Fruit in the russet treatments had about 10% of their surface affected by russet at harvest, compared with practically no russet visible on fruit classed as nonrusseted. Russeted fruit were also markedly more misshapen than nonrusseted fruit (Table 1).

None of the treatments affected seed number per fruit or total seed fresh weight per fruit at harvest (Table 1). There was a trend for russeted fruit to have smaller seeds (in terms of fresh weight per seed) but this was not significant ($P=0.057$). There were significant positive relationships between fruit weight and number of seeds per fruit ($r^2 = 0.16$, $P < 0.001$), total seed fresh weight per fruit ($r^2 = 0.22$, $P < 0.001$) and the fresh weight per seed ($r^2 = 0.15$, $P < 0.001$), however these relationships in all cases were weak.

In conclusion, russeted fruit were more misshapen than nonrusseted fruit, but neither russet nor carbaryl affected seed number nor seed weight per fruit. Chemically thinning with carbaryl did not preferentially thin russeted fruit and is therefore not a tool of use to growers to help eliminate fruit damaged by russet.

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The Green Brigade: The Educational Effects of a Community-based Horticultural Program on the Horticultural Knowledge and Attitude of Juvenile Offenders

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ADDITIONAL INDEX WORDS. extension programs, adolescents, probationary programming, vocational, education, at-risk youth, juvenile delinquent, gardening

SUMMARY. The Green Brigade horticultural program is a community-based treatment and diversion program for juvenile offenders. The program is used for vocational training and rehabilitation. The objectives of this study were to determine if participation in the Green Brigade program improved the horticultural knowledge and the environmental attitudes of participating juvenile offenders. Participants of the Green Brigade program significantly improved their horticultural knowledge exam scores as a result of

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participating in the program. Participants also had significant improvements in their environmental attitude scores after completing the program. However, participants attending the Green Brigade program less than 60% of the time had significantly more negative environmental attitude scores than participants attending more frequently. Further analyses showed the program was equally effective at improving environmental attitude scores for all participants regardless of gender, ethnicity, age or grade in school.

The securing of job skills by underprivileged groups became the interest of both government and business leaders when President Clinton signed the Personal Responsibility and Welfare Reconciliation Act in 1996. At that time, the President challenged employers to hire more than 2 million people from public assistance into work situations by the year 2000. One of the elements that companies found was lacking in the nontraditional labor pool was job skills, in addition to transportation and childcare. Once companies initiated programs to teach basic job and social interaction skills, however, the retention and promotion rates of participants within the workplace were higher (Leonard, 1998). In addition, corporate youth training programs in some of the major metropolitan areas of the nation discovered that by investing in innercity youth, they helped build a future customer base while students gained lifelong job skills and pride in their communities (Greengard and Solomon, 1994).

In the criminal justice system, horticulture programs are commonly used in the vocational training and rehabilitation of adult offenders, and are becoming more common in juvenile probation programs. Horticulture programs that emphasize the acquisition of horticulture skills have helped enhance inmates' employment opportunities as well as their sense of community (Flagler, 1995; Migura et al., 1997; Rice and Remy, 1994). Questionnaires given to the participants of a program for juvenile offenders conducted by Rutgers University, found that 87% of respondents thought their quality of life was improved; 80% felt they had more job skills; and 75% believed they had obtained experience that might help them

secure a job. All of these benefits were as a result of participating in the program (Flagler, 1995).

A respect for the community and the environment related to that community can also come from an increased awareness and increased knowledge of environmental issues. Environmental knowledge improves environmental attitudes, and positive attitudes toward the environment result in environmentally responsible behavior (Arcury, 1990; Hungerford and Volk, 1990; Newhouse, 1991; Ramsey and Rickson, 1976). Studies of environmental education programs involving activity-based learning have shown these programs to be highly successful (Campbell et al., 1997; McCormick et al., 1989; Ramsey, 1993; Shinn, 1988), and research indicates that children's past experiences with vegetation positively affect their environmental attitudes (Harvey, 1989; Skelly and Zajicek, 1998).

The Bexar County (Texas) Extension

Service's Green Brigade program for juvenile offenders is one program that combines horticultural activities and education with juvenile offender rehabilitation (Cammack et al., 2001). The purpose of this study was to determine if participation in the Green Brigade horticultural program resulted in an improvement in the horticultural knowledge and environmental attitude of juvenile offenders.

Materials and methods

POPULATION AND TREATMENT. Juvenile offenders from the 1996 spring and fall sessions of the Green Brigade program were asked to volunteer to participate in the study (Cammack et al., 2001). Juveniles participated in the program on Saturdays for 16 weeks for 6 h each day; 2 h of each day were spent in classroom instruction learning horticultural techniques, and the remaining 4 h were spent outdoors working on landscaping projects in the community. An

individual Bexar County Extension Service employee headed each Green Brigade section.

INSTRUMENTATION. The horticultural knowledge inventory consisted of 10 true/false statements designed to determine participants' knowledge of horticultural topics. The Green Brigade program focused on teaching xeriscape principles; therefore, the horticultural knowledge portion of the survey asked questions related to xeriscaping (Table 1). Correct responses received 10 points, while incorrect responses received 0 points. Possible scores ranged from 0 to 100. Cronbach's alpha determined the instrument to have a reliability of 0.60.

Questions included in the environmental attitude inventory were taken from existing instruments developed to test environmental attitudes for children and adolescents (Bradley and Dettling, 1994; Campbell, 1994; Waliczek, 1997). Various statements were selected for use in this inventory

Table 1. The *t* test for paired samples analyses comparing the pretest and posttest horticultural knowledge individual item scores of participants of the Green Brigade program.

Statement	Pretest mean ^z	Posttest mean ^z	<i>P</i>
A xeriscape is a creative and effective landscape that conserves water.	7.60	7.80	0.821
A xeriscape is a type of landscape consisting only of cactus and rocks.	6.80	7.80	0.255
Native plants require a lot of extra watering in addition to natural rainfall.	5.20	5.20	1.000
Mulches help keep the soil moist, prevent evaporation and keeps the weeds from growing.	7.20	8.80	0.044*
You should make the ground firm and compacted before planting grass.	3.00	5.80	0.001*
You don't really need to plan out your garden or yard before your plant it; you should just go with how you feel when you are actually planting it.	7.40	7.40	1.000
A nice looking xeriscape will require lots of care.	1.60	3.60	0.024*
Putting in a large grass lawn at a home, only because it looks nice is not an efficient use of water.	5.20	4.00	0.204
You should water your yard everyday, even if it doesn't need it.	6.60	7.40	0.376
Bark chips, pine needles and gravel are all examples of mulch.	7.60	7.80	0.811

^zIndividual item horticultural knowledge scores ranged from 0 to 10, with higher numbers indicating more knowledge of the correct answers.

*Statistically significant at $P \leq 0.05$.

Table 2. The *t* test for paired samples analyses comparing the pretest and posttest environmental attitude individual item scores of participants of the Green Brigade program.

Statement	Pretest mean ^z	Posttest mean ^z	<i>P</i>
Everyone should be aware of environmental concerns.	2.75	3.24	0.005*
Special places should be put aside for animals that are endangered.	2.65	2.80	0.156
It is all right to litter if you don't get caught.	2.69	3.18	0.019*
Environmental issues don't really effect people who live in the city.	2.45	2.80	0.063*
It's okay to pollute as long as you are on your own land.	3.02	3.06	0.799
Everyone should try to recycle as much as they can.	3.04	3.27	0.234
People should protect animals and plants.	3.00	3.18	0.380
All plants and animals are important.	3.00	3.41	0.012*
Plants that grow in parts of the world where there are not very many people are not important.	2.94	2.82	0.452
Big companies do not have a right to pollute rivers and streams	2.86	3.22	0.107

^zIndividual environmental attitude scores ranged from 0 to 4, with higher numbers indicating more environmentally positive answers.

*Statistically significant at $P \leq 0.05$.

from these existing instruments in order to represent a wide range of environmental topics. The inventory included ten statements that students rated on a 5-point Likert scale (Likert, 1967) (Table 2). The five possible responses to each statement were "strongly agree," "agree," "neither agree nor disagree," "disagree" and "strongly disagree." The environmental attitude surveys were scored by assigning 4 points to a response that demonstrated a strongly favorable environmental attitude, 3 points to a mildly favorable response, 2 points to an indifferent response, 1 point to a mildly unfavorable response and 0 points to a strongly unfavorable response. The range of scores indicating a favorable environmental attitude were from 21 to 40. A neutral score was 20 points and an unfavorable environmental attitude was indicated by a range of scores from 0 to 19 points. Cronbach's alpha (Borg and Gall, 1989) determined the instrument to have a reliability of 0.81.

The pretest questionnaire also included a section for student biographical information including questions on age, gender, ethnicity, grade and previous gardening experience. Green Brigade attendance records for individual participants were obtained from the directors of each Green Brigade session. Pretests were administered in Feb. and Sept. 1996 spring and fall sessions, respectively; and posttests were administered May and December 1996.

DATA ANALYSIS. Since another population with the exact characteristics of the youth participating would be difficult or impossible to obtain, pretest scores acted as a control for horticultural knowledge and environmental attitude. Paired sample *t* tests were used to identify significant differences between pretest and posttest means. Multivariate analysis of variance was used to determine the differences in posttest scores after participation in the Green Brigade program based on individual demographics, session attendance and participation. Pretest scores were used as a covariates in the analysis to account for any pre-existing differences among the groups. Data were entered into the Statistical Package for the Social Sciences (SPSS) for Windows95 Release 7.5 computer program and evaluated (SPSS, 1997). Missing scores such as incomplete answers were coded as missing values.

Results and discussion

Fifty participants of the Green Brigade program completed pretest and posttest horticultural knowledge exams and environmental attitude survey. Participants were primarily male (72.5%), and Hispanic (66.7%). The mean age of subjects was 15 years. About half of the participants had gardened before enrolling in the Green Brigade program. Due to the nature of the self-selection process, the responses acquired were adequate for supplying ideas and trends for the given sample population, but are not necessarily intended for generalizations to other populations.

HORTICULTURAL KNOWLEDGE. A significant difference of 7.4 points between pretest and posttest mean horticultural knowledge scores was found using a paired sample *t* test (Table 3). The weak correlation (Table 3) indicated individual participants' horticultural knowledge pretest scores were unrelated to their posttest scores. One possible cause for the lack of a strong correlation may be the participants' unfamiliarity with the xeriscape principles focused on in the instrument. This lack of familiarity with the subject may have caused the participants to simply guess which answer to select during the pretest. This further suggests the significantly higher posttest scores

were likely the result of a greater familiarity with the subject matter gained as a result of participating in the Green Brigade program.

Because there was a significant improvement overall in horticultural knowledge mean scores, individual item response means from the horticultural knowledge test were compared to determine if there were differences between pretest and posttest individual item responses (Table 1). After participating in the Green Brigade program participants scored 1.6 points higher on Statement 4 dealing with mulch, 2.80 points higher on Statement 5 dealing with soil and turf, and 2.0 points higher on Statement 7 dealing with the maintenance requirement of xeriscapes (Table 1). These findings suggest that classroom instruction, in addition to hands-on activities, were useful for improving horticultural knowledge, specifically knowledge of xeriscape principles, in participants of the Green Brigade program. These results support past research findings reporting that activity based learning is an effective teaching tool (McCormick et al., 1989; Shinn, 1988; Trexler and Barrett, 1992), and can be enhanced by incorporating other methods of learning such as classroom instruction, observation and reading (Rosenshine and Furst, 1971).

Additional analyses were conducted

Table 3. The *t* test for paired samples analysis comparing the pretest and posttest horticultural knowledge scores of participants of the Green Brigade program.

Group and variable of interest	N ^z	Mean score ^y	r ^x	SD	df	t	P
Pretest	50	58.20	0.181	25.78	49	-2.030	0.048*
Posttest	50	65.60					

^zN = 50.

^yHorticultural knowledge scores ranged from 20 to 100.

^xCorrelation coefficient.

*Statistically significant at $P \leq 0.05$.

Table 4. The *t* test for paired samples analysis comparing the pretest and posttest environmental attitude scores of participants of the Green Brigade program.

Group and variable of interest	N ^z	Mean score ^y	r ^x	SD	df	t	P
Pretest	50	28.98	0.454	7.60	50	-2.434	0.019*
Posttest	50	31.57					

^zN = 50.

^yEnvironmental attitude scores ranged from 18 to 40.

^xCorrelation coefficient.

*Statistically significant at $P \leq 0.05$.

since past studies have indicated that, in some instances, learning situations can favor one group of participants over another. For instance, studies have found that even when males and females are in the same classroom together their educational experiences are vastly different (American Association of University Women, 1992). Results of a multivariate analysis of covariance indicated no significant differences on posttest horticultural knowledge exam scores of Green Brigade program participants based on gender, ethnicity, age, grade and participation. In addition, there were no significant differences in horticultural knowledge posttest mean scores between the four Green Brigade sessions. Each Green Brigade leader was given the freedom to organize the daily learning and work activities within his/her own session. Differences in facilities, weather and project time constraints led to varying amounts of emphasis on the learning of horticultural topics between sessions. Lack of statistical significance due to demographic variables indicated the program was equally effective in teaching horticultural topics regardless of session, gender, ethnicity, grade or age.

ENVIRONMENTAL ATTITUDE. A paired sample *t* test was used to analyze the mean scores from the environmental attitude survey (Table 4). Participants scored significantly higher (2.59 points) on posttest scores in comparison to pretest scores (Table 4). Because there was a significant improvement overall in environmental attitude mean scores, individual item response means were compared to determine if there were differences between pretest and posttest individual item responses (Table 2). Statements 1, 3, 4, and 8 showed significant improvements. The improvement in the scores on statements 1, 3, and 4 suggest participation in the Green Brigade exposed urban youth to the effects of environmental misuse on people, plants and animals regardless of place of residence. Responses to Statement 8 concerning the importance of all plants and animals were also significantly improved as a result of participation in the Green Brigade program. Past studies have shown children living in urban environments have a lesser appreciation for nature and the outdoors and subsequently, a poor environmental attitude when compared to children living in rural settings (Bunting and Cousins, 1985; Hart, 1979). However, find-

ings from the Green Brigade study indicated that, while participants in the program lived in an urban setting, they had environmentally friendly attitudes towards animals and plants that became even more positive by the end of the project.

A multivariate analysis of covariance test indicated no significant differences in environmental attitude scores based on gender, ethnicity, age or grade for the participants of the Green Brigade program (Table 5). These results suggest the Green Brigade program was just as effective at improving the environmental attitudes of males and females, African-Americans and Hispanics, and participants of various ages.

Researchers have reported varied results when comparing the environmental attitudes for various demographic

groups. Results of this study supported past research suggesting that gender is not a factor in environmental attitudes (Table 5) (Bunting and Cousins, 1985; Hart, 1979; Harvey, 1989). Harvey (1989) reported that no matter how appealing girls or boys found an outdoor task, their experience with vegetation elicited an improvement in their environmental attitudes. Even under the constraints of the relatively laborious work of landscaping, Green Brigade participants' environmental attitude scores significantly improved regardless of gender.

The Green Brigade program also improved the participants' environmental attitudes regardless of ethnicity (Table 5). The exact relationship between ethnicity and environmental attitude is not clear from past research (Sheppard,

Table 5. Multivariate analysis of covariance determining the effects of gender, ethnicity, age, grade, session attended and participation on posttest environmental attitude scores of participants in the Green Brigade program.

Group and variable of interest	N ^a	Mean score	SE	df	F	P
Gender				1	1.712	0.197
Male	36	30.62	1.061			
Female	14	33.18	1.543			
Ethnicity				1	0.783	0.381
Black	17	31.08	1.381			
Hispanic	33	32.72	1.182			
Age				5	0.488	0.812
13	1	36.89	5.897			
14	12	29.49	2.168			
15	21	31.08	1.706			
16	12	33.26	2.056			
17	3	36.06	3.451			
18	1	34.24	5.841			
Grade				5	0.759	0.585
7	2	27.65	4.241			
8	14	33.13	2.327			
9	25	31.45	1.430			
10	5	34.38	2.788			
12	2	30.71	4.153			
GED ^b	2	37.32	4.127			
Session				3	0.821	0.489
East session, Spring 1996	15	30.77	1.412			
West session, Spring 1996	16	31.80	1.429			
East session, Fall 1996	8	34.66	2.030			
West session, all 1996	10	31.83	1.753			
Participation				4	2.650	0.047*
>90%	15	32.34	1.404			
80%–89%	10	30.23	1.705			
70%–79%	10	33.49	1.687			
60%–69%	6	34.26	2.202			
50%–60%	6	25.87	2.187			

^aN = 50.

^bGeneral Education Development High School Equivalent diploma.

*Statistically significant at $P \leq 0.05$.

Table 6. Pairwise analysis of covariance determining the effects of the level of participation on posttest and environmental attitude scores of participants in the Green Brigade program.

Group and variable of interest	N ^a	Mean score	Difference	SE	P
Participation					
>90%	15	32.34	6.47	1.404	0.017*
80%–89%	10	30.23	4.36	1.705	0.127
70%–79%	10	33.49	7.62	1.687	0.009*
60%–69%	6	34.26	8.39	2.202	0.010*
50%–60%	6	25.87	---	2.187	

^aN = 50.

*Statistically significant at $P \leq 0.05$.

1995). Earlier studies reported Caucasians were more concerned than African-Americans about environmental issues (Kellert, 1984; Van Ardsol et al., 1965; Waliczek, 1997). However, other studies found similar levels of environmental concern among African-Americans and Caucasians (Mitchell, 1979; Mohai, 1990).

Similar to horticulture knowledge improvements, there were no significant differences in environmental attitude posttest mean scores due to Green Brigade sessions (Table 5). This supports past research (McCormick et al., 1989) indicating that active learning will enhance children's environmental attitudes, and that children's experiences with vegetation positively affect their environmental attitudes (Harvey, 1989; Skelly and Zajicek, 1998).

Program participation was measured by the frequency that juveniles attended the Green Brigade sessions. Program participation was found to be a significant factor in posttest environmental attitude scores (Table 5). Posthoc pairwise comparisons indicated that participants with attendance rates less than 60% were found to have significantly poorer environmental attitudes (25.9 points) than those participating more frequently (30.2 to 34.3 points) (Table 6). The more positive environmental attitudes were likely the result of more exposure to topics and activities resulting from being present more frequently.

Participating in the Green Brigade program improved juvenile offenders' horticultural knowledge, which could aid them in future job placement. Other innercity youth training programs have been successful at not only providing job skills and work ethics, but also have mentioned evidence of participants displaying community pride (Greengard and Solomon, 1994), which could lead

to less vandalism and more positive involvement in the community. In addition, the Green Brigade program improved participants' environmental attitudes which is important for every member of the global community aiding in the preservation and conservation of natural resources.

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