CONTACT-TOXICITY OF AMINOCARB AND OTHER CARBAMATES AGAINST VARIOUS STAGES OF THE SPRUCE BUDWORM

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INTRODUCTION

Spruce budworm continues to be an important insect pest during the seventies. As an on going program against this pest, contact toxicity of carbamate insecticides was evaluated against different stages of laboratory reared spruce budworm and field collected fifth and sixth instar larvae. This report compiles all the data developed from 1972-1977, according to various stages in chronological order for internal use. This data will be further processed for future publication as required.

METHOD AND MATERIAL

(i) Field collected spruce budworm larvae:

Third and fourth instar larvae of spruce budworm were collected in the field from the Ottawa area. The larvae were kept in cold room at 10°C and 70-80% R.H. until they were sorted for different instars. They were provided with young tender buds of white spruce and balsam fir as food. The sorted insects were kept in growth chambers maintained at 20-21°C, 70 ± 2% R.H. and a photoperiod of 16 hours. The larvae were reared to 5th and 6th instars or to pupae as required in the growth chambers. The larval development was delayed at times to coordinate the spray program by lowering the rearing temperatures to 5°C.

(ii) Laboratory reared spruce budworm:

Diapausing second instar spruce budworm larvae were received from Insect rearing section. The larvae were kept first at room temperature (24°C) for 4-5 hours and were then placed inside an environmental chamber at 22°C, 70% R.H. and a 16 hour photoperiod for breaking their diapause. The larvae were transferred onto a synthetic diet poured into creamer cups and were reared inside the environmental chamber operating at the same settings as mentioned above. The various stages of spruce budworm were sorted out from the creamer cups as required.

(iii) Insecticides and their formulations:

The details of insecticide formulations used in this study are given in Table 31. The concentration of each insecticide used is given in the plan of each experiment. The insecticides were diluted from the concentrates with dyed Velsicol AR60 and Mix #1 to the final concentration (Table 31). Dupont oil red (0.5%) was used as a tracer dye.

(iv) Insecticide treatment:

The spraying procedure was very similar to that described by Nigam (1968 and 1969). A modified Potter's tower was calibrated to deliver volumes of dyed insecticide solutions resulting in deposits of 0.1 to 1.0 imperial gallons per acre (1.12 to 11.2 litres per hectare). The calibration of the tower was carried out in time Units (Nigam, 1967); using a microsyringe for the standard deposit on the required surface area (9 cm No. 1

Whatman filter paper circles). The deposits of insecticides were determined by colorimeter method as described by Rayner (1956). Thirty to ninety larvae per dosage in replicate groups of 10 were sprayed to determine contact toxicity. The spray was applied directly onto CO_2 anesthetized larvae placed on Whatman filter paper circles. The pupae were not anesthetized. The deposit was calculated in $\mu g/cm^2$ and used for probit analysis. Two types of controls were used in preliminary studies, re, controls treated with dyed solvents and without solvent treatments. There was no apparent effect of the solvent on the control mortality so controls without solvents were used in the final studies. The details of each experiment are described individually (Experiments 1-19).

(v) Observation and analysis of data:

The larvae were held at 21°C and 55-60% R.H. after treatment and provided with fresh foliage or synthetic diet. Mortality counts were made at 24, 48 and 72 hours after treatment and corrected for control mortality according to Abbott's formula (1925). Probit analysis of the data was carried out according to Finney (1964) using program No. S103 prepared by Statistical Research Science, Canada Department of Agriculture for a Univac 1108 computer and subsequently modified for Fortran. The computer service was provided by Biometric and Computer division of Canada Department of Fisheries and Forestry. The relative potencies of the insecticides were calculated according to Finney (1964) using aminocarb as the standard insecticide.

EXPERIMENTS AND RESULTS

Six types of studies were carried out during this period. The experiments and their results will be discussed under the following headings:

(i) Contact toxicity of Matacil® (aminocarb) to different instars of laboratory reared spruce budworm larvae.

(ii) Effect of synergist on the contact toxicity of Matacil® (aminocarb) against fifth instar laboratory reared larvae.

(iii) Contact toxicity of Matacil® (aminocarb) to laboratory reared and field collected fifth instar larvae.

(iv) Contact toxicity of Matacil® (aminocarb) and Methomyl (Lannate®) to laboratory reared fifth instar larvae.

(v) Contact toxicity of Matacil® (aminocarb) and Zectran® (mexacarbate) against field collected sixth instar spruce budworm larvae.

(vi) Contact toxicity of Matacil® (aminocarb), Methomyl (Lannate®) and Zectran® (mexacarbate) to laboratory reared pupae of spruce budworm.

The plan of each experiment is presented individually (Experiments 1-19) and mortality observed for 24, 48 and 72 hours after treatment are tabulated for each experiment (Tables 1-19). The results of probit analysis for each period of observation are given at the end of each experiment. The comparative contact toxicity at 24, 48 and 72 hours after treatment against larvae or pupae is presented in Tables 20-30.

(i) Contact toxicity of Matacil® (aminocarb) to different instars of laboratory reared spruce budworm larvae:

The experiments 1, 2, and 8 were carried out against second (L_2), third (L_3) and fifth (L_5) instars respectively during 1976 and 1977 to study the differences in their susceptibility. The LD_{50} and LD_{95} data for different periods of observations is summarized in Tables 20, 21 and 25. It is clear from these tables that L_2 were least susceptible to Matacil® as compared to L_3 and L_5. The LD_{50} for 24 to 72 hours of L_2 varied from 0.099-0.091 $\mu g/cm^2$ and that of L_3 and L_5 varied from 0.017-0.011 and 0.031-0.023 $\mu g/cm^2$ respectively. On the basis of these LD_{50} values L_3 are most susceptible followed by L_5. At LD_{95} level susceptibility of L_3 and L_5 is practically the same, while L_2 were approximately 4-6 times more tolerant as compared to L_3 and L_5.

(ii) Effect of synergist on the contact toxicity of Matacil® (aminocarb) against 5th instar laboratory reared larvae:

The experiments 6, 14, 15, 16, 17, 18, 19 were conducted in 1975 using Matacil® technical and three experimental synergists considered to enhance the toxicity of carbamate insecticides. The synergists were GA4-421, GA4-279 and GA4-282. They were tested at 0.001 and 0.005% concentrations. They have not increased the contact toxicity of Matacil® (Table 28-30).

(iii) Contact toxicity of Matacil® (aminocarb) to laboratory reared and field collected fifth instar larvae:

Experiments 3 and 5 were carried out in 1972 using laboratory and field collected fifth instar larvae. The data are summarized in Tables 22 and 23. It appears from LD_{50} values that laboratory larvae were more susceptible than field collected insects, however, at LD_{95} level differences were not very significant.

(iv) Contact toxicity of Matacil® (aminocarb) and methomyl (Lannate®) to laboratory reared fifth instar larvae:

Experiments 6 and 7 were carried out to study the comparative toxicity of Matacil® and methomyl against fifth instar larvae. The data are summarized in Table 24. At LD_{50} level there is no difference in the toxicity of these insecticides however Matacil® is significantly more toxic at LD_{95} level.

(v) Contact toxicity of Matacil® (aminocarb) and Zectran® (mexacarbate) against field collected sixth instar spruce budworm larvae:

Experiments 9 and 10 were carried out to study the comparative contact toxicity of these two insecticides against field collected sixth instar. The data are summarized in Table 26. It appears from this data that there is no significant difference in the toxicity of these two compounds to sixth instar larvae.

(vi) Contact toxicity of Matacil® (aminocarb), methomyl (Lannate®) and Zectran® (Mexacarbate) to laboratory reared pupae of the spruce budworm.

Experiments 11, 12 and 13 deals with the relative toxicity of these three insecticides to the pupae of spruce budworm. Data are summarized in Table 26. It appears from this data that at LD_{50} level Matacil® is least toxic and at LD_{95} level Zectran® is most toxic. There is not significant difference in over all toxicity of these insecticides.

REFERENCES

1. Abbott, W.S. 1925. A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265-267.

2. Finney, D.J. 1964. Probit Analysis Cambridge University Press, London. 318 p.

3. Nigam, P.C. 1968. Laboratory screening of insecticidal compounds for comparative contact toxicity against sawflies and forest tent caterpillar. Can. Dept. For. and Rural Dev., Bi-Mon. Res. Notes 24(1):4-5.

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EXPERIMENT NO. 1

Object: To determine the contact toxicity of Matacil® Technical (Aminocarb) against lab-reared 2nd instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.3%

Replications: Six

No. of Larvae per Treatment: Sixty

Total No. of Larvae Utilized: Six hundred and thirty

Computer Code: SBD MAT (634-636)

Experimental Code: SBD 42, 43, 44-1977

Table No.1

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0250	8/85	9	4	10/84	12	7	12/84	14	5
0.2	0.0484	19/84	23	19	20/84	24	20	22/84	26	19
0.4	0.0922	47/84	56	54	49/84	58	56	50/84	60	56
0.6	0.1447	60/85	71	69	60/85	71	69	62/85	73	70
0.8	0.1955	69/91	76	75	70/91	77	76	75/91	82	80
1.0	0.2414	70/83	84	83	73/83	88	87	75/83	90	89
CONTROL		5/91	5		5/91	5		8/88	9	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	2.62	.099	.087-.112	.4217	.3352-.5824
48 HOURS	2.60	.094	.082-.106	.4016	.3207-.5495
72 HOURS	2.85	.091	.080-.103	.3462	.2823-.4613

Remarks:

EXPERIMENT NO. 2

Object: To determine the contact toxicity of Matacil® Technical (Aminocarb) against lab-reared 3rd instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.05%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBT-MTT (185-187)

Experimental Code: SBT 4-1976

Table No. 2

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0010	0/30	0	0	1/30	3	3	1/29	3	0
0.2	.0050	3/30	10	10	4/30	13	13	4/30	13	10
0.4	.0120	14/30	47	47	18/30	60	60	19/30	63	62
0.6	.0180	21/31	68	68	24/31	77	77	24/30	80	79
0.8	.0260	21/30	70	70	27/30	90	90	27/30	90	90
1.0	.0350	19/30	63	63	22/30	73	73	23/30	77	76
CONTROL		0/30	0		0/30	0		1/30	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	2.08	.016	.012-.020	.097	.059-.241
48 HOURS	2.10	.010	.008-.013	.063	.042-.125
72 HOURS	2.51	.011	.008-.014	.050	.035-.096

EXPERIMENT NO. 3

Object: To determine the contact toxicity of Matacil® (Aminocarb) against lab-reared 5th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.1%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-MAT (97-99)

Experimental Code: SBL 20-1972

Table No. 3

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0050	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.0180	0/30	0	0	0/30	0	0	1/30	3	3
0.4	0.0230	9/30	30	30	14/30	47	47	14/30	4	4
0.6	0.0390	22/29	76	76	23/29	79	79	23/29	79	79
0.8	0.0470	27/30	90	90	27/30	90	90	27/30	90	90
1.0	0.0590	26/30	87	87	28/30	93	93	30/30	100	100
CONTROL		0/30	0	0	0/30	0	0	0/30	0	0

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	5.96	.032	.029-.035	.060	.053-.073
48 HOURS	5.88	.029	.026-.032	.055	.049-.066
72 HOURS	6.32	.028	.025-.031	.050	.043-.065

Remarks:

EXPERIMENT NO. 4

Object: To determine the contact toxicity of Zectran® (Mexacarbate) against lab-reared 5th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.1%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-ZCN (85-87)

Experimental Code: SBL 13-1972

Table No. 4

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0100	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.0180	7/29	24	24	7/29	24	24	7/29	24	24
0.4	0.0330	23/29	79	79	24/29	83	83	24/29	83	83
0.6	0.0390	25/29	86	86	27/29	93	93	27/29	93	93
0.8	0.0500	30/30	100	100	30/30	100	100	30/30	100	100
1.0	0.0600	28/30	93	93	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/30	0	0	0/30	0	0

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	5.50	.025	.021-.027	.049	.042-.060
48 HOURS	7.02	.023	.021-.026	.040	.035-.048
72 HOURS	7.02	.023	.021-.026	.040	.035-.048

EXPERIMENT NO. 5

Object: To determine the contact toxicity of Matacil® (Aminocarb) against field collected 5th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.1%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBT-MAT (82-84)

Experimental Code: SBWT 100 1972 (T = Thunder Bay)

Table No. 5

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.006	0/30	0	0	2/30	7	0	2/30	7	0
0.2	0.0170	0/30	0	0	0/30	0	0	0/30	0	0
0.4	0.0280	6/30	20	20	6/29	21	15	6/29	21	15
0.6	0.0410	15/30	50	50	17/30	57	54	18/30	60	57
0.8	0.0510	24/30	80	80	24/30	80	78	24/30	80	78
1.0	0.0640	29/30	97	97	29/30	97	97	29/30	97	97
CONTROL		0/29	0	0	2/29	7		2/29	7	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	7.19	.039	.036-.042	.066	.059-.077
48 HOURS	8.18	.040	.037-.043	.064	.058-.074
72 HOURS	8.15	.040	.036-.043	.063	.057-.074

Remarks:

EXPERIMENT NO. 6

Object: To determine the contact toxicity of Matacil® Tech. (Aminocarb) against lab-reared 5th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.05%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-MTT (187-189)

Experimental Code: SBL 205-1975

Table No. 6

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0050	0/29	0	0	0/29	0	0	0/29	0	0
0.2	.0090	1/30	3	3	2/30	7	7	3/30	10	10
0.4	.0200	13/30	43	43	14/30	47	47	14/29	48	48
0.6	.0320	27/29	93	93	27/29	93	93	27/29	93	93
0.8	.0420	27/30	90	90	28/30	93	93	28/30	93	93
1.0	.0570	30/30	100	100	30/30	100	100	30/30	100	100
CONTROL		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	5.3591	.021	.018-.023	.042	.035-.053
48 HOURS	5.1191	.019	.016-.022	.040	.034-.052
72 HOURS	4.7762	.018	.016-.021	.041	.034-.053

Remarks:

EXPERIMENT NO. 7

Object: To determine the contact toxicity of Methomyl (Lannate®) against lab-reared 5th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.1%

Replications: Nine

No. of Larvae per Treatment: Ninety

Total No. of Larvae Utilized: six hundred and thirty

Computer Code: SLMET5.DAT

Experimental Code: SBL 132, 139, 152-1975

Table No. 7

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0083	9/90	10	8	19/90	21	19	22/90	24	15
0.2	.0190	43/90	48	47	54/90	60	59	59/90	66	63
0.4	.0377	67/90	74	73	77/90	86	86	79/90	88	87
0.6	.0637	64/90	71	70	69/90	77	76	72/90	80	78
0.8	.0860	78/90	87	87	80/90	89	89	83/90	92	91
1.0	.1147	81/90	90	90	86/90	96	96	88/90	98	98
CONTROL		2/90	2		3/90	3		6/87	7	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	2.07	.026	.015-.037	.161	.094-.541
48 HOURS	1.94	.018	.007-.028	.127	.070-.631
72 HOURS	2.07	.017	.003-.030	.104	.052-2.064

Remarks:

EXPERIMENT NO. 8

Object: To determine the contact toxicity of Matacil® TECHNICAL (Aminocarb) against lab-reared 5th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.05%

Replications: Nine

No. of Larvae per Treatment: Ninety

Total No. of Larvae Utilized: Six hundred and thirty

Computer Code: SBL-MAT (688-690)

Experimental Code: SBL 346, 432, 439-1977

Table No. 8

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0042	1/90	1	0	4/89	4	0	5/89	6	2
0.2	0.0088	3/90	3	1	6/90	7	3	7/90	8	4
0.4	0.0179	25/90	28	27	27/90	30	27	34/90	38	35
0.6	0.0272	40/90	44	43	51/90	57	55	54/90	60	58
0.8	0.0376	49/90	54	53	66/90	73	72	70/90	78	77
1.0	0.0508	70/89	79	79	82/89	92	92	86/90	96	96
CONTROL		2/90	2	2	4/89	4	4	4/89	4	4

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	3.31	.031	.028-.034	.099	.079-.139
48 HOURS	4.23	.026	.023-.028	.063	.054-.078
72 HOURS	4.28	.023	.021-.025	.056	.049-.069

Remarks:

EXPERIMENT NO. 9

Object: To determine the contact toxicity of Matacil® (Aminocarb) against field collected 6th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.1%

Replications: Six

No. of Larvae per Treatment: Sixty

Total No. of Larvae Utilized: Four hundred and twenty

Computer Code: BS MAT 2.DAT

Experimental Code: SBWS 31, 35 - 1972

Table No. 9

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0070	0/59	0	0	1/59	2	0	4/59	7	0
0.2	.0180	2/61	3	1	4/60	7	4	7/60	12	5
0.4	.0390	14/61	23	21	17/61	28	26	18/61	30	25
0.6	.0590	34/60	57	56	36/60	60	59	42/60	70	68
0.8	.0790	47/60	78	78	49/59	83	82	50/59	85	84
1.0	.0990	53/60	88	88	54/60	90	90	54/60	90	89
CONTROL		1/60	2		2/59	3		4/59	7	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	4.82	.055	.051-.060	.122	.106-.147
48 HOURS	4.71	.052	.048-.057	.117	.102-.142
72 HOURS	4.66	.050	.044-.055	.114	.097-.146

EXPERIMENT NO. 10

Object: To determine the contact toxicity of Zectran® (Mexacarbate) against field collected 6th instar Spruce Budworm larvae.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.1%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBS-ZCN (64-66)

Experimental Code: SBWS 26-1972

Table No. 10

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0090	1/30	3	3	1/30	3	3	1/30	3	3
0.2	0.0160	1/30	3	3	2/30	7	7	2/30	7	7
0.4	0.0340	8/30	27	27	8/30	27	27	9/30	30	30
0.6	0.0530	14/30	47	47	14/30	47	47	14/30	47	47
0.8	0.0730	25/30	83	83	25/30	83	83	25/30	83	83
1.0	0.0930	27/30	90	90	27/30	90	90	27/30	90	90
CONTROL		0/29	0	0	0/29	0	0	0/29	0	0

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	3.62	.047	.040-.054	.133	.104-.199
48 HOURS	3.40	.046	.039-.053	.139	.107-.213
72 HOURS	3.36	.045	.038-.053	.139	.107-.213

Remarks:

EXPERIMENT NO. 11

Object: To determine the contact toxicity of Matacil® (Aminocarb) against the pupae of Spruce Budworm.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.6%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: 210

Computer Code: SBP-MAT (280-283)

Experimental Code: SBLP 34-1975

Table No. 11

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0690	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.1100	1/30	3	3	1/30	3	0	1/30	3	0
0.4	0.2390	2/30	7	7	4/30	13	6	7/30	23	14
0.6	0.3700	9/30	30	30	12/30	40	35	18/30	60	56
0.8	0.4860	17/30	57	57	19/30	63	60	23/30	77	74
1.0	0.6520	27/30	90	90	29/30	90	89	29/30	97	97
CONTROL		0/30	0	0	2/30	7	7	3/30	10	10

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	4.77	.430	.381-.490	.952	.757-1.454
48 HOURS	6.21	.426	.374-.475	.783	.655-1.138
72 HOURS	6.11	.359	.307-.402	.667	.566-.920

Remarks:

EXPERIMENT NO. 12

Object: To determine the contact toxicity of Methomyl (Lannate®) against the pupae of Spruce Budworm.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.5%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBP-MET (289-291)

Experimental Code: SBLP 37-1975

Table No. 12

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.0440	3/30	10	10	3/30	10	10	4/30	13	6
0.2	0.0910	10/30	33	33	17/30	57	57	20/20	67	65
0.4	0.1790	21/30	70	70	22/30	73	73	22/30	73	71
0.6	0.2990	22/30	73	73	25/30	83	83	25/30	83	82
0.8	0.3780	22/30	73	73	24/30	80	80	25/30	83	82
1.0	0.4930	24/30	80	80	29/30	97	97	29/30	97	97
CONTROL		0/30	0	0	0/30	0	0	2/30	7	7

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	1.9477	.1507	.1140-.1912	1.054	.6701-2.338
48 HOURS	2.2766	.1079	.0182-.1348	.5696	.4069-.9775
72 HOURS	2.2242	.104		.569	

EXPERIMENT NO. 13

Object: To determine the contact toxicity of Zectran® (Mexacarbate) against pupae Spruce Budworm.

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 1.0%

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBP-ZTN-(302-304)

Experimental Code: SBLP-32-75

Table No. 13

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	0.1190	12/30	40	4	13/30	43	43	16/30	53	46
0.2	0.2270	20/30	67	67	24/30	80	80	26/30	87	85
0.4	0.4010	26/30	83	83	28/30	93	93	29/30	97	97
0.6	0.6100	28/30	93	93	30/30	100	100	30/30	100	100
0.8	0.8310	27/30	90	90	30/30	100	100	30/30	100	100
1.0	1.0040	27/30	90	90	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/30	0	0	4/30	13	13

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	1.86	.139	.076-.195	1.070	.781-2.314
48 HOURS	3.60	.134	.098-.164	.383	.301-.585
72 HOURS	3.86	.126	.084-.158	.336	.261-.558

Remarks:

EXPERIMENT NO. 14

Object: To determine the contact toxicity of Matacil® & GA4-421 against lab-reared 5th instar Spruce Budworm larvae. (Aminocarb and synergist)

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.05% (Aminocarb) + .001% (GA4-421)

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-M21 (202-204)

Experimental Code: SBL 233-1975

Table No. 14

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0040	1/30	3	3	1/30	3	3	2/30	7	7
0.2	.0090	2/30	7	7	2/30	7	7	3/30	10	10
0.4	.0190	10/30	33	33	12/30	40	40	12/30	40	40
0.6	.0270	13/30	43	43	13/30	43	43	15/30	50	50
0.8	.0390	28/30	93	93	29/30	97	97	29/30	97	97
1.0	.0510	29/30	97	97	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/30	0	0	0/30	0	0

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	3.77	.022		.061	
48 HOURS	3.96	.021		.055	
72 HOURS	3.40	.019		.059	

Remarks:

EXPERIMENT NO. 15

Object: To determine the contact toxicity of Matacil® and GA4-421 against lab-reared 5th instar Spruce Budworm larvae. (Aminocarb and synergist)

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.05% (Aminocarb) & .005% (GA4-421)

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-M21 (205-207)

Experimental Code: SBL 237-1975

Table No. 15

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0050	0/30	0	0	0/30	0	0	2/30	7	4
0.2	.0090	0/30	0	0	1/30	3	3	2/30	7	4
0.4	.0180	4/30	13	13	5/30	17	17	5/30	17	14
0.6	.0280	23/30	77	77	25/30	83	83	27/30	90	90
0.8	.0370	25/30	83	83	26/30	87	87	28/30	93	93
1.0	.0460	30/30	100	100	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/30	0	0	1/30	3	3

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	7.56	.024	.022-.027	.040	.036-.049
48 HOURS	6.29	.022	.020-.025	.041	.035-.051
72 HOURS	9.26	.023	.020-.025	.034	.030-.041

Remarks:

EXPERIMENT NO. 16

Object: To determine the contact toxicity of Matacil® and GA4-279 against lab-reared 5th instar Spruce Budworm larvae (Aminocarb and Synergist)

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: .05% (Aminocarb) & .001% (GA4-279)

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL M79 (190-192)

Experimental Code: SBL 234 - 1975

Table No. 16

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0040	0/30	0	0	0/30	0	0	1/30	3	0
0.2	.0090	0/30	0	0	0/30	0	0	2/30	7	4
0.4	.0180	9/30	30	30	10/30	67	67	10/30	67	66
0.6	.0280	28/30	93	93	28/30	93	93	28/30	93	93
0.8	.0380	29/30	97	97	29/30	97	97	29/30	97	97
1.0	.0480	29/30	97	97	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/29	0		1/29	3	3

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	7.10	.021	.018-.023	.035	.031-.043
48 HOURS	8.34	.020	.018-.022	.032	.028-.039
72 HOURS	8.18	.020	.018-.022	.032	.028-.040

Remarks:

EXPERIMENT NO. 17

Object: To determine the contact toxicity of Matacil® & GA4-279 against lab-reared 5th instar Spruce Budworm larvae. (Aminocarb & synergist)

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: .05% (Aminocarb) & .005% (GA4-279)

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-M79 (193-195)

Experimental Code: SBL 238-1975

Table No. 17

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0050	1/30	3	3	1/30	3	3	3/30	10	7
0.2	.0080	0/30	0	0	0/30	0	0	1/30	3	0
0.4	.0170	2/30	7	7	2/30	7	7	2/30	7	4
0.6	.0280	24/30	80	80	25/30	83	83	25/30	83	82
0.8	.0370	27/30	90	90	27/30	90	90	27/30	90	90
1.0	.0480	30/30	100	100	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/30	0		1/30	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	8.82	.024	.022-.026	.037	.033-.043
48 HOURS	8.90	.024	.022-.026	.036	.033-.042
72 HOURS	9.24	.024	.022-.026	.037	.033-.041

EXPERIMENT NO. 18

Object: To determine the contact toxicity of Matacil® & GA4-282 against lab-reared 5th instar Spruce Budworm larvae. (Aminocarb & Synergist)

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: 0.05% (Aminocarb)+.001% (GA4-282)

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL-M82 (196-198)

Experimental Code: SBL 235-1975

Table No. 18

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0060	0/30	0	0	0/30	0	0.00	0/30	0	0
0.2	.0090	0/30	0	0	1/30	3	3	1/30	3	3
0.4	.0190	2/30	7	7	3/30	10	10	4/30	13	13
0.6	.0290	16/30	53	53	18/30	60	60	18/30	60	60
0.8	.0370	26/30	87	8	27/30	90	90	28/30	93	93
1.0	.0470	27/30	90	90	30/30	100	100	30/30	100	100
CONTROL		0/30	0		0/30			0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	7.52	.029	.026-.031	.047	.042-.058
48 HOURS	6.78	.025	.023-.028	.044	.039-.055
72 HOURS	6.74	.025	-	.043	-

Remarks:

EXPERIMENT NO. 19

Object: To determine the contact toxicity of Matacil® & GA4-282 against lab-reared 5th instar spruce budworm larvae (Aminocarb & Synergist)

Plan of Experiment:

Treatments: SEVEN-(six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 GPA and Control)

Concentration of Insecticide: .05% (Aminocarb) + .005% (GA4-282)

Replications: Three

No. of Larvae per Treatment: Thirty

Total No. of Larvae Utilized: Two hundred and ten

Computer Code: SBL M82 (199-201)

Experimental Code: SBL 239-1975

Table No. 19

INSECTICIDE		MORTALITY AFTER								
		24 HOURS			48 HOURS			72 HOURS		
GPA	DOSAGE ug/cm^2	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.	D/T	% MORT.	CORR % MORT.
0.1	.0050	0/30	0	0	1/30	3	3	1/30	3	3
0.2	.0090	1/30	3	3	1/30	3	3	2/30	7	7
0.4	.0170	0/30	0	0	0/30	0	0	2/30	7	7
0.6	.0280	21/30	70	70	23/30	77	77	25/30	83	83
0.8	.0360	21/30	70	70	25/30	83	83	27/30	90	90
1.0	.0460	30/30	100	100	30/30	100	100	30/30	100	100
CONTROL		0/30	0	0	0/30	0	0	0/30	0	0

Findings: The summary of probit analysis is as follows:

Period	b	LD_{50} ug/cm^2	FL	LD_{95} ug/cm^2	FL
24 HOURS	6.44	.026	-	.047	-
48 HOURS	5.25	.023	-	.047	-
72 HOURS	5.03	.021	-	.044	-

Remarks:

Table 20. Toxicity of Insecticides to lab-reared second instar Spruce budworm Larvae (1977)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® Technical (Aminocarb)	630	2.62	.099	.087 - .112		.422	.335 - .582	
			48 Hours After Treatment					
Matacil® Technical (Aminocarb)	630	2.60	.094	.082 - .106		.402	.321 - .550	
			72 Hours After Treatment					
Matacil® Technical (Aminocarb)	630	2.85	.091	.080 - .103		.346	.282 - .461	

Table 21. Toxicity of insecticides to lab-reared third instar spruce budworm larvae (1976)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® Technical (Aminocarb)	210	2.08	.017	.012 - .020		.097	.059 - .241	
			48 Hours After Treatment					
Matacil® Technical (Aminocarb)	210	2.10	.010	.008 - .013		.063	.042 - .125	
			72 Hours After Treatment					
Matacil® Technical (Aminocarb)	210	2.51	.011	.008 - .014		.050	.035 - .096	

Table 22. Toxicity of insecticides to lab-reared fifth instar spruce budworm larvae (1972)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® (Aminocarb)	210	5.96	.032	.029 - .035	1.0	.060	.053 - .073	1.0
Zectran® (Mexacarbate)	210	5.50	.025	.021 - .207	1.28	.049	.042 - .060	1.22
			48 Hours After Treatment					
Matacil® (Aminocarb)	210	5.88	.029	.026 - .032	1.0	.055	.049 - .066	1.0
Zectran® (Mexacarbate)	210	7.02	.023	.021 - .026	1.26	.040	.035 - .048	1.38
			72 Hours After Treatment					
Matacil® (Aminocarb)	210	6.32	.028	.025 - .031	1.0	.050	.043 - .065	1.0
Zectran® (Mexacarbate)	210	7.02	.023	.021 - .026	1.22	.040	.035 - .048	1.25

Table 23. Toxicity of insecticides to field collected fifth instar spruce budworm larvae (1972)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® (Aminocarb)	210	7.19	.039	.036 - .042		.066	.059 - .077	
			48 Hours After Treatment					
Matacil® (Aminocarb)	210	8.18	.040	.037 - .043		.064	.058 - .074	
			72 Hours After Treatment					
Matacil® (Aminocarb)	210	8.15	.040	.036 - .043		.063	.057 - .074	

Table 24. Toxicity of insecticides to lab-reared fifth instar spruce budworm larvae (1975)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® (Aminocarb)	210	5.36	.021	.018 - .023	1.0	.042	.035 - .053	1.0
Methomyl (Lannate®)	630	2.07	.026	.015 - .037	.81	.161	.094 - .541	.26
			48 Hours After Treatment					
Matacil® (Aminocarb)	210	5.12	.019	.016 - .022	1.0	.040	.034 - .052	1.0
Methomyl (Lannate®)	630	1.94	.018	.007 - .028	1.06	.127	.070 - .631	.31
			72 Hours After Treatment					
Matacil® (Aminocarb)	210	4.78	.018	.016 - .021	1.0	.041	.034 - .053	1.0
Methomyl (Lannate®)	630	2.07	.017	.003 - .030	1.06	.104	.052 -2.064	.39

Table 25. Toxicity of insecticides to lab-reared fifth instar spruce budworm larvae (1977)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® (Aminocarb)	630	3.31	.031	.028 - .034	1.0	.099	.079 - .139	1.0
			48 Hours After Treatment					
Matacil® (Aminocarb)	630	4.23	.026	.023 - .028	1.0	.063	.054 - .078	1.0
			72 Hours After Treatment					
Matacil® (Aminocarb)	630	4.28	.023	.021 - .025	1.0	.056	.049 - .069	1.0

Table 26. Toxicity of insecticides to field collected sixth instar spruce budworm larvae (1972)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® (Aminocarb)	420	4.82	.055	.051 - .060	1.0	.122	.106 - .147	1.0
Zectran® (Mexacarbate)	210	3.62	.047	.040 - .054	1.17	.133	.104 - .199	.92
			48 Hours After Treatment					
Matacil® (Aminocarb)	420	4.71	.052	.048 - .057	1.0	.117	.102 - .142	1.0
Zectran® (Mexacarbate)	210	3.40	.046	.039 - .053	1.13	.139	.107 - .213	.84
			72 Hours After Treatment					
Matacil® (Aminocarb)	420	4.66	.050	.044 - .055	1.0	.114	.097 - .146	1.0
Zectran® (Mexacarbate)	210	3.36	.045	.038 - .053	1.11	.139	.107 - .213	.82

Table 27. Toxicity of insecticides to lab-reared pupae of spruce budworm larvae (1975)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® (Aminocarb)	210	4.77	.430	.381 - .490	1.0	.952	.757 - 1.459	1.0
Methomyl (Lannate®)	210	1.95	.151	.114 - .191	2.84	1.054	.670 - 2.338	.90
Zectran® (Mexacarbate)	210	1.86	.139	.076 - .195	3.09	1.070	.718 - 2.314	.89
			48 Hours After Treatment					
Matacil® (Aminocarb)	210	6.21	.426	.374 - .475	1.0	.783	.655 - 1.138	1.0
Methomyl (Lannate®)	210	2.28	.108	.081 - .135	3.94	.570	.407 - .978	1.37
Zectran® (Mexacarbate)	210	3.60	.134	.098 - .164	3.17	.383	.301 - .585	2.04
			72 Hours After Treatment					
Matacil® (Aminocarb)	210	6.11	.359	.307 - .402	1.0	.667	.566 - .920	1.0
Methomyl (Lannate®)	210	2.22	.104	----------	3.45	.569	----------	1.17
Zectran® (Mexacarbate)	210	3.86	.126	.085 - .158	2.85	.336	.261 - .558	1.99

Table 28. Toxicity of insecticides to lab-reared fifth instar spruce budworm larvae (1975)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			24 Hours After Treatment					
Matacil® & GA4-421[1,2]	210	3.77	.022	-	.95	.061	-	.69
Matacil® & GA4-321[1,3]	210	7.56	.024	.022 - .027	.88	.040	.036 - .049	1.05
Matacil® & GA4-279[1,2]	210	7.10	.021	.018 - .023	1.0	.035	.031 - .043	1.20
Matacil® & GA4-279[1,3]	210	8.82	.024	.022 - .026	.88	.037	.033 - .043	1.14
Matacil® & GA4-282[1,2]	210	7.52	.029	.026 - .031	.72	.047	.042 - .058	.89
Matacil® & GA4-282[1,3]	210	6.44	.026	-		.047	-	.89
Matacil® (Aminocarb) (1975)	210	5.36	.021	.018 - .023	1.0	.042	.035 - .053	1.0

[1]Aminocarb & synergist

[2]Synergist at .001%

[3]Synergist at .005%

Table 29. Toxicity of insecticides to lab-reared fifth instar spruce budworm larvae (1975)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
			48 Hours After Treatment					
Matacil® & GA4-421[1,2]	210	3.96	.021	-	.90	.055	-	.73
Matacil® & GA4-421[1,3]	210	6.29	.022	.020 - .025	.86	.041	.035 - .051	.98
Matacil® & GA4-279[1,2]	210	8.34	.020	.018 - .022	.95	.032	.028 - .039	1.25
Matacil® & GA4-279[1,3]	210	8.90	.024	.022 - .026	.79	.036	.033 - .042	1.11
Matacil® & GA4-282[1,2]	210	6.78	.025	.023 - .028	.76	.044	.039 - .055	.91
Matacil® & GA4-282[1,3]	210	5.25	.023	-	.83	.047	-	.85
Matacil® (Aminocarb) (1975)	210	5.12	.019	.016 - .022	1.0	.040	.034 - .052	1.0

[1]Aminocarb & Synergist

[2]Synergist at .001%

[3]Synergist at .005%

Table 30. Toxicity of insecticides to lab-reared fifth instar spruce budworm larvae (1975)

Insecticide	No. of Insects	Slope	LD_{50} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity	LD_{95} $\mu g/cm^2$	Fiducial Limits	Relative Toxicity
				72 Hours After Treatment				
Matacil® & GA4-421[1,2]	210	3.40	.019	-	.95	.059	-	.69
Matacil® & GA4-421[1,3]	210	9.26	.023	.020 - .025	.78	.034	.030 - .041	1.21
Matacil® & GA4-279[1,2]	210	8.18	.020	.018 - .022	.90	.032	.028 - .040	1.28
Matacil® & GA4-279[1,3]	210	9.24	.024	.022 - .026	.75	.037	.033 - .041	1.11
Matacil® & GA4-282[1,2]	210	6.74	.025	-	.72	.043	-	.95
Matacil® & GA4-282[1,3]	210	5.03	.021	-	.86	.044	-	.93
Matacil® (Aminocarb) (1975)	210	4.78	.018	.016 - .021	1.0	.041	.034 - .053	1.0

[1]Aminocarb & Synergist

[2]Synergist at .001%

[3]Synergist at .005%

Table 31. Insecticides and their formulation

Year	Insecticide & Commercial Formulation	Type	Date Rec'd.	Laboratory Formulation (1.0% Stock Solution)	Source	Insect Code.
1972	Matacil 34% ULV	Carbamate	April 13/70	2.94 cc + 97.06 cc AR-60	Chemagro	SBW SBWS SBLP
1975	Matacil Tech. 99%	Carbamate	Feb. 3/70	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro	SBL SBLP
1975	Matacil Tech. 99% + .001% GA4-279	Carbamate Synergist	Jan. 8/75	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro Ciba-geigy	"
1975	Matacil Tech. 99% + .001% GA4-282	Carbamate Synergist	Feb. 3/70 Jan. 8/75	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro Ciba-geigy	"
1975	Matacil Tech. 99% + .001% GA4-421	Carbamate Synergist	Feb. 3/70 Jan. 8/75		Chemagro Ciba-geigy	"
1975	Matacil Tech. 99% + .005% GA4-279	Carbamate Synergist	Feb. 3/70 Jan. 8/75	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro Ciba-geigy	"
1975	Matacil Tech. 99% + .005% GA4-282	Carbamate Synergist	Feb. 3/70 Jan. 8/75	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro Ciba-geigy	
1975	Matacil Tech. 99% + .005% GA4-421	Carbamate Synergist	Feb. 8/70 Jan. 8/75	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro Ciba-geigy	"
1976	Matacil Tech. 99%	Carbamate	Feb. 3/70	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro	SBA SBLD SBT
1977	Matacil Tech. 99%	Carbamate	May 25/77	1g A.I. in 20% Mix #1 + 80% AR-60	Chemagro	SBL SBLD SBT SLA

Mix #1:

40% Xylene
30% Acetone
20% AR-60
10% Tween 80

1972	Zectran 92% Tech.	Carbamate	Jan. 14/71	1.09g A.I. + AR-60 to 100 cc Level	Dow	SBT SBWS SBL SBLS
1974	Zectran 93.3% Tech.	Carbamate	Apr. 13/73	1.07g A.I. + AR-60 to 100 cc Level	Dow	SBLP
1975	Zectran 93.3% Tech.	Carbamate	Apr. 13/73	1.07g A.I. + AR-60 to 100 cc Level	Dow	SBLP
1974	Lannate 99% Tech.	Carbamate	Jan. 21/70	5.05g A.I. in 25 cc Mix #1 + 75cc AR-60	Dupont	SBLP
1975	Methomyl 99% Tech.	Carbamate	Jan. 21/70	5.05g A.I. in 25 cc Mix #1 + 75 cc AR-60	Dupont	SBLP