Hormone sprays and their effects on the setting, yield and vigour of currant grapes

L. T. Jones

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Hormone Sprays and their Effects on the Setting, Yield and Vigour of Currant Grape Vines

By L. T. JONES, Senior Plant Research Officer

In 1942, the Department of Agriculture was asked to investigate a serious decline in yield and vigour of grape vines on certain areas in the Swan Valley. The varieties mainly affected were muscats and currants. The problem was most severe on the soil types of a sand or light sandy loam nature and in poorly drained areas. On areas of heavier textured soils with a friable clay subsoil the vines were generally regarded as economically satisfactory.

Immediate replanting of problem areas in practically all cases resulted in poor replant vines. In some cases, with replant currants, growth was judged satisfactory until they were cinctured and commenced cropping.

New plantings on virgin areas (including old pasture paddocks) resulted, initially at least, in good growth on all classes of soil. Originally, soil deficiencies were suspected, and this approach was in accord with the opinions of all growers consulted. As a consequence a series of fertiliser trials were commenced in 1942. By 1950 a great bulk of information consisting of yields, chemicals analyses and years of observations of the problem under a variety of conditions indicated that the vine deterioration and replant problem would not be adequately solved by fertiliser treatment. Up till this stage the deteriorated root system common to all problem vines had been accepted as the effect of a fertiliser deficiency. A previous local success with copper on currants with apparently identical growth symptoms had kept alive the hope that, given time, the root growth would improve under fertiliser treatment.

Having exhausted this line of attack the way was now clear for considering the theory that a deteriorated root system could in itself be the cause of the problem. This new outlook resulted in an immediate examination of all possible factors that would depress root growth. The list considered was as follows:

1. Cincturing of currant vines.
2. Nematode damage.
3. Waterlogging.
5. Plough soles.
6. Organic matter and soil deterioration.
7. Soil toxicities.
8. Overcropping.
9. Root injury from cultivation implements.

In 1951 a project was commenced, in co-operation with the Plant Pathology Branch, on an investigation of the part played by nematode damage in the vine deterioration and replant problem. The presence of nematodes was recorded but as their numbers were as high on healthy vines as on weak vines it was concluded that nematode damage was not likely to be a major factor in the decline of the grape vines. Soil fumigation of a replant area gave a small initial response which was most apparent under moisture stress. In the first season better root growth resulted in the fumigated area and leaf analyses showed a higher content of potassium and manganese as well as producing practically twice the amount of foliage. In this experimental area now, irrespective of fumigation treatment,
muscats have made poor growth, and uncinctured and uncropped four-year-old currants have made fair but not vigorous growth.

Fig. 1.—A cinctured currant vine showing an expansion in stem girth above the cincture cuts

The next major research project was to test the effect of eliminating cincturing, on the health and longevity of the currant vine. Before proceeding to deal with hormone spraying of currants let us very briefly summarise the findings of the main investigation.

Under present conditions in the Swan Valley vineyards fertiliser deficiencies are of less practical importance than such influences as management practices, the effective root zone and soil water relationships. It is apparent that any management practices that will improve the growth and efficiency of the observed deteriorated root system of the problem vines will result in some improvement in yield and vigour. Replanting after a period under undisturbed pasture, rather than immediate replanting, was recommended as a solution to the replant problem pending further research findings.

This procedure, as well as being thought to minimise the incidence of diseases and pests which built up under continual grape growing, was shown to have greatly improved the soil organic matter status and the physical condition of the soil.

A survey in 1952 indicated that the vigour of vines could be correlated with the organic matter contents of the surface soil and that continual cultivation had practically halved the organic matter of the lighter surfaced soils.

CINCTURING OF CURRANTS

The cincturing of currant grape vines at flowering time has been adopted as the standard method for improving fruit set since its introduction from Greece into Australia by Catton Grasby in 1897.

An important commercial characteristic of this variety is that it is normally seedless. In the absence of seeds the nutritional effect of cincturing is necessary to induce a satisfactory berry development. Cincturing involves the complete removal of a narrow strip of bark (the phloem), usually about \( \frac{1}{6} \) of an inch thick, from the trunk of the vine. It is claimed that optimum results are obtained if the cincture is applied when the grape flowers are in full bloom and have shed about 80 per cent of the floral caps. Locally this would be early in November.

It is generally believed that the phloem cincture restricts the movement of soluble nutrients to the roots and results in a temporary increased supply to the bunches, wood, and shoots.

During the investigation into the deterioration of replant currants it was observed that cincturing may cause a rapid deterioration in a weak vine, especially during periods of moisture stress. It was thought that one of the possible factors in the rapid decline of these problem currant vines was that cincturing damaged the conducting tissue and also restricted the flow of nutrients to an already weakened root system.
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HORMONE SPRAY TRIALS 1951-1952
SEASON

Hormone Sprays Used November, 1951.

Many synthetic plant growth regulators have been tested experimentally in this field but the early work of Coombe in South Australia and Antcliffe at the Merbein Research Station, Victoria, suggested confining our experimentation to two types of hormone spray namely:

(1) 2,4-dichlorophenoxyacetic acid (2,4-D).
(2) parachlorophenoxyacetic acid (P.C.P.A.).

The prime purpose of the use of the sprays was to measure the effect of the elimination of cincturing on the vigour and longevity of the currant grape vine.

Fig. 2.—The unhealed cincture cut on a weak currant vine

Quantities and Concentrations Applied.

The ethyl ester of 2,4-D was used. The 2,4-D spray was applied at the rates of 4, 2 and 1 pints per vine which is approximately equal to 200, 100 and 50 gallons per acre. The concentration of 2,4-D was 2½ parts per million.

It was found that for our normal-sized vines, 100 gallons per acre gave a thorough foliage and bunch cover. Two hundred gallons per acre was wasteful of spray, while 50 gallons per acre necessitated confining the spray to the main body of the vine where the fruit bunches are carried. Apart from normal leaf distortion, no damage was done to the vines with 2,4-D at 2½ parts per million and up to 4 pints to the vine.

The acid form of P.C.P.A. was used. Difficulty was experienced in making up a concentrated stock solution in water and alcohol was used as the solvent for the stock solution which was diluted with water for use as a spray. For this reason only, in later years the readily water-soluble sodium salt was used. Both forms are equally effective.

The P.C.P.A. spray was applied at 100 and 50 gallons per acre at a concentration of 50 parts per million. Various sites were also sprayed with P.C.P.A. at 20 parts per million at quantities varying from 50 to 75 gallons per acre depending on the size of the vines.

Hormone Damage.

Serious damage was confined to one treatment, namely P.C.P.A. at 50 parts per million and at 100 gallons per acre. It is thought that damage resulted because of the method of application. In an attempt to apply 2 pints per vine without losing spray on to the ground the foliage, canes, and arms were thoroughly drenched. Spray ran down erect canes and collected at the base of the cane and the bark of the arms absorbed abnormal amounts of spray. Apart from normal leaf distortion no ill-effects were seen on these vines until eight months later when at the break of dormancy and just before pruning time many canes split, became "corky" and died. The arms at the same time produced a lot of corky bark and, in some cases, died back. This resulted later in the production of a lot of barren shoots. Damaged vines left unsprayed and uncinctured the following season recovered their vigour while those sprayed with P.C.P.A. at 20 parts per million and 50 gallons per acre made a less complete recovery. The effect of cincturing following hormone damage was not tested. A block of treatments left unsprayed and
uncinctured the following season indicated that there can be a residual effect of hormone from one season to the next. The berries formed were intermediate in size between cinctured and uncinctured vines but they shed easily at picking time. There appeared to be a differential response depending on the concentrations and gallonage applied the previous season. However it must be remembered that the high concentrations, high gallonages, and methods of application are not those now recommended for commercial use. The available local evidence is that for up to four seasons, if the spray is applied properly, the vines are no easier or harder to set than at the commencement of spraying.

At some sites, especially on young vigorous vines, 2,4-D at 5 parts per million resulted in damage to the bunches.

**Foliage Spray Versus Bunch Spray.**

On all treatments fruit bunches were bagged to prevent the direct contact of the spray in order to test the necessity for hitting each bunch. The bagged bunches set very well but the berry stalks were thin and flexible like cinctured currants. It was therefore concluded that spraying the bunch was the most effective method and would be important where greatest activity was needed.

This was later confirmed next year in a trial with strong currants in which P.C.P.A. at 20 parts per million was superior to P.C.P.A. at 10 parts per million. At this site, with the lower concentration, any bunches not actually hit with the spray gave a very poor set.

In this last season it has been shown that by wetting bunches only with a small hand spray and placing no spray at all on

Fig. 3.—P.C.P.A. at 20 parts per million is the only treatment that is a commercial success. Left bunch—2,4-D at 2½ p.p.m.; centre bunch—1st year of cincturing; right bunch—P.C.P.A. at 20 p.p.m. These bunches are from three-year-old, very strong currants grown on fertile river flat. (T. C. Wilson—1951-52 season)
the foliage the fruit was set equal to normal spraying. This method used about 8 to 10 gallons to the acre instead of the standard 50 gallons to the acre.

RESULTS AND OBSERVATIONS, 1951-1952 SEASON

For a period of about a fortnight to a month after cincturing, the cinctured vines were paler in colour and leaf growth stopped. Hormone-treated and uncinctured vines showed continuous growth and remained a fresh, dark green colour.

A characteristic leaf distortion occurred on young foliage and growing tips. Even new shoots growing after the spray application may show distortion and elongation. The berry stalks became thickened and more rigid as a result of hormone treatment.

2,4-D at 2½ parts per million was not usually successful on young very vigorous vines. Old and less vigorous vines set fruit about equivalent to cincturing.

P.C.P.A. at 50 and 20 parts per million set fruit, at least equivalent to cincturing, on both weak and vigorous vines.

Generally speaking the hormone-treated vines produced bigger and softer berries, delayed ripening and tended to give a reddish tinge to the fruit. However the dried fruit was graded and hormone-treated fruit compared more than favourably with the cinctured fruit.

The vigour of the vines increased under hormone treatment and, in some cases, up to double the weight of pruning wood was produced when compared with adjacent cinctured vines.

HORMONE SPRAY TRIALS, 1952-1953 SEASON

Twelve sites were selected covering a wide variety of conditions. The plan of layout at each site was six treatments replicated four times. The quantity of spray was standardised at 1 pint per vine. In actual practice the quantity was up to 1 pint per vine because where very weak vines were involved only enough spray was applied to wet the bunches. Where very leafy and strong vines were encountered more care was taken in the movement and direction of the nozzles so that bunches were wetted and spray was not shed onto the ground by the shielding action of the leaves. Both sides of the vine were sprayed to minimise the chances of missing bunches and some attempt was made, within practical limits, to omit spraying young growing tips which so readily show leaf distortion from the effects of hormone.

Fig. 4.—2,4-D is inferior to P.C.P.A. for strong young vines. Left pair of bunches—2,4-D at 2½ p.p.m. yielding approx. 5 cwt. per acre of fresh fruit; right pair of bunches—P.C.P.A. at 20 p.p.m. yielding approx. 35 cwt. per acre of fresh fruit. The first crop on strong three-year-old replants. (T. J. Woolcott—1951-2 season)
SEASONAL OBSERVATIONS—1952-1953

Cinctured Vines.—Although initial berry development was much slower than hormone spray, the berries finally ripened earlier. Pale foliage colour extended in some cases up to two months after cincturing. Leaf scorch and moisture stress were more apparent in experimental cinctured vines than in those sprayed.

2,4-D Treated Vines.—The concentrations used were 2½ and 5 parts per million. The fruit set on late flowering bunches was inferior. A lot of green undeveloped berries were produced. 2,4-D at 5 parts per million was inferior to 2½ parts per million and on vigorous vines bunch damage occurred.

P.C.P.A. Treated Vines.—The more soluble sodium salt was used. Fruit set was very good under all conditions. Apparently more latitude is allowable with P.C.P.A. in regard to stage of flowering for successful fruit set than is possible with 2,4-D. Except for very strong vines P.C.P.A. at 10 parts per million and at 1 pint per vine (50 gallons per acre) gives satisfactory results.

Table 1.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dry Weights (cwts. per acre)</th>
<th>Drying Ratio</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A—Cinctured</td>
<td>19-6</td>
<td>2-0</td>
<td>2-5</td>
</tr>
<tr>
<td>B—2, 4-D (2½ p.p.m.)</td>
<td>11-4</td>
<td>2-0</td>
<td>2-5</td>
</tr>
<tr>
<td>C—2, 4-D (5 p.p.m.)</td>
<td>12-4</td>
<td>2-0</td>
<td>2-5</td>
</tr>
<tr>
<td>D—P.C.P.A. (40 p.p.m.)</td>
<td>19-2</td>
<td>1-6</td>
<td>3-5</td>
</tr>
<tr>
<td>E—P.C.P.A. (20 p.p.m.)</td>
<td>17-8</td>
<td>1-9</td>
<td>2-5</td>
</tr>
<tr>
<td>F—P.C.P.A. (10 p.p.m.)</td>
<td>16-4</td>
<td>1-8</td>
<td>3</td>
</tr>
</tbody>
</table>

Statistical Data for Dry Weight—

P-05 = 3-8 cwts. per acre.
P-01 = 5-2 cwts. per acre.

N. K. Waldeck, Caversham—Old weak vines.

A—Cinctured | 20-8 | 2-5 | 2 |
B—2, 4-D (2½ p.p.m.) | 25-6 | 2-5 | 2 |
C—2, 4-D (5 p.p.m.) | 25-7 | 2-3 | 2 |
D—P.C.P.A. (40 p.p.m.) | 25-6 | 2-3 | 2 |
E—P.C.P.A. (20 p.p.m.) | 24-7 | 2-3 | 2 |
F—P.C.P.A. (10 p.p.m.) | 21-4 | 2-3 | 2 |

Statistical Data—No significant difference between treatments.

J. E. Anderson, Upper Swan—Old average vines.

A—Cinctured | 31-7 | 1-9 | 3 |
B—2, 4-D (2½ p.p.m.) | 23-3 | 1-9 | 3 |
C—2, 4-D (5 p.p.m.) | 16-2 | 2-0 | 2-5 |
D—P.C.P.A. (40 p.p.m.) | 21-3 | 2-1 | 2-5 |
E—P.C.P.A. (20 p.p.m.) | 22-4 | 2-0 | 2-5 |
F—P.C.P.A. (10 p.p.m.) | 20-3 | 2-0 | 2-5 |

Statistical Data—No significant difference between treatments.

St. Alban's Vineyard, Upper Swan—Old weak vines.

A—Cinctured | 20-6 | 2-1 | 3 |
B—2, 4-D (2½ p.p.m.) | 23-3 | 1-9 | 2 |
C—2, 4-D (5 p.p.m.) | 25-7 | 2-0 | 2-5 |
D—P.C.P.A. (40 p.p.m.) | 27-7 | 2-3 | 2-5 |
E—P.C.P.A. (20 p.p.m.) | 28-8 | 2-3 | 2-5 |
F—P.C.P.A. (10 p.p.m.) | 20-3 | 2-0 | 2-5 |

Statistical Data—No significant difference between treatments.

Remarks on Table 1.

The first three properties tested showed, on statistical analyses, significant differences between treatments. On no occasion were treatments D and E (P.C.P.A. at 40 and 20 parts per million) significantly worse than treatment A (cincturing). At W. H. Taylor's site all P.C.P.A. treatments were better than cincturing. On all three areas, 2,4-D at 2½ and 5 parts per million...
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(treatments B and C) were significantly inferior to P.C.P.A. at 20 parts per million. On T. C. Wilson's and A. R. Hill's experiments 2,4-D was also inferior to cincturing and P.C.P.A. at 40 parts per million.

The three remaining trials showed no significant differences between treatments. Another two sites were harvested but due to the great variation between plots no conclusions could be drawn in respect to the effect of treatments on yields. On deteriorated problem currants at D. E. Thorn's Millendon, the fruit set was satisfactory under all hormone treatments, but plot yields varied from 3 to 15 cwts per acre of dried fruit. An experiment on old strong currants at A. de Marchi's vineyard at Bindoon similarly gave a good fruit set with all hormone treatments and here plot yields varied from 15 to 40 cwts. per acre of dried fruit.

The drying ratio is estimated from the ratio of fresh fruit picked to the weight obtained after drying. Their variability indicates the necessity for dry weight yields.

The fruit was classified before cleaning to measure the quality of the fruit from each treatment. Under this scheme a classification of 1 would pack mostly 4-crown currants; 2 mostly 3-crown; 3 mostly 2-crown and 4 mostly 1-crown. Thus the higher the classification the poorer the quality. Half numbers are introduced because of the averaging of 4 lots and because in some cases samples were intermediate between two classes.

For all practical purposes the table shows that P.C.P.A. at 20 parts per million will set currants as effectively as cincturing under a wide range of conditions and that quality is not impaired.

It also illustrates the point that 2,4-D is erratic in its effects and cannot locally be recommended for strong vines. There is a tendency for 2,4-D to produce better quality fruit but to what extent this is influenced by lower yields or smaller berry size has not been ascertained.

HORMONE SPRAYING DEMONSTRATED TO GROWERS

After two years of experiments a lecture and field demonstration was organised early in November, 1953, to acquaint growers with results. At this demonstration the following recommendations were given:

1. Use P.C.P.A. at 20 parts per million.
2. Concentrate the spray on the bunches and aim to wet the fruit thoroughly. Avoid if possible young growing tips.
3. Use 1 pint of spray per normally-sized vine (50 to 55 gallons per acre).
4. Spray both sides of the vine.
5. Apply the spray at what would normally be cincturing time, that is when the grape flowers are in full bloom and have shed about 80 per cent. of the floral caps.

Within the next month, at least 2,000 acres out of a total of 3,000 acres of currants were hormone sprayed. In the next season the acreage sprayed rose from about 60 per cent. to at least 95 per cent.

As a general recommendation to cover all conditions the method has not been substantially altered.

Many growers claim better results when the spray is applied when all the caps have fallen and this does seem to reduce the retention of small green berries. However for all practical purposes there is quite a degree of latitude permissible in regard to time of application to obtain a reasonable set.

The gallonage recommended is only a guide and the more accurate direction would be the quantity of spray necessary to wet the bunches.

Investigations of reported damage from currant-setting hormone spray suggests the importance of not spraying twice; not drenching the canes and arms; applying the minimum quantity necessary by aiming for the bunches; not drenching small young vines, and not spraying replants and "layers" until they are ready to crop. There have been a few reported cases of the death of spurs supposedly as a result of hormone spray. If this is so then the experimental results suggest a faulty technique of application as a probable cause.
HORMONE SPRAY TRIALS, 1953-1954 SEASON

Results and Observations.

This season the currant crop was severely damaged by rain. The first showers in many cases damaged the cinctured fruit most severely because it was comparatively more mature and was at a more susceptible stage. However later showers also damaged the hormone treated fruit and a final inspection showed equal damage between treatments within the experimental trials.

Before harvest hot dry weather was encountered and the cinctured vines showed more leaf scorch and moisture stress. The fruit on cinctured vines shed badly both prior to picking and at picking time and in some cases up to half the fruit showing was lost onto the ground. It was noticed that on the hormone treated fruit the berry stalk was greener and tougher than cinctured fruit which probably accounted for its better retention.

It was fortunate that two-thirds of the Swan Valley currant crop was hormone-treated in this year or otherwise yields would have been appreciably reduced. Under these conditions hormone-spraying allowed picking to continue over a longer period instead of being a rush job.

In the trials 2,4-D at 5 parts per million was omitted because of its damaging effect and 2,4-D at 1½ parts per million substituted.

On strong, vigorous vines, 2,4-D at 2½ and 1½ parts per million gave a poor set and P.C.P.A. at 10 parts per million was again inferior to 20 and 40 parts per million.

On weaker vines, P.C.P.A. at 40, 20 and 10 parts per million and 2,4-D at 2½ and 1¼ parts per million set fruit successfully. 2,4-D at ½ parts per million was tried at one site and proved successful.

THE EFFECT OF CINCTURING AND HORMONE SPRAY ON PRUNING WOOD

It has been observed that, generally speaking, hormone spraying instead of cincturing has improved the quality and quantity of the pruning wood. The greatest deterioration in pruning wood has been recorded in vines where cinctured currants have shown severe leaf scorch before picking time and consequently lowered leaf activity whilst the adjacent hormone treated vines continued active growth.

To illustrate the type of results obtained, some weights and chemical analyses of pruning wood are reported in Table 2.

From the exploratory trial laid down in 1951 on the property of H. E. Bailey at Caversham the total pruning wood from
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single vines was obtained in July, 1954, from three different treatments. The canes from each individual vine were separated into three classes and analysed for nitrogen, phosphorus and potassium. In selecting the three types of canes from each vine we followed the practice of growers who prefer average-sized canes (0.3 to 0.4 of an inch in diameter) to leave as spurs when pruning. It is the general practice to cut out weak canes and strong canes when pruning. The total amount of the three essential major elements was then calculated from the weight of wood produced and the percentage of each element in this wood. The moisture content of this newly pruned wood was approximately 50 per cent.

COMMENTS ON TABLE 2

It appears from these preliminary samplings that at this site, and under the climatic conditions prevailing during the 1953-54 season, cincturing has lowered the content of nitrogen, phosphorus and potassium in the canes. An investigation is under way to gather more detail on this aspect. Contrary to our expectations there is very little difference, chemically, between weak, average and strong canes.

Because there are approximately 450 vines to the acre the figures given as "weight of canes in grams" can be read directly as pounds per acre.

The hormone-sprayed vine grew pruning wood equivalent to 755 lb. per acre, the uncinctured vine 1,048 lb. per acre and the cinctured vine gave the comparatively low figure of 370 lb. per acre. These weights for single vines are in agreement with the pruning wood figures obtained over the last four years from the whole exploratory trial.

The character of the canes differs between treatments. The cinctured vine had 31 per cent. by weight of weak canes as compared with 15 per cent. and 18 per cent. in hormone-treated and uncinctured vines.

The hormone-sprayed vine has the equivalent of 3.4 lb. of nitrogen per acre in its canes, the uncinctured 3.7 lb. and the cinctured 1.4 lb. For phosphorus the corresponding figures are 0.4, 0.5 and 0.14 lb. of phosphorus per acre in the canes.

Table 2.

WEIGHT AND COMPOSITION OF PRUNING WOOD.

Comparison of Three Treatments.

<table>
<thead>
<tr>
<th></th>
<th>Weight, in Grams.</th>
<th>Percentage of Total Weight.</th>
<th>Cane Analyses.</th>
<th>Total Uptake, in Grams.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hormone - Sprayed</td>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Vine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak canes</td>
<td>116</td>
<td>15</td>
<td>.84</td>
<td>.10</td>
</tr>
<tr>
<td>Average canes</td>
<td>226</td>
<td>30</td>
<td>.97</td>
<td>.11</td>
</tr>
<tr>
<td>Strong canes</td>
<td>413</td>
<td>55</td>
<td>.87</td>
<td>.11</td>
</tr>
<tr>
<td>Total</td>
<td>755</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncinctured Vine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak canes</td>
<td>185</td>
<td>18</td>
<td>.94</td>
<td>.10</td>
</tr>
<tr>
<td>Average canes</td>
<td>405</td>
<td>38</td>
<td>.95</td>
<td>.10</td>
</tr>
<tr>
<td>Strong canes</td>
<td>458</td>
<td>44</td>
<td>.86</td>
<td>.09</td>
</tr>
<tr>
<td>Total</td>
<td>1,048</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cinctured Vine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak canes</td>
<td>115</td>
<td>31</td>
<td>.75</td>
<td>.08</td>
</tr>
<tr>
<td>Average canes</td>
<td>129</td>
<td>35</td>
<td>.78</td>
<td>.08</td>
</tr>
<tr>
<td>Strong canes</td>
<td>126</td>
<td>34</td>
<td>.77</td>
<td>.08</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The figures given as "weight of canes in grams" can be read directly as pounds per acre.
The most marked differences are in the potassium figures. The hormone-sprayed vines laid down in their canes, potassium equivalent to 2.5 lb. per acre, the uncinctured vines 3.4 lb. while the cinctured vines gave the low figure of 0.8 lb. of potassium per acre.

Although no detailed study has been made of the root systems of these experimental vines, because of the magnitude of such a project and the interference of such a study with an established experiment, it is thought that the responses in vigour and chemical composition of the canes must basically be the result of improved root growth when cincturing is eliminated.

Without going into a detailed discussion it may be stated briefly that to fit the known facts gathered over a period of some 12 years on the problem of deteriorated vines it is most likely that the poorer wood growth and limited nutrient absorption shown by the cinctured vine is due to cincturing further depressing an already weakened root system. Vines which show moisture stress before picking time as a result of cincturing are particularly prone to grow weak pruning wood.

The analytical data could also explain to some extent the seasonal occurrence of leaf symptoms of suspected potash, manganese and zinc deficiencies in cinctured currants on certain areas, the inability of applied fertilisers to fully control these suspected deficiencies and the elimination or improvement of these leaf symptoms when hormone-spraying replaces cincturing.

HORMONE SPRAY TRIALS, 1954-1955 SEASON

The gathering of yields this year was again complicated by heavy rain followed by flooding around picking time. However, the routine observations were made and yields were obtained from a few experimental sites which were picked early and escaped serious rain and mould damage.

These observations confirmed the findings of previous years in respect to fruit setting and only new findings will be briefly discussed and the results given from an area where harvest data is complete and where a marked deterioration has occurred on the cinctured vines.

Materials Included with Hormone Spray.

A trial at the Upper Swan Research Station on weak currants, yielding about 8 cwts per acre of dried fruit showed that “Ziram” and “Spersul” at 3 lb. per 100 gallons either singly or combined could
Fig. 7.—Hormone spray causes leaf distortion on young actively-growing shoots. Note leaf distortion at right hand side of photograph and that mature leaves are unaffected. This amount of leaf distortion is a normal consequence of the hormone spraying of vigorous currant vines and is not regarded as harmful.

be included with the routine hormone spray without affecting the efficiency of the fruit set. Commercial manganese sulphate at a concentration of 2 per cent. in the spray did not interfere with fruit setting. The included manganese improved leaf colour and vine vigour, but hot dry weather in January caused severe leaf scorch and this early advantage was lost. The yields show no significant benefit from manganese spray. In error, these inclusions were added at double the rates originally planned.

It has not yet been ascertained whether these results would also apply to strong vines which are more difficult to set.

Method of Application of Hormone Spray.

In order to compare the normal bunch and foliage-spray method with spraying bunches only, a trial was laid down on the Upper Swan Research Station on weak currants yielding about 8 cwts per acre of dried fruit.

The normal method of spraying with a knapsack (aiming at the bunches and applying a pint per vine of P.C.P.A. at 20 parts per million) was compared with spraying the bunches only and avoiding the leaves. The same yield and quality of fruit was obtained from both methods.

This type of trial has not yet been duplicated on vigorous vines which are usually more difficult to set.

The purpose of the trial was to further demonstrate to growers that for safe and satisfactory hormone-spraying it is of prime importance to wet the bunches and that although, in practice, a foliage cover cannot be avoided, it is not essential for fruit setting.

Time of Application of Hormone Spray.

In another trial at the Upper Swan Research Station, it was found that quality and yields were the same when spraying was spread over a ten-day period. The experimental vines were weak vines yielding about 13 cwts. per acre of dried fruit. The stages of flowering in the four successful sprayings were as follows:

1st Spray.—Half the bunches have flowered with 20 per cent. of floral caps off.

2nd Spray.—Three quarters of the bunches have flowered with 50 per cent. of floral caps off.

3rd Spray.—Full bloom and 80 per cent. of floral caps off. This stage usually taken as the normal time for cincturing and about this stage or slightly later is that favoured locally for hormone-spraying.

4th Spray.—Berries clear and the size of match heads.

Two weeks after the recommended time, the berries were the size of wheat grains and a week later the berries were the size of large wheat grains. When sprayed at these two later stages, the yield and quality was much inferior.

These results are in agreement with information gained in the 1952-53 season when it was observed that P.C.P.A. sprayed a week before and a week later than normal cincturing time gave a satisfactory set. The observations that year indicated that there was not the same latitude with 2,4-D.


This trial was laid down in November, 1952, and has been in existence now for three seasons. The first year's results are reported in Table 1, under the name of A. R. Hill, Bindoon.
The cinctured vines in this experiment have consistently shown pruning wood which is much inferior in quality and quantity to that found on the hormone-treated vines. When the vines were sprayed or cinctured early in November, 1954, it was observed that the cinctured plots were very backward in growth. The cinctured vines showed pale green foliage colour up to at least six weeks after cincturing. Early in January, 1955, hot dry weather caused severe foliage scorch only on the cinctured vines.

At pruning time there was an obvious difference in the quality and quantity of the pruning wood on cinctured compared with hormone-treated vines. The wood from cinctured vines was described as weak wood with a grey-brown colour, while wood from the vines in all hormone treatments was good strong wood with a golden-brown colour.

Table 3.
HORMONE EXPERIMENT WITH CURRANTS.
A. R. Hill, Bindoon.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dry Weights (cwt. per acre)</th>
<th>Classification</th>
<th>Weight of Pruning Wood (lb. per plot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A—Cinctured</td>
<td>8.1</td>
<td>5</td>
<td>3.9</td>
</tr>
<tr>
<td>B—2, 4-D (2½ p.p.m.)</td>
<td>16.1</td>
<td>4</td>
<td>8.6</td>
</tr>
<tr>
<td>C—2, 4-D (1½ p.p.m.)</td>
<td>17.2</td>
<td>5</td>
<td>10.5</td>
</tr>
<tr>
<td>D—P.C.P.A. (40 p.p.m.)</td>
<td>15.5</td>
<td>5</td>
<td>10.8</td>
</tr>
<tr>
<td>E—P.C.P.A. (20 p.p.m.)</td>
<td>19.1</td>
<td>4.5</td>
<td>10.9</td>
</tr>
<tr>
<td>F—P.C.P.A. (10 p.p.m.)</td>
<td>17.1</td>
<td>4.5</td>
<td>10.1</td>
</tr>
<tr>
<td>Statistical Data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P—05</td>
<td>5.4</td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>P—01</td>
<td>7.5</td>
<td></td>
<td>3.4</td>
</tr>
</tbody>
</table>

REMARKS ON TABLE 3
The drying ratios are not included in the table as they are very uniform between treatments and approximate a figure of 2.5. The yields from all hormone treatments are significantly better than the yields from cinctured vines. There is no difference this year between the various hormone treatments, although in the first year 2,4-D was inferior to P.C.P.A.

The increased yield obtained from hormone-spraying is worth an additional £36 an acre. To this saving must be added the increased labour cost of barking and cincturing vines.

There is a significant difference between the weight of pruning wood obtained from cinctured vines compared with that obtained from hormone treated vines. The average weight of pruning wood on a cinctured vine was 1.3 lb. which would be equivalent to approximately 585 lb. of pruning wood per acre. This low state of vigour does not hold much promise for the economic future of these cinctured vines.

The fruit was classified before cleaning. The method of classification differs from that previously in use at the packing sheds as quoted in Table 1. In Table 3 a classification of 4, means in effect that on cleaning the sample would pack mostly 3-crown currants, while a classification of 5, means that it would pack mostly 2-crown currants. Once again, the hormone-treated fruit was found to be at least as good, or even better in quality than the cinctured fruit.

CURRANT VARIETIES AND HORMONE INJURY
It has been assumed that our currants were identical with the Zante currants of Greece. However, Dr. H. P. Olmo, a visiting Fulbright Scholar and a specialist in viticulture, has drawn our attention to the fact that the currant vines grown locally are not the same as the Zante currant grown in California. Dr. Olmo also suggests that the variety of currant known locally, for want of a better name, as “the grey hairy currant,” is probably identical with the original Zante currant of Greece and the variety grown in America. Furthermore, he also suggests that the currant grown commercially in Australia was an importation from South Africa and is probably identical with the variety known as the “Cape” currant.

The practical significance of this difference with respect to hormone setting is that locally where a “grey hairy currant” has been sprayed with P.C.P.A. at 20 parts per million, it was found to be much more sensitive to hormone damage than our normal currant.
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Therefore, until further knowledge is gained on this varietal difference, it would be as well to restrict the findings of this investigation to the variety of currant grown locally, which is probably identical with the Cape currant.

This difference in varietal response to hormone injury may explain why it has not yet been possible to make a commercial recommendation in California, even though fruit setting with growth regulators has been studied there by R. J. Weaver and others for many years.

**CONCLUSIONS**

It has been demonstrated that P.C.P.A. at 20 parts per million will set currants as effectively as cincturing under a wide range of conditions and that yield and quality is not impaired. It was found that 2,4-D was erratic in its effects and could not be confidently recommended for strong vines.

All experimental vines showed an improvement in vigour, judged on leaf colour and vegetative growth, when hormone spray replaced cincturing. Vines which for various reasons show moisture stress and leaf scorch before picking time are those most seriously affected by cincturing. In such cases a marked decline in yield and vigour may occur.

Cincturing is one of the factors that has contributed to the vine deterioration problem in currants. However cincturing damage is still only one of the factors contributing to the decline of vines in the Swan Valley and long experience with the problem suggests that the part played by each factor, at each problem site, is best measured by the extent to which it affects root growth.
Fig. 9.—Illustrating the commercial success of all hormone treatments on five-year-old weak replant vines. The treatments are as follows:—A—cinctured; B—2,4-D at 2½ p.p.m.; C—2,4-D at 5 p.p.m.; D—P.C.P.A. at 40 p.p.m.; E—P.C.P.A. at 20 p.p.m.; F—P.C.P.A. at 10 p.p.m. (W. H. Taylor—1952-3 season)

ACKNOWLEDGMENTS

Mr. W. R. Jamieson assisted with the trials in the first year and Mr. C. R. Hale has taken an active part in the investigation since January, 1953. Various officers of the Plant Research Branch have assisted in spraying and harvesting operations.

Messrs. R. Haining and T. C. Wilson were responsible for the fruit classifications.

Thanks are also expressed to the many growers, of which only some are mentioned in the text, who made available experimental sites on their properties and assisted in the carrying out of the trials.

The chemical analyses reported were carried out in the Government Chemical Laboratories.

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