

# New Heat Tolerant Lima Bean

plant breeding program developed new variety of standard lima bean suitable for interior valleys

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**The new Mackie lima bean**—the result of a cross between a baby lima strain from the Hopi Indian reservation and a strain similar to Burpee's Bush—is a bush type variety.

In general appearance the Mackie resembles the Fordhook more closely than any other variety. It has an upright growth habit, and sets its pods high enough so water damage from late irrigation is minimized.

In most seasons the Mackie requires about 110-120 days from planting to cutting.

Seeds of the new lima are as large as those of the Ventura variety. Their chief distinction from established standard lima varieties lies in the seed coat color. The immature Mackie has a white—instead of green—seed coat. When mature, the Mackie seed coat is bright white rather than grayish-green.

Mackie seeds become quite brittle when cured in the low humidities which prevail in the fall in the interior valleys. As a result, they can be damaged easily in threshing and cleaning operations. Growers who plan to produce this variety should anticipate that great care will be necessary in the adjustment of machinery if damage is to be kept within acceptable limits. The production of planting seed promises to be particularly troublesome. It is possible that special equipment may be required to produce seed of reasonable germinability.

Cooking trials suggest that the new lima is indistinguishable from present varieties in its culinary characteristics.

Available seed of the Mackie lima—for 1954—will be sufficient to plant approximately 160 acres only. Not until 1955 will seed be available to supply the anticipated demand.

## Development

The breeding program—which produced the Mackie lima bean—began in 1928. Its purpose was to combine in a single strain of standard lima beans the characteristics necessary for production outside the fog belt of coastal southern California.

The parent strains were selected because they had these characteristics—heat tolerance in the baby lima parent and large seed size in the other parent.

The success of the project depended not only on the number of genes—factors in the determination of hereditary characters—governing the characters of heat tolerance and seed size but also on the precision with which desirable types could be identified. In general, the larger the number of genes and the less definite their effects, the greater will be the difficulty encountered by the plant breeder.

Many genes are known to govern seed size in lima beans and the available evidence suggests that at least an equally large number govern heat tolerance. Plants combining large seed size and heat tolerance were—as expected—extremely rare in the progeny of the hybrid. Following the original cross in 1928, it was necessary to examine thousands of plants each year to find a few which were sufficiently promising to justify a test of their progeny.

Comparatively little of the difficulty was associated with obtaining large seed size because it is an easily measured characteristic and also has high heritability.

The identification of heat tolerant plants was a different matter. High temperatures at blossoming time cause the flowers to drop off heat susceptible plants and this characteristic is not easily measured. It is markedly influenced by such factors as local variations in the available water in the soil, the amount of space between plants in the row, and the coincidence of flowering with periods of high temperatures. In some seasons no selection was possible because temperatures were below the critical level during the flowering period of most, or all, of the strains under test. Heat tolerance has low heritability and identifying heat tolerant plants was a slow and difficult process.

By 1946, 23 strains had been isolated which appeared to possess adequate heat tolerance—combined with acceptable seed size and quality—and good agronomic type. A program of evaluating these strains in the major baby lima producing areas was started in 1947. Gradually the strains were discarded until—in 1952—a quarter of a century after the original hybrid was made—only the Mackie variety remained.

Trials conducted in six different years—in a number of locations in the

state—indicate that the Mackie lima has much greater heat tolerance than any other large-seeded lima. However, it seems to be slightly inferior to the Wilbur and Westan baby lima varieties—in heat tolerance—in extremely hot areas such as the southern San Joaquin Valley.

The heat tolerance of the Mackie has been ample to protect it from damage in the established lima bean areas of the northern San Joaquin and Sacramento valleys. It has produced crops under many circumstances where the Ventura variety—commonly grown in the fog belt of coastal southern California—was a total failure. Although the Mackie has produced well in the fog belt, it does not seem likely it will replace the Ventura in that area.

The Mackie lima is at its best in the deep loam soils of the west side of the northern San Joaquin Valley. There it has been equal to or nearly equal to the Wilbur in yield. Compared to the Wilbur its performance is somewhat less promising in the subirrigated bean areas of the Sacramento Valley. It may have utility in some of the areas on the inland margins of the established standard lima producing areas where the Ventura is occasionally damaged by heat.

Trials will be initiated in 1954 to determine exactly its areas of adaptation.

Observation of the Mackie lima under a variety of conditions indicates that it is quite comparable to the Ventura and the Fordhook varieties in its reactions to the major diseases and pests. It is somewhat more tolerant of root-rotting organisms and root-knot nematode than is the Wilbur. However, it is much more likely to be damaged by red spiders than are any of the baby lima varieties. It may require dusting under circumstances when baby limas would not.

There is always danger that previously minor or unknown diseases may assume major status when a new variety suddenly occupies large acreages. For this reason watchfulness will be necessary with the new Mackie variety.

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