

Pesticide Resistance

IPM for San Jose Scale Resistant to Organophosphate Insecticides

R. E. Rice and R. A. Jones
University of California, Kearney Agricultural Center, Parlier, CA

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Field trials were conducted in several orchards at the Kearney Agricultural Center in 1997 to evaluate the efficacy of diazinon and carbaryl for control of San Jose scale and to also compare high-volume sprays (400 gpa) to low-volume (100 gpa) using the same material. In these trials, diazinon 50W was applied at 2.0 lb a.i./acre with 6 gal Volck Supreme oil per acre. Carbaryl 80S was applied at 4.0 lb a.i. with 6.0 gal oil per acre. All treatments were applied on January 24, 1997, using an Air-O-Fan GB-34 commercial sprayer. Only nectarine and plum cultivars were used in these trials because it is easier to evaluate scale control treatments on smooth-skinned fruit rather than on peaches. All orchards were mature (10-20 years old) and had been treated annually with standard organophosphate (primarily diazinon) and oil dormant sprays.

Trials were evaluated by inspection of fruit picked at random at the commercial harvest date for the respective cultivars. A minimum of 250 fruit per cultivar (range 250-600) was examined for presence or absence of scale, with presence of a single scale on a fruit scoring that fruit as infested.

The results of these trials (Table 1) show that in all comparisons of diazinon dormant sprays at 100 gpa versus 400 gpa (Fantasia, Red Diamond, Royal Diamond, and Casselman) there were no significant differences between the two rates of spray application. This result was not expected, but is consistent with a previous trial on nectarines (1996 Annual Report) and is believed due to the high level of tolerance or resistance in the respective scale populations to organophosphate insecticides. Consequently, the volume of diazinon spray applied was immaterial to success or failure of the treatment.

The comparisons of carbaryl dormant sprays at 100 versus 400 gpa (Red Diamond, Queen Rosa, and Casselman) showed that, although infested fruit levels were high in all treatments, the 400 gpa rates of application reduced the infestation levels on fruit by significant amounts in two of the trials compared to the 100 gpa rates of application.

In the two orchards where diazinon and carbaryl were compared directly to each other, the 100 gpa application of carbaryl was no better than either of the diazinon rates on Red Diamond nectarines, but was significantly better on Casselman plums. The 400 gpa application of carbaryl showed significant improvement over the diazinon treatments in both orchards. It should be noted, however, that this is probably a short-term effect. Continued reliance on only one new insecticide for scale control would probably quickly lead to resistance to that material as well. Cross-resistance to organophosphates (e.g., diazinon) and carbamates (e.g., carbaryl) has already been observed in other insect species.

Mite samples from Red Diamond nectarines and Royal Diamond plums on July 28 and August 6, respectively (100 brushed leaves per treatment), showed no significant differences in twospot, Pacific, or European red mite populations between the two types of insecticide. Red mite populations were somewhat higher in the carbaryl treatment in plums, but were countered by high populations of predaceous Phytoseiid mites.

These trials demonstrate conclusively that San Jose scale populations in orchards under commercial control practices are resistant to organophosphate insecticide sprays. These results add increased emphasis to the need for improved scale control with the development and registration of insect growth regulators (IGRs) as one of the better options for stone fruit IPM programs. In addition, in situations where growers have been having difficulty controlling San Jose scale, rotation of insecticides to other currently registered products such as carbaryl, and applications at higher volumes of spray per acre, would seem to offer improved control over previous practices using low-volume application rates and organophosphate insecticides.

Table 1. Efficacy of dormant sprays for control of San Jose scale on stone fruits.

Cultivar	Treatment ¹	GPA	Harvest date	Percent infested fruit ²
Fantasia nectarine	diazinon	100	7/7/97	20.4a
	diazinon	400	7/7/97	20.0a
Queen Rosa plum	carbaryl	100	7/10/97	61.2a
	carbaryl	400	7/10/97	34.4b
Royal Diamond plum	diazinon	100	7/16/97	26.2a
	diazinon	400	7/16/97	27.0a
Red Diamond nectarine	diazinon	100	7/9/97	23.3a
	diazinon	400	7/9/97	27.1a
Red Diamond nectarine	carbaryl	100	7/9/97	27.2a
	carbaryl	400	7/9/97	9.6b
Casselman plum	diazinon	100	8/21/97	39.2a
	diazinon	400	8/21/97	51.2a
Casselman plum	carbaryl	100	8/21/97	24.4b
	carbaryl	400	8/21/97	18.4b

¹Treatments applied on January 17, 1997, with an Air-O-Fan GB-34 sprayer. Diazinon @2.0 lb a.i.; carbaryl @4.0 lb a.i. per acre.

²Means followed by the same letter for respective cultivars are not significantly different at $P=0.05$, Fisher's Protected LSD test.