mould, or sand. Stratifying in flats of sand is also practiced. Sowing the seed in the nursery row or broadcasting in beds is another practice. The best method appears to be as follows:

- (a) Store the seed dry until spring.
- (b) Plant in beds or flats in protected cold frames.
- (c) Keep seedbed moist and free from weeds for the first year.
- (d) Cover with leaves or boards or both during the winter.
- (e) Uncover in spring and place sash or lath over the frames.
- (f) Keep the seedbed moist and free from weeds the second year.
- (g) Repeat treatment for the third year if necessary.
- (h) Keep the holly seedbed moist and shaded, especially during hot, dry days.
- (i) Mulch the seedlings for two years while growing in the seedbed.

The first year, 10 to 15 per cent of the seeds will germinate and the seedlings may be transplanted when three or more leaves appear. The second year about 50% of the seedlings will grow and the third year, a final germination of 10 to 15 per cent may be expected. Thus, in all, only 70 to 80 per cent germination and production of seedlings can be counted on. One seedbed may therefore be used for more or less continuous production of holly seedlings with small expense. In about two years after germination, the seedlings will have the diameter of a lead pencil and can then be used for budding or grafting.

Budding

The usual method of budding holly is by the well-known shield or T style. Bud sticks are taken in July, August, or September, from selected varieties and prepared in the usual manner, by taking vigorous, mature, current season's growth. The leaves should be removed, leaving one-half and inch of the petiole or stem subtending each wood bud. Tying is done with budding rubbers, tape, raffia, or cotton string. As soon as the bud has united, the old top should be cut off gradually and then completely, so as to force all the growth into the new bud. Its may be necessary to pinch off laterals and to tie the shoot to a stake for support. It will require three to five years in the nursery to produce a tree two to two and one-half feet high ready for transplanting.

Grafting

There are two types of grafts used for holly: (1) whip or tongue for small stock, and (2) cleft for large stock. In either case the scions are selected from proved trees and prepared from mature shoots of the past season's growth. Scions are made four to five inches long with three or four buds and with all leaves cut off. Grafting is done during the winter months when the holly is relatively dormant. As in grafting other plants, it is important to bring the cambiums into contact, tie firmly if necessary, and to cover all cut surfaces with grafting wax.

Layers

New plants of English holly may be propagated while still attached to the parent tree. The lower twigs or branches may be induced to root by bending them down and covering a portion with soil. First a cut about a third of the way through is made on the lower side where the plant is to be buried and soil is then mounded and pressed over it. It is sometimes necessary to peg it to hold it down. The tip should be left uncovered. This operation is done in the early winter, and the following season roots will be formed at the incision and other places where the twig or branch has been buried. After new shoots have been formed at the incision and other places where the twig or branch has been buried. After new shoots have been formed from these areas, the new individuals should be severed from the mother plant by cutting off the original member. If very carefully done, the new plants may be lined out in the nursery, but they usually are left where they are and not further disturbed until another year, when they may be transplanted.

Cuttings

Propagation by cuttings is one of the easiest and quickest ways of obtaining a large number new plants, all true to type from selected parent trees. An electric hot-bed or propagating bench with bottom heat is advantageous in starting cuttings. This should also have a glass cover to admit light and retain the moisture. River-washed sand or a mixture of half sand and half peat moss has been found desirable soil for rooting holly. The mixture should be sifted and packed about six inches deep over good drainage.

The cuttings may be taken in the fall or early winter from mature wood of the past season's growth. These are made six inches long with three or four healthy leaves. Making the cut at or above the internode seems to give better results than in the node. Also terminal cuttings

seem to be better than cuttings taken back from the tips. However, the type of cutting makes relatively little difference in the final tree.

The freshly made cuttings are set about three inches deep, slanting if necessary, so as the leaves are resting on or close to the soil. Pack the soil well around the base of the cuttings and set them close together, but not crowded so as to hinder aeration. The cuttings should be watered well several times during the first few days and then followed by daily or more frequent sprinklings. It is of utmost importance to keep holly fresh and moist at all times to prevent the slightest withering. Shading with cheesecloth a few inches above the cuttings has been found effective in keeping them in good condition. On bright, warm days, newspapers or some other material may be used to cover the glass, for shade. Ventilation should be provided by opening the glass frequently or leaving partly open, especially if the temperature goes above 80° F. If bottom heat can be used, this should be about 55 to 60° F. in the soil and the temperature above kept to about 65 to 75° F.

It will require three to four months to root the majority of holly cuttings, although some may start in about a month. They should not be disturbed until well rooted.

Transplanting

In order to provide the best development, rooted cuttings should be carefully lifted and planted individually in pots or beds, using a growing mixture or soil of half sandy loam and half peat moss. Here again no drying-out should be risked. Water well and keep covered with glass for a few days until the rooted cuttings become established. Then they can be gradually hardened by allowing more ventilation and, finally by removing their protection.

The rooted cuttings should be set out in the nursery row in the spring, spacing them about one to one and one-half feet apart. Here they should be mulched with compost, rotted manure, or similar material. Irrigation by overhead sprinkling is recommended. In two or possibly three years the plants will be two feet high and ready for transplanting to their permanent location. Holly plants should be moved with their roots balled. Although this is somewhat more laborious and expensive, it pays in the end. Nurserymen do this regularly and it is the only way to buy or sell holly plants." (5)

COST OF A HOLLY ORCHARD

Trees 10" to 15" in height of the French-English strain cost from \$1.00 to \$1.50 each. Laying out the orchard and planting will cost anywhere from 15 cents to 30 cents per tree depending on whether you do the work yourself or hire it all done and depending also on how well the trees are planted. The amount of soil preparation will affect this cost.

The cost of maintaining a holly orchard will vary very much. For those who live on the land where trees are planted, have their own equipment and do the work themselves, this question can be only settled by their own figures. Those who live in the city and maintain a planting far removed from home and without equipment will find it both profitable and practical to arrange for some farmer in the vicinity of the planting to keep the ground in the proper state of tillage. For the first three years after planting one should figure on a cost of maintaining the soil and trees in top condition of eight to ten dollars annually per acre. If one cares to drive out to the planting and do the hand-cultivating himself, the cash outlay would be only for the team or tractor work and this should not amount to more than five dollars per acre annually.

HARVESTING THE HOLLY

"Harvesting may begin in 12 to 20 years if the trees appear thrifty and are well clothed with foliage. The opera-

tion may begin about December 1, or even sooner, and continue for 2 or 3 weeks, depending upon market outlets for the material and how far it is to be shipped. Sprays cut too early will become too dry, and will be unsatisfactory, by Christmas. Though some of the younger English holly trees (20 to 25 years old) will yield as much as 35 to 40 pounds of foliage without being injured, they should not be trimmed too heavily. Trees should be left in good condition for recovery and growth. If they are not trimmed too heavily they will increase their size and the amount of foliage more rapidly and return larger yields later.

Cutting should be from the sides of branches and 2 or 3 inches of each twig should be left in place. This portion that remains usually has several buds which will give rise to more material the following year.

Holly branches are easily collected by spreading a canvas near the trees and dropping the sprays upon it as they are clipped, or by dropping the sprays into large baskets or hampers. Such methods are essential if the ground is wet or covered with snow and the sprays themselves dry. If possible, sprays should be collected only when they are dry."(7)

MARKETING THE HOLLY

METHODS

"American holly wreaths are usually 10, 15, 24, or even 36 inches in diameter. The 10-inch wreath is the most common. The wreath framework is comprised of wires, or withes of various hardwood species, formed into a hoop of appropri-

ate diameter, with the holly sprays bound to it. Bulk holly usually consists of sprays 2 to 3 feet long. Wreaths and bulk holly are usually shipped in standard holly boxes 2 feet square on the ends and 4 feet long, built of thin lumber. A few paper cartons are now being used.

Producers and growers of holly would do well to make all arrangements for marketing their product before they begin harvesting. Such arrangements should include details as to (1) time and place of delivery, (2) the basis and time for payment, (3) the size and kind of sprays most desired by buyer, and (4) the total quantity.

Many growers roughly grade their holly. The better holly sprays are those 6 inches or more in length with a goodly number of berries and leaves that are healthy and of a good color. The second class or grade includes shorter sprays, with or without berries, with leaves that are less attractive. The second grade is used for wreaths together with a few berried sprays of the better grade.

Wreaths, therefore, offer an outlet for male sprays and others that are not of the very best quality.

The possible markets for holly are numerous. Many growers can dispose of holly locally to wholesale gracers, florists, merchants at public markets, and persons who conduct open-air stands for the sale of Christmas trees just before the holidays. If local requirements have already been filled, similar agencies in other cities and states should be tried. In many sections making holly

Christmas wreaths is a business. Holly can sometimes be sold to those who make wreaths, or, where safe shipping conditions are assured, the grower can himself undertake to make wreaths and market his holly in that form, through channels mentioned above." (7)

In the Appendix I have placed an article that was taken from the Morning Oregonian, Farm and Home section, and gives a good description of this in the Pacific Northwest.

FOLIAGE DISCOLORATION

In shipping holly to all parts of the United States, there has been, in the past, a great deal of trouble from the foliage being discolored upon arrival at its destination. Because of this fact the U. S. Government made an investigation and published a Circular on the results. The following is taken from the conclusions and recommendations of this circular, entitled "Deterioration of Christmas Holly in Transit and Storage."

"When experimental lots of frozen and unfrozen branch holly or holly wreaths were stored at various temperatures, little or no discoloration developed at 32 or 40° F. At 50, 60 and 70° F., however, discoloration was found in both classes of material in increasing amounts as the storage temperature increased. In practically all instances more discoloration developed in the unfrozen than in the frozen holly. When commercial shipping case lots of frozen and unfrozen holly wreaths were used in transportation and storage tests, more discoloration was found in the frozen lots.

Analyzing the results of the various experiments, it seems conclusively proved that freezing of Christmas holly does not in itself cause discoloration in transit or storage. In most of the small lot experiments the frozen holly leaves presented a better appearance because they retained the

natural luster or gloss for a longer time than did the unfrozen holly. In experiments where stored lots of holly sprinkled with water were compared with lots of stored dry, more discoloration of the leaves at temperatures of 50° F. or above was noted in the sprinkled lots.

The explanation of the greater amount of discoloration developing in the commercial-case lots of frozen holly is based on generally familiar phenomenon. When any object is taken from a comparatively low temperature to a comparatively high one, where the air is sufficiently humid, condensation of moisture on the cold object will result. When a case of holly that has been frozen (the temperature going at least as low as the freezing point, which averaged around 26.3° F.) is subjected to a considerable rise in temperature as is quite likely to occur during transportation, condensation throughout the contents, caused by the entering warmer air being cooled below the dew point, may be expected. The moisture resulting from condensation will also be augmented by natural transpiration. This accumulation of moisture is apparently responsible for the discoloration complained of, rather than the fact that the holly had been frozen. Temperatures low enough to cause actual freezing injury are not necessary to produce moisture condensation; under proper conditions a rapid transfer from a comparatively low to a relatively high temperature is sufficient. In examining commercial cases of wreaths as they arrived on certain markets, condensation was often noted when the cases were opened.

More complaints are made relative to discoloration in crates of wreaths than in those of branch holly. This may be attributed to the fact that branch holly in cases is not so compact, and any condensation disappears more rapidly, the total quantity of actively transpiring green leaves being much less. In the experiments with relatively small lots of holly the contents of the packages were not so compact, and the surrounding paper very likely absorbed moisture.

Cases containing thick, full-foliaged wreaths should not be packed in the same number as when the wreaths are thinner and lighter. A maximum of 15 dozen of such heavy wreaths is recommended. The case then would not be so tightly packed and would be in less danger of heating.

Packers and shippers are advised not to have too many cases of wreaths packed up ahead of their shipping schedule during warm "muggy" weather, since heating and discoloration are likely to occur in a few days unless the inside temperature of the cases is kept at least as low as 40° F."

MONEY RETURNS FROM A HOLLY ORCHARD

The only data that I was able to find on this, was contained in a paper prepared by Holly Growers Inc., Portland, Oregon. This group advocates the growing of only French-English Holly, thus their figures are based on this strain of holly plantings.

"Well grown trees of this variety should come into production with a fair crop when they have been planted for ten years. Of course they will crop much sooner than this, but we believe that we will make more in the long run by allowing the trees this amount of time for developing before cropping.

Trees that have been planted for 15 years should produce from 30 to 40 pounds of cut holly in one season and the crop should materially increase each year thereafter.

A price of 60 cents per pound and a yield of 40 pounds would give a gross return of 24 dollars per tree.

Cutting, boxing and shipping together with the cost of fertilizing and tilling the ground and other incidental expenses should not exceed \$8.00 per tree which would leave a net annual return of \$16.00 per tree. In the above figures no account is taken of interest on investments, taxes, etc.

We believe we are ultra-conservative in all of our estimates and for our own planting of about 1500 trees at Wilsonville, Oregon, we are estimating a net average annual return of 10 dollars per tree. Our trees are planted 70 to

the acre which will mean, if our figures are correct, and annual net return of \$700.00 per acre.

When the Pacific Northwest has enough growers of French-English Holly to form a substantial association, it is probable that their entire product can be marketed for a price around one dollar per pound." (3)

CONCLUSIONS

Holly is a very important evergreen. It has been adopted by church and home, as a Christmas decoration. As the native holly in America has practically disappeared, only by growing holly in commercial plantings can we hope to have an enduring and adequate supply of this traditional evergreen.

As the potential market is about 100 times greater than the present supply, and Western Oregon and Washington having the best climatic conditions for growing holly, the industry in this region is destined to be very profitable.

One should plant an orchard of Select English Holly, which is about the best producer of the many holly varieties. It may be that a grower will desire to put in some trees of other varieties for special markets that he can depend upon. In the main, though, only the best should be planted.

Holly grows well on many types of soils, and is relatively easy to care for in comparison to other crops or trees. It is fairly resistant to diseases, especially the select varieties.

The best trees to buy are those that have been propagated by cuttings, balled, and burlaped. Though they cost more, these trees will fully pay for themselves in years to come.

Techniques of marketing holly from the Northwest are in their infancy. Only a few growers have large enough plantings to actually make up their own wreaths and ship in large quantities. When enough holly growers are really producing a high grade holly on a large scale, then an association can be formed to really push their select product and obtain markets all over the United States.

The life of the holly trees can be measured in centuries. Even though the owner of the plantation may have to wait 10 to 20 years after its establishment before he receives an income from it, he finally achieves a practically permanent asset.

By making a small investment now a person can insure an income that will increase with each year's growth of his trees. He can carry on his present work while his holly orchard is coming into bearing, and when he is ready to retire it provides him with economic security.

Teufel Holly Orchard Near Portland Ranks Among Largest in Northwest

BY D. E. LUCHA
Free Lance Writer

Oregon holly is going everywhere—to Boston, New York, Washington, Detroit. Holly is grown on the Atlantic seaboard from New Jersey to Florida, and a native American variety grows wild, usually in scattered trees in a belt that runs through Kentucky, Arkansas and into Texas, but none can compare with the English holly grown here. It lacks the dark green sheen and bright berries of the local tree.

Much holly used locally is cut from ornamental trees growing about the city or from hedge rows in the suburban area, and is a means to a little Christmas money for the unemployed.

However, there are a number of commercial orchards where the trees are cultivated much as an apple or cherry orchard is taken care of, where the trees are sprayed. Foliage and berries from these command a premium in the most select markets in America. As yet there is little co-operation between commercial growers, each finds his own markets and, as a rule, ships direct to the eastern or California buyer.

Teufel Orchard Big

Some make a trip in late summer or early fall through the middle west or California and book or pave the way for their Christmas orders. Others advertise in trade journals that cover the entire country.

Perhaps the largest commercial orchard in the northwest is about four miles west of Portland on Barnes road. The first trees were set out in 1895 by Gustav Teufel. More have been planted from time to time, until now there are 30 acres in bearing trees.

The elder Teufel has since retired, and the holly orchard, along with a very modern nursery and greenhouse, is operated by his son, George Teufel. The Teufel orchards are all on rolling, well-drained upland ground.

The variegated variety comprises about 5 per cent of the holly shipped, and should be planted in this proportion.

Trees Set Close

Three to 5-year-old trees are set about 15 feet apart. Here Mr. Teufel disagrees with most authorities, who recommend that they be spaced 20 to 25 feet. The reason, as explained by Mr. Teufel, is that it takes 10 to 15 years for holly trees to come into commercial production and perhaps 30 years before they really begin to crowd each other.

All this time the intervening ground must be cultivated and cover crops grown and plowed under. When one keeps this up for 20 years, that is a lot of work for a few trees. Trees can be thinned out after they begin to crowd and thus save considerable land and labor for other things.

The Teufel orchards, both young trees and those in production, are sprayed twice a year, as a rule; the winter spraying is done in February or early March and, if needed, a summer spray

is applied in August. He grows oats and vetch, which is plowed under green and then kept fallow until the following spring.

Assembly Line Used

The harvest begins about December 1. This year he began cutting on November 25. The first holly and wreaths were sent to cold storage, where they were kept at a temperature of 40 degrees Fahrenheit, until the first customers were ready for them. Clipping is done by young men working from the ground or on ladders. The clipped branches go into large baskets or hampers to be hauled to the receiving room.

It is no stretch of the imagination to call the Teufel plant a factory, and a very modern one, at that. Using the assembly line idea, the holly moves from room to room for the different operations, from the receiving room at one end to the door at the other, where it leaves crated, labeled and addressed, ready for the journey to New York or Los Angeles.

Commercial holly that has been properly taken care of does not need dipping, which has a tendency to discolor and rob the foliage of its brilliant luster. In the receiving room the holly is trimmed down to sprays about eight inches long; the leaf sprays pass through a chute down to the wreath room.

Wreath Making Outlined

Berry clusters pass to an adjacent room, where women prepare them for the wreaths. They are stripped of leaves and a stem eight or more inches long left. These clusters in small, flat boxes then go to the wreath room. The wreath makers stand at long benches with the trimmed leaf holly at one hand and a small box of berry clusters at the other.

The holly is bound to wire rings of various sizes with fine wire, the wire going round as the holly is laid on lap over lap, with berry clusters laid into the wreath and bound in by the same wrapping wire. The amount of berries varies according to the wishes of the customer and is a big factor in the value of the finished wreath.

Wreath sizes are expressed by the diameter of the ring upon which they are made, from six inches up. A number of wreaths were made for an Oakland customer on a four-foot ring, the completed wreath being a little over five feet over all. The wreaths are packed loosely in new fiber cartons, made to order and sized to the different sized wreaths.

15 Tons Harvested

All wreaths are packed flat with paper separators and cartons are made accordingly. The only containers that can be said to be of a standard size are the cases to hold ten pounds of holly sprays and the one-pound gift boxes.

Teufel holly goes practically everywhere in the United States. Express time to New York city is four days. Some time ago Mr. Teufel received a

letter from a customer in New Jersey who said that holly he had just received appeared as fresh as though it had been clipped the day before.

The short season in which holly is marketable calls for quick decisions and quick action, as witness the New York customer who called Mr. Teufel by phone the other day. He talked with the New Yorker at noon. At 10 A. M. the following day 200 ten-pound boxes of holly sprays were on their way.

The Teufel holly harvest gives employment to 20 people for about 25 days. About 15 tons were harvested this year. The eastern shipments stopped December 17, California shipment December 18 and local orders on December 20.

State department of horticulture officials have tried hard to build up an orderly system of growing and marketing holly. Their experiments and assistance have been a big aid in this promising northwest industry.

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