This unit of instruction was designed as a laboratory study of soils, plants, crop improvements and pesticides, and gives consideration to fish farming, tropical fish, and careers in agriculture. The booklet lists the relevant state-adopted texts and states the performance objectives for the unit. It provides an outline of the course content and suggests experiments, guest speakers, field trips, and topics for student projects, discussion questions and reports. Also listed are relevant films and filmstrips available from the Dade County Audiovisual Center. Reference books and other course materials are recommended, and a master sheet is provided relating each suggested activity to the specific performance objectives. (JR)
AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

AGRICULTURAL BIOLOGY
5314.09
SCIENCE
(Experimental)
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SCIENCE
(Experimental)

Written by Fred D. Basnett
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1972
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AGRICULTURAL BIOLOGY

COURSE DESCRIPTION

Laboratory study of soils, plants, crop improvements, and pesticides. Fish farming, tropical fish and careers in agriculture are included.

Rationale

Agriculture is a most important facet of our daily life. Food science and productivity increases are becoming more and more significant for our survival now and in the future. There are many areas of influence in the school and out that are available for the student who wishes to pursue a career in agriculture or simply to become more informed in the science. Soil science, meteorology, crop raising, pesticides, horticulture, food distribution, migrant labor, world supply and demand are only some of the important areas to consider. A greater understanding of some of the methods used in agriculture and the increasing awareness of the population problems may assist the student to make some contribution to our society through agriculture.

ENROLLMENT GUIDELINES

This course is designed for the terminal student either as a part of the basic biology requirement or as an interest course. The slow reader should be encouraged to take this course.

STATE ADOPTED TEXTS

The nature of the course is orientated toward involvement through experimentation and practical experiences. There is no state adopted text available.

The following books contain many relevant areas for study:

STATE ADOPTED TEXTS (Continued)


PERFORMANCE OBJECTIVES

1. Given three different soil samples, the student will describe two different characteristics of each.

2. The student, given a soil sample will analyze this sample for a pH reading to within one unit of measurement.

3. The student will discuss coordinates on a graph plotted from results of collected data of rainfall for a four week period.

4. Given the seal of chemical concentrations from a bag of fertilizer, the student will describe the characteristics of the soil to which this particular fertilizer should be added.

5. The student will collect data from the measurement of at least two types of seeds germinating in a germination plate, and prepare a graph showing growth rates.

6. Given three different examples of basic flower types, the student will predict the type and appearance of the seeds that will be produced.

7. Given mixed examples of fruit and vegetables, the student will categorize these according to fruit, vegetable root, stem or seed mass.

8. Given the necessary materials, the student will perform at least two grafting and budding operations on selected plants.

9. The student will, after collecting several different types of insects, separate them into groups according to their basic wing structure.
PERFORMANCE OBJECTIVES (Continued)

10. Given several examples of agricultural pests, the student will describe the economic problems related to their control.

11. Having visited a local nursery or school agricultural farm, the student will cite selected methods involved in the growing and marketing of landscape plants.

12. Given several major agricultural crops, the student will discuss their economic value in terms of labor problems, machinery needed, shipping procedures and disease problems.

COURSE OUTLINE

1. Soil Types and Agricultural Importance
   A. Distribution
   B. Characteristics
      1. Horizons
      2. Structure and size
      3. Porosity and leaching
      4. Zones of accumulation
   C. Limiting factors
      1. Chemistry
         a. pH
         b. Nitrogen
         c. Potassium
         d. Potash
         e. Trace elements
      2. Environmental considerations
         a. Temperature
         b. Rainfall
         c. Salt intrusion
         d. Fire
         e. Irrigation
         f. Pesticides residuals
         g. Decomposition
COURSE OUTLINE (Continued)

II. Economically Important Crops and Livestock

A. Citrus
   1. Commercial importance
   2. Home grown and use

B. Vegetables
   1. Commercial importance
   2. Home gardening

C. Timber
   1. Forest products
   2. Farm and home stocking
   3. Seedling availability and distribution

D. Nursery Stock
   1. Landscaping
   2. Growing techniques
      a. Grafting
      b. Budding
      c. Air layering
      d. Vegetative propagation

E. Livestock
   1. Types
   2. Commercial importance
   3. Car

III. Pests

A. Plant
   1. Rusts
   2. Smuts
   3. Wilts
COURSE OUTLINE (Continued)

4. Molds

5. Programs of eradication
   a. Quarantine
   b. Competition
   c. Removing intermediate hosts
   d. Field techniques

B. Animal

1. Insects
   a. Economic importance
   b. Pesticide and pollution
   c. Life cycles
   d. Identification
   e. Eradication programs

2. Nematodes
   a. Economic importance
   b. Identification
   c. Eradication techniques

IV. General Agriculture

A. Department of Agriculture

1. Extension services

2. Fish and wildlife service
   a. Farm ponds
   b. Fish farming
   c. Wildlife management

3. Seedling distribution programs

B. Educational agriculture and vocations

1. Extension services

2. County agent program

3. School agricultural farms
COURSE OUTLINE (Continued)

a. Garden clubs
b. 4-H clubs
c. FFA organizations

4. Conservation organizations

a. Sportsmen's clubs
b. Audubon society
c. Bird sanctuary programs
d. Izaac Walton league

C. Legislation and budget

1. Farm representation in legislature
2. Marketing techniques

EXPERIMENTS

1. Diversity Among Angiosperms (Ex. 5.2, p. 92)
2. Vegetative Reproduction: Regeneration, Plant (Ex. 15.4, p. 284)


4. Root Growth (Ex. 15, p. 41)
5. Cleft Grafting (Ex. 19, p. 51)
6. Root Cuttings (Ex. 21, p. 55)
7. Light Exercise (Ex. 1, p. 5)
8. Moisture (Ex. 2, p. 7)
9. Temperature (Ex. 3, p. 9)


10. Soil Texture (Ex. 5, p. 17)
11. How to Make a Miniature Soil Profile (Ex. 9, p. 39)
12. Soils are Different (Ex. 10, p. 45)
13. Soil Moisture (Ex. 13, p. 57)
14. Infiltration Rates of Soils (Ex. 14, p. 63)
15. Operation of Tensiometers (Ex. 19, p. 77)
16. Measuring Acidity and Alkalinity (Ex. 27, p. 125)
17. Saline and Alkaline Soils (Ex. 28, p. 131)
18. Sources of Nutrients (Ex. 29, p. 133)


19. Portrait of a Plant (Ex. 21, p. 177)
20. The Higher Plant--Basic Design of Organs (Ex. 22, p. 187)


21. Soil Organisms (Ex. 3, p. 19)


22. Producing More Potatoes (Ex. 21, p. 195)
23. Vegetative Reproduction (Ex. 21, p. 199)

PROJECTS

1. Obtain copies of various soil maps from the U. S. and/or Florida Department of Agriculture and make a survey of different types of soils found in South Florida and more particularly Dade County. Attempt to describe which soils are best for growing particular vegetable crops.

2. Collect several soil samples from various parts of the county. Weigh 100 grams of each and place in small containers such as Dixie cups. Add exactly the same amount of distilled water to each sample to obtain a "soupy" texture. Place a small piece of pH paper into the mixture and record the results in a notebook. Use at least a minimum of 25 samples. Do the pH readings change in different parts of the county? If so, why?
3. Develop a study of rainfall distribution in South Florida by using data from the U.S. Weather Bureau and the local newspapers. How does the South Florida Flood Control District attempt to "balance" the yearly rainfall? Locate the flood control conservation areas and drainage canals on a map. What differences should you expect if there were no conservation areas or irrigation and drainage canals?

4. Make a survey of several "outlets" for commercial fertilizers, and accumulate records as to the substances in each of the great variety of fertilizers. Find references as to what each of the three major components of the fertilizers does toward the total growth of a typical plant. Add to this research a sampling of plants that require different concentrations of chemicals for particular maximum growth and production rate.

5. Grow 12 or 15 seedlings to about 3 to 5 inches. Place these in three groups. Apply ¼ cup of 6,6,6 fertilizer around each seedling, approximately ½ inch from the base of the stem. Do not water group one at all. Add ½ cup of the same fertilizer to the second group and water moderately until the ground is continually damp. Repeat this test with group three and flood the plants each day. Record the results on a long term graph and attempt to find the optimum growth rate over a period of three or four weeks.

6. Collect at least five different flowers that will produce or have produced seeds and/or fruit. Review the types of reproduction and seed production capacity of a variety of flowers. Attempt to tell if each flower is a pistillate or staminate flower.

7. Make a study of edible fruits and vegetables. Taking at least thirty such examples, determine if the food comes from the flower, stem, or root. Determine which part of the plant is the major food producer.

8. Read information about different types of grafting and/or visit a nursery if a demonstration can be arranged. Make a series of sketches of the different types of grafting. Attempt a graft on a plant such as a rose or fruit tree. Also, produce a new plant by "air-layering."

9. Construct a nematode trap, learning the techniques for collecting and counting these worms. Study their typical life cycle, methods of obtaining food from vegetation and the resulting damage. What are some of the methods of control for this economically serious pest?

10. Visit a branch office of the Department of Agriculture, Seventh Avenue and 27th Street, Miami, Florida. Survey some of the many programs they support. They offer many brochures. Collect any brochures that may interest you.
PROJECTS (Continued)

11. Make a study of the deaths of people in the U.S. resulting from misuse of pesticides in agriculture. What are some safeguards employed by people who continually use these poisons?

12. Read selected portions of Rachael Carson's *Silent Spring* and summarize the effects of various pesticides used in agriculture in the U.S. List and describe the various side effects to other plant and animal life and attempt to explain how each upsets the ecological balance of an established area.

13. Diagram and explain how a plant is able to take water into its system. Study the terms of osmosis and diffusion. Relate how these apply to the water intake process.

14. Diagram and explain how ground water in soil is a result of several physical factors including adhesion, cohesion, hydrostatic forces and capillarity. Explain the importance of the water table in agriculture and how the water table may vary with poor irrigation practices.

DISCUSSION QUESTIONS AND REPORTS

1. What are the basic ingredients in a typical soil? How may these various substances be categorized to classify a particular soil type?

2. What is meant by "zones of leaching"? Soil horizons?

3. How does the level of the ground water table influence growth rate and abundance of vegetation endemic to that region?

4. Erosion of soil is a serious problem in the basic environment, particularly with reforestation problems and certain kinds of agriculture. What are some positive soil management techniques that make this problem less serious?

5. What is meant by "annual rainfall"? What are some of the local and statewide environmental conditions that determine the amounts and distribution of rainfall?

6. If a person overfertilized a plant but gave it sufficient water, it is likely to die. What is the basic reason for the dehydration of that particular plant?
DISCUSSION QUESTIONS AND REPORTS (Continued)

7. What are some of the components of fertilizers? What do the various groups of three numbers actually mean with relation to nutrient requirements?

8. What are some of the reasons that plants can grow in certain areas and not in others? What are some of the specific limits of the environment that restrict distribution and growth?

9. What are the different parts of a typical seed and what is the function of each part?

10. Discuss some of the specific differences between the seed and the growing sprout of monocots and dicots.

11. Why will seeds germinate in a warm environment and actually grow for some time in the absence of light? Why would they eventually die without sunlight?

12. What are the various parts of a typical flower? What function would each part have toward the entire flower? What is the difference between an incomplete and a complete flower? A staminate and a pistillate flower?

13. What are the substances that produce the color in many flowers? Why do you think flowers have colored petals?

14. Why are fruits and vegetables classed as such? What are some of the more prominent foods from plants and what part of the plant do they come from?

15. Seed pods assume many different forms. What are some of the unusual types of seed pods and how does seed dispersal occur?

16. Describe or sketch various methods by which plant grafting is accomplished. What would the benefits be for each particular type of grafting?

17. The citrus industry could never exist without the practice of grafting certain type branches and budding areas to a particular type stock. What are some of the problems that make this practice necessary?

18. Compare basic mouth parts of several different insect types. How is each adapted for the insect to take food? What are some of the more economically destructive insects in agriculture? How, specifically, do they cause a problem?
DISCUSSION QUESTIONS AND REPORTS  (Continued)

19. Life cycles of insects vary. Relate some of these cycles and the portion or portions of each cycle to actual agriculture damage.

20. It seems necessary to continually increase the strength and distribution of pesticides. How can the use of pesticides, even with careful control, disrupt our normal environment?

21. What are some of the eradication methods used against infestation of agricultural crops, particularly for an epidemic or invasion from other areas?

22. Why is it necessary at times to quarantine plants, not allowing them to be transported from state to state? Why, occasionally, is there an embargo placed on citrus shipments from Florida?

23. What are some of the projects students are doing at the school agriculture farm? What are some of the problems a student encounters if he is raising plants to sell commercially?

24. The migrant labor force is a great social and economic problem. What are some of the specific problems for the local government and more important, to the migrant individuals?

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Acid-Base Indicators  
   1-10799, 19', C, JS

2. Climate and the World We Live In  
   1-11007, 14', C, EJ

3. Conserving our Water Resource Today  
   1-00426, 11', C

4. Conserving our Forests Today  
   1-03767, 11', C

5. Adaptations in Plants  
   1-11107, 13', C, EJ

6. Adventures in Conservation  
   1-10218, 13', C, EJS

7. Alaska's Modern Agriculture  
   1-12313, 15', C, JS
FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER (Continued)

8. Corn Farmer
   T-11490, 17', C, EJS

9. Dairy Industry
   T-03893, 11', B/W, EJS

10. Insect Collecting
    T-11155, 14', C, EJS

11. Insect Enemies and Their Control
    T-02765, 11', C, EJS

12. Insect Life Cycle
    T-02787, 11', B/W, JS

13. Leaves
    T-02262, 10', B/W, EJS

14. Microscope, The
    T-02241, 11', C, S

15. Mountain Waters
    T-11439, 16', C, EJS

16. Origin of Weather
    T-30376, 26', C, EJS

17. Our Natural Resources
    T-00417, 10', C, EJS

18. Plant Reproduction
    T-30649, 28', C and B/W, S

19. Realm of the Wild
    T-30686, 30', C, EJS

20. Regulation of Growth
    T-30469, 28', C and B/W, S

21. Roots of Plants
    T-02320, 11', C, EJS

22. Seed Dispersal
    T-02293, 11', B/W, JS

23. Story of Sugar
    T-04063, 11', B/W, EJ
24. Story of Soil, The
   T-03718, 11', B/W, JS

25. Water and the Land
   T-03587, 11', C, EJS

26. Careers in Agriculture
   T-10327, 14', C, JS

FILM STRIPS

1. Introduction to the Microscope
   A448-1 SVE Films

2. Acid-Base Theories
   636, FOM Filmstrip of the Month Club

3. Hormone Control of Insect Development
   1571, Popular Science Audio-Visual Inc.

4. The World of Insects: Insects that Destroy Plants
   Eye-Gate House, Inc.

5. The World of Insects: Household Pests
   Eye-Gate Films

6. The World of Insects: The Mosquito
   Eye-Gate Films

7. The World of Insects: Some Useful Insects
   Eye-Gate House.

   Eye-Gate House

   Eye-Gate House.

10. Understanding Weather Conditions
    Popular Science A/V Publications

11. Solar Radiations
    681, Popular Science A/V Publications

12. Life in the Soil
    1549, FOM Filmstrip of the Month Club
FILM STRIPS (Continued)

13. Methods of Identifying Trees
   FOM Filmstrip of the Month Club

14. Structure of Flower Plants
    A465-2, SVE Films

15. What Makes Up a Flower Family
    A465-1, SVE Films

16. Forest Fires
    A429-9, SVE Films

17. Aiding Wildlife of Field and Stream
    A429-7, SVE Films

18. How Man Destroys Soil
    A429-2, SVE Films

19. Controlling Erosion in Fields and Woods
    A429-3, SVE Films

20. How Hormones Regulate Plant Growth
    171726, McGraw Hill Book-A Popular Science Filmstrip

21. Insects, Part VI
    LIFE Filmstrip

22. Plant Factories
    A427-12, Harper and Row

23. The Life Cycle of Rivers
    FOM Filmstrip of the Month Club
GUEST SPEAKERS AND FIELD TRIPS

1. Department of Agriculture
   2690 N. W. 7th Avenue
   Miami, Florida - or -

   1102 N. Krome Avenue
   Homestead, Florida

2. Extension Forester
   Division of Forestry
   6531 State Road 84
   Fort Lauderdale, Florida 33314

3. School Agriculture Farms

4. Florida Tropical Experiment Farm
   Punta Gorda
   Speakers on request

5. Customs Agencies
   Quarantine Laws

6. Garden Club Lecturers

7. Agricultural Research and Education Center
   (Formerly the Sub-Tropical Experimental Station)
   Homestead, Florida

8. Extermination Companies

9. Local Nurseries

10. Citrus Growers
REFERENCES


REFERENCES (Continued)


REFERENCES (Continued)


MATERIALS LIST


2. One rain gauge.

3. Ten thermometers, medium range.


6. Aneroid barometer.

7. Dew Point apparatus.

8. Triple beam balances, 6.


10. Soil types and distribution maps, Florida Department of Agriculture.

11. Charts of reforestation techniques, pulp and paper companies.


14. Portable pH meter, if available.

15. Available seeds for coleoptile growth, 10 flats.


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