The transplant method can be readily employed for ensured establishment of crown vetch on steep slopes or on other difficult areas where erosion effects make direct overseeding of dubious value. Virtually 100 percent survival was obtained during the initial establishment period at all three locations, including the badly eroded site of Caratunk. In addition, transplant seedlings are easily maintained until the actual planting date, which is in contrast to the short storage life of rhizome cuttings.

Seedling transplants of crown vetch suitable for field use can be readily produced in greenhouse flats within 2-3 months after seeding. Key factors in rapid seedling growth are adequate watering and supplemental fertilization. The soil used in the peat pots should be well fertilized and limed prior to seeding. In some cases, it may be desirable to top-dress a high-potash fertilizer over the flats of seedlings a month or two after seedling emergence.

The desired spacing of crown vetch transplants will vary with soil conditions (moisture and fertility), slope exposure, and other factors. Vegetative spreading by rhizome elongation (below ground) generally did not begin until early spring of the year following the year of transplanting. Further spreading then occurred during the cooler parts of each growing season; there was little or no rhizome extension during midsummer. By fall of the second year after the planting year, the more vigorous plants had spread laterally 122-152 cm under conditions of adequate fertilization and reasonably good soil moisture supply (Orland). Under more droughty conditions (Old Town), spreading was more limited. For all sites it appeared that supplemental fertilization was highly important to vigorous rhizome growth. Potassium was the key nutrient element in this regard, and it is recommended that crown vetch transplantings should be top-dressed with a high-potash fertilizer (e.g., 0-10-40) sometime during the year following the year of planting.

Winter survival of both crown vetch and bird's-foot trefoil was very good during the period of study (1976-1978). It appeared that these two legume species would prove to be long-lived on highway slopes in Maine. However, in 1979, 1980, and 1981, visual observations indicated that trefoil stands were beginning to thin at all locations but may improve from natural reseeding. Potential heaving problems were minimized by the natural surface drainage of these slopes. Low-temperature injury was minimized by the protected position of rhizome buds of crown vetch and the deep set crown of trefoil. Natural mulching by dead vegetation on these overwintering slopes was also an important factor that contributed to legume survival.

Overseeding of Bird's-foot Trefoil by Using a Herbicide

The overseeding of bird's-foot trefoil (Empire) in grassed slopes justifies certain conclusions regarding management practices for the successful establishment of bird's-foot trefoil in grass sods on Maine roadsides. They are summarized as follows:

1. Fewer established plants were obtained from the April 9 seeding; however, good stands may develop in subsequent years from delayed germination of hard seeds or from natural reseeding;
2. There is a definite advantage to using a herbicide such as paraquat to reduce competition, especially where the density of the initial ground cover is high;
3. Observations made during the growing season indicate that some initial ground cover is beneficial in protecting the seed from the herbicide and helps prevent the seed from being washed downslope during heavy spring rains;
4. Differences due to fertility treatments were not observed until the 1978 season;
5. No observed differences in trefoil stands could be attributed to the different clay and sandy soil types; and
6. The observations made in 1978 indicate that treatments 5 and 6, both of which had a May seeding and received paraquat, gave the best ground cover.

ACKNOWLEDGMENT

I wish to acknowledge the Materials and Research Division of the Maine Department of Transportation, without whose cooperation and financial support this study would not have been possible. I also extend my thanks to Laurie Shaw for typing the manuscript.

The opinions, findings, and conclusions expressed in this paper are mine and not necessarily those of the Maine Department of Transportation. No endorsement of named products is intended nor is criticism implied of similar products that are not mentioned.

Publication of this paper sponsored by Committee on Roadside Maintenance.

Abridgment

Environmentalism, Pesticide Use, and Rights-of-Way

RON ARNOLD

A spectrum of organized environmental groups is attempting to stop the use of pesticides that are vital to rights-of-way maintenance. Managers must supplement their scientific training with an understanding of social and political dynamics in order to preserve chemical programs. Affluence and occupational shift to the service sector are among the primary forces that gave rise to the environmental movement of the 1960s and shaped new laws and regulations. Five types of antipesticide groups are discussed, and differences in their internal dynamics and tactics are examined. The campaign to ban 2,4,5-T is a typical case that shows how antipesticide groups use sympathetic media coverage and political pressure on government agencies to obtain their purposes. The development of this campaign is outlined by using expert witness testimony at Administrative Law Hearings of the U.S. Environmental Protection Agency (EPA) to show how pressure tactics appear to have changed EPA policy from its original position that scientific opinion found no causal link between 2,4,5-T forestry spraying and miscarriages near Alsea, Oregon, to the position that statistical data showed a danger sufficient to ban 2,4,5-T for certain uses.

Rights-of-way managers are feeling pressures from groups opposed to chemical pest-control methods and, in general, they are ill-prepared to deal with such social and political forces. Most roadside managers are trained in a scientific discipline and tend to underestimate the power of laypersons who invade their field of expertise. Rights-of-way managers who wish to defend chemical programs are more likely to succeed by supplementing their scientific training with an understanding of society and politics and by familiarizing themselves with the nature of antipesticide activism. There is no predictive theory on these subjects, but a study of events and sociological analysis can yield useful information.

Environmental protection attitudes have become an integral part of American life. A 1978 survey (1) by the Washington, D.C., based group Resources for the Future found that 53 percent of the respondents felt that "protecting the environment is so important that the requirements and standards cannot be too high." A 1981 New York Times survey found that a plurality of respondents still support environmental protection despite a weak economy. Twenty years ago such feelings had little popular appeal. What forces were behind this change?

BACKGROUND

Of the numerous attempts to explain the rise of environmentalism, the most thoroughly documented is Inglehart's The Silent Revolution: Changing Values and Political Styles Among Western Publics (2). By using the mass survey method, Inglehart traced a shift from overwhelming emphasis on material values and physical security during the 1950s toward greater concern about the quality of life during the 1970s and an increase in the political skills enabling the public to play a larger role in decision-making. Inglehart isolated six major forces at the root of this shift, including technological innovation, economic growth, and changes in occupational structure, which created unprecedented physical and economic security. The expansion of higher education developed cognitive skills and raised political consciousness, while the growth of mass communications was a force for change by presenting dissatisfaction, alternative life-styles, and other dissonant signals. The final force studied by Inglehart was the rise of a new generation that was distinctive because it grew up in this affluent, communications-rich society, which was very different from that of its grandparents. This new generation was interested in ecology and natural beauty and willing to impose and endure substantial economic penalties to obtain related values. Inglehart characterized this population as "post-materialists" and looked for a psychological mechanism to explain their value changes.

He found it in Maslow's study, Motivation and Personality (3). Maslow suggested a specific direction in which values will change under given circumstances. He argued that physiological needs for food and shelter are given top priority while they are in short supply, and the need for physical safety comes next. However, once an individual has attained economic and physical security, discontent sets in and new nonmaterial goals arise. The first of these new needs is for love and a sense of belonging, then self-esteem becomes increasingly important, and then comes what Maslow calls self-actualization, or the need to be all that one can be. At the highest level, the desires to know and to understand, and also aesthetic needs, are powerful motivators. This scale, which ranges from basic physiological needs to aesthetics, is called the "needs hierarchy".

Inglehart was satisfied that the needs hierarchy explained the behavior of the new generation, but I find that Maslow had more to say that is pertinent. Maslow's studies showed that as one rises up the needs hierarchy, a feeling of independence from and a certain disdain for the old satisfiers and goal objectives sets in. The lower-level needs, once gratified, may seem boring or even repulsive, and one tends to undervalue the lower levels and overvalue higher, ungratified needs. Maslow calls this phenomenon postgratification forgetting and devaluation. I have found it to be a major factor in shaping attitudes about environmental protection standards that "cannot be too high" (4).

Kahn of the Hudson Institute found a similar phenomenon at the social level in societies that emphasize professional specialization; the more educated and expert people become, the more they are affected by educated incapacity, by which Kahn means "an acquired or learned inability to understand or see a problem, much less a solution" (5). Thus, in our modern world, in which the service sector makes up nearly 70 percent of the labor force, the lower levels, that is, agriculture, forestry, mining, construction, and manufacturing, can be collectively forgotten and devalued in the search for quality of life, and unrealistic attitudes about them can gain widespread acceptance.

Once these underlying dynamics of environmentalism are understood, it is important to understand the group dynamics of environmental and antipesticide organizations. Sociologists call organizations that fight for a cause "struggle groups" and note that they have certain structural features in common. Coser points out in The Functions of Social Conflict that "an organization must disintegrate if it cannot accomplish its purpose. It also destroys itself by accomplishing its purpose" (6). Typically, new purposes are found in order to avoid dissolution, and my study of the history of environmental groups indicates that most evolved in this way (7), including the Sierra Club and the Friends of the Earth, and, most obviously, the Environmental Defense Fund, which started as a single-purpose antipesticide group and branched into other fields when it won its campaign to ban dichlorodiphenyltrichlorethane (DDT) in June 1972. [See lawsuits Yannacone v. Dennison (55 Misc.2d 468, 285 N.Y.S. 2d 467, 1967) for denying injunctive relief against use of DDT for mosquito control in Suffolk County, New York; and Environmental Defense Fund, Inc. v. U.S. Environmental Protection Agency (DDT III) (160 U.S. App. D.C. 123, 489 F.2d 1247, 4 ELR 20031, 1973) for the full report of federal action against DDT.]

Simmel, in his study Conflict, found another important factor: "Struggle groups may actually attract enemies in order to help maintain and increase group cohesion. Continued conflict being a condition of survival for struggle groups, they must perpetually provoke it" (8). Environmental groups have a long record of provoking conflicts, perhaps best documented in the text Environmental Law by Rodgers, which lists more than 500 lawsuits initiated by environmental groups since 1960 (9).

ENVIRONMENTAL GROUPS

There is a distinct spectrum of groups that oppose pesticide use. The most familiar type is the general-purpose environmental group that has an antipesticide department, such as the National Wildlife Federation, Audubon Society, Natural Resource Defense Council, Greenpeace, and many others. These groups tend to be run by a paid professional staff, be directed by volunteer leaders on an elected board, and have paid lobbyists and

paid attorneys. They also tend to have well-developed communication networks and members who execute effective pressure campaigns aimed at legislative and regulatory bodies.

A second type of group is the single-purpose organization devoted solely to opposing pesticides, such as Protect Our Environment from Sprayed Toxins (PEST) in Maine and Citizens Against Toxic Herbicides (CATH) in Washington State. The organization of these groups is typically nonhierarchical, with no single leader; they have more of a network structure without specific responsibilities, which can make working with them somewhat difficult. Personal devotion to the cause and its attendant personality maintenance functions seem more important in single-purpose antipesticide groups, since most of them have no paid staff.

A third type of group is the ad hoc organization that forms around a specific incident such as a chemical spill, a miscarriage in which pesticides are suspected, or other such events, as in the case of the Succotash Alliance, which formed around miscarriages in Ashford, Washington. These groups tend to work with larger groups; the Succotash Alliance works closely with Greenpeace.

A fourth type of antipesticide group is not of the struggle-group class, but consists of life-style groups that oppose pesticide use as a matter of personal belief and have no activist program fighting legislative or litigable battles. Such groups may include health food cooperatives, organic gardening clubs, counterculture communes, and others who oppose pesticides for personal, ideological, or life-style reasons. A particularly influential example is the Rodale Press, an organic gardening publishing house that has a substantial mailing list, which opposes pesticides in many of its publications (10).

A final and worrisome type of antipesticide group is the sabotage organization, several of which have surfaced within the past two years. One made headlines on June 3, 1981, when two masked women calling themselves members of the People's Brigade for a Healthy Genetic Future told television reporters their group was responsible for blowing up a forestry herbicide spray helicopter (11). Three spray helicopters have been destroyed in such attacks since May 1980, and two incidents of ground spray crews being attacked by protesters have been reported in Oregon (12).

The most active antipesticide organization in America is the Northwest Coalition for Alternatives to Pesticides (NCAP) in Eugene, Oregon, which has 33 member groups from northern California to British Columbia, Canada. Social change is a prominent motive of NCAP, which is funded in part by a group describing itself as a progressive fund for social change in the Pacific Northwest. NCAP leader Fred Miller was quoted as saying, "I'm for centralization....I want to wipe out capitalism, eradicate it from the face of the earth" (13). Radical and activist statements are conspicuous in NCAP publications (14).

An NCAP affiliate published a handbook entitled The Toolkit (15), which contains 13 rules for fighting toxic sprays. Rule 3 advises, "Raise enough hell politically and through the media to get the spray plan postponed 'for further study'. From the start, spend time consulting your elected officials. They may not agree, but they're wary of offending active voters. If your name is in the paper a lot, that helps even more. In this way, you can at least neutralize some people who might be speaking out against you otherwise." Rule 9 states, "If your job [in the antipesticide group] is evaluating research, never trust the conclusions of the author." Rule 11 says, "Stay on the attack. You select the issues."

Toolkit author Merrell of NCAP told an April 16, 1981, meeting of the Izaak Walton League in Waldport, Oregon, "It doesn't matter how many studies are done. It doesn't matter what the facts are. This is a political issue and the political realities are that these chemicals are going" (16).

2,4,5-T CONTROVERSY

NCAP was prominent in the campaign to ban 2,4,5-T, along with Friends of the Earth and certain individuals. The 2,4,5-T campaign began with Bonnie Hill of Alsea, Oregon, who had suffered a miscarriage in 1975 for which her physician had no explanation. On April 11, 1978, Hill and seven other women wrote a letter to the U.S. Environmental Protection Agency (EPA), which contained charts correlating the dates of their miscarriages with spraying of nearby forest lands that used 2,4,5-T during routine brush-control programs. The eight women noted the high toxicity of 2,4,5-T contaminant 2,3,7,8 tetrachlorodibenzo-para-dioxin (TCDD) and asked EPA to investigate their concerns (17, p. 21).

The EPA agreed and sent a scientific team to Oregon, which administered a medical history questionnaire to nine women (one original letter writer refused to participate and two others volunteered). The medical questionnaires were evaluated by a panel of 10 experts, who were all medical doctors except for Robert C. Duncan, Director of Biostatistics, University of Miami School of Medicine. All 10 concluded that the data showed no causal connection between forest herbicide spraying and reproductive wastage. The reviewers also noted that there were more than a dozen other factors that might have caused the miscarriages, which could confound the statistical correlation asserted by the Alsea women. (Data are from evaluation letters of the 10 Alsea I scientists who reviewed the medical questionnaires. They are available in censored form from EPA, 401 M Street, N.W., Washington, DC 20004.) EPA did not release the experts' findings, but only their conclusion that 2,4,5-T was not causally connected to the Alsea miscarriages. Bonnie Hill, NCAP, and Friends of the Earth claimed EPA was whitewashing the issue, while defenders of 2,4,5-T asserted that marijuana smoking was the real cause of the Alsea miscarriages. The release of the expert review data might have prevented this media furor. I attempted to obtain the review data via the Freedom of Information Act, but all substantive facts had been deleted by EPA as "privileged personal information", including the numbers telling how many women were exposed to various other potential causes of miscarriage other than 2,4,5-T.

Of significance is the fact that the panel of experts recommended against further retrospective anecdotal studies of the issue and urged that laboratory testing and examination be the core of any future study relating 2,4,5-T and miscarriages. EPA did not follow these recommendations, but began another retrospective study called Alsea II, and the initial study became known as Alsea I. Alsea II investigators did not pursue laboratory testing or examination but sought statistical correlations between the spraying of 2,4,5-T and miscarriages in the Alsea Basin. The Alsea II report (18) claimed to find such a correlation and was used as a basis for the emergency cancellation of 2,4,5-T announced by EPA Deputy Director Barbara Blum in March 1979.

Bonnie Hill was lionized in the popular press as a folk heroine (19,20). The Alsea II report, however, was subsequently critiqued and denounced as unscientific and politically motivated by nearly 30

institutions, including the Oregon State University Environmental Health Sciences Center (21). NCAP, which had centered its anti-2,4,5-T campaign around the high toxicity of TCDD, immediately went to work on a campaign to ban 2,4-D, no sample of which has ever been found to contain a measurable amount of 2,3,7,8 TCDD, although some have been found to contain other dioxin isomers (22). NCAP's behavior in these circumstances appears to demonstrate the struggle-group pattern of Simmel.

Dow Chemical U.S.A. and others defended 2,4,5-T in Administrative Law Hearings beginning in 1980, which raised some questions about antipesticide tactics. During the hearings, Jack D. Griffith, chief of the EPA Hazard Evaluation Division, who headed both Alsea I and II, testified, "I think for a lady who is untrained in epidemiology, that [Bonnie Hill's] letter is remarkable....In fact, I might say it is better than reasonably good, it is better than some graduate students I have worked with....I'd like to know if she has a tutor--I'd like to employ him" (23). Bonnie Hill has never been cross-examined concerning collusion or conspiracy despite Griffith's statement in testimony.

A question arose concerning the role of political pressure in EPA's decision to reverse its original stand that there was no connection between 2,4,5-T and the Alsea miscarriages. Hill, NCAP, Friends of the Earth, and Congressman James Weaver (D-Oregon) had pressured EPA in the media (24). Dow Chemical counsel Rudolf Schroeter pursued this question for more than a day when cross-examining Griffith with no direct answer, and the question remains unanswered by EPA to this day (25).

Another serious question arose over the role of life-styles in the Alsea miscarriages. Defenders of 2,4,5-T, without adequate documentation, had asserted that marijuana smoking was to blame. Bonnie Hill refused to respond to such intimations "because they are not true, and because they are not an issue, but are rather attempts to distract people from the real issue," and she asserted that "such intimations, even if only implied, are slanderous and totally without substantiation" (17, p. 20). The question was settled in the hearing testimony of Steven Lamm (26), who revealed the findings of the Alsea I panel of experts in summary form and finally made the facts known. Life-style factors that could have caused miscarriages were in fact abundant among the Alsea women. Data from the medical questionnaires showed that all nine of the women in the study obtained their water from surface streams that could carry disease organisms capable of causing spontaneous abortions. Five women drank raw unpasteurized milk from local cows that could transmit brucellosis. Eight of the nine women had eaten deer meat, which the experts felt could transmit toxoplasmosis. Five smoked cigarettes (less than 1 pack/day). One was a regular marijuana user. Another experimented with marijuana and psychedelic drugs. Another was a heavy drinker. Household pesticides were used by several women, which led some of the experts to postulate houseflies and deerflies as a vector for tularemia. At least one household had no electricity and no modern refrigeration. Various types of contraceptives were used by several of the women for varying lengths of time. These potential causes of reproductive failure are substantiated by data taken from the women themselves and are all life-style related. Life-style is a documented issue in the Alsea case, but it never would have been positively known if Lamm had not revealed the findings that EPA refused to make known.

After the 2,4,5-T ban, NCAP continued its campaign to ban 2,4-D and other chemicals by hiring its own scientific experts (27) and rallying scientists of known antipesticide persuasion. The minority views of such scientists as David Pimentel of Cornell University and Melvin Reuber of the National Cancer Institute (NCI) were pitted against the majority view that most pesticides are safe when applied according to label directions, and a divisive "my expert's better than your expert" syndrome appeared in public debate. Such dissension among the ranks of scientists created public distrust. The unfortunate case of Reuber, who was censured by his superiors at NCI for raising unfounded alarms over certain chemicals and subsequently resigned (28), illustrates that a trained scientist with strong antipesticide beliefs may be tempted to make unrestrained interpretations of test results in a public forum and cause widespread but groundless alarm.

CONCLUSION

This discussion should alert rights-of-way managers to the complex social and political dimensions of antipesticide activism and to those group dynamics that may affect public disputes over pesticide use. It should be clear that a straightforward belief in the power of scientific facts must be tempered by the realities that government agencies, such as EPA, do not always make all the facts known; that popular sentiments in antipesticide issues are sometimes colored by life-style preferences that include anticapitalist views; and that antipesticide groups may act for personality maintenance reasons and from group preservation motives as well as for the public good and regard for the facts.

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Publication of this paper sponsored by Committee on Roadside Maintenance.

Report from Committee on Roadside Maintenance

The Landmark Reference subcommittee of the Transportation Research Board Committee on Roadside Maintenance, appointed by Committee Chairman Charles Edson in February 1979, included W.M. Gere, South Dakota Department of Transportation, subcommittee chairman; George Romack, Federal Highway Administration (FHWA), Washington, DC; Gerald Rowe, National Park Service, Washington, DC; and Carl Wells, Kentucky Department of Transportation. Allen Childers, Bill Morris, Larry Perkings, Robert Ross, and Laurence Stainton were later added to the initial group to complete the assignment.

Their assignment was to identify the 20 most widely used references that relate to the broad scope of the committee. Identification would result in a state-of-the-art document that includes available references and committee areas of concern.

In July 1979, Chairman Gere requested each member of the Committee on Roadside Maintenance to solicit responses to the task from neighboring agencies. The Chairman was informed that 55 agencies were requested to list the 20 most widely used roadside maintenance references. Although not all agencies responded, the committee felt the response was adequate to provide the following listing (by category) of roadside maintenance references most frequently used.

The committee believes that publication of this information not only provides guidance to individuals newly entering the field, but also provides insight into a mechanism by which technology transfer occurs.

LISTING OF ROADSIDE MAINTENANCE REFERENCES MOST FREQUENTLY USED

Government Agency Manuals, Publications, and Bulletins, Including Research Groups and Associations

Various agency manuals

American Association of State Highway and Transportation Officials (AASHTO) Maintenance Manual, 1976
Highway Research Information Service (HRIS) responses and National Cooperative Highway Research Program (NCHRP) reports, Transportation Research Board
Herbicide Handbook of Weed Society of America
FHWA reports
Bulletins, U.S. Department of Agriculture (USDA)
Manual on Uniform Traffic Control Devices
American Standard for Nursery Stock, American Association of Nurserymen
Roadside Vegetation Control
Trees--Yearbook of Agriculture, USDA, 1949
American Association of State Highway Officials (AASHO) guide for Highway Landscape and Environmental Design, 1970
Shade Tree Evaluation, International Shade Tree Conference
Sources of Plants and Related Supplies, American Association of Nurserymen
Forest Diseases and Insects
Golden Book Guide on Tree Identification
Landscape architectural site construction details
Seeds--Yearbook of Agriculture, USDA, 1961
Visual Resource Management for Highways
FHWA Litter Study, 1974
Turf Managers Handbook
A Guide to Site and Environmental Planning
Landscape Design for the Disabled
The Impact of Highway Systems on Water Quality, The National Highway Institute
Turf Science, American Society of Agronomy
Concrete Pipe Field Manual, American Concrete Pipe Association
Proceedings of the Northwest Weed Science Society
Planning for Wildlife in Cities and Suburbs, 1978
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