Scale Insects on Citrus

fumigation with hydrocyanic acid effective control treatment

D. L. Lindgren

Fumigating oranges for red scale control is most effective when done between the middle of December and the end of February.

A period of cold weather brings about a greater dormancy of the tree and higher dosages of HCN—hydrocyanic acid—may be used and better results are obtained. The fumigation dosage used in the winter season in the coastal district is 20 to 24 cc per unit—a unit being 100 cubic feet for the average sized tree—and in the interior districts 24 to 28 cc of HCN.

The next best period for fumigation is during mid-summer and very early fall.

The midsummer season permits treating heavy infestation of red scale that would cause severe injury if allowed to go until winter. The fumigation season may start a week or two earlier on navels than on Valencias.

Dosages in the coastal area for the summer treatment are 16 to 20 cc and in the interior from 20 to 24 cc HCN. There is a period in the fall, usually in October, when the citrus tree is very susceptible to fumigation injury. This is especially true in some of the coastal districts such as Orange County and in certain years.

The winter and spring fumigation season for lemons extends from December to the end of April usually. The fumigation dosage in the coastal areas is 22 to 24 cc and in the interior 24 to 28 cc of HCN.

For resistant red scale the highest dosage of HCN that can be used without injury will vary according to the locality, the season and the variety of tree.

It is well recognized that the citrus trees in the coastal areas are more susceptible to HCN injury than those in the interior areas; that the trees usually are more tolerant to HCN in the winter season; and, that the lemon usually is the most tolerant of the citrus varieties.

It is important that any treatment for red scale or for any citrus scale insect should be carried out before the infestation of the scale is great, otherwise it is difficult to reduce the population sufficiently to prevent injury before the next treatment.

The fumigation treatment for nonresistant red scale is the same as for the resistant scale except lower dosages may be used and winter fumigation is less important.

Since it is difficult to define resistant and nonresistant areas sharply, only a reasonable reduction or the avoidance of extremely high dosages is recommended.

Where heavy infestations of the red scale persist in spite of repeated treatments, either on lemons or oranges, both spraying and fumigation may be necessary, and this program can be relied upon to give excellent control.

On lemons a medium or heavy medium oil at a dosage of 2% as an emulsion or 1⅔% as an emulsive is used in October or November, or in April or May if the old fruit has been removed. The fumigation may follow in about two weeks or may precede the spraying, or it may be delayed several months.

On oranges a light medium or medium oil at a dosage of 2% as an emulsion or 1⅔% as an emulsive may be applied in August or September and followed by a fumigation in about two weeks or after four or five months.

Black Scale

The time for fumigation of black scale is when most of the eggs have hatched. In the interior areas this is in late July or early August, and in the coastal areas in midsummer and again in midwinter. The dosage in the coastal areas is from 16 to 18 cc and in the interior from 18 to 22 cc HCN.

Purple Scale

The purple scale occurs only in the coastal areas in southern California. The time for fumigation is during the summer and fall and is determined by the appearance of the younger or more susceptible stages.

The time varies between July and November although August and September are usually the preferred months.

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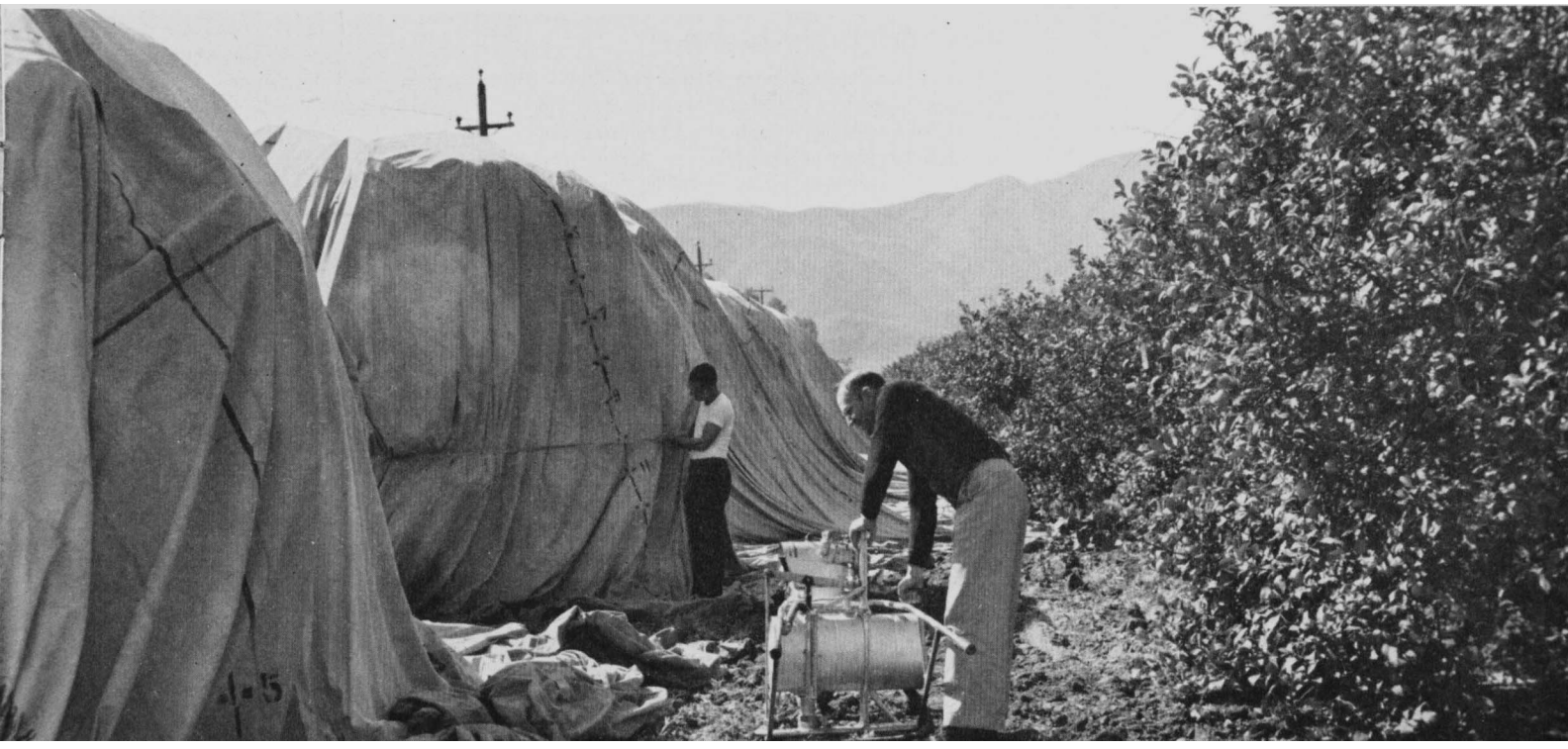
Man in rear is measuring the tented citrus tree for fumigation dosage and man in foreground is charging the tree with hydrocyanic acid gas. As many as 5½ million citrus trees in California have been fumigated annually but generally an avearge of about four million trees or 45,000 acres per year are treated by this method.



FUMIGATION

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The most satisfactory treatment is fumigation with 18 to 20 cc HCN.

Yellow Scale

The yellow scale occurs in the interior section of southern California and in the citrus areas of the San Joaquin and Sacramento valleys.

Fumigation with a dosage of 20 to 24 cc HCN in the summer months or 22 to 24 cc in the winter is recommended for yellow scale in the interior areas.

In central California fumigation is the preferred treatment for yellow scale using a 20 cc dosage.

Citricola Scale

The distribution of the citricola scale is restricted to Riverside and San Bernardino counties in southern California and in the San Joaquin Valley in central California and the Sacramento Valley in northern California.

Fumigation was relied upon for control of the citricola scale, but in recent years this insect has become so resistant to HCN fumigation that this method is no longer recommended in Riverside and San Bernardino counties.

Fumigation, particularly in conjunction with yellow scale control, is effective in central California except in some groves in the Ivanhoe and Exeter districts.

Whenever practicable it is desirable to control two or more pests by a single fumigation. If the nonresistant black scale occurs with the nonresistant red scale, fumigation will have a dual effect and control both.

A spray fumigation treatment should control the resistant red scale as well as the black and citricola scales and the red spider. Where purple scale is the major pest and black scale is present, a fumigation in August, using a 16 to 18 cc schedule on oranges and an 18 to 22 cc schedule on lemons will give good control of both these pests.

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SPRINKLERS

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smaller ones due to their mass and the fact the air interferes with them less. Large streams of water imply heavier application rates. The limit to the useful rate is when it exceeds the ability of the soil to absorb it.

Sandy soils will percolate away application rates exceeding one inch per hour and clays may have difficulty with as little as 0.1 inch per hour.

Service Lines

It is economically impossible generally to supply sprinklers and lines to cover the whole irrigated area so the sprinklers and lines must be moved from one setting to another as rapidly as sufficient water has been applied in each location. This may mean walking over the recently wet field to uncouple the sprinkler lines so they can be moved to the next place. Some heavy soils will not permit this practice because operators cannot walk across for several hours after irrigation has ceased. In this case, additional service lines and sprinklers must be provided if more or less continuous irrigation is to be made possible.

Factors for Consideration

If irrigation of a piece of land has been by gravity flow and it is a question whether to use sprinklers, the decision must be founded on the overall net savings and losses resulting from such factors as: (a) water use, (b) crop return, (c) power costs, (d) labor costs, and (e) interest on the investment, depreciation, and other fixed charges.

Of these items, power costs and fixed charges may need a little clarification before a comparison is drawn. It costs about $3 to pump sufficient water to cover one acre one foot deep if the lift is 100 feet. A pressure of 43.29 pounds per square inch is equivalent to a lift of 100 feet, so it will cost an additional $3 per acre-foot to put water through sprinklers if the pump pressure is 43.29 pounds per square inch and proportionally more or less as the pressure is varied. Fixed charges—item (e)—are a justified charge against the initial cost of the sprinkler and distribution system in order to pay it off in, say, 10 years and to return interest on the investment. This charge might be conservatively, 16%.

The accompanying table summarizes the values involved in the preceding list of factors for sprinklers and surface irrigation on rolling and level land. Each operator should set up his own balance by use of the table before deciding which type of irrigation he should employ for greatest efficiency.

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Comparison of Sprinkler and Surface Irrigation Costs

Contour of land and type of irrigation	Economy in use of water	Crop return	Power costs	Labor costs for applying water	Fixed charges for irrigating facilities
ROLLING GROUND					
Sprinkler system	Possible net saving of water due to its exact application and even distribution. Added evaporation losses during sprinkling period, 10–25%.	May produce crop in spots where satisfactory crops may not be produced under other methods of irrigation.	$3.00 per acre-foot for 43.29 pounds per sq. in. or about 6.8c per pound pressure per acre-foot.	Moving sprinkler lines and possibly pump. Variable from $10.00 per acre-ft. to as much as $25.00.	Cost of sprinkling system from $30 to $150 per acre. 16% = $4.80 to $24 per acre.
Other types of irrigation, such as furrows or flooding.	Loss of water from deep percolation and surface runoff due to difficulty of applying exact amount required.	Yield may be reduced in portions of fields by too little or too much water.	0.00	Some cost involved.	Negligible.
LEVEL GROUND					
Sprinkler system	No deep percolation losses but evaporation losses may be high.	Benefits some special crops such as beans. Little significant difference in return for other crops.	$3.00 per acre-foot for 43.29 pounds per sq. in. or about 6.8c per pound pressure per acre-foot.	Moving sprinkler lines and possibly pump. Variable cost about same as for rolling ground.	Cost of sprinkling system from $30 to $150 per acre. 16% = $4.80 to $24 per acre.
Other types of irrigation, such as furrows or flooding.	No percolation losses, if efficiently applied.	Normal returns.	0.00	Some cost involved.	Negligible.