SEVIN AS AN ORCHARD INSECTICIDE IN BRITISH COLUMBIA[1]

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The insecticide Sevin, unlike most of our present day insecticides, is an aryl urethane chemically termed N-methyl-1-naphthyl carbamate[3]. This compound has special interest where insects have become resistant to our commonly used insecticides such as DDT and malathion. Sevin has the very desirable characteristics of a comparatively low mammalian toxicity; the oral LD50 to rats of 500-700 mg/kg (1) is lower than that of DDT. Because of these factors, and since reports of preliminary experiments with Sevin for insect control from other institutions were favourable, experimental work with Sevin as an orchard insecticide was started at Summerland in 1957.

GENERAL METHODS

Sevin was compared with either DDT or malathion depending upon the insect involved. Sevin and DDT were used as 50 per cent wettable powders and malathion as a 25 per cent wettable powder.

The method of application of the insecticide depended on the type and size of orchard available for experimentation. Where a large orchard with large trees was available, an automatic concentrate air-blast sprayer was used, whereas if the orchard was small, or if the trees were small, a high-volume, hand-gun sprayer was used. Except for one instance in which a Trump AS 36[4] concentrate sprayer was used, all concentrate spraying was done with a Turbo-Mist[5] concentrate sprayer. These sprayers applied about 50 gallons of spray liquid per acre. Unless otherwise stated, all hand-gun spraying was done with a two-gun, high-pressure sprayer, and the spray material was applied until it started to drip from the tree foliage.

RESULTS AND DISCUSSION

Control of the Codling Moth

In 1957, Sevin and DDT were applied with a concentrate sprayer to McIntosh and Golden Delicious in one orchard, and Delicious apples in another orchard to control severe infestations of the codling moth, *Carpocapsa pomonella* (L.). Three first brood sprays and one second brood spray were applied in each orchard. The numbers of apples injured by the codling moth were recorded at harvest.

In 1958, Sevin and DDT were applied with a concentrate sprayer to a Northern Spy apple orchard to control an infestation of the codling moth that had practically destroyed the previous year's crop. Starting one week after petal fall, three first brood applications, and two second brood applications, were made.

Sevin at six pounds per acre gave better control of the codling moth (Tables 1, 2) than did DDT at the same dosage.

Observations on the abundance of the apple aphid, *Aphis pomi* DeG., indicated that Sevin, as used against the codling moth, also controlled the aphid; but DDT allowed the aphid to develop heavy infestations. This was confirmed by Pielou (2) who studied the compound strictly as an aphicide.

Some mites, on the other hand, were not suppressed by applications of Sevin and in this respect Sevin was similar to DDT. Both years that Sevin was used for codling moth control, mites increased in the orchards. In 1958, the two-spotted spider mite, *Tetranychus bimaculatus* Harvey, de-

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veloped to such high infestations that a special miticide, 18.5 per cent Kelthane wettable powder, 10 pounds per acre, had to be applied to all plots.

Control of the Eye-Spotted Bud Moth

The recommended method of controlling the eye-spotted bud moth, *Spilonota ocellana* (D. & S.) in the Okanagan Valley is to apply malathion in pre-bloom or summer sprays.

In 1957, Sevin was compared with DDT and malathion against the bud moth. The materials were applied at the pink bud stage with a stirrup pump sprayer to young Delicious apple trees. One week after treatment the bud moth nests on each of three, single-tree replicates were examined and the average percentage mortali-

TABLE 1—Percentage Apples Injured by the Codling Moth at Harvest After Four Summer Applications of Sevin and DDT to Three Varieties of Apple Trees by Concentrate Sprayer. Naramata, B.C., 1957.

Insecticide, 50% w.p.	Pounds per acre[1]	No. of apples examined	Wormy apples, %
Golden Delicious			
Sevin	6	3000	6.4
DDT	6	2535	12.5
McIntosh			
Sevin	6	1560	1.4
DDT	6	1536	8.4
Red Delicious			
Sevin	6	2060	2.0
DDT	6	2000	6.6

[1] Application made on May 23-24, June 3-6, June 17-20 and August 5-9.

TABLE 2—Percentage Apples Injured by the Codling Moth at Harvest After Five Summer Applications of Sevin and DDT to Spy Apple Trees by Concentrate Sprayer. Summerland, B.C., 1958.

Insecticide, 50% w.p.	Pounds per acre[1]	No. of apples examined	Wormy apples, %
Sevin	6	2518	0.0
DDT	6	2550	1.7

[1] Applications made on May 20, June 2, June 16-17, July 17, and August 7.

TABLE 3—Average Numbers of Eye-Spotted Bud Moth Nests Found in a Ten Minute Search Per Tree After Sevin and Malathion were Applied to Jonathan Apple at Pink Bud Stage by Concentrate Sprayer. Summerland, B.C., 1958.

Insecticide	Pounds per acre	Numbers of bud moth nests Rep. 1	Rep. 2	Ave.
Sevin, 50% w.p.	8	6	11	8
Malathion, 25% w.p.	16	8	21	14
Check—no treatment	—	65	92	79

ties of bud moth larvae were:

Insecticide	Pounds per 100 gallons	Mortality, %
Sevin, 50 per cent	1.5	100
Malathion, 25 per cent	2.0	100
DDT, 50 per cent	1.5	1.7
Check—no treatment	—	0

In 1958, Sevin and malathion were applied at the pink bud stage to replicated, one-half acre plots of Jonathan apple trees with a Turbo-Mist sprayer. One month after spraying, each of six trees per plot was examined for ten minutes and the number of infested bud moth nests recorded (Table 3). This showed that Sevin was just as effective as malathion in controlling the overwintered eye-spotted bud moth at the pink bud stage of apple.

Furthermore, when it was compared with DDT in summer sprays to control the codling moth, as in the experiments already discussed, Sevin prevented injury from the newly hatched bud moth larvae in late July and August. In the DDT-sprayed fruit, on the other hand, bud moth injury was common.

Control of the Fruit Tree Leaf Roller

Recommended control for the fruit tree leaf roller, *Archips argyrospila* (Wlk.) is by application of DDT at the pink bud stage of apple (3); at this stage about 15 per cent of the overwintered eggs of this species have hatched. However, reports from growers, and general observations by the writer in the past few years, indicate that DDT has proven only fairly successful.

Sevin, 1.5 pounds per 100 gallons, was compared with DDT, 1.5 pounds, for leaf roller control in 1957. A hand-gun sprayer was used to apply the insecticides at the pink bud stage to heavily infested Delicious apple trees. Three weeks after spraying, each of three trees per plot was examined for ten minutes, and the number of leaf roller nests found in that time was noted. The average numbers of nests per tree per plot were: Sevin, 1; DDT, 16; Check, 95.

In 1958, Sevin, 8 pounds per acre, and DDT, 12 pounds, were applied with a Turbo-Mist concentrate sprayer to very large Newtown apple trees in the early pink bud stage when the overwintered leaf roller eggs were starting to hatch. Records of leaf roller infestation were taken three weeks later and in the same manner as the previous experiment, but six trees per plot were examined instead of three. The average numbers of nests per tree per plot were: Sevin, 4; DDT, 17; Check, 108.

These experiments show that Sevin was more effective against the larvae of the fruit tree leaf roller than DDT when applied at the pink bud stage of apple.

When these materials were applied earlier, they were less effective. This was evident in 1958 when they were applied by hand-gun sprayer at the pink bud stage of apricot, i.e., approximately two weeks earlier than that stage on apple. One month after the application of Sevin, 1.5 pounds per 100 gallons, and DDT, 1.5 pounds, records of leaf roller infestation were taken by examining five trees per plot, and recording the numbers of leaf roller nests. By plots the average numbers of nests per tree were: Sevin, 53; DDT, 52; Check, 143. It is assumed, in this case, that after having weathered for two weeks or more, the deposits had deteriorated until they were incapable of killing the larvae as they hatched from the overwintered eggs.

Control of the Peach Twig Borer

The usual method of controlling the peach twig borer, *Anarsia lineatella* Zell., has been to apply DDT at the pink or petal-fall stage of peach, or apricot (4), with the intent of killing the larva before it can cause injury to the twigs.

Sevin, 1.5 pounds per 100 gallons, was compared to DDT, 1.5 pounds, in 1958 when both materials were applied with a hand-gun sprayer to apricots that were in the pink bud stage. One month later, the numbers of flagged twigs were counted on each of five trees per plot. The average numbers of flagged twigs per tree in each plot were: Sevin, 0.0; DDT, 0.7; Check, 28.7.

Control of Lecanium Scales

Soft scales, particularly *Lecanium* spp., have been particularly troublesome during the last few years, especially in 1957, in many peach and apricot orchards in the Okanagan Valley. Proverbs (5) experimented with scale insects that he designated as *Lecanium* sp. A and *Lecanium* sp. D. These have since been identified by Mr. J. H. H. Phillips, Vineland Station, Ontario as *Lecanium coryli* L. and *L. caryae Fitch*, respectively. Another species, *L. cerasifex* Fitch, has also become troublesome since Proverbs reported on his work. He stated (5) that malathion, as a summer spray, gave excellent control of nymphs of *Lecanium* sp. A, but a late pink bud spray was not so effective.

Because the fruit grower is usually very busy when summer spraying is most effective against *Lecanium* scales, pink bud, or pre-bloom sprays are considered preferable. With that in mind, Sevin was compared with malathion in concentrate application to peach or apricot trees at the pink bud stage. Large plots, one-half acre in size, were used to minimize reinfestation from one plot to another. In most cases, results were not recorded until the scale insect had matured, its eggs had hatched, and the young nymphs had moved from the twigs to the leaves. The results of these pink-bud spray experiments, conducted in 1957 and 1958 against *L. cerasifex*, are summarized in Table 4.

TABLE 4—Average Numbers of the Scale Lecanium cerasifex **Fitch per 50 Leaves in August After Application of Sevin and Malathion to Peach Trees, in 1957, and to Apricot Trees, in 1958, in the Pink Bud Stage by Concentrate Sprayer. Summerland, B.C.**

Insecticide	Pounds per acre	Average numbers of scales per 50 leaves On peach trees 1957[1]	On apricot trees 1958[2]
Sevin, 50% w.p.	8	64	77
Malathion, 25% w.p.	16	349	539
Check—no treatment	—	1580	958

[1] Average of two replicates.
[2] Average of four replicates.

In another apricot orchard, pink bud sprays of Sevin, 8 pounds per acre, and malathion, 16 pounds, applied with a concentrate sprayer, were compared for the control of *L. coryli*. One month after the applications, two twigs were sampled from each of five trees per treatment and the number of live and dead scales were counted. The percentage mortalities were: Sevin, 96.6%; malathion 94.4%; Check, 3.9%.

It is fairly evident from these experiments that Sevin was effective against the two species of *Lecanium*, being better than malathion against *L. cerasifex* and as good against *L. coryli*.

Chemical Control of the Pear Psylla

The pear psylla, *Psylla pyricola* Foerst., was a serious pest in 1958. Infestations were numerous early in the season, and many fruit growers had difficulty controlling the pest with the recommended spray chemicals, especially malathion.

Sevin, 12 pounds per acre, was compared with malathion, 12 pounds, as a spray concentrate for pear psylla control during the summer of 1958. In one orchard, 10 days after treatment, the average numbers of live psyllids counted on samples of 20 leaves taken from each of five trees per plot were: Sevin, 1.0; malathion, 18.6; Check, 41.3. In two other or-

chards where Sevin was used, similar results were obtained indicating that it is a promising chemical for the control of the pear psylla.

SUMMARY

Good control of eight species of insects was obtained from 50 per cent Sevin wettable powder [N-methyl-1-naphthyl carbamate] applied as follows:

1. Pink bud application on apple; 8 lb. per acre or, 1.5 lb. per 100 gal.
   Eye-spotted bud moth, *Spilonota ocellana* (D. & S.).
   Fruit tree leaf roller, *Archips argyrospila* (Wlk.).
2. Pink bud application on peach and apricot; 8 lb. per acre.
   Lecanium coryli L.
   Lecanium cerasifex Fitch.
3. Pink bud application on apricot; 1.5 lb. per 100 gal.
   Peach twig borer, *Anarsia lineatella* Zell.
4. Three or more summer applications on apple; 6 lb. per acre.
   Codling moth, *Carpocapsa pomonella* (L.).
   Apple aphid, *Aphis pomi* DeG.
5. Summer application on pear; 12 lb. per acre.
   Pear psylla, *Psylla pyricola* Foerst.

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Two Unusual Breeding Places of Ptinus tectus Boield. Ocellus Brown, the Brown Spider Beetle

A pest control operator consulted me about a house which he had twice fumigated with cyanide for so-called "wood borers" which were still coming out of the walls. I inspected the place and found spider beetles, on stairs on the upper floor, on the hall floor and issuing from the inner wall of the hall. Enquiry revealed that the owners had finished the top floor and the stairs with wall board about 5/8-inch thick that was apparently of corn stalk pulp bonded with casein, and had then papered over it. The emergence holes were distributed over the slabs of wallboard. Examination of the basement revealed a few beetles that had apparently emerged from the inner side of the wall board and had dropped or crawled down the inside of the wall. I came to the conclusion that beetles had oviposited on the boards in the factory, having been attracted by the casein bonding glue and that the grubs had fed and developed in the material and were now emerging as adults. The fumigation was not of sufficient strength to penetrate the wallpaper and kill the insects in their pupal cases inside the boards. Fumigation with methyl bromide corrected the trouble.

The second unusual breeding place occurred in a country cottage south of Langley. The owners wrote me about "wood-boring insects" issuing from papered walls around a plate glass window and from the hall. The walls showed emergence holes as plentiful as if the place had been hit by a blast from a shotgun. Opening the wall revealed laths covered with thick building paper, which had been stuck to the laths with a heavy coating of animal glue. Apparently spider beetles entered the wall and laid eggs on the glued paper; the grubs fed between the lath and the paper and formed pupal cells just below the wallpaper, through which they emerged leaving the shot-hole appearance, exactly like the emergence holes of Anobiid beetles.

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