

BIOL 695 Study Questions – Chaps 1, 2, 3

1. Comment on the veracity of the following statement:
The yield of sugar beets fertilized with NaCl was 20% greater than that of beets grown without NaCl fertilization; therefore Na and Cl are essential elements for the production of sugar beets.
2. What is the difference between a macronutrient and a micronutrient?
3. What are the 9 macronutrients required by plants?
4. What are the 7 micronutrients required by plants? Are there any other elements required by some species and not others?
5. What are the three criteria that plant nutrients must meet for them to be designated as essential?
6. Why is using visual deficiency symptoms not an absolute means to determine what type of fertilizer to add to cropland (or your yard)?
7. What is luxury consumption by a plant? What is the most important consequence of luxury consumption?
8. Imagine that you were provided an entire corn plant that was freshly dug from a field during the growing season and weighed 10 pounds.

How much of the plant would you estimate would be water?
How much of the plant would you estimate to be dry matter?
What minerals would you estimate to make up the majority of the dry matter.
9. How does the pathway traveled by ions from the root surface into the xylem differ between mature and immature portions of the root?
10. Soil analysis seems to be the most direct way to determine the nutrient status of soils. Comment on this statement.
11. What are the major factors that contribute to soil formation? Which is probably the most important?
12. Soil bulk density refers to : (a) fiber content; (b) weight per unit volume; (c) calcium content; (d) water content; (e) volume per unit weight.
13. Soils that hold fertilizers poorly when leached include(s)_____ soils. (a) organic; (b) clay; (c) sandy; (d) a + b; (e) b + c.

14. The inorganic (mineral) soil particle with the greatest cation exchange capacity is: (a) sand; (b) humus; (c) clay; (d) silt; (e) perlite.
15. Define and distinguish between passive and active nutrient uptake.
16. Describe one of the unique structural features of plant cell membranes.
17. Describe one of the mechanisms of ion transport through plant membranes.
18. What are some of the more important energy carriers in plant cells?
19. What is (are) the major product(s) of the processes of the Calvin Cycle?
20. Are there any characteristics common to the mycorrhizal fungi and *Rhizobium* bacteria? If so, explain.

BIOL 695 Study Questions Chaps 4, 5, 6

1. Discuss the relative order of the water potential gradient of: leaf cells, root cells, xylem sap, atmosphere, external soil solution.
2. Explain the process of osmosis in terms of water potential.
3. Describe/explain the concept of the Soil-Plant-Atmosphere Continuum. Be concise and answer within the allotted space.
4. How can the boundary layer of air around leaf surfaces affect transpiration? What may cause differences in the boundary layer of air around leaf surfaces of different plant species?
5. What may be the result of high evaporation rates when the high concentrations of solutes are transported to the leaves?
6. Which nutrients are considered mobile within the plant? Which nutrients are considered immobile?
7. What may result from excessive nutrient remobilization in plants?
8. What are the major growth stages and the characteristics of each stage?
9. Why is it important to match the nutrients supplied to plants with the major growth stages?
10. What are growth regulators? What are the major uses of growth regulators?
11. Explain the concept of the "Law of Minimum" or "Law of Limiting Factors."
12. Discuss some examples of how improper nutrition affects plant quality.

13. Explain the concept of nutrient cycling. What is its importance from a (a) horticultural and an (b) environmental standpoint?
14. Which nutrients are most likely to be lost via leaching? Which from volatilization processes?
15. What is the relationship between soil erosion and soil nutrient loss?
16. What are the advantages of the use of mineral fertilizers? Disadvantages?
17. How can leaching losses of mineral fertilizers be reduced?
18. What are some advantages and disadvantages of liquid fertilizers?
19. What is the primary mechanism for entry of foliar-applied into the plant cells?
20. Discuss the importance of nutrient ratios of applied fertilizers.
21. What do you think is the greatest challenge to continually increasing crop production in the 21st Century?
22. What is the major problem for ground water and drinking water relative to agricultural and horticultural practices?

BIOL 695 Exam 3 Study Questions (Ch 7-12)

1. Briefly describe root nodule formation by Rhizobium bacteria, from initiation to nodule completion.
2. What are the major effects of nitrification on the soil environment?
3. What can be done to slow the process of nitrification? Is this desirable?
4. Discuss inorganic nitrogen transformations and translocation within plants.
5. From an energy standpoint, does it make any difference if nitrate is reduced in the root of shoot?
6. What are the major visible nitrogen deficiency symptoms? What is the underlying physiological reason for each visible symptom?
7. How should the application of nitrogen fertilizers be managed on different soil types?
8. What factors should guide the amount of nitrogen fertilizer applied?
9. How important is soil organic matter as a significant reservoir for soil sulfur?

10. What factors affect the uptake and translocation of sulfur?
11. Describe the most important metabolic functions of sulfur.
12. What are the physiological effects of sulfur deficiency?
13. Are sulfur toxicity responses by plants common? Under what conditions might toxicity symptoms occur?
14. Is sulfur commonly applied as a fertilizer? Where does most of the sulfur utilized by plants originate?
15. Discuss/describe the major phosphorus soil fractions.
16. Discuss reactions of phosphorus forms in the soil.
17. Does the mechanism of phosphorus uptake by plant roots differ from other nutrients? How?
18. What is the importance of mycorrhizal fungi to the uptake of phosphorus?
19. Discuss absorption and translocation of phosphorus forms by plants.
20. What are the most important physiological roles of phosphorus?
21. How does a deficiency of phosphorus affect the physiology of plants?
22. What soil reactions occur for phosphate fertilizers that are unique and do not occur for other nutrients?
23. What soil minerals contain significant amounts of potassium?
24. Describe the process of potassium fixation by soil clays. Is this process important to K fertilization of crops?
25. Describe some of the more important functions of K in plants.
26. How is the K content in plants important to photosynthesis?
27. Describe the role and behavior of K in the regulation of stomatal movement.
28. What structural member of plants is necessary for K efflux during stomatal regulation?
29. How does the soil type guide the amount of K fertilizer to apply?
30. How may nitrogen fertilization affect the soil Ca?

31. What is a major reason to maintain relatively high Ca concentrations in soils, in addition to direct plant needs for Ca?
32. Describe any plant characteristics that limit the uptake of Ca.
33. Describe Ca transport and translocation within the plant.
34. Discuss the most important physiological functions of Ca in plants.
35. What internal physiological functions of plants are affected by Ca deficiency?
36. What external symptoms of Ca deficiency may be seen?
37. How may the addition of a Ca compound reduce the exchangeable Al in soils? Name a Ca compound that will have little effect on exchangeable Al.
38. How can the soil type be a general guide to the amount of lime that will need to be added to the soil?
39. Describe the distribution of Mg in soil fractions.
40. Compare the uptake of Mg to that of Ca and K with respect to soil solution concentrations and plant absorption.
41. Describe the major biochemical functions of Mg.
42. Describe/discuss the major physiological effects of Mg deficiency in plants.
43. What are the major visible symptoms of Mg deficiency?
44. Under what soil conditions are Mg deficiencies likely to occur?
45. What is the most commonly applied source of Mg to soils? What are some other Mg fertilizers. Discuss application strategies for Mg on sandy soils for crops with high Mg requirements.

BIOL 695 Exam 4/Final Study Questions (Ch 13-20)

1. Iron is a major element in the earth's crust. Why are there often problems with Fe crop deficiencies?
2. What is the most common form of soil Fe?
3. How do Fe forms respond to changes on the redox potential?

4. What mechanisms have been developed by plants to enhance uptake of Fe?
5. Discuss uptake, transport and translocation of Fe within plants.
6. Describe the most important biochemical functions of Fe in plants.
7. What is the role of Fe in photosynthesis?
8. Describe the pattern of Fe deficiency symptoms in plants.
9. What are the physiological responses to Fe deficiency?
10. Discuss/describe lime induced chlorosis of Fe deficiency.
11. What are the most effective forms of Fe fertilizers?
12. Why are inorganic salts mostly ineffective as a source of Fe for plants?
13. What soil conditions could lead to Mn deficiency in plants?
14. Discuss the primary plant biochemical functions of Mn.
15. Describe the primary deficiency symptoms for Mn.
16. Describe the primary symptoms of Mn toxicity.
17. How does toxic concentrations of Mn affect the biochemical functions of other elements?
18. Discuss how the steam sterilization of greenhouse soils affects the soil reactions and plant availability of Mn.
19. Discuss the uptake and plant transport of Zn.
20. Discuss some of the primary functions of Zn in the plant.
21. How is Zn involved in protein synthesis?
22. How does Zn deficiency affect plant biochemical reactions?
23. Discuss the primary soil conditions that affect the (soil) chemistry of Cu?
24. What soil conditions could cause plant deficiency of Cu?
25. How is Cu involved in the lignification of wounds in plants?

26. How does Cu deficiency affect pollen formation and development?
27. What factors/conditions affect the remobilization of Cu in plants?
28. Mechanisms of Cu tolerance by plants are also the same as for other trace elements. Discuss some of these mechanisms.
29. What are the primary plant functions of Mo?
30. How is Mo important in nitrogen reactions in plants?
31. Discuss the deficiency symptoms of Mo in plants. What other element do these symptoms most resemble? Why?
32. Discuss the primary biochemical functions of B in plants.
33. How does B deficiency affect transport within plants?
34. Discuss the retranslocation and remobilization of B in plants.
35. How does B content of plants affect phosphorus uptake?
36. How is B important for pollen formation in plants?
37. What soil conditions favor B deficiency in plants?
38. What nutrient has chemical properties similar to I and Br? Are there any problems associated with toxicity's of I and Br? Explain.
39. What is the mechanism of F toxicity to plants? Where is toxicity due to F likely to occur?
40. What is the major effect of Al on the soil system? What is its major effect on (1) plants and (2) other organisms?
41. How do excess concentrations of Al affect plants?
42. What is the most effective means of controlling Al toxicity/
43. What unique conditions are associated with the occurrence of Se in soils?
44. What are the major sources of Pb in the environment?
45. What are some management techniques to minimize uptake of Pb by plants and animals?
46. Which of the non-nutritive trace elements poses the greatest environmental threat? Why?