Using the World Wide Web for Enhancing Student Learning in Future Horticultural Curricula

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Summary. The use of the Internet and specifically the World Wide Web has grown rapidly in the last 2 years. There are now >60 million web pages on the Internet, each containing information on various subjects and many having very useful information. The text is viewed with a web browser, using a hypertext markup language, enabling formatting similar to word processing. Graphics, sounds, and video are accessed from hot links in the text. While commercial users are struggling with marketing strategies, the web will continue to evolve. We as educators will continue to dominate the rapid growth due to increased needs to reach more students with fewer resources. By adding course materials on-line, instructors can enhance the learning process. Interactive computer teaching modules will give students more one-on-one experience at their own pace. Then, by adding e-mail connectivity to instructors, students can have daily or even hourly access for questions. By careful Web page design, we can hold the interest of our students and disseminate more information than ever before.

Horticulturists involved in classroom instruction must, like others, look ahead to using evolving technologies in college curricula. Most instructors want to use multimedia approaches to teaching. Horticulture crops are not always in season during the academic semester, so slides of plants and other photocopy forms representing the plants must be used in teaching. All that is required to use the World Wide Web (WWW) for classroom instruction is a computer, scanner, and modem or network card. Features of the Internet were outlined by Sistrunk (1996). By using search features found in Yet Another Hierarchically Organized Oracle (YAHOO), Lycos, Alta-Vista, and other search engines, educators can find vast amounts of information to link to on many horticultural topics (Dyrli, 1995, 1996). Once the commitment is made, all the tools necessary to place educational materials on the Web through a campus server may be found on the Internet. Ask a lot of questions and access tips from other educators who have experience in using the Web.

There are several obvious benefits to using the WWW as a supplement to classroom instruction (Dyrli and Kinnaman, 1996). Information for class use can be updated immediately, unlike paper handouts. Once information is put on a server in a hypertext markup language (HTML) format, it can be rapidly updated (Don, 1995). Students accessing the information can proceed at their own pace, unlike some other teaching aids such as video tapes. Links and course materials are more interactive. Students can access the Web 24 hours a day from computers connected to campus networks or by remote access using a modem and an Internet service (Wallace, 1994).

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At Texas A&M, all students have an account on the VAX or UNIX servers as part of their registration fees. Any student with a modem can access the Internet through a port selector with campus dial-in modems at any time. Since the phone call is a local call, their are no air charges. This encourages remote learning use, as more materials every semester are being put on the Web. The horticulture classes at Texas A&M were the first on campus to incorporate teaching modules on the Web in 1994, but now many subjects are being taught by remote access, some from distant sites. We, as educators, must look to the future and promote horticulture by all means available. By setting the leading roles in using electronic technologies, we can enhance our industry's needs. Our departmental Web address is http://aggie-horticulture.tamu.edu.

Advantages of using the WWW as a teaching tool

Instructors find the Web very useful to manage as an instructional tool. Items for class use may be moved to the class Web pages from anywhere. The instructor does not have to be in the office to connect. No printing is required. Files are simply copied onto the server. Students may print the materials from campus computer labs or at their own computer. Teaching pages can be linked to external sources of information. Many sources for horticultural instruction are becoming available. Collections of plant pictures are appearing on the Web every day. Slides of plant propagation techniques are available. Almost every aspect of plant production has some information available for incorporating into class materials. The Web can also be used as a lecture aid when large data sets or presentation software files are accessed with a computer, a network connection, and a video projector to display the images (Fox, 1993).

In campus computer labs with adequate work stations, each student may access class sets on his own computer while receiving instruction from the teacher (Wallace, 1994). This is most effective for laboratory sections of classes. By allowing the students access to class materials beforehand, the learning process will be enhanced since students will be better prepared for the session.

Disadvantages of using the WWW as a teaching tool

Anyone can copy your work. Student password access can restrict this, but not completely eliminate it. Anyone can inspect, compare, access, and criticize your work. As above, password protection can limit. The main factor in usability is time of preparation. This can be critical unless the instructor is well versed in the best software tools available for Web authoring and can type easily. The basic premise of this technology is student computer literacy. Students not versed in computer use may show considerable resistance.

Designing your Web page

There are basic things the best classroom Web sites contain. Instructors commonly place the following elements on their sites: course schedules and objectives, grading criteria, policies, syllabi, assignments, test results and solutions, project guidelines, grade status, outside readings or links, notices and upcoming events, requests for information via e-mail, study guides, glossaries, previously given tests as study aids, annotated text and learning modules, programmed learning, photos of class related subjects, on-line quizzes and tests, self-tests, student reports and vitas, links to on-line reading assignments, Web-based class assignments, searches related to specific class projects (Scigliano, Levin, and Horne, 1996), term paper resource materials and links, interactive forms and image maps, and help links to commonly asked topics.

According to Nielson (Nielson, 1996), Web pages should be designed with accepted guidelines for user friendliness. Nielson recommends avoiding frames, since bookmarking, printing, and backtracking are difficult with this method. He also suggests avoiding complex backgrounds, complex uniform resource locators (URLs), orphan pages, lack of navigational support, and large graphics that slow down download times. These elements can decrease student acceptance of the material presented. Constant feedback from students is needed to make sure you are on track with your efforts. We have a message to convey to students that the Web will make easier to understand and use. This media is the one unifying source in which to incorporate our ideas.

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Research Updates

Yield and Virus Resistance of Summer Squash Cultivars and Breeding Lines in North Carolina

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Summary. Yellow and zucchini squash (*Cucurbita pepo* L.) cultigens (breeding lines and cultivars) were evaluated over a 2-year (1995 and 1996) period in North Carolina. Yellow squash cultigens that performed well (based on total marketable yields) were 'Destiny III', 'Freedom III', 'Multipik', XPHT 1815, and 'Liberator III' in Fall 1995 and HMX 4716, 'Superpik', PSX 391, 'Monet', 'Dixie', XPH 1780, and 'Picasso' in Spring 1996. Some of the yellow squash cultigens evaluated had superior viral resistance: XPHT 1815, XPHT 1817, 'Freedom III', 'Destiny III', 'Freedom II', TW 941121, 'Prelude II', and 'Liberator III' in Fall 1995 and XPHT 1815, 'Liberator III', 'Prelude II', and 'Destiny III' in Fall 1996; all these cultigens were transgenic. The yellow squash cultigens that performed well (based on total marketable yields) in the Fall 1995 test had transgenic virus resistance ('Destiny III', 'Freedom III', XPHT 1815, and 'Liberator III') or had the *Py* gene present in its genetic background ('Multipik'). Based on total marketable yields, the best zucchini cultigens were XPHT 1800, 'Tigress', XPHT 1814, 'Dividend' (ZS 19), 'Elite', and 'Noblesse' in Fall 1995; and 'Leonardo', 'Tigress', 'Hurricane', 'Elite', and 'Noblesse' in Spring 1996. The zucchini cultigens with virus resistance were TW 940966, XPHT 1814, and XPHT 1800 in Fall 1995 and XPHT 1800, XPHT 1776, XPHT 1777, XPHT 1814, and XPHT 1784 in Fall 1996. Even though TW 940966 had a high level of resistance in the Fall 1995 test, it was not as high yielding as some of the more susceptible lines. Viruses detected in the field were papaya ringspot virus (PRSV) and watermelon mosaic virus (WMV) for Fall 1995; while PRSV, zucchini yellow mosaic virus (ZYMV), and WMV were detected for Fall 1996. Summer squash cultigens transgenic for WMV and ZYMV have potential to improve yield, especially during the fall when viruses are more prevalent. Most transgenic cultigens do not possess resistance to PRSV, except XPHT 1815 and XPHT 1817. Papaya ringspot virus was present in the squash tests during the fall of both years. Thus, PRSV resistance must be transferred to the transgenic cultigens before summer squash can be grown during the fall season without the risk of yield loss due to viruses.

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Summer squash includes several types including scallop, crookneck, straightneck, vegetable marrow, cocozelle, and zucchini (Paris, 1996), and refers to those cultivars of these types that are used at the immature stage (Whitaker and Davis, 1962). Zucchini and yellow summer squash are important types grown in the United States. About 5000 acres of zucchini and yellow summer squash are harvested annually in North Carolina (North Carolina County Agents' Estimates, 1995). Production problems in North Carolina from July to November include distortion and discoloration of fruit due to virus infection. Viruses can also suppress squash production at other times of the year in other states depending on location. Problematic viruses include cucumber mosaic virus (CMV), papaya ringspot virus (PRSV, formerly known as watermelon mosaic virus 1), watermelon mosaic virus (WMV, formerly known as watermelon mosaic virus 2), squash mosaic virus (SqMV), and zucchini yellow mosaic virus (ZYMV) (Zitter et al., 1996). The precocious yellow gene (*Py*) in yellow squash offers an advantage by masking the green symptoms in virus-infected fruit. Fruit from plants with *Py* tend to remain yellow in color when infected with viruses compared to virus susceptible cultivars that do not have the gene (Snyder et al., 1993).

Recommendations for squash cultivars in the southeastern United States are often based on the season (spring or summer) in which they are grown due to the increase in viruses as the season progresses. In North Carolina, several cultivars are recommended for spring planting (Sanders et al., 1996), including the yellow types 'Dixie', 'Goldbar', 'Lemondrop L', 'Seneca Prolific', 'Picasso', and 'Prelude II' and the zucchini types 'Elite', 'Noblesse', 'Tigress', and 'Dividend'. The cultivars recommended for summer planting (Sanders et al., 1996) in North Carolina include 'Multipik' (Py), 'Sunbar' (Py), 'Superpik' (Py), 'Supersett' (Py), 'General Patton' (Py), 'Prelude II', 'Tigress' (zucchini), and