Goals

The Crop and Soil Science faculty have developed programmatic goals related to the previously stated mission and program level student learning outcomes as follows:

- Students will demonstrate research abilities.
- Students will demonstrate equipment usage.
- Students will demonstrate technical knowledge.
- Students will demonstrate individual and team skills.
- Students will demonstrate planning skills.
- Students will demonstrate professional development skills.

Student Learning Objectives/Outcomes

When students complete the major, they should be able to successfully:

1. access library, Internet and other informational resources to research topics related to agronomic plants, soils and associated, interdisciplinary agricultural topics;
2. demonstrate the practical use of equipment applicable to agriculture, including, but not limited to, field and laboratory equipment, and computers (and relevant software applications);
3. demonstrate an understanding of plant taxonomy, morphology, anatomy, physiology and production, as well as soil development, taxonomy, fertility, physics, and conservation;
4. demonstrate their ability to work as individuals as well as members of a team through superior human relations skills, communication skills and critical thinking skills;
5. develop professionally at places other than UW-River Falls through internships or other experiences.

Students within the Crop and Soil Science major select one of three options:

- Crop Science (Agronomy)
- Soil Science
- Sustainable Agriculture

Regardless of a student’s selection option, the student should be able to accomplish all of the five learning objectives/outcomes. For Learning Objective/Outcome #2, students selecting the Crop Science (Agronomy) option should be able to demonstrate their competency and show confidence in their ability to use field and laboratory equipment that specifically relates to crops (e.g. moisture testers, grain probes, grain bins, silos, sprayers, planters, electric fence…). Soils option students should be better versed in soils equipment and instrumentation (e.g. soil moisture instruments, soil probes/augers, colorimeters, flame photometers…). Sustainable Agriculture option students should demonstrate enhanced competency in the use of equipment that addresses sustainability issues (e.g. pheromone traps, reduced tillage implements, rising plate meters…).

For Objective #3, Crop Science (Agronomy) option students should demonstrate greater proficiency in plant taxonomy, morphology, anatomy, physiology and production than Soils option students, and Soils option students should demonstrate greater proficiency in soil development, taxonomy, fertility, physics and conservation than Crops option students. Those
selecting the Sustainable Agriculture option should demonstrate proficiency in all of these areas with special proficiency in the areas of conservation, fertility and production.

This level of detail, however, for outcomes/objectives 2 and 3 does not seem warranted for inclusion in those objectives.

**Where the learning objectives/outcomes will be achieved**

The curriculum map (following page) designates where the various learning objectives/outcomes will be achieved, including specific courses, internship offerings and student organization activities. During the students’ time here, faculty and others will introduce, emphasize and/or then reinforce the agreed-upon program level student learning outcomes.
## STUDENT LEARNING OBJECTIVES/OUTCOMES

### Crop and Soil Science Curriculum Map

I = introduced; E = emphasized; R = reinforced

<table>
<thead>
<tr>
<th>Outcome Number</th>
<th>Crop 161 Intro to Plant Sci</th>
<th>Crop 257 Genetics</th>
<th>Crop 260 Plant &amp; Seed</th>
<th>Crop 263 Forages</th>
<th>Crop 266 Corn &amp; Soybean</th>
<th>Crop 268 Grain Quality</th>
<th>Crop 345 Weed Control</th>
<th>Crop 363 Pasture Production</th>
<th>Crop 368 Sustainable Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E</td>
<td>I</td>
<td>R</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<tr>
<td>3</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>E</td>
<td>R</td>
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<tr>
<td>4</td>
<td>I</td>
<td>E</td>
<td>I</td>
<td>R</td>
<td>E</td>
<td>I</td>
<td>R</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>I</td>
<td>R</td>
<td>E</td>
<td>R</td>
<td>I</td>
<td>R</td>
<td>E</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome Number</th>
<th>Crop 410 Plant Breeding</th>
<th>Crop 435 Crop Physiology</th>
<th>Crop 451 IPM</th>
<th>Crop 495 Site Specific</th>
<th>Soil 210 Intro to Soils</th>
<th>Soil 311 Fertility</th>
<th>Soil 325 Hydric Soils</th>
<th>Soil 350 Pedology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>I</td>
<td>E</td>
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<tr>
<td>2</td>
<td>E</td>
<td>R</td>
<td>E</td>
<td>R</td>
<td>I</td>
<td>E.R</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>3</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>I,E</td>
<td>E.R</td>
<td>R</td>
<td>E</td>
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<td>4</td>
<td>E</td>
<td>R</td>
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<td>E,R</td>
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<td>5</td>
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<td>E</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome Number</th>
<th>Soil 440 Conservation</th>
<th>Soil 460 Soil Physics</th>
<th>Crop/Soil 270 Internship I</th>
<th>Crop/Soil 370 Internship II</th>
<th>Crop/Soil 485 Seminar</th>
<th>Crops &amp; Soils Club</th>
<th>Judging Teams</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
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<tr>
<td>2</td>
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<td>R</td>
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<td>E</td>
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<tr>
<td>3</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>E</td>
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<td>E</td>
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<tr>
<td>4</td>
<td>E</td>
<td>E</td>
<td>E.R</td>
<td>R</td>
<td>R</td>
<td>I,E.R</td>
<td>R</td>
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<tr>
<td>5</td>
<td>E</td>
<td>E</td>
<td>E.R</td>
<td>R</td>
<td>R</td>
<td>I,E.R</td>
<td>R</td>
</tr>
</tbody>
</table>

### Assessment Tools used to Measure Objectives/Outcomes

Crop and Soil Science faculty have decided that program assessment will include, but not necessarily be limited to, the following methods:

- Self assessment of progress by current majors and minors (Attachment A)
- Locally developed standardized examinations (Attachments B, C and D)
- Observation of student participation at national events
- Internship evaluations by employers and faculty supervisors (Attachment E)
- Interactions with members of our Crop and Soil Science Advisory (C&SA) Committee (comprised of government and industry professionals in industry)

Crop and Soil Science faculty will continue to focus on the following methods, which they selected as a starting point for the major assessment process, beginning Fall semester, 2004:

1) locally developed standardized examinations;
2) student self assessments; and
3) interactions with the C&SA Committee.
Faculty will continue to collect data related to student responses to agreed-upon pre-test and follow-up standardized exam questions (see Attachment B) in an attempt to assess student learning outcome #3 (demonstrate an understanding of plant taxonomy, morphology, anatomy, physiology and production, as well as soil development, taxonomy, fertility, physics, and conservation).

Note: In preparation for this, in the spring of 2004 faculty individually submitted 120 questions that they thought might provide a good measure of a students’ understanding of plant and soil taxonomy, plant morphology and anatomy, as well as soil chemical, physical and biological properties, and other Outcome/Objective #3 topics. Two tests were developed; one focused on crops topics, the other soils. Using a nominal group technique, faculty agreed upon a total of 15 standard questions for the “Crops Assessment Test” and 13 standard questions for the “Soils Assessment Test.” During Spring semester, 2006, faculty revised the tests and decided to combine the tests into one 27 question standardized exam (retitled “Crop and Soil Science Assessment Quiz”) and change several of the questions to improve relevancy to our graduates’ knowledge base. Beginning Fall 2006, faculty will administer this new test to all new entering freshmen. Faculty will continue to administer the earlier copy of the tests to the majors that matriculated earlier until they have completed their Agronomy Seminar class.

Faculty teaching Plant Science 161 will administer the standardized test and forward all copies to the assessment coordinator. The assessment coordinator will enter data from the majors and minors into a data bank, and save the tests of non-majors for a period of 3 years in case one or more of those decides to become a Crop and Soil Science major or one of the relevant minors. Agronomy Seminar will continue to serve as the final standardized test assessment opportunity, where the assessment tests in their entirety will be administered to senior majors and minors.

Crop and Soil Science faculty will continue to administer student self-assessment forms at regularly scheduled Crops and Soils Club meetings during fall semesters. The continuing purpose of these forms will be to secure student perceptions about the major/minor. Only the self assessment forms completed by Crop and Soil Science majors as well as Agronomy or Soil Science minors will be kept. The self-assessment form is illustrated in Attachment A. The forms direct students to note their perceptions related to each of the program’s learning objectives/outcomes.

To ensure that all students majoring in Crop and Soil Science or selecting an Agronomy or Soil Science minor have a chance to complete the self-assessment, a faculty member will either contact the academic advisors of all relevant students not at the meetings and send them self-assessment forms for the missing students to complete, or he will e-mail the missing students and request that they pick up the self-assessment form, complete it and then return it. A general linear model random measures test will be used to analyze these and other self-assessment data.

Beginning Fall Semester, 2006, program faculty who attend Crops and Soils Club meetings and activities will:

- observe students’ abilities related to outcomes 3 and 4; and
- share them at the annual Crop and Soil Science Assessment meeting (see section entitled “Data Presentation and Discussion Process”); and
- consider changes to the major and/or minor based on these conversations.
Beginning Summer Semester, 2007, faculty internship supervisors will:

- distribute a standardized form (see last page of this document) to both interns and intern supervisors that assesses the internship experiences related to specific Learning Objectives/Outcomes (see attached forms);
- summarize comments made by students and employers relevant to each of the agreed-upon learning outcomes;
- share the comments at the annual Crop and Soil Science Assessment meeting (see section entitled “Data Presentation and Discussion Process”);
- assess the effectiveness of the internship-related experiences in relation to the Learning Objectives/Outcomes; and
- consider changes to the internship program based on the comments and follow-up discussion.
The following table provides a snapshot of the various direct and indirect measures that will be used to assess progress in student completion of the Crop and Soil Science major’s learning objectives/outcomes:

### Measurement of Crop and Soil Science Learning Outcomes

<table>
<thead>
<tr>
<th>Measures</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
<th>Outcome 4</th>
<th>Outcome 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program faculty administer standardized exams or component questions to students in various courses.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Program faculty assess achievement of learning objectives/outcomes related to internship.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Program faculty assess achievement of learning objectives/outcomes related in Crop/Soil Seminar.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program faculty observe student personal traits in Crops and Soils Club Meetings and related club activities.</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Indirect</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current majors and minors complete self-assessment forms.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Alumni complete University-administered on-line surveys.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Crop and Soil Science Advisory Committee provides verbal feedback related to student achievement of learning outcomes/objectives.</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Internship supervisors assess achievement of learning objectives/outcomes for participating students.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**Outcome key**

When students complete the major, they should be able to successfully:

1. access library, Internet and other informational resources to research topics related to agronomic plants, soils and associated, interdisciplinary agricultural topics;
2. demonstrate the practical use of equipment applicable to agriculture, including, but not limited to, field and laboratory equipment, and computers (and relevant software applications);
3. demonstrate an understanding of plant taxonomy, morphology, anatomy, physiology and production, as well as soil development, taxonomy, fertility, physics, and conservation;
4. demonstrate their ability to work as individuals as well as members of a team through superior human relations skills, communication skills and critical thinking skills;
5. develop professionally at places other than UW-River Falls through internships or other experiences.
The following table designates when each objective/outcome will be measured, analyzed, and discussed. It is followed by the time frame for continuous improvement of our assessment efforts.

<table>
<thead>
<tr>
<th>Student Learning Objective/Outcome</th>
<th>When measured</th>
<th>When analyzed</th>
<th>When discussed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access library, Internet and other informational resources to research topics related to agronomic plants, soils and associated, interdisciplinary agricultural topics.</td>
<td>When faculty grade class projects or internship reports; during students’ self assessments</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
</tr>
<tr>
<td>Demonstrate the practical use of equipment applicable to agriculture, including, but not limited to, field and laboratory equipment, and computers (and relevant software applications).</td>
<td>When faculty visit interns, supervise laboratories, or observe students at the campus farms</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
</tr>
<tr>
<td>Demonstrate an understanding of plant taxonomy, morphology, anatomy, physiology and production, as well as soil development, taxonomy, fertility, physics, and conservation.</td>
<td>At the onset of Crop/Hort 161, and in Crop 485 (Seminar)</td>
<td>Just prior to Annual Crop and Soil Science faculty assessment meeting each spring</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
</tr>
<tr>
<td>Demonstrate their ability to work as individuals as well as members of a team through superior human relations skills, communication skills and critical thinking skills.</td>
<td>When faculty visit interns, supervise laboratories, attend Crops and Soils Club functions</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
</tr>
<tr>
<td>Develop professionally at places other than UW-River Falls through internships or other experiences.</td>
<td>When faculty visit interns, attend professional meetings with students, go on field trips with students</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
<td>Annual Crop and Soil Science faculty assessment meeting each spring</td>
</tr>
</tbody>
</table>
Data Presentation and Discussion Process

Crop and Soil Science faculty will meet at least once a year during the spring semester to discuss observations and to review data and statistics related to student achievement of the agreed-upon student learning objectives/outcomes.

Some of the ongoing conversations will include an assessment of whether or not students seem to be progressing; an evaluation of the validity and worth of the various assessment questions; and an evaluation of the effectiveness of the techniques chosen to distribute, collect and statistically analyze assessment data.

The assessment coordinator will statistically analyze the standardized pre-test question data plus follow-up data from the standardized questions administered at later dates using a General Linear Model Random Measures test. Program faculty teaching Introduction to Plant Science and Seminar will collect the data during each course offering. Faculty internship supervisors will compile their specific personal observations and those of their assigned employers to the annual meeting as well.

Implementation of Revisions Based on Assessment Results

As part of the annual meeting to discuss student achievement, faculty will agree on action steps (including responsible persons) that identify revisions to the curriculum, which will better meet the expectations of our stated student learning objectives/outcomes.

Results Availability

Program faculty will:

- place the Crop and Soil Science Assessment Plan on the University’s G drive under PES/Crop and Soil Meetings/Assessment Activities as well as in the designated CAFES folder;
- ensure that members of the Crop and Soil Science Advisory Committee receive copies of the plan;
- discuss the agreed upon learning objectives/outcomes with all incoming majors at Academic Day;
- share the learning objectives/outcomes with members of the Crop and Soil Science Club at least annually, when the self-assessments are administered; and
- post the learning objectives/outcomes on the bulletin board in the Crop and Soil Science Club meeting place (the Crops laboratory, where hundreds of students are served each semester).
  - Note: Program faculty have posted (since March 2004) and will continue to post the Crop and Soil Science goals and program level student learning outcomes in AgSc 217, the Crops Laboratory.

Program faculty will share the statistical analyses related to the self analyses and the pre- and post-tests with students (majors and minors) and with broader audiences. (Program faculty shared them with the Crop and Soil Science Advisory Committee in March 2005, and they will continue to do so at future meetings.)

Program faculty have asked Crops and Soils Club members to evaluate and help with ongoing development of the goals and outcomes, and faculty will continue to do so. Since AgSc 217 is also the principle crops laboratory, hundreds of students with agronomic interests or curricular requirements participate in laboratory activities in that room annually, so they have been exposed
to the information as well, and future students will receive similar exposure. When prospective students visit, faculty will show those students and members of their family the posted mission, goals and expected outcomes.

During Spring semester, 2007, program faculty will display a summary of our efforts to assess student learning objectives/outcomes; portions of the summary will be a bit nebulous, e.g. posting actual pre- and post-test questions would compromise our efforts to use them in future years.
ATTACHMENT A

Student Self Assessment Form

Name _______________________________ Date ________________________

Class rank (circle: freshman, sophomore, junior, senior)

Major (please check one):

_____ Crop and Soil Science (if you check this, please identify your option):
    Crop Science (Agronomy)
    Soil Science
    Sustainable Agriculture

Other (please identify: ___________________________ ____)  

Minor (please check one):  _____ Agronomy  Other (please identify: _________________________)

For each of the following statements, note in the column to the right the extent of your current vs. past capabilities, placing an “S” and a “C” below the appropriate number in the table. An “S” designates your estimate of your capabilities when you started your coursework here at the university, and a “C” designates your estimate of your capabilities currently.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Low capabilities</th>
<th>Intermediate</th>
<th>High capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note your perceived capabilities in accessing library, Internet and other information resources to research topics related to agronomic plants, soils and associated, inter-disciplinary agricultural topics (both S and C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived capabilities in using field equipment applicable to agriculture, including, but not limited to, sampling, surveying, production, or diagnostic equipment (both S and C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived capabilities in using laboratory equipment applicable to crops and soils (both S and C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived understanding of plant taxonomy, morphology, anatomy and physiology (both S and C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived understanding of crop production (both S and C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived understanding of soil development, fertility and conservation (both S &amp; C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived ability to work successfully as an individual and as a member of a team as a result of your communication skills (both S &amp; C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived ability to work successfully as an individual and as a member of a team as a result of your critical thinking skills (both S &amp; C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived ability to work successfully as a member of a team as a result of your human relations skills (both S &amp; C).</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived ability to construct a viable management plan for a farm or agri-business related to common Midwestern crops and soils.</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note your perceived capabilities as a result of professional development at places other than UW-River Falls (through internships and other University-related experiences)</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Attachment B

Soils Assessment Test

Name _____________________________________           Today’s date _____________

Class rank (circle one: Freshman, Sophomore, Junior, Senior)

Major (please check one):
___ Ag Education
___ Ag Studies
___ Animal Science
___ Crop and Soil Science
___ Horticulture
Other (please identify ________________________________)

Minor (if you have selected one)
___ Soil Science
___ Crop Science
___ Agronomy
Other (please specify ________________________________)

Please place the letter of the correct choice in the blank provided.

___ 1. Three hundred pounds of a fertilizer with an analysis of 10-20-30 would contain:
   A) 30 pounds of K$_2$O
   B) 10 pounds of nitrogen
   C) 60 pounds of P$_2$O$_5$
   D) 90 pounds of N

___ 2. Tillage operations almost always have a negative impact on soil:
   A) texture
   B) structure
   C) hue
   D) chroma

___ 3. Some losses due to erosion can be “tolerated.” These tolerable losses, or anything less, won’t tend to degrade long-term productivity of the soil. The loss of soil that can be tolerated is called the:
   A) RUSLE
   B) Erosivity factor
   C) T-value
   D) Universal soil loss

___ 4. The water in the soil between field capacity and the permanent wilting point is called:
   A) gravitational water
   B) plant available water
   C) capillary water
   D) the soil’s water holding capacity

___ 5. The conversion of nitrate in the soil to gaseous nitrous oxides that escape to the atmosphere is:
   A) nitrogen-fixation
   B) denitrification
   C) immobilization
   D) volatilization
6. What are three plant essential elements used in very small quantities, i.e., micronutrients?
   A) Ca, Mg, Fe
   B) N, P, K
   C) Cl, Zn, Mo
   D) C, H, O

7. If the volumetric water content of a soil is 54% at saturation, 38% at field capacity, 12% at the permanent wilting point and 2% at air dryness, what is the percent porosity of this soil?
   A) 26%
   B) 36%
   C) 42%
   D) 54%

8. What soil order, according to the USDA Soil Taxonomic Classification, consists of organic soils?
   A) Entisol
   B) Histisol
   C) Mollisol
   D) Spodosol

9. What tillage system used for corn production would likely lead to the coolest soil temperatures early in the spring?
   A) moldboard plow tillage in the fall
   B) mulch tillage using a chisel plow in the fall
   C) no till
   D) ridge till using a strip till planter in the spring

10. The atmospheric composition is about 78% N₂ gas, 21% O₂ gas and 0.03% CO₂ gas. Which of the following percentages of gases would you expect in the pores of a moderately well-drained soil?
    A) 21% O₂, 78% N₂, 0.03% CO₂
    B) 25% O₂, 65% N₂, 0.03% CO₂
    C) 22% O₂, 78% N₂, 0% CO₂
    D) 15% O₂, 78% N₂, 7% CO₂

11. In the determination of the soil textural class by mechanical analysis, the soil separate that settles out in 40 seconds is:
    A) sand
    B) silt
    C) clay
    D) humus

12. Gravitational water moving through the soil carries with it various components from the soil down into the groundwater below. One of these components that is very soluble and moves rapidly into the groundwater and has a serious negative impact on groundwater for drinking purposes is:
    A) Ca⁺⁺
    B) Na⁺
    C) SO₄²⁻
    D) NO₃⁻

13. Which of the following has the largest specific heat capacity?
    A) water present in the soil
    B) soil organic matter
    C) soil air
    D) dry soil separates
Below is an example of the Soils Assessment test data collection sheet (and included results) for one particular individual:

**Soils Assessment Test Result Example**

Name of student ____________________________

Major/minor ________________________________

In the table, please note dates of assessment and results (C = correct, I = incorrect).

<table>
<thead>
<tr>
<th>Question</th>
<th>Soil 210 Pre-test</th>
<th>Crops &amp; Soils Seminar</th>
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</table>

Soil science faculty will continue to observe these data, consider relevancy of the assessment questions, consider the adequacy of topic coverage, and/or contemplate ways to make the material more understandable.
Attachment C
Crops Assessment Test

Name ___________________________           Today’s date _____________

Class rank (circle one: Freshman, Sophomore, Junior, Senior)

Major (please check one):
___ Ag Education
___ Ag Studies
___ Crop and Soil Science
___ Horticulture
Other (please identify ________________________________)

Minor (if you have selected one)
___ Soils
___ Crop Science
___ Agronomy
Other (please specify ________________________________)

Please place the letter of the correct choice in the blank provided.

___ 1. The type of vascular tissue that conducts photosynthates and other organic materials throughout the plant is:
   A) phloem tissue
   B) xylem tissue
   C) both A and B
   D) none of the above

___ 2. Meristematic tissue is made up of cells that:
   A) store food.
   B) fill up excess space.
   C) are mature and fully expanded.
   D) divide repeatedly.

___ 3. Which is not part of the carpel (pistil)?
   A) ovary
   B) stigma
   C) anther
   D) style

___ 4. Horizontal underground stems that facilitate the vegetative spread of plants are called:
   A) stolons
   B) rhizomes
   C) corms
   D) stipules

___ 5. In what cellular organelle/location does photosynthesis occur?
   A) cytoplasm
   B) mitochondria
   C) ribosomes
   D) chloroplasts
6. What would happen to the photosynthetic rate of a plant if atmospheric levels of CO₂ would rise?
   A) It would increase.
   B) It would decrease.
   C) It would not change.
   D) None of the above

7. Which of the following plant hormones is involved in fruit ripening?
   A) auxin
   B) gibberellin
   C) cytokinin
   D) ethylene

8. A plant in which all of the gene pairs are identical is said to be:
   A) dominant
   B) homozygous
   C) recessive
   D) heterozygous

9. The binomial naming system identifies each plant by ___ and ___ names:
   A) variety and family
   B) cultivar and suborder
   C) trade and scientific
   D) genus and species

10. The scientific name of alfalfa is:
    A) Medicago sativa
    B) Lotus corniculatus
    C) Zea mays
    D) Cirsium arvense

11. If you grow the same corn variety this year that you grew last year, but plant it 3 weeks earlier than you did last year, you would expect (assuming similar growing seasons) that this year’s corn would be ____ than last year’s corn:
    A) shorter
    B) taller
    C) more pest resistant
    D) more nutritious

12. The insect pest life cycle stage that usually causes the most plant damage is the:
    A) adult
    B) pupa
    C) larva
    D) metamorphic

13. Weeds with which life cycle reproduce by both sexual and asexual means?
    A) biennial
    B) perennial
    C) summer annual
    D) winter annual

14. As organic matter in a field increases, the rate of a soil applied herbicide would need to:
    A) increase
    B) decrease
    C) stay the same
    D) no choice is correct
15. How does a surfactant improve the ability of an herbicide to cross a plant cuticle?
   A) It reduces the surface tension of water.
   B) It spreads out the droplet on the leaf surface.
   C) It helps dissolve the cuticle.
   D) All choices are correct.
Similar to the Soils Assessment Tests, data have been compiled for each individual related to the crops assessment test questions. The data sheet follows:

**Crops Assessment Test Results**

Name of student ________________________________

Major/minor ________________________________

In the table, please note dates of assessment and results (C = correct, I = incorrect).

<table>
<thead>
<tr>
<th>Question</th>
<th>P.S. 161 Pre-test</th>
<th>Crops &amp; Soils Seminar</th>
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</table>
Attachment D

Crop and Soil Science Assessment Quiz

Name _______________________________           Today’s date ____________________

Major (please check one):
___ Ag Education
___ Ag Studies
___ Animal Science
___ Crop and Soil Science
___ Horticulture
Other (please identify ________________________________)

Minor (if you have selected one):
___ Soil Science
___ Crop Science
___ Agronomy
Other (please specify ________________________________)

Please place the letter of the correct choice in the blank provided.

___ 1. Four hundred pounds of a fertilizer with an analysis of 10-20-30 would contain:
   E) 40 pounds of K₂O
   F) 240 pounds of N
   G) 80 pounds of P₂O₅
   H) 120 pounds of N

___ 2. Tillage operations almost always have a negative impact on soil:
   E) texture
   F) structure
   G) hue
   H) chroma

___ 3. The water in the soil between field capacity and the permanent wilting point is called:
   E) gravitational water
   F) plant available water
   G) capillary water
   H) the soil’s water holding capacity

___ 4. What is the bulk density of a 150 cm³ soil sample, which weighed 225 g at field moisture and 200 g after oven-drying?
   A) 0.67 g/cm³
   B) 0.75 g/cm³
   C) 1.33 g/cm³
   D) 1.50 g/cm³

___ 5. Under wet soil conditions, denitrification occurs. This refers to the loss of _____ as _____:
   A) NH₄⁺; mineralized organic forms
   B) nitrates; nitrous oxides and N₂ gas
   C) organic nitrogen forms; NO₃
   D) organic carbon forms; CO₂
6. What are three plant essential elements used in very small quantities, i.e., micronutrients?
   E) Ca, Mg, Fe
   F) N, P, K
   G) Cl, Zn, Mo
   H) C, H, O

7. What soil conditions would be most likely to result in the presence of mottles in a soil horizon?
   A) A changing water table that moves up and down through that horizon during the year
   B) A high water table that keeps that horizon continually saturated
   C) A low water table that keeps that horizon continually dry
   D) Rapid movement of air into the horizon that keeps the horizon well aerated

8. What soil order, according to the USDA Soil Taxonomic Classification, consists of organic soils?
   E) Entisol
   F) Histosol
   G) Mollisol
   H) Spodosol

9. What tillage system used for corn production would likely lead to the coolest soil temperatures early in the spring?
   E) moldboard plow tillage in the fall
   F) mulch tillage using a chisel plow in the fall
   G) no till
   H) ridge till using a strip till planter in the spring

10. What soil conditions lead to the development of a master B horizon?
   A) accumulation of soil organic matter
   B) the chemical breakdown of sand and silt particles into clay minerals
   C) eluviation (loss) of materials like iron or clay out of the horizon
   D) illuviation (accumulation) of materials like iron or clay into the horizon

11. In the determination of the soil textural class by mechanical analysis, the soil separate that settles out in 40 seconds is:
   E) sand
   F) silt
   G) clay
   H) humus

12. Gravitational water moving through the soil carries with it various components from the soil down into the groundwater below. One of these components that is very soluble and moves rapidly into the groundwater and has a serious negative impact on groundwater for drinking purposes is:
   E) Ca$^{++}$
   F) Na$^+$
   G) SO$_4^{2-}$
   H) NO$_3^-$

13. Approximately how much would an acre furrow slice of soil (assume a depth of 6 inches) weigh if the bulk density of the soil was 72 lb/ft$^3$? (There are 43560 ft$^2$ in one acre.)
   A) 1,600,000 pounds
   B) 2,200,000 pounds
   C) 3,140,000 pounds
   D) 5,858,000 pounds
14. Certain soil bacteria exist in a symbiotic relationship with legumes, converting atmospheric nitrogen in the soil pore spaces to organic nitrogen forms (which later mineralize upon the demise of the bacteria into useable plant forms). This conversion (and short-term immobilization) of atmospheric nitrogen to organic nitrogen forms is termed:
   A) ammonification
   B) nitrogen fixation
   C) nitrification
   D) organification

15. Root development is ________ by the growth regulator auxin:
   A) promoted
   B) inhibited
   C) not affected

16. These are the products of aerobic respiration:
   A) energy, moisture and carbon dioxide
   B) lactic, acetic, propionic acid and other volatile fatty acids
   C) nucleoside bases, ribose (and/or deoxyribose) and high energy phosphate bonds
   D) carbohydrates and O₂

17. Transgenic organisms are becoming commonplace as a result of modern biotechnology. These organisms are:
   A) the smallest of life forms, used principally in biochemical reactions such as fermentation, but also for gene insertion and retrovirus recovery.
   B) created by inserting genes from one organism into another very different organism.
   C) higher yielding and more nutritious; however, allergic reactions are becoming more commonplace as a result of their presence.
   D) basically clones of a desired plant or animal.

18. What would happen to a plant’s photosynthetic rate if atmospheric CO₂ levels would rise?
   A) It would increase.
   B) It would decrease.
   C) It would not change.
   D) None of the above

19. A plant in which all of the gene pairs are identical is said to be:
   A) a clone.
   B) homozygous.
   C) heterozygous.
   D) transgenic.

20. The binomial naming system identifies each plant by ___ and ___ names:
    A) variety and family
    B) cultivar and suborder
    C) trade and scientific
    D) genus and species

21. The emergence pattern in which the cotyledons remain below the soil surface at emergence is called:
   A) hypogeal.
   B) epigeal.

22. As alfalfa matures, forage quality:
   A) worsens.
   B) improves.
   C) stays the same.
23. Weeds with which life cycle reproduce by both sexual and asexual means?
   A) biennial
   B) perennial
   C) summer annual
   D) winter annual

24. As organic matter in a field increases, the rate of a soil applied herbicide would need to:
   A) increase.
   B) decrease.
   C) stay the same.

25. During the ensiling process, silage pH:
   A) increases.
   B) decreases.
   C) stays the same.

26. The growth regulator most involved in phototropism is:
   A) gibberellin.
   B) ethylene.
   C) auxin.
   D) cytokinin.

27. The structure that elongates after germination, pushing the first corn leaf out of the ground, is called the:
   A) coleoptile.
   B) plumule.
   C) radicle.
   D) mesocotyl.
Near the end of a student’s internship experience, faculty internship supervisors ask both the student and the employer to complete an assessment tool. The tool provides an indirect measure of student achievement related to the learning objectives/outcomes. The forms follow.
Crop and Soil Science Internship Assessment (Supervisor)

Student's Name _______________________      Supervisor's Name________________________

Instructions: Internships are a critical part of our students learning to become professionals in crop and soil science. Below are listed the learning objectives/goals of our major and tasks our students should be able to successfully complete upon graduation. Please evaluate the student's capabilities objectively by marking the appropriate box.

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<th>Statement</th>
<th>NA</th>
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Please summarize briefly the strengths of this student:

Please summarize the weaknesses of the student:

Please evaluate your experience working with UWRF's internship program:
Crop and Soil Science Internship Assessment (Student)

Student's Name _______________________     Supervisor's Name_______________________

Instructions: Internships are a critical part of our students learning to become professionals in crop and soil science. Below are listed the learning objectives/goals of our major and tasks our students should be able to successfully complete upon graduation. Please evaluate your capabilities objectively by marking the appropriate box.

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<td>Your perceived ability to demonstrate the practical use of equipment applicable to agriculture, including, but not limited to, field and laboratory equipment, and computers (and relevant software applications)</td>
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<td>Your perceived understanding of plant taxonomy, morphology, anatomy, physiology and production, as well as soil development, taxonomy, fertility, physics, and conservation</td>
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<td>Your perceived attention to developing professionally at places other than UW-River Falls (through internships or other experiences)</td>
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Evaluate your experience related to UWRF's internship program:

How did this experience assist you in choosing a career?