

Disease-free Geranium Stock

production of healthy cutting stock increased by growing system that permits higher returns from smaller acreage

Donald E. Munnecke and Philip A. Chandler

Several diseases of geraniums—*Pelargonium hortorum*—have, in recent years, severely limited the production of California-grown cuttings for shipment and sale throughout the United States.

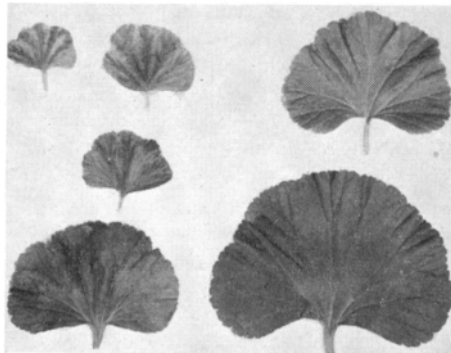
Of the four species of bacteria, 16 species of fungi, and five virus diseases reported as occurring on geraniums in the United States, the most important in California are a bacterium—causing stem rot and leaf spot—and viruses—causing leaf curl and mosaic diseases.

Bacterial stem rot and leaf spot, caused by *Xanthomonas pelargonii*, have resulted in field losses of 10%–100% and have limited the production of cuttings in California since 1951. The bacteria attack the leaves and stems of adult plants and cause a rot of the cuttings. The losses due to this disease are direct; plants are killed and cuttings do not root.

The virus diseases, mosaic and leaf roll, rarely kill the plant and may not even produce obvious symptoms for much of the growing season. The loss due to these diseases is often overlooked.

Mosaic is characterized by a mottling of the foliage with light-green and dark-green areas. All of the leaf or only portions may show symptoms. Infected plants are usually dwarfed, and leaves may be smaller than on normal plants.

Leaf curl is characterized by irregular to circular, pale yellow to white spots on the leaves, and the foliage is often ruffled, crinkled, malformed, or dwarfed. As a few of the common names—leaf curl, crinkle, measles—indicate, the symptoms are variable. Usually virus



All photos by B. B. Markley

Symptoms of geranium mosaic. Virus-infected leaves are at the left. Healthy leaves are at the right.

symptoms are obvious during the cool months, but pronounced symptoms have been observed during the warmer months.

The virus diseases result in lower production, poorer rooting for the producer of cuttings, and unsalable plants for the pot-plant producer.

Because these diseases are carried over from one planting to the next in infected cuttings, the control is to obtain disease-free propagating stock and to plant only disease-free material derived from that stock.

Disease-free propagating stock may be developed from a small number of healthy cuttings by establishing a mother-block, an increase-block, and a production-block.

The mother-block is the key to obtaining a stock of disease-free plants and as such it is the most important part and must be handled properly.

Cuttings to start a disease-free mother block should be carefully selected from individual plants which have no symptoms of disease. Each selected cutting should be propagated in its own pot—separate from other cuttings. By continual observation and discarding of all plants with even slight abnormalities—for at least one year—a nucleus of disease-free plants should result for the mother-block.

Between five and ten healthy cuttings of each variety to be propagated should be planted in raised beds or ground beds in previously steamed or chemically treated soil. Soil treatments with chloropicrin at the rate of 3 cc—cubic centimeters—on 12" centers, or methyl bromide at four pounds per 100 cubic feet of space beneath the cover have proved effective.

Each plant should be separately numbered and observed—frequently and carefully—for signs of disease. Diseased plants should be immediately rogued. Only cuttings from mother-block plants should be used to replace discarded plants.

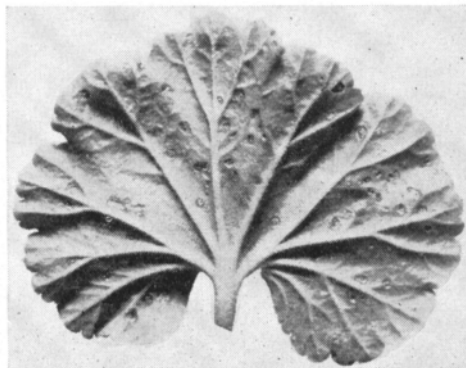
Plants in the developing mother-block must be kept pest-free by frequent spraying or dusting, preferably by enclosing the block within an insectproof cage or greenhouse.

To establish an increase-block, cuttings from the mother-block plants may be rooted directly in a soil mix of 50% peat moss and 50% fine sand, or in sand in 2¼" pots previously treated with steam, chloropicrin, or methyl bromide.

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Symptoms of bacterial stem rot and leaf spot of geranium.

Left—Terminal stage commonly called black stem rot or die-back. Center—Leaf spots caused by the bacteria. Right—Early stage of infection showing wilting and leaf spotting.



RANGE

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wild-rye were found in the measured areas. Purple stipa was entirely lacking.

On most ranges where there is a Klamath weed problem, both desirable and undesirable forage plants are present. Where a well-adapted forage grass, such as California oatgrass, is available, grazing use should be aimed toward encouraging this plant.

On most Klamath weed ranges of California, Medusa-head will thrive and provide serious competition to the more desirable forage plants. Range improvements can only be achieved where better annuals and perennials replace the undesirable plants.

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GERANIUM

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These rooted cuttings may be planted in ground beds or raised beds treated with chloropicrin or methyl bromide, as in the case of the mother-block beds.

Each plant in the increase-block should be identified by the numeral indicating its source mother-block plant.

In the event that virus symptoms appear on any of the plants in the increase-block, all plants of the same origin—including the mother-block plant—should be immediately rogued.

The increase-block should be kept free of insects in the same manner as the mother-block because it is designed to furnish cuttings for use in planting in the field.

When the cuttings in the increase-block are of sufficient size, they may be planted in the field. Field cuttings should never be used for replanting in the mother-block or the increase-block. If the field planting becomes diseased and is plowed up, or if diseased plants are rogued or plants are lost, replanting should be delayed—for at least three months—and then only cuttings from the increase-block should be used.

Cutting knives or clippers used on all cuttings in this system should be soaked in a 1:1000 mercuric chloride solution and wiped dry with a clean paper towel or toilet tissue between use on the plants. Two knives, or clippers, should be available; one set remaining in the disinfectant while the other is in use. Because there is danger of mercury poisoning by absorption through the skin, the operator should wear rubber gloves or use care that the solution does not come in contact with cuts or abrasions in the skin. Skill and careful work are required

in the mother-block and in the increase-block, and only an operator with those qualities should work in blocks, performing all operations himself.

Overhead watering must not be used.

All flowers should be removed from the mother-block and the increase-block to reduce Botrytis gray mold.

A number of California growers have set up a procedure for developing disease-free cutting stock and have found a substantial increase in growth of plants and yield of cuttings per plant, as compared to their field-grown material. Also, by using this system, geraniums may be grown intensively on much smaller acreage and yield a much higher return per acre compared with present returns. Perhaps of greater importance is the fact that by selling healthy cuttings, the California producer will capture a much larger share of the market for geraniums in the country.

This system of propagating disease-free cutting stock was set up for geranium production but it may easily be adapted to many other crop plants which are vegetatively propagated.

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AZALEAS

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when the plants are taken into the greenhouse for forcing. The first step is to remove from the plants all flowers and buds beginning to show their natural color. Removal and replacement of the surface litter help eliminate the shooting spore stage.

The most important control in the greenhouse is to reduce the humidity. The spores responsible for the secondary spread are extremely susceptible to dryness, and merely lowering the humidity to only 80% or 85% is enough to give a sure control of the disease.

The best control is to prevent the entrance of the fungus into a planting. Because the fungus is found only on the flowers or as resting bodies in the soil, new plants should not be brought in when in flower or if there is any color in the buds. Bringing in only bare-rooted plants will eliminate the soil as a source of the fungus.

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WALNUTS

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Where the basic lead arsenate treatment is used, it should be applied at four pounds per 100 gallons—by air carrier-type or the conventional high pressure spray rig—at the rate of 800 gallons per acre.

Where DDT is applied by a conventional high pressure spray rig, only 1½ pounds of DDT 50% wettable powder per 100 gallons are necessary when the finished spray is applied at 800 gallons per acre—only one half of the amount of material—listed in the dosage table—is necessary for European red mite and aphid control.

Dosage Table for Combination Codling Moth, European Red Mite, and Walnut Aphid Control. (With DDT applied by air carrier-type equipment only and the finished spray applied at the rate of 400 gallons per acre.)

Codling moth	European red mite	Walnut aphid
	Systox 21.2% emulsifiable 8-12 oz/100 gals	Not necessary if Systox is used for mite control
	or	
	Ovotran 50% wettable powder 1½-2 lbs/100 gals	Parathion 25% wettable powder 1 to 1½ lbs/100 gals
	or	or
DDT 50% wettable powder 3 lbs/100 gals	Aramite 15% wettable powder 3-4 lbs/100 gals	Malathion 25% wettable powder 1 to 1½ lbs/100 gals
		or
		TEPP 20% 8 oz/100 gals
		or
		Nicotine sulphate 40% 8-12 oz/100 gals

WARNING

Parathion, systox and TEPP—like certain other organic phosphate insecticides—are extremely toxic to human beings. Precautionary recommendation on manufacturer's label must be followed without exception or modification.

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VALENCIA

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The lack of a significant increase in the large-sized oranges in the moderately dry treatment as a result of the 2,4-D spray indicates that soil moisture is an important factor in obtaining consistent results with growth regulator sprays for increasing fruit size. While the results so far are impressive, they represent only one crop and should be considered as a progress report in this investigation.

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The above progress report is based on Research Project No. 1346.