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Mesquite - aerial spray to be tested

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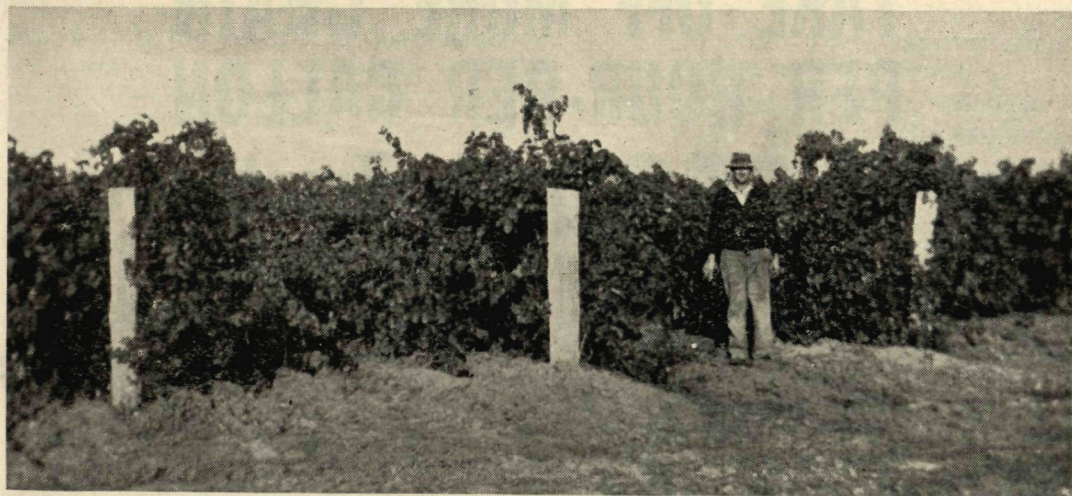
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View of well-grown Shiraz vines. In such vines mealy bugs find conditions ideal, and counts of over 90% infested bunches were obtained on untreated plots

THE CONTROL OF MEALY BUG ON VINES IN WESTERN AUSTRALIA

By P. N. FORTE, B.Sc. (Agric.), Senior Entomologist

THE mealy bug (*Pseudococcus maritimus* Ehr.) was first recorded on vines in Western Australia in 1898 (A. M. Lea, 1898). Since then it has been reported present in certain years in large numbers with consequent loss of quality in the vine products.

The control of the insect was presumed to be accomplished by ladybirds (*Cryptolaemus montrouzieri* Muls.) introduced from Queensland and New South Wales in 1902 (G. Compere, 1902) and lace-wings (*F. Chrysopidae*). The years of increased mealy bug activity were generally put down to variation in the host—predator population ratio. When troublesome, growers were advised to spray during the dormant period with lime sulphur. The losses caused by a heavy infestation of the insects can be considerable. In the case of currants with a light infestation in the bunches, the fruit is degraded with consequent loss of price or in cases of heavy infestation the currants are rejected and are only useful for distilling to produce alcohol.

In the case of wine grapes, e.g., variety Shiraz, the same thing applies—if the bunch infestation is gross then the grapes are only saleable for distilling which offers a much lower price per ton.

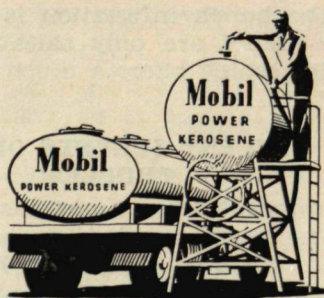
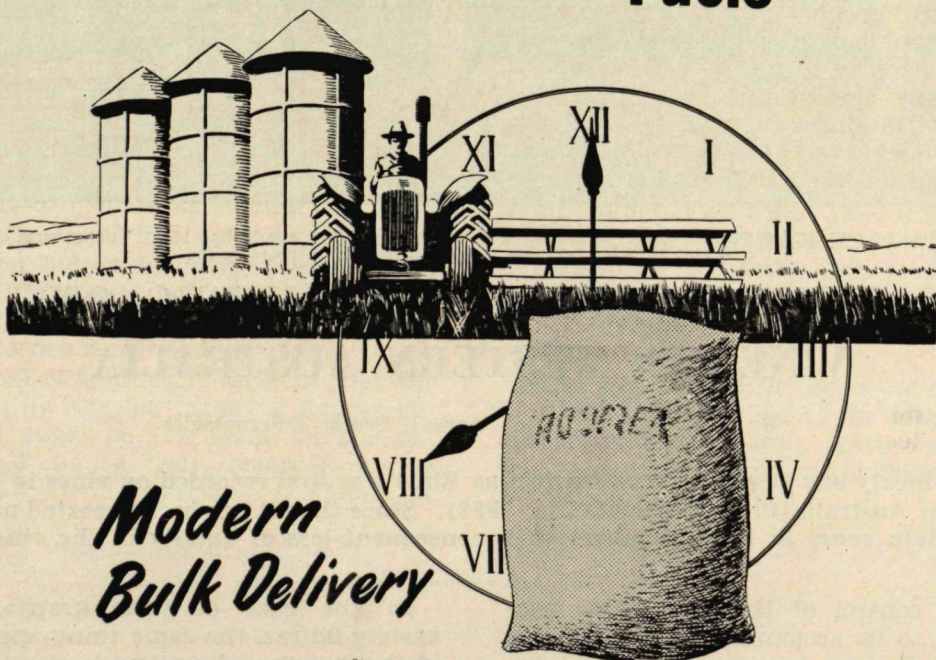
RECENT SURVEYS OF THE PROBLEM

In recent years, numerous complaints of increased mealy bug activity had been received by this Department. Many growers also claimed that they were not achieving control with the present recommendations. It was, therefore, decided to further investigate the control of the pest.

In 1948, therefore, a watch was kept on a number of vineyards on the Swan* to try to find out the status of the mealy

* "The Swan" constitutes the principal vine growing area in the State and includes the following localities—Caversham, Upper Swan, Middle Swan and Baskerville.

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bug with reference to loss to the industry and the control of the insects. Such items as the over-wintering habits of the mealy bug and actual economic loss to growers were considered important.

Although difficult to detect it was observed that most of the mealy bugs over-wintered on the vines and sheltered under the bark and on the layer next to the sap. It was also observed that the population varied considerably from place to place in a vineyard and, generally speaking, it was difficult to tell at the dormant stage of the vines where mealy bugs would become prevalent during the summer.

FIRST YEAR'S EXPERIMENTS—1949

It was proposed at this stage to test out a number of new insecticides to see if they would control the mealy bug and to compare them with lime sulphur.

Treatments Used: Six insecticides were selected as possibly being useful for controlling mealy bug and initially there appeared to be two periods when it would be useful to apply sprays, viz., at the dormant stage and at the open bunch stage of growth.

The following insecticides and concentrations were used:—

- (1) Lime Sulphur—1 part in 7 applied at dormant stage.
- (2) Lime Sulphur—1 part in 7 applied at dormant stage, but with all old bark removed from the vine.
- (3) 2% DDT emulsion (2% p.p. isomer) applied at the dormant stage.
- (4) 1% Benzene-hexachloride emulsion (1% gamma isomer) applied at the dormant stage.
- (5) Commercial Sulphuric Acid—1 part in 10 of water, applied at dormant stage.
- (6) Control—no treatment.
- (7) 0.5% DDT emulsion (0.5% p.p. isomer) applied in the summer.

- (8) 0.05% Benzene - hexachloride emulsion (0.05% gamma isomer) applied in the summer.
- (9) *Hexone—1 part in 800 parts of water applied in the summer.
- (10) †E.605—1 part in 2,400 parts of water applied in the summer.

* Hexone-active ingredient not less than 95% esters of polyphosphoric acid mostly hexaethyltetraphosphate.

† E.605 contains 22.4% Diethylparanitrophenylthiophosphate.

Selection of Sites: As it was evident that mealy bug infestation varied considerably, five areas likely to be infested were chosen in consultation with growers.

It was thought that if the experiments were laid down in these five places there was every chance of one having a good mealy bug population and hence yielding some results. Two of these areas were on the wine grape variety Shiraz and the other three on currants.

Design of Experiment: It seemed reasonable to find out the number of bunches of grapes or currants infested with mealy bug, as these would cause loss by lower price per ton. To use a figure of percentage-infested bunches, it was desirable to have large numbers per plot. The plot size selected, therefore, was six vines as it was expected that such an area would yield about 600 bunches.

The size of the experiment was limited by the manpower available to pick it at harvest time. So a randomised block design was used, having seven replications of 10 treatments.

Time of Application: The winter treatments were applied just prior to bud-burst (September) and the summer ones in December at the "open-bunch" stage of fruit development.

The sprays were applied thoroughly with a commercial spraying plant using 250 lb. per square inch pressure. The exception being Sulphuric Acid, which was applied with a lead-lined knapsack spray.

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Sampling: All the bunches for each plot were picked, examined, and counted and those with mealy bug present were recorded separately. This was found to be easily accomplished by having one person recording and five persons picking. The method was for each person to pick and examine five bunches and then to call out the count, giving the number of infested bunches first, e.g., 0-5, 3-2, 1-4 etc.

This method was rapid and worked very well. The grapes were picked at the usual time for harvesting the variety concerned. In sampling these five experimental sites, 150,000 bunches of grapes were picked.

Results: The results were calculated as percentages of infested bunches. However, on four of the five sites the mealy bug population was so variable that they were not suitable for analysis.

The fifth site (a block of currants) had a reasonably uniform mealy bug population and Table I shows the percentage of infested bunches for each treatment together with the means.

Inspection of the table shows that one treatment was outstandingly good, i.e., 2% DDT applied just before bud-burst. As this mean (0.11%) is about 40 times less than the next lowest mean, it is highly significant and was not included in the analysis of variance.

An analysis of variance, using Log (1 + x) transformation, was made on the remaining figures and no significant difference was found between any of the treatments.

SECOND YEAR EXPERIMENTS—1950

From the first year's results it became apparent that further work need only include varying concentrations of DDT to establish the lowest concentration to



Two bunches of grapes (variety Shiraz) picked at harvest time—one sound bunch and the other showing the result of heavy mealy bug infestation

give effective control. However, as a new systemic insecticide was available (Pestox 3H) and it had shown some indications of being useful against mealy bug it was included in the treatments.

Treatments: The following treatments were selected and DDT was also included in the form of water-dispersible powder:—

- (1) 4% DDT emulsion applied just before bud burst.
- (2) 2% DDT emulsion applied just before bud-burst.
- (3) 1% DDT emulsion applied just before bud-burst.
- (4) $\frac{1}{2}$ % DDT emulsion applied just before bud-burst.

TABLE I.—PERCENTAGES OF INFESTED BUNCHES.
MEALY BUG EXPERIMENT (CURRANTS) 1949-50—W. TAYLOR, CAVERSHAM, W.A.

	Lime Sulphur 1-7	Lime Sulphur 1-7 Barked	2% DDT	1% BHC	Sulphuric Acid 1-10	Control	$\frac{1}{2}$ % DDT Summer	0.05% BHC Summer	Hexone 1-800 Summer	E.605 1 in 2,400 Summer
Blocks	1	2	3	4	TREATMENTS 5	6	7	8	9	10
A	6.22	10.9	0.00	2.45	13.1	3.46	7.56	30.6	9.26	3.15
B	1.85	6.75	0.00	1.46	4.48	5.8	0.00	20.0	3.82	7.27
C	3.29	2.86	0.47	13.40	15.0	18.7	15.38	9.1	19.25	5.24
D	2.44	0.35	0.00	0.76	14.8	1.48	2.58	0.32	5.23	33.0
E	26.4	3.69	0.00	4.62	7.08	9.43	0.28	19.80	5.92	10.40
F	0.29	2.03	0.22	22.35	18.15	15.05	1.38	10.05	6.03	2.5
Total	40.49	26.78	0.69	45.04	71.81	52.42	27.18	80.87	49.51	61.56
Mean	6.75%	4.46%	0.11%	7.50%	11.96%	8.73%	4.53%	13.44%	8.23%	10.26%

(5) 2% DDT water dispersible powder applied just before bud-burst.

(6) *Pestox 3H (3 parts in 400 of water) applied at the open bunch stage.

(7) Control—no treatment.

* Pestox 3H contains 60% w/v dimethylamino phosphorus anhydride.

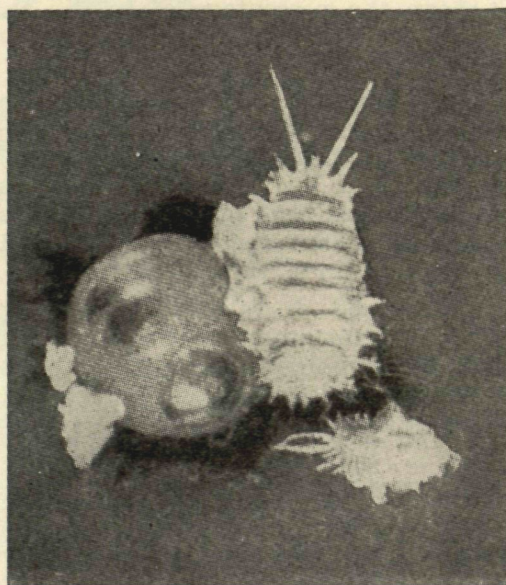
Selection of Site: In the previous year's work it was seen that the mealy bug population variation was much bigger than expected. Whereas in that year the areas chosen were those indicated by growers as mealy bug infested, every effort was made to find and mark a reasonably uniform mealy bug infested area for 1950.

Design of Experiment: This experiment was designed as a randomised block with 12 replications and seven treatments. As the mealy bug population was heaviest on the end vines of a row, it was necessary to run the blocks across the rows. The plot size was once again six vines yielding approximately 600 bunches.

Time of Application: The dormant sprays were applied just before bud-burst with the same plant as used previously. The systemic spray was applied with a knapsack spray in the

summer at the open bunch stage. At this time the vines had plenty of new growth showing.

Summer Observations: It was thought worth while to see if mealy bugs were present before the Pestox 3H was applied. Therefore a survey was made by examining the bunches at the open bunch stage. This revealed a heavy infestation on all the plots to be treated



Mealy bug (greatly magnified) feeding on a vine

TABLE II.—PERCENTAGES OF INFESTED BUNCHES.

MEALY BUG EXPERIMENT 1950-51 (VARIETY SHIRAZ)—W. TAYLOR, CAVERSHAM, W.A.

	4% DDT	2% DDT	1% DDT	½% DDT	2% DDT Water Dis- persible Powder	Pestox 3H	Control
Blocks	1	2	3	TREAT- MENTS. 4	5	6	7
A	1.74	1.34	15.14	65.7	47.00	79.80	97.4
B	8.65	0.00	0.39	4.45	3.72	71.1	64.6
C	0.68	0.00	4.44	4.57	4.45	77.1	76.4
D	8.25	0.44	1.84	7.9	16.45	38.3	82.0
E	4.48	0.58	2.46	6.07	10.26	48.6	58.0
F	0.45	0.00	10.89	0.45	4.6	26.95	82.3
G	1.86	3.96	0.00	0.86	0.00	27.5	67.0
H	0.81	0.19	0.39	10.35	2.56	54.1	56.2
J	2.08	1.15	6.12	0.28	6.38	54.3	58.5
K	2.62	0.26	0.00	6.43	10.85	30.4	8.98
L	0.00	0.17	1.12	0.00	0.83	34.7	27.8
N	0.36	0.68	0.00	0.00	0.75	65.7	29.8
Total	31.48	8.77	42.79	107.08	107.91	619.5	708.98
Mean	2.62%	0.73%	3.73%	8.92%	8.99%	51.6%	59.08%

with Pestox 3H. After spraying a close check was kept on these plots for 10 days and no dead or dying mealy bugs were found.

Sampling: The sampling was performed in the way previously described and involved the handling of 42,000 bunches of grapes.

Results: Once again these were calculated as percentage-infested bunches and Table II shows the figures for all treatments. It will be seen that all the DDT treatments were outstanding in their control and that the Pestox 3H was most disappointing.

An analysis of variance was performed on the DDT treatments using a log $(1 + x)$ transformation (Table III). Block A was excluded as apparently some unknown factor intervened.

Table III shows 2% DDT applied just pre bud-burst again to be outstanding for controlling mealy bug on vines on the Swan in Western Australia, although it was not significantly better than 1% DDT applied at the same time.

Further, ½% DDT applied just pre bud-burst, although significantly inferior to 2% DDT, did really reduce the mealy bug population to a very low level.

DISCUSSION

The method of applying the pre bud-burst treatments was to give a thorough application of spray at 250 lb. square inch pressure. When spraying large vines, such as the well grown Shiraz shown in the photograph, this took 150-200 gallons per acre. A lot of spray is wasted as it generally is when spraying deciduous fruit trees in the winter.

It was found that, generally speaking, few growers on the Swan had a good idea of what was meant by a thorough winter spray, but, of course, it is essential to spray thoroughly to hope to achieve control of insect pests during the dormant period of the vines.

Mention should be made of the effect of all the summer applied treatments on the berries. Where the spray touch-

TABLE III.—PERCENTAGES OF INFESTED BUNCHES.

MEALY BUG EXPERIMENT 1950-51 (VARIETY SHIRAZ)—W. TAYLOR, CAVERSHAM, W.A.

FIGURES USED FOR ANALYSIS OF VARIANCE (USING LOG (1+x) TRANSFORMATION).

	4% DDT	2% DDT	1% DDT	½% DDT	2% DDT Water Dispersible Powder.
Blocks	1	2	TREATMENTS 3	4	5
B	8.65	0.00	0.39	4.45	3.72
C	0.68	0.00	4.44	4.57	4.45
D	8.25	0.44	1.84	7.9	16.45
E	4.48	0.58	2.46	6.07	10.26
F	0.45	0.00	10.89	0.45	4.6
G	1.86	3.96	0.00	0.86	0.00
H	0.81	0.19	0.39	10.35	2.56
J	2.08	1.15	6.12	0.28	6.38
K	2.62	0.26	0.00	6.43	10.85
L	0.00	0.17	1.12	0.00	0.83
N	0.36	0.68	0.00	0.00	0.75
Total	29.74	7.43	27.65	41.38	60.91
Mean	2.70%	0.67%	2.55%	3.76%	5.53%
Mean (Log (1+x))	0.4519	0.1676	0.3880	0.5222	0.5864

Least significant difference of means at 5% level—0.2674

Least significant difference of means at 1% level—0.3577

ed them they were permanently disfigured and it is unwise to contemplate any spray applications from the period of bunch setting onwards into the summer.

The results show 2% DDT applied just prior to bud-burst to be the best concentration for controlling mealy bug in vines but such good results were obtained with ½% DDT experimentally that a practical test was carried out in 1951 by spraying a block of 2½ acres of vines, variety Shiraz, in early September. Throughout this area mealy bugs were found under the bark at the dormant stage. When the site was harvested it was difficult to find a mealy bug infested bunch of grapes and no economic loss of grapes was experienced in this area.

It is considered, therefore, that the concentration of ½% DDT applied just pre bud-burst is sufficient for general field use and, of course, much cheaper than 2% DDT.

In practice it was found that it is rarely necessary to spray a whole vineyard. The procedure should be to mark the infested areas or individual vines at the time of picking and then these areas can be treated during the winter with DDT spray.

Where mealy bug infested bunches are encountered during picking it is a good plan in the case of currants especially to pick them into separate tins and segregate them on the drying racks.

During the investigations a watch was kept for the mealy bug predators, the ladybirds and lace-wings, and it was found that they appeared wherever mealy bugs were found irrespective of whether the vines had been sprayed with DDT or not.

ACKNOWLEDGMENTS

My thanks are due to Mr. C. F. H. Jenkins (Government Entomologist) who suggested the project and for his continued interest over the years dur-

ing which it was carried out, and also for kindly reading through the manuscript.

I wish gratefully to acknowledge the assistance given by Mr. R. C. Rossiter, Senior Research Officer, Division of Plant Industry, C.S.I.R.O., Western Australia, in the statistical analysis of the results.

I wish to thank Mr. H. Thomas for his co-operation in the first year and also Mr. W. H. Taylor, on whose property almost all the work was carried out. His keen interest and ever ready assistance in the field work was greatly appreciated.

My thanks are also due to those other members of the Entomology Branch of the Department of Agriculture who shared with me the tedious task of sampling the experiments.

SUMMARY

1. Observations have been made on the mealy bug (*Pseudococcus maritimus* Ehr) attacking vines on "the Swan" in Western Australia.

2. The following list of insecticides have been tested at varying concentrations and times of application:—Lime Sulphur, DDT, Benzene-hexachloride (BHC), Commercial Sulphuric Acid, Hexone, E.605, Pestox 3H.

3. Two per cent. DDT emulsion spray applied pre bud-burst was found to give remarkable control of mealy bugs. Whereas none of the other insecticides gave any significant control.

4. For general spraying $\frac{1}{2}\%$ DDT emulsion applied pre bud-burst will also

reduce the mealy bug population to proportions where no economic loss is experienced.

5. General sprays of DDT at $\frac{1}{2}\%$ strength appeared to have little effect on the principal predators of mealy bugs—the ladybird (*Cryptolaemus montrouzieri* Muls.) and lace-wings (*F. Chrysopidae*).

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MESQUITE

AERIAL SPRAY TO BE TESTED

AN intensification of the spread of Mesquite in the North-West of the State was reported by the Chief Weed Control Officer of the Department of Agriculture (Mr. G. R. W. Meadly).

He stated that a spineless form of this tree had been introduced on certain North-West stations some years ago as it was thought that the plant would provide valuable topfeed in its highly nutritious pods and beans. Unfortunately, the trees had reverted to the spined type and dense thickets had developed in some areas. Approval was recently given for experiments in aerial spraying of these thickets in an attempt to control the pest by chemical means.



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