JOURNAL OF
ARBORICULTURE

June 1984
Vol. 10, No. 6

IMPLEMENTING LANDSCAPE PLANT MANAGEMENT PROGRAMS IN INSTITUTIONAL AND RESIDENTIAL SETTINGS[1]

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Abstract. Extension specialists at the University of Maryland cooperated with county agents, suburban homeowners and institutional groundskeepers to develop, implement, and evaluate integrated pest management (IPM) programs for landscape plants at homesites and a university campus. The programs enabled participants to deal with plant problems in economically and environmentally sound ways while maintaining or improving the aesthetic quality of their plants. Each program generated valuable regional information on the types of plant materials used, their susceptibility to insect, disease and cultural problems, and the relative importance of various pests encountered. An additional benefit included extensive on-the-job training for the students who conducted the programs. Both programs provide a dynamic method for managing landscape plants and their problems now and in the future.

In a recent issue of the Journal of Arboriculture, J.T. Walker (9) discussed the need for integrated pest management (IPM) programs in urban settings. Health and safety hazards may be more acute in cities and suburbs where people are densely clustered and relatively high rates of pesticide use increase the risk of exposure. Furthermore, in dealing with pests in urban settings, pest managers face problems that for years have plagued managers of agricultural systems. These include the buildup of resistance in pest populations, the rapid resurgence of pests, and the outbreak of new pests when pesticides selectively remove beneficial insects from the managed system (5).

Extension entomologists at the University of Maryland have responded to this need by conducting several IPM demonstration projects in a variety of urban and suburban settings (1,2,3,6,7). As an holistic approach to pest control, IPM ideally integrates all economically feasible and environmentally compatible management tactics (biological, chemical, cultural, etc.) to reduce pest populations to tolerable levels (4). Furthermore, IPM involves the management of all pests (insects, diseases, weeds, etc.) as well as cultural problems within the system under consideration.

In developing any IPM program several basic components must be assembled. Program supervisors such as landscape managers or arborists must gather or establish channels to access all available information and knowledge necessary to conduct the program and make sound management decisions. Literature, other plant care professionals, university researchers and extension specialists and personal experience will all serve as sources of information on pests, beneficial insects, control practices, and economic and environmental considerations that will affect management decisions. A procedure for regularly monitoring pests, beneficial organisms, and other system factors that affect plant health must be designed. Guidelines must be established for determining when pests and other problems achieve a status that warrants control. The

1. Presented by Dr. Raupp at the annual conference of the International Society of Arboriculture in Indianapolis, Indiana in August 1983.

methods and hardware of control must be assembled. These may include an array of chemical, biological, and cultural practices and the tools needed to implement them. Finally, a way to evaluate the effectiveness of control actions and the program in general must be developed.

This report will summarize two IPM programs designed to manage the pests and other problems of landscape plants. The first program was conducted with 100 homeowners in six suburban communities in central Maryland during the summer of 1982. The second is an ongoing program at the College Park Campus of the University of Maryland conducted in cooperation with the Grounds Maintenance and Development Division of the Department of Physical Plant. The following discussion will examine the organizational structure methods of implementation and findings of

The homeowner IPM program: organization and implementation. The primary objective of the homeowner IPM project was to develop and implement a program that homeowners could use to more effectively manage their lawns, shrubs and shade trees. As an educational program, the operational objectives included increasing the homeowner's ability to (1) recognize the ornamental plants at the homesite, (2) identify the agents creating problems for those plants, (3) decide if and when pests needed to be controlled, (4) select an effective control tactic from available alternatives and (5) apply controls in a timely, safe and cost effective fashion.

The program was orgnized and implemented following earlier ones developed by Davidson and Gill (1,2), Davidson et al. (3) and Hellman et al. (6). The foundation of the program was the 100 participating homeowners in Montgomery and Howard counties. Community leaders arranged for interested homeowners to meet with program supervisors during the spring of 1982. Homeowners paid a $50 fee to cover the scouting costs associated with the program.

After homeowners enrolled, IPM scouts were hired. Scouts were selected from undergraduate students at Maryland who had excelled in plant care and pest management courses, such as Woody Plant Materials, Pests of Ornamental Plants, Plant Diseases, etc.

The scouts made a preliminary visit to each homesite. The result of this visit was a detailed landscape map that indicated the location and type of each shrub and shade tree at the site (Figure 1). Once the maps were complete, the scout visited each homesite biweekly from late May through August to monitor all plants for pests and cultural problems. Populations of beneficial insects were also observed. Plants with unknown causes of damage were sampled as needed. In addition to examining plants, scouts used other techniques such as pheromone traps to monitor pest activity. Furthermore, soil samples were taken to evaluate and correct nutrient and pH problems in the lawn and selected beds.

Following each scouting visit, scouts met with supervisors to discuss remedial actions. Scout supervisors were county agents or graduate assistants at the University. Recommendations for

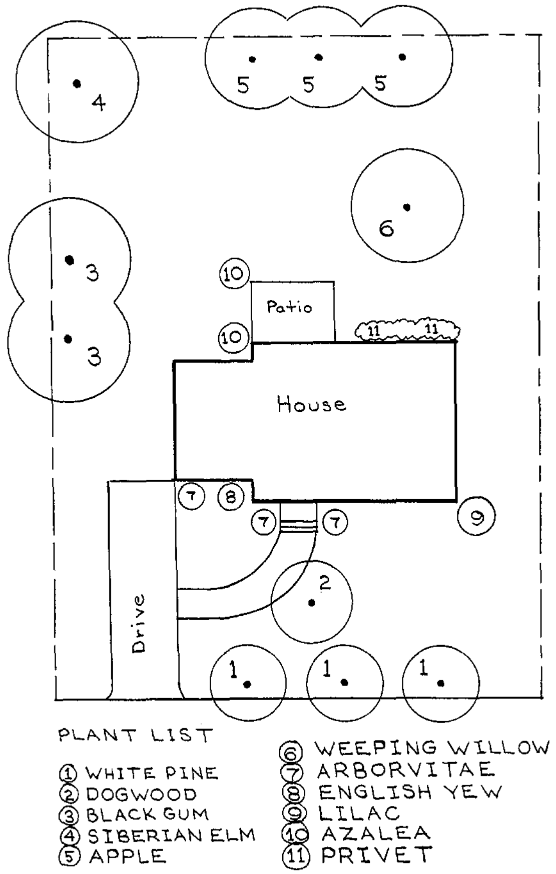

Figure 1. An example of a landscape map used in the homeowner IPM program.

most problems were made by the supervisor in consultation with the scout. However, problems that could not be solved at this level were forwarded to the University of Maryland's Plant Diagnostic Clinic and other appropriate extension specialists.

When all problems had been discussed, each landscape map was annotated to show the location of each problem encountered and management options available (Figure 2). Accompanying the updated landscape maps were newsletters that summarized pest activity within the community and extension fact sheets that provided detailed information on specific problems. Homeowners received this information by mail usually within a week of the scout's visit and incorporated it into a looseleaf binder provided at the beginning of the program. By the end of the summer, each homeowner had a personalized IPM guide of approximately 80 pages that could be used season after season.

During the latter third of the program, homeowners were surveyed by mail. The survey was a short questionnaire designed to evaluate how well the operational objectives of the program had been fulfilled.

Results and discussion. With respect to the operational objectives outlined above, we considered the homeowner project to be a success. Survey results indicated improvement in the homeowners' abilitities to recognize their ornamental plants and identify the agents causing plant problems. Furthermore, the majority of homeowners believed that their ability to select the correct chemical controls and apply them at the proper time had increased. Most believed that they were more likely to substitute control tactics other than sprays such as pruning out pests as a result of the program. More than 80% of those responding to the survey felt that their ability to deal effectively with plant problems had increased and that they would save money and reduce pesticide use in the long run by adopting an IPM approach.

In addition to evaluating program objectives, we also surveyed homeowner willingness to participate in IPM programs offered on a commercial basis. Half of those responding to the survey said they would subscribe to a commercial IPM service.

Data gathered during the homeowner program have been compiled and summarized below. These results provide information on the type of plant materials being used, their tendency towards various problems, and the types of problems encountered. Extension and research entomologists at the University of Maryland are using this information to focus educational and research activities.

Plants encountered. A total of 5,855 individual plants and plant units (plants of the same species with coalesced canopies) were encountered in the 100 homesites. The 10 most common trees and shrubs are listed in Table 1.

These lists agree very closely with earlier lists published for suburban Maryland homesites (Hellman et al. 6). Differences in plants scouted

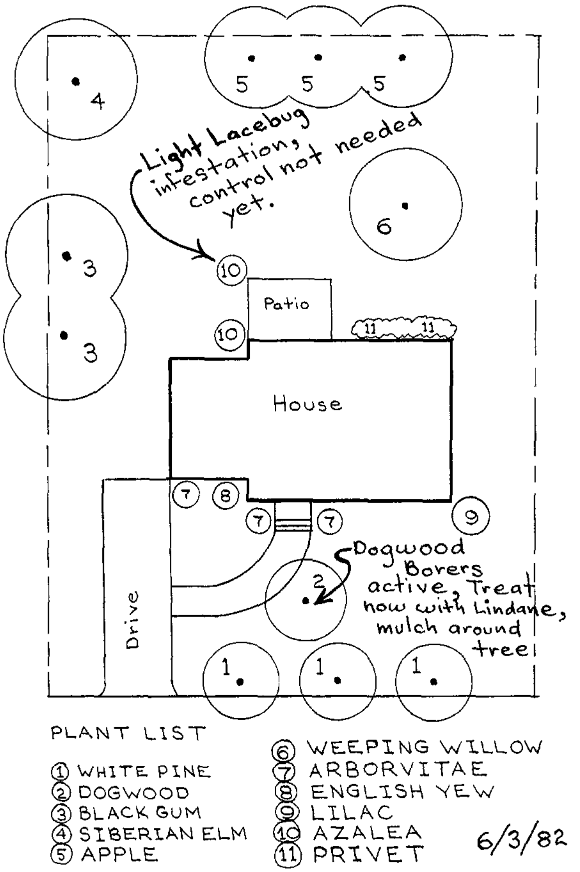

Figure 2. An annotated landscape map sent to the homeowner following the scout's visit. Location of pests and management recommendations are listed on the map.

reflect variation in characteristics such as the age and geographic location of the community.

During the 1982 growing season, 1716 plant problems, including those in lawns, were encountered in the 100 homesites monitored. The most common recommendation (43%) involved the application of chemicals to control the problem. However, 38% of the problems required non-chemical controls such as pruning, mulching, hand removal of pests or correction of water, nutrient, or pH levels. Nineteen percent of the problems required no action for reasons such as presence of natural enemies, or the lack of sufficient numbers or damage potential of the pest to warrant control.

When information on plant materials and types of problems are examined simultaneously, plant materials can be rated according to their likelihood of harboring problems. Table 2 lists the 5 most problem prone trees and the 5 most problem prone shrubs encountered in the 30 most common trees and shrubs. In contrast to the plants listed in Table 2, Table 3 lists the 5 trees and shrubs with the fewest problems of the 30 abundant plants. Trees such as peaches, apples, crabapples, cherries and dogwoods were beset with a great variety and number of insect, mite, disease and cultural problems. The same was true for pyracanthas, lilacs, boxwoods, roses and euonymus. Some plants such as peaches had multiple problems hence the percentage of plants with problems exceeded 100. Of the 1390 chemical and non-chemical control recommendations made for all plants during 1982, 520 or 37% were made for the 10 plants listed in Table 2 alone. These 10 plants comprised only 21% of the total plants encountered. Therefore, homeowners could greatly reduce time and money spent on plant maintenance by replacing these plants with others that would achieve the same effect or by using available cultivars that are more resistant or tolerant to diseases, insects and environmental stress. Greater consideration of the placement of plants at homesites would also help alleviate many problems.

Table 1. Ten most common trees and shrubs encountered in 6 Maryland communities in 1982.

	% of total plant units (5855)
Tree	
Dogwood	7
Maple	4
White pine	4
White oak	4
Spruce	3
Holly	2
Red oak	2
Hemlock	2
Apple (fruit)	1
Tulip poplar	1
Shrub	
Azalea	14
Juniper	6
Yew	4
Euonymus	4
Japanese holly	4
Arborvitae	3
Forsythia	3
Rose	3
Rhododendron	3
Boxwood	2
Total	76

Several commonly used shrubs such as yew, honeysuckle, and viburnum were almost pest free (Table 3). We found black gum to be an excellent native tree lacking insect, disease, and cultural problems. While black locust and tulip poplar are attacked by leaf miners and aphids respectively, they are trees least preferred by the gypsy moth, a serious regional threat to landscape plants. These plants probably deserve more attention in landscape design and construction.

Of the 1716 pest and cultural problems encountered, 53% could be attributed to insects and mites. Ten percent were caused by plant pathogens including bacteria, fungi, and viruses, while weeds accounted for only 2% of the problems. Nematodes were found killing a zoysia lawn at one homesite. The remaining problems could be attributed to cultural problems such as improper soil pH, fertility, exposure, etc.

The 10 most common insect and mite (arthropod) pests are summarized in Table 4. Several of the cateogries in Table 4 are groups of several pest species. The most common lacebug was the azalea lacebug. This pest was the single most common insect species encountered in 1982. Spider mites were the most common type of mite found. The abundant scale insects were euonymus, juniper and obscure scales, and the most common borers were the dogwood and peach tree borers and the oriental fruit moth. Important leaf miners included those on boxwood, arborvitae and birch. The most common aphids of import were on roses and the most common galls were those on spruce caused by adelgids. The primary weevil pest was the Japanese weevil.

Our findings agree well with results of previous homeowner programs (Hellman et al, 6). The majority of pests listed in Table 4 are now considered key pests or ornamental plants in typical suburban Maryland homesites. However, in situations where plant materials differ from those found at homesites, pest complexes will also differ. For example, the pests of large scale plantings at the University of Maryland, reported on later in this paper, are quite different than those found at homesites. Furthermore, Holmes and Davidson (7) worked with homeowners of a different socioeconomic class and found differences in plant materials and associated pests. A thorough study of the types of plant materials and their pests is vital to conducting any IPM program.

Table 2. Five most problem prone trees and shrubs of the 30 most common ones encountered in 6 Maryland communities in 1982.

	% of plants with problems
Tree	
Peach	110
Crabapple	78
Apple (fruit)	67
Flowering cherry	31
Dogwood	26
Shrub	
Pyracantha	67
Lilac	60
Boxwood	43
Rose	37
Euonymous	36

Table 3. Five least problem prone trees and shrubs of the 30 most common ones encountered in 6 Maryland communities in 1982.

	% of plants with problems
Tree	
Black locust	0
Black gum	0
White oak	3
Tulip poplar	4
Hickory	4
Shrub	
Yew	0
Honeysuckle	0
Barberry	6
Arborvitae	7
Viburnum	8

An Institutional Landscape IPM Program at the University of Maryland Campus: Organization and Implementation

The primary objective of the campus IPM program was to design, implement, and evaluate an IPM program for managing pests in a large scale landscape. The operational objectives included improving decision making regarding the need for control tactics, providing better selection and timing of controls, and reducing the amount of chemicals being applied by adopting practices such as spot sprays. By altering management practices we hoped to reduce economic and environmental costs associated with unnecessary or poorly timed sprays and yet maintain or improve the aesthetic quality of ornamental plants in the landscape.

The program was modeled after ones developed for homeowners by Davidson and Gill (1,2), Davidson et al., (3) and Hellman et al., (6). The University of Maryland at College Park occupies a 1300 acre site. The large size of the campus and the limited budget for scouting precluded the possibility for monitoring all the plants. Therefore, several high priority areas such as the Administration Building, Chapel, and Plant Nursery were selected by the Grounds Division to receive regular monitoring.

Each week all plants or plant units (clusters of the same species with coalesced canopies) were inspected for insect, mite, disease and cultural problems. When problems such as plant diseases could not be diagnosed in the field, plant samples were taken to the University's Plant Diagnostic Clinic where identifications and control recommendations were made (extension specialists in Entomology, Botany, Horticulture, and Agronomy assisted in this process).

In addition to visually monitoring pest activities, pheromone traps were used to sample Japanese beetles, clearwing borers, and the gypsy moth. Data gathered from these traps served as a basis for timing chemical applications. Information gathered by the IPM scouts was summarized in a report. This report included control recommendations for the observed problems. Recommendations were based on pest populations and damage levels, densities of natural enemies, environmental and site conditions, and the landscape use and value of the plant. Plants with problems warranting control were indicated on a map (see Fig. 2).

Within three days of the actual scouting, written reports were given to Grounds personnel. Problems that required immediate attention were communicated verbally to maintenance people as rapidly as possible. Each week scouts and Grounds personnel met to discuss the findings of the scouting activities and to plan the spray schedule for the following week. The verbal communication was an important aspect of the management process.

Applications of chemicals were made by Grounds personnel and 1 of the 2 IPM scouts under their supervision. Although some treatments required the use of a large hydraulic sprayer, many were adequately administered with a backpack sprayer. Spot applications were used whenever possible.

Results and discussion

Plants encountered. In total, 4072 plants including plant units were regularly monitored during the 1981 scouting program. The 10 most commonly encountered trees and shrubs are listed in Table 5. These lists vary considerably from those generated in the homeowner program. For example, oaks, pines and maples accounted for over ⅓ of the trees monitored on campus while the 10 most common trees sampled previously at Maryland homesites accounted for less than ⅓ of the total plants found. These differences reflect the reduction in plant diversity characteristic of many large scale plantings. Oaks, pines, and maples have been extensively used as specimens and in mass plantings at the College Park campus.

Shrubs used in homesites and on campus also differed in several ways. For example, Hellman et al. (6) and we found azaleas and junipers to comprise about 20% of the total plant units scouted at homesites. However, at the Maryland campus

Table 4. Ten most common insect and mite pests encountered in 6 Maryland communities in 1982.

Pest	*% of total arthropod pests (913)*
Lacebugs	21
Mites	19
Scales	13
Borers	7
Leaf miners	7
Japanese beetle	4
Aphids	4
Bagworms	4
Galls	3
Weevils	1
Total	83

Table 5. Ten most common trees and shrubs encountered at the University of Maryland in 1981.

	% of total units (4072)
Tree	
Oak	20
Pine	10
Maple	5
Crabapple	3
Magnolia	1
American holly	1
Willow	1
Cherry	1
Dogwood	1
Deodar Cedar	1
Shrub	
Japanese holly	13
Hollies (other)	4
Juniper	4
Yew	3
Privet	3
Cherry laurel	2
Rhododendron	2
Pyracantha	2
Azalea	2
Boxwood	1
Total	80

these plants represented only 6% of the total plant units monitored in the program. On campus, Japanese and other hollies largely replaced azaleas and junipers as the most common schrubs. The likely explanation for this is the use of hollies as large scale foundation plantings.

Pests encountered. Insect and mite problems encountered at the University of Maryland were also quite different from those found at homesites (Table 6). Lacebugs and mites accounted for 40% of the arthropod pests at homesites while these pests represented only 17% of the pests on campus. This difference reflects the greater use of azaleas and junipers at homesites. The azalea lacebug and spider mites were the major arthropod pests of these widely used plants. In contrast, oaks were the most commonly encountered plant at the University of Maryland campus. Early season defoliators such as cankerworms and forest tent caterpillars were the major pests of these plants and assumed primary status in the pest ranking. These defoliators were primarily pests of trees at the plant nursery rather than landscape plants on campus. Another striking difference between pests found at the University and those found at homesites was the preponderance of pine tip moths such as the Nantucket pine tip moth as pests. The wide use of susceptible pines, especially Mugo pines, accounts for this result. The complexes of scales, lacebugs, leaf miners, and aphids were similar on campus and at homesites. In general the insect and mite pest fauna was much less diverse on campus than at homesites. This probably reflects the lower plant diversity on campus.

Operational aspects. A comparison of pesticides used in the year prior to (1980) and during (1981) the campus IPM program is presented in Table 7. Herbicides are excluded from this summary because IPM scouts did not make herbicide recommendations. These figures represent an estimate generated from Pesticide Application Records kept by the Physical Plant. Dormant oil sprays applied in 1980 are excluded from the analysis because equipment breakdown prevented their application in 1981. In general, pesticide use decreased during the 1981 program primarily due to reductions in the use of the insecticide diazinon, the fungicides benomyl and zineb, the miticide kelthane, and the nematicide dazanit. These reductions resulted from selection of materials that controlled pests more effectively, application of materials at the proper time, and adoption of practices such as spot versus cover spays. The increase in the amount of lindane applied in 1981 is noteworthy. This reflects the increased use of trees susceptible to attack by clearwing borers such as dogwood and cherry. These trees require preventative sprays to control borers (8).

Table 6. Ten most common insect and mite pests encountered at the University of Maryland Campus in 1981.

Pest	*% of total arthropod pests (1262)*
Cankerworms	29
Pine tip moths	17
Scales	15
Lacebugs	11
Forest tent caterpillar	6
Eastern tent caterpillar	6
Mites	6
Leaf miners	4
Aphids	2
Bagworms	1
Total	97

Table 7. A comparison of pesticide usage prior to (1980) and during (1981) IPM program at the University of Maryland's College Park Campus.

Pesticide	*Amount applied*	
	1980	*1981*
Lindane (gal)	2.7	16.0
Diazinon (gal)	14.4	.4
Cygon (gal)	1.3	1.1
Sevimol (gal)	.3	0
Dursban (gal)	0	.3
Orthene (lb)	18.1	12.0
Methoxychlor (lb)	0	2.3
Kelthane (lb)	4.5	0
Benlate (lb)	2.9	1.0
Zineb (lb)	4.7	0
Dazanit (lb)	50.0	0
Total (gal)	18.7	17.8
(lb)	80.1	15.3

The estimated cost of materials applied in 1980 (adjusted for inflation) was $657. In 1981 the materials cost $565. If the fixed cost of prevenative borer sprays is removed from these costs (borer sprays would have been applied regardless of the scouts' recommendations), the variable costs of materials were $601 in 1980 and $149 in 1981. This change reflects a 75% reduction in variable costs of materials during the IPM program.

The savings realized by applying less material did not compensate for the greater labor costs associated with scouting during the first year of the program. However, during the second year of the program a significant savings was realized in material and labor costs due to more selective use of pesticides, especially dormant oil sprays for scale control. Furthermore, managers at the Grounds Division believe that the aesthetic value of the landscape has improved as a result of the program. IPM practices such as regular monitoring of pests prevented major problems from developing. Serious problems of mass plantings had occurred prior to the program. For these reasons, and the commitment of the Grounds Division to consider long term economic and environmental benefits as well as short term ones, a campus landscape IPM program is operational now and similar ones are planned for the future.

Due to the progress made by the Grounds Division IPM program, the Department of Resident Life established an IPM program in 1982 to manage problems of trees and shrubs surrounding campus dormitories. This program was modeled after the one conducted by the Grounds Division. Although figures are not available regarding biological and economic aspects of the program, the program has provided more effective pest control while maintaining or improving the aesthetic quality of plants due to more effective needs assessment and timing of pesticide sprays. Like the Grounds IPM program, the one at Resident Life is considered successful and is scheduled for continuation.

Conclusion

The accomplishments of the homeowner and institutional landscape IPM programs may be viewed at several levels. First, we have demonstrated that the IPM approach can be implemented in small and large landscape systems such as homesites and institutions. Second, participants in both programs believed that they were able to deal more effectively with their plant problems as a result of the program. Homeowners felt that they would save money and reduce unnecessary pesticide application with an IPM approach. Similar changes in pesticide use patterns were seen on campus. A third and vital benefit of these programs has been the production of highly trained plant care personnel. The students trained in these programs have moved on to jobs as arborists, research technicians, institutional pest control supervisors, and private consultants. Finally, these programs along with their antecedents and descendents, are generating a much needed data base documenting the occurrence and status of pests in the mid-Atlantic region.

The introduction to this paper lists several elements basic to an IPM program. Many of these elements such as information sources, control tactics and hardware are available and in widespread use in the plant care industry. However, other aspects such as the regular monitoring of pest populations and those of beneficial insects are not widely used. Progress in developing decision-making guidelines for the major pests of ornamental plants lags far behind the progress made in agronomic systems. Compounding this problem is a devastating lack of detailed information regarding the biology and ecology of the major pests or ornamental plants. Although preliminary IPM programs can and should be designed, implemented, and demonstrated in suburban settings, maximum benefits will not be realized until basic research needs have been fulfilled. Unless priorities shift in sources of funding for ornamental plant IPM or new sources become available, we believe progress in these areas will be slow. Despite these obstacles, we firmly support IPM as the most rational approach to managing the pests and problems of trees, shrubs, and turf in suburban systems.

Acknowledgements

We thank the participating homeowners of Montgomery and Howard Counties, Maryland and the Ground Maintenance and Development Division of the Department of Physical Plant, University of Maryland for providing funding for these programs. We also are indebted to John Holmes, Raymond V. Bosmans, and Stanton A. Gill for supervising various aspects of the program. We thank John A. Davidson and Mark Snyder for reviewing earlier drafts of this paper.

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ABSTRACT

LITZOW, M. and H.M. PELLETT. 1983. **Reflective materials show promise in helping prevent sunscald.** Am. Nurseryman 157(12): 69-70, 72-75.

Sunscald is a major problem on many shade trees grown in the North. The exact causes of sunscald are not well defined, but this malady often does much damage in areas where there are rapid and wide temperature fluctuations in winter. Various methods of preventing sunscald have been recommended. These include using Kraft paper tree wraps, whitewash, board shields, a white, water-based paint, a whitewash slurry of lime, casein and a sticker, slaked limed, and aluminum foil. Because rapid temperature changes appear to cause sunscald, materials that prevent these changes under alternating periods of shade to sun and vice versa should have the greatest potential for preventing injury. The following study was conducted to determine the effectiveness of various protective materials in preventing rapid temperature fluctuations under alternating sunny and shady conditions. Effective products could then be tested in the field. The test materials were wrapped around stakes and white ash sections in a spiral arrangement. The Kraft paper tree wrap consistently showed a faster rate of temperature change than the control, suggesting that materials commonly used for sunscald prevention may not provide the expected protection. The three treatments using reflective materials (foil, foil over AirCap Barrier coated bubbles, and Foylon 7018) had the slowest rates of temperature change.