LIMITATIONS. The database, while a useful tool, has limitations and problems which include: incomplete plant clinic forms, software incompatibility, and time required to incorporate reports from previous years. Easily answered questions are not included in the database. Perhaps the most severe limitation is that past recommendations for control may no longer be applicable. Pesticides may be relabeled, disallowing prior uses of the products. For example, the registration uses of Dursban (chlorpyrifos), the fifth most often recommended control, have recently changed. Users of the database must confirm their diagnoses and check their current references before making pesticide recommendations.

FUTURE USES. This article presents only a few examples of the data analysis types possible with a plant clinic database. Other correlations and trends can be examined. Tools such as a month-by-month guide for regional insect, disease, and weed problems could be developed using the database. Telephone numbers in the database allow contacting past clients to determine the efficacy of the recommendation and satisfaction with clinic service. Posting the database on the Internet may allow the data to be shared more widely. New Master Gardeners will be recruited to continue building the database.

Conclusion

The project was a success that enabled new Master Gardeners to accelerate their learning about local plant disease, insect, and weed problems. Master Gardeners and extension agents at New Hanover County now have seven years of data at their fingertips to aid in answering horticultural questions and predicting future pest trends. For others who may want to develop similar databases, the keys to success are a leader who values the project and dedicated volunteers to input and evaluate the data. The database has limitations, but contains a wealth of information in readily accessible form.

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Junior Master Gardener Programs in Minnesota

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ADDITIONAL INDEX WORDS. teaching, careers, youth, school gardens

SUMMARY. A new gardening curriculum, developed by Texas A&M University, the Junior Master Gardener_{SM} (JMG_{SM}) program, has been taught in several locations in formal and informal settings in Minnesota. Two projects are outlined here, one an after-school program offered through a community education program, and the other a traditional elementary school setting. With hands-on activities and leader presentations, students learn horticulture as well as language arts, science, mathematics, and social science and are encouraged to volunteer in a community service project within each unit. Students reported they shared the information with their family and friends; most indicated more of an interest in gardening and horticulture after the classes. Teachers may find the curriculum helpful in developing environmental sensitivity and career interests in horticulture.

Curriculum for teaching horticulture in grades K through 12, especially grades 7 through 12 is limited. Grow-Lab, sponsored by the National Gardening Association (Burlington, Vt.), has been one of the few programs available nationwide for teaching plant science in elementary schools (Pranis and Cohen, 1995). In 1999, Texas A&M University introduced the JMG_{SM}, a curriculum written primarily for grades 3 through 6 (Welsh et al., 1999). JMG_{SM} is composed of eight units: plant growth and development; soils and water; ecology and environmental horticulture; insects and diseases; landscape horticulture; fruits and nuts; vegetables and herbs; and life skills and career exploration (Whittlesey et al., 1999). Each unit concludes with suggestions for students to do volunteer community service based on the activities of that particular unit. The service component of this curriculum is patterned after the Master Gardener program (Bobbitt, 1997). The goals of the program are to build leadership, self-confidence, and foster a positive academic learning environment (Welsh et al., 1999). The objectives of this project were to 1) determine the suitability of the JMG_{SM} curriculum at the Bryn Mawr Elementary School in Minneapolis and Rice County after-school program in Northfield, Minn., and 2) evaluate the curriculum for recommendation to other youth programs across Minnesota.

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Table 1. One of eight horticulture units and the activities and teaching concepts covered in the Bryn Mawr Elementary School (Minneapolis) Junior Master Gardener (JMG) program.

JMG unit activity	Teaching concept ^a
Plant growth and development	
Hamburger plant	LA, S, SS
Benefits mobile	LA, S, SS
Leaf and seed sort Information	LA, M, S, SS
Plant parts rap	LA, S
Plant parts we eat	LA, S, SS
Plant needs	LA, S, SS
Oxygen factory	LA, M, S
Gas gobblers	M, S, SS
Propagation demonstration	M, S

^aLA = language arts; M = mathematics; S = science; SS = social studies.

Methods and materials

JMG_{SM} student handbooks (Whittlesey and Seagraves, 1999) were purchased for \$14 each and JMG_{SM} teacher/leaders guide (Whittlesey et al., 1999) for \$38 for use in these two programs. The Minnesota State Master Gardener office purchased the books for both sites. The student's handbook was used as a school textbook. Each student used a book, but they remained the property of the school or the Extension office.

Bryn Mawr project

Bryn Mawr is a public, preschool through grade 6 elementary within the Minneapolis School District. Students have a wide variety of ethnic backgrounds including Hmong, Asian, and African-American. Many students are bilingual in Southeast Asian languages. With the assistance of the science teacher, 12 grade 4 students were selected to participate in this project using the JMG_{SM} curriculum. Students met with two Master Gardeners in the science classroom for 60 min each week for 12 weeks. Table 1 shows the activities of one unit taught over 3 weeks of the program used at Bryn Mawr; weekly classroom time is outlined in Table 2.

One of the curriculum goals is for students to do a service or outreach project for each unit. Students discussed what they would do and voted to 1) teach what they had learned in the program to younger students at the school; 2) clean up the courtyard; and 3) grow plants to give to adult volunteers at the school. The students then contacted a preschool and first grade classroom and prepared and reviewed the material they would teach to their fellow students. They also made arrangements with the custodial staff to spend one of the final classes pruning and weeding one of the school courtyards.

Rice County community education

In Northfield, Minn., the JMG_{SM} program was taught as a community education after-school program. The classes were held at an elementary school. Seventeen students, ranging from kindergarten through grade 3, participated in the class. Students were Caucasian, with one Asian student. The sessions were 1.5 h in length, lasting for three sessions. An extension educator (agent) and parent volunteer worked

with the program. Units taught were: insect and diseases, fruits and nuts, and vegetable and herbs. Students learned how to plant and each took home 12 plants after the final session to use in their community.

At the end of the programs, students were asked to complete evaluations (Table 3). At Bryn Mawr, the evaluations were conducted orally, with the science teacher asking each student to respond to the questions individually. In Rice County, students were mailed the evaluations after completion of the program.

Results and discussion

The JMG_{SM} program was well received by the students, (Table 3). They were eager to try the projects and were proud to teach the younger students at Bryn Mawr. They especially liked the hands-on activities. Midden and Chambers (2000) indicate gardening activities may be the first step in developing environmental sensitivity in children. Most students indicated they talked to their parents about the program and that they had more interest in gardening after the program. Studies have shown that students introduced to gardening early in life often choose horticulture for a career (Bradley et al., 2000). Thus this curriculum can benefit students in learning about their environment as well as encouraging them to pursue a career in horticultural science.

The JMG_{SM} curriculum provides prepared horticultural activities for children. Many of these appeal to children's curiosity and provide a hands-on approach that actively involves the learners so they remember important concepts. The format of the teacher/leaders guide and the gardeners handbook is easy to read and follow. The illustrations are age appropriate and attractive to children. According to Dobbs et al. (1998), teachers have a high interest in horticulture, but need in-depth training and prepared activities. This curriculum should prove useful for formal school settings as well as after school or informal programs. It is easy to adapt to meet a wide variety of needs.

The cost of purchasing student books and teachers guides may be difficult for some programs. The science teacher at Bryn Mawr liked the curriculum but indicated that, to purchase these materials, they would need several months notice to put it in the teaching budget and the cost would take most of their annual budget. Additional sources of funding, such as parent teacher organizations, Master Gardener programs or other grants may be needed to initiate these programs, especially in lower income schools. However in traditional 4H programs, participants often pay for class materials, so purchasing the student books may not be a problem in informal settings.

Based on the success of these two programs a one-day

Table 2. Typical schedule for teaching the Junior Master Gardener (JMG) program in a formal classroom setting.

Activity	Time (min)
Welcome/greeting	5
Agenda for the day	5
Teaching presentation	20–30
Hands-on activity	20–30
Snack/review	5
Clean-up/goodbye	2

Table 3. Student evaluations of two Junior Master Gardener (JMG) programs in Minnesota.

gram Survey question	Response [no. (%)]			
	Bryn Mawr Elementary School		Rice County after-school pro-	
	Minneapolis, Minn. n = 12		Northfield, Minn. n = 17	
Q1. What did you like best about the JMG _{sm} class?	Courtyard work	4 (30)	Planting	5 (29)
	Teaching others	4 (30)	Taking plants home	1 (6)
	Insects	2 (15)	Learning how plants grow	1 (6)
	Snacks	2 (15)	Learning when to plant	1 (6)
Q2. Was there anything you did not like about the program?	Plant Parts Rap	1 (8)	Prefers other classes	1 (6)
	Nothing	10 (83)	Finding no bugs	1 (6)
	Problems planting seeds	1 (6)	Nothing	3 (17)
	Did not work with plants at first session	1 (6)		
Q3. Have you shared gardening information from this program with your parents?	Yes	9 (75)	Yes	8 (47)
	No	2 (16)	No	1 (6)
Q4. How did you feel about the part of the class where you taught others?	Good	9 (75)	Fun	3 (25)
Q5. Did you teach anyone else about gardening?	Dad	1 (6)	Friends	1 (6)
	Sister	1 (6)		
Q6. Do you have more interest in gardening since the JMG _{sm} program?	Yes	10 (83)	Yes	5 (29)
	No	2 (16)	No	2 (12)

training workshop was held in Minnesota for interested teachers and youth leaders in extension to introduce them to the curriculum. Participants saw or completed 18 activities from the curriculum. Several participants were identified to work with in evaluating the overall JMG_{sm} program goals of leadership, self-confidence, and fostering a positive academic learning environment. At the annual fall state Master Gardener conference, JMG_{sm} leaders will have a chance to meet and discuss their programs. An e-mail discussion list may be developed to address youth education issues, especially program evaluation.

The JMG_{sm} curriculum provides new horticultural resources for teachers in a classroom or informal setting. Students liked the program. Teachers may find it helpful in developing environmental sensitivity and career interests in horticulture.

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