PLSC 210-Horticulture Science Name_____
Fall Semester, 2003
Exam III

I. Essay Questions (*5 points each*)

1. The thermal properties of air as influenced by temperature and relative humidity (RH) are illustrated by a psychrometric chart (see attached). Using the chart, answer the following questions:

   a. Contrast "dry-bulb" temperature and "wet-bulb" temperature.

   b. Define "heat of vaporization" and give a reason why the difference between dry-bulb temperature and wet-bulb temperature for an ambient air becomes greater as the relative humidity (RH) decreases.

   c. You have a greenhouse in Chicago, IL, and your brother also has a greenhouse in Las Vegas, NV. Given the predominant temperature and relative humidity conditions for Chicago (80 °F dry-bulb, 80% RH) and Las Vegas (105 °F dry-bulb,10% RH) for a typical summer day, find out who (you or your brother) can grow better-quality carnation flowers using an evaporative cooling system in the greenhouse and explain the reason why? Remember that carnation is a cool-temperature crop, requiring 70 °F or lower temperatures for high quality flower production.

2. Contrast "frost pocket" and "thermal belt" with an illustration and show where a deciduous fruit orchard should be located. Provide reasons for your decision.

3. What causes the onset of "physiological" seed dormancy and "physical" seed dormancy? Discuss ways by which each of the two types of seed dormancy can be overcome.

4. Demonstrate how organic matter is broken down and converted into ammonium, nitrite, and then finally nitrates during soil nitrification. Include the sequence of events taking place, showing the kinds of soil microorganisms involved in each step.

5. Answer the following questions relating nitrogen and iron deficiency symptom development in plants:

   a. What symptoms are similar for nitrogen and iron deficiencies?

   b. How can you distinguish deficiency symptoms for N and Fe?

   c. Explain the reason why such difference occurs, indicating the mobility of each in plant tissues.

II. Short Answers

1. If your orchard located in a "frost pocket" is in danger of being frozen due to cold air drainage, what can you do to protect your fruit trees from cold damage? (*3 points*)

   _____
   _____
   _____

2. List four most important environmental parameters that affect plant growth and performance in a controlled environment agriculture (CEA) system: (*3 points*)

   a._____ b._____
   c._____ d._____

3. Why is a commercial apple cultivar like 'Golden Delicious' propagated vegetatively, not by seed? (*2 points*)

   _____
   _____

4. List three reasons why most vegetable and flower seeds are produced in the western states of the U.S.? (*3 points*)

   a._____
   b._____
   c._____

5. What is meant by seed priming and why is it used? (*2 points*)

_____

_____

6. For woody plants, a proper union of the rootstock and the scion is required fora successful graft. List three essential requirements for successful graft and give reasons for your choice: (*2 points*)
   a._____
   b._____
   c._____

7. List the names of the six macronutrients and seven micronutrients that are essential for plants: (*4 points*)
   a. Macronutrients: _____
   b. Micronutrients: _____

8. The commercial analysis of a fertilizer shows percent weights of nitrogen (N), phosphorus (P_2O_5), and potash (K_2O) in that order, while an elemental analysis indicating percent weights of elemental nitrogen (N), phosphorus (P), and potassium (K) in the same order. If you bought a 50-lb bag of 20-20-20 commercial analysis fertilizer, your fertilizer bag would contain: (*4 points*)
   (Conversion factors: $P/P_2O_5 = 0.44$, $K/K_2O = 0.83$)

   a. (including oxides): _____ lb N, _____ lb P_2O_5, and _____ lb K_2O (per 50-lb bag).
   b. (elemental basis): _____ lb N, _____ lb P, and _____ lb K (per 50-lb bag).

   (*Show calculations*)

9. Explain the reason why chloride (Cl^-) as a micronutrient is never applied to crops: (*2 points*)

_____

_____

10. What meant by "chelate" and why are certain nutrients applied to plants as chelated forms? (*2 points*)

_____

_____

_____

III. Multiple Choice/Matching/True and False (*2 points each*)

1. Super-cooling of the cytoplasm (the living portion of cell content) and intercellular water is a prerequisite for the survival of evergreen trees during sub-zero temperatures. When tissues are super-cooled, the cytoplasm and intercellular water:

   a. are mostly evaporated.
   b. are completely frozen.
   c. stay in aqueous condition without ice crystal formation.
   d. actively diffuse solutes into adjacent tissues.

2. Heat loss from a tightly sealed greenhouse is likely to occur due to:

   a. heat energy transfer to outside by convection.
   b. transfer of heat by conduction through glazing (cover) material.
   c. heat of vaporization.
   d. dispersal of the heat of fusion on the surface of the glazing material.

3. When water freezes, it will:

   a. release heat to the surrounding (heat of fusion).
   b. absorb heat from the surrounding (heat of vaporization)
   c. lower the dry-bulb temperature.
   d. raise the relative humidity (RH) in the air.

4. Match each of the following terms with a correct definition for underground plant structures:

   ____ Corm ____ Rhizome ____ Tuber
   ____ Bulb ____ Tuberous root ____ Stolon

   a. An underground, horizontal stem usually producing roots and shoots at the notes
   b. A short underground stem that is covered by fleshy, enlarged leaf bases containing stored food
   c. An enlarged, short, flesh underground stem
   d. An enlarged or swollen root that was developed originally as a fibrous root
   e. A horizontal stem that grows along the ground surface, often producing roots and shoots at the nodes
   f. The swollen base of a stem that is covered with dry papery leaves

5. The “embryo rescue” method of propagation is used to obtain plants of interspecific (between species) crosses, in which the zygotic embryos are naturally destined to abort. The incidents of zygotic embryo abortion will be higher in intraspecific (within species) crosses than in interspecific crosses.

   a. Both statements are true.
   b. The first statement is true and the second statement is wrong.
   c. The first statement is wrong and the second statement is true.
   d. Both statements are wrong.

6. Plants grown from apomictic seeds are genetically identical to:

   a. the pollen parent.
   b. the seed parent.
   c. an hybrid between the pollen and seed parents.
   d. neither the pollen parent nor the seed parent.

7. Double-eye nodal cuttings can be used for both opposite leaved and alternate leaved woody plants.

   a. True
   b. False

8. Which of the following chemicals is a growth regulator commonly used to stimulate root initiation on woody plant cuttings?

    a. Benzyl adenine (BA)
    b. Naphthaleneacetic acid (NAA)
    c. Colchicine
    d. Indolebutyric acid (IBA)

9. A chimeric plant is composed of genetically dissimilar tissue sectors. Grafted plants are good examples of chimeras.

    a. Both statements are true.
    b. The first statement is true and the second statement is wrong.
    c. The first statement is wrong and the second statement is true.
    d. Both statements are wrong.

10. Which of the following growth regulator combinations in the medium would stimulate multiple shoot formation from a shoot tip cultured in vitro?

    a. High concentrations of cytokinin and auxin
    b. High concentration of cytokinin plus low concentration of auxin
    c. Low concentration of cytokinin plus high concentration of auxin
    d. Low concentrations of cytokinin and auxin

11. Adventitious shoots and roots develop from any plant parts other than shoot or root primordia. When a potato tuber is planted, it will produce adventitious shoots from eyes.

    a. Both statements are true.
    b. The first statement is true and the second statement is wrong.
    c. The first statement is wrong and the second statement is true.
    d. Both statements are wrong.

12. Which of the following grafting methods can best be used when one wants to change an existing old apple cultivar to a new one on a well established tree?

    a. Bridge graft
    b. Inarching
    c. Topworking
    d. Side graft

13. Which of the following fruit crops can best be propagated by hardwood cuttings?

    a. Apple
    b. Peach
    c. Grape
    d. Pear

14. Phosphorus (P) is absorbed by plant roots as a(n) (____ cationic, ____ anionic) form. (Check one)

15. Which of the following microorganisms can fix atmospheric nitrogen into useful forms of nitrogen for plants by establishing a mutually beneficial symbiotic relationship?

    a. Nitrobacter
    b. Rhizobium
    c. Azotobacter
    d. Actinomycetes

16. Nitrogen is absorbed by plant roots in two different forms: ammonium (NH_4^+) and nitrate (NO_3^-). The nitrate form of nitrogen (NO_3^--N) can easily be leached out of soil into groundwater or nearby streams, because:

    a. most soils are high in cation exchange capacity (CEC) repelling anions.
    b. nitrate is heavier than ammonium.
    c. most soils are high in anion exchange capacity (AEC), repelling cations.
    d. plants prefer ammonium form of nitrogen (NH_4-N) to nitrate form of nitrogen (NO_3-N).

17. A late application of nitrogen for tomato plants is not recommended, because:

    a. it increases the C/N ratio, enhancing flowering and fruit development.
    b. it decreases the C/N ratio, delaying flowering and fruit development.
    c. of high incidents of disease development following N fertilization.
    d. such a practice encourages development of blossom-end rot.

18. Given that the atomic weight of nitrogen (N) is 14 and the molecular weight of nitrate (NO_3^-) is 62, which of the following fertilizer solutions would contain the highest concentration of N?

    a. 200 ppm nitrogen (N)
    b. 10 mM nitrogen (N)
    c. 10 meq/liter NO_3^- solution
    d. 620 ppm NO_3^- solution

19. Which of the following macronutrients is essential for the development of aromatic compounds and pungency in plants?

    a. Calcium (Ca)
    b. Sulfur (S)
    c. Potassium (K)
    d. Phosphorus (P)

20. Which of the following is **NOT** true for the function of potassium (K^+) as a macronutrient for plants?

    a. It affects membrane function and integrity.
    b. It regulates the opening and closing of guard cells on stomata.
    c. It influences water movement across tissues.
    d. It is structural component of many enzymes.

21. Magnesium (Mg) is a core component of chlorophyll molecule. Magnesium deficient plants develop interveinal chlorosis more on the mature leaves than the new leaves. From these two statements, one can conclude that:

    a. magnesium is needed for greening of the leaves and it is highly mobile in plant.
    b. magnesium deficiency produces a similar symptom as iron (Fe) deficiency.
    c. magnesium is immobile in plant tissues.
    d. light intensity influences the development of magnesium deficiency symptoms.

22. The "blossom-end rot" of tomato is a typical symptom for:

    a. calcium (Ca) deficiency.
    b. magnesium (Mg) deficiency.
    c. potassium (K) deficiency.
    d. nitrogen (N) deficiency.

23. Ornamental plants grown in high pH soils often develop iron (Fe) deficiency symptoms. Which of the following Fe fertilizers would be considered the best for correcting iron chlorosis on plants grown in high pH soils (greater than pH 8.0)?

    a. Fe-EDTA (Fe-330)
    b. Fe-EDDHA (Fe-138)
    c. Ferrous sulfate ($FeSO_4 7H_2O$)
    d. Ferric sulfate ($Fe_2(SO_4)_3 4H_2O$)

24. A fertilizer solution containing 200 ppm N has been used to grow your chrysanthemum plants in the greenhouse. If you are asked to prepare 100 liters of a nutrient solution containing 200 ppm N, how much 20-20-20 (commercial analysis) fertilizer should you use?
    (*Note: 1 ppm = 1 mg/lite; 1 g = 1,000 mg; 1 liter water = 1 kg = 1000 g = 1,000, 000 mg*)

    a. 200 g
    b. 100 g
    c. 50 g
    d. 10 g

25. Which of the following hydroponic culture systems, is the nutrient solution retrieved and recirculated?

    a. The open system
    b. The closed system
    c. Aeroponic system
    d. Aggregate culture system

26. (**Bonus Question**) Ask a question of your own from topics you have studies but not covered in this exam and answer it correctly. (*5 points*)

Honor Pledge: *Upon my honor I have neither given nor received aid in writing this examination.*
*Signed*_____