Large colony populations, which resulted from the stimulant feedings, provided more pollination than the unfed control colonies in these Fresno County tests.

The dry form of sugar and pollen mix was carried out of the colonies when fed during warm dry weather. The liquid syrup form of the same foods was readily accepted in all weather.

Timing

SUPPLEMENTAL FEEDING OF HONEY BEES

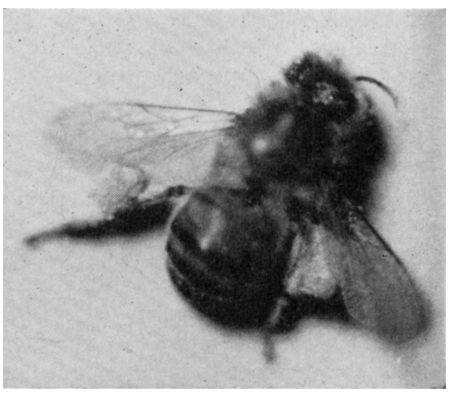
for improved crop pollination

BOB SHEESLEY
BERNARD PODUSKA

THE VALUE OF A CORRECTLY TIMED supplementary feeding of honey bees with natural pollen, or with a combination of drivert sugar and natural pollen, has been demonstrated in Fresno County during four field-scale experiments. Each of these experiments included 60 bee colonies which were rented for crop pollination of almonds and alfalfa seed during 1968 and 1969. The provision of a pollen and sugar source two and a half to three weeks prior to the occurrence of the first natural bloom in the area caused a rapid increase in the queen bee's egg laying activity. A 2-lb feeding of drivert sugar and a 1 per cent pollen was adequate to maintain the rapidly growing colony population for the three weeks prior to natural bloom. The timing of the stimulant feeding is important, since it takes 21 days for a brood cycle of worker bees to mature.

Early feeding provided a rapid increase in colony population, resulting in more pollination of almond blooms.

The large colony populations, which resulted from the stimulant feeding, collected more pollen than did the unfed control colonies. One of the four experiments included fall and winter feeding treatments beginning October 15, 1968. Fall feeding with Beevert (a combination of drivert sugar mixed with 1 per cent natural pollen by weight) resulted in a measurable increase in bee populations which provided a 49 per cent increase over the unfed control colonies in the amount of pollen collected during the almond bloom the following spring.



A "silent hero" of crop pollination returns to the colony with her pay-load of pollen on each rear leg.

Feeding of Beevert or natural pollen alone two and a half to three weeks prior to the first natural bloom after winter resulted in a pollen collection increase of 97 per cent over the control colonies during the 1969 almond bloom. The feeding of Beevert eight days prior to the first natural bloom in 1968 resulted in increased pollen collections of 44 per cent in almonds during that year's bloom.

The earliest blooming plant in the experiment locations was pussy willow,

which normally begins blooming between January 10 and 14. Under these conditions, supplemental feeding should be done between December 20 and 25 to prepare colonies for almond pollination in February. The date of the first natural bloom will vary with plant species growing in winter locations of colonies.

Feeding colonies with Beevert two weeks before they entered alfalfa seed fields for pollination in 1968 resulted in a 15 per cent increase in the amount of pollen collected during alfalfa bloom.

The consistency of results obtained in these four Fresno County bee feeding experiments suggests it is advisable for beekeepers in this area to feed weak colonies in the fall and to feed *all* colonies two and a half to three weeks before the first natural bloom after winter to increase the strength of bee colonies for almond pollination. When natural pollen supplies are not adequate, supplemental feeding of natural pollen or natural pollen mixed with drivert sugar has stimulated an increase in egg laying. Weak colonies should also be fed two and a half to three weeks before they move to alfalfa seed fields for pollination purposes.

Pollen or pollen and sugar supplemental foods have been readily accepted in the liquid syrup form; however, bees in these experiments have rejected the dry form of these same foods during warm dry weather.

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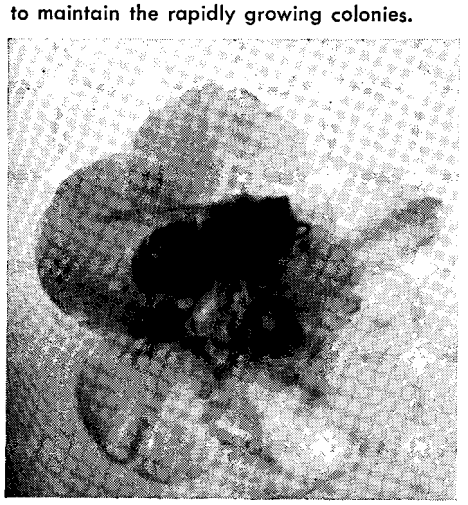
By feeding pollen 2½ to 3 weeks prior to the occurrence of natural bloom in the area, repeated supplemental feedings were not needed to maintain the rapidly growing colonies.



YUMA SPIDER MITE ON CITRUS

H. S. ELMER

THE YUMA SPIDER MITE, *Eotetranychus yumensis* (McGregor), was first observed near Yuma, Arizona, in about 1928 by J. L. E. Lauderdale, and was described in 1934 by E. A. McGregor from specimens collected on lemon foliage by R. S. Woglum and H. C. Lewis. This mite occasionally becomes a serious pest on citrus in certain desert regions of the southwestern United States, but little information has been published on its life history, distribution, host range, and the means of reducing injurious populations.

Limited areas

The Yuma spider mite is evidently confined to very limited areas: the citrus areas around Yuma, Arizona, the Coachella and Imperial Valleys in California, and adjacent desert regions in northern Mexico. In the Coachella Valley it is further limited to citrus plantings within a 20-mile radius of the northern end of the Salton Sea—although citrus plantings extend much farther than this. The reason this mite has not become established in other desert citrus growing areas of California and Arizona with similar climatic conditions is not known, especially since there are few restrictions on the transportation of citrus fruit and nursery stock between mite-infested and noninfested areas. In addition to citrus, this mite has been found on grapes, castor beans, grain sorghum, puncture vine (*Tribulus terrestris* L.), brown-eyed primrose (*Oenothera clavaeformis* Torr. & Frem.), and on quail brush [*Atriplex lentiformis* (Torr.) Wats.]. The mites have been found on quail brush far removed from citrus trees, therefore suggesting that this plant may be the native host of this mite species.

The body of the Yuma spider mite is usually pinkish but may become quite dark, particularly in older adults. It resembles the six-spotted mite, *E. sexmaculatus* (Riley), and the Lewis spider mite, *E. lewisi* (McGregor). Eggs vary in color from white to almost colorless but become light pink just prior to hatching. The mite feeds on the leaves, fruit, and green twigs of the citrus tree and produces a heavy webbing to which dust particles adhere. This dust-covered webbing facilitates detection of heavy infestations. The mites may produce a silvering of mature fruits similar to that caused by the Lewis spider mite, and they are believed to accentuate a tree condition known as "fall dieback," which may also be enhanced to a lesser degree by the citrus red mite, *Panonychus citri* (McGregor). Branches up to 1½ inches in diameter may lose their leaves and die due to the combination of mite injury, low humidity, wind, and lack of sufficient soil moisture.

Population increase

Yuma spider mite populations generally begin to increase in October and November and may remain high throughout the winter, then decreasing in the spring and early summer. The mites live through the summer as adults under the bark of the trunk or limbs and in cracks in shaded areas. Large populations remain alive later in the spring near the Salton Sea. At Yuma, Arizona, moderate infestations may be found throughout the summer. Mite population numbers may be quite variable during the winter