AGRICULTURAL EXPERIMENT STATION
Oregon State College
Wm. A. Schoenfeld, Director
Corvallis

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SUGGESTIONS FOR GROWING EASTER LILY BULBS IN THE PACIFIC NORTHWEST

Frank P. McWhorter, Plant Pathologist, O.S.C.
S. L. Emsweller, Principal Horticulturist, U.S.D.A.
and Philip Brierley, Pathologist, U.S.D.A.

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PURPOSE OF THIS CIRCULAR

This circular discusses in detail some of the specific problems involved in growing Easter lily bulbs in Oregon and Washington. It is designed to supplement the mimeograph on the culture and diseases of Easter lilies recently issued by the U.S.D.A. The U. S. mimeograph discusses procedures followed in the entire United States; this circular elaborates the special problems of the Pacific Northwest and is intended especially for those who wish to found a permanent industry.

WHAT IS AN EASTER LILY

Commercial Easter lilies are varieties of the lily species longiflorum and have white trumpet-shaped flowers. They are called Easter lilies because they are adapted to forcing for Easter, a time when the white flowers symbolized by a white lily are in demand.

Bermuda was for many years the chief source of Easter lilies used by American florists. In fact, a popular name of the species was "The Bermuda Lily" until losses from serious virus diseases put the Bermuda growers out of business and Japan became the new source of commercial bulbs. It is not surprising that Japan became the new source since Japan is the native home of the Easter lily. The favored Japanese variety was called "Giganteum" and American florists became very adept in forcing it. The popularity of the "Gig" lily declined by 1939 because of irregularities in performance due partly to the presence of virus diseases which ruined large percentages of the plants during forcing. This circumstance started the commercial growing of Easter lilies in the Pacific Northwest where certain local varieties were free from these virus diseases.* Keeping Northwest lilies free from virus diseases will be an important factor in continuing the industry here.

MARKETING MUST BE CONSIDERED WHEN PLANNING A PLANTING

Easter lily bulbs are marketed in the United States almost exclusively for forcing under glass. The Northwest grower must attempt to produce bulbs that will meet the requirements of the florists who will be his customers. Most of the markets are centered in the East and Middle West and are comparatively near the Atlantic Seaboard and the "Deep South" where Easter lilies have long been grown. The southern locations have the advantage of nearness to the markets as well as the advantage of a climate which permits earlier harvest. The western grower who wishes to make a permanent success must therefore carefully consider what requirements the florists will demand. Some of the requirements are:

1. The bulbs must be true to the variety specified. The cases must be plainly labeled.

2. They must be closely graded as to size and each case should be packed to insure the utmost uniformity. Each case should contain bulbs dug from the same field at approximately the same time and graded to the same size. Florists prefer to order 7-inch bulbs, 8-inch bulbs, etc.; the closer the bulbs are graded to a size the better the florists will like them.

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* See discussion of virus diseases on page 12.

3. The date the bulbs are dug should be marked on the cases so that the florists may judge the proper temperature and length of time for precooling when these essential data have been determined and made available to them.

4. They must be dug and shipped in time for the florists to handle them with a minimum of expense. The later the florist receives the bulbs, the more heat he may have to use to flower them in time for his best market.

5. They must be free from diseases which will affect the bulbs in transit or reduce the quality of the plants in the greenhouse.

6. They must be so grown that they can be sold at a reasonable price compatible with a good product grown by American labor.

This circular is planned to discuss the problems involved and methods available for growing bulbs to meet these requirements. Those who wish to become permanent growers of lily bulbs must realize at the outset that they can achieve that end only by continuously producing good bulbs justly popular with the florists and readily available to them through reliable channels of trade.

POINTS TO CONSIDER WHEN SELECTING A PLACE TO PLANT

Contrary to popular opinion Easter lilies do not require a continuously warm climate for their culture. Recently the U. S. Dept. of Agriculture has shown that they may be efficiently grown in Maryland and that some of their new varieties grown there are early enough to force for Christmas. We do not yet know whether warm coastal areas or intermountain valleys of the Pacific Northwest will be preferable for growing the bulbs. The following points must be considered in choosing a location for a commercial planting:

1. Fields that do not drain well and soils that tend to become "water-logged" are unsafe for lilies.

2. The location must not be regularly subject to flood-water at any time of the year.

3. Sandy loams are preferable because they afford good conditions for planting, cultivating and harvesting the bulbs. Heavier soils can be used.

4. Locations where frosts occur in April and May must be avoided.
SPECIAL NOTE. The practice of mulching lily plantings to protect against winter injury as is done in the East is unsafe for Northwest plantings.

5. The field must not be subject to continuous or frequent cold winds in the late spring and summer.

6. Fields badly infested with moles and pocket gophers are not safe for lily cultures.

7. The rainfall should be less than 70 inches.

8. Facilities for irrigation are desirable most seasons for both coastal and inland plantings.

9. Clearings in forest areas frequented by deer should be avoided unless one is able to protect the planting with a deer-proof fence.

10. Fields badly infested with quackgrass should be freed from this pest before lilies are planted. The grass will penetrate the bulbs and spoil them.

VARIETIES SUITABLE FOR NORTHWEST PLANTINGS

As mentioned above the grower should choose a variety suitable for the florist trade. Moreover, if immediate commercial success is anticipated by the grower, the one chosen must be one well known to the florists. For practical purposes, the many varieties may be classified into two groups, namely pot-lilies and cut-flower lilies. While the same lily may serve both purposes, most florists prefer to use a variety especially adapted to their particular trade which may be all cut-flower or all pot-lily.

The varieties now being grown in the United States include Creole and the closely related Floridana, the Estate, the Ace, the Croft, and a group of seedlings originally marketed under the name Kenyon-Davidson.

The Croft lily will likely be considered a good pot-lily for some time to come. The original stocks sold by Mr. Sydney Croft in Washington and Oregon were free from the more serious virus diseases. When properly forced it is a "short" lily, with wide dark green foliage and large bell-type flowers. Florists object to the width of the foliage which makes the potted plants occupy more space than would the same number of "Gig" lilies. This lily, as grown in the Northwest, is reckoned as a somewhat tardy forcer, an objection that may be removed when the ideal time of digging has been determined. However, the attractive appearance of the potted plants makes them sell well and they may be considered one of the better pot-lilies now in extensive culture. They are recommended for Northwest planting, but their popularity may wane as newer lilies prove their worth.

The Kenyon-Davidson name refers to a group of at least 30 different seedlings grown for many years as a mixture. Among them are some very good varieties including both pot and cut-flower types. They can be grown as a mixture to sell to those florists who wish lilies to come into bloom over a considerable period of time or varieties can be selected among them and grown as separate units.

The Estate is a tall late variety. It was introduced primarily for home garden planting but it can be grown as a cut-flower lily for forcing. Precautions must be taken to flower the plants early enough for a suitable market.

The planting of either Creole or Floridana lilies in the Pacific Northwest is definitely not advised as a general practice. There are two reasons for this: (1) Most stocks of these lilies contain the dangerous virus disease known as fleck which is not present in most of the Northwest locations. (2) These lilies are already standardized for florist use on a basis of early harvesting made possible by growing the lilies in southern Louisiana and Florida. Experienced growers who have facilities for complete isolation may at some future date wish to arrange for growing carefully rogued planting stock of Creole lilies on consignment for southern use, but the general practice of planting Creole lilies in the Pacific Northwest is definitely not recommended.

SUGGESTIONS ABOUT PROPAGATING EASTER LILIES

Easter lily bulbs can be grown from stem bulblets, scales, or seeds. Propagating by means of stem bulblets or scales involves vegetative reproduction; each new bulb so produced will be of the same variety as that from which the stem bulblet or scale was removed. Easter lily seeds result from sexual reproduction; each seedling is potentially a new and different variety. The commercial grower must therefore propagate his variety (or varieties) by means of scales and stem bulblets.

While stem bulblets and scales do continuously reproduce the same variety, they perform differently at different locations and form what are called "stocks." Thus there are several stocks of the daffodil King Alfred and A's stock may be far superior to B's stock. We frequently observe the decline of once fine stocks of this or that bulb variety. The following recommendations are made to prevent the decline of the better stocks of Easter lilies:

1. Start a mother block as soon as possible. (See page 6.)

2. Don't plant trash. Plant only your best stem bulblets.

3. Practice scale propagation along with stem bulblet propagation.

4. Do not expose your planting to dangerous diseases or follow practices that lead to the introduction of diseases.

Seeds can be used to start plantings and grow bulbs, but this procedure is definitely not recommended for commercial plantings for three reasons. These are: (1) Each seedling will be a different variety; (2) it takes two to three years to grow a bulb big enough to flower and five to seven years to propagate enough bulbs of one seedling to determine whether it is of any value to the florists who might want it; and (3) growing from seeds requires too much puttering. However, it may be profitable for florists who have lily bulb plantings to experiment with seedlings. They are equipped to handle them effectively, and can test the seedlings that seem desirable.

SUGGESTIONS FOR PLANTING BULBS AND BULBLETS

The following points should be emphasized when planting lily bulbs under Northwest conditions.

Crop Rotation. Do not plant lilies after any other bulb crop. Some disease or pest of every other bulb crop can injure lilies. Plant them in well-prepared soil that has previously had a cover crop.

Rows vs. Beds. Rows rather than beds are advisable for bulbs. It is easier to plant, cultivate, weed, and spray a row planting. Scales may be planted advantageously in beds.

Placement. All bulbs larger than stem bulblets must be carefully spaced and placed. Large bulbs must be hand planted so the roots will be below the bulbs. Do not plant bulbs on their sides. The more the care one uses in placing bulbs, the better will be the shape of the bulbs that form.

Depth of Planting. How deep to plant depends on three factors:

1. Climate. Bulbs planted in inland locations where the ground may freeze for a depth of several inches must be covered six to seven inches. It may be advantageous to hill row bulbs so that the top of the hills can be removed in the early spring to reduce the depth.

2. Size of bulbs. The larger the bulbs the deeper they can be planted. Mother block bulbs should be planted about 6-8 inches; yearlings 4-6 inches; propagation 3-4 inches.

3. Whether for market or propagation. The deeper bulbs are planted the more the growth of propagation and the less the growth of the mother bulb. Depth of planting, therefore, should be carefully judged for each location and purpose. It is our opinion that many growers plant too deeply for best market bulb growth.

SELECTION OF PLANTING STOCK

The quality of any bulb planting is directly proportionate to the quality of the planting stock from which it is grown. New growers should, therefore, begin with the best they can get; old growers should continue with the best they have.

One who wishes to buy stock, especially large amounts, should see the plants growing and arrange for purchasing bulbs or entire plants of the desired type. This procedure is superior to buying "blind," as one does when purchasing stem bulblets. The ideal system is to buy the entire plants, mother bulb and propagation, and plant each bulb and its propagation as units together in a row, the first year. If this procedure is not feasible, buy fine bulbs and scale them. In either case plant them in the mother block system described. (Page 6)

Growers who wish to buy stocks should never purchase bulbs from greenhouses where several kinds of lilies have been forced. There are two reasons for this: (1) forced bulbs are weak, and (2) such lilies are frequently exposed to serious virus diseases under conditions perfectly adapted to the spreading of viruses. It is equally dangerous to plant scales in a greenhouse where various lilies are being grown.

Select only bulblets free from blemishes, incipient rots, etc., for planting. The ideal size of bulblets for planting will vary at different locations and each grower should determine what sizes will produce marketable bulbs in not more than two years under his conditions. We know that a certain proportion of the stem bulblets remain dormant after planting and represent a total loss. When it is learned how to recognize these dormant bulblets, removing them will be a chief consideration when planting. The bulblets should be saved only from the best plants. The practice of continually selling the best bulbs and keeping the poorest will ruin any bulb culture. The mother block system described below is designed to assure a good source of planting stock and may be an immediate help in overcoming some of the dormancy problems.

THE MOTHER BLOCK SYSTEM APPLIED TO LILY CULTURES

The mother block system has improved every type of bulb culture to which it has been applied. It consists essentially of selecting one's best bulbs to develop a special planting for propagation purposes only. The special planting which eventually becomes the source of the propagation used for producing commercials, is called the "Mother Block." This does not imply that at the present time one would discard good stem bulblets from plants not in the mother block. The mother block looks to the future. The advantages of the system are:

1. Holds stock to a type. Propagating from a relatively few plants selected to a type holds one's commercials to a very close type. Commercial bulbs so produced are just what the florists wish.

2. Eliminates much roguing. Roguing large fields for variety mixtures, "off-types," etc., is a lot of work. The larger the field the less perfect the roguing is likely to be. Conversely, the smaller the field, the more perfect the roguing is likely to be. Mother blocks represent small plantings which can be completely or partially isolated and kept to a standard of perfection. Plantings made from mother-block stock should be absolutely free from variety mixtures.

3. Prevents stocks from "running out." It has proven true of all bulb varieties that in time they show tendencies to weaken or "run out." No matter what the cause of the weakening, the mother block system has many times proved a means of avoiding or circumventing "running out."

4. Best method for controlling virus diseases. Should virus diseases become a problem in a planting, the mother-block system is frequently the only means of eliminating them. There are two reasons for this: (a) A mother block can usually be isolated, and (b) virus diseases which are readily distinguishable in mature plants may be indistinguishable in small plants. It is difficult to rogue the "yearlings." The first step to avoid such diseases is to grow the "yearlings" from plants which do not have them.

The mother-block system is good insurance for any bulb culture.

HOW TO START A MOTHER-BLOCK SYSTEM

The number of bulbs or clump units selected to start a mother block should be not more than 10 percent of the total stock. However, the number of units to begin with should be not less than 100 nor more than 1000. A unit is a mother bulb and the stem bulblets formed by it. The procedures can be illustrated by considering a grower who has a half acre of lilies supposed to be Crofts and who wishes to form a mother block of 100 units. The selections as directed below must be made from blooming-sized bulbs.

1. Beginning when the plants are about four inches high, select and stake 200 plants on a basis of the following characteristics:

   a. They should be outstandingly vigorous.

   b. They should be of the same form or type. The type chosen must be typical of the variety concerned. Croft lilies at this stage have a symmetrical pyramidal habit.

c. The leaves should be green - not mottled, blotched or otherwise discolored. Croft leaves are dark green.

d. If Botrytis blight (page 10) is present in the field, select plants that show relatively little of the blight.

Excellent stakes for marking the selected plants can be split from "ends" of Venetian blinds sold as "waste" by the mills at Coquille, etc. Some growers use canes. Short lengths of wires dipped in white or colored paints are very efficient. The staking must not interfere with cultivation.

2. About four weeks before the blooming period, regrade your 200 plants for the above points. Emphasize c and d above and consider carefully e and f, as follows:

e. Grade closely for tendencies of the stem to branch and assume a bunchy habit. Good plants will be symmetrical and each stem will have only one tip or growing point.

f. Plants showing any tendency to early maturity must be discarded from the mother block.

At this second grading remove approximately 30 stakes, the 30 removed representing plants that have fallen down on some of the counts, or in some ways appear inferior. You would then have 170 marked plants left.

3. The plants chosen for the mother block should be allowed to bloom. Then again select them, grading them especially on the points c, d, and f, above, and add:

g. The first flowers on every plant suitable for a mother block should open within a day or two of each other.

h. The flowers must be typical for the variety concerned.

Grading the flower performance should reduce your selection some 20 plants leaving 150 out of the original 200 first selected as best. Remove the flowers as soon as they have opened to avoid the hazard of Botrytis infection from decaying flowers.

4. At digging time, dig the remaining 150 staked plants, being very careful to leave the main bulb and its propagation attached to the stem. Lay the plants down so they can be conveniently compared. You will note differences in tendency to form good bulblets, in appearance of the bulbs, in amount of scale-rots, discolorations, etc. These characteristics must be considered in selecting your final 100 plants for the mother-block units. A good way to accomplish this final selection is to take one factor at a time (for example i) and arrange the plants according to that factor. Then regrade them according to the other factors so that the final 100 are relatively best for all the desired characteristics. The points to consider are:

i. Tendency to form good large bulblets, at least six to a stem instead of a large number of small bulblets or very few of any size. Bulblet formation is in part a function of variations in planting, fertility, etc., but nevertheless in starting your mother block, select only those plants which did form good stem bulblets.

j. Select bulbs which are relatively free from scale-rots.

k. Do not include misshapen bulbs or those with too many growing points or "noses" as they are called. Well-formed bulbs up to eight inches in circumference should have only one growing point. Florists usually prefer pot lilies with only one stem.

When you have picked the 100 best plants on a basis of these various qualities, you are ready to start your mother block. If they are not to be planted at once, put each bulb with its stem and bulblets still attached, in individual sacks until you can do a careful job of planting. The mother block must be kept in family units until you are ready to plant.

PLANTING THE MOTHER BLOCK

The place chosen for planting the mother block should be away from the commercials and in a location where excellent culture can be provided. Should virus disease problems become involved, the mother block must be located at a distance of at least 100 yards from the commercials. Never plant the mother block in land which has just been planted to lilies. In choosing the locations, one must decide whether the planting is to be left in for one or two years. With proper precautions, two-year plantings seem to be advantageous, especially for starting a mother block. The following directions favor a two-year planting:

1. Plant the mother bulbs and their bulblets as family units in a row or in a bed in such fashion that you can identify each unit. Row planting is desirable since you can more easily recognize the units. Each unit should consist of the mother bulb and the five to seven best bulblets; the large plant produced by the mother bulb will serve as a stake to identify the units when they come up.

2. Plant the mother bulb first and follow with her bulblet progeny. They should be at least seven inches apart and the mother bulbs should, of course, be planted deeper than the bulblets.

3. When the plants come up in the spring, proceed with the next scoring. Any units which show any of the objectionable features mentioned above, should be removed. Rogue the mother bulb and all her bulblets.

4. Any units which show a low germination should be discarded. Usually low germination implies dormancy; the bulbs do not sprout during the entire year. We do not know the cause of dormancy in these lilies but it may be associated with tendencies apparent in the individual clump units. One of the purposes of the mother block system is to obtain propagation stock not prone to dormancy.

5. At the end of the growing season, remove the stems from the mother bulbs and (former) stem bulblets which remain in your mother block after all undesirables have been removed. It is not necessary to dig the bulbs. Plant the propagation from these stems alongside your mother block. At the end of two year the mother block will consist of approximately 2000 plants representing the choicest bulbs on the place.

6. The mother block then becomes the chief source of planting stock for growing the commercials. The quality of the mother block will determine the quality of the commercials.

After the mother block has become established, it will be no longer necessary to keep the stock, as finally selected, in the family units. Maintain it with great care and use every precaution to keep it as your best stock.

SUGGESTIONS FOR PROPAGATING BY SCALES

Propagating by scales is the fastest method for increasing a variety. This form of propagation should be included in the mother block program because (1) exceptionally well-formed bulbs can be grown from scales, and (2) selecting scales free from blemishes tends to avoid scale rots in bulbs. Propagating by scales is called "scaling."

Scaling depends on the fact that detached scales will form bulblets on their bases if proper moisture is provided. There are many ways this can be accomplished commercially. One may remove the scales in the fall and plant them in the ground with a covering of about one inch of soil. This procedure leads to serious weed problems, especially in coastal plantings. They can be started in greenhouse benches or in cold frames. However, for average northwest conditions, the following program seems advisable:

1. Scale the bulbs late in October. If not more than two layers of scales are removed, the bulbs will not be injured.

2. Discard scales showing any noticeable rot. Pile the good ones loosely in shallow trays and cover them with a cloth such as cheesecloth. On top of the cloth put a layer of moist peat about one inch thick. The peat must be kept barely moist. The trays can be stacked.

3. Keep the trays of scales at a temperature around 50° to 60° F. The scales should soon callous over and begin to "set" bulblets.

4. Plant the scales and attached bulblets out-of-doors in previously prepared beds or rows during open weather in late January or during February or early March. February is likely the best time for coastal locations. They should have well-formed bulblets with tiny roots when planted. They should be spaced two to four inches apart, depending on whether they are to be left in for one or two years.

5. They should be covered one and a half to two inches deep. An ideal system is to cover them with about one-half inch of loam and one inch of weed-free sand. The white or gray sand which occurs in layers beneath the soil and is exposed in roadside cuts almost everywhere near the coast is especially desirable.

There are other ways in which scale propagation can be done more rapidly but the above system has many advantages. Some of these are (1) it eliminates the very serious winter and early spring weed problem, (2) there is no puttering with planting and replanting of scales, and (3) there are no "grassy shoots" to interfere with the out-of-door planting.

Scales handled as above suggested can be dug at the end of the first growing season or can be left in place for two years. The two-year program produces very vigorous bulbs, especially if the scales are planted at least three inches apart.

THE FERTILIZER PROBLEM

Some growers have the false conception that lilies require some special plant food or that some one element such as phosphorus or sulfur will furnish all the fertility they need. There is no one chemical element that is a panacea for growing lilies. They require all the elements used by plants - nitrogen, potassium, phosphorus, iron, etc. The limited food ration supplied by bone meal is not enough; they need a complete fertilizer. Commercial fertilizers present many mixtures of the necessary elements. The choice of a fertilizer depends on what the soil is deficient in as well as what mixture or proportion of plant food elements the lily plants may prefer. Most of the Northwest soils are deficient in phosphorus. For this reason bone meal, which slowly supplies phosphorus, has proved consistently useful but bone meal is not a complete fertilizer. The best fertilizer and how and when to apply it will have to be determined for each location.

It is always advisable to grow cover crops and prepare the land for planting bulbs by turning under the cover crop several months before the bulbs are planted. At planting time a complete fertilizer can be thoroughly mixed into the soil of freshly opened rows just before the bulbs are placed. What fertilizer will be best is a local problem.

PART 2. CONTROL OF LILY DISEASES

General Statement. Preventing the introduction and spreading of diseases is the most important consideration for their control. Development of a mother block system, good culture, and continuous roguing of plants that "don't look right" are of paramount importance. Aphids carry viruses from plant to plant. Control of aphids is important and there is no danger of introducing virus diseases into lily plantings by spraying against aphids with tobacco products.

FIRE OR BOTRYTIS BLIGHT

The disease: All lilies and most other bulb crops are subject to Botrytis blight. The leaf spot common on Croft and other Easter lilies is typical of this disease. If not checked Botrytis will blight and blacken the foliage so that there will be no bulb growth. Control of this disease is imperative.

Control:

1. Avoid cultivating around the plants when they are wet with rain or dew.

2. Start spraying when the plants are about 3 inches high and keep them well covered during the wet spring months. The recommended spray is Penetrol-Bordeaux. (See directions for bordeaux, page 12.)

3. Spraying is a protective, not curative, measure. Keep the foliage well covered to prevent the fungus from infecting.

4. Remove flowers either in the bud stage or before they wither.

5. Especial care should be taken to prevent Botrytis infection during June and early July in locations where heavy dews occur. Bordeaux spray can be used but dust treatments seem advantageous at that time and are being tested.

6. If the lilies are irrigated with a sprinkler system, they must be sprayed (or dusted) immediately thereafter to prevent serious Botrytis infection.

SOUTHERN WILT

The disease. Southern wilt is caused by the fungus Sclerotium rolfsii which forms small, brown, seed-like bodies in the soil around and on the plants it attacks. These bodies function like seeds and enable the fungus to live over in the soil. In southern and eastern states it produces a serious wilt and rot of many vegetables but in the northwest it usually attacks bulb crops, especially Dutch iris and Regal lilies. When it attacks Easter lilies it causes a characteristic chalky rot of the outside.

Control:

1. Dig all the bulbs in the infected area. Do not leave bulbs in rows for two years where the disease occurs.

2. Destroy obviously diseased bulbs.

3. Do not replant apparently healthy bulbs dug from portions of rows in which the disease is known to occur. They can be safely sold for forcing.

4. Replant the areas where the disease occurred with a cereal cover crop. Never follow with vegetables of any kind. It requires at least two years of cereal cover crops to make the ground safe for lilies again.

5. This disease is rare in northwest plantings and precautions should be taken to prevent its introduction. These are:

a. Do not plant Easter lilies after bulbous iris.

b. Do not plant Easter lilies after Regal lilies.

c. When planting new stocks do not plant bulbs that have white, chalky rot lesions on the outside of the outer scales.

SCALE TIP-ROT

The disease. Northwest-grown Easter lilies, especially when grown in coastal locations, develop a terminal scale rot which disfigures the bulbs. It is especially noticeable on the tips of central scales of large bulbs where it appears as ugly black lesions on freshly dug bulbs and as brown lesions on bulbs that have dried somewhat. This scale rot does not prevent good growth of the plants. However, it is objectionable because it often permits the entrance of lesser bulb-flies and because it mars the appearance of the bulbs. It is dangerous because it can permit the entrance of moulds that rot bulbs during transit and because affected scales are unfit for propagation. The cause is a combination of fungi which are active in moist conditions at temperatures around 50° F.

Control: The use of the mother block system (page 6) and selection of planting stock are at present the only feasible suggestions for control; later disinfection methods may be developed.

BUNCHY TOP AND DIEBACK

The disease. All varieties of Northwest lilies develop an abnormal growth condition known as bunchy top. In the field affected plants grow irregularly. Usually, but not always, they begin as stunted plants, then they develop several branches and assume an irregular appearance. The leaves of such plants are always thickened and pointed so they appear like little green daggers. The bulbs of such plants may appear normal or have small closely imbricated scales at their tips. Plants that develop this disease in greenhouses are a total loss to the florists. Dieback is the name of a very serious malady that develops on plants in greenhouses. The upper or lower leaves turn brown and die. The flower buds are killed and fail to open. Very recent tests have shown that both bunchy top and dieback are caused by infestations of the leaf nematode Aphalenchoides olesistus.

Control:* Since bunchy top plants contain a nematode which is a dangerous greenhouse pest they must be eradicated as soon as they can be detected in field plantings. All plants which show any bunchy-top symptoms should be dug and burned. Be certain to destroy not only the above-ground parts but also the main bulb and the propagation.

FLECK AND OTHER VIRUS DISEASES

Fleck and other virus diseases of Easter lilies which are uncommon in northwest plantings have been described recently in trade journals.** Fleck causes many small white spots in leaves and makes the plants unfit for propagation and forcing. Every possible precaution should be taken by growers to prevent the introduction of infected lily stocks into locations or fields where it is not present. Do not plant any "new" varieties near the lilies you already have. Preventing the entrance of this disease will be much easier than controlling it after it occurs.

DIRECTIONS FOR MAKING BORDEAUX MIXTURE

Homemade bordeaux mixture is still the "best bet" against Botrytis blight of lilies. Growers are urged to read carefully pages 16-20 and 31-34 of Oregon Agricultural Experiment Station Bul. 393, before attempting to prepare large quantities of bordeaux mixture. The following statements answer the questions most frequently asked:

What formula to use:

Copper sulphate (bluestone)	4 pounds
Quicklime (stone lime or process lime)	4 pounds
Water	50 gallons

Hydrated lime can be used instead of quicklime but use one pound more, making 5 pounds of hydrated lime for each 50 gallons of water.

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* A special circular will be issued on this subject.

** Brierley, P., Smith, F. F., and McWhorter, F. P. Diseases of Easter lily important in domestic production. Florist Review, Feb. 10, 1944.

Make the bluestone and lime solutions up separately in 25 gallons of water. When ready to spray pour the bluestone solution INTO the lime solution. Small spray tanks can be filled from these solutions by first filling the tank half full of this lime solution, then adding an equal amount of the copper solution. After the bordeaux has been mixed, add the sticker or spreader and use at once.

What spreader or sticker to use:

For early season spraying, use Penetrol at the rate of one pint to 50 gallons of spray. The Penetrol MUST be emulsified, as with an eggbeater, in a small amount of water, before adding it to the bordeaux. For small amounts of spray use one ounce to three gallons. Nicotine compounds for aphids can be used effectively in bordeaux when Penetrol is used as a spreader.

For late-season spraying skim-milk spreaders have proved effective. To make, stir four ounces of hydrated lime in two quarts of skim milk and use one quart of the mixture for every 50 gallons of spray.

Precautions:

Use wooden containers for both lime and copper solutions.

If hydrated lime is used, it must be fresh. It is advantageous to filter any milk of lime solution through a 20-mesh copper screen before using.

Hydrated lime solutions should stand at least 30 minutes before using.

Always pour the lime solution into the spray tank before pouring in the copper solution.

Wash out the spray equipment with water immediately after using.