The Soil Science Graduate Major at Iowa State University of Science and Technology

1 - Introduction

The graduate program in soil science is affiliated with the Department of Agronomy (DoA) at Iowa State University (ISU). Agronomy is the science and technology of producing plants that serve humans, using practices essential for maintaining and improving life. Soil science overlaps with agronomy in that it is concerned with soils as natural resources on the surface of the earth, and increases knowledge about soil formation, classification and mapping; physical, chemical, and biological properties and processes of soils; and how those properties and processes can be managed to promote sustainable crop production, environmental quality and ecosystem functions.

The goal of the graduate program in soil science is to educate new scientists to advance our understanding of the physical, chemical and biological processes in soil systems and their role in supporting sustainable resource management; food, feed, fuel, and fiber production; and ecosystem services.

All graduate students and faculty members *must* read ISU's Graduate College Handbook (GCH) in order to ensure that they understand their responsibilities and to stay up–to–date on the requirements for graduate degrees. It is the student's responsibility to make sure that all requirements for a specific degree are met. Faculty members act as "coaches" who advise, encourage, and advocate for students in their pursuit of a graduate degree.

The information provided in the present document supplements but does not supersede the policies outlined in the GCH, as well as specific policies of the DoA found on its website. The policies of the Soil Science Graduate Program that are optional or have adjustable aspects are described here.

2 - Graduate Degrees Offered

The soil science graduate program offers two graduate degrees: a master of science (MS) in Soil Science; and a doctorate of philosophy (PhD) in Soil Science.

Students who have earned an undergraduate degree in any physical or life science or engineering discipline are deemed qualified to enroll in Soil Science. Students with degrees in other disciplines are welcome to apply for provisional enrollment, although undergraduate coursework in sciences and mathematics is likely to be required. Prospective students be able to demonstrate strong quantitative skills, good communication skills in English, and a desire to study the physical, chemical and/or biological aspects of the soil–plant system. To receive full admission status, prospective students should have an undergraduate GPA of at least a 3.00 (4.00 scale) or rank in the upper one–half of his or her undergraduate class. Provisional and restricted admission can be offered, requiring the student to fulfill certain requirements before full admission. Non–native English speakers must take the Test of English as a Foreign Language (TOEFL) exam. A recommended score for acceptance into the program is 550 (paper) and 79 (internet). A faculty member in soil science must agree to advise the student before the student is admitted.

To be considered a full–time student, a typical graduate student (on a "1/2–time appointment") must be registered for a minimum of 9 credits with a maximum of 12 credits each fall and spring semester. Since there is no difference in tuition between 9 and 12 credits, it is in the best interest of both the student and our department for the student to register for the full 12 credits each fall and spring semester. Consequently, students should register for the appropriate number of research credits that, when added to the credits associated with courses, the sum is 12. During the summer, graduate students should register for one credit of course work to remain full–time (GCH Sections 2.1.6 and 3.2). Normally this credit will be in AGRON 599 or 699. If a graduate student is registered for more than one credit, then *additional* summer tuition will be assessed. In the semester of graduation, graduate students must be registered for at least one credit (GR

ST 681B if no coursework is needed) (GCH Section 2.1.5).

Please see the DoA website for information regarding annual reviews, grievance procedures, and assistantship policies.

3 - Program of Study

Students pursuing a major in soil science may specialize in one of six areas: soil chemistry; soil fertility; soil management; soil microbiology and biochemistry; soil morphology and genesis; or soil physics. If a specialization is chosen, the major professor must be in the designated specialty area.

The academic courses used to satisfy requirements for a graduate degree are listed on the student's Program of Study (POS). The POS must be approved by the student's POS committee. At the MS degree level, the POS committee is composed of at least three faculty members. Two of these must be faculty members in soil science (see Section 4). At the PhD level, the POS committee must have at least five members; three of these must be faculty members in soil science and at least one member must come from outside the DoA. An "outside member" will provide a different perspective and serve as an intermediary between the POS committee and the Graduate College. The POS committee members can be tenured or non–tenured, but each must be a member of ISU's graduate faculty. The chair of the POS committee is called the "major professor" and is the student's adviser. The student and the major professor work together to assemble the POS and to choose the POS committee. For more information on the POS and POS committee, including changes to the POS committee, see the GCH.

At present, one course must be included in each student's POS - AGRON 600B (Soils Seminar, 1 credit) is required for the MS and PhD degrees. It is well known that experience in teaching can improve and polish important disciplinary concepts and communication skills. All students in soil science are encouraged to have at least one teaching experience that can be documented on the POS as AGRON 698. The *recommended* effort in teaching at the MS level is for the student to assist with one course in one semester (either the fall, spring, or summer) each year. The level of involvement in teaching at the PhD level will depend on the career goals of the student, the source of funds supporting the student, and the teaching needs of the DoA.

There are some restrictions on the type of courses that can be included in the POS. Some of the most important are the following. No more than 9 credits of 400–level courses or no more than 3 credits of 300–level and 6 credits of 400–level courses may be included on the POS. If a 300–level course is listed on the POS, it must be outside of the graduate major, but could include other courses offered in the Agronomy Department. Any 400–level course may be used. If a student is considering a dual–listed AGRON course for their POS (e.g., one offered as either a 400– or 500–level course), the student can take either the 400–level or 500–level version. However, the preceding rules still apply. Only the courses needed to satisfy degree requirements must be listed on the POS, but students may decide to take additional courses that are shown as electives on the POS.

The responsibilities of the POS committee are specifically listed in the GCH. However, there is one additional requirement imposed by soil science and two responsibilities worth repeating here.

First, students in soil science must meet with the entire POS committee at least twice in the case of an MS degree, and at least three times during study for a PhD degree. Besides the final oral examination (see GCH Sections 3.2.1, 3.2.2, and 3.3.3) and another for the preliminary exam (in the case of the PhD study) (see Section 3.3.2), an additional meeting must be held near the beginning of the graduate program. At this meeting the student will introduce the area of research to be pursued, potential research questions and methods, and propose a POS. The committee can at that time critically evaluate the plans and make suggestions.

Second, the major professor is the student's primary point of contact with the faculty, but it is wise for the student to periodically update the other POS members to avoid surprises during the final oral defense.

Finally, it is critical that the student and major professor have a good working relationship. If this relationship is not functioning properly, then both the student and major professor should ask the other members of the POS for help and support. If this step does not improve the situation, then the director of graduate education (DOGE) should be contacted for assistance. Formal grievance procedures, if needed, are outlined in the GCH.

4 - Master of Science

According to the GCH the general requirements for an MS degree include:

- a minimum of 30 credits from academic courses and research activities;
- at least 22 credits earned at ISU;
- at least two–thirds of earned credits related to the major; and
- completion of a final oral examination.

Both non–thesis and thesis options for an MS degree in Soil Science are available.

4.1 Creative Component

If the non–thesis MS degree is chosen, then the student must:

1) register for at least two credits of AGRON 599F (Creative Component, Soil Science) that will be used to complete a "creative component;" and
2) pass a comprehensive final oral examination.

The creative component is work that presents "substantial evidence of individual accomplishment." The POS committee, led by the major professor and with input from the student, will specify the creative component, how it will be documented, and how it will be evaluated. The POS committee also has flexibility in determining the format of the final oral examination.

4.2 Thesis

In the thesis option, the student must

1) pursue a research project culminating in a written thesis; and
2) pass a comprehensive final oral examination.

The thesis will be completed under the guidance of the major professor. A minimum of three research credits of AGRON 699 must be listed on the POS to account for work on an MS thesis. Normally, several more credits of AGRON 699 are part of the POS. Students should sign up for these research credits to an extent appropriate for the amount of time that will be spent each semester conducting research. Typically, one research credit corresponds to roughly four hours of research work per week. The thesis is submitted to the POS committee prior to the final oral examination. During the final oral examination, the student will present their research a seminar that is open to the public and defend the thesis before the POS committee.

5 - Doctor of Philosophy

The general requirements for a PhD degree include:

- a minimum of 72 credits from academic courses and research activities;
- at least 36 of these credits earned at ISU;
- completion of a preliminary oral examination;
- a written PhD dissertation; and
- completion of a comprehensive final oral examination.

Note that the 72 credits can include credits earned in pursuit of an MS degree. If an MS was earned at another institution, credits earned at the other institution can be listed along with the ISU courses, but only if the POS committee determines that the courses involved are appropriate for the ISU degree program. It is in this case that the "36 credits at ISU" requirement becomes relevant.

5.1 Preliminary Exam

Students in soil science must pass a written preliminary examination. Exam questions are authored by members of the POS committee. The format of each question is left open to each member of the POS committee, and they may be formulated as open– or closed–book questions. A reasonable period for completion may be set by the author of the question. The student's responses are formally scored or ranked only by the POS committee member who authored the question. A copy of the student's responses to all questions is submitted to all POS committee members at least one week before the student's preliminary oral examination. When the student submits a request to schedule the preliminary oral examination, the student's major professor certifies by signing the form that the student has satisfactorily completed a written preliminary exam. The nature of the preliminary oral exam is determined by the student's POS Committee.

5.2 Doctoral Dissertation and Final Oral Exam

All students must include at least three AGRON 699 credits in their POS for work on their PhD dissertation. During the required final oral examination, a student presents and defends the dissertation. This presentation (also called the "exit seminar") is open to the general public. Only POS Committee members may attend the examination that follows the presentation.

If a student enters ISU with the intent to earn a PhD and has not yet earned an MS, the student can either complete an MS degree first before completing the PhD degree, or immediately pursue the PhD. Many students will benefit from the experience of completing an MS thesis. At the MS level the topic addressed in the thesis is in most cases established by the major professor. The student conducts research on this topic with a significant amount of supervision and guidance. At the PhD level the dissertation should consist of research questions and hypotheses that have been formulated by the student. In this case the major professor works with the student to make sure the questions and hypotheses are consistent with the resources that are available to conduct the research.

Specific deadlines *not* discussed in this document include: the completion of the final exam (GCH); and the date after which courses may not be listed on the POS (GCH).