Defect in Limas for Freezing

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

John H. MacGillivray, Mas Yamaguchi, and Louis K. Mann

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.

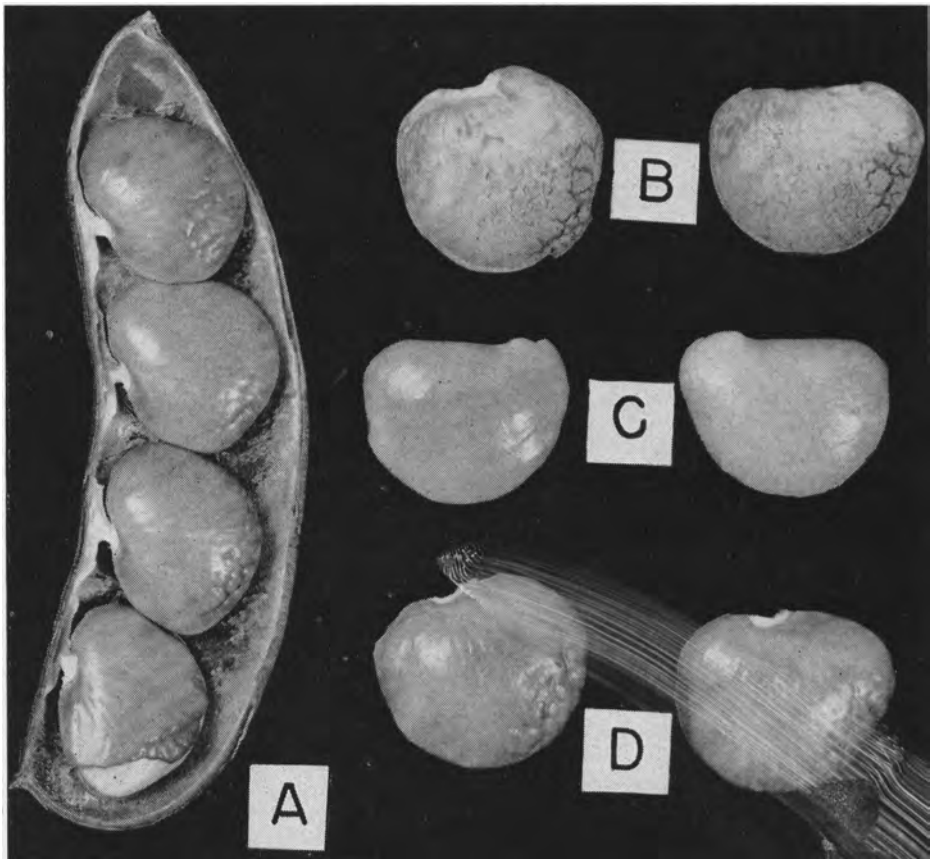
Because wrinkling cannot be detected from the appearance of the pod, it must be opened and the beans examined. Consequently, it is difficult for the processor's field men to identify affected areas within a field.

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

Concluded on page 14

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.*



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.

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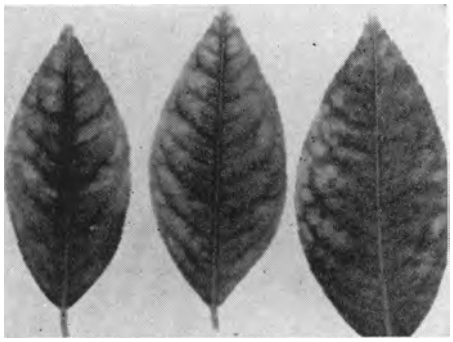

Effect of excessive concentrations of urea spray mixtures on leaves of lemon trees on sour orange rootstock grown in soil cultures resembles the patterns induced by biuret.

BIURET

Continued from page 9

To explore excessive spray applications 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 of the leaves of the sprayed trees—kept continuously out-of-doors—had symptoms 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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The above progress report is based on Research Project No. 1086.

DEFECT

Continued from page 7

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 examined 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 experiments included three irrigation treatments—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 irrigations 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 Concentrated Fordhook, it might be desirable to use the U. S. 242 variety—in less favorable 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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FUMIGATION

Continued from page 10

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

In the greenhouse fumigation experiment at Riverside, methyl bromide, chloropicrin, vancide 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 fastest 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 bromide can be effective in sterilizing potting 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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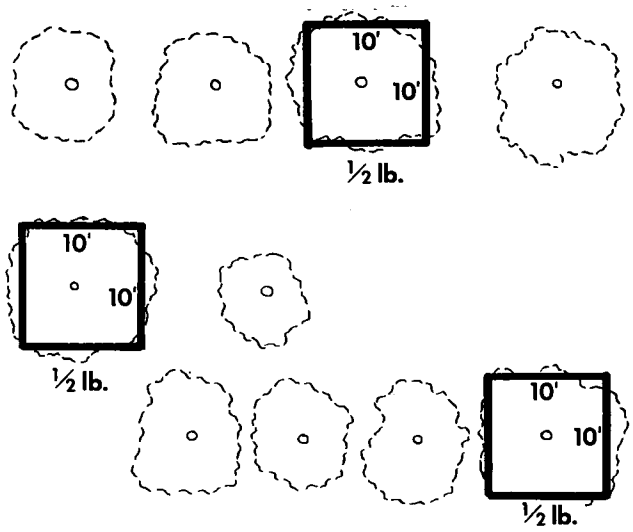

Test plot at the University of California, Los Angeles, involved three diseased trees. Three 10' × 10' areas, with a diseased tree in the center of each, were fumigated with methyl bromide, ½ pound per 100 square feet.