

Great Basin area *P. pruinosa* has worked its way at least as far north as the southern limits of the Snake River Valley in Idaho. The form *angelica* occurs in abundance north of the Tehachapi Mountains throughout a large portion of California and has been taken as far north as Susanville.

During 1963 a poor set of squash and pumpkin in some northern regions and isolated areas was attributed to a lack of squash bees. It is believed that further investigation might show possibilities for introduction and establishment of *P. pruinosa* or its form *angelica* in some of these areas. However, surveys have indicated that the northernmost limit of squash and pumpkin growing extends beyond the climatic range of this species.

Although the habits of squash bees follow a general pattern, there is apparently considerable variation in the response of the several species to environment. Comparative ecological studies (particularly at critical levels) are needed to analyze the magnitude of these interactions.

Surveys conducted in Mexico and Central America during 1963 indicate that the abundance of squash bee species was probably associated with abundance of gourds. The center of this complex appeared to be in the Colima to Oaxaca area of Mexico. Squash bees are so intimately associated with the ecology of squash and gourds that they may well furnish a clue to the parents and region where aboriginal man developed the ancestors of our domestic products.

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# MALEIC HYDRAZIDE

## Retard Topping Regrowth Lemon Tests

Spraying young regrowth shoots of mechanically top-pruned lemon trees with Maleic hydrazide (MH) resulted in a significant inhibition of growth for almost a year after treatment in tests reported in this article. Top growth was retarded without appreciably affecting fruit quality or yield through use of a concentration of about 400 ppm of MH.

**M**ECHANICALLY CUTTING the tops of lemon trees has been a commercial practice in California for a number of years. The expense of cutting and hauling away the brush or brush shredding and spreading, suggests a possible economic advantage by using a growth inhibitor, such as Maleic hydrazide (MH). In 1959 the Ventura Coastal Lemon Company conducted promising trials with MH sprays on recently-topped lemon trees. The experiments reported here were made to further measure the growth inhibition and to evaluate possible effects of MH on yield and quality of lemons.

In 1960, an orchard of vigorous six-year-old Frost nucellar Eureka lemon trees on Sweet orange rootstock were selected for uniformity at Ventura. The orchard was mechanically topped to a height of 9 ft on March 28. The trees were sprayed on May 27 when top regrowth was approximately 8 inches in length. MH sprays of 500 and 1,000 parts per million (ppm) active ingredient were applied for comparison with unsprayed controls. The 30% diethanotamine salt of MH was used with 50 milliliters (ml) of X-77 wetting agent per 100 gallons of spray mixture. Only the top growth was sprayed and this was done with a mist to minimize runoff. A randomized block experimental design was used with six tree plots and eight replications.

Ten months after spraying, measurements showed a significant reduction of top growth and shoot length. Three days after measurements, the tops were mowed to a height of 9½ ft above ground, and the brush was collected and weighed for each tree. Large reductions in the weight of top growth were found for both MH concentrations.

No MH sprays were applied after the second topping March 9, 1961. On August 2, 1961, the regrowth measurements averaged: Control, 3.5 ft; 500 ppm, 3.0 ft; and 1,000 ppm, 3.1 ft. These differences, although significant, are slight and of no commercial importance. However, they do show a persistent growth inhibition the year following treatment.

INHIBITING EFFECT OF MH SPRAYS ON REGROWTH OF TOPPED LEMON TREES

Treatments	Regrowth in Feet		Weight lbs/tree
	Tallest shoot	Bush top	
0	7.29	5.83	15.10
500 ppm	4.84	3.74	8.64
1,000 ppm	3.94	2.87	5.71

Topped March 28, 1960; sprayed May 27, 1960; measurements March 6, 1961; topped again and growth weighed March 9, 1961.

### Vegetative response

Two weeks after spraying, the young leaves were bent downward with the leaf margins rolling toward the midrib. After one month, the malformed leaves and young shoot tips in the treated area fell off. Leaf curl chlorosis and abscission were limited to tops of MH-sprayed trees. Normal top growth started three months after spraying on the 500 ppm MH-treated trees and after four months for those receiving 1,000 ppm MH.

### Fruit quality

Previous work on oranges and grapefruit showed that an undesirable effect of MH was an increase in rind thickness. In these tests, lemon samples were se-

# SPRAYS

in

lected from high on the trees near the sprayed tops and compared with samples from low on the trees. A significant increase in rind thickness was found for fruit growing in or near the region of MH application at the harvest, 10 months after treatment and at all subsequent harvests. A complete analysis of fruit quality showed no real differences in per cent soluble solids, per cent total acid and per cent juice for MH and control treatments.

## Yield

Fruits of marketable size or color were harvested prior to the first top pruning of March 28, 1960. Yield records for the 10 harvests (20 months) following treatments varied, but the production for the total period was not significantly reduced by MH. However, total production for the last six harvests was reduced significantly by the 1,000 ppm treatment.

## Fruit size

During winter and early spring, most lemons are picked by size, but in summer and early fall, picking is also influenced by color. Because of this dual standard, no

definite determination of fruit size could be made. However, no differences in size were observed of fruit on the tree or from random samples. The decrease in production for the last six harvests of high MH concentration was probably due to fewer fruit reaching maturity. This could be the result of depressed flowering or an increased drop of small fruit.

## 1961 experiment

A second experiment to determine a possible optimum MH concentration was started on additional trees in the same orchard in 1961. MH was sprayed May 25, 1961, on trees topped March 9. The vegetative regrowth averaged six inches. MH concentrations from 100 to 1,000 ppm (at 100 ppm intervals) were compared with nonsprayed controls. Single tree plots with nine replications were used.

Seven weeks after spraying, top growth had stopped on all concentrations except the 100 ppm and controls. Only slight modification was noted on young leaves in the 100 and 200 ppm treatments, with increasing modification and abscission above 400 ppm. Chlorosis was rated slight for 100 ppm, moderate for 200 ppm, and severe for all other MH levels.

## Regrowth

Regrowth of all MH concentrations was reduced at four months. At 10 months only the 400 ppm and higher applications were significantly different from controls.

A number of relatively small demonstration plots were also established on mature Eureka and Lisbon lemons in Los Angeles, Orange, Riverside and San Diego counties. There was a retardation of top growth in all cases; however, at both 500 and 1,000 ppm MH, the inhibition was not apparent on some of the older, less vigorous trees.



Topper built by Ventura Coastal Lemon Co. at work in their groves.

Since there is no USDA registration for the use of Maleic hydrazide sprays on lemons, the chemical cannot be recommended at this time.

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Mechanically top-pruned lemon grove in San Diego County.