PLS 15: Soils & Fertility
Lab Handout & Assignment

This lab will focus on four relatively simple assessments that can be useful in evaluating a soil and making soil and fertility management decisions. You will complete some of the tasks in this lab as individuals and some as groups. Your group in today's lab will *not* be your normal lab groups. Each lab section will be split into four groups that will work together only for this one lab. This will give you a chance to interact a bit more with some of the other students in your lab section. Each group will be given a "group number" to use during today's lab; remember this group number.

This lab involves a number of activities and an assignment (the last two sheets of this handout). This is an *individual* assignment that each student will complete; it is due at the beginning of lab on Week 6. Everyone in the lab section will do all the activities, but in somewhat different orders. However, because one activity, the Soil Nitrate-N Quick Test, involves allowing soil to settle in a sample tube for a period of time, everyone will start today's lab by doing the first part of that activity. Two of the activities include some simple calculations and there are some questions that are part of the lab assignment.

The activities in the lab are described in the following order:

Soil Nitrate-N Quick Test	**Soil pH Test**
Determining Soil Texture by Feel	**Estimating the N Content of a Cover Crop**

Soil Nitrate-N Quick Test
(Group Activity)

Working as a group, and using the soil probe (soil auger) and the method you are shown in the field, you will collect composite soil samples from **two** designated areas of the beds that you planted last week in the *Crops Lab*. Using the method described below, you will determine the amount of NO_3-N in these samples.
For each of the two designated areas, each group will use the following procedure:

1. Each student in your group will collect two soil cores from the top 8" – 10" of the soil. Place all of your group's soil cores in a bucket and blend them thoroughly by hand. This is your 'composite sample.'

2. Label a centrifuge tube with your group number (e.g., "Group No. 3") and the soil treatment ("Alfalfa Hay" or "Wheat Straw" or "No Amendment"). Fill the centrifuge tube to the 30 ml level with the.01 M calcium chloride extracting solution.

3. Add a small amount of your thoroughly blended composite sample to the tube until the level of the solution rises to 40 ml; cap tightly and shake vigorously until all clods are thoroughly dispersed.

4. Let the sample sit until the soil particles settle out and a clear zone of solution forms at the top of the tube. This may take only a few minutes for sandy soils, an hour or more for clay soils.

   At this point, start working on other activities. Return to finish this activity later.

5. After the soil particles have settled and there is a clear zone at the top of the tube, you can proceed as follows. Dip a nitrate test strip into the clear zone of solution, shake off excess solution, and wait **60 seconds**. Compare the color that has developed on the strip with the color chart provided.

6. Conversion of results from test strip reading to NO_3-N concentration. The nitrate test strips are calibrated in parts per million (ppm) NO_3^-. You will convert this number to ppm NO_3-N of dry soil, using the following equation and table:

   Equation: ***Test Strip Reading ÷ Correction Factor = ppm NO_3-N in dry soil***

Table:	Correction factor	
Soil texture*	Moist soil	Dry soil
sand	2.3	2.6
loam	2.0	2.4
clay	1.7	2.2

* use information from the "Determining Soil Texture by Feel" activity to determine appropriate texture

Fill in the following chart (and transfer this information to the assignment portion of this handout on the last 2 sheets):

Your Group Number	Soil Treatment	Test Strip Reading	Correction Factor	NO_3-N in dry soil (ppm)

Soil pH Test
(Group Activity)

In this activity, you will measure the pH of soil from the same two designated areas of the beds that you sampled for the *Soil Nitrate-N Quick Test* to of the soil, using a similar technique. However, in this activity, some of your work has already been done for you. **Each** member of your group should determine the pH of **one** of the samples (half of your group should determine the pH of one of the samples and the other half determine the pH of the other sample). The procedure is as follows:

1. At least a day prior to lab, composite soil samples were made and small amounts of the samples were placed in distilled water in a centrifuge tube to achieve a 1:2 (soil to water, by volume) ratio. The tubes were capped tightly and shaken vigorously until all clods were thoroughly dispersed. The samples were allowed to sit so that the soil would settle.

2. With the soil particles settled and a clear zone at the top of the tube, you can proceed as follows. Dip a pH test strip into the clear zone of solution and remove it. Do not shake it off. **Wait for full color to develop** before "reading" the pH. This may take several minutes. When the color stops changing (but before the strip dries), compare the color that has developed on the strip with the color chart provided.

Provide the information indicated below (and transfer this information to the assignment portion of this handout on the last 2 sheets):

Soil treatment	*pH*
_____ (treatment used for your determination)	_____ (your determination)

Determining Soil Texture by Feel
(Individual Activity)

Each student will use the "feel method" to determine the soil texture class of three soil samples, including one taken from the Market Garden beds used in the *Crops Lab* and the NO_3-N and pH tests described above. Follow the method in the *Soil Texture Decision Chart* (page 4) to make these determinations and indicate what you think are textures of the soils below (and transfer this information to the assignment portion of this handout on the last 2 sheets). [Note: page 5 shows the soil texture triangle, for your reference]
:

Soil Sample	*Texture*
Soil from the Market Garden beds	_____
Soil sample "A"	_____
Soil sample "B"	_____

(Insert soil texturing graphic pages here)

Estimating the N Content of a Cover Crop
(Group Activity)

In this activity, you will work with your group to estimate the amount of N contained in the above ground portion of cover crops using the procedure described below. You will be given instructions in the field on how and where to complete this exercise.

Each group will make two estimates of the N content of a cover crop. Working with one or two others from your group, use the following procedure for making each estimate.

1. Cut the fresh above-ground cover crop biomass from a 9 square feet (e.g. a 3 ft x 3 ft area - OR - a 1 ft, 9 in length of a 5 ft wide bed) area.

2. After removing weeds from the sample, place the sample in a burlap sack. Weigh the sample (make sure you don't include the weight of the empty sack).

3. Use the appropriate conversion factor from the table below and the equation below to estimate the number of pounds of nitrogen per acre contained in the cover crop.

Crop	Conversion Factor
Woolypod Vetch	28
Purple Vetch	28
Fava or Bell Beans	18
Berseem clover	23
Blackeyed peas (Cowpeas)	21
Legumes (average, can vary)	23
Grasses (average, can vary)	11

Fresh Weight x **Conversion Factor** = **Amount of Nitrogen in Cover Crop**
(in lbs) *(see below)* *(in lbs/acre)*

Fill in the following table with information gather from everyone in your group (and transfer this information to the assignment portion of this handout on the last 2 sheets):

Cover Crop	Fresh Weight (lbs)	Conversion Factor	N in cover crop (lbs/acre)

Name _____

Lab Section (M or R) _____

PLS 15: Soils & Fertility
Lab Assignment (3 pages [2 sheets] long)

Due on Week 6
Remove this assignment from the rest of the handout and hand in at the start of lab

Determining Soil Texture by Feel

Indicate what you think are textures of these soils below:

Soil Sample	*Texture*
Soil from the Market Garden beds	_____
Soil sample "A"	_____
Soil sample "B"	_____

Questions:
Based solely on your texture determinations, answer the following questions:

Do you expect soil A or soil B to have a higher water holding capacity? Why?

Do you expect soil A or soil B to be able to store and release more cations? Why?

Soil Nitrate-N Quick Test

Fill in the following chart:

Your Group Number	Soil Treatment	Test Strip Reading	Correction Factor	NO_3-N in dry soil (ppm)

Everyone in both lab sections will share their NO_3-N determinations. This information will be distributed to the class during the lab sections on Week 5 and on the course SmartSite page. Use that information to fill in the table below:

Soil Treatment	*Mean NO_3-N in dry soil (ppm)*
No Amendment	_____
Alfalfa Hay	_____
Wheat Straw	_____

Questions:

Are the results above consistent with your expectations of how alfalfa hay and wheat straw would impact nitrate levels in the soil? If so, explain. If not, explain and also indicate what you think might explain the unexpected results.

Soil pH Test

Everyone in your lab section will share their pH determinations in the classroom following the field activities. Using the information provided, indicate below the results of your pH determination and that of other students in your lab section below.

Soil treatment	*pH*	
_____	_____	_____
(treatment used for your determination)	(your determination)	(other determinations)
_____	_____	
(other treatment)	(determinations by others in lab section)	

Question:

Based solely on the pH information your lab section developed, do you expect there to be any *pH related* nutrient deficiencies in the soil used for the *Crops Lab*? Why or why not?

Name _____

Lab Section (M or R) _____

Estimating the N Content of a Cover Crop

Fill in the following table with information gather from everyone in your group:

Cover Crop	Fresh Weight (lbs)	Conversion Factor	N in cover crop (lbs/acre)

Everyone in your lab section will share their Cover Crop N estimates in the classroom following the field activities. Use that information to fill in the table below:

Cover Crop	Mean N Content Estimate (lbs N/A)
_____	_____
_____	_____
_____	_____

Answer the following questions:

Regarding the **vetch** cover crop:
A. If this cover crop were mowed and incorporated, what would you expect to be happening two weeks later in the soil (circle one):

- Cover crop decomposition is releasing available (mineral) N
- Cover crop decomposition is immobilizing available (mineral) N
- Cover crop decomposition is having no impact on available (mineral) N

B. What are the possible sources of N in the cover crop?

Regarding the **wheat** cover crop:
A. If this cover crop were mowed and incorporated, what would you expect to be happening two weeks later in the soil (circle one):

- Cover crop decomposition is releasing available (mineral) N
- Cover crop decomposition is immobilizing available (mineral) N
- Cover crop decomposition is having no impact on available (mineral) N

B. What are the possible sources of N in the cover crop?