SAHN Clustering and enter the input file name acarnsri and acarnclus as the output file. Select UPGMA (unweighted pair group cluster analysis using arithmetic means) and run by pressing F2. To print the tree (Fig. 5A), select Tree Display, use Acarnsi as the input file, and choose phenogram. Follow the remaining directions. To complete principal component analysis (PCA), transform the acarnsri data matrix using the Double Center option and record the output as acarnsi. Now select Eigenvectors, use acarnsi as the input file, and label the output as acarns. The plot of PCA is completed by selecting 3-D Model and inputting the file acarnsi. The direction to plot the analysis is by columns. Run the program with F2 and view the graph and print with ALT P (Fig. 5B). Compare the output of the cluster analysis with that of PCA—they should be similar.

**Concluding comments**

These laboratory exercises or similar ones have been conducted successfully on the first attempt by several classes of beginning graduate students as well as research personnel. DAF is not a difficult technique and with a little planning should provide an enjoyable learning experience depicting a practical application of a molecular technique for solving horticultural problems and needs. Additional help in the form of photographs illustrating various techniques and operations are available on the home page of the Department Ornamental Horticulture and Landscape Design under the author's names at http://funnelweb.utcc.utk.edu/~authord.

**Additional index words.** vegetable crops, teaching, students

**Summary.** For many years, the former Vegetable Crops Department, now the Horticultural Sciences Department, at the University of Florida offered a vegetable crop industries course. This one-credit course is offered each year as a 3- to 5-day field trip into vegetable production areas of Florida in the spring semester during spring break. The intent of the course is to give undergraduate students an extensive on-site evaluation of the application of scientific principles learned in lectures related to Florida’s commercial vegetable industry. A new, innovative approach to structuring this course was initiated recently wherein only alumni of the department interacted with the students on all phases of commercial vegetable agriculture in Florida. These alumni had obtained degrees at the BS, MS, or PhD level and represented many professional backgrounds related to agriculture.

**Practical Training in Horticultural Undergraduate Courses: Understanding Job Opportunities and Availability through a Study Tour of Alumni**

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**Literature cited**


Caetano-Anollés, B.J. Bassam, and P.M. Gresshoff. 1992. Primer-template interac-


producing, handling, and marketing vegetables. Students were exposed to real-life situations and were encouraged to discuss and seek employment opportunities during the farm visitations. Student expenses were offset by donations from the Florida vegetable industry.

Many undergraduate students majoring in horticultural science programs do not have vast experience and practical training in their chosen field (Ballinger, 1980). Course requirements and much of the educational offerings are centered on classroom contact. Seemingly fewer and fewer courses in horticulture related to fruit and vegetables require hands-on laboratory interaction.

Several courses have been designed to help students visualize real-world situations with regard to the various horticultural professions. Ferguson (1994) describes a horticultural manager’s seminar course wherein horticulture professionals from various industry discipline areas discuss real-world horticulture with students in a 2-hour session held weekly for a semester. Students are confronted by industry persons and are thus introduced to the complex challenges faced by horticultural production, marketing, and processing managers. Other courses have been described that help students develop interpersonal skills by using background in socioeconomic ideas to help students understand horticulture (Reif, 1990). Davis (1992) used a model of decision cases as a teaching component for horticulture courses. The model was derived from business school practices and was used in an agricultural setting to help undergraduates become better practitioners, thus gaining better confidence and decision-making skills.

A traditional method used to help undergraduates obtain practical experience is through an internship program (Ballinger, 1982). For this reason, the American Society for Horticultural Science set up an Internships Working Group in 1980, which, unfortunately, was short-lived. The importance of and need for practical experience for horticulture undergraduates was emphasized in the ASHS Strategic Plan developed in 1993; however, action directed by ASHS on improving horticulture internship programs has generally been inactive. Problems generally cited as deterrents include scheduling conflicts, cost, lack of housing, lack of time, and problems obtaining suitable intern partners (i.e., employers). Haque and Lewis (1988) suggested strengthening internship programs so that students would get involved with a program and, more importantly, gain valuable practical work experiences.

Although an intern program may still be the best mechanism to help students obtain a broad practical work experience, most students still resist this opportunity, citing reasons why not to do an internship the lack of time and the high costs generally related to moving, living, and extending the time period needed to complete an undergraduate degree. In an attempt to develop more hands-on practice with regard to plasticulture technology, Lamont (1995) described how 15 students were provided a meaningful outdoor experience involving the latest plasticulture technology. The idea was to reinforce information gained in the classroom with actual field experience. To conserve time, the laboratories were provided in nearby greenhouse facilities instead of production sites or distant university research facilities.

Recently, Russell et al. (1996) described an animal science industry travel course based on a 3,000-mile trip during spring break to observe various components of animal agriculture, see variations in production practices, and network for internships and jobs. The course was well received by participating students, who indicated that they gained knowledge that could be applied directly to classroom studies, enhanced their job opportunities, understood better what was required for success in agricultural positions, and understood better the rationale for many agricultural practices.

A similar course, which includes travel to vegetable farm operations, should be very popular, as Florida’s vegetable industry has much to offer students, especially in terms of production, packing, and marketing activities and opportunities. Unfortunately, the course that was to do so—Vegetable Industries (VEC 3943)—had at least two major drawbacks. First, the course was given during spring break, a major sacrifice for many undergraduates who often seek employment during break. Second, and perhaps more importantly, the course catalog stated (and the policy was) that any additional expenses incurred during this class were the student’s responsibility, including the costs for room and food. These expenses proved to be a major deterrent, since many undergraduates did not have the financial ability to cover the additional costs. Thus, the course did not meet the minimum enrollment to be offered from 1989 to 1993.

There were still many benefits of VEC 3943, including the opportunity to see and hear the realities of working in diverse areas of the vegetable horticulture profession. Students were also exposed to more job opportunities available upon graduation through interactions with a diverse group of industry persons. The intent of VEC 3943 was to complement two other vegetable production courses—Commercial Production of Warm Season Vegetables (VEC 3221) and Commercial Production of Cool Season Vegetables (VEC 3222). Students generally would have taken VEC 3221 in the previous fall semester and be concurrently enrolled in VEC 3222. Thus, they would have a lecture background on some of the cropping systems they would see in VEC 3943.

The enrollment dilemma was solved by redesigning the course to meet the needs of the students by showing them firsthand employment opportunities in the vegetable crops area, including the possibility of applying for jobs while on the trip. The problem of student expenses was also corrected; out-of-pocket expenses were reduced by having all visits hosted by departmental alumni who helped defray student expenses. Alumni were contacted in person or by telephone by either author. When prudent, contacts were asked if they or their company could help defray the costs of the trip. Requests were made for sleeping and meals, and in no case was either author turned down. The University of Florida provided transportation. Further, the course included host alumni representing graduates at the BS, MS, and PhD levels, serving the Florida vegetable industry in various capacities including the extension service, independent growers and producers, commercial agriculture industries, research personnel, faculty, and packinghouse managers.
Preparation

A tentative outline for the course, including the various visits, was developed early each December. The course itself was publicized in various courses wherein students might be interested in the subject matter. The early preparation was needed to encourage either preregistration and/or regular registration. During our first attempt (after the redesign) we had nine students register for the course. All were horticultural sciences majors interested in fruit or vegetable crop production. The course was scheduled to run from 7–11 Mar. We had a preliminary orientation meeting with the students a week before departure to review the itinerary and discuss details of sleeping arrangements and other related travel items. The two graduating seniors were told also to bring an ample supply of vitae if they were interested in employment. A necessities list was developed (Table 1).

The course was developed to expose students to the ample diversity of Florida’s vegetable industries, a goal reached by visiting the four major vegetable production areas and the three major soil types of southern Florida: (1) southwest Florida (Naples and Immokalee area of Collier County, sandy soils), (2) Everglades area (South Bay and Belle Glade, muck soil), (3) South Dade County (Homestead area, rock soil), and (4) lower east coast (including Palm Beach and Martin Counties, sandy soils).

Destinations

On Monday we left the home base of Gainesville, which is in north-central Florida (365 miles from Homestead) and made our first stop at the Disney Corp., EPCOT—The Land, near Orlando, to meet with Disney staff (University of Florida PhD graduates) and interns (University of Florida undergraduates) to review their operations in research and development at The Land Pavilion (Fig. 1). Special emphasis was given to cultivar selection, nutrition, pest management, and plant growth systems. From Disney, we traveled southwest to Naples, where we met two alumni for dinner to review production and marketing activities of a large tomato operation in the area. The next day the group visited the company’s farm operations (Fig. 2), packinghouse, and research facilities where students met additional alumni. In the afternoon, the group moved northeast to Immokalee to meet another farm operation to review tomatoes grown on sandy soil with drip irrigation, pepper production (Fig. 3), potato production and packing, and a scouting and integrated pest management (IPM) program. The late afternoon was filled with a visit to the packinghouse. The students met growers and managers with BS and MS degrees from the University of Florida.

On Wednesday the group departed eastward at 7:00 AM for Belle Glade to visit a local salad processing plant, a lettuce, celery, sweet corn, and radish packinghouse; celery field operations (Figs. 4 and 5); and lettuce production and harvest operations grown on muck soil. The group was hosted by a PhD alumnus and met many other BS alumni at the various stops. The afternoon was devoted to sweet corn production and celery research studies on the muck soils of West Palm Beach County. A highlight was a visit to a young independent lettuce grower who started the farming operation on his own in the 1980s after receiving his BS degree at the University of Florida and was farming in excess of 600 acres (Fig. 6). The University of Florida Everglades Research and Education Center provided dinner and overnight accommodations, where the students informally talked to various alumni families in the area.

The fourth day was another early departure to visit the Tropical Research and Education Center in Homestead, where the students met another BS alumnus who was a longtime PhD faculty member there. The class then visited field production sites for snap beans, pole beans, tomatoes, tropical vegetables, potatoes, herbs, pickling cucumbers, squash, and specialty vegetables, all grown on rock marl soil (Figs. 7 and 8). After lunch, stops included a greenhouse operation (Fig. 9); a farmer’s market; cucumber, squash and bean packing houses; and several tomato packing houses in the area. Once again, the group met many University of Florida alumni.

On the final day, we left Homestead and traveled through the highly urbanized areas of Miami and Fort Lauderdale to the sandy soils of Palm Beach County, where we met a University of Florida MS graduate, who was one of two vegetable agents in the county, at a diverse family farm operation with many University of Florida alumni in the family. Emphasis was given to reviewing cherry tomato, pepper, and eggplant (Fig. 10) production as well as packing lines and a U-pick operation growing a diversity of vegetable crops, including strawberries. Our host alumnus at the farm had a BS from the former Vegetable Crops Department, while most of her brothers were likewise University of Florida graduates. A later visit took the group to a Chinese and oriental vegetable farm and then on to several pepper farms to view organic production, IPM, and the use of compost for commercial pepper production, which was an off-farm research project being conducted by one of our PhD students (Figs. 11 and 12). The group rode a packing house on wheels called a mule train, wherein the crop is harvested and placed directly onto a moving packinghouse for washing, grading, and packing.

Our final stop was in Martin

Table 1. Necessities list for the vegetable crops industry tour.

- Money for miscellaneous meals, all breakfasts, breaks, and postcards.
- Clothes for field wear and casual dinner attire.
- Overnight gear—pillow, blanket, sleeping bag if available, soap, and towels.
- Camera and film.
- Materials to take lots of notes.
- Biographical sketches if you are looking for employment, summer internship, etc.
- Extra space is limited, so pack accordingly. A large cooler with ice will be provided daily. You may bring snack food and beverages.
- Be on time, especially at the scheduled departure time; an alarm clock or watch would be helpful.
- If you have any special requirements (i.e., medication, food, etc.) please inform D.J. Cantiliffe immediately.
County, near Stuart, to view corn and cucumber production on lands that were abandoned in the 1960s by vegetable producers who moved to the Immokalee area. Before the common use of methyl bromide and plastic mulch, growers were forced to frequently move on to new land to avoid disease and insect buildup. In southern Florida it was called slash-and-burn agriculture.

**Student comments**

Students were required to write a detailed report on their site visits, relating each visit to classroom principles regarding vegetable production practices. The report was due by the end of the spring semester and often echoed the perceived success of this type of course as evidenced by the following paraphrased comments. One student stated, “This spring break I spent my vacation riding in a van for most of the day, sleeping on the floor a few nights, sleeping for about 41/2 hours a day, and having a blast during the day. It
may sound like an ordinary spring break, but it was far from that. I had a great time going on this vegetable crops industries course. I learned so much in such a short time, it was amazing. I couldn’t gain the knowledge I know now from just a lecture class, it was exciting to see everything in practice, up-close, and personal.” Another student commented, “I thought that this course was a very informative and enjoyable experience. In my other courses I learned agriculture through a text book approach. This is fine, but I was finally able to apply what I am learning at a human level. I can see where the information that I am learning is lead to and how it is applied. I obtained a wealth of information and I was able to view agriculture at a much clearer perspective. This was a highlight of my semester and my entire schooling. I look forward in the future to taking other courses such as this.”

Job contacts

The two graduating seniors were able to generate a lot of interest from prospective employers and were subsequently hired: one by a vegetable grower-shippers and the other by a transplant production company. In fact, we quickly found that we did not have enough students for all the potential jobs. Two other students are now pursuing MS degrees at the University of Florida, while another rejoined her family tomato farming operation in southern Florida.

Thus, the course now offers direct contact between students and industry, with a real-world focus on vegetable production agriculture. The contact with alumni helped our students visualize and experience the job diversity available and the ability of any graduate to succeed after graduation. Also, alumni could come into a more intimate contact with our students, which was extremely important in bringing together students with future employers.

Evaluation and followup

VEC 3943 received perfect student evaluations in 1994. Students strongly believed in our unique approach and urged continuation of this format. The course was set out in a truly interactive atmosphere in which students were encouraged to ask questions and the participants asked questions of the students. Because of the ample time in the vans, the instructors could lecture and answer and ask questions immediately after each visit. The student numbers were limited to 15 the first year. Nine students registered, and several graduate students also audited the course. This required two vehicles and thus two faculty to accomplish travel logistics. In 1995–97, the course was limited to 10 students as to require one van and one instructor (Stephen R. Kostewicz) and to reduce costs and increase the one-to-one interactions amongst the participants. The University of Florida liability insurance required that each driver be an employee of the university and that all passengers be affiliated with the university. Should the demand for the course exceed this number, an additional instructor and van can be added, but 15 people reduces the individual contact, and the intent of the course becomes jeopardized. Student numbers in the past 3 years have averaged eight per year.

The trip is designed with different stops each year so that our alumni are not burdened with the same format and request for hospitality. As Chair of the Horticultural Sciences Department, I received the following letter from VEC 3943 students in March, 1997: “Recently, my friend and I went on the vegetable crop industries trip (VEC 3943). While most of our friends spent spring break on vacation on the beach, we decided to go on Dr. Kostewicz’s trip. We are both very glad that we made this decision.

This trip enabled us to observe the everyday operations of a vegetable farm. While on the trip, we were able to talk to farmers, and hear from them the problems and pleasures that keep them in the business. We were able to observe seedling production, growing, packing, harvesting, and see the industry from the farmer’s point of view. When we are in the classroom, there are many things that we study that do not hit home until one goes out into the field. The practical experience and knowledge we received during the trip was worth as much as some full semester classes.

We definitely would recommend this course to all students in the agricultural field and more of these types of courses should be offered. Dr. Kostewicz should be highly commended on an excellent job during this trip.”

Literature cited


