FILBERT GROWING IN WASHINGTON
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Filbert growing started on a commercial basis in the Pacific Northwest as early as 1900. The industry had made only slight expansion by the early 1920's, but expanded considerably after about 1925 as indicated by the fact that the production increased from 60 tons in 1927 to 1,850 tons in 1936, and to 3,170 tons in 1939. The acreage in 1937 was approximately 11,000. From 1938 to 1940, inclusive, the annual plantings in Oregon amounted to approximately 1,000 acres. The total plantings up to 1941 increased the acreage in the United States to approximately 14,000 acres.

Washington and Oregon produce most of the filberts grown in the United States. It is likely that the percentage produced in Washington has increased slightly since 1930. Prices per ton received by farmers in Oregon for the period 1929 to 1939, were as follows: 1929, $300; 1930, $340; 1931, $250; 1932, $200; 1933, $300; 1934, $200; 1935, $260; 1936, $270; and 1938, $220.

CONSUMPTION TRENDS
The per capita consumption of filberts in the United States for the period 1925 to 1930 was .09 pound. During the subsequent 10-year period it decreased to .04 pound, and the acreage increased from less than 10,000 to more than 14,000 acres. In 1936 the total United States consumption equaled what could have been grown on 15,000 acres of mature trees. Since approximately three-fourths of the present acreage is not yet in full bearing, it is evident that a large part of the consumed crop is imported.

FILBERT-PRODUCING REGIONS
Because the catkins are killed by temperatures 15° below zero Fahrenheit, commercial plantings are confined to areas of mild climates. Italy, Spain and Turkey are the centers of production in Europe and Asia; whereas the Willamette Valley in Oregon produces the bulk of the tonnage grown in the Pacific Northwest. In southwestern Washington the principal plantings are in Clark and Lewis counties. Fairly extensive plantings are found in Snohomish,
Skagit and Whatcom counties. Although these are some of the leading filbert counties in Washington, plantings varying in size from a few trees to several acres occur in most coastal counties.

SOILS AND SITE.

Selecting the site for the orchard is an important step. The success or failure of growing filberts may be determined at this point. Natural advantages characteristic of good locations may provide reasonable assurance of profitable production; likewise locations which not only lack these advantages but possess serious disadvantages can hardly be expected to furnish a profit under any circumstances.

Late-maturing sections may sometimes be at a disadvantage. Orchards planted in locations exposed to continual sea breezes, which apparently carry varying amounts of salt unfavorable to the luxuriant growth of trees, often fail to make satisfactory growth. Orchards located adjacent to forests inhabited by blue jays and squirrels often suffer serious losses just before harvest. Because it is difficult to train young trees properly in badly wind-swept areas, such areas should be avoided.

Filberts are grown successfully in Washington on several types of soil. Among these are loam, sandy loam, clay loam, and shot clay. Unless prevented by impervious layers of hardpan, rock, gravel, or sand, the filbert root system extends to a depth of approximately 10 feet. Trees located on deep soils, therefore, have numerous advantages over those located on shallow soils. The depth of the soil may be determined by the use of a soil auger. Limited soil depth is likely to restrict root and top growth. Such restriction upon growth is sometimes so pronounced that the trees, even with the best of care, never reach a stage of profitable production. Because high production can be obtained from good, deep soil more easily and at less cost than a low yield can be produced on shallow soil, high-priced land usually is cheaper in the long run.

The presence of wild hazel on a piece of land is not necessarily assurance that this land is suitable for filberts. The plant growth on the land generally is a better indication. If in doubt as to the suitability of land proposed for filberts, the county extension agent should be consulted.
Drainage

The soil should be well-drained during the entire year. If the water table rises during any part of the season and keeps the lower part of the root system submerged for any length of time, injury may be expected. In soils that are too wet the growth and extension of the root system are inhibited. Consequently, during the growing season, when the tree requires large amounts of plant food materials and water, the root system is inadequate. Lack of drainage, therefore, may result in stunted, undersized, low-producing trees.

FERTILIZATION

The fruit is usually borne on spurs of the current season (Fig. 1, A). These arise from fruit buds on one-year-old wood (Fig. 1, B). Spurs may arise from twigs in either the outer or inner portion of the tree. Whether they are produced on the periphery or on the inside, it is essential that a sufficient amount of new wood be produced each season. The production of the new wood is influenced to a large extent by the fertility of the soil. Other factors, such as pruning, which is discussed later, are also important.

Growing cover crops in filbert orchards is a successful and economical means of improving soil fertility. Cover crops not only produce fertility but organic matter as well. The lack of organic matter sometimes is an important limiting factor. Commercial fertilizers may supplement the cover crops to advantage. Supplying commercial fertilizers when needed by applying them to the cover crop is more satisfactory than applying them directly to the trees without a cover crop. In poorer soil it sometimes requires several years before a cover crop can be grown satisfactorily.

Because it is necessary to conserve moisture during the growing season, a cover crop that makes the maximum growth by early spring is desirable. Mustard and turnips have been used to a limited extent, but because they lack hardiness and are not legumes, they are not entirely satisfactory. Annual crimson clover, while grown in some of the southern counties with fair success, is not hardy in the northern counties. It is sown at the rate of 10 pounds per acre.

A mixture in which hairy vetch or Austrian winter peas are included seems to be most satisfactory. Either Rosen rye, winter


Figure 1. Branch taken from Du Chilly tree in September. The leaves were removed artificially. Note that there are seven fruit-bearing spurs and approximately nine vegetative twigs without fruit. Catkins for next year's crop have arisen from some of the fruit buds. A—fruit-bearing spur. B—lateral bud on one-year twig. Fruit-bearing spurs and vegetative shoots arise from lateral and terminal buds.

wheat or winter oats may be used with vetch or peas. Of the three, rye is preferable because it makes more growth during low winter temperatures and starts rapid growth earlier in the spring. When Rosen rye and hairy vetch are used, they are sown at the rate of 90 pounds and 30 pounds per acre respectively. The cover crop ordinarily is sown just before the ground is leveled preparatory for nut
drop. It should be sown before the fall rains start in order to obtain as much fall growth as possible.

During some seasons the cover crop does not make the desired amount of growth before time to disc it in. Ordinarily it should be turned under by April 20 in the southern counties and by May 1 in the northern counties irrespective of the amount of growth it has made. Although it is true that during some seasons it may be permitted to grow beyond these dates and produce no injury to the trees, this is a dangerous practice unless means for providing needed moisture are available. Several orchards have been seriously injured by permitting the cover crop to utilize too much of the summer moisture supply.

After the cover crop has been disc'd in, the orchard is kept clean until time to sow another crop in the fall. Shallow cultivation is preferable to deep cultivation. Light discing is a good type of cultivation.

**PROPRIAGATION**

Most filbert trees are propagated by some form of layerage. Tip and continuous layerage are the common forms. The layering stock is produced by trees which are allowed to sucker freely. Only healthy trees known to produce satisfactory fruit should be used as propagating stock. While suckers may be layered from trees of almost any age, the preferred age is from four to eight years. The top of the layer-producing tree is usually removed just above the ground. Healthy and mature suckers approximately one-half inch in diameter at the base are selected in early spring as layering stock. As many as can be accommodated in the space around the tree may be layered from one tree.

The tip layer is bent in a horizontal position radially from the side of the tree on which it is located. Approximately 18 inches from the tip of the layer, it is bent upward rather sharply, forming a "V." The bend is buried in a hole six to eight inches deep and about the same width, leaving the portion beyond the bend extending in an upright position. Roots ordinarily arise at the bend, and the tip continues to grow. A well-rooted tree two to six feet tall, ready for planting the following spring, is produced by the end of the first growing season after layering. When removed from the nursery, the tree is cut off just above the bend. In this way a minimum amount of layering stock is left on the new tree.
The continuous layer is placed in a three- or four-inch trench extending the entire length of the layer when bent in a horizontal position. (The basal portion which cannot be bent to the ground is excepted.) The layer is pegged down in several places to hold it in position. To avoid trees with crooked basal trunks, the buds from the lower side of the layer are sometimes removed. Growth starts at each bud. As the young shoots grow, the trench is gradually filled. The new trees make a growth of one foot or more the first season. In the spring the layer is lifted and the little trees cut off just above the point of attachment to the layer. Removal at this point completely eliminates the layering stock, which is sucker-producing wood. The new trees are then set in a nursery row, where they are grown for one season. They are usually headed three or four inches from the ground and trained to single whips during the first part of the growing season.

**PLANTING DISTANCES**

It is difficult to specify the planting distances under which the trees, when mature, will fully occupy the land and not be crowded. It may be stated that the danger of failing to utilize all of the soil because of planting the trees too far apart is slight; for the trees, when given adequate room, make an unlimited spread. Furthermore, when they reach maturity, trees with ample growing space are much easier to care for than crowded trees.

It has been suggested that filberts should not be planted on poor soil. On the assumption that they are to be planted only on good soil, 25 feet apart is probably the preferred distance.

Although the use of fillers permits more efficient use of the land, it must be kept in mind that the extra cost of trees, too, is appreciable. The experience of many growers indicates that planting filler trees, to be removed when they start crowding the permanent trees, is not advisable. Even though the grower, when setting the trees, fully intends to remove the fillers at the proper time, he usually fails to remove them before considerable damage is done to the permanent trees. When fillers are used they should be removed as soon as they start crowding.
PLANTING

Good nursery stock is essential. First grade trees at usual nursery prices are cheaper than cull trees gratis. One-year-old trees generally give better results than do two- or three-year-old trees.

After the orchard plan is laid out according to a recommended system, dig holes large enough to accommodate the roots without crowding in any way. If the holes are likely to dry out when dug several days ahead of setting, dig them as the trees are set.

When all preparations have been made for the actual setting, the trees are taken to the orchard. Use all precautions to keep the roots from being exposed to drying wind and sun. If part of the layering stock has been left on the tree, remove as much of it as possible without eliminating too much of the root system. Care at this time will aid in reducing the amount of suckering to be done later. If the root ends are torn and broken during the digging operation, cut them off smooth; root formation is stimulated at the newly cut surfaces.

Just before placing the tree in the hole, loosen the bottom of the hole and partly fill it with top soil. Preparing a mound in the center of the hole and setting the tree on it with the roots radiating downward in all directions aids in minimizing the sucker-producing wood. Make the mound high enough to allow the tree to be set one inch deeper than it grew in the nursery. It is of extreme importance to spread the roots in all directions; so that as they grow anchorage for the tree from all directions is formed. Carefully work fine soil in around the roots and firm it so that all air pockets are eliminated. If the soil is dry, water the tree before the hole is completely filled. During most
seasons it is unnecessary to water. Following the setting, cultivate thoroughly and regularly. Neglect at this time is costly. More trees fail to start well because of improper care after setting than for any other one reason.

**POLLINATION**

Filberts generally are sufficiently self-sterile to necessitate cross pollination.

Daviana, Du Chilly, Nooksack, Nottingham, and White Aveline are good pollinizers for Barcelona. Aveline may be substituted for White Aveline if the right strain is obtained. Investigating the history of the strain to be purchased will establish this point.

Daviana, Alpha, Gassaway and Clackamas are good pollinizers for Du Chilly. Barcelona is not a good pollinizer for Du Chilly even though Du Chilly is good for Barcelona.

Hall’s Giant is a good pollinizer for Brixnut, and vice versa.

The wild hazel is of little or no value as a pollinizer for commercial varieties of filberts.

The pollen is produced in the catkins. When the pollen is mature, it is carried from the catkins to the female, or pistillate, flowers by the wind. Obviously, pollen-producing varieties must shed pollen when the female flowers of the varieties to be pollinated are open. The period during which pollen is shed is relatively short, although the female flowers of some varieties, particularly Barcelona, are open for a period of several weeks. In order to be sure that pollen will be shed while the pistillate flowers are receptive to pollen, it is advisable to include several pollinating varieties that blossom at different times.

Because filbert pollen is carried by the wind, some consideration must be given to this fact in locating pollinizers in areas where strong prevailing winds occur during the pollination period. The number of pollinizers required will depend upon usual weather conditions during blossoming. A common practice is to set a pollinizer in every third space of every third row. Eleven per cent of the trees are pollinizers in orchards where this plan is used. This system is generally satisfactory, provided varieties blossoming at different times are included. It is well to alternate the varieties of pollinizers, so that each variety will be distributed uniformly over the
orchard. In so doing, each variety will occur in every ninth space of every third row if three varieties are used. (Fig. 2).

PRUNING AND TRAINING

Intelligent pruning and training favors the continuous production of fruiting wood. With no training, excessive scaffold branches develop so that some of them necessarily are choked out. The pruner can plan and lay the foundation work for the development of fruiting wood and its renewal when necessary by foreseeing the development of the tree and removing those branches which, if not removed, will eventually be choked out by the tree itself.

HEADING THE TREE

The height at which a young tree is headed influences its rate of growth during the first several years at least. Trees headed at 24 inches, for example, grow faster than those headed at 48 inches. Some growers prefer high heading to permit close cultivation. The manner in which the low scaffold branches are handled after heading probably has more to do with the convenience of close cultivation than does the height of heading, except for trees headed very high. For example, if the low branches on a high-headed tree are allowed to hang down, the interference may be greater than that caused by low branches trained upward on a low-headed tree. When taking into consideration all factors, such as rate of growth, convenience of cultivation, and exposure to air currents for pollination, it appears that a good average height is about 24 inches.

The number of scaffold branches, including the central
leader, varies from three to five. To increase this number complicates the development of the scaffold branches and may ultimately result in the elimination of fruiting wood except on the tips of the branches, because of a crowded condition of the inside of the tree. Obviously the scaffold branches should be distributed evenly around the main trunk. No branch should be directly above another. It is equally important that they be well distributed up and down on the main trunk. It is well to allow six to eight inches between branches which are to become scaffolds, although this is not essential. The selection of the scaffolds may require two years. Once they are selected, little or no pruning is practiced until the tree comes into bearing.

![Figure 4. Young trees at the end of the fourth growing season in the orchard. A—scaffold branches selected. B—no pruning.](image)

Wide-angled branches are stronger than those with narrow angles. To avoid breakage, select branches forming wide angles, although with filberts this is not serious.

In training young trees during the first five years, the scaffolds are not headed. (Fig. 5).
Figure 5. A young tree at the end of the second growing season in the orchard. Note that the previously selected scaffolds have been permitted to grow with little or no pruning.

PRUNING MATURE TREES

A tree is as old as its fruiting wood. If it is so thick that all of the fruiting wood except that on the outer shell of the tree has died, it may be considered a relatively old tree. If, however, it has been kept relatively open, so that new growth has been produced throughout the tree each season, it probably is more productive than ever before. The extent to which one can go in developing fruiting wood on the inner parts of the tree is limited, but it seems certain that the capacity of a dense, unpruned, mature tree is less than that of one on which some renewal pruning has been practiced. The pruning may consist simply of thinning some of the crowded branches, so that the twigs arising near the terminal area of the main branches will not die out at the age of two or three years. By such thinning it may not be possible to develop fruiting wood on the very inner part of the three, but it should extend the fruiting area into the tree so that it will not consist simply of a thin outer shell.
VARIETIES

Barcelona and Du Chilly are the most common varieties in the Pacific Northwest at the present time. Barcelona is the principal variety in Oregon. In Washington, progressively northward from the Columbia river, the Barcelona becomes less adapted and the Du Chilly apparently better adapted, although the Barcelona is a better grower in all areas. In comparison with the Du Chilly, the Bar-

Figure 6. Photograph showing basal, tip and lateral views of nuts of six varieties of filberts.
celona produces a greater percentage of blanks progressively northward from the Columbia river.

Figure 7. Photograph showing basal, tip, and lateral views of nuts of six varieties of filberts.

**Barcelona**: Tree, spreading, vigorous, medium producer; nut medium oval to triangular in cross section, fairly flat at base and larger above, with rather blunt point; rich brown, with darker striping lost in pubescence on upper third of shell; shell medium thick;
kernel with hollow space in center; husk one-third longer than nut, opens and sheds nut freely.

**Du Chilly:** Tree, spreading, of medium vigor, heavy producer, shoots forming right angles with main branches; nut large, long, and flattened, lighter brown than Barcelona, requires husking; shell medium thick and slightly rough; kernel shriveled on outside; husk one-third to three-fourths longer than nut.

**Nooksack:** Tree, spreading, of good to medium vigor, medium producer; nut large, long, similar to Du Chilly, lighter brown than Barcelona, about 90 per cent of nuts drop free of husks; shell slightly thinner than that of Du Chilly; slightly later than Du Chilly.

**Daviana:** Tree, vigorous, upright close-growing, subject to bud mite; very light producer; good pollinator for Barcelona, and in some seasons for Du Chilly.

**White Aveline:** Tree of medium size to small, lacking vigor; nut distinguished from Red Aveline by white skin of kernel; medium producer; catkins grayish yellow, compared with red or purple of Red and Purple Aveline; excellent pollinator for Barcelona.

**Alpha:** Tree of medium vigor; nut smaller than Du Chilly, blunt, oval; husk two-thirds as long as nut; medium producer; good pollinator for Du Chilly.

**Clackamas:** Tree of medium vigor; nut round and slightly flat; medium producer; good pollinator for Du Chilly.

**Brixnut:** Tree moderately vigorous; with tendency to droop; high producer; nuts large, roundish at base, tapering sharply toward apex, base flat, drops freely from husk; shell medium thick, covered with light pubescence on upper half, making color slightly dull; pollinated by Hall’s Giant.

**Scherf, Royal and Fitzgerald** are among the new varieties which are showing promise. These varieties are still considered experimental.

**SUCKERING**

Suckers arise in varying amounts on all root stocks except the Turkish root. Although this root stock does not produce suckers, it has not proven satisfactory. Suckers appear in greatest numbers
during the first five years. If kept off well during this period, the suckering tendency is usually discouraged to a considerable extent.

Remove the suckers before they harden to any extent. Dig away the soil and cut off the suckers at the points of attachment. While the roots are exposed, rub off all sucker buds. It is often necessary to sucker three or four times per year. Using nursery stock on which the amount of suckering wood has been reduced to a minimum, as mentioned previously, aids greatly in reducing suckering labor.

HARVESTING

Smooth the soil beneath the trees before the nuts start dropping to aid gathering. To avoid discoloration and loss of quality from lying on the wet ground, make two or three pickings.

The quality of the nuts is seriously injured if they are stored for any length of time in large containers before drying. A common injury is a discoloration of the kernels which may not be apparent on the shells. If the nuts cannot be dried immediately, they should be spread evenly, not more than a couple inches deep on a protected floor until they can be dried. It is important that the high quality of the fresh, sweet kernels be preserved.

HUSKING

There is no standard filbert husker on the market at the present time. Individuals have improvised huskers varying from simple structures to elaborate machines. These individually constructed machines, lacking standardization, vary in capacity from one to five tons.

A simple type consists of an old automobile tire and a 2" x 8" plank about six feet long. The tire, mounted on a wheel and placed on a stationary axle, is raised so that the lower edge of the tire is about two feet from the floor of the husking room. A cup, with a maximum depth of one inch and as wide and as long as necessary to fit the tire when set into the cup, is cut out of the plank, with the center 18 inches from one end. This cup is referred to as the friction point. The plank is then fastened firmly at an angle of 30° to 40° with the floor. The tire should fit loosely into the cup. If it is too tight, some nuts will be cracked. A trough-like hopper, narrowing down toward the friction point, is made to facilitate feeding. Below
the friction point at the end of the plank is placed a piece of half-inch wire cloth approximately two feet square. The hulled nuts are allowed to roll over the screening apron into a small bin from which they are taken and placed on the drier. A fan may be placed beneath the apron to blow out the dust and husks.

A more elaborate type of husker is built around a cylinder to which strips of belting are fastened. The cylinder is like that of a fanning mill except that it is much more rigid. As the cylinder rotates, it presses and rubs the nuts against a heavy wire cloth which fits loosely around the lower side of the cylinder. The wire cloth herein is referred to as the friction apron. The cylinder is approximately 12 inches in diameter and 20 inches long. The size varies with the desired capacity. The belting strips vary in width from two to four inches. These strips are staggered so that those in adjacent rows across the cylinder alternate. By this arrangement they do not cover the same space when rubbing against the friction apron. The strips extend about two inches beyond the surface of the cylinder, from which they protrude. The rows across the cylinder are about three inches apart, making approximately 12 in number depending upon the diameter of the cylinder. The strips may be fastened into the cylinder in various ways. A common method is to wedge and bolt the ends between radial sections of boards comprising the surface of the cylinder. These sections must necessarily be of heavy material and wedged and held firmly together.

One of the very successful growers has improvised a satisfactory husker from an abandoned threshing machine cylinder. The concave teeth are removed and replaced by strips of heavy belting extending crosswise on the cylinder. The strips are about six to eight inches wide and close enough together so that they overlap slightly. The top side of each strip is fastened firmly to the bar from which the concave teeth were removed and the other side is left free. The free side presses loosely against the friction apron. The cylinder is adjustable, so that it may be set to press as firmly as desired against the friction apron. The friction apron in this case consists of heavy belting instead of wire cloth as in the other types of huskers.

The cylinder of these types of huskers is boxed in, allowing space for the feeding hopper, the friction apron, and the nut exit.
The feeding hopper is adjustable so that the rate of feeding may be regulated. The husker is set so that the nuts will be pressed firmly against the screen but not firmly enough to crack them. As the nuts are hulled, they and the hulls drop from the top of the friction apron and roll down over a wire cloth apron about as wide as the cylinder is long and 18 inches to two feet long, under which a heavy fan is located. A blower may be installed to carry the hulls and dust outside the building. Some blanks are removed if the fan is large enough. The nuts roll down into a bin from which they are taken to the drier. Huskers are usually driven by electric or gasoline motors.

**DRYING**

When first gathered, the nuts usually contain excessive moisture which is eliminated by artificial drying. Various kinds of improvised driers are being used. For the most part they are simply remodeled buildings or sections of buildings originally built for other purposes. Such buildings as abandoned poultry houses, wood sheds and pump house towers frequently may be converted into driers at little cost.

Approximately 100 square feet of floor space is required for drying four tons. The nuts should not be piled more than six inches deep. Stirring occasionally favors uniform drying. The floor consists of half-inch wire cloth tacked to two-inch sills sufficient in number and dimensions to support the anticipated load. The wire cloth permits the passage of air upward through the layer of nuts. Slanting the floor slightly aids in removing them. Approximately 10 feet of space between the drying floor and the floor beneath should be allowed.

The heating unit frequently consists of a wood stove or heater improvised from an oil drum. A fairly large firebox to accommodate large pieces of wood aids in holding an even temperature. To keep the heat from rising directly to the nuts immediately above the stove, a baffle plate four or five feet square is installed about two feet above the stove. The size of the baffle plate will depend upon the size of the stove. Adjustable openings near the base of the side walls for the intake of cold air and at the top for the exit of warm air provide circulation to ensure fairly rapid and even drying. For 100 square feet of floor space an outlet of approximately 10 square
feet and an intake of half this size are recommended. It may be advisable, where large quantities are to be dried, to install fans for forced ventilation.

The temperature directly beneath the layer of nuts at no time should exceed 100° F. The moisture content of the nuts when dry ranges from 8 to 10 per cent. A drying period of 48 hours, with the temperature ranging from 90° to 100° F., ordinarily is required to reduce the moisture content to this amount. To test the dryness of the nuts, bite into the kernels when they are cold. If they snap they are dry.

**GRADING**

The value of the crop can often be improved by careful grading. In the absence of standard graders, growers have improvised inexpensive structures which work quite satisfactorily. They are built on the principle of a series of bars with interspaces as wide as necessary to sort out the desired sizes.

The grades are based upon the diameter of the nuts and are given in 64ths of an inch. Barcelona grades are: (1) jumbo—over 58/64; (2) large—over 52/64; (3) fancy—over 45/64 and up to and including 52/64; (4) baby—45/64 and under. Du Chilly grades are: (1) jumbo—over 47/64; (2) large—over 44/64 and up to and including 48/64; (3) fancy—over 34/64 and up to and including 45/64; (4) baby—35/64 and under.

A 12 per cent tolerance by count for sizes other than the specified size is allowed for variations incident to commercial grading and handling.

The grading table consists of a floor made of narrow boards such as laths, or of iron rods or bars placed far enough apart to produce the right grades. Enough cross rods are set in to keep the bars from springing. The size of the floor may be adjusted to the desired capacity. Slanting the floor slightly will aid in passing the nuts over it. The floor is made in three series. The width of the interspaces between the bars is determined by the grades to be produced. For Barcelona grades the interspaces are 45, 52, and 58 sixty-fourths. For Du Chilly grades they are 34, 44, and 47 sixty-fourths. Suitable bins are constructed below the grader to catch the graded nuts.
LITERATURE CITED


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