Defect in Limas for Freezing

wrinkled seed coat a new defect in green lima beans for freezing economically important in few areas only

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A seed-coat deformity in lima beans—responsible for lowering the grade of the frozen product—has appeared in some of the green lima bean areas of California during the last two years. The deformity has received various names, including wrinkled, pebbled, blister, alligator hide, and brown spot.

Wrinkled beans have occurred in only a few areas—primarily in Santa Clara and Monterey counties. However, in certain fields, wrinkling has been so severe it was impossible to comply with the standards for U.S. Grade A frozen lima beans, which allow only 2% of wrinkled beans or about four per package. Cases are known where the economic loss to the freezing plant has been $30,000 to $45,000 per season for sorting alone. During 1954, this defect has caused the abandoning of about 200 acres in one area of the state. In other areas, wrinkled beans have caused but little economic loss.

Wrinkled seed coat was first observed in a field of Concentrated Fordhook—the only variety to exhibit an appreciable amount of the defect—that was suffering from a water shortage, as indicated by the appearance of the plants and the soil, as well as by the remarks of the grower.

It seems likely that the defect was caused by poor growing conditions during the last third of the growing season because it is found most frequently on plants somewhat stunted in growth.

Soil moisture is such an important factor in plant growth that a water shortage might well be the major causal agent of wrinkling. High temperatures have also been suggested as a cause. During such periods, soil moisture is likely to be a limiting factor. Early fields are more apt to have the defect, and usually wrinkling is more severe on the plants from the poorer areas of the field. In certain cases, 15% to 30% of the beans in one area of a field had wrinkled seed coats, while other areas of the same field were only slightly affected.

Because wrinkling cannot be detected from the appearance of the pod, it must be opened and the beans examined. Consequently, it is difficult for the processor's field men to identify affected areas within a field.

Wrinkled defect in green lima beans. A, Pod with beans showing wrinkled defect and a cotyledon which has burst the seed coat. B, The inside of the removed seed coat showing cracked condition caused by defect. C, Cotyledon removed from seed coat. D, Beans before removal of seed coat showing wrinkled defect on lower margin. Photograph by W. B. Neuburg.

The defective area of the bean is usually wrinkled. When the seed coat is split, its inside surface appears cracked and is yellowish brown. The cracked condition affects the layers of cells near the green cotyledon but does not extend through the seed coat to the outer surface. After blanching, however, the affected area turns yellow-brown and the discoloration shows on the outside of the whole bean. The cotyledon of the bean—the green part within the seed coat—is not affected.

Occasionally, pods are opened whose cotyledons have burst the seed coat. In only a few cases has this defect been found near the hilum—the junction of seed and pod—and is generally more common near the outer circumference of

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QUALITY

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If textural quality is used to determine maturity, the complete history of the frozen beans must be kept uniform. Otherwise, grades and standards will lack equivalence. If physiological maturity—as indicated by alcohol-insoluble solids or moisture content—is used as a standard, variations in processing treatments will have a relatively minor influence in grade determination.
sprayed out-of-doors, but this time with

tions of such urea mixtures, these same
the glasshouse following the second
spraying trees-continuously left out-of-
the glasshouse after each spraying.

nearly as green as the trees moved into

cultures formerly in the glasshouse
showed considerable new growth whereas
kept out-of-doors. Within three weeks the
all four sprayed cultures. The test was
nonsprayed control trees but were not
those continually out-of-doors showed
none.

Following the double spraying, some
of the leaves of the sprayed trees—kept
continuously out-of-doors—had sym-
toms with patterns suggestive of biuret.
The marked change to continuously high
air temperatures, together with the high
concentrations of the urea spray, were
possibly responsible for the appearance
of leaf patterns having some resemblance
to those produced by biuret.

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To explore excessive spray applica-
tions of such urea mixtures, these same
four cultures on July 22, 1954, were again
sprayed out-of-doors, but this time with
a mixture three times as concentrated
as previously. The two cultures formerly
in the glasshouse were again placed in
the glasshouse following the second
spraying. Leaf burn was soon evident in
all four sprayed cultures. The test was
continued until August 4, 1954, when the
sprayed trees—continuously left out-of-
doors—were considerably greener than
nonsprayed control trees but were not
nearly as green as the trees moved into
the glasshouse after each spraying.

After August 4, 1954, all cultures were
kept out-of-doors. Within three weeks the
cultures formerly in the glasshouse
showed considerable new growth whereas
those continually out-of-doors showed
none.

Following the double spraying, some

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the bean. The affected beans are usually
at the blossom end of the pod—at the
end away from the place of attachment
of the pod to the plant. Sometimes all the
beans in a pod are affected, but most
frequently only one or two.

Half-grown beans show this defect less
frequently than beans that are at the
mature green stage for freezing.

In laboratory tests, thin sections from
affected beans were stained and ex-
amined microscopically to determine
precisely the region of the seed covering
which becomes discolored. The dark
tissue showing injury—except where the
whole seed covering is split—is confined
to the inner surface of the covering. The
exact nature of the affected layer cannot
be determined without study of younger
seeds, but it appears to be the remains
of a nutritive tissue known as endosperm.
It is this layer and not the testa or the
cotyledons that disorganizes, cracks, and
discolors.

Fertilizer experiments in Santa Clara
County did not indicate any important
relationships to soil nutrients. The ex-
periments included three irrigation treat-
ments—normal and with one and two
irrigations omitted late in the season. In
all cases, the omission of two irrigations
increased the percentage of wrinkled
beans. However, on the lightest soil, even
the normal irrigation gave 3.4% wrinkled
beans, whereas when two irri-
gations were omitted, 8.8% of the beans
were affected. These data indicate a
relationship between the relative amount
of this defect and irrigation treatment.

There are two sources of economic loss
from wrinkled beans: the added cost of
extra help to sort the defective beans at
the processing plant—as well as the loss
due to lower grades with lower sales
value—and the abandoning of fields or
sections of a field.

Because most of the difficulty with
wrinkled beans has been with Concent-
trated Fordhook, it might be desirable
to use the U. S. 242 variety—in less fa-
vorable climates and on marginal soils
low in water-holding capacity—although
it does not always give as high yields
and the plant is larger.

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the study reported above.

FUMIGATION
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does not seem practical because of the
damage done to them.

In the greenhouse fumigation experi-
ment at Riverside, methyl bromide,
chloropicrin, vincide 51, and dithane
D-14 were tested. Cultures of the fungus
were inserted in wire mesh traps on
strings of wire and placed in large cans
of sterilized soils. Results showed that
all four fumigants and fungicides were
effective in killing the fungus, but methyl
bromide and chloropicrin were the fast-
est acting and gave the most complete
destruction.

Although treating diseased trees in
place does not seem practical because of
the damage done to them, methyl bro-
mide can be effective in sterilizing pot-
ting soil prior to its use for growing
avocado seedlings. It is possible that
methyl bromide could also be used as a
chemical barrier to isolate infected areas
in an orchard, but further work needs
to be done on the uses of methyl bromide.

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Test plot at the Univer-
sity of California, Los
Angeles, involved three dis-
eaed areas, with a diseased tree
in the center of each, were
fumigated with methyl bro-
mide, ½ pound per 100
square feet.

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