

PHENOTHIAZINE AS A CODLING MOTH INSECTICIDE

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Phenothiazine (thiodiphenylamine), an organic insecticide, was first brought into prominence as a control for codling moth by E. J. Newcomer of the U.S. Bureau of Entomology, in 1936. (Phenothiazine, a promising new insecticide for codling moth control. Wash. State Hort. Assoc., Proc. 32nd. Ann. Meeting, p. 119-120, 1937). In 1937 the British Columbia Department of Agriculture in cooperation with the Dominion Entomological Branch conducted spraying trials with phenothiazine in the Hart orchard at East Kelowna and the Ramsay orchard at Okanagan Mission.¹

According to the manufacturers, the material used in these tests contained a wetting agent, so nothing was added at the spray tank. Control, as Table 1 indicates, evidently was not as satisfactory as with arsenate of lead.

Table 1. Codling Moth Infestation at Harvest, 1937

Material per 100 gal.	Per Cent of Fruits Stung Wormy	
Ramsay Orchard		
Phenothiazine 2 lb.	13.4	21.
Arsenate of lead 3.2 lb.	15.6	5.1
"Fluxit"* 0.25 lb.		
Hart Orchard		
Phenothiazine 3 lb.	2.5	7.5
Arsenate of lead 3.2 lb.	1.5	2.5
"Fluxit"* 0.25 lb.		

*Proprietary spreader containing casein and hydrated lime.

In 1938 spraying tests were continued in the Hart orchard and phenothiazine was used in the same concentration as arsenate of lead. Both plots received arsenate of lead for the first three cover sprays. One of the plots received phenothiazine for the last two cover sprays while the other received the lead arsenate. The infestation at harvest is shown in Table 2.

1. The late A. A. Dennys of the Dominion Entomological Branch assisted in applying all sprays and checking apples in 1937 and 1938.

Table 2.—Codling Moth Infestation at Harvest, 1938

Material per 100 gal.	Per Cent of Fruits Stung Wormy	
	Phenothiazine 3.75 lb.	3.0
Arsenate of lead 3.75 lb.	6.3	2.4
"Fluxit" 0.25 lb.		

Used at the same concentration as lead arsenate, phenothiazine gave equal control of worms, and a considerable reduction in the number of stings. Results in 1937 and 1938 applied equally to McIntosh, Stayman, Winesap, and Delicious. It was concluded that phenothiazine was as effective as lead arsenate for codling moth control when applied in comparable amount and uniformity. Because of high cost of material and pressure of other work, phenothiazine was omitted from our spraying experiments during 1939 and 1940. Field trials in 1941 and 1942 were conducted in the Keloka orchard at East Kelowna, in a mature McIntosh Red orchard².

Even at reduced concentration micronized phenothiazine with stove oil and soap gave codling moth control equal to the standard spray schedule of arsenate of lead and cryolite in 1941 and better in 1942.

Owing to heavy flocculation of phenothiazine in the spray tank some trouble was experienced in applying the mixture in the 1941 trials. In the last application 0.5 oz. casein and 4 oz. hydrated lime were added per hundred gallons. No further trouble was experienced and a heavy uniform deposit on the fruit and foliage resulted. The better cover obtained by the addition of casein-lime throughout 1942 undoubtedly was responsible for the improvement in control.

2. These trials were conducted in cooperation with the Dominion Division of Entomology, Vernon. Assistance was given by Dr. J. Marshall with spray formulae and by members of the Branch in applying the spray and checking apples.

Table 3.—Codling Moth Infestation at Harvest, 1941 and 1942

Material per 100 gal.		Per Cent of Fruits Stung Wormy	
1941			
4 Sprays arsenate of lead "Fluxit"	3.3 lb.	9.8	10.9
	0.2 lb.		
2 Sprays "Alorco" synthetic cryolite "Fluxit"	3.75 lb.	5.6	9.8
	0.2 lb.		
3 Sprays arsenate of lead as above			
3 Sprays micronized phenothiazine	1.8 lb.		
Monoethanolamine oleate	0.5 lb.		
Stove oil	0.25 gal.		
1942			
Arsenate of lead and cryolite as in 1941		1.8	3.5
Phenothiazine as in 1941 throughout the season except arsenate of lead in calyx spray		.9	1.4

No check was made for differences in size or color of fruit between the phenothiazine and standard schedule plots, but general observation throughout the season and at the time of examining the fruit at harvest revealed no marked differences. Superiority in this regard lay, if anything, with the phenothiazine. An undesirable

feature of phenothiazine is that it causes irritation of the skin similar to sunburn. The lips are particularly affected. In 1941, girl thinners working in Keloka orchards the day following spraying had to be removed because of irritation to arms and face. Men thinners were not affected.

PREVENTION OF FRUIT DEVELOPMENT AND ITS EFFECT ON THE SURVIVAL OF THE CODLING MOTH

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In recent years considerable attention has been given to the possibility of spraying apple trees to destroy the blossoms without causing other injury. This procedure has been undertaken for the following purposes: (1) to eliminate a portion of the crop and so overcome the alternate bearing habit, (2) to thin the crop and so increase the size of the fruit left on the tree, and (3) to control certain orchard insects, particularly the codling moth. The practice of blossom removal by spray applications has been referred to as "deblossoming", a term which will be used here because it is concise and expressive.

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Review of the Literature

As yet, few definite recommendations have been made on deblossoming sprays. Holbeche (1941) found that 2 per cent "cresol" or 3 per cent tar-oil gave the most satisfactory results in removing an unprofitable crop. Gardner et al. (1939) in endeavoring to thin the apple crop by spraying at bloom period, used at 0.25 per cent to 0.5 per cent concentration, a commercial petroleum oil spray containing 4 per cent 2, 4-dinitro-6-cyclohexylphenol. The treatments were effective and appeared to cause no permanent injury to Duchess, Wealthy and Ontario apple trees. Results of five seasons' experiments by Shepard (1939) showed that 2 per cent cresylic acid and 3 per cent tar-oil were effective in destroying the blossoms of Beach, Champion, Willow Twig, York and Jonathan varieties and