

NARRATIVE COVERS ACCOMPLISHMENTS FROM 01/01/2002 – 12/31/2003

1). Teaching/Advising:

Courses:

PSS 011 Principles of Plant Science (3 credits): F'02 = 54 undergraduates and F'03 = 49 undergraduates.

PSS 124 Vegetable “Fruit” Crops (2 credits): S'03 = 21 undergraduates.

PSS 126 Vegetable “Root” Crops (2 credits): F'03 = 13 undergraduates.

PSS 127 Greenhouse Operations and Management (2 credits): S'03 = 32 undergraduates.

PSS 196 Postharvest Horticultural Physiology (2 credits): S'02 = 9 undergraduates.

PSS 301 Plant Science Colloquium (1 credit): F'02 = 3 graduate students, S'03 = 6 graduate students, F'03 = 3 graduate students.

Student Advising:

Plant and Soil Science Undergraduate Majors: (8 students)

Plant and Soil Science Undergraduate Minors: (2 students)

Urban Forestry and Landscape Horticulture Undergraduate Majors: (2 students)

Sustainable Landscape Horticulture Undergraduate Majors: (4 students)

Graduate Students: (5 students; major advisor for 1, comm. member for 2; chairperson for 2) ---- **TOTAL advisees: 21 students**

I have 70% general fund appointment and I am responsible for 6 courses (5 undergraduate and 1 graduate level) Some courses are alternate year courses, but I average approximately 5 credit hours of teaching per semester. This is a challenging assignment that requires me to teach courses in a variety of different horticultural disciplines from greenhouse operations and management to postharvest physiology. However, my diverse background and training make me uniquely suited to meet the rigors of this challenge.

Teaching has been my primary professional responsibility since leaving my postdoctoral research work to become an Assistant Professor first at the University of Florida (2 years) and now at the University of Vermont (approaching 4 years). I enjoy teaching, but I also am attempting to manage my career in such a way to allow me to stay active in the research arena. I feel strongly that to stay on top of my field I need to have an active research program, especially for teaching upper-division undergraduate courses.

Teaching highlights for the period from January 2002, through December 31st, 2003 include:

Teaching Award:

2002. National Association of Colleges and Teachers of Agriculture and UVM Teaching Award of Merit.

Course summaries and teaching highlights for the period from January 2002, through December 31st, 2003 include: All of the courses have been offered with a WebCT Internet Supplement.

PSS 011 Principles of Plant Science: The study of plant science is a challenging pursuit covering many exciting topics which I have categorized under the four broad topics of plants, soils, the environment, and people. The course has been designed to introduce students to concepts that will be essential to their successful completion of upper-division courses in the Plant and Soil Science major. The course should also be interesting and useful to those in allied majors such as Environmental Studies, Botany, and others. However, it should be noted that this course is designed for the major and not for a general audience. Those students who may want a more general introduction for non-majors are encouraged to enroll in PSS 10 Home and Garden Horticulture.

Highlights: PSS 011 continues to grow and expand with development of a new major in the Plant and Soil Science Department. Due to growing public concern over GMO's and the departments intrinsic interest in sustainable agriculture a new text book was sought that would address both these issues. Chrispeel and Sadava's Plants, Genes, and Crop Biotechnology was adopted due to its integration of biotechnology topics in the framework of sustainable agriculture. Personally, I don't care what a student's opinion is on biotech as long as they support their decision with good information and sophisticated arguments. I have found that most students with strong opinions lack the foundation knowledge necessary to adequately support their viewpoints. The website was upgraded to include a glossary with over 3000 definitions related to plant science, a 500 picture searchable image gallery, and 6 interactive learning modules on photosynthesis, respiration, soils, meiosis, mitosis, and plant nomenclature. Graduate and undergraduate students worked with me on special projects to create the learning modules. This work was funded by an internal competitive grant from UVM's Center for Teaching and Learning.

PSS 124 Vegetable 'Fruit' Crops: The current version of this course emphasizes the amalgamation of Horticulture, Plant Physiology, Economics, and farming system concepts that comprise the basis of professional vegetable production. The class was designed to be a two-hour modular course that introduces students to a large number of concepts, from the disciplines mentioned above to applying them to vegetable crop production. Vegetable production is a complex discipline that requires years of study and practice before mastery is achieved. This course provides students a foundation of knowledge, which can be used to begin the journey. *Learning facts* and *Learning how to learn* are parceled out in roughly equal doses.

Highlights: Agricultural Practices were emphasized in my lectures. Students were assigned presentations on minor vegetable crops to present to the class. A majority of the student presentations are available on-line. I was impressed with the quality of many of the student talks. Vern Grubinger also gave a guest lecture on organic soil fertility management and organic weed control. Many of our students are interested in sustainable farm management practices.

PSS 126 Vegetable ‘Root’ Crops: The study of vegetable root crop production was presented to students as a multidisciplinary science covering several major vegetable root crops and a few minor ones as well. The course has been designed to introduce students to concepts that will be essential to understanding the complexities involved with vegetable root crop production. This course was designed for upper division PSS majors and covered cultural practices for the production of potatoes, allium crops, carrots, parsnips, beets, and tropical ‘root’ crops.

Highlights: New England cultural practices for crop production were emphasized in my lectures and groups of students were assigned presentations on some aspect of potato production. A majority of the group presentations are available on-line. I was impressed with the quality of many of the student talks. One student group designed a sustainable organic potato production manual for the Slade Hall residents. Students were also invited to attend a Northeastern Organic Farmers Association (Vermont) tour of my research at the Horticultural Research Center. Approximately one-third of the students also participated in grading potatoes (based on USDA standards) for my research project as a ‘hands-on’ extra-credit assignment.

PSS 127 Greenhouse Operations and Management: No doubt, most students have a concept of what a greenhouse is. Depending on their personal experiences, the level of detail and amount of information incorporated into that concept will vary. A mechanic looks at an automobile quite differently from someone who has never peered beneath the hood of car. The overall learning objectives of this course were to enhance the student vision of the greenhouse concept, expand their basic skill set and knowledge of greenhouse operations and management, and to help them understand the diverse nature of disciplines involved in mastering *greenhouse operations and management* science and art.

Highlights: Greenhouse construction, heating, cooling, lighting, temperature control were emphasized through math intensive problem sets. The horticultural aspects of greenhouse management were also introduced spanning the topics of rooting media, irrigation, and growth regulators. After completing the problem sets students were assigned a final project that required applications of the concepts they had learned to the design of a greenhouse of their choosing. Designs ranged from small personal greenhouses to large (several acre) gutter-connected production houses. Many students were surprised at what they were capable of following their mastery of the calculations. Recently, java script calculators that are used for calculating heating and cooling demands for greenhouses were added to the course website. These were created under my supervision by a undergraduate completing an independent study.

PSS 196 Postharvest Horticulture: Materials covered in this course are critical for our undergraduates to have. This course had not been offered in our department prior to my arrival. It will be a modular course designed for upper-division undergraduates covering postharvest physiology and cultural practices for vegetable, fruit, and ornamental horticulture crops. The course requires students to synthesize information they have learned from a variety of courses including the Principles of Plant Science, Plant Physiology, and other production courses such as Vegetable 'Root' Crops and Tree Fruits.

A large collection of visual materials are used in this course that originate from small organic farms to large conventional farms in excess of 3,000 acres. Videos and slide sets are shown that demonstrate the range of postharvest facilities that are available for storing crops such as potatoes, endive, bananas, and cut flowers. The course also covers the role of temperature, humidity, plant metabolism, plant growth regulators, and cultural practices play in the proper storage of horticultural crops.

PSS 301 Plant Science Colloquium: In this course graduate students discuss current topics in plant science research. For example, in fall '01 students selected the topic of plant-to-plant interaction. The course was conducted in a journal discussion format. Each student selects two refereed journal articles (which had to have been published in 2001 or 2002) and presented them to the other students. Student presentations ranged from 30-45 minutes and then a discussion among students concerning the paper followed. Introduction, material and methods, statistical analysis, hypotheses, and conclusions are all discussed.

Highlights: Although the number of students participating in the course is generally small (3-6), I continue to be impressed by the presentations that students make. Students also regularly engage in in-depth discussions concerning key aspects of the papers often teaching each other scientific principles in the process. It also tends to be an environment where graduate students are comfortable asking questions about the basics that might be missing from their knowledge base. I work hard to keep the atmosphere open and non-threatening. Competition is an important part of graduate school, but there should be settings where aren't afraid to ask some fundamental questions. I feel that as faculty sometimes we expect beginning graduate students to understand more than their undergraduate training actually provided them with.

Student Extracurricular Activity Advising

Common Ground Student Run Educational Farm (faculty co-advisor):

Serve as resource for approximately 15 students that are heavily involved in the organic production of vegetables on a student-managed farm at the Horticultural Research Center in South Burlington. For many students this is their first and only hands-on agricultural production experience during their undergraduate careers. Students operate the farm as a CSA (Community Supported Agriculture) and donate all remaining food (not going to farm shareholders) to either the Salvation Army Food Shelf or the Chittenden County Emergency Food Shelf (approx. 6000 lbs in 2000, over 19,000 lbs in 2001, and 15,000 lbs in 2002). Gave tours of the student run farm to distinguished visitors including Ross A. Virginia, Ph.D. (Professor, Dartmouth) Ron Sonoda, Ph.D. (Professor Emeritus, UF), Tulio Goncalves de Melo (Agronomist, EMBRAPA, Brazil), and Duangpom Suwanagul, Ph.D. (Assistant

Professor, Kasetsart University; Bangkok, Thailand). Due to research obligations and a focus on greenhouse studies my advising role for Common Ground has been less than it was. Currently, Dr. Wendy-Sue Harper serves as a coadvisor to the club reducing my time commitment.

Other Educational Projects:

Assisted in the development of a design exercise utilized in PSS 131 in fall '01. I met with the Jericho Underhill Park District Board of Directors and the group decided that they could use the help of the students in the Landscape Design Course to assist them in redesigning the entrance at Mills Riverside Park. Students worked on designs with the best being presented to the JUPD BOD in January '02 for consideration and possible implementation.

Developed an academic relationship with Brown's River Middle School 5th grade instructor Rita Clark. Students received four lectures on pumpkin and potato history and cultural practices from my graduate student Nathaniel Sands. Undergraduate Sarah Rose Cameron also gave a series of lectures on the horticulture industry in Central America to highlight the students' geography unit on the same.

2.) Research/Scholarship/Creative Work

I have a 30% Agricultural Experiment Station appointment on a 9-month contract. I am in the process of developing a new expertise in vegetable horticulture. Formerly, I worked on tropical tree fruit physiology and pathogen defense mechanisms of forest trees. My research is taking form in the three major areas of vegetable crop production, sustainable vegetable production practices, and plant-microbe interactions in crop plants and phytoremediation systems. It will take time to make the transition. However, there has already been some success in my research program.

Highlights for the period from January 2002, through December 31st, 2003 include:

Six research presentations (total) at local, state, national, and international meetings:

Stover, E., Tignor, M., Timmer, P. Overview of citrus culture. Invited Presentation to the Bermuda Fruit Growers' Association, June, 2002, Hamilton, Bermuda.

Sands, N., D. Heleba, and M. Tignor. 2002. Effects of a single addition of compost on potato yields when nitrogen and plant available water are not limiting. Proceedings of XXVIth International Horticultural Congress:105.

Sands, N., D. Heleba, and M. Tignor. 2002. Marketable yield evaluation of eleven heirloom tomato varieties. Proceedings of XXVIth International Horticultural Congress:535-536.

Tignor, M. 2002. Heirloom tomato variety trials: findings and reflections from year 2. Presented at Vermont Vegetable and Berry Grower's Association Annual Meeting. February 19th, 2002.

Sands, N. and M.Tignor. 2002. Effect of a single compost amendment at three different rates on yield and water use by potato. Presented at Vermont Vegetable and Berry Grower's Association Annual Meeting. February 19th, 2002.

Tignor, M. 2002. Implementation of subsurface constructed wetlands to treat dairy farm stormwater runoff at the University of Vermont. PSS Seminar Series. November 13th.

Submission of 5 grants related to research:

Tignor, M. 2003. Long-term compost amendment study for Vegetable Production Research Education and Outreach. (\$149,676) pre-proposal approved (only 60 of 210 research pre-proposals selected). PENDING

Tignor, M., G. Giacomelli, T. Irani, M. McMahon, S. Wilson. 2003. Multimedia instrument for worldwide greenhouse education. USDA Higher Education Challenge Grant. Multi-state proposal: UVM (lead institution, University of Arizona, Ohio State University, and the University of Florida. (\$247,563). FUNDED

Tignor, M. 2003. Dairy manure compost effects on root architecture and growth of vegetables. Competitive USDA Hatch Funds. (\$20,000). FUNDED

Hession, W.C., T. Lewis, D. Rizzo, and M. Tignor. 2003. Correlation of wastewater treatment efficiency, Plant-Root Architecture, and Microbial Ecology to Measurement of Subsurface Flow Constructed Wetland Redox Potential. NSF. (356,961). NOT FUNDED.

Hession, W.C., M. Tignor, and N. Hayden. 2002. Demonstration/Research Constructed Wetland to Treat Dairy Wastes. Lake Champlain Basin Project. (\$58,000). FUNDED

Refereed journal articles:

Whitney, D. N. Hayden,, W. Hession, and M. Tignor. 2003. Effects of supplemental aeration on dairy wastewater treatment efficiency in laboratory-scale subsurface flow constructed wetlands. *J. Eco. Eng.* *In Review*

Tignor, M.E., S.B. Wilson, and P.C. Wilson. 2002. Development of an undergraduate plant science course promoting environmental awareness, native flora and critical thinking skills. *NACTA J.* 46(1):26-32.

Scientific proceedings:

Whitney, D., N.J. Hayden, W.C. Hession, and M. Tignor. 2002. Developing a constructed wetland center at the University of Vermont. In: *Wetlands and Remediation II: Proceedings of the Second International Conference on Wetlands and Remediation.* Eds. Nehring and Brauning. Battelle Press. Columbus, OH.

Creative Work: Multimedia lecture developed on Apomixis for Plant Propagation CD:

Wilson, S.B. (editor), M.Thetford, D.G. Clark, F.T. Davies, B. Dehgan, G.A. Giacomelli, M.E. Kane, K.A. Klock-Moore, S.M. Scheiber, R.K. Schoellhorn, M.E. Tignor, W.A.

Vendrame, and J.F. Williamson. 2002. Principles and Practices of Plant Propagation CD (PLS 3221/5221), Institute of Food and Agricultural Sciences, University of Florida.

One book chapter submitted to editors for Plant Propagation Text:

Tignor, M.E. 2003. Chapter 3: Laboratory exercise “holistic thought process for the design of a mist/fog/cutting/seed propagation facilities.” To be published in: Plant Propagation Concepts And Laboratory Exercises. By CRC Press. (Submitted to editors Preece, Beyl, and Trigiano on 8/1/2003).

Summary of Current Research Foci:

- The Vermont vegetable industry has an estimated worth of between 6.5 and 10 million dollars. Vermont vegetable growers face many unique climate and weather challenges, some of which can be managed by improved irrigation scheduling. In order to make improved scheduling recommendations to growers, maximum yields for vegetable crops need to be established on various soil types in different microclimates. Additionally, irrigation scheduling regimes need to be optimized with the small and large-farm in mind. The resulting increases in irrigation efficiency will maximize yields and minimize water waste, thus helping to protect Vermont water resources and preserve natural areas. Members of the Solanaceae family will be used as model crops for the experiments. A standard experimental design has been developed that can be replicated on many soil types eventually resulting in more comprehensive recommendations to growers. Likewise by utilizing weather stations and soil moisture probes careful studies of irrigation scheduling will produce recommendations to improve water use efficiency thus increasing profit by reducing water costs. Progress: We have completed the second replication of a potato yield study examining the effects of compost on potato production in Vermont. Preliminary findings include: the amount of irrigation water required to maintain 65% plant available water was 23% less in the 40 tons/acre compost treatment as compared to the control, however compost had no effect on total marketable yield, and the number of culls and weight of culls significantly increased with the addition of compost. A poster was presented at the 26th International Horticultural Congress & Exhibition held August 11th-17th, 2002. A journal article is in preparation.
- Many New England growers are producing heirloom tomato varieties in order to attract consumers to retail farm operations. In 2002, we tested eleven different heirloom varieties of tomato (*Lycopersicon esculentum* Mill.) for production characteristics and fresh market suitability in Vermont. ‘Amish Paste,’ ‘Brandywine,’ ‘Cherokee Purple,’ ‘Cosmonaut Volkov,’ ‘Costoluto Genovese,’ ‘Green Zebra,’ ‘Ida Gold,’ ‘Mosvich,’ ‘Purple Calabash,’ ‘Prudens Purple,’ and ‘Yellow Brandywine’ varieties were produced organically using plastic mulch beds and drip irrigation. ‘Better Boy’ served as a hybrid control. Tomatoes were harvested weekly (9 total harvests) and every fruit was individually graded according to USDA standards. Sample findings include: ‘Costoluto Genovese’ produced significantly greater total marketable yield by weight when compared to ‘Brandywine’, ‘Mosvich’ produced the greatest amount of US#1 large fruit, and ‘Cherokee Purple’ had a significantly greater amount of culls by weight when

compared to ‘Cosmonaut Volkov,’ ‘Green Zebra,’ and ‘Ida Gold’. Interestingly, several heirloom varieties outperformed ‘Better Boy’ in certain instances during this trial. For example, the round red variety ‘Mosvich’ produced significantly more U.S. No. 1 large fruit (11.35 kg) than ‘Better Boy’ (2.26 kg). A poster was presented at the 26th International Horticultural Congress & Exhibition to be held August 11th-17th, 2002. A journal article is in preparation.

- When you take into account the large amounts of dairy manure available and the large portion of that manure that could be composted it is clear that this is a vast untapped horticultural resource. Increased utilization of this resource could not only help dairy producers manage a by-product of environmental concern, but could help local vegetable growers improve soils, increase plant water availability, and serve as a local source of supplemental nutrients. The EPA suggested that the agriculture industry could provide a potential market for 895 million yards of compost annually, but the estimated market penetration of compost was less than 2%. There are still many logistic, economic, biological, and horticultural issues to be worked out before the use of compost in agriculture becomes more widespread. Producing compost requires space and specialized skills and knowledge and must be managed in such a way as not to add a new source of non point pollution to surrounding watersheds. The organic sector of vegetable production is also rapidly growing in Vermont. Vermont ranks 9th in the nation for the number of certified organic farming operations. Compost is a viable alternative for organic crop nutrient management programs. Dairy manure compost amendment can completely meet the nutritional needs of some vegetable crops (Sands et. al., 2002) while improving soil tilth. Recently at the 2001 annual meeting of the American Society for Horticultural Science (Frontiers in Organic Horticulture Workshop), it was stated that current experiments comparing organic systems to conventional farming systems needed to be complimented by experiments that test hypotheses related to the impact of organic farming directly. By conducting experiments with various mixes of organic soil, soil less root substrate and compost the effects of compost and organic farming methods can be examined. Additionally, it has been highly recommended that soil for experiments examining the effects of organic management practices be collected from farms that have been organically managed for at least 10 years. It is thought that a minimum of a decade is required to realize maximum production benefits from organic practices. I am trying to obtain SARE funding to begin a initiate a long-term field study.
- Treating dairy wastewater in the unique environment and harsh climate of Vermont presents special challenges. There is a lot of new research being conducted on constructed wetlands. I was initially involved in a large project examining the contribution of plants to wastewater treatment in subsurface constructed wetlands. I am currently supervising one graduate student who is examining the root architecture of different emergent aquatic plants currently used in the design of subsurface constructed wetlands. Aeration, which is commonly used to deal with ammonia in animal waste, also impacts root development. We are determining which plant species/aeration level combination maximizes root surface area and thus maximizes the substrate available for bacteria to grow on and remediate wastewater quality problems.

3.) Service:

University

I have been active in CALS and PSS academic committees since my arrival at UVM. I am also currently serving on a Botany faculty search committee. List of committees presently or formerly a member of:

- CALS Honors Committee. 2000 – 2003.
- PSS Chair Search. 2002-2003.
- PSS Horticultural Research Center Advisory Committee. 2000 – present.
- BOT Search Committee for new Ecologist Faculty Position. 2001 – present.
- PSS Curriculum Committee. April 2000 - present

Extension and Outreach: Although I have no official extension appointment, the nature of the work I do on vegetable crops provides many opportunities for extension and outreach.

Highlights for the period from January 2002, until December 31st, 2003 include:

Presentation of constructed wetlands information and tour for the Agri-Mark Young Cooperator site visit. February 13th, 2003.

Tignor, M. 2003. Principles of Irrigation. 2003 Farm Show Program. January 29th, Barre, VT.

Participated in State Farm Insurance Co. Public Bicycle Safety Training for children. May 19th, 2002.

Tour of Horticulture Research Center. 2002. Given to Wake Robin Nature Club. September 9th.

Presentation of Common Ground at CALS Alumni and Friends Dinner. May 11th, 2002.

Genetically Engineered Crop Plants: Scientific Gift to Mankind or Trojan Horse?. February, 26th, 2002. Wake Robin Community, VT.