New York State Agricultural Experiment Station

Geneva, N. Y.

FILBERTS
G. L. SLATE

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INTRODUCTION

In 1924, this Station set out a filbert orchard of 280 trees comprising approximately 40 varieties procured from New York and Oregon nurseries. In 1928, 40 additional varieties were imported from Europe, the object of the importation being to secure hardy sorts from Germany. A few more varieties from various sources, as well as several varieties of the native hazel, have been added to the collection.

The success of the original planting and reports of the success of other smaller plantings indicate that filberts may have a place in this State as a commercial crop. Certainly they are worth trying in the home orchard and by those who wish to experiment with new crops. The objects of this bulletin are to bring filberts to the attention of New York growers, to state what knowledge and experience have shown to be necessary for success in filbert cultivation, and to report on the behavior of the Station planting. The experience of others has been drawn upon for those phases of culture not treated in the Station experiment.

Filberts possess several advantages as a crop. Their culture is simple. Spraying is not necessary. Harvesting consists of picking up the nuts, which may be done by cheap labor and over a relatively long period. Careful handling and expensive storage conditions are not needed. Filberts never need thinning. The trees come into bearing relatively early, bear annual crops which ripen sufficiently early in the fall to assure the proper maturity of the nuts. In this respect the filbert surpasses the other nut trees, many of the best varieties of which fail to mature in New York in unfavorable seasons. The nuts are well known and popular on the market. The propagation of filberts is simple and more certain than the propagation of other nut trees, thus the trees are less expensive. For the orchard of the nut grower the filbert is a suitable filler tree.

American-grown filberts have a decided advantage over imported European nuts in that they can be dried and put on the market before the holiday season, whereas the imported nuts cannot be gotten to the American markets until after Christmas when the demand has slackened.
Consequently foreign nuts which constitute a large part of the filberts in the trade are a year old and inferior in flavor to fresh nuts of the current crop.

Filberts are particularly desirable for the home orchard because of the simple cultural requirements, and the small size of the plants which may be grown either as trees or as bushes, thus making them suitable for odd corners around farm buildings. The trees are also somewhat more tolerant of shade and crowding than fruit trees.

When grown as bushes they make a tolerably good high hedge. A purple-leaved variety is frequently grown as an ornamental but rarely produces fruit, probably because of the lack of another variety to provide cross pollination.

As a food the filbert ranks high, the edible portion of the nut having 3,100 calories per pound. In cracking quality it ranks above the other nuts which may be grown in New York.

Filberts also have their disadvantages which should be considered before extensive plantings are made. Filbert blight may enter the planting and be difficult to control. Severe winters may cause winter killing of wood. Warm days in the winter often bring the catkins, or pollen-bearing flowers, to the point where subsequent cold kills them, thus failing to provide for cross pollination which is necessary for the nuts to set. Production is increasing rapidly in the Pacific Northwest, and eventually over-production may lower the price of nuts to unprofitable levels. Under some conditions the nuts do not fill out properly, but at Geneva this seems to be a variety characteristic, the majority of varieties yielding very few "blanks" or unfilled nuts.

HISTORY OF THE FILBERT

The filbert is among the oldest of cultivated plants and many references to it are found in ancient horticultural literature. It was cultivated by the Romans, and according to Pliny (9), they were called Abellinae after their native place, Abellina, supposed to be the valley of Damascus in Asia, from whence is derived the specific name, avellana. Pliny states further that the filbert was brought into Greece from Pontus, and hence it was called nux pontica.

The word filbert is applied in England to those long nuts in which the husk is longer than the nut and by some is supposed to be derived from "full beard." According to Bunyard (4), the name may have come from St. Philibert whose day is August 22, at which time filberts

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1 Refers to Literature Cited, page 32.
ripen in England. In Sturtevent's Notes (9) the name filbert is said to be derived from Philibert, a king of France, who "caused by arte sundry kinds to be brought forth."

The origin of the word Cob, which is applied to those nuts which are short, nearly round, and not covered completely by the husk, may be compared, according to Bunyard (4), to the use of the same word for a stout small horse.

Hazel is derived from the Anglo-Saxon haesel, a hood or bonnet. In this publication the term hazel is applied to the native American species and varieties of Corylus, while filbert is used for all varieties of *C. avellana*.

Filbert culture is an important industry in parts of Turkey, Spain, Italy, and in Kent, England, where they grow to perfection. Many are grown in other European countries, especially in Germany where many excellent varieties originated.

Filberts have been grown more or less on the Pacific Coast since the region was settled, but only in recent years have large plantings been made. At present the acreage is being extended very rapidly in Oregon and Washington, and since the bulk of the nuts consumed in this country are of foreign origin, the industry has a promising future if American-grown nuts can compete successfully with the imported nuts.

Filberts have long been cultivated in gardens in the East. In 1629 they were among the seeds mentioned to be sent to the Massachusetts Company. Prince in his nursery catalogue for 1771 offered filbert plants for sale and in the catalogue for 1790 appeared the items "American hazlenuts" and "Barcelona nuts." Prince (11) and Downing (5) both mentioned the filbert and recommended its culture. In spite of this, filbert growing never developed beyond a few trees in gardens.

Fuller (6), in 1896, described two attempts to establish filbert orchards in Brooklyn, N. Y. Both orchards thrived for a few years but then succumbed to the ravages of filbert blight.

About 1912, Conrad Vollertsen of Rochester, N. Y., set out an orchard of about 2 acres which has been growing successfully since then, and various nut enthusiasts have been cultivating them more or less successfully in recent years.

The reasons for the previous failures and successes have not been well established. Various causes of failure are listed here that the prospective grower may know what he has to face: Filbert blight, winterkilling of catkins, inability of varieties to set fruit to their own
pollen, poor varieties, lack of cultural knowledge and neglect of plants, winterkilling of tree, and unsuitable soil conditions.

In the opinion of the writer, it is possible to avoid these troubles and to cultivate filberts successfully, if the necessary precautions are observed.

In recent years various attempts have been made to improve the native hazels and a few superior types of the American hazel have been selected, named and propagated. The late J. F. Jones of Lancaster, Pennsylvania, raised a number of seedlings from various crosses between the Rush hazel and filbert varieties. According to Bixby (3), Jones found the Cosford variety a notable parent because the nuts of its seedlings were much larger than either parent. Bixby, who has recently made various filbert crosses, has told the writer that the crosses succeeded much better when the Rush was the seed parent. The writer failed to cross several varieties of filberts with the Rush and Manitoba hazels.

One usually thinks of the filbert as being used only for its edible nuts, but in the literature many other uses, some of them interesting and unusual, have been recorded. An excellent oil may be pressed from the kernels. They are sometimes made into bread, and have been used in the preparation of a poor kind of chocolate. The young wood, which is very tough and elastic, has been used for fishing rods and walking sticks. In Norway hoops for herring barrels are made of hazel wands. The wood makes an excellent charcoal, often used for making drawing crayons. The roots which are curiously veined are sometimes cut into veneers. It is recorded that forked twigs of the hazel have long been used as divining rods for locating veins of metals and subterranean streams of water. The young twigs have also been used in the clearing of beer.

**CLIMATIC REQUIREMENTS**

The present areas of commercial production indicate in a general way the climatic requirements of the filbert. In the cool moist climate of Oregon and Washington it is particularly happy and a thriving industry is being established. In Europe large orchards are found in Spain and Italy, and they are a common crop in England, Germany, and even as far north as southern Norway.

The filbert is probably adapted to those parts of this State where the peach and sweet cherry are grown successfully. The limiting factor as regards temperature will probably not be the winterkilling of the
wood, but instead, the killing of the catkins by severe cold following periods of warm weather during the latter part of the winter. Presumably the equable temperature of the fruit belt along Lakes Erie and Ontario and near the Finger Lakes in the central part of the State will be most suitable for filbert culture. Various old trees scattered about the State and a number in Ontario that have reached the age of 50 to 60 years attest the ability of the filbert to endure our winters.

**SITES**

In selecting a site for the filbert orchard one should bear in mind the early blooming habit of the tree and choose a site that will tend to delay the opening of the flowers until after the time when temperatures lower than 15° may be expected. A north slope or the neighborhood of a large lake will probably be the most satisfactory place for filberts. Warm southern slopes or warm, sheltered spots near buildings should be avoided as a period of warm weather early in the winter might render the catkins susceptible to low temperatures later. Cold exposed sites should also be avoided as the drying effect of continuous winds is a factor in causing winterkilling.

Air drainage is not as important as with other fruits since the filbert flowers will endure considerable frost. If only a few trees for home use are to be planted, the north side of farm buildings should be a suitable site.

The Station orchard is well located, being on a gentle northern slope and protected from the prevailing west winds by buildings and trees.

If native hazels are present near the orchard, it will be advisable to grub them out, owing to their tendency to harbor filbert blight.

Since nuts do not require gentle handling, it is not necessary to locate on hard roads, and the crop may be transported at any time without fear of low temperatures.

**SOILS**

Filberts are not particular as to soils and will probably thrive on the average farm and garden soil. Light sands or heavy clays should be avoided as the nuts will be small on the former and the wood may not ripen sufficiently to be hardy on the latter. In Oregon a deep, fertile soil is advised; in England they are recommended "as a plant for rough, stony banks on which no other profitable crop can be grown." At the present price of trees the writer is rather skeptical as to the advisability of planting filberts on poor soils where the native hazels are often found.
As with other fruit trees, drainage is important since the filbert will not endure wet feet. Winter injury is severe on a wet soil.

**PLANTING**

The rules for planting the various fruit trees apply to filberts. The roots should be protected from drying from the time the plants are received until they are in the ground. Long, sprangling, and injured roots should be cut back to healthy wood. As much as possible of the original layered shoot should be removed or suckers will start from it. The soil should be firmly packed about the roots, leaving no loose earth and air spaces. Fertilizer is not needed at planting time.

Several classes of trees are available as planting stock. The first, and by far the most desirable, is the layered tree, which is of course on its own roots. Some nurseries offer trees budded or grafted on seedling roots of the common filbert, but these should not be considered owing to the suckering habit of the filbert. Should the tree be neglected or grown as a bush, or should the grower wish to propagate his own plants, trees on other than their own roots will not be suitable.

In recent years some of the Pacific Coast nurseries have been offering trees propagated on *columna* roots, this being *Corylus columna*, the Turkish, or Constantinople hazel. This root has the merit of not suckering, but little is known as to the behavior of other than young trees on it. Should it prove satisfactory its use will undoubtedly become general, since the suckering habit of the filbert is bothersome in a commercial orchard.

There is also the possibility of grafting the European filbert on the native hazels in the wild, but to the writer this appears inadvisable. Morris (10) who tried it, reported that the European hazel soon developed into such a heavy bush that it blew or bent over from its own weight, thus necessitating staking. The presence of disease in native hazels is an additional reason for not using this stock in the wild.

Trees that have grown one or two years in the nursery are preferable to older trees. Rooted layers are hardly large enough to withstand orchard conditions.

The proper planting distance is not known for New York as most of the trees are comparatively young. However, 16 to 18 feet will probably suffice, altho the usual distance on the Pacific Coast is 20 feet or more, and the recommendations for that region are being revised upwards as the trees become older. In general, it may be expected that the trees will not become much larger than peach trees. If the plants
are grown as bushes in a hedge, 4 or 5 feet will be a sufficient distance, and only trees on their own roots should be used for this purpose.

CARE OF PLANTATION

In general, the soil should be managed as with tree fruits. Cultivation should be shallow and sufficient to keep down weeds. Provision should be made for keeping up the supply of organic matter in the soil either by means of manure or with cover crops. Any of the various systems of soil management suitable for the tree fruits will be satisfactory for filberts. For the home garden, mulching will be a convenient method of handling the soil. If the planting is cultivated a cover crop will be necessary to check the growth and permit the wood to ripen before winter. The cover crop seed should be sown in July and any of the common crops used for this purpose, such as barley, buckwheat, rye, millet, and others, will be suitable.

It is the natural habit of the filbert to grow as a bush, and as soon as the tree is well established it will send up many suckers or shoots from the roots. In time if these are not subdued, a veritable thicket will result. These suckers should be removed promptly, as soon as they appear, by pulling or twisting them off. No stub should be left as each stub will send up several more suckers, necessitating more work. If the suckers are removed promptly for a few years, the tree will produce fewer suckers as it becomes older.

If trees are planted in waste places, such as fence rows, they should be cared for until large enough to compete successfully with the weeds and brush found in such situations.

FERTILIZERS

Fertilizers will probably not be needed. However, if growth is unsatisfactory, though cultural conditions seem all right, nitrate of soda may be tried, but should not be used until one is certain that something else is not at fault. Filberts are naturally vigorous and sufficient growth should result from cultivation and the necessary pruning.

PRUNING

Filberts may be trained either as bushes or as standard trees, but the tree form is generally considered by commercial growers to be far superior to the bush. Profitable crops may be obtained somewhat sooner from the more closely planted orchard trained as bushes, but the difficulties incident to the management of a bush orchard, the slip-
shod appearance of the plants, and the eventual small size of the bushes make the tree more desirable.

At the time of setting the young tree the top should be formed as with the other tree fruits. It should be cut back to balance the root system, headed at from 18 to 20 inches above the ground, and with four to six scaffold branches, well distributed to avoid the formation of weak crotches. The object in pruning during the early life of the tree should be to develop the modified central leader type of tree which has proved so successful with the tree fruits. The height at which the head is formed is usually not of great importance since spraying is not necessary and since the nuts are picked up from the ground. Varieties with the spreading, almost drooping habit like the Red Lambert will need to be headed higher than upright sorts in order to facilitate cultivation. Until the tree reaches bearing age it will suffice to remove the broken or crossing branches, and to head back any branches that may be growing out of bounds.

Filberts have not been the subject of pruning experiments so no recommendations based on experimental evidence may be made, but a study of the bearing habits of the tree will indicate in a general way how it should be pruned.

The filbert bears its fruit laterally and terminally on wood of the previous season's growth, and pruning, after the tree has reached bearing age, should be such as to stimulate a moderate amount of new growth each year. A fairly good tree will result from little or no pruning, but it is generally too thick and the bearing surface is on the outer portion of the tree. If the tree is kept fairly open, bearing wood will develop throughout the tree even down to the crotches of the scaffold branches. If satisfactory growth is being maintained, moderate thinning without heading back will be all the pruning that is necessary. If growth is short, some heading back will be needed in addition to the thinning in order to stimulate the production of new wood. In general, the pruning should be somewhat less and of the same general type as for peaches. As the tree becomes older growth slows up and it may be necessary to resort to fertilization in addition to pruning to stimulate the growth of a sufficient amount of new wood.

In England filberts are pruned more severely than in this country. The basin-shaped tree is considered most satisfactory and the tree when mature resembles somewhat an inverted umbrella with a height of about 6 feet and a width of 8 to 10 feet. The young tree is started off with six scaffold branches the first year. Each season the shoots are cut
back about one-half, so that the last bud points outwards. The leaders
on the primary branches are cut back each winter in order to strengthen
the framework of the tree and stimulate the development of laterals
along the branches. When the trees have reached the desired height the
leaders are stopped.

The laterals are thinned and cut back to a fruiting bud, and the
wood which fruited the previous season is cut back to two or three buds.
The center of the tree is kept open by removing the suckers.

During August all the strong lateral shoots are broken back one-
half their length, and late in the winter these broken ends are cut off.

The most suitable time for pruning is after the blossoming period
and before the leaves appear. If done at this time, the catkins which
are removed have served their purpose and their pollen will not be
wasted.

PROPAGATION

Several means of propagation may be followed with filberts, but vari-
ous methods of layering are most suitable because of their simplicity,
certainty, and the fact that the resulting plants are on their own roots.
Only those trees which are on their own roots are suitable for layering,
since the suckers which are layered come from the roots. The simplest
method is that of mound layering, and it is recommended for those who
wish to raise only a few plants. With this method the earth is mound-
up around the suckers to a depth of several inches. By the following
spring a good root system will have developed on the mounded por-
tion of the sucker, which is then taken up, set in the nursery row for a
year, when it is then ready for the orchard.

The method of sucker layering is one of the best for the production
of plants on a commercial scale. In early spring the sucker is bent over
and pegged down to the bottom of a trench several inches in depth.
To facilitate bending, the sucker is notched on the side towards the
tree. As soon as the growth from the buds has reached a height of
several inches, soil is carefully worked around the base of the upright
shoots to a depth of 2 or 3 inches. This depth is increased at intervals
during the season as the shoots increase in height. By fall a good root
system will have developed at which time the layer may be dug, the
shoots severed, and the plant transferred to the nursery row for a year.

Tip layering may also be practiced to advantage where only a few
plants are desired. A short section of the sucker near the tip is covered
with earth, the end of the sucker being allowed to protrude beyond
the covering. The shoots which arise between the covered section and
the base of the sucker may be similarly layered the following year.

Budding and grafting on seedling roots are somewhat uncertain and
not to be recommended, owing to the disadvantages of seedling roots.
If rapid multiplication of a scarce variety is desired, grafting may be
practiced. The same methods as are used with fruit trees will apply
to filberts, except that a more careful job must be done. Cion wood
must be cut before March as filberts start growth early. Grafting
should be done just before the buds break.

Grafting and budding will necessitate the growing of seedlings. Seeds
should be planted in the fall before they dry out or kept in moist sand
until spring and then planted in the nursery row.

INSECTS AND DISEASES

No insects or diseases have appeared in the Station planting or in a
planting near Rochester which has been growing over 15 years. How-
ever, if extensive plantings are made, certain insects and diseases may
appear and become troublesome. Those which may prove troublesome
are described briefly that they may be recognized and subdued promptly
when they appear. Until they do appear no spraying or other pest
control measures will be necessary.

INSECTS

Certain nut weevils (Balaninus spp.) attack the native hazels, but
the writer does not know that it attacks the European filbert. The
European species (B. nucum) is troublesome in Europe, but has not
become established in this country, altho often found in imported nuts.

The bud mite (Eriophyes avellanae) is reported by Schuster (13)
as being prevalent in Oregon. The insect attacks the buds which be-
come enlarged and fail to open normally. The treatment recommended
is spraying with lime-sulphur 1 to 12 as soon as the pistillate flowers
have finished blooming and before the leaf buds open.

Aphids have been abundant in the Station orchard, but apparently
do not do much damage. Nicotine sulfate 1 to 1,000 will take care
of them.

DISEASES

Bacterial filbert blight is present on the Pacific Coast where it may
do considerable damage. The writer can find no record of its occur-
rence in the East, but it is described briefly so that growers may be
on the lookout for it. Symptoms of the blight are a blackening and wilting of the young shoots and leaves. The disease is most serious on young trees, where cankers develop which may girdle the trunk.

Barss (1), who studied the disease in Oregon, reported that certain varieties, which he did not name, appeared to be immune, that others were somewhat resistant, and that still others were very susceptible, among them being Du Chilly (Kentish Cob) and Aveline. Barcelona was less seriously affected than the other varieties mentioned.

Schuster (13) states that the disease is spread by wind, rain, and insects. He recommends cutting out the infected parts and disinfecting both wounds and tools with a solution made up of cyanide of mercury, 1 part by weight; bichloride of mercury, 1 part by weight; and water, 500 parts by weight. This solution is poisonous and corrosive, so should not be put in a metal container.

Eastern hazel blight is caused by a fungus (Cryptosporella anomalal), and in the past has been very destructive to the European filbert in the East. It is present on the common hazel (Corylus americana) where it does little damage. Halsted (7) describes the disease and states that it apparently resembles the fungus causing black knot of plums. Symptoms of the disease are rough oval warts from a quarter to a third of an inch in length and a shrinking and dying of the affected portion. If the disease is unchecked, the entire top of the tree will be killed in two or three years.

No experimental work has been done with control methods for this disease, and any recommendations as to control are only suggestive. In view of its similarity to black knot of plums, the same control measures should be tried, namely, cutting out promptly all diseased twigs and branches and burning them immediately. The cut should be made well back into healthy wood and wounds and tools disinfected with the solution recommended for bacterial blight. All plants of the native hazel within the vicinity of the plantation should be dug out and destroyed or they will serve as a source of reinfection. In regions where the wild hazel abounds it will probably be inadvisable to attempt the culture of the European filbert. Morris (10) is of the opinion that the previous destructiveness of this disease was due to the fact that it was overlooked until it had completely girdled limbs or trunks. He says, "If we go over the orchard once a year, cutting out blighted bark and protecting the exposed area, it is a comparatively simple matter to manage this pest.”
HARVESTING, STORING, AND MARKETING

Filberts are usually harvested by allowing them to drop to the ground and picking them up. Some varieties drop free from the husk, but others must be husked out by hand. They should not be allowed to lie on the ground too long or they will discolor and become moldy. Just before the nuts ripen, which is early September at Geneva, the ground, if rough, should be smoothed to facilitate gathering the crop. Two or three pickings will be necessary as the nuts do not all ripen at once. At each picking the tree is shaken lightly to loosen all nuts that may be mature at that time. Those varieties with long husks, like Kentish Cob and White Aveline, will not all drop free from the husk and hence must be husked, which is most easily done before the nuts become too dry.

The nuts will require drying before storing. If stored while too green, a mold and stale flavor will develop. A satisfactory method is to spread them out in shallow layers in a dry room. After drying they may be stored in bulk. If kept in too dry an atmosphere, the nuts become dry and hard, and lose much of their flavor.

Hartman (8) at the Oregon Station has shown that filberts absorb moisture readily, and that the flavor will return if the nuts are kept for a while in a moist atmosphere. Nuts kept in a steam-heated office at this Station soon became unpalatable, but recovered their original flavor on being returned to an unheated shed. Nuts kept in the latter building were ready to eat by early November. From time of harvest until ready for consumption, Barcelona nuts decreased in weight about 10 per cent this year.

In England and parts of Europe the nuts are harvested in the husks as the latter are turning brown, dried thoroughly, packed in a crock, and covered with a layer of sand or salt. They are also stored in small quantities in a cool cellar in a drainpipe covered with a slate.

The New York grower should sell on the local market, either to stores or neighbors, as the large markets are well supplied with Western and foreign nuts. It will be well to sort out the unusually small or poorly colored nuts, as they are generally not filled out.

At present prices higher than 18 cents a pound for the smaller varieties and 20 cents for the large varieties at wholesale should not be expected. At retail the grower should secure from 25 to 30 cents a pound. The rapidly expanding Western production may lower these prices somewhat.
YIELDS

Filberts frequently bear a few nuts in the nursery row, but not much of a crop will be secured until the trees are five or six years of age. In 10 or 12 years they will be in full bearing and, barring accidents, they should continue many years. A young orchard in Rochester used chiefly for propagating purposes has yielded 500 to 600 pounds to the acre. Trees not used for propagating purposes should yield considerably more. The Oregon growers consider 1,000 pounds to the acre an average crop, and occasionally yields may reach a maximum of 3,000 pounds. In England six-year-old trees will yield about 4 pounds and established orchards about 1,000 pounds to the acre on the average, altho in good years 2 tons to the acre have been obtained. The Station orchard in its fourth year yielded from a few nuts to 1 1/4 pounds per tree. In the fifth year, Barcelona averaged 3 pounds to the tree. The yields for the sixth year showed only a slight increase due to severe pruning. The average yields for the fifth and sixth years are shown in Table 1.

In this table is also included data on the weights of nuts, percentage of blanks or unfilled nuts, and the proportion of kernel in the different varieties. It will be noted that certain varieties do not fill out as well in certain years as in other years. Due to the dry summer of 1929, the nuts averaged smaller in size than those of the previous year.

BOTANY

The genus Corylus which comprises the filberts and hazels belongs to the family of Betulaceae, which includes the birches, alders, hornbeams, and hop-hornbeams. Rehder (12) describes 11 species in the genus of which only one, Corylus avellana, is cultivated extensively for its nuts. In this species characterized by having the husks equal to or shorter than the nuts, Rehder places the varieties known as Cob-nuts in England. C. maxima (C. tubulosa of the older writers) is characterized by having the downy tubular husks about twice the length of the nuts.

Two species are common in eastern North America, C. americana, the American hazel, and C. cornuta, (C. rostrata of Gray's "Manual of Botany" and other authors), the horn or beaked hazel; C. californica is the Pacific Coast form of C. cornuta. Both species are bushes which sucker freely and are common along fence rows and waste land. C. cornuta, which is readily identified by its long tubular bristly husk, is of no value for its nuts. C. americana is more promising and a few varieties have been selected by those interested in the improvement of native nuts. The best varieties, however, are inferior to the European filberts.

C. colurna, the Turkish tree hazel, is of considerable interest, since it
<table>
<thead>
<tr>
<th>VARIETY</th>
<th>NUMBER OF TREES</th>
<th>AVERAGE YIELD PER TREE, OUNCES</th>
<th>WEIGHT PER NUT, GRAMS</th>
<th>NUMBER NUTS PER POUND</th>
<th>PERCENTAGE OF KERNELS</th>
<th>PERCENTAGE OF BLANKS</th>
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<td>187</td>
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<td>201</td>
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<td>22</td>
<td>1.6</td>
<td>1.0</td>
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<td>Early Globe</td>
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<td>25</td>
<td>20</td>
<td>1.8</td>
<td>2.3</td>
<td>188</td>
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<tr>
<td>Althaldenslebener</td>
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<td>8</td>
<td>29</td>
<td>1.8</td>
<td>1.9</td>
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<td>77</td>
<td>13</td>
<td>28</td>
<td>1.7</td>
<td>2.0</td>
<td>232</td>
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<td>4</td>
<td>8</td>
<td>2.4</td>
<td>2.5</td>
<td>182</td>
</tr>
</tbody>
</table>

*Varieties arranged according to classification, pages 25-31.
does not sucker and makes a large tree, sometimes attaining a height of 60 to 70 feet. It is said to be free from blight and is being used as a rootstock for filberts in the Pacific Northwest. Several large, handsome specimens of this species are growing in Highland Park, Rochester, N. Y., and in the opinion of the writer *C. columna* is well worth using as an ornamental tree because of its sturdy appearance and the rough, corky rather picturesque bark. The tree is rapid growing, late in coming into bearing, and in Highland Park bears heavy crops of nuts in alternate years, altho they are too small and thick-shelled to be of commercial value.

*C. chinensis* is another tree hazel that in China may attain a height of 120 feet and is described by Rehder (12) as a “handsome tree with large leaves and spreading branches forming a broad oval head.” Undoubtedly it would make a fine ornamental.

**POLLINATION**

Filberts are monoecious plants, that is, the staminate and pistillate flowers are separate, as in the corn plant. The staminate, or male flowers, are in the catkins and produce the pollen. The pistillate, or female flowers, are borne in small, scaly buds with only the stigma or pollen-receiving surfaces protruding during the blooming season. They are small, red and threadlike. The blooming period starts about March 20 to 25 at Geneva, and lasts about a month. The pistillate flowers usually appear a few days before the catkins are shedding pollen. The catkins appear in late summer. There is considerable variation in length of blooming season and some varieties bloom earlier than others.

Filberts are wind-pollinated plants, hence no bees are needed in the orchard. Altho pollination occurs in March and April, the nuts do not appear until early July. The flowers in bloom will stand considerable frost, no injury to either female or male flowers being noted when the temperature dropped to 16°F during the blooming season. Near zero temperatures after several days of warm weather in late February killed a large proportion of the catkins on the more tender varieties.

Schuster (13) has shown that practically all varieties of filberts are self-unfruitful and that the proper varieties must be planted together in order to insure a maximum set of nuts. Generally speaking, those varieties which bloom together will pollinate each other. In Table 2 are shown the blooming periods of both pistillate and staminate flowers of the more important varieties grown at Geneva.

Table 3 indicates the number of catkins that a variety will normally
produce. In the same table the percentage of winterkilled catkins for the various varieties is shown. It will be noted that there is considerable variation in hardiness between the different varieties and between different trees of the same variety. Varieties averaging more than 50 per cent of winterkilled catkins should be avoided as pollinizers.

**Fig. 1.—Filbert Flowers.**
1, Catkin, or male flower; 2, pistillate, or female flowers (the tiny flowers are protruding from the buds); 3, Winterkilled catkin (upper).
In the spring of 1930 a tree of Barcelona was pollinated with pollen of several other varieties to determine their value as pollinizers for Barcelona. The tree (which was growing in a variety collection) was enclosed in a tent made of heavy cotton cloth to prevent uncontrolled pollination. All catkins on the enclosed tree were removed before they had shed any pollen.

Since the pistillate flowers do not all bloom at once two pollinations were made with an interval of two weeks. Pistils when not pollinated will often remain receptive until the leaf buds have broken and considerable green is evident.

In Table 4 the results of these pollinations are shown. The varieties used were those with hardy catkins, or sorts that it was desired to cross with Barcelona to produce improved varieties. In general, any of the varieties tried, except Rush, which is a native hazel, were satisfactory pollinizers for Barcelona.

Owing to the light, feathery nature of the pollen which is naturally windblown it was not possible to prevent some grains from drifting about in the tent when pollination was being done. Consequently, on one branch of the tree the flowers were left unpollinated to serve as a check upon the amount of drifting pollen. The results showed that some pollen escaped, but that the set of fruit was considerably smaller

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>PISTILLATE FLOWERS</th>
<th>STAMINATE FLOWERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barcelona</td>
<td>Mch. 17—Apr. 12</td>
<td>Mch. 20—Apr. 13</td>
</tr>
<tr>
<td>Clackamas</td>
<td>Mch. 17—Apr. 16</td>
<td>Apr. 4—Apr. 23</td>
</tr>
<tr>
<td>White Lambert</td>
<td>Mch. 17—Apr. 14</td>
<td>Mch. 27—Apr. 14</td>
</tr>
<tr>
<td>Fertile de Coutard</td>
<td>Mch. 29—Apr. 11</td>
<td>Mch. 22—Apr. 12</td>
</tr>
<tr>
<td>Bollwiller</td>
<td>Mch. 18—Apr. 21</td>
<td>Apr. 2—Apr. 21</td>
</tr>
<tr>
<td>Halle</td>
<td>Mch. 27—Apr. 15</td>
<td>Apr. 1—Apr. 15</td>
</tr>
<tr>
<td>Red Lambert</td>
<td>Mch. 22—Apr. 9</td>
<td>Mch. 22—Apr. 9</td>
</tr>
<tr>
<td>Large Globe</td>
<td>Mch. 23—Apr. 15</td>
<td>Apr. 1—Apr. 15</td>
</tr>
<tr>
<td>Daviana</td>
<td>Apr. 3—Apr. 16</td>
<td>Mch. 24—Apr. 15</td>
</tr>
<tr>
<td>Italian Red</td>
<td>Apr. 3—Apr. 11</td>
<td>Mch. 22—Apr. 11</td>
</tr>
<tr>
<td>Medium Long</td>
<td>Mch. 30—Apr. 21</td>
<td>Mch. 29—Apr. 21</td>
</tr>
<tr>
<td>Cosford</td>
<td>Mch. 27—Apr. 15</td>
<td>Mch. 22—Apr. 9</td>
</tr>
<tr>
<td>Kentish Cob</td>
<td>Apr. 3—Apr. 22</td>
<td>Apr. 5—Apr. 22</td>
</tr>
<tr>
<td>White Aveline</td>
<td>Mch. 17—Apr. 17</td>
<td>Mch. 31—Apr. 20</td>
</tr>
<tr>
<td>Oregon</td>
<td>Mch. 17—Apr. 20</td>
<td>Mch. 19—Apr. 20</td>
</tr>
<tr>
<td>English Cluster</td>
<td>Mch. 17—Apr. 20</td>
<td>Mch. 24—Apr. 12</td>
</tr>
<tr>
<td>Nottingham</td>
<td>Apr. 2—Apr. 16</td>
<td>Apr. 6—Apr. 17</td>
</tr>
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<td>Mch. 20—Apr. 21</td>
<td>Apr. 5—Apr. 21</td>
</tr>
<tr>
<td>Purple Aveline</td>
<td>Mch. 17—Apr. 21</td>
<td>Apr. 5—Apr. 21</td>
</tr>
<tr>
<td>Early Globe</td>
<td>Mch. 17—Apr. 12</td>
<td>Mch. 22—Apr. 15</td>
</tr>
<tr>
<td>Althaldenslebener</td>
<td>Mch. 17—Apr. 23</td>
<td>Mch. 18—Apr. 22</td>
</tr>
<tr>
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<td>Mch. 17—Apr. 16</td>
<td>Mch. 18—Apr. 15</td>
</tr>
<tr>
<td>Minna</td>
<td>Mch. 31—Apr. 11</td>
<td>Mch. 17—Apr. 11</td>
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## Table 3.—Pollen Production and Winterkilling of Catkins in Filbert Varieties Grown at Geneva.

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<th>NUMBER OF TREES</th>
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<th>PERCENTAGE INJURY, 1929-30</th>
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<td></td>
<td></td>
<td>MINIMUM</td>
<td>MAXIMUM</td>
<td>AVERAGE</td>
</tr>
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<td>20</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Few</td>
<td>6</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Clackamas</td>
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<td>4</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Few</td>
<td>4</td>
<td>99</td>
<td>100</td>
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<td>Numerous</td>
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<td>10</td>
<td>60</td>
</tr>
<tr>
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<td>60</td>
<td>95</td>
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<td></td>
<td>Medium</td>
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<td>5</td>
<td>5</td>
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<tr>
<td>Bollwiller</td>
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<td>20</td>
<td>95</td>
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<td>10</td>
<td>10</td>
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<tr>
<td>Red Lambert</td>
<td>Medium</td>
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<td>10</td>
<td>10</td>
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## Table 4.—Results of Filbert Pollination, 1930.

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<th>NUMBER FLOWERS POLLINATED</th>
<th>NUMBER CLUSTERS SET</th>
<th>PERCENTAGE OF SET</th>
<th>NUMBER NUTS SET</th>
<th>AVE. NO. NUTS PER CLUSTER</th>
<th>NUMBER BLANKS</th>
<th>PERCENTAGE OF BLANKS</th>
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<tr>
<td>Barcelona</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>× Early Globe</td>
<td>52</td>
<td>43</td>
<td>82</td>
<td>115</td>
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<td>6.9</td>
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<tr>
<td>× Italian Red</td>
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<td>76</td>
<td>118</td>
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<td>5</td>
<td>4.2</td>
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<tr>
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<td>70</td>
<td>62</td>
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<td>89</td>
<td>42</td>
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<td>14.2</td>
</tr>
<tr>
<td>× Red Lambert</td>
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<td>82</td>
<td>132</td>
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<tr>
<td>× White Lambert</td>
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<td>65</td>
<td>178</td>
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<td>2.8</td>
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<tr>
<td>× Self</td>
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<td>1</td>
<td>3</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>× Unpollinated</td>
<td>49</td>
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<td>38</td>
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<td>3</td>
<td>10.7</td>
</tr>
<tr>
<td>× Rush</td>
<td>37</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</tbody>
</table>

Rush

| ° Barcelona              | 143                       |                     |                   |                 |                           |               |                      |
| ° Kentish Cob            | 172                       |                     |                   |                 |                           |               |                      |
| ° Red Lambert            | 95                        |                     |                   |                 |                           |               |                      |
than where hand pollinations were made. The necessity for an abundant supply of pollen in the orchard is thus indicated.

Another branch which was self-pollinated set only two nuts, as contrasted with the unpollinated branch which set 28 nuts. This suggests that the large amount of pollen of Barcelona on its own stigmas may have prevented the loose pollen in the tent from reaching the stigmas, or if the pollen grains did reach the surface of the stigma the stylar tissue was so choked with the Barcelona pollen tubes as to make it impossible for the foreign pollen to effect fertilization.

Rush, a variety of the native hazel, *Corylus americana*, was not a satisfactory pollenizer for the Barcelona, and it is possible that the three nuts resulting from this cross were the result of pollen contamination during hand pollination.

Two plants of the Rush growing in the garden of Dr. L. H. Mac-Daniels of Ithaca, New York, were pollinated with Barcelona, Kentish Cob, and Red Lambert. A good set of nuts was obtained. It is evident then that varieties of the European filbert, *Corylus avellana*, may be used to pollinate the native hazel. The breeder who would combine these two species must therefore use the varieties of the native hazel *C. americana*, as the seed parents, since the reciprocal cross will probably not be successful.

Since filberts are wind pollinated, some attention should be paid to direction of the prevailing wind when setting the orchard, especially if it is a small planting. In the Station orchard the yields of a number of trees of Barcelona and of an unknown variety in the first row on the west side of the orchard were only slightly more than half as much as the yields of the same varieties growing in the center of the orchard where they were surrounded by several varieties. Presumably the lower yields were due to lack of pollination, since the prevailing wind at Geneva on days when pollen is shedding freely is usually from the west. It will be advisable, then, to plant the pollinizers which generally yield less than Barcelona in the row towards the prevailing wind and the heavier-yielding types where they will be completely pollinated. If every third row is planted with two pollinizers, an early and a late pollen-shedding variety alternating in the row, the pollination of the orchard will probably be taken care of satisfactorily.

**VARIETIES**

Varieties of filberts are as distinct as varieties of tree fruits and each variety has its faults and merits. In order to select satisfactory sorts,
the prospective grower must know the characteristics of a good variety and the good and bad points of the varieties available from nurseries.

A good variety is characterized by a strong, vigorous, hardy, and productive tree of upright spreading growth habit. The catkins must be hardy and preferably abundant. The blooming season must coincide with that of the variety with which it is interplanted. The nuts should be large, thin-shelled, of good quality, well-filled, and should drop freely from the husk to facilitate harvesting. (See Figs. 2 and 3.)

Until the Station orchard has been bearing for several years longer, it can not be definitely determined which are the best varieties for this region. However, certain varieties are showing indications of superiority, and in general these are varieties that have proved satisfactory under other conditions. If nut characters alone are considered, many varieties will be satisfactory. In the recommendations which follow the emphasis has been placed on productiveness of the tree and hardiness of catkins, the latter character being of prime importance in a variety planted chiefly as a pollinizer.

Barcelona seems the best variety in the test because of its heavy production. Red Lambert, White Lambert, Cosford and Kentish Cob are probably suitable pollinizers.

Other varieties that show promise are Italian Red, Medium Long, and perhaps Bollwiller.

Early Globe, Medium Long, and the members of the Aveline group may have value for pollination purposes because of the relatively hardy catkins.

Varieties apparently of little or doubtful value here are Clackamas, Halle, Large Globe, Daviana, Montebello, Athaldensleber, Fertile de Coutard, Minna, Norelins, and an unknown sort noted on page 30.

About 1912 a number of varieties were imported from Germany by a Rochester nurseryman and were propagated and disseminated by him before they fruited. After they fruited many proved identical, and among several others the names could not be found or the varieties did not agree with their descriptions in European literature. Inasmuch as the varieties have been propagated for several years under the names under which they are here described, it is doubtful whether it will be advisable to change these names should their identity with European varieties later be proved.

CLASSIFICATION OF VARIETIES

A study of varieties shows that many of them are very similar, and that they may be separated into definite groups in which the varieties
FIG. 2.—TYPES OF HUSKS.
Cluster, Italian Red; top row, left to right, Barcelona, Kentish Cob, Nottingham; lower row, left to right, White Aveline, Corylus americana, C. rostrata.
Fig. 3.—Varieties of Filberts.
1, Barcelona; 2, Kentish Cob; 3, Red Lambert; 4, Bollwiller; 5, Halle; 6, Large Globe; 7, Daviana; 8, Italian Red; 9, Medium Long; 10, White Aveline; 11, Red Aveline; 12, Purple Aveline; 13, Nottingham; 14, White Lambert; 15, Althaldenslebener; 16, Early Globe; 17, Corylus colurna; 18, C. rostrata; 19, Rush; 20, Winkler.
comprising the group have many common characteristics. Therefore, the varieties growing in the Station orchards have been arranged in groups named after the principal variety in the group, as follows.

BARCELONA GROUP

BARCELONA (GROSSE BLANCHE)\(^2\)

Barcelona is the commercial variety of the Pacific Northwest, and judging from its performance in the Station orchard, it will be the best variety for New York conditions. Its merits are the large, vigorous, productive tree which has outyielded all other varieties nearly two to one on five-year-old trees. The nut is of good size, and attractive appearance. Introduced in 1885 by Felix Gillette, Nevada City, California, as "Grosse Blanche de Angleterre" and by him later renamed Barcelona. The introducer claimed this variety to be identical with the Barcelona of Spain.

Tree productive, taller, larger, and more vigorous than other sorts; catkins medium in number, fairly hardy, blooming early; husk one-third larger than nut, pubescent with numerous glands, opens and sheds nut freely; nuts in cluster 1 to 5, usually 2 or 3, large, moderately thick-shelled, broad-shouldered with a blunt point, rich chestnut brown, striped with darker brown, upper third pubescent, base nearly flat to bluntly pointed; kernel moderately large, somewhat irregular, bluntly pointed, with much pellicle.

CLACKAMAS

This variety of Oregon origin seems to have little merit as grown at this Station. The nut resembles Barcelona in shape, but is lighter in color, the tree is less vigorous, and not as tall as that of Barcelona, and the glands on the husk are very few. The tree is moderately productive, suffered more from drought injury in 1930 than other sorts, and the nuts are variable in size.

WHITE LAMBERT

This is a large nut resembling Barcelona in shape, but differing from that sort in being narrower, lighter in color, with less distinct stripes, and much more pubescence. It is considered a promising nut by those who have grown it. This variety is one of the number imported from Germany about 1912 by Conrad Vollertsen of Rochester who has disseminated it in this country. The small amount of winter injury to the catkins make this sort worthy of trial.

Tree vigorous, rather late in coming into bearing, broad, spreading; leaves borne in characteristic drooping manner and of a lighter green than other varieties; catkins medium in number, hardy; husk pubescent, glandular, slightly longer than nut; nuts in cluster, 1 to 4, usually 2 or 3, large, thick-

\(^2\)Synonyms given in parenthesis.
shelled, broad-shouldered with a short, blunt point, medium brown, faintly striped with darker brown, heavily pubescent; kernel medium size, fairly regular, plump, bluntly pointed, with much pellicle.

**FERTILE DE COUTARD**

This nut is of the Barcelona type, but seems without merit as grown at this Station. The trees thus far are unproductive and not very hardy; the catkins are few and very susceptible to winter injury; the nuts do not fill out well.

**BOLLWILLER GROUP**

**BOLLWILLER (WUNDER VON BOLLWILLER, MERVEILLE DE BOLLWILLER)**

Bollwiller is an old variety of German origin that generally has the reputation of being unproductive. It is very similar to Halle, but may be distinguished from that variety by the red-pointed winter buds. In the Station orchard it is not an outstanding variety and the catkins are rather tender to cold.

Tree vigorous, upright spreading, only moderately productive; catkins numerous, not very hardy; husk pubescent, glandular, not completely covering nut; nuts in cluster 1 to 5, usually 2 or 3; nut large, thick-shelled, nearly round in cross-section, tapering to a blunt point, upper third lightly pubescent, base nearly flat; kernel pointed, fairly regular, with a moderate amount of pellicle.

**HALLE (GEANT DE HALLE, HALLE’SCHER RIESENNUSSE, HALL’S GIANT)**

Halle is a large nut of the Bollwiller type that has shown little merit at this Station. The tree is unproductive and lacking in vigor, and the catkins are subject to winter injury. It originated in 1788 with C. G. Buttner at Halle, Germany, and in that country the variety is still highly esteemed.

**LARGE GLOBE**

A large-pointed nut very similar to and perhaps identical with Bollwiller. Imported from Germany by Conrad Vollertsen about 1912.

**RED LAMBERT**

This variety was imported by Mr. Vollertsen about 1912 and is highly regarded by him. As grown at this Station it is rather promising because of its large nut and relatively hardy catkins which have suffered very little winter injury the past two seasons. The tree is very spreading, only moderately productive while young, and the nuts do not fill out as well as many other varieties. It has a place in the orchard as a pollinizer for the early pistillate flowers of Barcelona.

Tree vigorous, moderately productive, very spreading, nearly saucer-shaped; catkins medium in number, hardy, blooming early; husk equals nut in length, eglandular, finely pubescent; nuts in cluster 1 to 3, usually 2, very large, mod-
erately thick-shelled, tapering gradually from the base to the apex, rich chestnut brown, striped with darker brown, upper third finely pubescent, base nearly flat; kernel long, pointed, fairly regular with a moderate amount of pellicle.

**DAVIANA GROUP**

**DAVIANA**

Daviana, an excellent variety in many places, falls short at this Station in hardiness of catkins and wood, and consequently in productivity. In Oregon it is esteemed as a pollinizer for Barcelona and Du Chilly, but the tenderness of the catkins renders it of little value for that purpose under New York conditions. The nut is large, nearly oblong, medium brown, striped with darker brown with a fairly thin shell.

**ITALIAN RED**

This is another of Mr. Vollertsen's importations from Germany which seems fairly promising as tested at this Station, because of the size and vigor of the tree and the large, handsome nut.

Tree tall, vigorous, upright and moderately productive; catkins numerous, moderately hardy; husk equal to nut in length, finely pubescent, slightly glandular; nuts in cluster 1 to 4, usually 2 or 3, large, with moderately thick shell, long, tapering gradually to a sharp point, medium brown, faintly striped with darker brown, upper third faintly pubescent, base nearly flat; kernel medium size, fairly regular, with a medium amount of pellicle.

**MEDIUM LONG**

This variety is very similar to Daviana in appearance, but the stripping is less distinct, the tree is more productive, and the catkins somewhat hardier. It may be considered fairly promising. The name Medium Long was used by Mr. Vollertsen to designate a tree from which the label had been lost and plants have since been disseminated under that name.

Tree vigorous, upright, and moderately productive; catkins numerous, moderately hardy; husk slightly longer than nut, finely pubescent, moderately glandular; nuts in cluster 1 to 4, usually 2 or 3, large, with moderately thick base, tapering abruptly to a blunt point, medium brown, faintly striped with darker brown, upper third faintly pubescent, base slightly rounded; kernel large, nearly oblong to slightly tapering, bluntly pointed, with much pellicle.

**COSFORD**

This is another variety of the Daviana group that may have promise as a pollinizer for Barcelona because of its early blooming habit and its numerous hardy catkins. The nuts are very thin-shelled and the proportion of kernel to shell is high. The variety was first brought to notice in England in 1816.
Tree tall, vigorous, upright; catkins numerous, hardy, opening early; husk about equal to nut in length, pubescent, very slightly glandular; nuts in cluster 1 to 2; large, thin-shelled, nearly oval, shoulder broader than base, tapering abruptly to a blunt point, medium brown, faintly striped with darker brown, upper third faintly pubescent, base slightly rounded; kernel medium size, nearly oblong, slightly irregular, with a heavy pellicle.

MONTEBELLO

Only one tree of this variety is fruiting in the Station orchard and it has not yet shown any promise.

KENTISH COB GROUP

KENTISH COB (COB-NUT, LAMBERT’S FILBERT)

This is one of the most widely grown and satisfactory filbert varieties. Its popularity is due to the vigorous, productive tree and the large, handsome, thin-shelled, high-quality nut. Its late blooming habit would make it an excellent variety to plant with Barcelona for pollinating the late flowers of that variety were the catkins harder. It is not a Cob-nut in the precise sense of the word since that term should be applied only to those short, round nuts which are not covered by the husk. Since only about half the nuts drop freely from the husk, the remainder must be husked by hand, which adds somewhat to the cost of production.

It was raised about 1830 by a Mr. Lambert of Goudhurst, Kent, England, and it is now the leading variety in that important nut-producing region.

Tree vigorous, upright, productive; catkins numerous, moderately hardy, opening late; husk much longer than nut, finely pubescent, eglandular; nuts in cluster 1 to 9, usually 3 to 5, large, long, moderately thick-shelled, flattened, grooved, medium brown, striped with darker brown, upper two-thirds pubescent, base slightly rounded to nearly flat; kernel large, long, flattened with a deep groove in the center, pellicle medium thick.

DU CHILLY

This variety, which is apparently identical with Kentish Cob, is grown extensively in Oregon and Washington as a standard variety and as a pollinizer for Barcelona. It was introduced into that region prior to 1887 by Felix Gillette, Nevada City, California. The description of Kentish Cob applies to Du Chilly.

BONY BUSH

A very long, grooved, heavily pubescent nut grown to a limited extent in the East by nut enthusiasts. It has not fruited at this Station.
CORNICONICK

Another long, grooved, very pubescent nut whose value is not known to the writer. It is being tried by a few amateurs.

AVELINE GROUP

WHITE AVELINE (WHITE FILBERT, WEISSE LAMBERTS NUSS, AVELINE BLANCHE LONGUE)

According to Bunyard, this variety is one of the oldest of filberts and has been grown for several centuries. It is the Corylus tubulosa alba of the botanists. Altho it is an excellent pollinizer and the catkins are abundant and hardy, the small size and only moderate vigor of the tree and the small nut make it of doubtful value commercially. The thin shell and high quality of the nut make it worthy of consideration for the home garden.

Tree small, moderately vigorous, upright spreading, of medium productivity; catkins numerous, moderately hardy; husk pubescent, glandular, twice the length of the nut, often split down one side; nuts in cluster 1 to 7, usually 3 to 4, small, thin-shelled, long, bluntly pointed, slightly grooved, dull brown, occasionally faintly striped with darker brown, pubescent except near base, base bluntly pointed to rounded; kernel long, regular, with a curved suture running from base to apex, pellicle slight.

OREGON

This variety is very similar to White Aveline and the description of that variety will apply to Oregon.

ENGLISH CLUSTER (CLUSTER)

This sort is very similar to White Aveline.

RED AVELINE (RED FILBERT, RED-SKINNED FILBERT, AVELINE ROUGE, ROTE LAMBERTSNUSS)

According to Bunyard, this very old sort was known in 1623. At this Station the variety is of little value because of the small, weak, unproductive tree and the small fruit which is typically Aveline in appearance. The skin of the kernel is dark red with a long brown spot on one side which is bounded by the suture. The young leaves and the catkins have a reddish tinge.

PURPLE AVELINE (PURPLE FILBERT, PURPLE-LEAVED HAZELNUT, ROTBLATTRIGE LAMBERTSNUSS)

Because of the purple foliage this variety is often used as an ornamental. The tree is too small, weak, and unproductive to be of value for the nuts which are typically Aveline in appearance. The pellicle is
somewhat darker than White Aveline. When grown on lawns where no pollinizer is provided, very few or no nuts are produced.

NOTTINGHAM

Nottingham is becoming popular in the Pacific Northwest as a pollinizer for Barcelona and its behavior at this Station indicates that it is worthy of trial in New York. The nut is typically Aveline in appearance, but the variety differs from the other members of the group in that the tree is taller and more vigorous and the nuts average 6 to 8 in a cluster. The nut is pointed at each end and broader at the shoulder than at the base.

Tree vigorous, upright, moderately productive; catkins numerous, moderately hardy; husk finely pubescent, very glandular, one-third longer than nut; nuts in cluster 2 to 9, usually 6 to 8, small, thin-shelled, long, flattened, apex sharply pointed, width decreasing from shoulder to base which is sharply pointed, medium brown faintly striped with darker brown; kernel medium size, long, regular, pellicle slight.

EARLY GLOBE GROUP

EARLY GLOBE

This is another of the varieties imported from Germany by Mr. Vollertsen. The nut is rather small and thick-shelled to be of much commercial value; but owing to the hardiness of the catkins and the productiveness of the tree, it may be of value for home use in certain sections.

Tree small, vigorous, spreading, inclined to bushiness, productive; catkins medium in number, hardy; husk pubescent, very glandular, slightly longer than nuts; nuts in cluster 1 to 6, usually 3 to 4, small, medium length, thick-shelled, nearly oval, bluntly pointed, medium brown, striped with darker brown, upper half pubescent, base rounded to bluntly pointed; kernel small, regular with a small amount of pellicle.

ALTHALDENSLEBENER

This variety resembles Early Globe, but is slightly longer, more pubescent, and the tree is taller and more upright. Its value is doubtful. Althaldenslebener is another of Mr. Vollertsen’s importations from Germany.

UNKNOWN

The varieties listed below were all imported from Germany by Mr. Vollertsen and some of them were disseminated before they fruited. This Station secured plants, but after the trees came into bearing they proved to be identical and the writer has been unable to identify the variety. In view of their identity, their untruthness to name, and lack of merit the following varieties (where descended from the original im-
portation) should no longer be propagated. The nut is very similar to that of Early Globe, but the tree is more vigorous and upright. The varieties are as follows:

- Blumberger Zeller
- Burchardt's Zeller
- Buttner's Zeller
- Cob-Nut
- Early Long
- Fichtwerdersche Zeller
- Gubener Barcelloner
- Gunslebener Zeller
- Gustav's Zeller
- Grosse Bunte
- Hempel's Zeller
- Halle'sche Riesen
- Landsberger Zeller

**MISCELLANEOUS VARIETIES**

**MINNA**

Minna is a nearly round, very thick-shelled nut that is of doubtful value. Thus far the tree is unproductive and the catkins not hardy enough to compensate for the faults of tree and nut. The variety does not agree with the description in Goeschke. Mr. Vollertsen imported this variety from Germany.

**NORELINS**

An Oregon variety that is wholly without merit in the Station orchard. The nut is very small and nearly round.

**AMERICAN VARIETIES**

**RUSH**

This is probably the best variety of American hazel, and is worthy of trial where the European type fails. The bush is somewhat taller and more vigorous than the average type of American hazels. The nut is large for a native hazel, bright chestnut brown, and rather thick-shelled. The kernel has considerable pellicle. Rush was selected from wild plants growing near New Providence, Lancaster County, Pennsylvania, by J. G. Rush of West Willow, Pennsylvania.

**WINKLER**

Winkler is described as having the largest nuts of any American hazel yet found. It was selected from the wild about 1910 by Wendell Williams of Danville, Iowa, and introduced in 1927 by Snyder Bros., Center Point, Iowa. It should be tried by those interested in the native hazel.

**MERRIBROKE**

This is a native variety from Stamford, Conn., that is described as having beautiful autumn foliage. The tree is low, bushy, of slender habit, and very productive. The nut is very small and thick-shelled.
MANITOBA

This is a selection from several generations of seedlings of the native hazel of Manitoba made by N. E. Hansen of the South Dakota Experiment Station, Brookings, South Dakota. At this Station the plants are very small and bushy and vary greatly in productiveness and size of nuts.

LITTLEPAGE

Selected from the wild by T. P. Littlepage of Washington, D. C., in Anderson Township, Warrick County, Indiana. It is described as very prolific, but has not yet fruited at this Station.

LITERATURE CITED

6. Fuller, A. S. The Nut Culturist. 1896. (Pages 132-144.)
11. Prince, Wm. Treatise on Fruit Trees. 1828. (Page 37.)