REPORT OF THE 1981 COOPERATIVE

BACILLUS THURINGIENSIS (B.I.) SPRAY TRIALS

O. N. MORRIS

FOREST PEST MANAGEMENT INSTITUTE

SAULT STE. MARIE, ONTARIO

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MORRIS, O.N. 1982. Report of the 1981 Cooperative *Bacillus Thuringiensis* (*B.t.*) Spray Trials. Forest Pest Management Institute, Can. For. Serv., Sault Ste. Maire, Ontario FPM-X-58.

ABSTRACT

A total of 79 378 hectares of balsam fir and white, red and black spruce stands were treated with *B.t.* in 1981 using the registered products Thuricide 16B®, Thuricide 32B® and Dipel 88 (4L)®, and to a limited extent, the experimental formulations, Thuricide 32BX, Thuricide 24B and Futura 64B. Based on the proportions of treated areas reported as acceptably protected (50% or less defoliation), the overall success rate of registered *B.t.* products ranged from 88% to 100%. Success rates in white, red and black spruce stands ranged from 85% to 100% but population densities were generally low in these stand types. The overall success rate in the more vulnerable balsam fir stands with moderate to high larval populations was 88%, representing an improvement in *B.t.* effectiveness over the 1979-1980 treatments which was 70%.

Analysis of the 1981 data indicated the following trends: 1. An operational dosage rate of 20 BIU/ha produces inconsistent results in terms of effectiveness. The application rate of 30 BIU/ha was consistently effective. 2. Ground deposit rates lower than 25 droplets/ cm^2 produce inconsistent results. 3. Operational dosage rates of conventional chemical pesticides are only slightly more effective than *B.t.* applied at 30 BIU/ha.

Recommendations for future work include development of a quantitative foliage deposit technique, dosage and volume response relationships, increased potency of commercial products, integration of *B.t.* with other pest control agents and formulation of new guidelines for *B.t.* use.

Morris, O.N. Rapport sur les essais coopératifs de pulvérisations de *Bacillus thuringiensis* de (*B.t.*) en 1981. Environ. Can., Can. For. Serv., For. Pest. Man. Inst. Inf. Rep. RPM-X-58.

RÉSUMÉ

En 1981, 79 378 ha de peuplements de sapin baumier, d'épinette blanche, d'épinette rouge et d'épinette noire ont été traités au *B.t.*, sous les formes homologuées Thuricide 16B®, Thuricide 32B® et Dipel 88® (4L), et, sur des surfaces restreintes, sous les formes expérimentales Thuricide® 32 BX, Thuricide 24B et Futura 64B. D'après le porucentage des superficies traitées reconnues comme ayânt été convenablement protégées (50% ou moins de défoliation), dans l'ensemble, l'efficacité des produits homologués variait de 88 à 100%. Pour les peuplements d'épinettes, le taux variait de 95 à 100%, mais les populations d'insectes y étaient généralement faibles. Pour les peuplements de sapin, plus vulnérables et où les populatins larvaires étaient de modérées à élevées, l'efficacité a été de 87% comparativement à 70% en 1979-1980- ce qui dénote une amélioration.

L'analyse des données a révélé les tendances suivantes: (1) l'efficacité d'une dose opérationnelle de 20 x 10^9 U.I./ha est variable tandis qu'elle est constante à 30 x 10^9 U.I./ha; (2) au sol, des dépôts inférieurs à 25 goutelettes/cm^2 donnent des résultats erratiques; (3) l'efficacité des doses opérationnelles des pesticides chimiques classiques n'est que légèrement supérieure à celle de 20 x 10^9 U.I. de *B.t.*/ha et elle est similaire à celle de 30 x 10^9 U.I./ha.

Pour les travaux à venir, on recommande de mettre au point une technique quantitative d'application sur le feuillage, de comparer l'efficacité en fonction du dosage et du volume, d'augmenter la force des produits commerciaux, d'employer le *B.t.* avec d'autres anti-parasitaires et de formuler de nouveaux modes d'emploi du *B.t.*

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INTRODUCTION

From 1979 to 1981 inclusive, operational and experimental field trials of *Bacillus thuringiensis* were conducted against the spruce budworm, *Choristoneura fumiferana* (Clem.) in eastern Canada and the U.S.A. using common technical guidelines previously formulated by both countries. The area of spruce-fir stands treated totalled 44 499 hectares in 1979, 100 413 hectares in 1980 and 79 378 hectares in 1981, including 365 hectares in Manitoba. The main aim of the trials was to limit defoliation to 50% of the current year's growth.

Based on the proportions of the treated areas acceptably protected, *B.t.* success rates during 1979 and 1980 combined were 90% on white spruce, *Picea glauca*, 97% on red/black spruce, *Picea rubens/ Picea mariana* and 70% on balsam fir, *Abies balsamea*. The 1980 data from Quebec indicated that *B.t.* was no less effective than fenitrothion, and data from Maine indicated that, in cases where *B.t.* failed to give satisfactory results, Seven-4-oil also performed poorly when applied at the same time and in the same geographical area.

The present report summarizes the results of the 1981 trials in Ontario, Quebec, Nova Scotia, Newfoundland, Maine and, for the first time, Manitoba. The data are analyzed to show overall success rates of *B.t.* by jurisdiction, product and tree species, trends of efficacy in relation to dosage applied, ground level droplet density, current year's shoot density and larval density. In addition, the costs of materials and application are presented by jurisdiction and the efficacies of *B.t.* and conventional chemical pesticides in Ontario, Quebec and Maine spray trials are compared.

EFFICACY OF 1981 B.T. TRIALS

Ontario: J.R. Carrow

In Ontario, 23 202 hectares of mixed white spruce- black spruce-balsam fir stands were treated with Thuricide 16B®, Thuricide 32BX and Dipel 88®, mostly as single applications of 13-20 BIU/ha (Table 1). Pre-spray population densities were very low in nearly all treatment plots and, consequently, the overall effectiveness of the trials is difficult to assess. There were, however, four balsam fir plots with 6-15 larvae per 45-cm branch which were acceptably protected with *B.t.* Four out of five white spruce plots with 9-18 larvae per branch were also protected satisfactorily.

FPMI - O.N. Morris

FPMI investigated the relationship between dosage rate applied and efficacy of Thuricide 32BX and Dipel 88® applied at 10, 20, 40 and 80 BIU/ha. In addition, the efficacy of double versus single applications of both products was compared (Table 2).

The following conclusions were drawn from the results. 1. Efficacy increases with dosage rate applied between 10 and 40 BIU/ha in terms of population density reduction, but levels off above 40 BIU/ha. A dosage rate of 20 BIU/ha is sub-optimal for consistently acceptable insect kill. Reduction in weight of surviving larvae is proportional to dosage applied. 2. Dipel® applied at rates up to 80 BIU/ha had no significant deleterious effect on budworm parasites. 3. The efficacy of *B.t.*, in terms of foliage preservation on balsam fir, generally increased with dosage applied. The most effective economical dosage tested ranged between 20 and 40 BIU/ha. 4. Under the conditions of the test, there was no advantage to double applications over a single application of the same dosage. 5. It appears that an increase in operational dosage rate from 20 to 30 BIU/ha would give more consistently acceptable results when *B.t.* is applied against the spruce budworm.

Quebec - L. Dorais and M. Pelletier

In Quebec, Thuricide 32B®, Dipel 88® and Futura 64B were applied against population densities of 11, 24 and 16 larvae per 45-cm branch respectively, in balsam fir stands (Table 3). The areas treated were 1 875 ha, 12 188 ha and 938 ha respectively. Thuricide® applied at 5.9 ℓ/ha and Dipel® applied at 7.0 ℓ/ha both produced satisfactory results. Futura applied at 2.34 ℓ/ha produced unsatisfactory results, reportedly as a result of improper aircraft calibration.

Nova Scotia - T.D. Smith

Nova Scotia treated a total of 31 916 ha of red, white and black spruce, and balsam fir with Thuricide 16B® (24 703 ha), Dipel 88® and Dipel® plus Thuricide 16B® (7 213 ha), including regeneration and cone production areas (Table 4). Population densities were very low on white spruce and balsam fir and only moderate (17-19 larvae/45-cm branch) on red spruce. Of the 25 treatment plots, 3 balsam fir treatment areas and two white spruce cone producing areas were considered unacceptably protected despite the apparently low population densities and a 20-40 BIU/ha application rate. Since deposit rates for these areas were not recorded, the failures cannot be explained.

Newfoundland - N.E. Carter

Newfoundland treated 1 200 ha with Dipel 88® and 720 ha with Thuricide 16B®, both at 20 BIU/ha. Population densities in the balsam fir treatment plots were 20 and 12 larvae/45-cm branch respectively. Because of a natural population collapse, it was not possible to demonstrate any significant larval mortality or foliage protection due to treatment (Table 5).

Maine - H. Trial Jr.

Maine treated a total of 17 424 hectares of mixed red spruce and balsam fir stands with Dipel 4L (Dipel 88®): 2 413 ha were sprayed at 2 x 20 BIU/ha, 8 256 ha at 30 BIU/ha and the remainder at 20 BIU/ha (Table 6). In addition, 2 038 ha were treated at 20 BIU/ha of Thuricide 16B® and 3 740 ha at 30 BIU/ha of Thuricide 24B. Population densities were moderate-to-high (5038/45-cm branch) on balsam fir and moderate on red spruce (8-24 per branch). The data show generally that balsam fir trees sprayed at the rate of 20 BIU/ha were not satisfactorily protected, but those sprayed at 30 BIU/ha were. All the red spruce treatments gave satisfactory results. These data support the 1981 FPMI conclusion that a 20 BIU/ha dosage rate is sub-optimal for spruce budworm control.

Manitoba - K. Knowles

Manitoba treated 365 ha of mixed white spruce and balsam fir stands in Riding Mountain Park with Dipel 88® at 20 BIU/ha with satisfactory results (Table 7).

COST ESTIMATES

The average cost of materials and application in 1981 varied widely between jurisdictions (Table 8). The reason for this is unclear. The relatively high cost in Manitoba may be partially due to the small size of the operation.

DISCUSSION

B.t. Success Rates by Jurisdiction

The overall success rates of *B.t.* treatments in 1981, based on area protected, ranged from 70% to 100% in Canada and was 62% in Maine (Table 9). If the 40 hectares of the FPMI experimental trials which were treated at 10 BIU/ha (i.e. 1/2 the operational rate) are excluded, the success rate becomes 88%. The success rate within the

20-40 BIU/ha dosage range was 100%. The success rate in Maine, based on area protected, was relatively low, although five of their eight treatments fell well within the established criteria of success. Red spruce in the other three plots was well protected, but balsam fir carrying high larval populations was not (Table 6). The overall success rate for *B.t.* in 1981 showed an improvement over that in 1979 and 1980 combined (Morris 1981).

B.t. Success Rates by Product

Based on the percentage of treated area acceptably protected, there was no substantial difference in efficacy between commercial Dipel 88® and Thuricide 16B®. The experimental product Futura 64B, applied only in Quebec, was not effective under the conditions of their experiment (Table 10). The registered products above performed somewhat better in 1981, with success rates of 93% and 88% respectively, than in 1979 and 1980 combined, with success rates of 71% and 69% respectively (Morris 1981).

B.t. Success Rates by Tree Species

The data on overall success rates by tree species (Table 11) showed that 85% of the white spruce and 88% of the balsam fir, 93% of red spruce treatments and all treatments on black spruce were successful in 1981. This represents a marked improvement over the 1980 rates, viz 67% and 53%, for white spruce and balsam fir. Based on the percentage of treated area acceptably protected, the success rates on white spruce and red and black spruce were similar to the 1979 and 1980 rates combined, but the success rate on balsam was 20% higher in 1981 than in 1979-1980 treatments (Morris 1981). The high success rate in 1981 is partly attributable to low larvae population densities.

Trend in B.t. Efficacy Relative to Dosage Applied

The relationship between dosage applied and efficacy is difficult to assess since the applied dosage rate may have no direct bearing on the deposit rate of active ingredient at the feeding site. Nevertheless, the data submitted by cooperators permitted an estimation of this relationship in balsam fir stands (Table 12). The data show a success rate of 81% at the 20-24 BIU/ha rate compared with 100% success at 30 BIU/ha and above. The combined 1979-1980 results (Morris 1981) show 62% success at 20 BIU/ha and 92% success at 30 BIU/ha. These data tend to confirm the hypothesis that the commonly-used operational dosage rate of 20 BIU/ha applied by most cooperators is marginal in effectiveness.

Trend in B.t. Efficacy in Relation to Ground Level Deposit Rate (Droplets/cm^2)

It is generally accepted that ground deposit rates bear little direct relationship to deposit at the feeding site. Nevertheless, a trend was apparent in white spruce and balsam fir stands, indicating that ground deposit rates below 20 droplets/cm^2 were ineffective in protecting the foliage on trees with moderate budworm population densities (Table 13). The high success rate of treatments among balsam fir stands receiving 8 droplets/cm^2 is mainly due to the low larval densities in these plots. The evidence from the 1981 data corroborates that of the 1979 and 1980 combined data, where droplet densities below 21 drops/cm^2 proved ineffective in balsam fir stands (Morris 1981).

Trend in B.t. Efficacy in Relation to Pre-Spray Population Density

The 1981 data (Table 14) show an inverse relationship between pre-spray population density and *B.t.* effectiveness in balsam fir stands. This trend is similar to that generated from the combined 1979 and 1980 data (Morris 1981). Unfortunately, insufficient data was collected in white spruce stands to indicate any meaningful relationship.

Trend in B.t. Efficacy Relative to Current Year's Shoot Density

No direct relationship was detected between efficacy and shoot density or shoot/larva ratio in white spruce treatment plots (Table 15). This may be due in part to the generally low larval densities and extreme variations in densities between plots. There was, however, a direct relationship between shoot/larvae density in balsam fir stands, and *B.t.* efficacy, corroborating the results obtained in the combined 1979 and 1980 treatments (Morris 1981).

Comparative Efficacy of B.t. and Conventional Chemical Pesticides in Three Geographic Locations

The effectiveness of *B.t.* compared with conventional chemical pesticides for spruce budworm control has been questioned in the past but, to-date, the data from operational use of both products have not permitted a reasonable comparison. For such a comparison to be legitimate, both products should be applied in the same year and in the same geographical location. Cost-benefit comparisons are also necessary, but are beyond the scope of this report and the capability of the author.

Data on the comparative efficacy of *B.t.* and chemical pesticides from operational sprays in 1980 and 1981 are presented in Tables 16, 17 and 18. The Ontario data (Table 16) show that, in both white spruce and balsam fir stands, the chemical pesticides Matacil® and Orthene® were consistently only slightly superior to *B.t.*, based on the ratios of percent defoliation to pre-spray larval densities. The *B.t.* dosage rate was nearly always 20 BIU/ha in these operations. The Quebec data (Table 17) indicate a reverse trend, in that the *B.t.* treatments tended to be slightly more effective than treatments of Matacil® and fenitrothion on balsam fir stands. In Maine (Table 18), the efficacy of operational dosage rates of Sevin-4-Oil® and Orthene® were consistently superior to *B.t.* applied at 20 BIU/ha in balsam fir stands. However, when *B.t.* was applied at 30 BIU/ha, the levels of effectiveness of the chemical pesticides and *B.t.* were similar. The overall efficacy of *B.t.* at 20 BIU/ha was similar to that of the chemical insecticides in red spruce stands and superior to the chemical pesticides when applied at 30 BIU/ha.

The data from the three jurisdictions indicate that operational dosage rates of conventional chemical pesticides are only slightly more effective than 20 BIU/ha of *B.t.* for spruce budworm control and similar in effectiveness to *B.t.* applied at 30 BIU/ha. Considering the environmental safety of the biological and inspite of its high cost, one must conclude from the three-year cooperative study that *B.t.* is an effective alternative to chemical pesticides and that it should be widely used, especially in environmentally sensitive forest areas.

RECOMMENDATIONS FOR FUTURE RESEARCH

1. A quantitative method is required for measuring deposit of *B.t.* on foliage so that deposit rate can more accurately be correlated with treatment efficacy. Research in this area should be considered a high priority.

2. Dosage and volume response relationships should be established for various tree types and population densities in order to provide forest managers with cost-benefit options.

3. A major effort in increasing the potency of commercial strains of *B.t.* and/or in formulating more highly concentrated products in order to reduce transport costs and applied volume of spray mixes is justified.

4. The integrated use of *B.t.* with other types of pest control agents in the management of forest insect pests requires concerted exploration.

5. A new set of guidelines for the use of *B.t.* in spruce budworm control is now justifiable.

REFERENCES

MORRIS, O.N. 1981. Report of the 1980 cooperative *Bacillus thuringiensis* (*B.t.*) spray trials. Can. For. Serv. Rept. #FPM-X-48, 74 pp.

Table 1

Efficacy of 1981 *B.t.* Trials - Ontario Ministry of Natural Resources

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red.	Defol.	Protection
THURICIDE 16B	wS 4	13 (1)	-	9	44
	bS 1		-	5	50
THURICIDE 16B	wS 18	20 (1)	-	63	1
	bF 7		-	37	56
THURICIDE 16B	wS 1	20 (1)	-	4	42
THURICIDE 16B	wS 7	20 (1)	-	9	80
THURICIDE 16B	wS 14	20 (1)	-	59	0
THURICIDE 16B	wS 2	16 (2)	-	4	82
	bF 1		-	1	97
THURICIDE 16B	wS 2	16 (1)	-	4	82
	bF 1		-	1	97
THURICIDE 16B	wS 1	20 (1)	-	1	67
THURICIDE 16B	wS 1	20 (1)	-	1	50
THURICIDE 16B	bS 1	13 (1)	-	0	100
DIPEL 88	wS 9-25	20 (1)	-	2-30	0-78
	bS 15	20 (1)	-	2-30	0-78
DIPEL 88	wS 11	20 (1)	-	1	89
	bS 1		-	1	90
DIPEL 88	wS 16	24 (1)	-	7	75
	bF 7		-	2	94
DIPEL 88	wS 6	20 (1)	-	10	54
	bF 3		-	4	88
THURICIDE 32 BX	wS 17	20 (1)	-	25	14
	bF 6		-	3	90

(-) Data not available.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State: Ontario
2. Area - acres (ha) 81 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 1 (bS) 4 (wS)
5. Pre-spray bud density (per m^2) 99 (bS), 127 (wS)
6. Spray time larval development L_3-L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 13 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 6.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used one Bell 47 Helicopter
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species bS
17. Date spray started June 17
18. Date spray finished June 17
19. Met conditions at spray time satisfactory
20. Met conditions following spray (rain?) satisfactory
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $40.77/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 5/10 (bS), 9/16 (wS)
25. Percentage foliage protection [c] 50% (bS), 44% (wS), marginally acceptable
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 670 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 18 (wS), 7 (bF)
5. Pre-spray bud density (per m^2) 273 (wS), 110 (bF)
6. Spray time larval development peak L_5 (wS), peak L_4 (bF)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used Rhodamine B
11. Applied volume rate/acre (ha) 7.2 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Two Ag-Trucks
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species wS, bF
17. Date spray started June 10
18. Date spray finished June 12
19. Met conditions at spray time satisfactory
20. Met conditions following spray (rain?) satisfactory
21. Deposit rate 10 colonies/cm^2 (Millipore)
22. Cost/acre (ha) - optional [a] $24.08/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 63/64 (wS), 33/77 (bF)
25. Percentage foliage protection [c] < 1% (wS), 56% (bF), acceptable - bF
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 2.5
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 1 (wS)
5. Pre-spray bud density (per m^2) /18" branch 113 (wS)
6. Spray time larval development peak L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used One Bell 47 Helicopter
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species wS
17. Date spray started June 10
18. Date spray finished June 10
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Light drizzle within 2 hours or spray, lasted 1 hour (not detrimental).
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $45.73/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 4/7 (wS)
25. Percentage foliage protection [c] 42% acceptable, in consideration of pop'n levels.
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 123 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 7 (wS)
5. Pre-spray bud density (per m^2) 138 (wS)
6. Spray time larval development peak L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Bell 47 Helicopter
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species wS
17. Date spray started June 7
18. Date spray finished June 7
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Rain 24 hours after application
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $45.73/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 9/45 (wS)
25. Percentage foliage protection [c] 80% (wS) acceptable
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 97
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 14 (wS)
5. Pre-spray bud density (per m^2) /18" branch 161 (wS)
6. Spray time larval development L_3-L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used one Bell 47 Helicopter
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species wS
17. Date spray started June 7
18. Date spray finished June 7
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Rain 24 hours after application.
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $45.73/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 59/45 (wS)
25. Percentage foliage protection [c] 0% (wS) unacceptable
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 262 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 0.7 9bF), 1.7 (wS)
5. Pre-spray bud density (per m^2)/18" branch 117 (bF), 138 (wS)
6. Spray time larval development peak L_4
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 16 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 6.2 l/ha
12. Number of applications Two
13. Time between applications (days) 3 days
14. Aircraft type used 3 Grumman Ag Cats
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species bF, wS
17. Date spray started June 17
18. Date spray finished June 20
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $33.44/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 1/34 (bF), 4/22 (wS)
25. Percentage foliage protection [c] 97% (bF), 82% (wS)
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 1731
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 0.7 (bF), 1.7 (wS)
5. Pre-spray bud density (per m^2)/18" branch 117 (bF), 138 (wS)
6. Spray time larval development peak L_4
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 16 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 6.2 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used 3 Grumman Ag Cat
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species bF, wS
17. Date spray started June 14
18. Date spray finished June 17
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $16.71/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 1/34 (bF), 4/22 (wS)
25. Percentage foliage protection [c] 97% (bF), 82% (wS) acceptable
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 89 ha
3. Status - operational or experimental
4. Pre-spray larval density/14" branch 1 (wS)
5. Pre-spray bud density (per m^2) /14" branch 50 (wS)
6. Spray time larval development peak L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used one Bell 47 Helicopter
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species wS
17. Date spray started June 12
18. Date spray finished June 12
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Light drizzle within 2 hours of spray. Lasted 1 hr (not detrimental)
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $45.73/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 1/3
25. Percentage foliage protection [c] 67% acceptable, in consideration of pop'n levels
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 32.5 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 1 (wS)
5. Pre-spray bud density (per m^2) /1.5 m tree 269 (wS)
6. Spray time larval development peak L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used One Bell 47 Helicopter
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species wS
17. Date spray started June 14
18. Date spray finished June 14
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Light dirzzle within 2 hours of spray Lasted 1 hr. (not detrimental).
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $45.73/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 1/a
25. Percentage foliage protection [c] 50% acceptable, in consideration of pop'n levels.
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 385 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 1 (bS)
5. Pre-spray bud density (per m^2)/18" branch 111 (bS)
6. Spray time larval development L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 16B
9. BIU applied/acre (ha) 13 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 6.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used 2 Bell 47 Helicopters
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species bS
17. Date spray started June 19
18. Date spray finished June 20
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $40.77/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 0/3
25. Percentage foliage protection [c] 100% acceptable
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 1099
3. Status - operational or experimental
4. Pre-spray larval density/18" branch avg. 9-25 (wS), 15 (bS)
5. Pre-spray bud density (per m^2)/18" branch avg. 122 (wS), 131 (bS)
6. Spray time larval development peak L_4
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Dipel 88
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used Rhodamine B
11. Applied volume rate/acre (ha) 5.9 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Two Ag-Trucks
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species wS
17. Date spray started June 7
18. Date spray finished June 9
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Light drizzle began two hours after Dipel application.
21. Deposit rate 25 colonies/cm^2 (Millipore)
22. Cost/acre (ha) - optional [a] $24.08/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 2-30/9
25. Percentage foliage protection [c] 0-78%, range of acceptability
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 862 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 1 (bS), 11 (wS)
5. Pre-spray bud density (per m^2)/18" branch 56 (bS), 81 (wS)
6. Spray time larval development peak L_4
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Dipel 88
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used Rhodamine B
11. Applied volume rate/acre (ha) 2.4 l/ha (neat)
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Two Ag-Trucks
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species bS
17. Date spray started June 9
18. Date spray finished June 10
19. Met conditions at spray time satisfactory
20. Met conditions following spray (rain?) Heavy rain after part application
21. Deposit rate 30 colonies/cm^2 (Millipore)
22. Cost/acre (ha) - optional [a] $24.08/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 1/10 (bS), 1/9 (wS)
25. Percentage foliage protection [c] 90% (bS), 89 (wS), acceptable
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 296 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 7.2 (bF), 15.9 (wS)
5. Pre-spray bud density (per m^2)/18" branch 139 (bF), 193 (wS)
6. Spray time larval development L_3-L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Dipel
9. BIU applied/acre (ha) 24 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.0 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Piper Pawnee
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle
16. Predominant tree species bF
17. Date spray started June 2
18. Date spray finished June 2
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 8 colonies/cm^2 (Millipore)
22. Cost/acre (ha) - optional [a] $32.79/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 2/31 (bF), 7/29 (wS)
25. Percentage foliage protection [c] 94% (bF), 75% (wS) acceptable
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 846 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 3.4 (bF), 5.6 (wS)
5. Pre-spray bud density (per m^2)/18" branch 103 (bF), 134 (wS)
6. Spray time larval development peak L_4 (wS, bF)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Dipel 88
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 5.9 l/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used 3 Grumman Ag Cat
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species bF, wS
17. Date spray started June 13
18. Date spray finished June 13
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $21.44/ha
23. Percentage control [b]
24. Percent defoliation (treated/check) 4/34 (bF), 10/22 (wS)
25. Percentage foliage protection [c] 88% (bF), 54% (wS) acceptable
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario
2. Area - acres (ha) 324 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 5.5 (bF), 17.4 (wS)
5. Pre-spray bud density (per m^2)/18" branch 140 (bF), 197 (wS)
6. Spray time larval development L_3-L_4 (est.)
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Thuricide 32 BX
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 4.7 l/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Stearman
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species bF
17. Date spray started June 2
18. Date spray finished June 2
19. Met conditions at spray time Satisfactory
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 8 colonies/cm^2 (Millipore)
22. Cost/acre (ha) - optional [a] n/a
23. Percentage control [b]
24. Percent defoliation (treated/check) 3/31 (bF), 25/29 (wS)
25. Percentage foliage protection [c] 90% (bF) acceptable, 14% (wS) not acceptab
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 2

Efficacy of 1981 *B.t.* Trials - FPMI Ontario

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red.	Defol.	Protection
THURICIDE 32BX	bF 16	10 (1)	57	69	14
	bF 12	20 (1)	92	45	44
	bF 16	40 (1)	97	36	55
	bF 36	80 (1)	99	61	24
	bF 20	40 (2)	81	35	56
DIPEL 88	bF 19	10 (1)	80	71	11
	bF 18	20 (1)	98	24	70
	bF 25	40 (1)	99	39	51
	bF 18	80 (1)	96	37	54
	bF 18	20 (2)	91	35	56

Data for Each Spray Block Requested for CANUSA Report

1. Province or State: Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 15/100 shoots; 16/br.; Check: 18, 14, res
5. Pre-spray bud density (per m^2): 1366/m^2; 106/45 cm br.
6. Spray time larval development Index 3.7
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Thuricide 32BX
9. BIU applied/acre (ha) -10/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronair AU 3000
16. Predominant tree species bF
17. Date spray started May 31
18. Date spray finished May 31
19. Met conditions at spray time Temp. °C, 21-22; RH 59%, Wind 0-1 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 31 droplet/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction/treated/check - 57/67
24. Percent defoliation (treated/check) 69/80
25. Percentage foliage protection [c] 14%
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 14/100 shoots; 12/br.
5. Pre-spray bud density (per m^2) 1054/cm^2; 87/45 cm br.
6. Spray time larval development Index 4.1
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Thuricide 32BX
9. BIU applied/acre (ha) 20/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronairs - AU 3000
16. Predominant tree species bF
17. Date spray started June 4
18. Date spray finished June 4
19. Met conditions at spray time Temp. °C 19; RH 70%; Wind 4-5 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 28 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check)-92/67
24. Percent defoliation (treated/check) 45/80
25. Percentage foliage protection [c] 44%
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 27/100 shoots; 16/br.
5. Pre-spray bud density (per m^2) $893/m^2$; 60/45 br.
6. Spray time larval development Index 4.4
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Thuricide 32BX
9. BIU applied/acre (ha) 40/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronairs - AU 3000
16. Predominant tree species bF
17. Date spray started June 6
18. Date spray finished June 6
19. Met conditions at spray time Temp. °C 27; RH 56%; Wind 3-5 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 77 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 97/67
24. Percent defoliation (treated/check) 36/80
25. Percentage foliage protection [c] 55%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 35/100 shoots; 36/br.
5. Pre-spray bud density (per m^2) 1157/m^2; 100/45 cm br.
6. Spray time larval development Index 4.4
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Thuricide 32BX
9. BIU applied/acre (ha) 80/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronair AU 3000
16. Predominant tree species bF
17. Date spray started June 6
18. Date spray finished June 6
19. Met conditions at spray time Temp. °C 22; RH 64%; Wind 0-2 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 80 droplet/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 99/67
24. Percent defoliation (treated/check) 61/80
25. Percentage foliage protection [c] 24%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 23/100 shoots; 20/br.
5. Pre-spray bud density (per m^2) 1156/m^2; 85/45 cm br.
6. Spray time larval development Index 4.4
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Thuricide 32BX
9. BIU applied/acre (ha) 2 x 20/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications Two
13. Time between applications (days) 5
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronair AU 3000
16. Predominant tree species bF
17. Date spray started June 1
18. Date spray finished June 6
19. Met conditions at spray time Temp. °C 22; RH 64-95%; Wind 0-5 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 71 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 81/0
24. Percent defoliation (treated/check) 35/80
25. Percentage foliage protection [c] 56%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 22/100 shoots; 19/br.
5. Pre-spray bud density (per m^2) 1193/m^2
6. Spray time larval development Index 3.5
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Dipel 88®
9. BIU applied/acre (ha) 10/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronair AU 3000
16. Predominant tree species bF
17. Date spray started May 30
18. Date spray finished May 30
19. Met conditions at spray time Temp. °C 13; RH 34%; Wind 7 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 40 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 80/67
24. Percent defoliation (treated/check) 71/80
25. Percentage foliage protection [c] 11%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 24/100 shoots; 18/br.
5. Pre-spray bud density (per m^2) $955/m^2$; 73/45 cm br.
6. Spray time larval development Index 4.1
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Dipel 88®
9. BIU applied/acre (ha) 20/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronair AU 3000
16. Predominant tree species bF
17. Date spray started June 3
18. Date spray finished June 3
19. Met conditions at spray time Temp. °C 23; RH 65%; Wind 5-6 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 43 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 98/67
24. Percent defoliation (treated/check) 24/80
25. Percentage foliage protection [c] 70%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 32/100 shoots; 25/br.
5. Pre-spray bud density (per m^2) 897/m^2; 77/45 cm br.
6. Spray time larval development Index 4.1
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Dipel 88®
9. BIU applied/acre (ha) 40/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronairs AU 3000
16. Predominant tree species bF
17. Date spray started June 4
18. Date spray finished June 4
19. Met conditions at spray time Temp. °C 10; RH 92%; Wind 0 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 25 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 99/67
24. Percent defoliation (treated/check) 39/80
25. Percentage foliage protection [c] 51%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 19/100 shoots; 18/br.
5. Pre-spray bud density (per m^2) 935/m^2; 91/45 cm br.
6. Spray time larval development Index 4.1
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Dipel 88®
9. BIU applied/acre (ha) 80/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronairs AU 3000
16. Predominant tree species bF
17. Date spray started June 4
18. Date spray finished June 4
19. Met conditions at spray time Temp. °C 17; RH 88%; Wind 4-5 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 23 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 96/67
24. Percent defoliation (treated/check) 37/80
25. Percentage foliage protection [c] 54%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Ontario (FPMI)
2. Area - acres (ha) 20 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 23/100 shoots; 18/br.
5. Pre-spray bud density (per m^2) 1102/m^2; 76/45 cm br.
6. Spray time larval development Index 4.4
7. Percent bud flush at spray time (by tree species) 100%
8. *B.t.* formulation and trade name Dipel 88®
9. BIU applied/acre (ha) 2 x 10/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 9.4 ℓ/ha
12. Number of applications Two
13. Time between applications (days) 5
14. Aircraft type used Cessna 185
15. Nozzle system used (boom & nozzle, micronair etc.) 4 Micronairs AU 3000
16. Predominant tree species bF
17. Date spray started June 2
18. Date spray finished June 7
19. Met conditions at spray time Temp.°C 13-22; RH 59-84%; Wind 0-5 km/h
20. Met conditions following spray (rain?) Satisfactory
21. Deposit rate 82 droplets/cm^2
22. Cost/acre (ha) - optional [a]
23. Percentage control [b] population reduction (treated/check) 91/0
24. Percent defoliation (treated/check) 35/80
25. Percentage foliage protection [c] 56%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 3

Efficacy of 1981 *B.t.* Trials, Quebec

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red.	Defol.	Protection
THURICIDE 32B + CHITINASE	bF 11	20 (1)	51	32	61
DIPEL 88 + CHITINASE	bF 24	20 (1)	73	16	69
FUTURA 64B	bF 16	20 (1)	9	74	0

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Quebec (block 305)
2. Area - acres (ha) 4 631 (1 875 ha)
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 24,4
5. Pre-spray bud density (per m^2) 122 buds/45 cm or 1720 buds/m^2
6. Spray time larval development 3.1-4.0 (dev. index)
7. Percent bud flush at spray time (by tree species) 4.1 (shoot index)
8. *B.t.* formulation and trade name Thuricide 32B water, chevron, chitinase
9. BIU applied/acre (ha) 8 BIU (19.76)
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 0.625 USg/acre (5,85ℓ/ha)
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Constellation L-749
15. Nozzle system used (boom & nozzle, micronair etc.) Boom and open nozzles
16. Predominant tree species bF
17. Date spray started June 3 a.m.
18. Date spray finished June 3 a.m.
19. Met conditions at spray time RH 85% wind speed 8 km/h
20. Met conditions following spray (rain?) No rain
21. Deposit rate 19.34 colonies/cm^2
22. Cost/acre (ha) - optional [a] $29./ha
23. Percentage control [b] 51%
24. Percent defoliation (treated/check) 32/82
25. Percentage foliage protection [c] 61%
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Quebec
2. Area - acres (ha) 30 104 (12 188)
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 10,6
5. Pre-spray bud density (per m^2) 114,4 buds/45 cm or 1,815 buds/m^2
6. Spray time larval development 3.1-4.0 (dev. index)
7. Percent bud flush at spray time (by tree species) 3.8-4.1 (shoot index)
8. *B.t.* formulation and trade name Dipel 88, water, chevron, chitinase
9. BIU applied/acre (ha) 8 BIU (19.76)
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 0.75 USg/acre (7,017ℓ.ha)
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Constellation L-749
15. Nozzle system used (boom & nozzle, micronair etc.) Boom and open nozzles
16. Predominant tree species bF
17. Date spray started June 1
18. Date spray finished June 10
19. Met conditions at spray time wind speed 8 km/h
20. Met conditions following spray (rain?) No rain
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] $29.00/ha
23. Percentage control [b] 73%
24. Percent defoliation (treated/check) 16/52
25. Percentage foliage protection [c] 69%
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Quebec (block 309)
2. Area - acres (ha) 2,317 (938 ha)
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 16,1
5. Pre-spray bud density (per m^2) 98 buds/45 cm or 1505 buds/cm^2
6. Spray time larval development 3.1-4.0 (dev. index)
7. Percent bud flush at spray time (by tree species) 4.1 (shoot index)
8. *B.t.* formulation and trade name Futura 64B, water
9. BIU applied/acre (ha) 8 BIU/acre (19,76)
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 0.25 USg/acre (2,34ℓ/ha)
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Constellation L-749
15. Nozzle system used (boom & nozzle, micronair etc.) boom and open nozzles
16. Predominant tree species bF
17. Date spray started June 8 a.m.
18. Date spray finished June 8 a.m.
19. Met conditions at spray time RH 95% wind speed 3 km/h
20. Met conditions following spray (rain?) No rain
21. Deposit rate 15,5 colonies/cm^2
22. Cost/acre (ha) - optional [a] $29/ha
23. Percentage control [b] 9%
24. Percent defoliation (treated/check) 74/68
25. Percentage foliage protection [c] 0%
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 1752.4 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 17.6
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development (IV) 40, (V) 49, (VI) 11
7. Percent bud flush at spray time (by tree species) 100 bF, 80 rS
8. *B.t.* formulation and trade name Thuricide 16B flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (A)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species rS
17. Date spray started June 15
18. Date spray finished June 19
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 6.3 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 82
24. Percent defoliation (treated/check) 18/42
25. Percentage foliage protection [c] 57
26. No Pupae/45 cm tip (treated/check) 1.0/4.9

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 4

Efficacy of 1981 *B.t.* Trials - Nova Scotia

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red. (Residual Pop.)*	Defol.	Protection
THURICIDE 16B	rS 18	20 (1)	82 (1)	12	57
	rS 19	20 (1)	50 (1)	16	77
	rS 17	20 (1)	58 (0.9)	15	62
	bF 4	20 (1)	67 (0.1)	2	66
	bF 4	20 (1)	67 (0.1)	2	67
	bF 4	20 (1)	33 (0.1)	3	50
	bF 4	20 (1)	? (0.03)	1	83
	bF 18**	20 (1)	52? (2.5)	17	-
	bF 2 (regen.)	20 (1)		Acceptable	
	bF 2 (regen.)	20 (1)		Acceptable	
	bF 2 (regen.)	20 (1)		Acceptable	
	bF 2 (regen.)	20 (1)		Acceptable	
	bF 2 (regen.)	20 (1)		Acceptable	
	bS (cone)	20 (1)		Acceptable	
	wS (cone)	20 (1)		Acceptable	
	bS (cone)	20 (1)		Acceptable	
	bS (cone)	20 (1)		Acceptable	
	bF (cone)	20 (1)		Acceptable	
	bF	20 (1)		Unacceptable	
	bF	20 (1)		Unacceptable	
	bF	20 (1)		Acceptable	
	wS 10 (cone)	40 (2)		Unacceptable	
	wS 10 (cone)	40 (2)		Unacceptable	
	bF 4	20 (1)	17 (0.2)	1	93
DIPEL 88	bF 4	20 (1)		Unacceptable	
	bF 9, rs?	20-22 (1)	86, 66	8, 8	87, 87

*No. per 45 cm branch tip. "Acceptable" or "unacceptable" are for inaccessible areas.

**Check trees dead.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 1869.0 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 19.2
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development IV:40, V 49; VI 11
7. Percent bud flush at spray time (by tree species) 100 bF, 80 rS
8. *B.t.* formulation and trade name Thuricide 16B, flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used AG-Cat (Model A)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8804)
16. Predominant tree species rS
17. Date spray started June 15
18. Date spray finished June 19
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 6.2 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 50
24. Percent defoliation (treated/check) 16/70
25. Percentage foliage protection [c] 77
26. No Pupae/45 cm tip (treated/check) 1.0/5.1

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 4586.0 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 16.7
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval developmenIV:5, V:40, VI:55
7. Percent bud flush at spray time (by tree species) 100 bF, 100 rS
8. *B.t.* formulation and trade name Thuricide 16B, flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (model A)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species rS
17. Date spray started June 13
18. Date spray finished June 25
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Fog
21. Deposit rate 8.2 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 58
24. Percent defoliation (treated/check) 15/39
25. Percentage foliage protection [c] 62
26. No Pupae/45 cm tip (treated/check) 0.9/3.3

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$.

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 5570.0 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 4.4
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development III: 35, IV: 65
7. Percent bud flush at spray time (by tree species) 85 bF
8. *B.t.* formulation and trade name Thuricide 16B, flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 12
18. Date spray finished June 15
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 7.6 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 67
24. Percent defoliation (treated/check) 2/6
25. Percentage foliage protection [c] 66
26. No Pupae/45 cm tip (treated/check) 0.1/0.2

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 3147.0 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 4.4
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development III:7, IV: 70, V: 23
7. Percent bud flush at spray time (by tree species) 90 bF
8. *B.t.* formulation and trade name Thuricide 16B, flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications one
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 13
18. Date spray finished June 19
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 7.6 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 67
24. Percent defoliation (treated/check) 2/6
25. Percentage foliage protection [c] 67
26. No Pupae/45 cm tip (treated/check) 0.1/0.2

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 933.1 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 4.4
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development IV: 25, V: 75
7. Percent bud flush at spray time (by tree species) 90 bF
8. *B.t.* formulation and trade name Thuricide 16B, flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 20
18. Date spray finished June 22
19. Met conditions at spray time acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 7.6 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 33
24. Percent defoliation (treated/check) 3/6
25. Percentage foliage protection [c] 50
26. No Pupae/45 cm tip (treated/check) 0.1/0.2

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 942.0 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 4.4
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval developmentIV; 25, V: 75
7. Percent bud flush at spray time (by tree species) 90 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 19
18. Date spray finished June 20
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate not measured
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] ?
24. Percent defoliation (treated/check) 1/6
25. Percentage foliage protection [c] 83
26. No Pupae/45 cm tip (treated/check) 0.03/0.3

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 2997.4 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 17.8
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development III: 5, IV: 55, V: 35, VI: 5
7. Percent bud flush at spray time (by tree species) 95 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 14
18. Date spray finished June 20
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 9.4 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] 52?
24. Percent defoliation (treated/check) 17/14 (majority of trees in checks dead
25. Percentage foliage protection [c] 0
26. No Pupae/45 cm tip (treated/check) 2.5/2.3

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 368.1 ha
3. Status - operational or experimental (regeneration)
4. Pre-spray larval density/18" branch 2.1
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development III: 10, IV: 70, V: 20
7. Percent bud flush at spray time (by tree species) 85 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF (regeneration)
17. Date spray started June 19
18. Date spray finished June 19
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 5.5 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] n/a
24. Percent defoliation (treated/check) 2/1
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) 0.0/0.0

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 291.8 ha
3. Status - operational or experimental (regeneration)
4. Pre-spray larval density/18" branch 2.1
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development III: 5, IV: 65, V: 30
7. Percent bud flush at spray time (by tree species) 85 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Noxxle (8004)
16. Predominant tree species bF regeneration
17. Date spray started June 20
18. Date spray finished June 20
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 5.5 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] n/a
24. Percent defoliation (treated/check) 2/1
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) 0.0/0.0

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 94.8 ha
3. Status - operational or experimental (regeneration)
4. Pre-spray larval density/18" branch 2.1
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development IV: 45, V: 45, VI: 10
7. Percent bud flush at spray time (by tree species) 85 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF regeneration
17. Date spray started June 22
18. Date spray finished June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) 1/1
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) 0.0/0.0

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 70.5 ha
3. Status - operational or experimental (regeneration)
4. Pre-spray larval density/18" branch 2.1
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development IV: 45, V: 45, VI: 10
7. Percent bud flush at spray time (by tree species) 85 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF regeneration
17. Date spray started June 22
18. Date spray finished June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) 1/1
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) 0.0/0.0

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 234.0 ha
3. Status - operational or experimental (regeneration)
4. Pre-spray larval density/18" branch 2.1
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development IV: 45, V: 45, VI: 10
7. Percent bud flush at spray time (by tree species) 85 bF
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF regeneration
17. Date spray started June 22
18. Date spray finished June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] n/a
24. Percent defoliation (treated/check) 2/1
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) 0.0/0.0

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 32.4 ha
3. Status - operational or experimental (Cone Area)
4. Pre-spray larval density/18" branch Inaccessible
5. Pre-spray bud density (per m^2) Inaccessible
6. Spray time larval development Inaccessible
7. Percent bud flush at spray time (by tree species) Inaccessible
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications Two
13. Time between applications (days) 3.5
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bS
17. Date spray started June 18, June 22
18. Date spray finished June 18, June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) Not determined
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) Not determined

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 67.5 ha
3. Status - operational or experimental (Cone Area)
4. Pre-spray larval density/18" branch Not determined
5. Pre-spray bud density (per m^2) Not determined
6. Spray time larval development 1st III: 7, IV: 70, V: 23
   2nd IV: 25, V: 75
7. Percent bud flush at spray time (by tree species) Not determined
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications Two
13. Time between applications (days) 6
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species wS
17. Date spray started June 13 (1st) June 22 (2nd)
18. Date spray finished June 15 (1st) June 22 (2nd)
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $38.02
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) Not determined
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) Not determined

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 24 ha
3. Status - operational or experimental (Cone Area)
4. Pre-spray larval density/18" branch Not determined
5. Pre-spray bud density (per m^2) Not determined
6. Spray time larval development Not determined
7. Percent bud flush at spray time (by tree species) Not determined
8. *B.t.* formulation and trade name Thuricide 16B, flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications Two
13. Time between applications (days) 4
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bS
17. Date spray started 1st June 16 2nd June 20
18. Date spray finished June 16 June 20
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) Not determined
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) Not determined

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 116.0 ha
3. Status - operational or experimental (Cone Area)
4. Pre-spray larval density/18" branch Not determined
5. Pre-spray bud density (per m^2) Not determined
6. Spray time larval development Not determined
7. Percent bud flush at spray time (by tree species) Not determined
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications Two
13. Time between applications (days) 5.5
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bS
17. Date spray started June 16 1st June 22 2nd
18. Date spray finished June 16 June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Not determined
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) Not determined
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) Not determined

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 151.2 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch Inaccessible
5. Pre-spray bud density (per m^2) Inaccessible
6. Spray time larval development Inaccessible
7. Percent bud flush at spray time (by tree species) Inaccessible
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 22
18. Date spray finished June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Inaccessible
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Inaccessible
24. Percent defoliation (treated/check) Inaccessible
25. Percentage foliage protection [c] Unacceptable
26. No Pupae/45 cm tip (treated/check) Inaccessible

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 336.3 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch Inaccessible
5. Pre-spray bud density (per m^2) Inaccessible
6. Spray time larval development Inaccessible
7. Percent bud flush at spray time (by tree species) Inaccessible
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 20
18. Date spray finished June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Inaccessible
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Inaccessible
24. Percent defoliation (treated/check) Inaccessible
25. Percentage foliage protection [c] Unacceptable
26. No Pupae/45 cm tip (treated/check) Inaccessible

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 809.9 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch Inaccessible
5. Pre-spray bud density (per m^2) Inaccessible
6. Spray time larval development Inaccessible
7. Percent bud flush at spray time (by tree species) Inaccessible
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 14
18. Date spray finished June 18
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate Inaccessible
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Inaccessible
24. Percent defoliation (treated/check) Inaccessible
25. Percentage foliage protection [c] Acceptable
26. No Pupae/45 cm tip (treated/check) Inaccessible

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 154.6 ha
3. Status - operational or experimental (Cone area)
4. Pre-spray larval density/18" branch 10.1
5. Pre-spray bud density (per m^2) Not determined
6. Spray time larval development 1st III: 10, IV: 60, V: 30
7. Percent bud flush at spray time (by tree species) 2nd IV: 30, V: 47, VI: 23 1st 90 wS, 2nd 100 wS
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications Two
13. Time between applications (days) 5.5
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species wS
17. Date spray started June 16 June 22
18. Date spray finished June 16 June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 1st - not determined 2nd - 10.9 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) Not determined
25. Percentage foliage protection [c] Unacceptable
26. No Pupae/45 cm.tip (treated/check) Not determined

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) I54.6 ha
3. Status - operational or experimental (Cone area)
4. Pre-spray larval density/18" branch 10.1
5. Pre-spray bud density (per m^2) Not determined
6. Spray time larval development 1st III: 10, IV: 60, V: 30
7. Percent bud flush at spray time (by tree species) 2nd IV: 30, V: 47, VI: 23 1st 90 wS 2nd 100 wS
8. *B.t.* formulation and trade name Thuricide 16B, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 7.1
12. Number of applications Two
13. Time between applications (days) 5.5
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species wS
17. Date spray started June 16 June 22
18. Date spray finished June 16 June 22
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 1st - not determined 2nd - 10.9/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] Not determined
24. Percent defoliation (treated/check) Not determined
25. Percentage foliage protection [c] Unacceptable
26. No Pupae/45 cm tip (treated/check) Not determined

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 4891.9 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 3.5
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development IV: 8, V: 66, VI: 26
7. Percent bud flush at spray time (by tree species) bF
8. *B.t.* formulation and trade name 1) Thuricide 16B, 2) Dipel 88, Flowable
9. BIU applied/acre (ha) 20
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) Thuricide 16B 7.1, Dipel 88 5.35
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model B)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species bF
17. Date spray started June 24
18. Date spray finished June 25
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Acceptable
21. Deposit rate 15.1/cm^2 / 5.0/cm^2
22. Cost/acre (ha) - optional [a] $33.08 / $33.08
23. Percentage control [b] 17 17
24. Percent defoliation (treated/check) 1/ 15 2 / 15
25. Percentage foliage protection [c] 93 87
26. No Pupae/45 cm tip (treated/check) 0.2 / 0.7 -

	Thuricide 16B	Dipel 88

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Nova Scotia
2. Area - acres (ha) 2321.4 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 9.2
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development bF: III 8; IV: 90; V: 2, rS: III: 12, IV: 88, V:
7. Percent bud flush at spray time (by tree species) 65 bF, 0 rS
8. *B.t.* formulation and trade name Dipel 88 Flowable
9. BIU applied/acre (ha) 20 → 22
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 5.35
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Ag-Cat (Model A)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species 50% bF, 50% rS
17. Date spray started June 2
18. Date spray finished June 3
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) Fog
21. Deposit rate 2.6 colonies/cm^2
22. Cost/acre (ha) - optional [a] $33.08
23. Percentage control [b] bF rS
24. Percent defoliation (treated/check) 86 66
25. Percentage foliage protection [c] 8/63 8/61
26. No Pupae/45 cm tip (treated/check) 0.6/3.0 0.6/3.5

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 5

Efficacy of 1981 *B.t.* Trials, Newfoundland and Labrador

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red.	Defol.	Protection
DIPEL 88	bF 20	20 (1)	Population collapse		
THURICIDE 16B	bF 12	20 (2)	Population collapse		

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Newfoundland and Labrador
2. Area - acres (ha) a) 1 200 ha; b) 720 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch a) 19.7 larvae/45-cm branch tip
5. Pre-spray bud density (per m^2) a) b) 11.6 " " " " " 616.5 Buds/m^2, 2) 292.5 Buds/m^2
6. Spray time larval development a) ID_L = 4.4; b) ID_L = 4.9 (1st); ID_L = 5.3 (2nd)
7. Percent bud flush at spray time (by tree species) a) ID_B = 5.0; b) ID_B = 5.0 (1st) ID_B = 5.0 (2nd)
8. *B.t.* formulation and trade name a) Dipel 88; b) Thuricide 16B
9. BIU applied/acre (ha) a) & b) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) a) & b) 7.0L/ha
12. Number of applications a) one; b) two
13. Time between applications (days) b) 4 - 7 days
14. Aircraft type used Grumman Ag Cats (team of two)
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzles; 8004 tee-jet tips
16. Predominant tree species bF
17. Date spray started a) June 13 b) June 19 (1st) June 25 (2nd)
18. Date spray finished a) June 19, b) June 21 (1st) June 28 (2nd)
19. Met conditions at spray time b) rain shortly after 1st application
20. Met conditions following spray (rain?) b) rain shortly after 1st application cool nights; cool days; occasional rain
21. Deposit rate Not measured
22. Cost/acre (ha) - optional [a] $13.50/ha approx. (incl. *B.t.* + a/c only)
23. Percentage control [b] Unable to provide due to collapse in checkplots
24. Percent defoliation (treated/check) Unable to provide due to collapse in
25. Percentage foliage protection [c] " " " checkplots
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 6

Efficacy of 1981 *B.t.* Trials - Maine

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red.	Defol.	Protection
DIPEL 4L	rS 10	20 (2)	81	50	62
	bF 26		83	17	46
DIPEL 4L	rS 19	20 (1)	0	36	5
	bF 38		57	87	13
DIPEL 4L	rS 11	30 (1)	29	34	48
	bF 14		25	24	37
DIPEL 4L	rS 8	20 (1)	81	12	46
	bF 5		87	14	50
DIPEL 4L	rS 24	30 (1)	56	23*	72
	bF 26		89	31*	66
DIPEL 4L	rS 9	20 (1)	86	13	66
	bF 23		95	58	34
THURICIDE 24B	rS 15	30 (1)	16	22	66
	bF 19		0	26	70
THURICIDE 16B	rS 16	20 (1)	0	18	53
	bF 31		0	71	29

*Defoliation on check plot, 81% rS and 92% bF.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 2 413 ha New Sweden
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 25.56 fir 9.95 spruce
5. Pre-spray bud density (per m^2) fir - 172.3 spruce 177.6 per 18" tip
6. Spray time larval development 1st) 3.8 (population > 20) Quebec
   2nd) 4.0 (population > 20) Index.
7. Percent bud flush at spray time (by tree species) 1st) 3.7 (population > 20)
   2nd) 4.0 (population > 20)
8. *B.t.* formulation and trade name Dipel 4L
9. BIU applied/acre (ha) 14 BIU (20 + 20)/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 5.9 ℓ/ha
12. Number of applications Two
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle (8004)
16. Predominant tree species fir and spruce
17. Date spray started June 4 (1st) June 8 (2nd)
18. Date spray finished June 6 (1st) June 9 (2nd)
19. Met conditions at spray time Acceptable
20. Met conditions following spray (rain?) O.K.
21. Deposit rate 14.44 droplets/cm^2 (1st) 24.35 droplets/cm^2 (2nd)
22. Cost/acre (ha) - optional [a] $8.92/single application
23. Percentage control [b] 82.5 fir 80.7 spruce (% reduction in spray

	Fir	Spruce
	95.7	96.5
	75.4	81.9

24. Percent defoliation (treated/check) fir 50 treated 92 check
25. Percentage foliage protection [c] spruce 17 treated 45 check
    Fir 45.7 Spruce 62
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 1 991 ha Southern Aroostook 18-1
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 37.93 fir 18.91 spruce
5. Pre-spray bud density (per m^2) 158.76 buds/18" tip - Fir 122.2 buds/18" tip - Spruce
6. Spray time larval development Population > 20-3.5 Quebec Index
7. Percent bud flush at spray time (by tree species) " < 20-4.0 Quebec Indes
8. *B.t.* formulation and trade name Dipel 4L Pop. >20-3.7 Quebec Index " " <20-4.0
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 5.9 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle 8004
16. Predominant tree species Fir and Spruce
17. Date spray started May 23
18. Date spray finished May 25
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) Yes
21. Deposit rate 20.28 droplets/cm^2
22. Cost/acre (ha) - optional [a] $8.92
23. Percentage control [b] 56.7 fir, 0 spruce (% reduction in spray " " " control)

	Fir	Spruce
	95.5	91.5
	89.6	93.4

24. Percent defoliation (treated/check) Fir 87% treated 100% Check Spruce 36% treated 38% Check
25. Percentage foliage protection [c] fir 13% spruce 5.3%
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State. Maine
2. Area - acres (ha) 5 165 ha Long A
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 14.48 fir 11.45 spruce
5. Pre-spray bud density (per m^2) 118.43 buds/18" tip - fir, 145.2 buds/18" tip spruce
6. Spray time larval development 3.3 on spruce (Quebec Index)
7. Percent bud flush at spray time (by tree species) Bud Index spruce 1.2 Quebec Index
8. *B.t.* formulation and trade name Dipel 4L
9. BIU applied/acre (ha) 30 BIU/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 8.8 ℓha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle 8004
16. Predominant tree species spruce and fir
17. Date spray started May 25
18. Date spray finished May 28
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) rainy period after spray
21. Deposit rate 39.22 droplets/cm^2
22. Cost/acre (ha) - optional [a] $7.97
23. Percentage control [b] 25.3 fir 28.7 spruce

	Spruce	Fir
(% reduction in check	80.2	88.
" " " spray	85.2	91.

24. Percent defoliation (treated/check) fir - 24 treated 38 check
25. Percentage foliage protection [c] spruce 34 treated 65 check
26. No Pupae/45 cm tip (treated/check) fir 36.8 spruce 47.7

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 1 816 ha Western Mtns.
3. Status - operational or experimental
4. Pre-spray larval density/18" branch Fir 4.8 Spruce 8.4
5. Pre-spray bud density (per m^2) Fir 68.5/18" tip Spruce 110.7/18" tip
6. Spray time larval development Pop. > 20 = 3.5 Pop. < 20 = 4.0 Quebec Index
7. Percent bud flush at spray time (by tree species) Pop.> 20 = 3.7 Quebec Index
8. *B.t.* formulation and trade name Dipel 4L < 20 = 4.0
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 5.9 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle 8004
16. Predominant tree species Fir and Spruce
17. Date spray started June 3
18. Date spray finished June 5
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) Yes
21. Deposit rate 15.74 droplets/cm^2
22. Cost/acre (ha) - optional [a] $8.92
23. Percentage control [b] Fir 87.2 spruce 81.4

	Fir	Spruce
(% reduction in spray	95.8	94.1
" " " check	67.1	68.2

24. Percent defoliation (treated/check) Fir 14 treated 28 check
25. Percentage foliage protection [c] Spruce 12 22 check
    Fir 50 Spruce 45.5
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 3 091 ha New Sweden
3. Status - operational or experimental
4. Pre-spray larval density/18" branch rS 24.4, bF 26.3
5. Pre-spray bud density (per m^2) Fir 222.43 Spruce 209.35
6. Spray time larval development 3.5 population > 20 Quebec Index
7. Percent bud flush at spray time (by tree species) 3.7 - pop.> 20 Quebec Index
8. *B.t.* formulation and trade name Dipel 4L
9. BIU applied/acre (ha) 30 BIU/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 8.8 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle 8004
16. Predominant tree species Fir and Spruce
17. Date spray started June 3
18. Date spray finished June 5
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) Yes
21. Deposit rate 9.37 droplets/cm^2
22. Cost/acre (ha) - optional [a] $7.97
23. Percentage control [b] 89.4 fir 55.7 spruce

(% reduction in spray	Fir	Spruce
" " " check	97.4	96.9
	75.4	93.0

24. Percent defoliation (treated/check) Fir 31 treated 92 Check
25. Percentage foliage protection [c] Spruce 23 treated 81 Check
    Fir 66.3 Spruce 71.6
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 2 948 ha Forks - Western Me. Twp.
3. Status - operational or experimental Assessment and timing controlled
4. Pre-spray larval density/18" branch Fir 23.4 Spruce 9.0
5. Pre-spray bud density (per m^2) 68.95 Fir 82.6 Spruce
6. Spray time larval development Pop. > 20 = 3.5 Pop. < 20 = 4.0 Quebec Index
7. Percent bud flush at spray time (by tree species) Pop.> 20 = 3.7 Quebec
8. *B.t.* formulation and trade name Dipel 4L < 20 = 4.0 Index
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 5.9 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom + Nozzle 8004
16. Predominant tree species Fir and Spruce
17. Date spray started June 4
18. Date spray finished June 6
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) Yes
21. Deposit rate 12.7 droplets/cm^2
22. Cost/acre (ha) - optional [a] $8.92
23. Percentage control [b] Fir 95.0 Spruce 86.3

	Fir	Spruce
(% reduction in spray	97.4	93.3
" " " check	47.1	51.1

24. Percent defoliation (treated/check) Fir 58 treated 88 Check
25. Percentage foliage protection [c] Spruce 13 treated 38 Check
26. No Pupae/45 cm tip (treated/check) Fir 34.1 Spruce 65.8

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 3 740 ha New Sweden
3. Status - operational or experimental assessment and timing
4. Pre-spray larval density/18" branch 18.78 Fir 14.94 Spruce
5. Pre-spray bud density (per m^2) 176.8 Fir 138.55 Spruce
6. Spray time larval development 3.5 population > 20 Quebec Index
7. Percent bud flush at spray time (by tree species) 3.7 population > 20 Quebec Inde
8. *B.t.* formulation and trade name Thuricide 24B
9. BIU applied/acre (ha) 30 BIU/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 7.1 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle 8004
16. Predominant tree species Fir and Spruce
17. Date spray started June 5
18. Date spray finished June 7
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) Yes
21. Deposit rate 66.19 droplets/cm^2
22. Cost/acre (ha) - optional [a] $12.90
23. Percentage control [b] 16.1 Fir 0 Spruce

	Fir	Spruce
(% reduction in spray	95.3	95.2
" " " check	94.4	97.1

24. Percent defoliation (treated/check) Fir 26 treated 86 Check; Spruce 22 treated 65 Check
25. Percentage foliage protection [c] Fir 69.8 Spruce 66
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Maine
2. Area - acres (ha) 2 038 ha Southern Aroostook
3. Status - operational or experimental assessment and timing
4. Pre-spray larval density/18" branch 31.38 Fir 15.96 Spruce
5. Pre-spray bud density (per m^2) 129.18 Fir 142.3 Spruce
6. Spray time larval development Pop. > 20- 3.5 Quebec Index, Pop. < 20-4.0 Quebec Index
7. Percent bud flush at spray time (by tree species) Pop. > 20-3.7 Quebec < 20-4.0 Index
8. *B.t.* formulation and trade name Thuridice 16B
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used No
11. Applied volume rate/acre (ha) 5.9 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Bell 204 + Bell 205
15. Nozzle system used (boom & nozzle, micronair etc.) Boom & Nozzle 8004
16. Predominant tree species Fir and Spruce
17. Date spray started May 24
18. Date spray finished May 26
19. Met conditions at spray time Yes
20. Met conditions following spray (rain?) Yes (some rain)
21. Deposit rate 20.43 droplets/cm^2
22. Cost/acre (ha) - optional [a] $10.30
23. Percentage control [b] 0 Fir; 0 Spruce

	Fir	Spruce
(% reduction in spray	87.9	88.8
" " " check	89.6	93.4

24. Percent defoliation (treated/check) Fir 71% treated 100% Check
25. Percentage foliage protection [c] Spruce 18% treated 38% Check
    Fir 29% Spruce 52.6%
26. No Pupae/45 cm tip (treated/check)

---

[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\text{\% living untreated - \% living treated}}{\text{\% living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation - observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 7

Efficacy of 1981 *B.t.* Trial - Manitoba

Formulation	Larval density per 45 cm branch	Appl. Rate BIU/ha (No. appls.)	Percentage		
			Pop. Red.*	Defol.*	Protection*
DIPEL 88	wS and bF 9.3	20 (1)	70	11	63

*White spruce and balsam fir combined.

Data for Each Spray Block Requested for CANUSA Report

1. Province or State Manitoba
2. Area - acres (ha) 365 ha
3. Status - operational or experimental
4. Pre-spray larval density/18" branch 9.3
5. Pre-spray bud density (per m^2) n/a
6. Spray time larval development larval index = 3.6
7. Percent bud flush at spray time (by tree species) n/a
8. *B.t.* formulation and trade name Dipel 88
9. BIU applied/acre (ha) 20 BIU/ha
10. Tracer dye used n/a
11. Applied volume rate/acre (ha) 5.6 ℓ/ha
12. Number of applications One
13. Time between applications (days) n/a
14. Aircraft type used Cessna Ag Wagon
15. Nozzle system used (boom & nozzle, micronair etc.) Micronair
16. Predominant tree species white spruce and balsam fir
17. Date spray started June 11
18. Date spray finished June 11
19. Met conditions at spray time Sunny; Temp.10°-20°C; Wind 8 km/h, gusting to 16 km/h
20. Met conditions following spray (rain?) warm and sunny for 2 days following spraying
21. Deposit rate n/a
22. Cost/acre (ha) - optional [a] Approximately $40.00/ha
23. Percentage control [b] 69.7%
24. Percent defoliation (treated/check) 11%/30%
25. Percentage foliage protection [c] 63
26. No Pupae/45 cm tip (treated/check)

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[a] Include costs of materials and application

[b] Abbott's formula: $\frac{\%\text{ living untreated} - \%\text{ living treated}}{\%\text{ living untreated}} \times 100$

[c] $\frac{\text{Expected \% defoliation} - \text{observed \% defoliation}}{\text{Expected \% defoliation}} \times 100$

This list is essentially the same as that requested by the Forest Pest Control Forum.

Table 8

Cost of *B.t.* treatments for materials and application in 1981

Jurisdiction	Total area (ha)	Litres/ha	Cost/ha ($)
Ontario	6 576	2.4-7.0	24.88
Quebec	15 001	2.3-7.0	29.00
Newfoundland and Labrador	1 920	7.0	13.50
Nova Scotia	31 790	5.7	33.08
Maine	23 202	6.0-8.8	23.08
Manitoba	365	5.6	40.0

Table 9

Overall success rates of *B.t.* trials in 1981 by jurisdiction in Eastern Canada and Maine, based on percentage of sprayed area acceptably protected.

Jurisdiction	Tree species	Products	Total area treated (ha)	Percentage of area acceptably protected
Maine	rS, bF	Dipel 4L Thuricide 16B Thuricide 24B	23 202	62
Ontario	wS, bF	Thuricide 16B Thuricide 32B Dipel 88	6 900	89
FPMI	bF	Thuricide 32BX Dipel 88	200	70
Quebec	bF	Thuricide 32B Dipel 88 Futura	15 001	94
Nova Scotia	rS, bS, wS, bF	Thuricide 16B Dipel 88	31 790	98
Manitoba	wS, bF	Dipel 88	365	100
Newfoundland and Labrador	bF	Thuricide 16B Dipel 88	1 920	No data due to population collapse

Table 10

Overall success rates of *B.t.* trials in 1981 by product used in eastern Canada and Maine, based on percentage of sprayed area acceptably protected.

Products	Area treated (ha)	No. applications	Percent of area acceptably protected
DIPEL 88 (4L)	30 081	18	93
THURICIDE 24B	3 740	1	100
THURICIDE 16B	30 139	33	88
THURICIDE 32B	12 512	2	100
FUTURA 64B	938	1	0

Table 11

Overall success rates of Thuricide and Dipel treatments by tree species, 1981

Tree species	No. of application	No. successful (%)	Area treated (ha)	Percent of area acceptably protected
White spruce	17	13 (76)	6 812	85
Balsam fir	41	33 (80)	64 753	88
Mixed white spruce and balsam fir	1	1 (100)	365	100
Red spruce	12	11 (92)	33 730	93
Black spruce	6	6 (100)	1 500	100

Table 12

Trend of *B.t.* efficacy in 1981 in relation to dosage applied to balsam fir.

Dosage BIU/ha	No. of treatments	Larvae/45 cm branch (range)	Area treated (ha)	Area protected (% of treated)
10-13	2	17.5 (16-19)	40	0 (0)
20-24	20	13.7 (4-38)	41 419	33 504 (81)
30	3	16.5 (14-19)	11 996	11 996 (100)
40	4	21.8 (16-26)	2 473	2 473 (100)
80	2	27 (18-36)	40	40 (100)

Table 13

Trend of *B.t.* efficacy in 1981 in relation to ground deposit rate (droplets or colonies/cm^2)

Droplets/cm^2 (range)	No. treatments	Larval density per 45 cm branch (range)	Area treated ha	Area protected, ha (% of treated)
		WHITE SPRUCE		
8.7 (8-10)	3	17 (16-18)	1 296	620 (48)
27.5 (25-30)	3	18 (11-25)	1 961	1 961 (100)
		BALSAM FIR		
8.1 (8-10)	11	7.7 (4.4-26.3)	22 580	22 580 (100)
17.6 (12-20)	5	24.3 (4.8-37.9)	10 668	8 677 (81)
26.5 (25-28)	2	18.5 (12-25)	40	40 (100)
59.6 (39-82)	7	18.5 (16.0-(25.6)	11 398	11 398 (100)

Table 14

Trend of *B.t.* efficacy in balsam fir stands in 1981 in relation to pre-spray population density per 45 cm branch tip; application rate 20-40 BIU/ha.

Larvae per 45 cm branch range (average)	No. treatments	Area treated ha	Area protected, ha (% of treated)
3.9 (1-10)	18	24 810	24 810 (100)
16.2 (11-20)	10	25 128	24 190 (96)
25.9 (21-30)	5	9 294	4 308 (46)
38 (31-40)	1	1 991	0 (0)

Table 15

Trend in relationship between current year's shoot density and efficacy of *B.t.* applied at 20-40 BIU/ha - 1981

Av. No. shoots per 45 cm branch (range)	No. treatments	Pre-spray larval density/45 cm branch (range)	Ration of shoots/larvae	Area treated (ha)	Area protected (% of treated) (ha)
		WHITE SPRUCE*			
55.5 (50-81)	2	6 (1-11)	9.3	951	951 (100)
130 (113-138)	7	5.4 (1-17)	24	4 145	4 145 (100)
218.5 (161-273)	5	13.3 (1-17)	16.4	1 420	329 (23)
		BALSAM FIR			
76 (60-98)	9	17 (5-25)	4.8	5 822	1 936 (33)
121 (103-140)	10	10 (1-31)	12.0	25 395	23 357 (92)
169 (159-177)	3	28 (19-38)	60	8 144	6 153 (76)

*Data from Ontario only.

Table 16

Comparative efficacy of *B.t.* and chemical pesticides for spruce budworm in white spruce - balsam fir stands in Ontario - 1980 and 1981 spray trials combined.[1]

Insecticide	Dosage/ha	No. applications	Pre-Spray larval density per 46 cm branch	% population reduction due to treatment	% defoliation	Ration of % defol./pre-spray density
			WHITE SPRUCE			
DIPEL 88	20-24 BIU	7	21 (12-29)	46 (0-81)	26 (7-63)	1.2
THURICIDE 32BX	20 BIU	1	17	30	25	1.5
THURICIDE 16B	20 BIU	2	41 (14-67)	36 (0-72)	65 (59-70)	1.6
NOVABAC-3	24.7 BIU	1	24	66	27	1.1
MATACIL	86 g	4	19 (11-33)	73 (53-92)	18 (3-36)	0.9
ORTHENE	0.56-1.12 kg	10	47 (17-74)	34 (0-98)	47 (19-95)	1.0
			BALSAM FIR			
DIPEL 88	20 BIU	5	18 (12-28)	70 (50-92)	38 (18-48)	2.1
THURICIDE 16B	20 BIU	1	49	68	62	1.3
NOVABAC	24.7 BIU	1	22	82	28	1.3
MATACIL	86 g	3	15 (12-19)	82 (69-100)	17 (4-29)	1.1

[1]Only plots with 10 or more larval per 45 cm branch included.

Table 17

Comparative efficacy of *B.t.* and chemical pesticides for spruce budworm in balsam fir stands in Quebec, 1980 and 1981, operational spray trials.[1]

Insecticide	Year	Dosage/ha	No. applications	Pre-Spray larval density per 45 cm branch	% population reduction due to treatment	% defoliation	Ratio of % defol./pre-spray density
FENITROTHION + MATACIL	1980	210 g F 52 g M	9	13.3 (10-19)	79 (68-96)	39.6 (19-80)	3.1
THURICIDE 32B	1980	30 BIU	2	16.3 (15.6-17)	84 (79-88)	34.5 (15-51)	2.1
MATACIL + FENITROTHION	1981	52 g M 210 g F	12	16.1 (13-20)	82 (30-100)	43.5 (12-56)	2.7
DIPEL 88	1981	20 BIU	3	12.7 (10-16)	89 (85-92)	17 (16-19)	1.3

[1]Only plots with 10-20 pre-spray larvae/45 cm branch included.

Table 18

Comparative efficacy of *B.t.* and chemical pesticides for spruce budworm in red spruce and balsam fir stands in Maine, 1980 and 1981 operational spray trials combined.

Insecticide	Dosage/ha	No. applications	Pre-Spray Larval density/45 cm branch	% population reduction due to treatment	% defoliation	Ratio of % defol./pre-spray density
			BALSAM FIR			
THURICIDE 16B	20 BIU	5	24.4 (17-32)	42 (0-68)	52 (37-71)	2.1 (1.9-2.3)
THURICIDE 24B	30 BIU	1	19	16	26	1.4
DIPEL 4L (88)	20 BIU	5	26.2 (12-38)	62 (22-95)	59 (30-87)	2.2 (1.2-2.7)
DIPEL 4L (88)	30 BIU	2	20.5 (15-26)	59 (29-89)	28 (24-31)	1.4 (1.2-1.6)
SEVIN-4-OIL	0.84 kg	11	28.1 (17-52)	73.8 (24-92)	34.9 (16-65)	1.4 (0.6-3.2)
SEVIN-4-OIL	1.03 kg	2	25 (14-36)	91.5 (86-97)	31 (25-37)	1.4 (1.0-1.8)
SEVIN-4-OIL	1.12 kg	2	23 (19-27)	83.5 (76-91)	34.5 (20-49)	1.5 (1.1-1.8)
ORTHENE	0.56 kg	2	32.5 (32-33)	80 (63-97)	28.5 (18-39)	0.9 (0.6-1.2)
			RED SPRUCE			
THURICIDE 16B	20 BIU	1	16	0	18	1.1
THURICIDE 24B	20 BIU	1	16	0	22	1.4
DIPEL 4L (88)	20 BIU	1	19	0	36	1.9
DIPEL 4L (88)	30 BIU	2	18 (12-24)	40.5 (25-56)	20.5 (18-23)	0.75 (1.0-1.5)
SEVIN-4-OIL	0.84 kg	9	23.2 (13-37)	54.9 (0-87)	27.1 (13-50)	1.2 (0.7-2.1)
SEVIN-4-OIL	1.03 kg	2	12.5 (11-14)	55 (39-71)	27.5 (27-28)	2.2 (1.9-2.5)
SEVIN-4-OIL	1.12 kg	2	16.5 (15-18)	56.5 (27-86)	26 (16-36)	1.5 (1.0-2.0)
ORTHENE	0.56 kg	1	32	63	18	0.6