Treatment of Gladiolus Cormels

hot-water bath treatment of planting stock shows promise
as means of controlling serious corn-borne fungus diseases

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Diseases of gladiolus—especially those carried on the planting stock—are the limiting factor in commercial production of gladioli in California.

Apart from foliage diseases—now partly under control—crippling losses are caused by soil- and corn-borne diseases. Almost any lot of gladiolus corms—bulbs—carries enough of these diseases to contaminate disease-free soil, which, in turn, infects a proportion of any healthy gladioli planted in it. However, most serious fungus and bacterial diseases of gladiolus attack only gladiolus and perhaps a few closely related plant species. The risk of infection from outside sources is slight.

A hot-water treatment of gladiolus cormels—small tubers produced annually by the parent corm—was tested as a method for obtaining fungus-disease-free planting stock. Cormels were used rather than corms because of their heat resistance, small size, and because they are readily available in large numbers.

Planting stock was grown—as parent corms must be—in warm soil and harvested before cold weather. Until treatment, the cormels must be kept at room temperature—never in cold storage—so for these studies the corms were dug with cormels attached, and stored at 95°F and 80%-85% relative humidity. When the old corm and roots could be broken off easily—often after about one week of warm-temperature curing in pretreatment storage—the cormels were cleaned, separated, and both were returned to 95°F storage.

Cormel Treatment

Cormels are at the right stage for treatment about two months after digging and thereafter for a period of at least two months.

In these experiments, treatment was started by soaking the cormels in water at air temperature for two days. Then they were removed and immersed in a 1:200 dilution of commercial 37% formaldehyde. After about four hours in the solution, they were placed in containers—which allowed thorough water penetration and complete immersion—and held for 30 minutes in water heated to 135°F. The hot water in the bath must be well circulated and of a large enough volume to restrict temperature drift to 1°F above or below 135°F. After the hot water bath, the cormels were cooled immediately with clean cold water from a hose and dried quickly.

Drying the cormels after treatment is essential because they must not be stored until thoroughly dry. In warm dry climates this may be done by spreading the cormels thinly under a draft of warm air indoors or outside in the sun.

When dry and before storage, the cormels should be dusted with a fungicide—such as Spergon—as a precautionary measure.

Treated cormels should be stored in mesh-bottomed trays on racks; or if in sacks, the sacks should be only partly filled, loosely tied, and suspended, or placed on racks with good air circulation below.

Clean benches, floors, and equipment are essential to prevent contamination of treated cormels. One of the standard fungicidal Soaks, sprays, or fumigants should be used around the working area and on the storage trays. Formaldehyde, 1:50, commercial sodium hypochlorite solution 1:20; or methyl bromide gas at one pound per 100 cubic feet under a plastic sheet have all been used.

Rapid and even germination may be encouraged by storage at 40°F for a period of six weeks or more before planting time.

Treated cormels should be planted in soil not previously used for gladiolus or related crops. Otherwise, the soil should be treated with an effective fungicide such as methyl bromide, chloropicrin, or steam. Any diseased plants that appear—and also those growing beside them in the row—should be destroyed.

Percentage germination and vigor of most treated lots of cormels have been increased by the hot-water treatment provided they are planted during the spring. In instances where preplanting germination trials have indicated decreased viability after treatment, growers have obtained an even and vigorous stand by increasing the planting rate.

Grower Experience

In 1953, a grower bought two thirds of a bushel of Spotlight gladiolus corms with a high disease content. Spotlight is very susceptible to Fusarium disease. After the hot-water treatment, the cormels were planted in old citrus land in a climate very favorable for the development of Fusarium wilt. Less than 0.5% diseased plants appeared.

From the two-thirds bushel of treated corms the grower obtained 19,300 corms in sizes No. 1 to No. 4. Two bushels of No. 5 and No. 6 corms and cormels were kept for further treatment. All corms of sizes No. 1 to No. 4 were large enough for flowering.

A second grower bought the No. 1 to No. 4 size corms from the first grower and some untreated Spotlight corms from another source. The 19,300 corms yielded a 95% cut of 1,528 dozen flowers and 10 bushels of cormels. The untreated bulbs yielded a 25% cut of 402 dozen flowers. The grower reported an 80% recovery of 15,440 corms from the treated stock. The bulk of the 20% loss was caused by damage and nonrecovery of all corms by a mechanical digger. No corms were salvaged from the untreated stock. The re

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GLADIOLUS
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covered corms were grown again in 1955
and produced an excellent flower crop.
The yield of cormels and small corms
—sizes No. 5 and No. 6—from the original
two-thirds bushel was two bushels.
These were hot-water treated and replanted
the following year by the first grower.
During the second year, the 10
bushels of cormels obtained by the second
grower represented a ratio of 15:1
of the original two-thirds bushel stock.
On this basis, multiplication of clean
stocks from small lots of treated cormels
would appear easy and rapid.

Advantages
There are numerous advantages of the
hot-water treatment of gladiolus corms.
Bigger corms and a much higher yield of
cormels are produced and most corms produced the first year are of
blooming size.
Clean corms yield a higher flower cut
and flowers are produced from smaller
corms when they are disease free.
Furthermore, the same planting stock
may be used for a number of seasons.
The hot-water treatment enables the
growing of several varieties which demand
a high price, but which have been
unprofitable since planting stocks have
become infested with disease. Also, treat-
ment preserves rare varieties or new
crosses and makes possible a more rapid
increase.

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WALNUT KERNELS
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upon the length of time nuts have been
so separated. If the moisture content of the
kernels is above 25%, they will freeze
at 28°F plus or minus 1°F. Mathematical
curves showing the freezing point and de-
gree of undercooling of hulled nuts of
different moisture contents are shown in
the graph in column 1, page 7. The graph
in columns 2 and 3 on the same page
shows a portion of a recorder chart of
laboratory frozen walnuts. As the mois-
ture content is reduced, the freezing point
is lowered. Experimentally, no freezing
could be produced at 10°F when the
moisture content fell below 12%.
The undercooling curve reflects a
phenomenon that may or may not occur
to the same degree in nature. In this case,
conditions favorable to radiation assume
a role of consequence. A low dew point
and dry ground may retard freezing and
cause undercooling. Dew deposit or any
other condition that promotes formation
of ice crystals on the shell assists freezing
without undercooling when the tempera-
ture of the kernel falls below its freezing
point. The undercooling is of practical
importance to the grower, for undercool-
ing without freezing does not damage the
kernel.
The degree to which a walnut may
undercool is not predictable. As much as
10°F of undercooling was recorded in
laboratory experiments. However, the
majority of undercooling minima fell in the
0°F-4°F range. All data on walnuts
frozen under field conditions fell in the
latter range. The duration of undercool-
ing is also unpredictable. Experimental
values range from zero to 15 minutes, but
conditions in an orchard might be some-
what different. The thermocouple is a
foreign body in a kernel and, as such, it
acts as a focal point where freezing may be
initiated. The duration of undercool-
ing may be greater under field conditions
than under experimental conditions if no
ice crystals form on the nut surface.

Influence of the Hull
When an early frost occurs, a substan-
tial part of the crop may be on the trees
with hulls intact to a varying extent. The
moisture content of an intact hull or one
just beginning to split is about 86%.
This high moisture content favors freez-
ing of the nut. Experimental freezing of
intact hulls shows that the freezing point
is the same as that for kernels of high
moisture content, that is, 28°F plus or minus 1°F. The hull also may or may not
pass through the undercooling stage be-
fore freezing, but whatever happens to
the hull will affect the nut. If the tempera-
ture of the hull after undercooling rises
above the freezing point, the nut will
not freeze. But the kernel will freeze in
the same instant if the hull freezes.
Attempts to induce independent freezing of
the hull and of the nut by creating a
moisture-proof barrier between the hull
and the shell failed.
The condition of the hull may serve as
an indicator as to whether or not frost
damage has occurred. A frozen hull
breaks down quite rapidly. The hull of
experimentally frozen walnuts became
dark and mushy in 24 hours, staining the
shell.

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ALMONDS
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copper chelate in 100 gallons of water
produced an average kernel weight of
1.07 grams and no kernel shrivel. The
copper content of the hull was 2.7 ppm—
parts per million—and the copper con-
tent of the kernel was 7.3 ppm. The aver-
age kernel weight from trees not treated
was 0.75 gram with 42% shrivel; the
content of the hull was 1.4 ppm and
6.8 ppm in the kernel.

Experimental Treatments
Copper materials were applied both
to the soil and to the leaves. Twenty
pounds of copper sulfate applied in a
bushel around the base of a tree produced
a marked response in the amount of new
shoot growth and an improvement in leaf
color. Applications of one pound of cop-
per sulfate mixed with the soil at plant-
time, however, did not produce a re-
sponse during the first year. Three
pounds of copper sulfate applied to the
soil around an extremely dwarfed older
tree also produced a decided improve-
ment in the condition of the tree.
During April 1955, spray applications
of one pound of copper chelate per 100
gallons of water were made to a number
of trees in the area. These sprays pro-
duced a marked response in the amount
of shoot growth, an improvement in leaf
color, and an increase in the copper con-
tent of the leaves. Marked response was
also produced in the color and copper
content of the leaves of Marianna plum
grafts which had been placed on some of
the trees.
The treatments were experimental ap-
lications designed to show whether or
not copper deficiency was present. Ex-
periments are underway to determine dos-
ages which will serve to correct the de-
fiency and which will not be injurious
to the trees in this orchard.

Varying Conditions
Response to any particular treatment
does not always occur. Variations in soil
type, growing conditions, species of tree,
and perhaps rootstock are influential in
the amount of response to various treat-
ments. At the present time it appears that,
in California, the distribution of copper-
deficient trees—of all species—is re-
stricted to comparatively quite small
areas in different districts.

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