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Summary: Based on the results of recent field trials, trunk sprays of Guthion and Sevin applied to skirt-pruned trees are no longer recommended for control of Fuller Rose Beetle. In a few cases, sunburn injury has been seen with applications of sticky polybutenes applied to the trunks of young citrus and on topworked trees in which the canopy did not shade the trunk from the sun. Injury has not been seen in California, however, on mature trees where the canopy protects the trunk from the sun. Applications of an experimental material, Deadban, directly to the trunk of shaded trees has resulted in phytotoxicity.

A recent article by Morse et al. (*The Pest Control Circular*, May 1988, Sunkist Growers, Inc.) listed options and considerations in dealing with the Fuller Rose Beetle (FRB) on California citrus. To summarize briefly, FRB is a problem mainly in relation to citrus which is exported to Japan. Because FRB has not been discovered in Japan in recent years, Japanese officials inspect all imported citrus, and any load found to contain viable egg masses under the calyx of the fruit is fumigated with methyl bromide. This treatment is both costly and damaging to the fruit.

FRB populations are present at high levels in many citrus groves in California, being somewhat more common in southern California coastal and interior regions. FRB is relatively scarce in the desert regions of southern California and Arizona and is spotty in distribution in the San Joaquin Valley (SJV). Populations are generally lower in the SJV compared to the non-desert regions of southern California, but an occasional grove may have moderate populations.

In dealing with the FRB problem, it makes good sense to monitor citrus groves to determine the level of FRB present in each grove so that, if possible, fruit from groves with very low natural populations may be selected for shipment to Japan (see Morse et al., *The Pest Control Circular*, August 1987, Sunkist

Growers, Inc.). Grove and packinghouse inspection of fruit for the presence or absence of viable FRB egg masses is also important. Options for FRB control listed by Morse et al. (*The Pest Control Circular*, May 1988), some of which are currently only in the research stage, include: (1) postharvest control of eggs on fruit; (2) allowing eggs on lemons to hatch in storage; (3) biological control by egg parasitoids; (4) control of larvae in the soil; (5) timing field treatments for adult FRB in anticipation of harvest; and

Carmen (1987) and Bailey and Morse (1988). At these rates, Sevin is slightly more effective than Guthion, and these materials are both somewhat more effective than Kryocide.

When FRB adults emerge from the ground (peak emergence June-November, see Fig. 1), they gradually move up the tree, feeding first on the skirts, and are often found on the inside water sprouts. They are relatively inactive during the day and do most of their feeding and moving around at night. If

Caution Urged in Using Trunk Treatments for Fuller Rose Beetle Control

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(6) local intensive suppression of adult FRB populations throughout the season.

Based on field trials run in 1986 and 1987, recommendations useful in controlling adult FRB under options (5) and (6) above, were released in June 1987 [Haney et al. (1987), Carman (*The Pest Control Circular* June 1987), Bailey and Morse (1988)]. These included (a) foliar sprays of either azinphos-methyl (Guthion), carbaryl (Sevin), or cryolite (Kryocide); (b) trunk sprays with azinphos-methyl or carbaryl on skirt-pruned trees; and (c) trunk sticky bands applied to skirt-pruned trees. Further field control trials were run during late 1987-1988. This article summarizes the impact of these recent field trials on recommendations for adult FRB control.

Foliar Sprays

Of the pesticides registered on citrus in California, Guthion, Sevin, and Kryocide appear to be the most effective in control of adult FRB. Recommended rates are listed in Haney et al. (1987),

foliar sprays are applied early in the season (May-June), before many beetles are present in the tree, a spray applied only to the lower half of the tree is effective and economical. Once adults are present in the tree, the entire tree should be sprayed, and inside coverage is important.

In field trials with pesticides applied to the foliage, the persistence of residual control (the ability of residues to kill new adults emerging from the soil) varies greatly from trial to trial. In general, Sevin 80S at 1.0 lb a.i. (active ingredient)/100 gal, thorough coverage (at least 1,000 gpa on mature trees) was found to be effective for one to three months. Both Guthion and Kryocide applied at recommended rates show similar residual activity but with somewhat less reliability. Several factors affect spray persistence, including the method of spray application, spray coverage, the number of newly emerged beetles which challenge the treatment, temperature and humidity, rainfall, and the amount of new

foliar growth.

The most important factor determining how long these materials will remain effective seems to be the amount of new foliage flush which appears after the treatment. FRB adults prefer to feed on the young flush, and a significant portion of the residual activity of these three pesticides results from the beetles feeding on leaves containing foliar residues rather than from contact activity (cryolite acts purely as a stomach poison). Obviously, if small leaves are present at the time of the treatment, the efficacy of pesticides residues will be diluted as the leaves expand. If a flush appears after treatment, the beetles may feed on the new flush, thus avoiding pesticide residues to a large extent.

Morse et al. (*The Pest Control Circular*, May 1988) discuss how foliar sprays may be used either (1) in anticipation of harvest so as to insure that only hatched FRB egg masses are present on the fruit at the time of harvest, or (2) in a program aimed at intensively suppressing local FRB populations.

Trunk Sprays

Recommendations released in June, 1987 [Haney et al. (1987), Carman (1987), Bailey and Morse (1988)] included sprays of Guthion or Sevin applied to the trunks of pruned citrus so as to control adults as they emerge from the soil and climb up the trunk. These recommendations were based on several 1986-87 field trials in which a large number of different pesticides were evaluated as trunk sprays. Of the materials evaluated, Guthion and Sevin were found to be the most effective.

As might be expected, the efficacy of trunk sprays of Sevin was found to be markedly reduced in groves where sprinkler irrigation contacted the treatment. These high concentration Sevin treatments, which initially had the appearance of a "whitewash" application, faded with each irrigation with a concurrent drop in efficacy against FRB adults.

In 1987-88, a large number of field trials were conducted to further evaluate trunk sprays of Guthion and Sevin. Regardless of whether sprinklers impacted the treatment, the results of these trials were extremely disappointing — in several cases, the trunk sprays failed as early as three weeks. Based on their high cost and inconsistent efficacy, *we no*

longer recommend trunk sprays of Guthion or Sevin for control of FRB on pruned citrus.

Trunk Applications of Deadban

Over the past year, we have been evaluating an experimental trunk treatment called Deadban which is composed of the inert ingredients in the snail material Deadline (an oil-based product) mixed with chlorpyrifos (Lorsban). For reasons that we don't completely understand as yet, chlorpyrifos appears to be the most effective toxicant against FRB adults when mixed with the Deadline base. These trunk treatments are applied with a paint brush and appear to give persistent control of FRB adults for 2-5 months. This product is *not registered* for use on California citrus as yet, but a number of field trials were conducted in 1988 under a research authorization obtained from CDFA.

Unfortunately, in some cases, we have recently seen phytotoxicity when Deadban treatments are applied directly to the trunk. When treatments were applied to the trunks of young citrus (approx. 1 year old) in Riverside, a majority of the trees were severely girdled during a hot spell in July-August. This Deadban formulation contained a black dye, and it is likely that the girdling was caused by overheating of the very thin layer of bark present on young citrus. Similar girdling has not been seen on young trees in which the trunk is protected (shaded) from the sun or on older trees which are exposed to the sun. We are presently experimenting with a white formulation of Deadban (without the dye) to see if trunk girdling will occur when treatments are exposed to the sun.

Even on mature citrus trees shaded from the sun, we have seen some phytotoxicity (not as severe as the girdling described above) with Deadban treatments applied directly to the trunk. The injury can be observed by scraping the outer layer of bark with a knife. Healthy bark tissue has a bright green color whereas injured tissue will be brown, and small cracks in the bark will eventually appear with some gumming. We are watching this type of injury in several groves at UCR to determine the extent of injury. At present, we have shifted the focus of our work with Deadban to the evaluation of trunk treatments applied on top of a barrier which protects

the trunk from direct contact with the treatment.

Trunk Treatments with Sticky Polybutenes

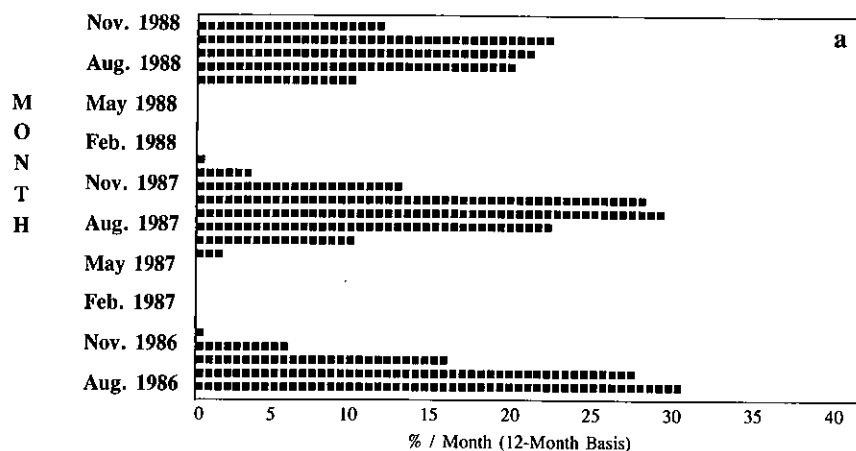
Of the trunk treatments we have evaluated to date, one of the most persistently effective is sticky polybutene formulations such as Stickem Special Extra or Stickem Green (19 lb. Stickem Special Tropical mixed with 6 lb. Tribasic Copper Sulfate; note — the premixed Stickem Green is *not registered* for California citrus as yet but growers may obtain and mix the ingredients themselves).

Three factors appear critical in obtaining persistent control with these sticky products (up to 8-10 months with a single treatment). If the treatment is impacted by sprinkler irrigation, the Stickem will lose its tackiness within 1 month or so. Secondly, a thicker band will run down the trunk during the heat of the day and will provide a more difficult path for the beetle to cross. The most critical factor is that the sticky band should be applied quite high in the tree (at least three feet above the ground) to reduce its contamination by dust and debris. High applications are more laborious and costly to apply and will often require that a number of scaffold branches be treated whereas a single band would suffice were the treatment applied close to the ground. In view of the labor costs involved in applying sticky products, however, it is our opinion that a *high application is more economical*.

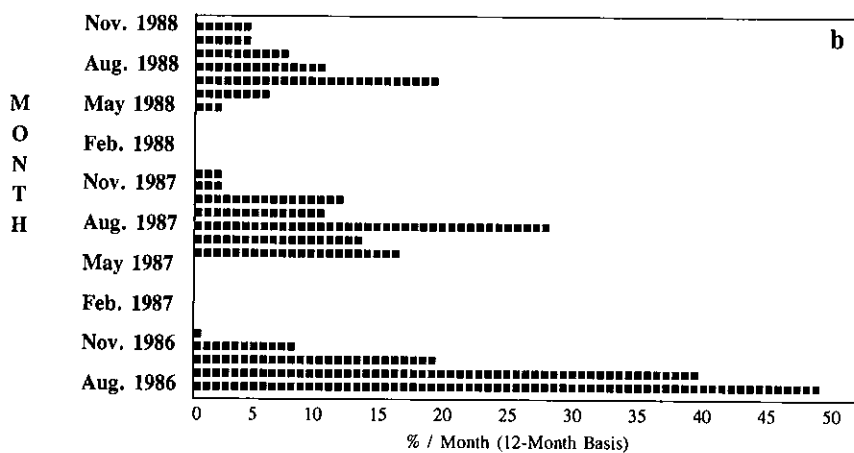
One advantage of the sticky treatment is that it is quite easy for the grower to evaluate the efficacy of the treatment. With a little experience (aided by observing beetles placed in regions of the band which are suspected to be insufficiently sticky), a grower can test the sticky treatment with a finger to determine whether or not the treatment is still effective. In addition, as the sticky treatment starts to lose efficacy, beetles will be seen higher and higher on the sticky band.

Recently, we have seen some sunburn damage in Hemet caused by polybutene treatments applied to topworked grapefruit in which the trunk treatment was exposed to the July-August sun. The sunburn injury was seen in one grove with Stickem Special Tropical treatments and was even more severe in a grove with Stickem Green applications. The injury

Average % FRB Emergence - Riv./S.B. Co.



Average % FRB Emergence - Ventura Co.



Average % FRB Emergence - SJV

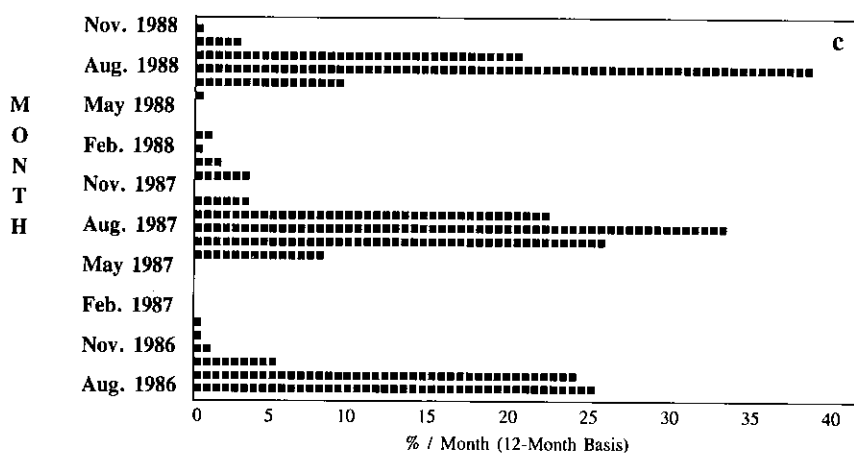


Figure Legends

Figure 1. Pattern of average percent monthly emergence of FRB adults out of the soil as monitored with 20-40 emergence traps at each of (a) 4 groves in Riverside and San Bernardino counties; (b) 4 groves in Ventura County; (c) 4 groves in Tulare and Kern counties; and (d) all 12 groves in California. Percent monthly emergence is adjusted to a 12-month basis. (Figure 1d appears on page 4.)

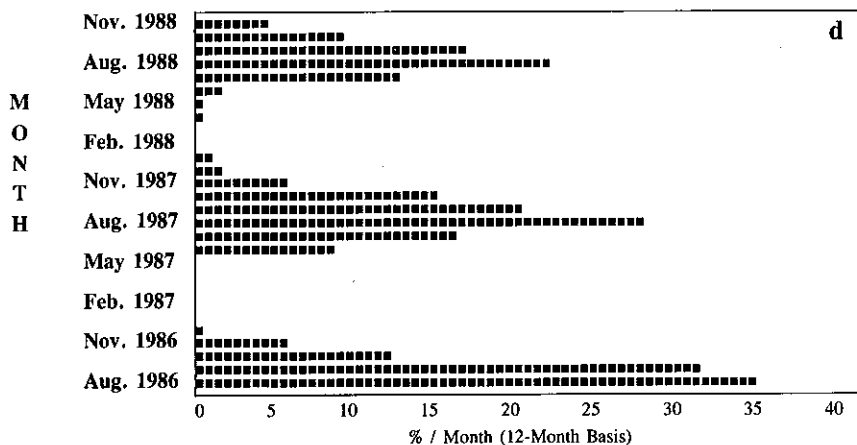
could be observed by scraping the bark with a knife and was evident as dead bark tissue on the southwest side of the trunk for as much as one-third of the trunk circumference. For this reason, we recommend that sticky treatments *not be applied* to young or topworked trees in which the treatment is not shaded from the sun.

Recent information received from citrus researchers in South Africa indicated that the majority of trunk injury observed with sticky polybutenes (materials similar to Stickem) was due to sunburn, especially on young trees and on trees exposed to the low winter sun. Some injury was seen, however, on mature shaded trees. In some cases, no injury was observed on mature trees with applications over 10-15 years. In other cases, the trees appeared to be fine for two, three, and even four years and then suddenly in the fifth year the damage appeared. As a result, in South Africa, sticky polybutenes are now recommended for application only on top of a tree wrap consisting of a cottony fabric covered with plastic wrap.

As yet, we have not seen trunk injury on trees in California where polybutene treatments are shaded from the sun. We recently examined 20 trees in each of 7 different citrus groves in Corona which had each received four applications of Stickem over the period 1986-88. In general, two applications of Stickem were applied in 1986, and the second application was applied on top of the first. The single applications in 1987 and 1988 were applied higher on the tree, each separate from previous applications so that there were three separate rings of Stickem on each tree. We did not see injury associated with the Stickem applications in any of the seven groves which were examined. Bark tissue which was scraped under the Stickem was healthy in appearance.

The reports from South Africa, however, point to the need for caution in relation to the application of sticky products directly to the trunks of citrus. On one hand, these treatments appear to be the most effective means of controlling FRB in the field. On the other hand, there is valid concern over possible phytotoxicity which might not show until after treatments are applied for five years or more. We do recommend that sticky treatments *not* be applied to young

Average % FRB Emergence - All Sites



(nonbearing) citrus and that treatments which are going to be applied directly to the trunk be applied quite high in the tree in order to increase residual activity and to avoid the possibility of sunburn. We are continuing our observations for any phytotoxicity which may result from treatments and are attempting to develop

economical tree wraps upon which trunk treatments may be applied safely.

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