Proc. Fla. State Hort. Soc. 123:333–338. 2010.

Bringing Master Gardening to Costa Rica

Daniel F. Culbert*[1], Alejandro Bolques[2], Larry Halsey[3], Adrian G.B. Hunsberger[4], Henrique Mayer[4], David W. Marshall[5], Linda M. Seals[6], Pete Vergot[7], Luis N. Bulgarelli[8], and B.K. Singh[8]

[1]*University of Florida, IFAS, Okeechobee County Extension Service, Okeechobee, FL 34972*

[2]*Florida A&M University, CESTA, Gadsden County Extension Service, Quincy, FL 32351*

[3]*University of Florida, Jefferson County Extension Service, Monticello, FL 32344*

[4]*University of Florida, IFAS , Miami-Dade County Extension Service, Homestead, FL 33030*

[5]*University of Florida, IFAS, Leon County Extension Service, Tallahassee, FL 32301*

[6]*University of Florida, IFAS, Brevard County Extension Service, Palm Bay, FL 32909*

[7]*University of Florida, IFAS, North Florida District Extension Office, Quincy, FL 32351*

[8]*EARTH University, Daniel Oduber – La Flor Campus, Liberia, Costa Rica, C.A.*

Additional index words. best management practices, Guanacaste, Hispanic landscapers, international Extension, Spanish training, volunteers

The University of Florida Extension Service initiated Costa Rica's first training of non-formal landscape managers in 2008. Three county agents and two administrators spent a week in Apr. 2007 visiting EARTH University's new LaFlor campus near the Pacific coast. That region is experiencing rapid growth in tourist development. Stresses of rapid growth, decreased water quality and quantity, and misuse of horticultural chemicals now impact the local economy and environment. In 2008, seven county agents provided two concurrent 7-week programs. Each agent spent 2 weeks at LaFlor. Agents rotated in and out each week for program continuity. Course materials and lessons were taught in Spanish. The "Master of Gardens" program was designed for nursery and landscape professionals. The "Gardeners of Costa Rica" course focused on homeowners and ecotourism personnel. Participants learned about best management practices suitable to the dryland tropics, practiced concepts with hands-on exercises, and installed demonstration gardens. After 7 weeks, a graduation ceremony was held and 47 participants received completion certificates. Pre/post, testing results showed up to 38% improvement in test scores on the concepts taught. Follow-up activities include an ongoing website. Materials developed will be utilized in Florida to deliver programs to Spanish-speaking audiences. This project provided an international experience for Extension faculty to broaden their knowledge of different environments and cultures.

Hispanic employees in landscape businesses represent nearly 60% of all employees in southern Florida (Jordi, 2010). A recent survey of Florida Extension agents (Escobedo, 2009) indicated they were not prepared to reach out to Spanish-speaking segments of the population, and teaching materials are inadequate for reaching this expanding part of Florida's population.

Florida's landscape professionals must develop approaches to effectively manage and train the Spanish-speaking workforce.

Two recent examples of success that can be cited in developing teaching materials in Spanish-speaking landscaping audiences are an IPM program (Mayer, 2008) and a podcast used to train landscapers and homeowners to control the fig whitefly (Lamberts, 2008). Extension agents must develop additional materials and methods to enable them to meet the educational needs of this workforce.

Developing countries in Latin America are experiencing challenges in managing the resources needed to develop landscapes associated with desirable tourist destinations. They also have expressed concerns with a lack of training opportunities in environmentally appropriate landscape horticulture.

*Corresponding author; phone: (863) 763-6469; email: indianco@ufl.edu

Northwestern Costa Rica is becoming a popular tourist destination due to the opening of a new international airport and its close proximity to the increasing numbers of coastal resort communities. The combination of rapid development of these Pacific resort locations and the use of landscape methods and plant materials from Costa Rica's humid tropic environments has led to pockets of wrong plant/wrong place landscapes. These methods result in increased use of scarce water resources.

Authors of this paper that toured Costa Rica horticulture have observed that locally indigenous plant materials are infrequently available. Additionally, they observed that water conservation practices suitable to the dry tropical climate of the Guanacaste region are underutilized as ways to address these strains on local natural resources.

This paper describes an Extension program designed to teach commercial landscapers and community volunteers in Latin America about landscape best management practices for landscapers. It describes the methods used to develop a training program for Hispanic landscape professionals and reports on the results of this effort.

This team of seven University of Florida county Extension agents were asked by Costa Rica's EARTH University to provide

training to selected horticultural professionals and community gardeners in that country's northwestern region. EARTH (Escuela de Agricultura de la Región Tropical Húmeda) is a private, international, nonprofit university dedicated to education in the agricultural sciences and natural resources (EARTH website, 2010). While the main campus is located in the humid tropics in Guácimo, Province de Limón, Costa Rica, a secondary campus (LaFlor) is dedicated to the study of dryland tropics and is located near the northwestern town of Liberia in the Province of Guanacaste.

With predictions that the Guanacaste region of northwestern Costa Rica will continue to experience intense development with limited natural resources, having a trained workforce and knowledgeable community volunteers able to provide appropriate landscape management practices will be an important factor in the sustainable development of that region.

It is suggested that the methods used here may find applicability in teaching other Hispanic landscapers in Florida, in other areas with Latin American populations, both domestic and international. Examining what has been done by others may help to illustrate what works and what does not.

Preliminary Site Review Visit

Three UF county Extension faculty and the project team leader conducted a 7-d exploratory visit to Costa Rica in Apr. 2007. The agents were introduced to the staff and resources available at the main campus of EARTH University in Guacimo. The team traveled across the country assessing how landscaping was practiced and looking at the needs of horticultural industries. The trip ended at the EARTH campus of LaFlor adjacent to the Pacific coast (Fig. 1).

While exploring the Guanacaste region, team members met with community leaders, golf course superintendents, plant nursery owners, and members of the Costa Rican Ministry of Agriculture Extension system. The training needs of employees in these industries and local homeowners in horticultural issues were examined.

After the exploratory team returned to Florida, they developed the idea of enhancing the capacity of Extension faculty by delivering horticultural programming in Costa Rica to those already in the profession and to interested homeowner clientele. The program proposal developed by UF Extension faculty was further refined by the EARTH LaFlor program professionals (Vergot, 2009)

Fig. 1. Map of Costa Rica, showing locations of main EARTH Campus near Guacimo, and LaFlor, located near Liberia in the Province of Guanacaste (graphic: EARTH University).

Four additional Florida Extension agents were recruited based on their desire to practice curriculum development skills and a willingness to teach in Costa Rica during a 2-week stay at the EARTH LaFlor campus. Mastery of the Spanish language was not a factor in the selection of the county Extension faculty.

The following items were identified as the contributions from EARTH University: 1) an on-site program development person; 2) horticultural teaching facilities in Guanacaste; 3) translation of teaching materials and conversation during training; 4) landscapes and equipment for hands-on training; 5) EARTH students to assist as interns for future training programs; 6) team transportation, housing, and meals would be provided for UF faculty; 7) facilitating collaboration with other area community institutions and organizations; and 8) a realization that program alumni would become potential graduate students or trainers for similar programs.

Conversely, the following were provided by UF/IFAS to the LaFlor program: 1) trained county and state Extension faculty with skills in Extension education and expertise in environmental horticulture; 2) IFAS research-based educational materials and knowledge would be made available to program participants; 3) Extension administration would provide travel costs of UF faculty to Costa Rica; 4) faculty would take on short-term (10–14 d) assignments in Costa Rica; 5) the possibility of future UF Extension sabbaticals would be explored; 6) distance education models using instructional technology would be developed for graduate studies; and 7) UF would assist EARTH faculty to implement their new third-year academic internship program at LaFlor.

Program Goals

Agents also sought to identify potential drought-tolerant ornamentals that could be adapted to Florida conditions. During the length of this program, agents made observations as they compared climate/soil and plant differences among different regions of this country. A long-term benefit from this international program will be the introduction and testing of new materials and methods utilized in Costa Rican landscape horticulture.

The program goals (Program Objectives, 2008) for this international Extension program were multifaceted. For Costa Rican clientele, the program was designed to provide hands-on horticultural knowledge and skills to: 1) enable community personnel to teach gardening for improved food self-sufficiency; 2) increase technical competence of landscape installers and maintenance personnel; and 3) reduce waste of natural resources used in high-maintenance landscapes by increasing the use of native plant materials (Fig. 2) in commercial landscapes.

For both the visitors and hosts, the program was designed to 1) bring improved awareness of cultural differences and development of strategies to work with others; 2) provide experiences in building horticultural curriculum for non-English speaking clientele; 3) broaden the knowledge base of different environments and plant specifies; and 4) build relationships with faculty and students for future collaboration between EARTH and UF.

Teaching Plan and Methods

The methods at LaFlor involved the students in practicing landscaping skills, visiting plant nurseries, and installing demonstration gardens at the LaFlor campus. Most plants used in these projects were those with low water needs. Water conservation landscaping methods were taught. It was felt that this approach

Fig. 2. Showy flowers of the native Poroporo tree [*Cochlospermum vitifolium* (Willd.) Spreng.] are often seen on Guanacaste roadsides but are rarely planted in landscapes (photo: Dan Culbert).

would enable program participants to transfer this knowledge into landscaping projects and demonstration gardens in local Costa Rican communities and schools.

UF IFAS county Extension faculty provided training for 47 landscapers, ornamental producers, and homeowners. Faculty and staff of EARTH University at the LaFlor campus advertised and recruited participants for the program from the surrounding communities and villages. Participants paid a fee equal to US $150, provided in-kind donations (e.g., landscape plant material), or received scholarships from community organizations or their employers. The Costa Rican Ministry of Agriculture (MAG) Extension system, a key partner in the training program, provided this training for many of their Extension staff.

Each agent drafted their own presentations before traveling to Costa Rica. (Table 1) Logistical updates and program planning coordination efforts were conducted via periodic videoconferences. These were held prior to the beginning of the classes and continued over the course of the 7 weeks. Polycom technology (Fig. 3) and voice-over internet programs (e.g., Skype, VoipStunt) were used to connect agents across Florida with the agents in Costa Rica. This technology was also used to broadcast the final "graduation ceremony" in Costa Rica live to agents that had already returned to Florida.

Extension faculty stayed in Costa Rica for 2 weeks. Each week, a new agent arrived to replace the one that returned home from their 2-week assignment. During the first week in Costa Rica, agents further refined their presentations and assignments and assisted another Extension agent. During their second week, they provided the lead instruction and practical exercises to the Costa Rican audiences. This week-long overlap of instructors allowed for program continuity, and allowed time for developing course materials. It also allowed agents proficient in Spanish to assist

Table 1. Course curriculum for EARTH LaFlor Master of Gardens/Gardeners of Costa Rica.

Wk	Topic(s)	Selected practical learning experiences
1	Introductions, class overview	Icebreakers; pre-test; welcome from EARTH and UF staff
	Basic plant science, botany	Collecting and pressing plant and entomology specimens (Fig. 4); field ID of campus plants
2	Soil and nutrition, fertilizer, compost	Fertilizer calibration and application (Fig. 5); mulching plant beds
3	Right plant/right place	Landscape design arrangement with containerized plants (Fig. 6)
	Environmental plant requirements	Landscape evaluation: What is right? What is wrong? (Fig. 7)
4	IPM: Pest ID and management	Insect and pest identification
5	Pesticide safety	Read a pesticide label
	Irrigation, watering (half-day)	Calibrate: hand sprayer (Fig. 8) and microjet system; demonstration of hose/ sprinkler use
6	Landscape maintenance and care	Proper landscape plant pruning (Fig. 9); lawnmower, weed trimmer use and chain saw safety
7	Extension and informational resources	Hands-on computer practice; provide CD of reference materials
	Program review	*El Gran Desafio!* (The Great Challenge), a *Jeopardy!* game show format used for a review.
	Evaluation and recognition	Post-test; award certificates of completion

Fig. 3. Computer screen photo of team members during weekly videoconference (photo: Dan Culbert).

Fig. 4. Student display botany prints. Note woman on right is holding a plant press used for this exercise (photo: Pete Vergot).

Fig. 5. Leon County Horticulture Agent David Marshall shows students how to adjust the calibration of a fertilizer spreader. Note his portable headset attached to a speaker at his waist (photo: Linda Seals).

Fig. 6. EARTH LaFlor Outreach Program Director Luis Bulgarelli (kneeling) shows students how to plant a palm to Wednesday commercial worker class (photo: Linda Seals).

Fig. 7. Miami/Dade County Agent Adrian Hunsberger critiques landscape design installed by community worker class during fourth week of program (photo: Larry Halsey).

Fig. 8. Jefferson County Agent Larry Haley demonstrates sprayer calibration methods to Costa Rica Ministry of Agriculture employee (photo: Henry Mayer).

Fig. 9. Miami/Dade County Agent Henry Mayer discusses principles of tree growth and how it affects pruning (photo: Alex Bolques).

in delivering lessons for those that were non-Spanish speaking.

Different audiences were targeted on different days of the week. Wednesday classes were for "Master of Gardens/Maestro del Jardin" (Commercial Landscape and Nursery Workers–CLNW), and included those working in the resort landscapes and golf courses on Pacific coastal areas, nursery growers, and Extension field personnel from the Ministry of Agriculture (MAG). Friday classes focused on the "Gardeners of Costa Rica/ Jardineros de Costa Rica" (Community Volunteers and Homeowners–CVH). Community groups (such as Project Papagayo) provided students for this class with financial support for those employed in the tourist industry. Various schools in the area were also contacted to locate teachers who would include horticulture in their curriculum. Other "Jardineros" were MAG employees who could not be scheduled on Wednesday.

The program also produced some challenges that had to be solved by the county faculty along the way. The originally hired interpreter was not able to arrange for transportation, so a bilingual student in the class was employed to serve as an interpreter. Extension faculty found many Extension materials that have been translated, but few in horticulture and fewer with basic readability

levels suitable for the audiences. Many original teaching materials were developed for this audience, and some are now archived online (UF EARTH/LaFlor website, 2010). Other issues such as transportation for students were solved over time with ride shares and use of public transportation.

Audience Characteristics

An examination of the cultural differences between traditional audiences and these learners was essential to ensure program success (Seals, 2008). The following characteristics of the learners taught in this program were based on information obtained from the first week's pretest.

As shown in Table 2, student self-assessment of their English language skills showed that for the commercial audience, 33% spoke English and 33% could write it. Their perceived English language ability was less than that of the community gardener class, of which 53% reported themselves as English speakers and 71% as English readers. Instruction was provided in Spanish either by agents with proficiency in the language, or was translated by a local EARTH staff person or student in the class.

Table 3 shows the technology literacy of these students. The majority of the students felt they could use computers and said they had access to computers. It was important to know if their systems had a CD drive, as we had provided a CD of class references to each student during the last week of the course. EARTH staff suggested that students without a computer would be likely to give their CD to other colleagues or family members who could make use of that resource.

The last day of the course also provided a brief lesson on computer use, demonstrating to students how to access the Internet, and introducing a few websites believed to be of use to these students. Students were shown a website for the program (http://LaFlor.ifas.ufl.edu) (Culbert, 2010), created for additional student access to referenced teaching materials and links to other pertinent websites. The website is also used by our EARTH team to plan and evaluate this international Extension program, and provides a place for others to access and use these materials elsewhere.

Pretest/Post-test Results

To evaluate the success of the program students were given a written pretest in Spanish during the first day of the program. Thirty-two questions sampled their knowledge of concepts that were to be provided during the 7-week course. At the conclusion of the last class, students were again given the same test to assess any immediate gain in knowledge. Overall scores (from 0 to 100% correct) were calculated for individual students, as reported in Table 4, and the gain in knowledge among the concepts presented was calculated, and presented in Table 5.

Pre and post results for the Wednesday commercial landscaper's class showed that this group increased their knowledge by 25% over the 7-week class. The range of scores, from lowest to highest, was reduced at the lower end of the range over the length of the class as well. These scores indicate that improvement in knowledge was gained among this audience.

The Friday class of community gardeners improved their test scores by 38%, a greater level of improvement than those students in the commercial audience class. The range of their test scores expanded on the upper end of the grading scale, but some students still failed to demonstrate knowledge gain on the post test. Their average test score was lower that that of the commercial audience, which is understandable as these persons would be expected to have less familiarity with the concepts from their employment experience.

Another comparison between the pre- and post-test scores looked at the progress made by these students in specific subject matter categories. The number of correct answers given for specific questions on the tests were combined to represent subject area clusters. The net change in correct answers from pre- to post-test scores among these subject matter clusters was calculated and is shown in Table 5.

Table 2. Student self-assessment of English language skills.

Self-assessment	Wednesday class[z]	Friday class[y]
I can speak English	33%	53%
I can read English	33%	71%

[z]Commercial audience: Maestro del Jardin (Master of Gardens).
[y]Community audience: Jardineros de Costa Rica (Gardeners of Costa Rica).

Table 3. Student self-assessment of technology skills.

Self-assessment	Wednesday class[z]	Friday class[y]
I can use a computer	52%	77%
I have access to a computer at home or work	57%	88%
The computer has a CD drive	75%	82%
I have access to the internet at home or work	50%	76%

[z]Commercial audience: Maestro del Jardin (Master of Gardens).
[y]Community audience: Jardineros de Costa Rica (Gardeners of Costa Rica).

Table 4. Summary of individual learners' test scores, pre- and post-test.

Class	Test	Range of individual's test scores[z]	Avg score
Wednesday class[y]	Pretest	25% to 91%	61.5%
	Post test	59% to 94%	83.9%
Friday class[x]	Pretest	22% to 78%	40.81%
	Post test	22% to 84%	65.90%

[z]Individual scores for the 32 questions were converted to a 0 to 100% scale.
[y]Commercial audience: Maestro del Jardin (Master of Gardens).
[x]Community audience: Jardineros de Costa Rica (Gardeners of Costa Rica).

Table 5. Knowledge gained by learners according to subject matter.

Change in pre/post test scores[z]	Wednesday class[y]	Friday class[x]
Botany	6%	36%
Soils and Fertility	35%	35%
Right Plant/Right Place	–10%	–18%
IPM / Pest Management	38%	24%
Pesticide Safety	9%	29%
Irrigation	28%	35%
Pruning	13%	22%
Extension and Info Resources	9%	11%

[z]Clustered by subject area.
[y]Commercial audience: Maestro del Jardin (Master of Gardens).
[x]Community audience: Jardineros de Costa Rica (Gardeners of Costa Rica).

The Wednesday class of commercial workers showed 35% improvement in their test scores in the soils and fertilizer cluster. The concepts of soil testing, managing soil erosion and composting were reported by the instructor to be fairly novel to this audience. The content provided in the area of IPM showed 38%, the greatest level of subject matter improvement among both classes. This is understandable in that their employment puts them in a greater familiarity with and need for pest management issues.

The Friday class of community gardeners showed improvement in almost all areas, and in most cases had stronger improvement in their test scores than their commercial class counterparts. This is to be expected when it is remembered that these students are not as familiar with these issues on a day-to-day basis, and the subjects were often new to them.

It is noted that the scores for the landscape design section actually fell from the pre-testing to post-testing time frame. An explanation is that the content for that week's class was changed from the original plan, so the tests did not reflect what was covered.

Considerable effort was expended during all classes with the hands-on design and installation of landscape projects on campus. A major goal of the class was to instill a new way of thinking among those involved in resource-efficient landscapes for Costa Rica. The campus landscape at LaFlor was enhanced by the installation of landscape plants by the students. A typical change in the campus landscape can be seen in Figures 10 and 11. The gardens they installed stand as a testament to the application of the landscape management principles taught during this program.

Fig. 10. Before: Landscape used considerable turf with occasional *Cordyline* plants placed near the edges of driveways and sidewalks. No use of landscape mulch was observed on site. Photo was taken Jan. 2008 (photo: Dan Culbert).

Fig. 11. After: gardener class installed *Codiaeum variegatum* plants into mulched beds on either side of a sidewalk. The amount of turf and maintenance levels have been reduced, and more diversity exists in the landscape. Photo taken in May 2010 (photo: Luis Bulgarelli).

Conclusions

The materials and methods used in this program have already been used in a similar program in Ecuador (Seals, 2009), and other agents are using the program materials found on the website in their local Extension programs (Hunsberger, 2010; Jordi, 2010).

When resources permit the continuation of this program at EARTH University, UF agents have expressed interest in returning to offer this program again. Horticulture agents from other state's land-grant institutions could also be invited to be short-term instructors. (Bolques, 2009) The need for a more long-term evaluation of the class members would be helpful in demonstrating the impact of this kind of instructional approach. Expansion plans for the future could include the possible sabbatical of a UF agent which would mentor an EARTH staff person responsible for developing and maintaining a locally delivered curriculum. A community agency or institution could be designated to then take over the responsibility for a Master Gardener volunteer program similar to those available in the United States and Canada.

Literature Cited

Bolques, Alex. 2009. Application of Extension horticulture training concepts in Costa Rica. AIAEE Conf., San Juan, Puerto Rico.

Culbert, D. 2010. UF EARTH LaFlor International Program website. <http://laflor.ifas.ufl.edu>.

EARTH University website. 2010. <http://www.earth.ac.cr/ing/index.php>.

Eseobedo, F., M. Wyman, S. Varela, C. Asuaje, E. Mayer, and M. Swisner. 2009. Analyzing Extension needs of the Spanish speakers in Florida. Proc. Fla. State Hort. Soc. 122:354–358.

Hunsberger, A.G.B. and H. Mayer. 2010. A hands-on course to improve the professionalism of "Green Industries" personnel. Fla. State Hort. Soc. Conf., Crystal River, FL, 6–8 June 2010. (Poster OGL27-P-2.)

Jordi, R.L., H. Mayer, and E. Skvarch. 2010. Designing an integrated pest management program for Hispanic landscape maintenance professionals. Fla. State Hort. Soc. Conf., Crystal River, FL, 6–8 June 2010. (Poster OGL32-P-7.)

Lamberts, M., H. Mayer, R. Regalado, A. Hunsberger, and C. Mannion. 2008. Developing a bilingual video/video podcast to teach clients how to apply a soil drench insecticide to control a new pest, the fig whitefly. Proc. Fla. State Hort. Soc. 121:358–359.

Mayer, H., E. Skvarch, P. Mattis, and R. Jordi. 2008. Designing an integrated pest management (IPM) program for Hispanic landscapers. Proc. Fla. State Hort. Soc. 121:356–357.

Seals, L.M., A. Bolques, P. Vergot, and W. Bowen. 2009. Summary of UF/IFAS Extension international horticulture in Guayaquil, Ecuador. Internationalizing Extension webpage: <http://international_extension.ifas.ufl.edu/2008/>.

Seals, L., D. Culbert, L. Halsey, A. Hunsberger, H. Mayer, D. Marshall, A. Bolques, and P. Vergot III. 2008. Developing and implementing an international program—Gardeners of Costa Rica. NACAA Conf., Greensboro, NC. (Poster)

Vergot, Pete, B.K. Singh, D. Culbert, L. Halsey, A. Hunsberger, L. Seals, H. Mayer, D. Marshall, and A. Bolques. 2009. Internationalizing University of Florida IFAS Extension—Developing and implementing a innovative horticulture Extension program in Costa Rica. AIAEE Conf. Proc., San Juan, Puerto Rico.