Chemical thinning controls biennial bearing in apples

J E L Cripps
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CHEMICAL THINNING CONTROLS BIENNIAL BEARING IN APPLES

Department of Agriculture experiments have shown that biennial bearing of apples can be controlled by chemical thinning, but both winter and spring weather conditions must be taken into account when the need for spraying is assessed.

By J. E. L. CRIPPS, Research Officer, Plant Research Division

BIENNIAL BEARING is a regular cycle in which each heavy crop of fruit is followed by a light crop, or, in extreme cases, no crop at all.

A heavy crop of fruit uses most of the food material available in the tree so that little or none is left for the formation of fruit buds for the following season. The degree of fluctuation varies with seasonal conditions and tree management.

At present the intensity of the cycle in most orchards has been reduced by chemical thinning and favourable seasonal conditions. Chemical thinning corrects biennial bearing by reducing fruit set and leaving more food available for the formation of fruit buds to flower in the following spring. Hand thinning is carried out too late to affect fruit bud formation.

A poor set of fruit caused by seasonal conditions usually starts a State-wide biennial bearing cycle. The present cycle was triggered by the warm winter of 1959, which led to severe delayed foliation and a light set of fruit in the following spring.

The cycle remained intense for eight years, after which it moderated somewhat, but it still operates on trees which have never been spray-thinned.

Orchards sprayed with D.N.C. in the winter of 1959 to reduce delayed foliation appeared to be less severely affected, indicating that spraying with D.N.C. in mild winters can help overcome one cause of biennial bearing.

Even without widespread influences such as the warm 1959 winter, different orchards and different trees within one orchard, can have differing cropping patterns. There is a normal tendency for trees to become biennial in cropping habit.

### Materials

- N.A.A.—naphthalene acetic acid.
- N.A.D.—naphthalene acetamide or Amid-thin (registered trade name of Amchem Products Inc.)
- Sevin or Carbaryl-1-naphthye N-methyl carbamate. (Sevin is a registered trade name of Union Carbide Corporation.)
- Tween 20—poly oxyethylene sorbiton monolaurate. Tween 20 is a surfactant and not a thinning spray.

### Weather conditions at the time of setting

Even if winter weather has been satisfactory and the tree seems likely to over-crop, poor setting conditions in spring may still reduce the fruit set. Less fruit is set in cool, cloudy, wet, spring weather than in warm, sunny, dry weather. Investigations in England have shown that the best temperature for pollination in apples is 70° F.

Orchardists should therefore take spring as well as winter weather into account when assessing degree of chemical thinning needed.

### Corrective measures

**Chemical thinning for Granny Smiths**

Experiments with Granny Smiths which were acutely biennial in cropping have
demonstrated that chemical thinning is the best means of improving cropping regularity.

Results of some treatments in long-term biennial bearing trials are shown in the graphs (Figs. 1 to 4). In reading these graphs it must be remembered that the fruit counts (Figs. 1 and 3) were influenced only by spray treatments and setting conditions (Figs. 2 and 4); while the weight of the crop was also influenced by rainfall and the availability of irrigation water.

THE EFFECT OF CHEMICAL THINNING SPRAYS ON BIENNIAL BEARING OF GRANNY SMITH APPLES
MANJIMUP TRIAL

Fig. 1.—Fruit counts—Manjimup.

Fig. 2.—Fruit weights (lb.)—Manjimup.
The fruit counts show the extreme biennial habit of the untreated trees in the two trials. The yield results are the weight of crop for the particular year, excluding badly blemished fruit.

Most of the fruit in the “on” year reached the minimum size, although four picks were often necessary. A high proportion of fruit in these heavy crops was usually unsuitable for export because of limited demand for small fruit and a high incidence of blemishes.

The trials included both drastic and moderate chemical thinning treatments. Drastic treatments such as one or two “on” year sprays of Amid-thin at 8 oz. per 100 gallons plus Tween 20 produced regular cropping of Granny Smiths with an eventual tendency for larger “off” than “on” year crops. (Such treatments were used in 1962-63 at Manjimup, Figs. 1 and 2, 1962-63 and 1966-67 at Bridgetown, Figs.)
3 and 4, and in 1968-69 in another experiment, not shown, at Kendenup).

The larger "off" year crops in the experiments in 1969-70 could have been corrected by "off" year sprays but these were not given because the experiments were due to end. In other treatments, not shown in the graphs, potentially heavy "off" crops were successfully treated with chemical thinning sprays.

At Kendenup, and in other trials, it was later found that Amid-thin at 6 oz. with Tween 20 plus 1½ lb. of Sevin per 100 gallons was a superior spray, as it gave thinning equal to Amid-thin at 8 oz. with less foliage damage. This mixture can be recommended for Granny Smith trees which do not respond to more moderate treatments, but one "on" year application of the Amid-thin and Sevin mixture is all that should be required to bring trees into regular bearing.

The moderate treatment of Amid-thin at 5 ounces plus Tween 20 gave regular cropping at Manjimup after applications in two successive "on" years. (Figs. 1 and 2). A further application led to larger "off" than "on" year crops.

At Bridgetown three applications of Sevin at 1½ lb. per 100 gallons were required to give regular cropping (Figs. 3 and 4), but at Kendenup moderate treatments failed to promote regular bearing. These were old trees which had experienced difficult conditions in past years.

On the other hand experiments and field observations in Western Australia have shown that moderate treatments coupled with thorough spray application are sufficient to bring the majority of Granny Smith trees into regular bearing.

**Thinning other varieties**

In the experiments, regular cropping of Delicious has resulted from one "on" year application of N.A.A. at 7½ parts per million (p.p.m.) plus Tween 20 followed a week later by a spray of Sevin at 1½ lb. per 100 gallons. Golden Delicious has responded to single sprays of N.A.A. or Amid-thin.

The Jonathan variety is not very biennial in cropping, but if trees expected to crop heavily they should be sprayed with a mixture of Amid-thin at 6 oz. with Tween 20 and Sevin at 1½ lb. Only one of these two materials should be used if a moderate crop is expected.

With Yates, drastic thinning with N.A.A. at 10 to 15 p.p.m. plus Tween 20 is often necessary, but setting is variable and care should be taken not to over-thin when a lighter crop is expected. In these circumstances lower spray concentrations should be used.

**Trees in regular bearing**

Trees of all varieties which crop regularly present the grower with a choice between light to moderate chemical thinning or hand thinning every year. The choice will probably depend on the availability of water for irrigation and the setting potential of the trees. Trial results suggest that annual spraying treatments are the best choice with old heavy-cropping trees particularly if they are adjacent to pollinator rows.

**Cross pollination**

Cross-pollinated trees usually set heavier "off" year crops than self-pollinated ones when "on" year thinning sprays have been used. Although cross-pollination may slightly reduce fluctuations in cropping it is essential to ensure an adequate overlap in blossoming between the main variety and the pollinator. For example, a late-flowering variety can be sprayed with D.N.C. in winter to advance flowering and improve its overlap with one that flowers early.

**Other factors**

Autumn nitrogen dressings and autumn urea sprays have been investigated in a number of trials, but no significant increases in "off" year crops have been recorded.

Sprays of the growth substance Alar have not increased crops carried by old trees, but they may be useful in bringing young trees into cropping.

**Future prospects**

Heavy cropping, drought and insect pest damage were characteristic of some orchards last season. These could reduce fruit set in 1970-71, although most growers would expect an "on" year. Caution should therefore be exercised in the application of thinning sprays.

If a heavy crop is still expected only moderate spray treatments should be used, but if doubt exists in the grower's mind...
advice should be sought from the local Horticultural Adviser or Instructor.

In general terms it would seem that a situation has been reached where some orchards will have an "on" year crop in 1970-71, some will only have a light setting while others may carry regular crops. In this situation the control of biennial bearing will depend on the judgment of the orchardist, his assessment of his own trees and his willingness to seek advice.

Looking further into the future it is always possible that weather conditions, such as a warm winter, may again engender an intense biennial bearing cycle such as that experienced over the past decade.

Acknowledgments

Thanks are due to all orchardists who loaned their trees to the Department for chemical thinning and biennial bearing trials. More than 25 orchards were involved over the last 5 seasons. The co-operation of Messrs. A. McAlinden, W. Mottram and H. Stain in making trees available for the long term trials was invaluable.

### APPLE SPRAY THINNING RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Variety</th>
<th>Spray Mixture</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>GRANNY SMITH</td>
<td>(1) 6 ozs. Amid — thin + 1/2 pint Tween 20</td>
<td>If considerable thinning is required (1) should be followed by (2) or the two sprays should be applied together.</td>
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<td></td>
<td>(2) 1 1/2 lb. Sevin (80%)</td>
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<tr>
<td>CLEOPATRA</td>
<td>NAA 10 ppm + wetting agent OR 6 ozs. Amid — thin + 1/2 pint Tween 20</td>
<td></td>
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<tr>
<td>DELICIOUS</td>
<td>&quot;on&quot; year trees which require considerable thinning.</td>
<td>If light thinning required use SEVIN (1 1/2 lb) only.</td>
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<tr>
<td></td>
<td>7 1/2 ppm NAA + 1/2 pint Tween 20 followed 7-10 days later by a second spray consisting of Sevin 1 1/2 lb (80%).</td>
<td></td>
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<tr>
<td>GOLDEN DELICIOUS</td>
<td>&quot;on&quot; year trees which require considerable thinning.</td>
<td>Trees requiring moderate thinning should be given only a light spraying.</td>
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<tr>
<td></td>
<td>10 ppm NAA + 1/2 pint Tween 20 OR</td>
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<td></td>
<td>8-10 oz. Amid — thin + 1/2 pint Tween 20</td>
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<td></td>
<td>Apply 4-7 days after full bloom.</td>
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<tr>
<td>YATES —</td>
<td>&quot;on&quot; year trees which require considerable thinning.</td>
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<tr>
<td></td>
<td>10-15 ppm NAA + 1/2 pint Tween 20</td>
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<tr>
<td></td>
<td>&quot;off&quot; year trees which require only moderate thinning.</td>
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<tr>
<td></td>
<td>7 1/2 ppm NAA + 1/2 pint Tween 20</td>
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<tr>
<td>DOHERTY —</td>
<td>&quot;on&quot; year trees which require considerable thinning.</td>
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<tr>
<td></td>
<td>12 1/2 - 15 ppm NAA + 1/2 pint Tween 20</td>
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<tr>
<td></td>
<td>&quot;off&quot; year trees which require moderate thinning.</td>
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<tr>
<td></td>
<td>12 ozs. Amid — thin + 1/2 pint Tween 20 OR 10 ppm NAA + 1/2 pint Tween 20</td>
<td></td>
</tr>
<tr>
<td>JONATHAN —</td>
<td>(1) 1 1/2 lb. Sevin 80% OR 6 ozs. Amid — Thin + 1/2 pint Tween 20</td>
<td>Only use (2) if considerable thinning is required.</td>
</tr>
<tr>
<td></td>
<td>(2) 1 1/2 lb. Sevin 80% + 1/2 pint Tween 20.</td>
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