Soils 201 **Exam #3** Name_____

7 November 2001 (120 points total)

**I. Single-Answer Multiple Choice** (2 points each): Circle the **one** solution that answers each question or completes each sentence.

1. Concerns about conventional agriculture by some people include

   a. removal of soil by erosion.
   b. a decrease in the number of small family farms.
   c. pollution of surface and ground waters with agricultural chemicals and sediment.
   d. all of the above.
   e. both a and c.

2. Organic compounds vary greatly in their rate of decomposition. Which of the following organic compounds are listed correctly in order from the most rapidly decomposed to the most slowly decomposed?

   a. Sugars > fats and waxes > cellulose > lignins.
   b. Crude proteins > hemicellulose > cellulose > lignins.
   c. Fats and waxes > hemicellulose > simple proteins.
   d. All of the above.
   e. Both b and c.

3. Which of the following organisms are prokaryotes?

   a. Protista
   b. Fungi
   c. Actinomycetes
   d. Earthworms
   e. None of the above

4. Some scientists prefer to classify organisms into three domains. Which of the following is one of these domains?

   a. Archaea
   b. Bacteria
   c. Prokaryota
   d. All of the above
   e. Both a and b

5. Which combination of the following soil properties (soil temperature, pH, aeration, and organic matter) is most conducive to microbial activity (especially bacteria) in soils?

   a. $0^oC$ ($32^oF$), pH 7.0, high $O_2$, high humus content
   b. $30^oC$ ($86^oF$), pH 5.5, high $O_2$, low humus content
   c. $30^oC$ ($86^oF$), pH 7.0, high $O_2$, high humus content plus high fresh residues

d. 30°C (86°F), pH 7.0, low $O_2$, high humus content plus high fresh residues

e. 30°C (86°F), pH 6.0, high $O_2$, high humus content

6. Aerobic conditions can be maintained in a compost pile by

a. frequent turning.
b. compacting the pile.
c. creating a very large pile greater than 1 cubic yard.
d. overwatering.
e. both a and c.

7. Which of the following has the lowest C/N ratio?

a. Alfalfa
b. Manure
c. Humus
d. Bacteria

8. ____ can fix nitrogen.

a. Bacteria
b. Actinomycetes
c. Fungi
d. All of the above
e. Both a and b

9. Lichens are a symbiotic association of

a. fungi and algae.
b. bacteria and fungi.
c. bacteria and algae.
d. protozoa and fungi.

10. Benefits of adding materials that have been composted versus the same materials in their original "raw" form is that the composted materials

a. already have had their C/N ratio lowered.
b. weigh less.
c. have similar effects to that of adding humus.
d. all of the above.
e. both a and c.

11. Actinomycetes

a. aid in the development of good soil structure.
b. can produce many useful antibiotics.
c. can fix nitrogen.
d. all of the above.
e. both b and c.

12. Organic agriculture

a. considers the soil as one of the major management components of the farm system.
b. can have higher net returns in particular enterprises than conventional agriculture.
c. excludes the use of synthetic fertilizers and pesticides.
d. all of the above.
e. both a and b.

13. Soil microorganisms have many beneficial effects on soils and plants which include

a. soil aggregate destabilization.
b. antagonistic action against plant pathogens.
c. humus formation.
d. all of the above.
e. both b and c.

14. Sustainable agriculture is

a. a step backward.
b. another name for organic farming.
c. only for small farms.
d. the same thing as conventional agriculture.
e. none of the above.

15. For a farm to be sustainable it must be

a. socially just.
b. economically profitable.
c. nonconventional.
d. all of the above
e. both a and b.

16. In a soil, microbial activity would be greatest at which depth?

a. 0-10 centimeters.
b. 10-20 centimeters.
c. 20-30 centimeters.
d. 30-40 centimeters.
e. 40-50 centimeters.

17. Which of the following is a common practice in organic farming systems?

a. Use of green and/or animal manures
b. Crop rotations
c. Biological pest control
d. All of the above
e. Both a and c

18. Which of the following has the greatest amount of carbon storage on Earth?

a. Vegetation
b. Atmosphere
c. Soil
d. Oceans and lakes

19. The second stage of three stages in the composting process is called the

a. mesophilic stage.
b. humic acid stage.
c. thermophilic stage.
d. curing stage.

20. The nutrient most often limiting the decomposition of organic matter added to soils is

a. nitrogen.
b. phosphorus.
c. calcium.
d. carbon.

21. Of the following, which are the smallest in size?

a. Bacteria
b. Actinomycetes
c. Fungi
d. Viruses

22. The desirable moisture content in a compost pile is

a. 10 to 30 percent.
b. 30 to 50 percent.
c. 50 to 70 percent.
d. 70 to 90 percent.

**II. Multiple-Answer Multiple Choice** (1 point for each answer): Each problem set below consists of one problem with four possible answers. At least one answer listed is correct but two, three, or four of the answers may be correct. Mark "T" (for true) for each answer that solves the problem correctly and "F" (for false) for each answer that is incorrect.

23-26. Concerning soil organisms,

____23. algae are capable of performing photosynthesis.

____24. fungi have mycelia, a vegetative mass of hyphae.

____25. soil fungi generally cannot tolerate acid soils.

____26. many bacteria are able to produce spores, which allow them to survive unfavorable conditions.

27-30. Soil organic matter

____27. as it decomposes may release substances that have as yet unidentified effects on plants.

____28. acts as a chelate helping to immobilize micronutrient metal ions and to decrease their availability to plants.

____29. must be in the soil at a concentration of about 7% for good plant growth.

____30. contributes to the cation exchange capacity of soils.

31-34. In my study with the two adjacent organic and conventional farms in the Palouse, I found

____31. erosion rates to be less on the organic farm.

____32. wheat yields per acre on the organic farm to be about 25% less than on the conventional farm.

____33. organic matter to be higher on the organic farm.

____34. topsoil thickness to be 16 inches greater on the organic farm.

35-38. Concerning soil organisms,

____35. viruses are not considered "alive" by some scientists.

____36. bacteria are not significant in decomposing soil organic matter.

____37. fungi can cause many plant diseases.

____38. nematodes are classified in the Animalia Kingdom.

39-42. Alternative farming systems

____39. include nonconventional farming systems like organic and no-till.

____40. include biological farming systems like those practiced in Europe.

____41. can include additions of synthetic fertilizers and pesticides.

____42. can be sustainable.

43-46. Concerning composting,

____43. it can save a gardener money with the fertilizer bill.

____44. it reduces the amount of materials taking up space in landfills.

____45. adding synthetic N fertilizer to compost speeds up the compost process.

____46. when added to heavy clay soils, compost can improve soil structure.

47-50. Earthworms

____47. eat ants and termites.

____48. excrete small granular aggregates called casts.

____49. prefer sandy soils.

____50. generally have a favorable effect on soil productivity.

51-54. The narrower or smaller the C/N ratio of a freshly added organic residue to the soil,

____51. the longer the nitrate depression period.

____52. the faster the suitable planting time for the farmer.

____53. the slower the decay rate of the organic residue.

____54. the lower the N content relative to the C content in the residue.

55-58. Over time, organic matter additions to the soil

____55. increase the bulk density of the soil.

____56. generally have little effect on soil structure.

____57. generally increase water infiltration rates.

____58. can alter soil texture.

59-62. Concerning alternative and conventional farmng systems,

____59. integrated farming is a blend of organic and conventional farming practices.

____60. no-till directly drills in the seed in the residue of the previous crop.

____61. biological and ecological farming systems are alternative farming systems.

____62. conventional farming relies on synthetic chemical fertilizers and pesticides.

63-66. Earthworm casts are

____63. the skins of dead earthworms.

____64. lower in available nutrients (per unit weight) than the surrounding soil.

____65. more acid than the surrounding soil.

____66. the feces of earthworms.

67-70. From the film "Life in the Soil", we learned that

____67. the film took place in Korea.

____68. adding organic matter helps build the soil.

____69. fungi eat fungi and nematodes.

____70. the pathogenic fungi, *Fusarium*, can be controlled by mixed cultivation (growing two or more crops together at the same time).

**III. Fill-Ins** (2 points for each space): Fill-in each space below with the correct word or words.

71. _____ is the more or less stable fraction of the soil organic matter remaining after the major portions of added plant and animal residues have decomposed. Humus

72. _____ is the conversion of molecular nitrogen ($N_2$) to organic nitrogen utilizable in biological processes. Nitrogen fixation

73. Carbon dioxide is produced in the soil through the _____ of plant roots and microorganisms. respiration

74. The _____ is that portion of soil in the immediate vicinity of plant roots. Rhizosphere

75. _____ is an association between fungi and plant roots which is usually symbiotic. Mycorrhiza
76. Two enemies of soil organic matter are _____ and _____ . erosion; excessive tillage; burning
77. _____ is the conversion of an element or compound from the inorganic to the organic form in microbial or plant tissues, rendering it not readily available, whereas _____ is the conversion from an organic to an inorganic form. Immobilization; mineralization
78. The name of the landfill in New York City that just closed down (except for the debris from the New York Trade Center Towers) is _____ . The state, that accepts a lot of garbage from New York as well as other places and has lots of undeveloped, inexpensive land in the middle of eastern seaboard, is _____ . Fresh Kills; Virginia
79. _____ is the living or dead plant and animal materials in the soil. Organic matter
80. The bacteria of the genus _____ live symbiotically in the roots of legumes. Rhizobia, rhizobia, or Rhizobium
81. The total amount of living organisms in a volume of soil is called _____ . biomass