members in commodity departments and interacting with students, some of whom are interviewed later for internships or employment in their firms. For graduating students entering the work force, agricultural managers' seminars can fulfill the mission of the land-grant university for practical education for the marketplace of the 1990s.

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Dandelion Dilemma: A Decision Case in Turfgrass Management

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Additional index words. herbicide, pesticide, social impact

Summary. This paper presents a decision case concerning the application of herbicides to turfgrass at a public university housing project. Some residents opposed pesticide use, even though the grounds were infested with weeds. The chair of the grounds committee had to decide whether or not to use herbicides given the resulting social implications. The case was written for use in turfgrass management or introductory horticulture classes and possibly for turf and landscape personnel taught through extension education. Students assume the role of a decisionmaker in the complicated issue of pesticide use.

Turfgrass management is a major industry in the United States, and the benefits of turfgrass are well-documented (Beard, 1993; Roberts and Roberts, 1988). High-quality lawns fulfill aesthetic, recreational, and functional needs. Typically, pesticides are used to achieve desired turf quality, especially in controlling undesirable weeds such as dandelions (*Taraxacum* spp.). However, pesticides have received considerable negative publicity, and many people are opposed to their use. Students of landscape horticulture will likely face the complicated issue of pesticide use repeatedly in their professional careers.

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In Apr. 1989, John Atwood was nearing completion of a PhD at the Univ. of Minnesota with an emphasis in turfgrass management. He, along with his wife and three children, lived adjacent to campus in a student housing project called Commonwealth Terrace Cooperative (CTC). John was chair of the Building, Energy and Grounds (BEG) committee at CTC, with responsibility for seeing that landscaped areas were well-maintained. Members of BEG were concerned with the poor condition of lawns and faced the decision of whether or not to recommend the use of herbicides. Because of his horticulture background and position as chair of the committee, John was particularly concerned with the need to improve lawn quality. While nearly all residents desired lawns that were attractive and healthy, a small, but vocal, group of residents were opposed to any use of pesticides at CTC. The following case study highlights decisions likely to be encountered by turf professionals as pesticide use is questioned by society.

Commonwealth Terrace Cooperative

CTC was a 464-unit housing complex in St. Paul, Minn., and encompassed 22 acres (8.9 ha), including 12.5 acres (5.1 ha) of lawn areas. About 1800 residents, consisting of students and their families, lived in two-story, multifamily dwellings. Lawn areas were extensively used for recreation and play, especially by children.

CTC employed a full-time manager and maintenance staff. A board of directors comprised of residents and staff governed CTC. Some residents volunteered service on a separate committee—Building, Energy and Grounds (BEG)—which gave input to the board of directors. The board valued input from BEG in establishing policies and making decisions regarding landscaped areas. Atwood became a member of BEG in Jan. 1989, and was elected chair of the committee in Apr. 1989.

In addition to conducting doctoral research in turfgrass science, Atwood was employed as extension turfgrass specialist. Part of his work involved providing information to homeowners, landscape managers, etc., on topics related to turfgrass management. He considered himself to be a

realist, willing to consider all sides of an issue, noting that, as a scientist with a turf background, he had tried to be reasonable in making decisions based on facts, rather than on emotions, while being sensitive to the needs and opinions of others.

Atwood had several objectives as chair of BEG: 1) to assure an attractive and safe landscape for CTC members to enjoy, in addition to satisfying expectations of the Univ. of Minnesota; 2) responsibility to provide accurate horticultural information to BEG and CTC; 3) to recommend landscape maintenance policies that were efficient and economically cost-effective, but was also concerned for the well-being of residents and the environment. After all, CTC was his home too.

Weather conditions

The summers of 1987 and 1988 were very hot and dry throughout much of the Midwestern United States. Lawns in Minnesota had experienced prolonged stress due to lack of water. Irrigation was restricted for nearly all residents of St. Paul and surrounding areas. CTC had used a manual irrigation system on a limited basis, but, after two hot summers with little precipitation, the Kentucky bluegrass (*Poa pratensis* L.) lawns were competing poorly with an extensive weed population. During 1988, some neighbors had complained about seeds from CTC dandelions blowing into their yards.

During the fall and winter of 1988–1989, BEG members became increasingly concerned about lawn quality. After some discussion, Atwood was asked to write specific turf management recommendations for CTC; these were approved by BEG subsequently (Exhibit 1). These management recommendations called for sound cultural practices and, due to the history of weed infestations, an annual herbicide application. It was now Apr. 1989, and dandelions were beginning to flower and germination of crabgrass (*Digitaria* spp.) would soon occur.

The decision

While preparing the turf management recommendations, Atwood was contacted by Bill Morgan, manager of CTC and also a board member. Morgan informed Atwood that the board of directors had received a letter from a resident who was concerned about the use of herbicides at CTC (Exhibit 2). Morgan recommended that Atwood consider this letter in preparing the BEG recommendations for the board. Shortly thereafter, Atwood learned that the student newspaper, *The Minnesota Daily*, had included an article about the danger children faced from herbicide applications at CTC (Exhibit 3). Accompanying the article was a picture of a concerned resident with a poster that called for no herbicides at CTC.

The next BEG meeting included a lengthy discussion of alternatives for dealing with the weed problem. Several alternatives raised by various members were discussed, including 1) pay-

Exhibit 1 . ***Specific recommendations for CTC turfgrass.***[z]

Fertilizers and Herbicides

Most years:

Two applications of nitrogen fertilizer at a rate of 3/4 lb per 1000 square feet. The first application should be made in early September (after children have begun school). At the same time a broadleaf herbicide, such as 2,4-D and MCPP, is to be applied. The herbicide/fertilizer application should be made on a Monday or Tuesday. Signs will be posted to notify residents. This will allow the children to be off the lawns on weekdays but resume lawn activities on the weekend. Only EPA approved herbicides are to be used and applied only by a licensed professional registered applicator.

The second application of nitrogen (3/4 lb per 1000 square feet) should be made in mid October. If a serious weed problem arises, a second herbicide application can be included at this time. Otherwise, only nitrogen is to be applied and no reentry restrictions apply.

A less expensive alternative to the above recommendation would be to apply all nitrogen during the first application. *This modification would require* that 1.25 lb. N/1000 square feet be applied and that half of the nitrogen be in a "slowly available" form.

Note: The above recommendation allows for the possibility that herbicide application may not be necessary every year. If weed populations are very low during the summer, the herbicide treatment may be cancelled. However, based on the history of weed infestations at CTC it will probably be necessary to treat for weeds nearly every year.

Special recommendations for 1989:

Due to the drought and heat of 1987–88, the following additional applications are recommended:

A spring application of preemergent herbicide for crabgrass control following spring cleanup.

A spring application of nitrogen fertilizer (same rate as above) to benefit sodded and seeded areas.

Irrigation (Watering)

Newly seeded and sodded areas will require that soil not be allowed to dry until roots are established. All such areas should be watered regularly (if needed) during the first growing year.

Soil should have enough moisture to support vigorous lawn growth and recovery during the fall. If soil is fairly dry at the end of August, it is recommended that lawn areas receive 1 inch (2.5 cm) of water (approximately 2 hours with sprinkler for all areas) the first week of September. This will also increase the effectiveness of fertilizer/herbicide treatments in the fall.

Mowing

Lawns should never be mowed shorter than 2 inches (5 cm) and always be mowed by the time the lawn reaches 3-1/2 inches (9 cm). This will require mowing *more than once each week* during the late spring and early summer approximately once per week during the summer and fall.

Mowers should be sharpened a minimum of once a year.

Improper mowing leads to a reduction in roots and leaves, increasing weed infestations and reducing stress tolerance of lawns.

Other Maintenance Practices

Aerification would be beneficial in high traffic areas.

[z]Essential excerpts from the original by John Atwood and approved by BEG.

Exhibit 2. **Letter from coop member to the CTC board of directors.**

To the Board of Directors, CTC:

The use of herbicide at CTC should be stopped because they are a hazard to the health of our families. There has been some confusion about the term "herbicide." An herbicide is a pesticide specifically intended to kill plants.

A 1987 National Cancer Institute study showed children living in homes where household and garden pesticides were used were seven times more likely to develop childhood leukemia, (R. Lowengart, et. al. 1987. "Childhood Leukemia and Parents' Occupational and Home Exposures", Journal of National Cancer Institute, 79:39–46.)

When herbicides are sprayed on the ground up to 90% of the chemical spray may drift away from its target and travel for miles. This fact greatly increases the risk to CTC residents, since these poisons may be drifting in the air and blowing in our windows even when the application is happening in another area. These chemicals are readily taken in through inhalation, as well as by swallowing or through the skin.

A National Cancer Institute study found that farmers exposed to herbicides had a six times great risk of contracting cancer than nonfarmers. (S. Hoar, et. al. 1986. "Agricultural Herbicide Use and Risk of Lymphoma and Soft-Tissue Sarcoma", Journal of the American Medical Association, 256:1141–1147). Other studies have shown similar results. (A. Blair, et. al. 1979, "Leukemia Among Nebraska Farmers", American Journal of Epidemiology, 110:264-273; L. Burmeister, et. al. 1983, "Selected Cancer Mortality and Farm Practices in Iowa,: American Journal of Epidemiology, 118:72–77.)

Attachment 1[z] is the material sent out by Green Lawn on the chemicals they use at CTC. Three hazardous components are listed. Please note that there is no data available on the synergistic hazard of these combined chemicals for humans. The chemicals are tested for toxicity, carcinogenicity, etc. one at a time, not together. Note that even though dicamba is not considered to be carcinogenic, it is commonly contaminated with carcinogenic nitrosamines.

Attachment 2[y] is information on 2,4-D and dimethylamine from *Dangerous Properties of Industrial Materials* by N.I. Sax, et. al. and *The Sigma–Aldrich Library of Chemical Safety Data*.

Both of these chemicals are given a toxicity rating of 3 by Sax, the highest rating, because of their severe toxicity. Note that 2,4-D is suspected of causing cancer and is known to cause mutations and birth defects as well as damage to the liver, kidneys and central nervous system. Central nervous system damage may not be immediately evident, and according to the St. Paul Dept. of Public Health, the medical literature contains reports of nervous system damage following minor skin exposure of 2,4-D.

We know these chemicals are harmful; what we do not know is what level of exposure is sufficient to cause human damage, and which individuals will be especially susceptible.

We need to find strategies for maintaining our grounds which avoid the health risks brought by pesticide spraying. Summer help could be hired to give the grounds extra help where it is needed. Fertilizer could be applied. A "natural" lawn care company which does not use toxic chemicals could be hired. There may be other alternatives, as well. We must look for them, since we cannot, in good conscience, expose our families to the needless risk imposed by lawn pesticides.

[z] *Editor's Note*: Attachment 1 is not presented here, but is a label from Fairway "weed-no-more®", which contains Trimec® herbicide.

[y] *Editor's Note*: Attachment 2 is referenced and not presented here.

ing children for every dandelion they picked; 2) resodding the weediest areas; 3) hiring more maintenance workers to manually pull or dig weeds; 4) employing a lawn care company to control weeds with herbicides; 5) employing an organic lawn care company that would not use herbicides. Atwood argued that, because of the intensive use of lawn areas and the severity of weed problems, the desired level of lawn quality was not attainable without using herbicides. He outlined several approaches to minimize health concerns by residents (Exhibit 3). For example, applications of broadleaf herbicides would be made only on Monday or Tuesday when children were in school, thereby reducing the difficulty of keeping children off lawns following applications. Following the discussion, BEG members chose to rely on Atwood's expertise and support his decision concerning herbicide use. A few days later, he was to attend a board of directors meeting to present and discuss BEG's lawn maintenance recommendations. In addition, he prepared a statement arguing the desirability of high-quality lawns at CTC (Exhibit 4).

While walking to the board of directors' meeting, Atwood learned that a few vocal residents opposed to herbicide use would also be in attendance. He felt annoyed that these residents had declined an invitation for their involvement in BEG's efforts to develop lawn maintenance guidelines, but would likely be given the opportunity to have an impact on the board of directors through vocal opposition. What he had tried to approach as an objective process based on consideration of realistic alternatives was now becoming an increasingly more complex and emotional issue. In a few minutes, he would have to discuss (and defend) BEG's recommendations on the use of herbicides at CTC. He believed that the board would follow his decision, as they had on previous occasions. The social implications of pesticide use were a volatile issue, yet the grounds were in poor condition. What would his decision be?

Interpretive or teaching note

Dandelion dilemma describes an authentic situation, perhaps typical of many now occurring in community governance. Participants' names have been changed or omitted, however. The case can be used to illustrate the decisionmaking processes involved in dealing with issues such as pesticide use in public areas, and is therefore suitable for classes in turfgrass science and introductory horticulture, as well as extension courses involving landscape managers. The case has the potential to expose students to real-life situations involving pesticide use. The horticulture background of students will likely affect subsequent discussion.

In discussion of this case, factors that affect decisionmaking regarding pesticide use in public areas should be identified. Some of these include: Safety and play areas for children, resident opposition to pesticides, environmental impact, public image, unsightly and unhealthy turf areas, efficient use of community financial resources, and loss of turf benefits with improper management.

Suggested questions to stimulate

Exhibit 3. **Article from the *Minnesota Daily*, May 1989.**

St. Paul Campus

Lawn chemical use at St. Paul co-op has some worried

Student residents warned to keep off the grass

By Wayne Nadis
Staff Reporter

Katie Rosaud, a resident of Commonwealth Terrace Cooperative on the St. Paul campus, has protested the use of chemicals on the cooperative's lawns, fearing for the safety of her 3½-year-old son.

"I could spray water on your lawn and it would work until a drought hit," he added.

Crab grass, as well as many other undesired lawn plants, can be easily controlled by simply raising the mower blade, he said.

A lawn that is fed organic nutrients and is three inches or longer will prevent most weeds, particularly crab grass, from gaining a foothold, he said.

The organic method, however, has some limitations.

Miles, who was once a farmer and has experience using chemicals, said that on large turf areas it might be necessary to make one commercial herbicide application a year, depending on the conditions of the lawn.

discussion include:

1) What is Atwood's objective in this dilemma?

2) What function do lawns have at CTC?

3) Does CTC have a "public image" that must be addressed?

4) Does the environmental viewpoint (Exhibit 2) make sense? Is it based on facts? On emotions? How should Atwood deal with it?

5) How important are weed-free or relatively weed-free lawns at CTC?

6) What is your reaction to the statement, "We cannot in good conscience expose our families to the needless risk imposed by lawn pesticides"?

7) What should Atwood recommend to the board of directors?

8) What arguments could Atwood use to defend BEG's recommendations on herbicide use?

9) What additional information be helpful in making decisions about pesticide use in a public area?

10) Could Atwood have effectively dealt with residents opposed to pesticides before facing them at the board of directors meeting? How?

11) Is the university (owner) likely to become a player in solving the problem?

This case is designed to be used in a horticulture classroom (see Davis, 1992, for a discussion of using case studies in teaching). Students should read the case in advance of class and come prepared to discuss the questions listed above. With discussion and analysis of the horticultural and social issues involved, students will be faced with making choices and selecting priorities. There is no "right or wrong" decision to this case; decisions are based on many factors, specific to a given situation.

Student outcomes are 1) to realize the complexity of issues facing horticulturists today; 2) to address the issue that horticulture decisions have social implications; and 3) to experience the decision case method as a teaching tool.

Exhibit 4. **Lawn Quality At CTC: Putting the Issues in Perspective and Developing a Responsible Strategy for Lawn Maintenance. by John Atwood.**

High quality lawns are desirable at CTC. Why don't we just have concrete? Because lawns at CTC provide the outdoor environment for recreation, social interaction, and aesthetic perception. For several months during a year, these areas provide the playground for our children. Additionally, they provide noise reduction, temperature modification, dust entrapment, pollution reduction, injury reduction, erosion control, etc.

We need to have healthy lawns. It is important that we use responsible strategies for maintaining an acceptable level of lawn quality. Following the drought and heat of 1987 and 1988 lawns at CTC are in a precarious position. If we don't respond to the needs of the grass we can't expect to obtain the desired benefits.

The suggested use of "natural" products infers that natural is good and that "man-made" is bad. The logical outcome of this reasoning forces the conclusion that nicotine (because it is natural) is good and that most prescription drugs, because they are "unnatural" are bad. Organic lawn care usually provides no control for dandelions and is quite costly with respect to nutrients provided.

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