

Teaching Plan:

Module: Crawfish Farming - Section B

Problem Area: Establishing and Using Growing Facilities

Estimated Time: 4-6 hours

Goal: The goal of problem area is understand the facilities that are needed to raise crawfish, with emphasis is on pond design and construction and water.

Learning Objectives: Upon completion of this problem area, students will be able to:

describe the facilities needed to raise crawfish
explain design considerations with crawfish ponds
describe water requirements for crawfish farming

Resources: The following instructional resources are needed to complete this problem area:

Essential:

Transparencies.

Additional:

Crawfish Culture: Site Selection, Pond Construction and Water Quality (SRAC Publication No. 240) available from the Cooperative Extension Service in each state.

Third Report to the Fish Farmers, by Dupree, Harry K. & Huner, Jay V., Washington: U.S. Department of the Interior, Fish and Wildlife Service, 1984.

Introduction to Aquaculture, by Landau, Matthew, John Wiley & Sons, Inc., NY, 1992.

Crustacean Farming, by Lee, Daniel O.C. & Wickins, John F., John Wiley & Sons, Inc., NY, 1992.

Aquaculture: An Introduction, by Lee, Jasper S. & Newman, Michael E., Danville, IL, Interstate Publishers, Inc., 1992.

Journals that include articles on crawfish farming, such as the **Water Farming Journal**, published by Carroll Trosclair and Associates, Inc., 3400 Neyrey Drive, Metairie, LA 70002.

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Content and Procedures

Preparation (Interest Approach):

To develop student interest in this module, ask students to describe the environment needed to produce different crops, such as chickens, wheat, corn, and beef cattle. Ask them to compare their suggestions to the environment needed by crawfish.

Conclude by asking students to name the major factors in the environment that influence crawfish growth. (These were covered in Section A - Determining the Nature of Crawfish Farming.) List the major points the students name on the chalkboard. These should include quality water that is free of harmful substances, proper water pH, right water temperature, as well as facilities to hold the water.

Presentation:

A. What facilities are needed to raise crawfish?

Show TM B1 to present the objectives for the problem area. Use TM B2 to outline the 5 major areas of facility needs. Tour a crawfish farm to observe the facilities. Have students prepare a bulletin board or poster that describes the 5 areas of facility needs. Ask students to list factors that determine the size of ponds, such as natural lay of the land and overall size of farm. Make a field trip to observe harvesting, if available in the community

General facility needs relate to the production functions that must be carried out. Facilities are needed in 5 major areas:

1. Water supply and regulation facilities: May be from wells and other sources that provide quality water.
 - a. Facilities must be available to remove water from ponds and add oxygen to water in ponds.
 - b. Crawfish ponds require a high volume of water.
 - c. The water source and pump capacity must provide for 70-100 gallons of water/minute/surface acre of crawfish pond.
2. Water impoundments: Include structures that will hold water and allow its proper regulation, e.g., ponds and rice fields.
 - a. Ponds are typically 40-60 acres, though smaller and larger sizes can be used.
 - b. Amount and lay of land influence size. Rotation ponds with rice and other crops are the size of the field.
3. Feeding facilities: In addition to vegetation that is grown for forage, crawfish are often fed supplemental feed.
4. Harvesting facilities: Requires traps to catch the crawfish and boats with the proper containers to collect the crawfish from the traps.
5. Grading and storing facilities: Equipment is needed to grade crawfish, transport, and store crawfish.

B. What design considerations are important with crawfish ponds?

Use TM B3 to outline factors to consider in selecting a site for a crawfish pond. Arrange for students to view various locations in the community and assess their potential for crawfish ponds.

Have students examine soil to determine clay content. Have students assess the water supply locally to determine the best sources.

1. Crawfish ponds are often known as water impoundments. They must be capable of holding water and also allow it to be drained off, as needed in the production cycle of the crawfish.
2. Selecting a site for crawfish ponds requires attention to several factors:
 - a. Flat and open land: Allows better water management and even distribution of water over the pond area. Land with trees and other obstacles is more difficult to harvest and manage.
 - b. Heavy clay soil: Crawfish ponds should be located on heavy clay soil. This type of soil holds water well and allows the crawfish to dig the essential burrows. Sandy soils are not recommended for crawfish ponds even if they hold water.
 - c. Proximity to water source and disposal: Ponds should be located close to sources of water and places where water can be run when no longer needed.
 - d. Convenient and accessible: Ponds must be easy to reach in all kinds of weather.
3. Ponds should be constructed to allow for good management of the crawfish pond.

Show TM B4 to outline factors in pond construction. Use TM B5 to illustrate levee arrangement and overall pond layout. Use TM B6 to outline major points in levee construction. Have students review related literature on levee construction and determine the slope and volume needed to construct levees of varying lengths. Ask a student to explain the meaning of 3 to 1 slope [4c below]. (Base of levee extends outward 3 feet on each side for every foot of height.)

- a. Use levee-type ponds: They have a levee built around them above the level of the surrounding land.
 - b. Levee layout. The levee around a crawfish pond is known as a perimeter levee. Baffle levees are built into larger ponds to insure good water flow.
 - c. Perimeter levees are located around the pond and keep water in as well as flood water from nearby creeks out.
 - d. Baffle levees are built 150-300 feet apart inside of the perimeter levee to help enhance water movement throughout the pond.
4. Construct levees properly. Good levees require attention to important details:
 - a. Levees should have a core of clay to prevent water seepage.
 - b. The levees should be about 3 feet high to allow water 18 to 22 inches deep. This will leave a freeboard (distance between level of water and top of levee) of 14-18 inches.
 - c. A slope of 3 to 1 is frequently used in constructing both sides of levees.
 - d. Levees are usually planted with grass or other vegetation to prevent erosion.
 - e. Design should allow motor vehicles to move on the levees, such a tractor-powered mower to cut weeds and grass.
 - f. Both perimeter and baffle levees have the same specifications.
5. Form the bottom of ponds: Should slope no more than 6 inches between levees. Some land forming may be needed if the land is not level.

Ask students to explain why farmers want the bottom of crawfish ponds to be level. (Ponds with level bottoms are easier to manage in harvesting, water control, and vegetation production.)

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6. Economize water use: Crawfish ponds require a lot of water.
 - a. A recirculation canal can be built outside the perimeter levee to allow reuse of water.
 - b. A return channel can be constructed inside the pond for reusing water before it is disposed of.
7. Have proper drains. They should be matched to the capacity of the pond.

Make a field trip to observe the drainage system on a crawfish or another aquaculture farm. Arrange for a technician from the Soil Conservation Service to act as a resource and discuss the design of crawfish ponds.

- a. Drains should be adequate to handle all water added to the pond.
 - b. Drains should be able to handle rainfall plus the growing water.
8. Use aerators: Aeration screen and circulation pumps are needed to insure good quality water.
 - a. Crawfish need water with an oxygen level of at least 3.0 ppm.
 - b. Adequate pumps and power to operate the pumps will be needed.

C. What types of crawfish ponds are used?

1. Three main types of ponds are used: wooded, semi-wooded, and open. Wooded ponds are in forested areas and are constructed by building levees around the desired area. They typically involve less intensive crawfish production and produce 200-800 lbs of crawfish per acre a year.
2. Semi-wooded ponds typically develop after a wooded pond has been used for several years.

Ask students to explain why standing water may kill trees that don't naturally grow in water. (They should mention oxygen in the soil for the roots of the tree.)

- a. The trees in the pond are killed by excessive water.
 - b. Various vegetation may grow in the pond.
 - c. Semi-wooded ponds produce 230-1,000 lbs of crawfish a year, depending on the rate of stocking and extent of management.
3. Open ponds are most widely used by commercial crawfish farmers. Tree-free lanes are needed so that boats can move about to manage and harvest the crawfish.

Have students construct a bulletin board or poster that contrasts the types of crawfish ponds.

- a. These ponds have been cleared of all trees and other obstacles.
 - b. Three types are typically used: permanent crawfish ponds, crop rotation ponds, and dammed marshes.
 - c. Permanent ponds are used only for crawfish farming, with a yield of 1,000-3,000 lbs a year with good management.
 - d. Crop rotation ponds typically involve rice farming along with the crawfish, with crawfish yields of 1,000-2,500 lbs per acre a year with good management.
 - e. Dammed marshes are constructed by damming natural marshes. They are less productive than other types of ponds.

D. How much water is needed for crawfish farming?

Have students calculate the amount of water needed to fill a 40-acre pond 12 inches deep. (One acre-foot contains 325,851 gallons of water; therefore, multiply the number of acres by the gallons in an acre-foot to determine the amount of water in a pond. A 40-acre pond with water 12 inches deep contains 13,034,040 gallons of water. Note: An acre-foot is an acre of water that is 1 foot deep.)

1. The amount of water needed depends on the production system that is being used and the size of the crawfish farm.
2. Sufficient water must be available to allow the complete exchange of water in a crawfish pond in a period of 4-5 days.
 - a. Water is typically exchanged 9 times during a growing cycle.
 - b. The water level in the spring may be higher than in the fall, with 18-22 inches in the spring and 8-10 inches being sufficient in the fall.
3. Pumping capacity should be 70-100 gallons per minute (gpm) per surface acre of pond.

With the above example of 13,034,040 gallons of water in a pond, how long would it take to replace the water in the pond if four 1,000 gpm pumps were used? (Divide 13,034,040 by 4,000 [capacity of 4 pumps] and then divide by 60 [minutes in an hour] to get the number of hours: 54.31 minutes needed to fill the pond.

- a. Large ponds may require several pumps.
- b. Water volume can be calculated by multiplying acres in the pond by 70 (the minimum rate). For example, a 50-acre pond would need a minimum of 3,500 gallons per minute total pumping capacity.
4. Recirculation can reduce the volume of new water that is needed.
5. Water for crawfish ponds can be obtained from wells or surface sources, such as streams and lakes.
 - a. Surface water may contain trash fish and bring diseases to the crawfish ponds. In some cases, surface water can introduce pesticides and other hazardous materials.
 - b. Well water may be low in oxygen and have harmful minerals, such as iron and sulfur.

E. What kind of water is needed for crawfish farming?

Use TM B9 to outline the importance of dissolved oxygen in the water.

1. Crawfish require quality water that has sufficient dissolved oxygen (DO).
 - a. DO should be a minimum of 3.0 ppm for crawfish.
 - b. Crawfish die when the oxygen gets too low.
 - c. Significant numbers of crawfish will die if the water DO reaches 1.0 ppm.
2. Oxygen deficiency is typically corrected in two ways: replacement and aeration.
 - a. Water low in oxygen may be replaced with water that is high in oxygen. (This requires more water!)
 - b. Water may be aerated and recirculated in the pond.

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3. Crawfish are also subject to other water problems.

Have students test various water samples for hardness, alkalinity, and other qualities.

- a. The preferred pH for water in crawfish ponds is 6.5 to 7.5.
- b. Total hardness and total alkalinity should range between 50 and 250 ppm of CaCO_3 .
- c. Agricultural lime can be mixed into the pond bottom to raise pH when the pond is dry.
- d. Ammonia, nitrite, iron, and hydrogen sulfide content can also make water unfit, but these problems are not likely to occur in crawfish ponds. Increased levels of stocking could result in these problems occurring.

4. Crawfish prefer water with a temperature of 65-85°F.

Ask students to explain what they would do to warm cold well water before dumping it into a crawfish pond. (Some farmers pump it into a holding reservoir for the sun to warm it before it is used.)

- a. Too much cold well water can lower the temperature below the optimal level.
- b. Thermal heated water and water exposed to the sun in warm climates could be too warm.

Review:

Review the problem area by having students explain the objectives. Call on various students to explain the content related to each objective. The problem area can also be reviewed by asking questions about the content and by observing how students carry out their laboratory or supervised practice activities.

Application Activities:

Application can occur in supervised practice, in the school laboratory, or later as a crawfish farmer.

Evaluation:

Evaluation should focus on the extent to which students have achieved the objectives of the problem area. Written and oral tests can be used. Example exam questions are attached.

TM B1

Objectives

- Describe facilities needed to raise crawfish
- Explain design considerations with crawfish ponds
- Describe water requirements for crawfish farming

TM B2

5 Areas of Facility Needs in Crawfish Farming

- Water supply and regulation facilities
- Water impoundments
- Feeding facilities
- Harvesting facilities
- Grading and storing facilities

TM B3

Factors to Consider in Selecting Site for Crawfish Pond

- Flat and open land
- Heavy clay soil
- Proximity to water source
- Convenient and accessible

TM B4

Factors in Crawfish Pond Construction

- Use levee-type ponds
- Properly layout levees
- Construct levees properly
- Form the pond bottom
- Consider economy of water use
- Provide proper drains
- Plan for aeration of water

TM B5

TM B6

Major Factors in Levee Construction

- Use clay core to prevent seepage
- Construct levee 3 feet high
- Use 3:1 slope on both sides
- Ease of operation of motor vehicles
- Protect with ground vegetation cover

TM B7

Types of Crawfish Ponds

- Wooded
- Semi-wooded
- Open:
 - Permanent
 - Crop rotation
 - Enclosed marshes

TM B8

Sources of Water for Crawfish Ponds

- Wells (Aquifers):
Deep in the earth
Expensive to pump
Usually best quality
More dependable on a year-round basis
- Surface (From Streams or Lakes):
May contain pollution
May dry up at some times of the year

TM B9

Crawfish Dissolved Oxygen Responses

- Crawfish prefer DO level of 3.0 ppm
- Crawfish will die at DO level of 1.0 ppm
- Insure Adequate DO:
Replace pond water with water high in DO
Aerate water in the pond

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Quiz for Section B

Name:

Date:

Quiz on Establishing and Using Growing Facilities for Crawfish

Directions: Answer the following questions in the space provided. Be sure to spell correctly and provide the most complete information you can.

1. Name the 5 major areas of facilities needed to raise crawfish.
2. What major factors should be considered in selecting a site for a crawfish pond?
3. Why should crawfish ponds be located on flat and open land?
4. What is a levee-type pond? Why are they used?
5. Draw a sample layout of a crawfish pond showing perimeter and baffle levees.
6. Explain the following major factors in constructing levees on crawfish ponds.

Preventing seepage:

Levee height:

Levee slope:

7. Name and distinguish between the types of crawfish ponds.
8. Describe the following as related to water in a crawfish pond.

Complete exchange:

Water depth (fall through spring):

Needed pumping capacity:

Desired level of DO for crawfish:

Level of DO that will cause crawfish mortality:

Preferred water temperature range for crawfish:

9. What are the ways of correcting oxygen deficiency?

10. How many gallons of water are in a 30-acre pond when the water is 18 inches deep?

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Key for Quiz - Section B

1. The major areas of facilities needed to raise crawfish are the following: water supply and regulation facilities, water impoundments, feeding facilities, harvesting facilities, grading and storing facilities
2. The major factors that should be considered in selecting a site for a crawfish pond are as follows:
Flat and open land.
Heavy clay soil.
Proximity to water source and disposal. Convenient and assessable.
3. Crawfish ponds should be located on flat and open land because they are easier to manage. The water is more evenly distributed. Trees do not provide obstacles in the work.
4. A levee-type pond is one that is built above the ground with a levee on all sides. This method of construction makes it easier to remove the water from the pond.
5. The drawing should be similar to that in TM B5.
6. Preventing seepage involves constructing pond levees with a clay core in the center. Levees for crawfish ponds are usually about 3 feet high. The slope is often 3 to 1 on both sides.
7. The types of crawfish ponds are as follows:
Wooded: located in forested areas, constructed by building a levee around the forest).
Semi-wooded: fewer trees than a wooded pond, usually develop in wooded ponds after several years of use (trees are killed by water).
Open: No trees and may be of 3 types: permanent, crop rotation and dammed marshes.
8. The following are described as related to water in a crawfish pond:
Complete exchange: removing old and adding new water so that it is complete in 4 to 5 days.
Water depth: Water ranges from about 8 inches in the fall to 22 inches in the spring in crawfish ponds.
Needed pumping capacity: Pumps should provide 70-100 gallons/minute/surface acre of crawfish ponds.
Desired level of DO for crawfish: 3.0 ppm.
Level of DO that will cause crawfish mortality: 1.0 ppm.
Preferred water temperature range for crawfish: 65-85°F.
9. Oxygen deficiency can be corrected by aerating the water in the pond or adding new water that is high in oxygen.
10. A 30-acre pond that has water 18 inches deep will contain 14,663,295 gallons. (Calculations: $1.5 \times 325,851$ gives gallons per acre, or 488,776.5 gallons; amount for pond is $30 \times 488,776.5 = 14,663,295$.)

