

**DEPARTMENT OF HORTICULTURE
AND LANDSCAPE ARCHITECTURE**

**GRADUATE STUDIES
MANUAL**

(2007 revision)

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1. GENERAL INFORMATION

The purpose of this manual is to provide information concerning departmental policies for the planning and execution of graduate study programs and to facilitate mutual understanding between students and faculty. All students pursuing the Master of Science, Master of Agriculture and Doctor of Philosophy degrees in the department are expected to become familiar with this material pertaining to departmental policy, regulations and requirements in the graduate program. As this document is intended only to supplement items included in the Graduate Catalog each student is also responsible for knowledge of and adherence to all the rules and regulations of the Graduate School, including all deadlines for submission of completed forms and reports to the Graduate School, the department and elsewhere.

Graduate work is offered in the Department of Horticulture and Landscape Architecture leading to the Master of Science, Master of Agriculture, and the Doctor of Philosophy degrees. Students are expected to develop knowledge and technical skills in a science-based discipline related to horticulture that will enhance completion of a research project for the graduate degree. Examples include plant breeding and genetics, environmental and stress physiology, physiological ecology, plant growth and development, plant biotechnology and genomics, germplasm conservation, crops for health, and sustainable horticulture. Laboratories, greenhouses and field research facilities are available to grow crops, collect data and analyze plant material. Interdisciplinary research projects may provide access to additional specialized technologies on campus including macromolecular resources, mass spectroscopy, electron microscopy, and animal feeding facilities. Courses in horticulture are generally balanced with courses in soil and crop sciences, botany, genetics, statistics, plant pathology, plant physiology, chemistry, biochemistry, entomology, ecology, food nutrition, food safety and agricultural economics as decided upon by the student's graduate committee.

Unlike undergraduate studies, the graduate program is not based entirely on the ability of the student to earn good grades in organized course work. Within the graduate program, the student is expected to develop an appreciation of the broad field of horticulture. This will not likely be accomplished through strictly formal studies but will come from working closely with faculty and with other graduate students. Students should be knowledgeable of pertinent literature and devise a well-thought out research project. They must develop a research project proposal that includes well-designed experiments to address hypotheses. A Graduate Research Committee is selected by the adviser in consultation with the student to help in all aspects of this experience.

Objectives of Graduate Programs

Unlike undergraduate programs, the Plan A masters and the Ph.D. degree are research degrees that require conducting and reporting research projects in addition to course work and literature investigation.

The M.S. program aims to: 1) provide an opportunity for study beyond the baccalaureate level and to acquire some degree of specialization in horticulture; and 2) develop proficiency in scientific investigation and in reporting the results of these investigations. These goals are accomplished through coursework, seminars, and research investigations. The Plan A program requires conducting a research investigation that generates statistically analyzable data reported in a comprehensive scientific thesis. Plan B Master of Science candidates are not required to conduct a laboratory or field plot research project, but are required to write a scholarly paper based on library research. A Plan B master's is not recommended if students plan to eventually acquire a Ph.D.

Successful candidates for the M.S. in horticulture are qualified for technical and related positions in research, consultation in governmental agencies or private industry, and certain horticultural positions in higher education involving intermediate-level teaching, research, public service and extension.

The Ph.D. is the highest earned degree offered by universities. It is conferred only for independent work of distinction in which the student displays original scholarship of marked ability and achievement. The Ph.D. program aims to: 1) provide an opportunity for advanced study and specialization in horticulture; 2) assist the student in developing proficiency in independent, scientific investigation; and 3) allow the student to rigorously acquire and develop new knowledge, technical skills, communication skills and creative problem solving capabilities enabling conduct of advanced research in horticulture. Thus, the Ph.D. degree enables a student of horticulture to develop into a professional horticulturist on the highest plane. Successful candidates for the Ph.D. in horticulture are qualified for positions of advanced research and consultation in governmental agencies or private industry, or for positions in higher education involving teaching, research, or extension work in horticulture.

Admission

Applicants should have a grade point average in previous course work from a four-year degree program of at least 3.0 on a 4.0 scale; or meet the qualifications outlined in the Graduate School admission requirements for special consideration based upon professional and related work experience. All students applying for admission to the Ph.D. program in the Department of Horticulture & Landscape Architecture are expected to take the Graduate Record Examination (GRE). Applicants who rank in the upper 50 percentile and attain a combined score for the combined verbal and quantitative portions of the Graduate Record Examination (GRE) of at least 1100 will meet the Department's expectations for GRE scores. International students must also have an electronic TOEFL score of at least 213.

The Department of Horticulture and Landscape Architecture graduate admissions committee accepts only those students who provide acceptable GRE and TOEFL scores, provide evidence based upon transcripts, letters of reference and a professional

goals statement that show potential and promise to complete the requirements for the degree being sought. Applicants seeking graduate degrees in horticulture should have adequate preparation in the fundamental sciences (biology, chemistry, biochemistry, statistics, physics) and at least 20 semester credit hours of undergraduate course work in the plant sciences (e.g., agronomy, botany, ecology, horticulture, genetics, plant physiology, plant pathology, plant anatomy). Applicants lacking adequate preparation may be accepted conditionally, with the provision that required undergraduate courses must be completed before the degree can be awarded.

Research and Teaching Assistantships

Applications and need for financial support during graduate study always exceed available funds. Acceptance for graduate study in the department is not considered to be a commitment for present or future financial support. Students with exceptional qualifications are urged to apply for University- or College-wide fellowships. Individual faculty may have research assistantships available for specific projects tied to grant funds.

Applicants for departmental assistantships should have a minimum 3.25 GPA, score in the top 50 percentile in the combined verbal and quantitative areas and, if required, have an electronic TOEFL score of at least 213 (paper score = 550). Consequently, a careful evaluation of each applicant is made and offers are extended to those candidates who show the greatest potential for graduate study and use of the knowledge gained.

Departmental graduate teaching and research assistantships are assigned annually or each semester as needs arise. Assistantships are subject to renewal based on satisfactory progress and availability of funds. In general, and depending on the nature of the research project expectations are that M.S degrees should be completed in 2 to 3 years, and PhD. degrees in 3-4 years.

Research assistants are expected to work part-time for their assistantship. Work hours for students are determined on the basis of a forty-hour week. Accordingly, a one-half time research assistantship requires at least twenty hours per week. The specific nature of this service is determined by the student's major professor and may be exclusive of thesis/dissertation research, depending on the integration of student and advisor project activity and needs. Support for students not fulfilling their assumed responsibilities can be terminated at the discretion of the advisor, the advisory committee and the Head of the Department. The graduate school does not regulate vacation policy. Leave may be granted on an individual basis upon the timely request of the student and at the discretion of the student's major professor.

Teaching

All Ph.D. students are expected to gain teaching experience in a lecture or laboratory course for at least one semester. International students may satisfy this

requirement through registration in a teaching seminar. M.S. students, while not required, are also strongly encouraged to gain teaching experience.

Major Professor

While all faculty are available to assist and consult with graduate students, the key individual in the development of the graduate program is the major professor. The major professor is responsible for helping the student plan a program of study that will provide the opportunity to reach a satisfactory level of excellence. It is important to recognize that the role of a major professor is to advise, counsel and provide professional expertise to guide the student in pursuit of a graduate degree. It is the responsibility of each student to achieve excellence in his or her program.

Any member of the faculty, including affiliate faculty, within the Horticulture and Landscape Architecture Department may serve as major professor to M.S. and Ph.D. candidates. The acceptance by a major professor is based on the interests and goals of the student, the source of funding if the student is provided financial assistance, the current workload and interest of the faculty, and the availability of facilities. In the working relationship between major professor and student, every effort will be made to ensure that the student has the best possible opportunity to achieve graduate program goals.

The working relationship between the major professor and graduate student is vital. In the event that satisfactory progress, unmet expectations, or conflict should arise and appear beyond the student's control, the student has the right to discuss matters with the department head.

Graduate Committee

It is the function of the student's Graduate Committee to assist the major professor and the student in developing an appropriate course of study, and to review the student's detailed research proposal, once the project has been outlined by the student and the major professor. The role of the committee is to offer ongoing consultation, helpful suggestions, and expertise toward the most effective execution of the research effort. It is the student's responsibility to keep the graduate committee regularly informed of progress and setbacks in research and the study program. Students should, arrange meetings of their Graduate Committees as needed and at least once per year.

During the course of each graduate program of study, students are required to meet several deadlines. These deadlines are regulated by the Graduate School and administered through completion of forms that students are responsible to obtain online. The GS-6 form is used to specify the committee and the courses to be taken in the program of study. While current graduate school regulations require submission of a GS-6 form before the end of the fourth semester, a departmental expectation is that the GS-6 form be completed before the end of the second semester of study for both M.S.

and PhD. programs. Each graduate student is responsible to meet Graduate School deadlines.

Composition of the graduate committee will be determined by the student and major professor with final committee members officially approved by the Graduate School Dean. Emphasis should be placed on adding technical and scientific expertise to complement the knowledge and technical skills provided by the major professor. The M.S. committee shall consist of at least 3 faculty members, one of whom is the major professor and another from the faculty in the Horticulture and Landscape Architecture Department; the third must be from outside of the Department of Horticulture & Landscape Architecture and must be approved by the Graduate School following recommendation by the advisory committee.

For Ph.D. candidates, the Graduate Committee is composed of at least 4 faculty members, two or three are from the Department of Horticulture and Landscape Architecture and at least one from another department. Members of the Graduate Committee will usually constitute the Final Examining Committee.

In all instances the major professor will serve as Chair of the Graduate Committee. The Head of the Horticulture and Landscape Architecture Department may serve as an ex-officio member of all departmental graduate committees. Additional committee members may be recommended at any time, as deemed necessary by the major professor and the Graduate Admissions and Studies Committee. Additions or changes in the composition of the Graduate Committee must be approved by the Department Head and by the Dean of the Graduate School.

Program Planning Meeting

Before the end of the second semester of graduate study, a program planning meeting should be held with the student and the Graduate Advisory Committee. The meeting will be arranged by the student and the major professor, with the student providing transcripts and career goal statements to each committee member prior to the meeting. The purpose of this meeting is to determine the student's current level of competence and to begin development of a total plan of study to assist the student in achieving the determined career goals. The meeting will typically be an informal discussion with the committee.

Plan of Study

Within two weeks after the program planning meeting, a complete program of study will be prepared by the student and the major professor. This plan will include a schedule of courses, an outline of the proposed research project, and a timetable of the proposed program. The plan of study and the timetable will serve as a working plan for the student, major professor and graduate advisory committee. The plan of study recorded on the GS-6 form shall become the minimum coursework requirement for

graduation. All members of the student's Graduate Committee must be provided a copy of the plan. If there is to be any deviation from the plan, modifications must be approved by the student's Graduate Advisory Committee. The Graduate School must be notified of the proposed changes.

Research Proposal

A specific research proposal must be developed by both M.S. and Ph.D. candidates by the end of the second semester of study. It is to be developed by the student in consultation with the major professor and presented as a proposal seminar or poster presentation in Hort792. Copies of the proposal are submitted to the Graduate Committee for review of the general area of research and approval at a meeting held for this purpose. The research proposal should include the following:

1. Title – A clear, concise statement of the subject of the research. The title, used by itself, should give a good indication of what the project is about.
2. Previous Work – A brief review of the current state of knowledge on the problem, how it falls short of meeting current and future needs, and how the proposed work will extend present knowledge (literature citations should be listed at the end of the project outline). The conclusion of this section should lead the reader directly into the next two subsections.
3. Justification – A concise statement of the importance of the problem to state, regional, national, or international agriculture; reasons for doing the work; and potential benefits to agriculture, the scientific community, and the public at large.
4. Objectives – Enumerated, clear, complete, and logically-arranged statements describing the specific objectives of the project and any hypotheses to be tested.
5. Procedure – A statement of the essential working plans, methods, experimental designs, and statistical analyses to be used in attaining each of the stated objectives. The procedures should correspond to the objectives and follow the same order. A tentative schedule of the work to be undertaken should be presented. The location of the work and the facilities and equipment available and needed should be indicated. The statement on procedure should indicate that the research has been carefully planned and provide for changes when they are necessary to improve the work.
6. Duration – An estimate of the time required to complete the planned research and to publish the results.

Whenever any material change in the objectives of a project is advisable, a new or revised project outline should be prepared and circulated to the Graduate Committee. A major change in procedure may also necessitate a revision of the project outline.

Graduate Admissions and Studies Committee

The Graduate Admissions and Studies Committee (GASC) consists of six Horticulture and Landscape Architecture Department faculty members whose role is to ensure that students admitted into the program meet the minimum departmental admission standards. The GASC also makes recommendations to the department

head concerning various aspects of the departmental graduate program, including allocation of scholarships, assistantships, and travel grants. This committee does not usurp the responsibility of the student's Graduate Committee for academic and research guidance.

Graduate Coordinator

The Graduate Coordinator (a faculty member selected by the department head) serves as chair of the GASC. The role of the Graduate Coordinator is to provide a liaison between faculty and graduate students with respect to recruitment, application procedures, sources of graduate funding, and consistent interpretation of graduate program policies.

Graduate Seminar in Horticulture

Departmental seminars will be held throughout the academic year. All resident graduate students and faculty are expected to attend departmental seminars. These consist of presentations by graduate students, visiting lecturers, departmental scientists and faculty, and graduate student professional development specialists.

Graduate students are required to register for graduate seminar in horticulture (Hort792) two semesters in residence during each M.S. or Ph.D. degree. This course is graded Pass/Fail. A letter grade is given only to registered students who present during a registered semester. Occasionally, registration and presentation of a seminar within another department may substitute for Hort792 for that semester. Each student is required to present a proposal seminar and a Thesis/Dissertation research seminar of their results to the entire Horticulture and Landscape Architecture Department prior to graduation. The seminar can be given as a PowerPoint presentation or given as a poster with oral explanation.

REQUIREMENTS FOR M.S. DEGREE

The Department of Horticulture and Landscape Architecture has specific requirements that must be met in addition to the general requirements for the M.S. degree as presented in the Colorado State University Graduate School Catalog. The student must demonstrate a high degree of familiarity with the subject of horticulture, especially in the student's area of specialization. Also, a thesis must be presented based on original research results worthy of publication in a refereed scientific journal.

Coursework

Coursework programs are varied to meet the needs and interests of individual students. Those students who are deficient in horticulture or other fields important to their program will be required to improve their background by taking certain undergraduate courses that may not count for graduate credit. In some cases, 300 and 400-level courses taken for this purpose may be included as credit courses.

The minimum course requirement for the M.S. degree in Horticulture is 32 (35 for non-thesis option) total semester hours of graduate work. In order to achieve familiarity with the subject matter, students are required to earn at least 16 semester hours of credit at 500 level or above. Of those 16 semester hours, a minimum of 12 must come from regular lecture graduate courses. Non-lecture classes including seminar (Hort792) and Hort588, Hort698, Hort699, Hort784 and Hort795 can be used to fulfill additional 500 level credit requirements. The remaining credits required to fulfill the 32 (35 for non-thesis option) credit requirement come from approved 300-400 level courses, 500 level or above courses, or non-lecture 500 or above courses. Note: A maximum of 20 credits are allowed from non-lecture 500 or higher level courses and a maximum of 12 credits are allowed from 300-400 level courses. The Department of Horticulture & Landscape Architecture requires each student to enroll in graduate seminar (Hort792) two semesters, for a total of two credits, while in residence during pursuit of the degree. A limited number (up to 6 semester hours) of transfer credits may be accepted from accredited institutions provided they are approved by the major professor, the Graduate Committee, the department head, and the Graduate School.

There are no specific credit requirements for:

- Hort 588 – Supervised Extension Practices
- Hort 698 – Research
- Hort 699 – Thesis
- Hort 784 – Supervised College Teaching
- Hort 795 – Independent Study

In the Plan B program a student is required to take additional hours of formal coursework in horticulture or a related field instead of doing a research thesis ('non thesis' option). This results in a total course work requirement of 35 semester hours. The Plan B option must be approved early in a student's program of study by his/her Graduate Committee. Students choosing to pursue the M.S. degree through this optional procedure generally will not be considered for doctoral studies at Colorado State University. A final oral comprehensive examination and a scholarly manuscript (approved by the Graduate Committee) are required for all Plan B non-thesis M.S. students.

Thesis Research

The thesis must fulfill several requirements. It must be an **original** contribution to knowledge in horticulture. It should illustrate that the student has knowledge of research methods, the ability to conduct research, the necessary skill to obtain and analyze research data, the judgment to interpret the data logically and objectively, and the capacity to write an acceptable paper.

The research work leading to the thesis begins early in the student's program of study. Ordinarily, assignment of a particular problem is made by the major professor or the student is allowed to choose or develop a project that is considered appropriate by

the major professor. This decision is usually made during the first semester of study. The student prepares a thesis proposal in outline form to be generally followed during the course of research. The proposal must be approved by the major professor and by the members of the student's Graduate Committee. Alterations may be made in the proposal at the suggestion of any committee member, subject to concurrence by the major professor and the other members of the Graduate Committee.

Once the proposal is approved, the student relies heavily on the major professor for guidance and advice in carrying out the research work necessary for the thesis. In most cases, however, additional consultation with other members of the Graduate Committee may be advisable.

When the research has been completed, the student must document the project in the form of a thesis. At least five weeks prior to the thesis defense ('final exam'), a draft of the thesis must be submitted to the student's major professor. This draft should be considered acceptable to the committee by the student and the major professor. The major professor is responsible for reviewing and editing logic, spelling, punctuation, grammar, sentence structure, organization, and format. Once these changes have been incorporated, the thesis should be circulated to the rest of the student's Graduate Committee for input.

All members of the examination committee must receive the thesis two weeks before the date of the final examination. Final acceptance of the master's thesis rests with the examination committee. The format of the thesis must be in accordance with instructions from the Colorado State University Graduate School. As a guideline for preparation of the thesis, students are advised to follow the American Society for Horticulture Science Style manual for format, abbreviations and literature citations, consistent with requirements for submitting a paper to the Journal of the American Society for Horticultural Science, or a style required of another suitably related professional journal.

Final Examination (Thesis Defense)

The final examination shall be taken during the final semester as a Master's degree candidate. The members of the Examination Committee are the same individuals who have served on the student's Graduate Committee. The final examination usually consists of a short seminar presented by the student describing the thesis research, followed by questions from each member of the Graduate Committee. The questions pertain primarily to the thesis but may apply to related areas such as courses taken in the major or minor fields. There is no time limit on the examination. The outcome of the M.S. final examination is either pass or fail (elimination from the departmental graduate program). In order for the student to pass this examination, there can be only one dissenting vote. In case of a failure students can retake the final defense in accordance with provision of Graduate School regulations.

If the committee approved the thesis, the student must make whatever alteration the committee has agreed upon and submit two copies to the Graduate School, one copy to the major professor, and one copy to the department head. It is common courtesy to offer a copy to each member of the Graduate Committee as well.

For non-thesis option students, a comprehensive final exam of general knowledge in horticulture related to courses taken during the graduate program will be given after submission of the scholarly paper to the Graduate Committee and prior to the end of the final semester of studies.

Publication Policy

The schedule and procedures described in this section have been established to ensure that there will be adequate time for all involved to provide as much assistance as possible in helping the student develop a paper that will be submitted to a scientific journal. The student is expected to submit at least some portion of the thesis for publication in a nationally or internationally recognized, refereed, scholarly journal. When preparing a paper for publication, the student is responsible for senior authorship, and the major professor and possibly others who have made significant contributions to the work usually act as junior authors. Only upon direction from major professor will exceptions to publishing be made. All manuscripts must include acknowledgment of the University, the department, and other personnel who have rendered valuable service to the project. A draft of the paper or a copy of the completed manuscript to be published must be submitted to the major professor before the student's graduate program is officially completed.

Time Limit

A candidate for the master's degree must complete all requirements for the degree within ten calendar years after first registering in a graduate program.

Sequence of M.S. Program: Summary and Timetable

1. Acceptance by major professor.
2. Graduate Committee selected prior to registration for the second semester of study.
3. Program planning meeting with Graduate Committee to determine the plan of coursework that will be required during the student's graduate program. A copy of this plan of study and a timetable for completion must be given to each Graduate Committee and member within two weeks of the planning meeting.
4. Research (or non-thesis project) proposal developed, submitted and reviewed by the Graduate Committee, presentation of research or project at Hort792, and final submittal and approval by the student's Graduate Committee by the end of the second semester.

5. Submit a draft of thesis to major professor with sufficient time for review and corrections prior to final exam. Copies of the thesis must be submitted to the student's Examining Committee at least two weeks prior to the exam. Students should consult the Graduate School academic calendar for appropriate deadlines during the semester of expected graduation.
6. Submit manuscript from thesis research for publication in appropriate refereed journal at any time prior to graduation.
7. Presentation of student's research (or non-thesis project) results in the departmental seminar prior to exam.
8. Thesis defense (comprehensive final exam for non-thesis option).

REQUIREMENTS FOR PH.D.DEGREE

In addition to the general requirements for the Ph.D. as presented in the Colorado State University Graduate Catalog, the Department of Horticulture and Landscape Architecture has certain specific requirements that must be met. The student must demonstrate unmistakable evidence of mastery of the subject of horticultural science, especially in the horticultural area of specialization. Such evidence is ordinarily provided by passing a preliminary examination. Students must demonstrate the ability to complete a significant program of original research by preparing a dissertation embodying scholarship worthy of publication in refereed scientific journals. A rigorous final examination must also be passed.

Coursework

A minimum of 72 credits beyond the baccalaureate is required to meet Graduate School and departmental requirements for the Ph.D. degree. Students who have previously earned a M.S. degree may apply to transfer 30 credits towards the required 72 credits. The Department of Horticulture & Landscape Architecture requires Ph.D. candidates to complete 2 credits of seminar (Hort792). Remaining credit requirements can be made up by from any combination of approved 300, 400, 500, 600, and 700 level courses. Students cannot take more than 12 credits of approved 300 and 400 level courses not including courses taken in a previous Masters program. Even though there are no requirements to take formal lecture courses for the Ph.D. (Graduate School provision), students must be aware that they are required to pass written and oral preliminary examinations that will test both breadth and depth of knowledge in plant science and horticultural topics prior to proceeding to preparation of a dissertation based upon independent research. Taking lecture courses is often the most effective manner in obtaining this knowledge. Students with extensive professional experience from previous employment may not require additional course work to pass the preliminary examinations.

Note: A departmental exception to the above applies to students who enter a Ph.D. program directly from a baccalaureate without a prior M.S. degree. In this case students will be required to complete the course requirements outlined for the M.S. degree in the Department of Horticulture & Landscape Architecture.

Coursework programs are varied to meet the needs and interests of individual students. Students who are deficient in horticulture or other fields important to their program will be required to improve their background by taking certain undergraduate courses which do not carry graduate credit.

There are no specific credit requirements for:

- Hort 588 – Supervised Extension Practices
- Hort 698 – Research
- Hort 784 – Supervised College Teaching
- Hort 795 – Independent Study
- Hort 799 – Dissertation

It is strongly recommended that all candidates for the Ph.D. in Horticulture shall complete at least one of the following:

- a. One semester of Hort784 Supervised College Teaching (2 credits) and: either GS792 Seminar on College Teaching (2 credits) or H588 Supervised Extension Practices (2 credits).
- b. Satisfactory completion of BY701-704 (3 credits) modules in molecular biology.
- c. Demonstration of competency in a foreign language. This requirement can be met by satisfactory completion of L120 Reading for Graduate Students (4 credits) or, for foreign students, achieving a TOEFL score of at least 550.

Together, the student and the major professor draw up a tentative "Program of Study" and schedule a program planning meeting with the student's Graduate Committee. During this meeting, the Graduate Committee will be consulted regarding program development. A minor field may be chosen but is not required. A "Program of Study" form (GS-6) from the Graduate School is used to obtain the signatures of the major professor, the department head, and the Dean of the Graduate School.

Graduate Student Dismissal Policy

Students admitted to the M.S. and Ph.D. degree programs in the Dept. of Horticulture and Landscape Architecture must remain in good academic standing at all times. In addition to meeting the scholastic standards listed in the Graduate and Professional Bulletin, a student must consistently demonstrate satisfactory progress to their graduate committee. At the discretion of the student's graduate committee, any student whose cumulative GPA falls below 3.00 in courses included in the formal program of study may be dismissed immediately and without benefit of a probationary period—if it is the judgment of a majority of the graduate committee members that satisfactory progress cannot reasonably be anticipated.

The graduate committee's recommendation must be presented in writing, with substantive justification for immediate dismissal in lieu of probation. The recommendation must be approved by the Department Head and by the Dean of the Graduate School. The student may appeal a decision for immediate dismissal through existing Graduate School grievance procedures.

Preliminary Examination

Those students working toward the Ph.D. degree are required to successfully complete a Preliminary Examination prior to admission to candidacy status for the doctoral degree. The time and dates of the Preliminary Exam shall be announced to the faculty in the department two weeks prior to the exam. The Preliminary Examination shall be taken following completion of the majority of the formal coursework, but shall be administered at least two semesters (summer session equivalent to a semester) before the final examination. If the student holds an M.S. degree, the oral Preliminary

Examination for the Ph.D. shall be given no later than the end of the second year after enrollment in the Graduate College for a Ph.D. degree. .

The purpose of the Preliminary Examination is to ensure that the student is competent in the chosen fields of specialization and can be expected to successfully conduct the research outlined in the dissertation research proposal. The Preliminary Examination is a comprehensive examination of general knowledge which includes a written examination and an oral examination. Not only is it important that the candidate demonstrate a thorough mastery of the specific subject matter within the chosen discipline, but he/she must also demonstrate a clear comprehension of how specific concepts and facts fit together and how this knowledge is utilized in problem-solving situations. The exam is a comprehensive test of the student's mastery of the subject matter, the ability to think and express oneself clearly and effectively, and the capacity to pursue independent research. It is not limited to courses taken. The written exam shall be administered by the student's major professor and include questions submitted by the student's graduate committee. Members of the horticulture faculty not serving on the candidate's graduate committee may be selected by the candidate's major advisor to submit written questions.

The oral preliminary examination is chaired by the major professor, with participation by all members of the graduate committee. During this examination, the student is expected to demonstrate a high level of competence in the field of horticultural science, with in-depth knowledge in the area of specialization. The length of this examination is a matter of discretion by the graduate committee.

The outcome of the Ph.D. general examination is either pass (not more than one dissenting vote) or fail. If, in the judgment of the examining committee, the student passes the general examination, a form is filled out and signed by the major professor and each committee member stating the results of the examination and requesting the admission of the student to "candidacy" status for the Ph.D. degree. This form is likewise submitted to the Dean of the Graduate School for approval within two days after the oral examination. In the event of failure, the student may retake the exam within one semester if agreed upon by the graduate committee. Any appeal process will follow that described by the Graduate School Handbook.

Dissertation Research

The dissertation must fulfill several requirements. It must be an original contribution to scientific knowledge in horticulture. It should reflect the student's thorough familiarity with research methods in horticulture, the ability to conduct independent research, the necessary skill to obtain and analyze research data, the judgment to interpret the data logically and objectively, and the literary capacity to prepare a document of significance and impact.

The research work leading to the dissertation begins early in the student's program of study. Ordinarily, a particular problem is either assigned by the major professor or the student is allowed to choose or develop one that is considered

appropriate by the major professor. This decision is usually made before the program planning meeting. After the meeting, the student prepares a dissertation proposal in outline form to be followed generally during the course of research. Approval of the proposal must be obtained from the major professor and other members of the student's graduate committee. Alterations may be made in the proposal at the suggestion of any committee member, subject to concurrence by the major professor.

Once the proposal is approved, the student is expected to assume full responsibility for the independent thought and research activities necessary for successful completion of the project. A close "working relationship" with the major professor will provide a level of expert guidance and advice in carrying out the research work necessary for the dissertation. In most cases, however, additional consultation with other members of the Graduate Committee or campus experts will be needed on matters specific to their field.

Final Exam (Dissertation Defense)

Students are advised that, in general, 3 to 6 months are required to prepare a draft of the dissertation that is acceptable by the student's major professor. A draft copy that is considered in acceptable form is then submitted to the student's committee at least two weeks prior to the final exam. The format of the dissertation must be in accordance with instructions from the Colorado State University Graduate School. Detailed guidelines for format and style are available to the student from the Graduate School. When the student has finished preparing a draft of the dissertation, it is submitted to the major professor who reviews the work for logic and possible errors in spelling, punctuation, grammar, sentences structure, organization, and format. After revisions are approved by the major professor, copies are distributed to each member of the graduate committee at least two weeks prior to the final exam for input.

Final acceptance of the dissertation rests with the examination committee. The format must be in accordance with instructions from the Colorado State University Graduate School. As a guideline for preparation of the dissertation students are advised to follow the American Society for Horticulture Science Style manual and published papers in J. Amer. Soc. Hort. Sci. for format, abbreviations and literature citations, consistent with requirements for submitting a paper to the Journal, or a style required of another suitably related professional journal, agreed upon by the advisory committee.

Final examination (Dissertation Defense)

The final examination shall be taken during the final semester as a doctoral candidate. The members of the Examination Committee are the same individuals who have served on the student's Graduate Committee. The final examination usually

consists of a short seminar presented by the student describing the thesis research, followed by questions from each member of the Graduate Committee. It is the general practice for questioning to pursue lines of thought and argument from data and concepts that have contributed to the research and to its critical evaluation by the student. This broadening of the base is acceptable for the purpose both of defending the dissertation and of determining the intellectual qualifications of the candidate for the degree. The Ph.D. degree is conferred on the basis of originality, independence of thought, and capacity to synthesize and interpret.

The outcome of this examination shall be pass (no more than one dissenting vote) or fail. If the outcome is fail, the committee decides:

1. That the examination should be rescheduled after a short interval.
2. That the failure to pass should be recorded, but that the candidate should be given another opportunity after completing additional coursework or research.
3. That the failure is final.

If the committee approves the dissertation, the student makes whatever alterations the committee has agreed upon and submits two copies of the dissertation to the Graduate School (Library), one copy to the major professor, one copy to the department head, and retains one copy for himself/herself. Common courtesy calls for the student to offer a copy to each Graduate Committee member.

Publication Policy

The Ph.D. student is expected to submit at least some portion of the dissertation for publication to a nationally or internationally recognized, refereed, scholarly journal prior to the dissertation defense. In preparing a paper for publication, the student is responsible for senior authorship, and the major professor and possibly others who have made significant contributions to the work usually act as junior authors. Only upon direction from major professor will exceptions to publishing be made. All manuscripts must include an acknowledgment of the University, the Department, and other personnel who have rendered valuable service to the project.

Time Limit

A candidate for the Ph.D. must complete all requirements for the degree within ten calendar years after first registering for this graduate program degree.

Sequence of Ph.D. Program: Summary and Timetable

1. Acceptance by major professor.
2. Graduate Committee selected prior to registration for the second semester of study.

3. Program planning meeting with Graduate Committee to determine the plan of coursework that will be required during the student's graduate program. The "Program of Study" form from the Graduate School should be developed and filed with the Graduate School.
4. Research proposal developed, submitted and reviewed by the Graduate Committee, and presented at Hort792 by the end of the second semester.
5. Completion of majority of formal coursework.
6. Submit a request to the Graduate School for approval of the preliminary examination date at least two weeks prior to the requested date. The preliminary examination (written and/or oral) should be taken by the end of the second year of graduate study.
7. Completion of research.
8. Submit a draft of the dissertation to major professor prior to final oral exam and with sufficient time for review and rewriting. Submit a notice to the Graduate School for approval of the final examination time at least two weeks prior to the exam. Copies of the dissertation must be submitted to the student's examining committee at least four weeks prior to the exam. Students should consult the Graduate School academic calendar for appropriate deadlines during the semester of expected graduation.
9. Completion of dissertation.
10. Presentation of research results in the Departmental Seminar during final semester.
11. Dissertation defense (final oral exam) by student's graduate committee.
12. Submit manuscript(s) from dissertation research for publication in appropriate refereed journals prior to exam.

2. FACULTY AND INTERESTS

Michael E. Bartolo: Ph.D., University of Minnesota

Appointment: Vegetable Crops Research and Extension Specialist, Arkansas Valley Research Center

Research Expertise and Interests: Vegetable cropping systems with emphasis on irrigation, pest and fertility management. Production of onions, melons, and peppers.

William L. Bauerle: Ph.D., Cornell University

Appointment: Appointment: 70% Research, 20% Resident Instruction, 10% Service/Outreach

Research Expertise and Interests: I am interested in physiological characteristics of woody plants that ameliorate the effects of drought and thermal stress. The results of this work are multifaceted: 1) to learn how physiological processes are integrated into water use and growth responses, 2) to explain the mechanisms by which multiple water stress interactions influence long-lived perennials, and 3) to predict the intrinsic physiological responses of woody perennials to water deficit. I draw on the results of my water stress physiology research program to develop spatially explicit physiologically- and genetically-constrained models. Process modeling allows me to scale the research findings from the molecular to the ecosystem level. The biologically based modeling is an integrated component of my research program where the focus of the effort is on water and thermal abiotic stress and their respective interactions. Thus, by linking genetic predisposition with mechanistic models, I quantify ecosystem-atmosphere energy exchange and net primary production at the intraspecific level.

Teaching: Hort 475 – Environmental Requirements of Horticultural Plants.

Horst W. Caspari: Ph.D., University of Bonn

Appointment: Professor and State Viticulturist, Western Colorado Research Center - Orchard Mesa

Research Expertise and Interests: Vineyard management systems, woody plant physiology, especially water relations, and irrigation management.

Robert D. Davidson: Ph.D., Colorado State University

Appointment: 1.5 month Potato Certification Service Plant Pathologist, 6 months Ag Experiment Station, 4.5 months Cooperative Extension, State Seed Potato Specialist.

Research Expertise and Interests: Potato bacterial, fungal and viral diseases; tissue culture techniques and greenhouse production schemes for certified seed potatoes. Certified seed potato production methods. Strawberry nursery stock production. Screening of new potato cultivars for diseases/pests and writing cultivar management guidelines.

David Holm: Ph.D., University of Minnesota

Appointment: 12 months research, Potato Breeding and Selection Project Leader, San Luis Valley Research Center

Research Expertise and Interests: Breeding and selection of new potato cultivars (russets, reds, specialties, and chippers) through traditional hybridization methods for increased yield, improved quality, improved nutritional characteristics, resistance to diseases and pests, and tolerance to environmental stresses. Emphasis has been placed on breeding for improved postharvest and processing qualities such as early blight and soft rot. Development of seed stocks of advanced selections for growers, shippers, processors, and other research personnel for evaluation and increase is also an integral part of the breeding and selection project.

Harrison G. Hughes: Ph.D., Purdue University

Appointment: Resident Instruction 9 months, Research 3 months

Research Expertise and Interests: Propagation in general, small fruit culture, ornamentals and turf relative to their assessment of weediness, plant biotechnology including plant microporpagation, germplasm preservation, regeneration via tissue culture, transformation via particle bombardment, isozyme analyses and RAPD analyses for fingerprinting.

Teaching: Hort 100 – Basic Horticulture; Hort 260 – Plant Propagation; Hort 450 C, D – Fruit Crop Production; Hort 452 – Viticulture; Hort 454 – Horticulture Production and Management; A 545 – Plant Tissue Culture; Hort 575 – Plant Germplasm Preservation and Conservation.

James E. Klett: Ph.D., University of Illinois

Appointment: Resident Instruction (50%), Research (25%), Extensions (25%)

Research Expertise and Interests: Landscape plant (woody and herbaceous) evaluation and introduction; nursery production; landscape management; water requirements of landscape plants; weed control of landscape plants.

Teaching: Hort 221 – Landscape Plants; Hort 322 – Herbaceous Plants; Hort 321 – Nursery Production and Mangement.

Anthony J. Koski: Ph.D., Ohio State University

Appointment: Resident Instruction, Research, Extension Turfgrass Specialist

Research Expertise and Interests: Turf water use, management effects on irrigation requirement, turf weed control, management of turf soils and the development and evaluation of turf species and cultivars for adaptation to the Rocky Mountain region.

Teaching: Hort 341 – Turfgrass Management.

Harold J. Larsen: Ph.D., Oregon State University

Appointment: Interim Manager-Western Colorado Research Center
Research Pathologist and Extension Fruit Disease Specialist at the Orchard Mesa Research Center

Research Expertise and Interests: Fruit disease identification and treatment recommendations for Colorado; integrated pest management for fruit; fruit replant problems and treatment; virus and virus-like diseases of fruit crops; yellow tree syndrome causes and cures.

Patrick Martin: Ph.D., Cornell University

Appointment: Research (45%), Resident Instruction (45%), Outreach, Service & Extension (10%)

Research Expertise and Interests: Landscape Ecology, Exotic Plant Invasions, Forest Dynamics and Modeling, Ecological Impacts of Climate Change, Fire Ecology, Dendrochronology, Disturbance Ecology, and Tropical Ecology

Teaching: LAND/SOCR 220 Fundamentals of Ecology; LAND 444 Ecology of Landscapes

Steven E. Newman: Ph.D., Texas A&M University

Appointment: 75% Extension 15% Teaching and 10% Research

Research Expertise and Interests: Greenhouse production of flowering and vegetable crops. Water and nutrient use of greenhouse crops.

Chemical and environmental regulation of growth of greenhouse crops.

Teaching: Hort 310 - Greenhouse Management and Hort 412 Floriculture Crops

Yaling Qian: Ph.D., Kansas State University

Appointment: 70% Research and 30% Resident Instruction

Research Expertise and Interests: Turfgrass stress physiology; Turfgrass water requirements; Salinity tolerance mechanisms; Irrigation water quality; Impacts of management practices on greenhouse gas fluxes from turf systems.

Teaching: Hort 441 – Turfgrass Science; Hort 571 – Plant-Water Relations/Water Stress Physiology.

Matthew Rogoyski: Ph.D., Cornell University

Appointment: 12 month Agricultural Experiment Station

Research Expertise and Interests: Stress and postharvest physiology; flower biology. Current research: blossom thinning of treefruit crops; cucurbit fruit maturity; development of barriers for sustainable fruit and vegetable production; application of geographic (GIS) information systems to sustainable horticultural production, postharvest of herbaceous ornamentals.

Cecil Stushnoff: Ph.D., Rutgers University

Appointment: Part-time Research; Graduate Studies Coordinator and Chair Graduate Studies Admissions Committee.

Research Expertise and Interests: Environmental and plant stress physiology, plant germplasm cryopreservation, antioxidant biochemistry, health attributes of food crops, sustainable and organic food crop production, international agriculture.

Teaching: Graduate student advising

Henry Thompson: Ph.D., Rutgers University

Appointment: Research (100%)

Research Expertise and Interests: Human nutrition. Breast cancer prevention. Crops for Health.

Steve J. Wallner: Ph.D., Iowa State University

Appointment: Administration, Head of Department

Research expertise and interests: Stress and postharvest physiology.

Teaching: Over the years: Plant Stress Physiology; Environmental Requirements of Horticultural Plants; Postharvest Physiology.

Jorge M. Vivanco: Ph.D., The Pennsylvania State University

Appointment: Research (80%), Resident Instruction (15%), Extension (5%)

Research Expertise and Interests: Research projects center on the metabolism and biochemistry of biologically active compounds produced in plant roots, and the uses of plants for nutrition, pharmaceutical and agro-chemical applications. Goals include developing a better understanding of the biosynthetic potential of plant roots and underground plant organs in general.

Teaching: Medicinal Plants - Current topics in roots and rhizosphere biology

3. FACILITIES

The Department of Horticulture & Landscape Architecture, including offices, classrooms, and laboratories is housed in the Shepardson Building on the main campus. Other facilities include the University Greenhouse directly south of Shepardson, the research greenhouses and extensive trial gardens at the W.D. Holley Plant Environmental Research Center (PERC) on West Lake Street, and the 65 acre Horticulture Field Research Center located 7 miles northeast of Fort Collins. The department works closely with 4 research centers administered by the CSU Experiment Station on the Western slope of Colorado, Orchard mesa Research Center outside of Grand Junction and the Rogers Mesa Research Center in Hotchkiss, and in the high mountain valley at the San Luis Valley Research Center in Alamosa, as well as at the Arkansas Valley Research Center in Rocky Ford.

The department has extensive facilities for laboratory investigations into biochemistry, tissue culture, applied plant biotechnology, and in plant growth analysis. Facilities include: laminar flow transfer hoods, chemical hoods, autoclaves, cold rooms, gas and liquid chromatography, microplate spectrophotometer, microscopy, freeze driers, programmable freezer, centrifuges, thermo cycler, gel electrophoresis, photosynthesis, water relations, and other laboratory and field equipment. Sophisticated chemical analyses and molecular profiling services are available on a fee for service basis in the Macromolecular Resources Facility on campus.