Study Questions Exam 5

1. List three best management practices intended to reduce the loss of nutrients from agroecosystems.

   No problem.

2. Explain how buffer strips work.

   Runoff enters at higher velocity, which drops in strip. Therefore, suspended solids tend to settle in strip. Also, higher organic matter level in strip tends to retain a wide range of dissolve chemicals. Since the higher level of organic matter tends to support a larger population of microorganisms, the rate of decomposition of many chemicals is sped up.

3. List three benefits of cover crops.

   Better protection of the soil surface from raindrop impact also slower runoff so that erosion is lessened where these planted. Nutrient cycling through the planted cover crop may reduced leaching losses. If a N-fixing crop is used, there would likely be less N needed for the following cash crop. Others.

4. Give a benefit and disadvantage of organic fertilizers compared to inorganic fertilizers.

   Slow release character is perhaps a plus. They by definition add organic matter, with all the pluses that usually entails. On the other hand, slow release may be a disadvantage, particularly coupled with the fact that the concentration of targeted nutrients is comparatively (inorganic fertilizer) low, so that a much greater mass of the organic fertilizer is needed.

5. To what do the three numbers of a fertilizer grade, X - Y - Z, refer?

   % N - % P_2O_5 - % K_2O, of which there is 0 of the latter two, regardless of what the guarantee guarantees. Odd.

6. The grade of a fertilizer is 12 - 12 - 12. How many lbs of N, P and K are in a ton (2000 lbs) of it? Atomic weights of P = 31 g / mole, K = 39 g / mole and O = 16 g / mole (or use conversion factors if you remember these).

   See review for lab final.

7. Explain the von Liebig concept of a limiting factor.

   There is an optimum combination of light level, soil moisture level , available soil N level, etc. for which the genetic potential of species / variety X can be fully expressed. There is an infinitesimal likelihood that this combination exists. Thus, some and likely most of these factors are sub-optimal. The one that is lowest, relative to its optimum, controls plant growth and yield. It is the limiting factor.

8. To what do the plant analysis terms, "hidden hunger" and "critical concentration," refer?

The tissue concentration of nutrient element X may be low relative to what is optimum (see # 7), but not so low as to manifest deficiency symptoms. Growth is stunted but the plant doesn't look sick and malnourished. This is the condition of "hidden hunger" that can be identified by use of plant tissue analysis which, if done, would show tissue concentration of X lower than the "critical concentration" for normal or near (~ 90%) normal growth and yield.

9. Why are multiple random samples taken in soil sampling?

What do you think?

10. You want to take soil samples from a 80 acre field. Propose two different cases (combinations of different soils, previous cropping systems and / or fertilizer and lime programs) that would require you to submit samples from 6 different subareas.

Here's one possibility: In this ½ x ¼ mile tract, the upper 20 acres is a sandy loam, the middle 40 acre band is a loam, and the lower 20 acres that is crossed by a stream is a clay loam. Half the sandy loam is used for grazing and the other half is used for hay. The whole 40 acres of loam is used for hay and ½ of it was limed a couple of years ago. That's 5 at this point, and you see where it's going.

11. List three general ways in which fertilizer is applied. Give a situation in which each would be the rational choice.

Broadcast	--non-row crop and / or to uniformly raise fertility level
Localized	--like sub-surface band along row length to supply ample nutrient to a portion of the root system as with P, in which high concentration in the band maintains solubility and availability of this easily fixed element, or with N to limit potential volatilization, etc.
Foliar	--to supply a deficient nutrient in small quantity, as with micronutrients

12. Timing of fertilizer application is important. Do the below suggestions make sense? Why or why not?

To supply N, apply organic fertilizer well ahead of planting.

Yes, since this would tend to compensate for slow release, giving time for mineralization to occur.

Split application of N -starter and later second application.

Yes, since sometimes this is found to give better fertilizer use efficiency

13. The likelihood of a profitable response to fertilizer amendment is greatest if soil test levels are very low, low, medium, high or very high?

Very low. Make sense?

14. Why is the most economical rate of fertilizer application somewhat less than the rate required for maximum growth and yield?

Yield response to added fertilizer tapers off, costs of fertilizer rise linearly with amount applied. Thus, there is a point of diminishing returns.

15. Water erosion occurs because soil particles are detached, then transported. What causes detachment? What is the transport agent?

Raindrop impact. Runoff water.

16. List the three types of water erosion. Which are most damaging?

Sheet, rill and gully. The first two are responsible for most soil moved by water.

17. List the factors controlling water erosion.

Climate (rainfall characteristics, particularly, duration and intensity of storms and when in the year they occur, like whether more so in winter when the soil is less protected by canopy cover). Natural erodibility of the soil –fine sandy / silty soils being the most erodible since the typical particle size is small enough to be easily transported but large enough that they do not tend to form aggregated, larger bodies which would be less easily transported. Slope length and grade –more and faster, hence erosive, runoff for long, steep slope than short, flat run. Soil cover, i.e., C, crop and management factor, which sets the extent and quality of cover (canopy and residue) protecting the soil surface from the detaching effect of raindrop impact. Whether erosion control practices such as contour planting (of row crops), intermixed contour planting and strips of non-row crops, terraces, edge-of-field filter strips, and several engineered water flow control devices are used.

18. How do conservation tillage and cover crops limit soil erosion?

These decrease the C factor in USLE by helping protect the soil surface from the impact of raindrops.

19. What are three water erosion control practices? How does each work?

Contour planting of row crops breaks the downhill grade of water flow, with beds or even just rows of stems tending to hold up downhill flow of runoff, slowing it down so that it is less erosive and some of its suspended load tends to settle.

Intermixed strips along the contour act as in-field filter strips (see # 2).

Terraces break the length of slope and decrease the slope grade, therefore, decreasing the LS factor in the USLE.

20. Where is wind erosion typically a problem?

Where it is dry and windy.

21. List the three types of wind erosion?

Saltation –medium size particles, bouncing along carried a short distance by the wind

Suspension --small particles uplifted high and carried long distances (dust storm)

Soil creep --large particles swept short distances along the soil surface

The amount of soil transported in these forms decreases along the above sequence.

22. List the factors controlling wind erosion.

Somewhat analogous to water erosion, 1) climate (dry and windy), 2) soil erodibility (same size particles most subject to wind and water erosion), 3) vegetative cover (protection of surface from wind and soil-laden wind), 4) unsheltered length of field (openness means windiness, compare slope length for water erosion), and surface roughness (rough surface tends to better trap and retain soil particles that have been dislodged and are being moved by wind).

23. Which three of the above are subject management?

What do you think?

24. Erosion can destroy the productivity of soils and spoil water quality. So, too, can chemical pollution. Name a few soil pollution problems.

There are many.

25. When an organic contaminant is released into soil all of it does not stay there forever. What can happen to it? Specifically, list and describe those processes controlling its fate.

It may be: 1) volatilized and lost into the air where you can inhale it; 2) leached into groundwater bottled by Hole Foods and sold to you for drinking; 3) lost in runoff bottled by Hole Foods and sold to you as spring water for drinking (free from sediment bound contaminants, containing only dissolved forms), 4) adsorbed onto soil solids or precipitated (therefore restricting its loss in percolating water and in dissolved form in runoff, though not sediment-bound form in runoff), or 5) it can be degraded by biotic and abiotic processes.

26. The half-life of organic contaminant A in a soil is 100 days. The half-life of organic contaminant B in the same soil is 200 days. Assuming dissipation only by degradation, what fraction of the initial amount of A and B would remain after 400 days in this soil?

400 / 100 = 4 half lives gone through by A, leaving only $1/ (2)^4$ of it remaining. Similarly for B ($1/ (2)^2$).

27. A nasty mix of chemical A and chemical B are dumped on a field by an outlaw hazardous waste contractor. Contaminant A is strongly adsorbed onto soil colloids. Contaminant B is very weakly adsorbed. Both are very resistant to degradation. Three years later high concentrations of one of these chemicals is found in samples taken from a nearby shallow well. Which chemical is it and why?

B, it is much more mobile in the soil since it is much less adsorbed.

28. You are an outlaw hazardous waste contractor and have the choice of dumping your foul cargo on a silty clay loam soil or on a sandy soil. Although you are an environmental outlaw, you have some scruples. Being a little concerned about off-site movement, you decide to dump on which soil?

Silty clay loam, since adsorption of chemicals would be greater, and hydraulic conductivity lower (hence, reduced mobility based on chemical and physical properties of the silty clay loam compared to the sandy soil).

29. What's the difference between bioaugmentation and biostimulation?

Bioagumentation –fortify the soil with an organism that has a high capacity to degrade a target contaminant. Biostimulation –improve the chemical fertility of the soil to encourage larger numbers and activity of native organisms, tending to increase the rate of biodegradation.

30. In selecting a species for phytoremediation of a soil contaminated with heavy metals, what general characteristics of the plant are necessary?

You want a plant that has a high uptake rate (high tissue concentration) of the metal and that produces a large biomass since total mass in plant is tissue concentration x biomass. Harvest and remove.