OVERALL ASPECTS OF B. t. IN FOREST SERVICE COOPERATIVE GYPSY MOTH SUPPRESSION PROJECTS

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Improvements in B. t. performance and cost, coupled with public concerns over human health risks have elevated B. t. to a viable alternative to chemical insecticides. Operational use of B. t. in recent years has demonstrated that while foliage protection can generally be achieved in most situations, gypsy moth population reduction cannot. Efforts are needed to improve B. t. performance in healthy, building gypsy moth populations.

Introduction

Bacillus thuringiensis (B. t.) has had a long and sometimes arduous journey in gaining acceptability and respectability in Forest Service cooperative gypsy moth suppression projects. The insecticide's slow acceptance stemmed not only from its high cost, special operational considerations, and erratic performance demonstrated in early field trials, but perhaps also from the misconception of B. t. as a replacement for chemical insecticides. Today, users realize that B. t. is not appropriate in all situations, and efforts are directed at finding the proper role for the insecticide.

B. t. Use in Cooperative Suppression Projects

The use rate of B. t. in cooperative gypsy moth suppression projects reflects an ebb and flow relationship, with increased or decreased use rates in 1 year directly related to the results of field tests or operational trials the previous year. Some of the earliest operational trials with B. t. in Forest Service cooperative gypsy moth suppression projects occurred in 1973-1975. The number of acres treated with the insecticide were small, and never exceeded 1.5 percent of the total project acreage (Table 1). Although foliage protection was generally acceptable in these trials, State cooperators expressed doubts about the prospect of achieving desired population reduction levels. Problem areas were identified in methods improvement, including application timing, dosage, and number of applications required (USDA 1974). During the next 4 years, 1976-1979, B. t. was not used operationally in cooperative gypsy moth suppression projects (Table 1), although field trials continued.

In 1980, B. t. operational use skyrocketed. The three States participating in cooperative suppression projects that year treated more than 37,000 acres with the insecticide or approximately 46 percent of the total project acreage (Table 1). Unfortunately, the results were dismal in most cases (USDA 1981). Operational use of B. t. dropped considerably in 1981 and 1982 (Table 1) as States directed resources to more economical and efficacious insecticides in wake of the increased gypsy moth activity throughout the Northeast.

Table 1.--B. t. use in Forest Service cooperative gypsy moth suppression projects 1973-1984.

Year	Total acres treated	Acres treated with B. t.	Percent treated with B. t.
1973	173,570	2,570	1.5
1974	252,844	2,305	0.9
1975	48,579	700	1.4
1976	42,270	0	0
1977	96,146	0	0
1978	169,880	0	0
1979	69,887	0	0
1980	81,370	37,663	46.0
1981	350,299	22,436	6.4
1982	726,757	66,470	9.1
1983	598,760	418,434	70.0
1984 a/	543,613	214,010	40.0

a/ Proposed.

A variety of factors returned B. t. a leading role in 1983 suppression projects with applications made to more than 400,000 acres or 70 percent of the total project acreage (Table 1). Current plans in 1984 call for B. t. application to 214,010 acres, representing 40 percent of the total acreage proposed for treatment (Table 1).

The acceptability and almost standard use of B. t. in cooperative gypsy moth suppression projects in recent years can be attributed to the following:

1. Methods improvement.
2. Cost reduction.
3. Public acceptance (and pressure).

Since 1980, rapid advances have been made in the methods improvement area. The introduction of new formulations of B. t. have eased mixing, loading, and application difficulties experienced in the past making B. t. more efficient to use operationally. More than any other improvement, the demonstration of acceptable performance with a single application at higher dose rates has elevated B. t. to a viable, cost effective alternative. Marketplace competition by B. t. manufacturers has also served to drive down material costs.

For example, material and application costs in 1983 cooperative suppression projects were as low as $5.50 per acre. Bids already received by the West Virginia Department of Agriculture (WVDA) for 1984 project work indicate that material and application costs could be near $6.00 per acre (personal communication, Alan R. Miller, WVDA). These costs are lower than all of the chemical insecticides except Dimilin.

Public concerns over human health risks have generated a tremendous appeal for the use of B. t. in place of the chemical insecticides. Pressure has been applied to public officials by local citizenry through State legislatures and the courts to ban or severely curtail the use of chemical insecticides. Comment letters received for and published in the current USDA Final Environmental Impact Statement for gypsy moth suppression and eradication projects (USDA 1984) are replete with questions on public health risks, particularly cancer and birth defects. Most of these letters support the use of B. t. instead of chemical insecticides. The recent increase in B. t. use, particularly in populated areas, can be largely attributed to public pressures, and States' responses to address these concerns.

B. t. and Project Objectives

Is B. t. adequately achieving the objectives of cooperative gypsy moth suppression projects? The track record of B. t. in the last several years is mixed. Comments from State cooperators and data in post-suppression evaluation reports indicate that except in extremely high gypsy moth populations, the objective of foliage protection can be achieved. Population reduction, however, is variable.

During the 1983 cooperative suppression projects, 418,434 acres comprising 70 percent of the total project acreage in 7 States were treated with B. t. These treatments were applied to a wide range of gypsy moth population levels (250 to more than several thousand egg masses per acre) in different phases of outbreak (building, static, declining) and provide a good evaluation of B. t. The results of 1983 suppression activities in Maryland, New Jersey, Pennsylvania and West Virginia demonstrate similar trends. Treatments in these four States accounted for 98 percent of all the B. t. used in cooperative suppression projects last year.

Maryland.--The Maryland Department of Agriculture (MDDA) treated 50,242 acres with B. t. in 1983. Foliage protection was achieved; however, approximately 42 percent of the treatment areas Statewide contain gypsy moth populations averaging more than 250 egg masses per acre and qualify for retreatment in 1984. Up to 90 percent of treatment areas which have never sustained defoliation, but contain building populations, qualify for retreatment in 1984 (personal communication, Robert Tichenor, MDDA).

New Jersey.--The New Jersey Department of Agriculture (NJDA) reported that 5,000 of 11,000 acres treated with B. t. last year need to be retreated in 1984. When B. t. is used in areas containing building gypsy moth populations in excess of 1,000 egg masses per acre, NJDA expects the need to retreat nearly 50 percent of the acreage the following year (personal communication, John Kegg, NJDA).

Pennsylvania.--The Pennsylvania Bureau of Forestry (PA BOF) treated more than 326,000 acres with B. t. in 1983, accounting for 88 percent of their total project acreage. Statewide, 25 percent of the treatment areas qualify for retreatment; however, this ranges from a low of 15 percent to a high of 84 percent. In areas where building gypsy moth populations were present, 44 percent of the treatment areas qualify for retreatment (personal communication, William Slippey, PA BOF).

West Virginia.--The West Virginia Department of Agriculture treated 16,735 acres with B. t. in 1983. These areas had never before sustained gypsy moth defoliation, but contained building gypsy moth populations averaging several hundred egg masses per acre. Foliage protection was achieved, but population reduction was variable, averaging 43 percent overall. In some areas, gypsy moth populations increased more than twice the pretreatment levels. A total of 9,775 acres of the area treated in 1983 (58 percent) may be retreated in 1984 (personal communication, Alan R. Miller, WVDA).

The overall experience with B. t. by State cooperators can be summed up by the conclusions drawn in Pennsylvania's 1983 post-suppression evaluation. In that report, it is stated that "treatments...in healthy-building populations gave inconsistent results. Overall, however, foliage protection was still achieved in the vast majority of areas." Furthermore, "Most treatment areas will not need respraying in 1984, the exceptions being most of those areas which exhibited healthy-building populations." (PA DER 1983).

Planned B. t. use in proposed 1984 cooperative suppression projects will drop to about 40 percent of total project acreage as State users reevaluate the most efficient role for the insecticide (USDA 1984). Pennsylvania, the largest user of B. t. in 1983, plans to treat only 49 percent of project acreage with the insecticide in 1984 while West Virginia's B. t. use will encompass only 16 percent of proposed treatment acreage. B. t. treatments in Maryland and New Jersey will be in between these figures.

It appears that 1984 will be a year of retrenchment as States evaluate new techniques with B. t. in building gypsy moth populations. Pennsylvania, for example, plans to pursue 20 BIU applications in healthy-building populations, and will also gather more operational data on reduced volume applications (96 ounces per acre) and various stickers. New Jersey plans to conduct similar activities. A concerted effort is necessary to continue methods improvement activities in order to improve B. t. performance in these building population situations.

For the foreseeable future, B. t. will continue to be the insecticide of choice in populated areas given the public mood concerning other treatment alternatives. State cooperators agree that single applications of 12 Billion international units (BIU) per acre in static or declining gypsy moth populations do an excellent job and can achieve both foliage protection and population reduction. Where gypsy moth populations are healthy and building, however, B. t. will lose favor unless performance improvements can be demonstrated.

Literature Cited

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