PART II

FFS CURRICULUM FOR AQUACULTURE IN RICE-BASED FARMING SYSTEMS FOR GUYANA AND SURINAME

INTRODUCTION

Background:

Rice-fish culture is one component of aquaculture which has great potential for development in Guyana and Suriname due to the vast areas of irrigated rice fields. If properly implemented, it could increase rice farmer's production and income derived from rice and fish. Adoption of proper techniques in rice-fish culture is expected to help improve food security in the Caribbean Region and increase profit of rice farmers in Guyana and Suriname.

Objectives

The ultimate objective of this season long rice-fish culture FFS is to train rice farmers in the application of low-cost appropriate technology for the production of fish in irrigated rice fields in Guyana and Suriname.

a. General:
   - to increase rice farmers' food production and income through diversified utilization of rice field area for production of rice and fish.

b. Specific:
   - to introduce and promote rice-fish culture to interested rice farmers;
   - to establish farmers-based rice-fish culture trial and demonstration/training sites;
   - to train farmers/aquaculturists and other interested parties on the proper techniques of rice-fish culture;
   - to be able to extend technical assistance to farmers doing rice-fish culture.

Expected Output

- Increased rice field production through diversification of rice and fish.
- Farmers reduced dependence of chemicals in their rice production.
- Farmers succeeded in diversifying their farming activity aimed at increasing farm income and improving family nutritional status.

Strategy of implementation:

- Train farmers on the proper method of aquaculture in rice-based farming system through the FFS approach.
- Conduct two types of field trials on the culture of tilapia or *Hassar* with interested farmer-cooperators using available on-farm resources and compound artificial feed.

WEEKLY SESSION GUIDES

WEEK 1- INTRODUCTION TO RICE-FISH CULTURE

Rice-fish culture is the simultaneous or alternate production of fish in a rice field. It consists of stocking the rice field with fish of selected size and species to obtain a fish crop in addition to rice which is the main crop.

Rice in combination with fish forms an ideal food for both the Guyanese and Surinamese people. While rice is the main dietary source of carbohydrates, the fish supplies protein, being an important source of cheap and easily digestible animal protein.

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Although, rice-fish culture has just been tried in Guyana, indications showed that it can be successful. It is relatively easy, low cost and a low risk entry point for rural farming communities to improve their livelihood and household income without jeopardizing the sustainability of rice production.

Rice fields to be used for rice fish culture have to be renovated to varying degrees to make them favorable for fish growth. The physical renovation includes the excavation of ditches and sumps as shelter for fish and building of higher and wider dikes to prevent escape of cultured fish, and at the same time to preventing flooding.

WEEK 2- MODIFIED RICE-FISH CULTURE FOR GUYANA AND SURINAME

Background:

Conventional rice-fish farming systems successfully practiced in Asia may not do well in either the Guyana or Suriname situation, unless the existing physical rice field conditions in both countries are modified, taking into consideration the constraints raised by farmers, especially their dependence on chemicals for rice production.

In this exercise, the area to be utilized for the project trial and demonstration is 2 000 square meters (less than half of an acre) for easy management, where one-fourth of it is developed into a fishpond. The fishpond is located at the lowest portion of the rice plot.

A rice field comprising ¾ of the total plot area is modified by raising and widening the bunds to hold enough water during the culture period of the fish. A center trench is constructed lengthwise of the rice field, one end connecting directly into the opening in-between the rice field and the pond. The trench does not occupy more than 10% of the total rice field area.

Objectives:

i. To know the advantages of having the modified system of rice-fish culture.
ii. To know how a modified rice-fish culture is managed.
iii. To be able to prepare the pond and rice field for the growing of natural fish food.
iv. To know and practice the calendar of activities for rice-fish culture.

Time Frame:

Whole rice-fish cropping season.

Resources Needed:

Fishpond, rice field, animal manures, one PVC pipe 5 ft. length 3" diameter with fine mesh screen at one end, one PVC pipe elbow 3" diameter with fine mesh screen at one end, seed paddy, fish fingerlings.

Activities to be undertaken:

i. For good pond rice field management: apply right amount of fertilizer, use appropriate fish stocking density (start at 2 fish/m^2), eliminate and control weeds, prevent entry and control of predatory animals and competitors of fish, practice proper water management, use supplemental feeds, and correct harvesting technique.
ii. Pond/rice field preparation: For old fishpond, dry the pond bottom under sunlight to kill fish predators and organisms that may cause fish diseases. In new pond, apply lime (if available) to pond bottom and dikes at 5 kg/100 m^2 to neutralize the soil, making it suitable for production of natural food for the fish and to kill bacteria harmful for the fish to be stocked. Apply animal manure to the pond at the rate of 50 kg/100 m^2. Let water in gradually to allow production of natural food for the fish until desired water level is attained.
iii. Present/discuss to the farmers a prepared calendar of activities for modified rice-fish culture for Guyana and Suriname and a prepared illustration for construction of a modified rice-fish culture farm.

WEEK 3- TRANSPORTING AND STOCKING OF LIVE FISH

Background:

The transport of live fish from the hatchery to any unit of water plays an important role in aquaculture management. Transporting fish involves the hauling of a large number of fish in a small quantity of water. Unless this is done properly, the length of time involved can quickly deteriorate the water quality which can cause fish mortality.

Objectives:

i. To know the different ways of transporting live fish.
ii. To know the causes of fish stress and prevent them.
iii. To know and apply the proper techniques of stocking fish.

Time:

10 minutes discussion and 20 minutes demonstration on actual stocking of fish.

Resources Needed:

Happa net for holding fingerlings, plastic bags, pandan bag, prepared fishpond or rice field with rice 21 DAS.

Procedures in stocking of fish:

i. Upon arrival, float the fish container into the pond water surface for 15 minutes to balance water temperature between the container and pond water.
ii. Let the pond water come inside the fish container and allow the fish to swim outside into the pond.

WEEK 4- CONSTRUCTION OF NETS FOR USE IN RICE-FISH CULTURE

Background:

Nets are among the basic gears and equipment in fish culture, and are indispensable in rice-fish culture operations. For ease of use, without harming the fish, it is important for a fish farmer to have knowledge on how to make the right net and its proper use. The types of nets most commonly used in rice fish culture are: happa net, lift net, and scoop nets.

A happa net, which looks like an inverted mosquito net, is used to nurse fry until fingerling size (fine mesh happa net) or used to hold or keep large sized fish alive before stocking or marketing (larger mesh size happa net).

A lift net is an assembly consisting of a plain net cut in a square shape measuring 2 m by 2 m seamed with a rope along the edges of its four sides. It is made ready for lift netting operation by stretching it, through the use of two bamboo splits measuring 3 cm wide by 8 m long, tied at the net's opposing corners forming a crossed arc position. It is very effective in catching fishes with no injuries sustained.

A scoop net is a device made of a fine netting material with all openings at the sides and bottom stitched together forming a purse and the upper opening stitched into a round or square shaped iron rod.

Objectives:

i. To know the different kinds of nets commonly used in rice-fish farming.
ii. To be able to construct and use the right nets in rice-fish culture.

Time:

One whole session for discussion and demonstration on construction of nets.

Materials needed:

- 4 square meters of ¼ inch mesh size net for making lift net;
- bamboo splits measuring 3 cm width by 8 m long;
- 1 bamboo pole 6 m long;
- 8 m of fine mesh net, 1 m wide (for making happa net of size 1 m x 1 m x 2 m);
- 8 m long small size rope for edging the happa net;
- 0.5 m x 1.0 m of ¼" mesh size net for making scoop net;
- 0.5 m x 1.0 m of fine mesh net for making fry/fingerlings scoop net;
- fine nylon twine for stitching the seam of nets;
- pieces ¾ inch iron rod 1.5 m long each, for ring and handle of scoop nets.

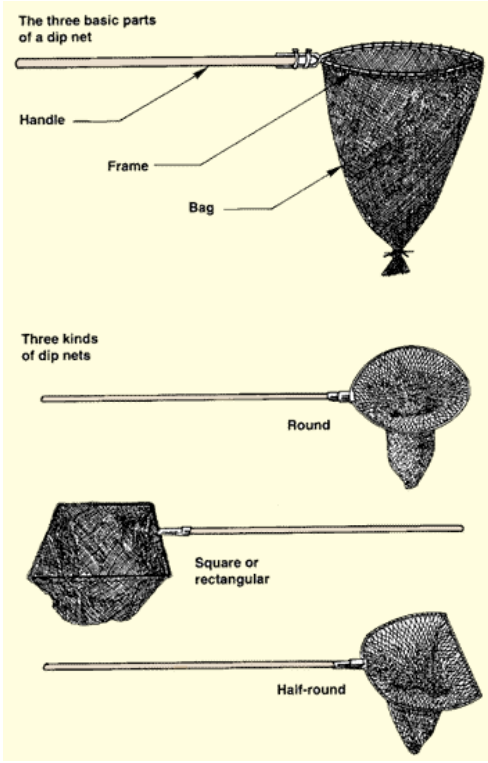
Activities to be undertaken:

i. Construction of a happa net:
    1. From the netting material measuring 1 m width x 8 m long, cut out a piece measuring 2 m long
    2. Stitch the remaining 6 m of net into the just cut 2 m length by joining their sides together until both ends met for final joining by stitching.
    3. After an inverted mosquito net shape is formed, fold one inch of the edges of the opening and stitch it all around.

4. Insert a small size rope into the folded edges of the assembled happa net and leave knots at each of the four corners for tying into wooden posts upon installation into the fish pond.

ii. Construction of a lift net:
   1. Prepare a ¼ inch mesh size net measuring 2 m by 2 m.
   2. Reinforce four sides of the net by inserting a small size rope all around at its edging mesh. Stretch the rope and distribute its length equally into four sides of the net. Make a knot in every corner of the net with the rope.
   3. To assemble the lift net, connect opposing corners of the net to each opposing ends of the bamboo split measuring 3 cm width by 8 m long. The remaining two corners are also tied to another bamboo split of the same measurement the same way as the previous one, making the net stretched out by the bamboo splits formed in a crossed arc position.
   4. After this assembly, the lift net is made ready for lift netting of fish operation by submerging it the inside the pond. It is lifted by using an extended bamboo pole of 6 m length hooked into the crossing portion of two bamboo splits.

iii. Construction of a scoop net:
   1. Make a circular or square frame out of a ¾ inch iron rod having a length of 1.5 m.
   2. From the netting material measuring 0.5 m x 1.0 m, join together by stitching its side and bottom to form like a purse. The upper opening is also stitched into a round or square shaped iron rod.



WEEK 5- FISH FEEDS AND FEEDING

Background:

Fishes cultured in ponds or rice fields get their initial source of food from the natural food present in the water. The natural food consists mainly of planktons, which are produced after thorough pond or rice field preparation. As the fishes grow, their food-needs increase, to the point where the natural food present in the water may not be enough to sustain them. At this stage, it is essential that supplementary feeding be applied to the cultured fish.

Objectives:

i. To know and use the different types of supplementary feeds available locally.
ii. To know and apply the proper and effective method of fish feeding.
iii. To know the growth performance of feeds comparing on farm and compound artificial feeds.

Time frame:

Feeding trial- one whole cropping season; lecture and discussions - 30 minutes.

Resources Needed:

Fishpond and rice-fish field, fish fingerlings, on farm feeds (rice bran, termites, leftover foods, wheat bran, sliced papaya leaves, vegetable wastes, crushed snail meat, etc.), compound artificial feeds, feeding box or pan, 1 happa net, scoop nets, gram scale, ruler, prepared illustrations on the different on farm fish feeds available locally.

Activities to be done:

i. Feed on farm feeds to the fish in the pond by using feeding box or pan at a quantity of 5% of the fish total biomass. Adjust the amount of feeds monthly based on the result of the latest fish sampling conducted. If floating type of on farm feeds (like termites) is applied, observe the fishes' daily consumption and make adjustments for the right quantity that the fishes are able to consume.
ii. Make another feeding trial by using a happa net suspended in the same pond using compound artificial feeds. The stocking density of the happa net should be the same as of the pond. Feed the fish regularly at same time of feeding the fish in the pond.
iii. Sample the fishes cultured in the pond using lift net, and those in the happa net using scoop net, on the same day every month to determine growth rate. Make adjustments of the fish feeds for the next one month feeding ration.
iv. Compare the results after a six month culture period and discuss with the farmers.

WEEK 6- WATER MANAGEMENT

Background:

Water is the only medium that makes the culture of fish with rice possible. Too little or too much of it would be detrimental to the fish. Therefore, proper water management in rice-fish culture is essential to make both rice and fish co-exist harmoniously in the same field.

Objective:

To know the proper management of water in rice-fish culture.

Time:

Actual field activities last during the whole rice-fish cropping season; lecture and discussions - 15 minutes.

Resources Needed:

A fishpond connected to a rice field, one 5–inch diameter PVC pipe with fine mesh screen at one end, one PVC elbow attached to the PVC pipe with fine mesh screen at one end.

Activities to be done:

i. Install the screened PVC pipe into the dike of the rice field with the rotating elbow located inside of rice-fish plot. The elbow should be tilted at an angle that would enable water to be maintained at the depth desired for the rice-fish plot.
ii. Water management starts at the point of letting water into the pond or rice field, and its preparation for growing of natural food. At this time (the pond and the rice field are still separated by a dike), gradually let the water come inside to the pond and maintain to the level of the rice field bed.
iii. During sowing of pre-germinated seeds in the rice field, irrigate water into the pond at 3" higher than the water level in the rice field.
iv. In the 2nd week after sowing, irrigate water into the rice field. As much as possible, maintain the pond water level at 3" higher than the water in the rice field.
v. In the 3rd week after sowing, when the rice is fertilized, stock the fish at a rate of 2 fish per square meter.
vi. On the 25th D.A.S. open the dike/blockade in-between the pond dike and rice field and let fishes swim out from the pond into the rice field through the center trench.
vii. On 45th D.A.S. raise water level in the rice field in 5 "to 8" deep (water level in the pond rises same level with the rice field).
viii. On 60th D.A.S. raise water level in the rice field from 8" to 12" deep (water level in the pond also rises at same level with the rice field).
ix. On the 80th to 85th D.A.S. drain the water gradually and let fishes inside the rice field go back into the fishpond through the center trench.

WEEK 7- POND AND RICE FIELD FERTILIZATION

Background:

Fertilizers stimulate the growth of plankton, which is the natural food of the fish. When the fish are still small, they rely on the natural food present in the water to sustain their growth. Therefore, since fertilization increases the availability of natural foods in the water, fertilization is a key factor for increasing fish yields. It is important for farmers to know which fertilizer to apply, and when to apply the fertilizer in his pond or rice field.

Objectives:

i. To know the different types of fertilizer and when to use them in rice-fish culture.
ii. To know and be able to apply simple methods of measuring pond water fertility.

Time needed:

15 minutes for lecture and discussion; 15 minutes for field demonstration.

Resources Needed:

Animal manure, chemical fertilizers (Urea and TSP), sample plankton inside a transparent plastic bottle, prepared illustration on how to measure fertility of pond water.

Activities to be done:

i. Demonstrate to the farmers the different types of fertilizers for use in fertilizing pond or rice field: organic animal manures, chemical fertilizers (Urea and TSP).
ii. Initial organic fertilization of the pond is done by applying animal manure at 50 kg/100 m² while the rice field is undergoing preparation. For maintenance fertilization, chemical fertilizer (TSP or Urea) could be applied at a rate of 0.6 kg/100 m² per week. It should be dissolved in a few liters of water using a bucket. Or, animal manure could be used, at a rate of 50 kg/100 m² every other week.
iii. Adjust the quantity of maintenance fertilizer applied (increase or decrease) depending on the greenness of the pond water. To measure the water quality to determine if there is enough natural food, submerge your hand under the pond water until at elbow level with palm facing upward
    - If the palm is seen very clearly, there is not enough natural food in the water; therefore, apply more animal manure or chemical fertilizer;
    - If the palm is not visible, there is over production of natural fish food, that may lead to bad pond water; reduce application of animal manure or chemical fertilizer and exchange about 6 inches of the pond water
    - If the palm is slightly visible, there is enough natural fish food present in the pond water, maintain the current amount of animal manure and/or chemical fertilizer.
iv. For the rice field, apply first doze of fertilizer to the rice on the 21st D.A.S. and second doze of fertilizer on the 48th D.A.S.
v. Show to the farmers the specimen planktons inside a transparent plastic bottle produced from a fertilized pond.

Week 8- FISH PREDATORS AND OTHER PESTS

Background:

Fish production in ponds and rice fields is commonly affected by some pests and predators. Predators are organisms which prey on the fish being cultured. The animals that compete for food or space are called competitors.

Objectives:

i. To know the predators and competitors of fish cultured in ponds and rice fields.
ii. To be able to control fish predators and competitors.

Time needed:

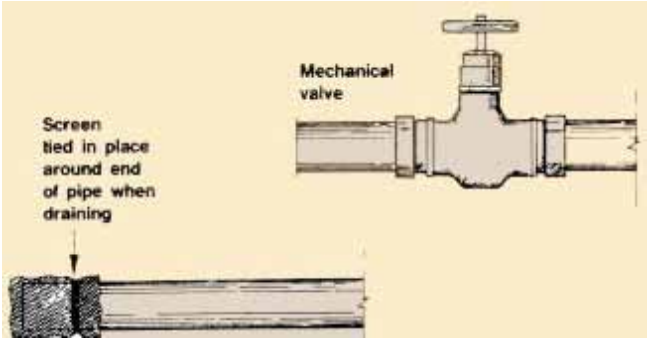
Lecture and discussions - 20 minutes; actual field demonstration - 1 hour.

Resources Needed for Field Activity:

Vicinity of a rice-fish plot, predator trap, screened PVC pipe for passage of water, barbed wire (to prevent fish poaching by use of cast net inside the pond).

Activities to be done:

i. Demonstrate to farmers how to assemble a trap designed for catching fish predators using locally available materials. Trap to be installed within the vicinity of the rice-fish plot located at a passageway of the fish predators.
ii. Demonstrate the way to control entry of unwanted fish competitors and some predatory fish species, at same time preventing escape of cultured fishes inside the pond, by the installation of a fine mesh screen at both ends of the water irrigation/ drainage PVC pipe.
iii. Show to the farmers a prepared illustration of most common predators and competitors of fish cultured in pond and rice fields.



WEEK 9- POND /RICE FIELD FISH CULTURE SYSTEMS

Background:

There are two systems of culturing fish in ponds or rice fields: monoculture and polyculture. Monoculture is the rearing of a single species of fish, while polyculture is the rearing of two or more non-competitive species in the same pond. The adoption of each system would depend on the farmer's choice and the availability of fish seed species to use.

Objective:

In the end of the farmers' field school season the farmers will have an idea of which culture system he will adopt.

Time requirements:

One crop season or during the entire FFS period.

Resources Needed:

a pond and rice-fish plot, two happa nets of same size, fingerlings of *Hassar* and tilapia, fish feeds, gram scale, scoop net, lift net, ruler, pen and paper.

Procedure:

i. Install two happa nets in a prepared pond. Assign one happa net for monoculture of tilapia, while the other happa net should be used for polyculture of tilapia and Hassar.
ii. Stock tilapia fingerlings at 2 fish/m^2 into the monoculture net; stock tilapia and *Hassar* fingerlings together into the polyculture net at 2 fish/m^2.
iii. Feed the fish daily with same amount of feed.
iv. Sample the fishes in the two nets every month and adjust the amount of feeds to be given at 5% of fish biomass, based on the latest fish sampling conducted.
v. Sample the fish at harvest day and compare the result. Discuss results with the farmers.

Questions:

i. Which type of fish culture gave the higher profit? Why?
ii. How will these types of fish culture be scaled up to other farming communities?

WEEK 10- FISH STOCKING DENSITY

Background:

The growth of fish depends on the number of fish stocked and the number of fishes present in the pond or rice field. This is due to several factors that include density and competition.

Fish stocking density is one of several factors that affect fish growth. At low stocking density, the amount of natural food in the pond is higher for each individual fish and the excess food is not utilized. However, at higher stocking density the growth of fish will be slow because the capacity of the natural food to support the fish population will be limited to a certain extent. The maximum physiological growth of tilapia is attained at low stocking density.

Objectives:

i. To know the factors that influence the selection of the correct stocking density in the pond and rice field.
ii. To compare the growth difference of fishes stocked at two different densities using happa nets.

Time:

Three months culture period.

Resources Needed:

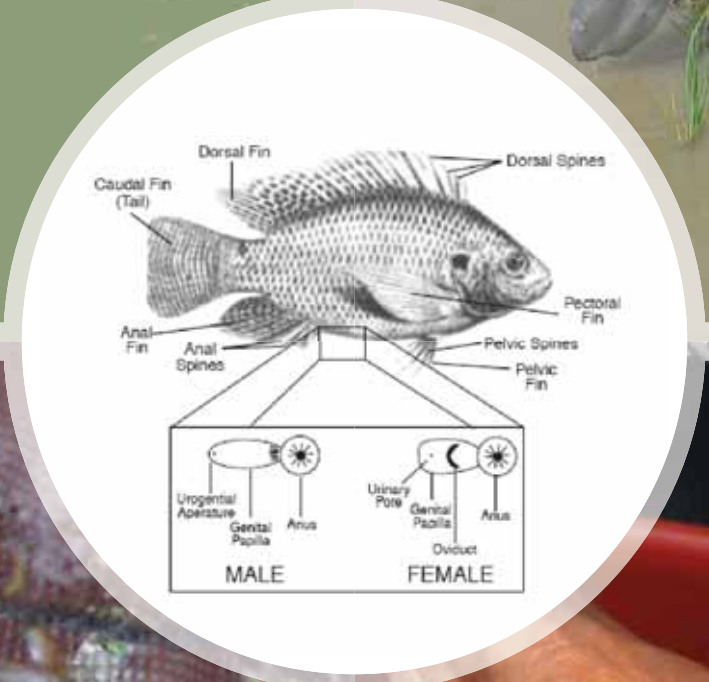
A fishpond, 2 happa nets (measuring 1 m x 1m x 1 m), gram scale, ruler, 6 tilapia fingerlings of the same size, fish feeds (on-farm and compound formulated feeds)

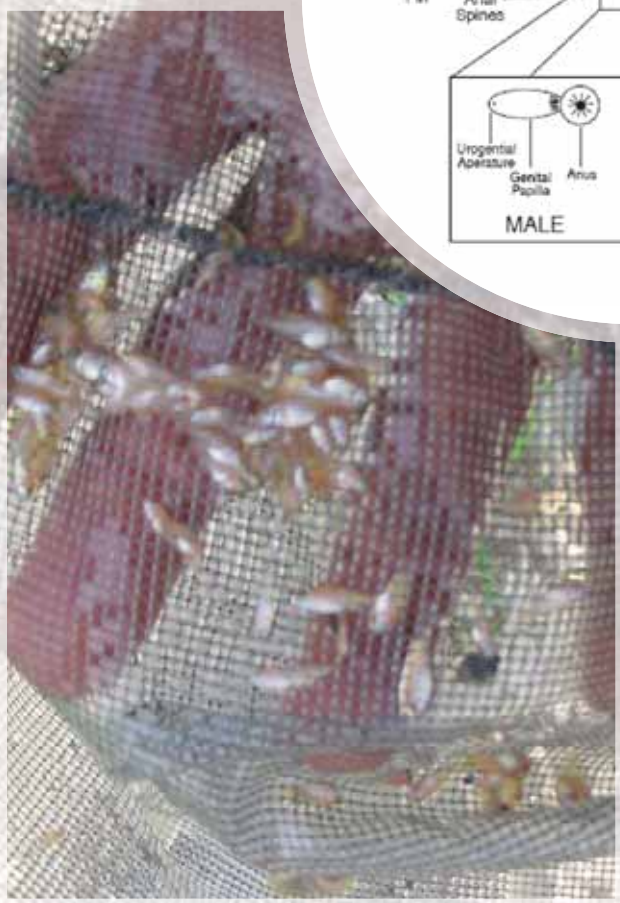
Procedures:

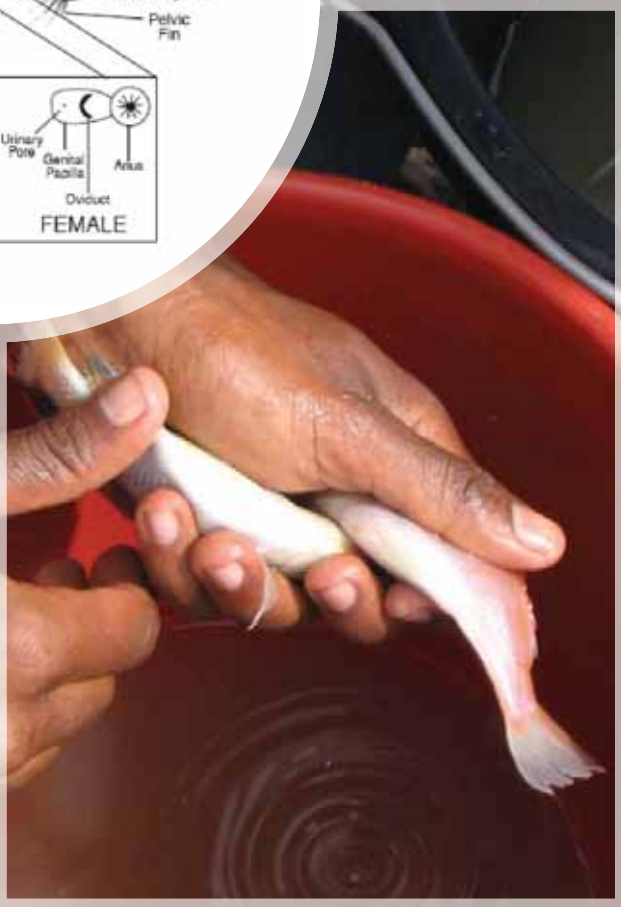
i. Install 2 happa nets in the pond.
ii. Get the individual initial weights of the 6 tilapia fingerlings,
iii. Stock 2 tilapia fingerlings in the first happa net and the remaining 4 tilapia fingerlings into the second happa net.
iv. Feed the fishes in the two happa nets with same amount of feeds at 5% of their total body weight, to be adjusted accordingly based on result of the samplings to be conducted monthly.
v. After three months of culture weigh individual fishes from separate happa nets upon harvest and compare the results.

Discussion:

Which stocking density gave better result over the other? Why? Discuss further other factors that affect growth rate of the fishes stocked at two different densities.


Dorsal Fin
Dorsal Spines
Caudal Fin (Tail)
Pectoral Fin
Anal Fin
Anal Spines
Pelvic Spines
Pelvic Fin
Urogenital Aperature
Genital Papilla
Anus
Urinary Pore
Genital Papilla
Anus
Oviduct
MALE
FEMALE





WEEK 11- PRODUCTION OF TILAPIA FRY AND FINGERLINGS

Background:

Tilapia is a very prolific fish species. The female starts reproducing in the third month after hatching and will continue spawning every four to six weeks thereafter. During spawning, the female tilapia enters the nest built by the male and lays the eggs. The eggs are fertilized by the male. The female then collects and incubates the eggs in her mouth. Because they are mouth brooders, they do not feed during incubation or in brooding period.

Objectives:

i. To be able to identify the sex difference between male and female tilapia.
ii. To know the spawning characteristics of tilapia.
iii. To know the number of eggs a female tilapia can produce.

Time:

One session for lecture, discussions and actual field demonstration.

Resources Needed:

Fishpond, tilapia broodstock, lift net, scoop net, feeds.

Activities to be undertaken:

i. Difference between male and female: Using a lift and scoop net, catch mature tilapia broodstock and identify male from female tilapia using the following identification: male has two openings just in front of the anal fin. The large opening is the anus and the smaller opening at the tip is the urogenital pore; the female has three openings- the anus, the genital pore, and the urinary pore. The genital papilla is usually smaller in the female.
ii. Spawning characteristics of tilapia: The male establishes a territory and builds a round nest at the pond bottom. Usually the diameter of a nest is 30 to 60 centimeters. The size of the nest is correlated to the size of the male. The female enters the nest and lays the eggs. The eggs are fertilized by the male. The female then collects and incubates the eggs in her mouth. The eggs are yellow in color. Eggs hatch in about five to seven days. After hatching the fry remain in the mouth of the female for another four to seven days. The fry begin to swim freely in schools, but may return to the mouth of the mother when threatened.
iii. Number of Eggs Produced: The number of eggs per spawning is related to the size of the female. A female of about 100 grams may produce approximately 100 eggs per spawning while a female weighing 100 to 600 grams can produce 1 000 to 1 500 or more eggs per spawning.

WEEK 12- FRY NURSING

Background:

Shortly after the fry have been hatched, it is wise to separate them from their mother fish and transfer them to a nursery area to prevent higher mortality caused by several factors, mostly by predation. There are many forms of nurseries which can be used to successfully rear fish fry. The decision as to which nursery system to use depends upon the species of fish, materials available and the amount of money that farmers can invest.

Objectives:

i. To know the different types of nursery facilities to use for nursing fry.
ii. To know the activities to be done for ensuring success in fry nursing.
iii. To know the difference in growth and survival rate of fry nursing using earthen pond and happa net cage.

Time:

15 minutes lecture and discussions; one and a half months actual fry nursing duration.

Resources Needed:

Earthen pond, happa net cage, one week old tilapia fry, fine mesh lift net, fine mesh scoop net, formulated fish feed or chicken starter feeds.

Activities to be done:

i. For fry nursing in earthen nursery pond:
   Good nursery pond preparation requires the following steps to be observed:
   - Empty the water out of the pond (drain or use a pump) and dry the pond.
   - If water can not de drained, predators in the pond can be killed by the addition of rotenone (derris powder) at a rate of 1.5 grams per cubic meter of pond water. If derris is difficult to obtain, draining and drying the pond is the most effective method of eliminating predators.
   - Add lime at a rate of 1 kg for every 25 m^2 of pond area. Lime can usually be purchased from building supplies shops. Lime assists soil fertility and reduces the amount of fertilizer required to produce green water in the nursery pond.
   - Add fertilizer to the pond at the rate of 1.5 kilos per 10 m^2. This is equivalent to one full bucket per 20 m^2 of pond area. Fertilizers that can be used include buffalo, cow, chicken, goat, sheep, and pig manure. After the manure is applied the pond can be filled to a depth of 5 to 10 centimeters to allow the breakdown of the manure. After 3 to 5 days, the pond should be filled to a depth of 30 to 50 centimeters, and it is then ready for stocking.
   - Fry are stocked into the nursery pond at a rate of 125 - 500 individuals per m^2.
   - After stocking the fry into the pond (usually done in the early evening), the water level is maintained for one week. One week after stocking the water level is then increased to 80 centimeters.
ii. For nursing of fry in happa net cage
   Once fry are large enough not to escape through blue netting (about 2 to 3 weeks

after hatching), they can be cultured in cages made of this material. The advantage of fry culture in cages is that they do not suffer from predation from larger fish, frogs or large water insects. The fish need to be fed more than if they were cultured in the pond, but the high survival will compensate for the extra cost of the feed.

If water can be supplied to the cage this will increase aeration and remove waste products. This will allow higher densities of fry to be cultured than is otherwise possible without water flow.

- Blue net cage (4 x 5 m) without water supply - stock 2 000 fry (>2 weeks old).
- Blue net cage (4 x 5 m) with water supply - stock 5 000 to 10 000 fry (>2 weeks old).

The fish should be fed with pig or chicken starter feed mixed with soft rice bran to ensure they obtain sufficient food and grow well.

iii. After the fry nursing period is completed, compare the growth performance and survival rate between the two fry nursing systems. Which one is better? Discuss results with the farmers.

WEEK 13- POND /RICE-FISH FIELD MAINTENANCE

Background:

To be able to do effective maintenance of a rice-fish farm, it is a must for a farmer to regularly visit his farm site. By having the farmer's regular presence in his farm he can immediately take remedial actions to whatever problems he could see, before the problem gets serious.

Objective:

To be able to maintain operation of a pond and /or rice-fish culture farm.

Time frame:

Lecture and discussions - 15 minutes; actual field activity - whole fish cropping season.

Resources Needed:

A fish pond connected to a rice field through a center trench.

Activities to be done:

i. Among the major maintenance and operational activities to be done by farmers are the following:
ii. Always maintain the desired water depth of the pond/rice field and make sure both ends of water inlet/outlet pipes (if any) are properly screened. Maintain the desired greenness of pond water. Change the pond water when it is smelling bad, or when fishes are seen gulping at the water surface due to a lack of oxygen.
iii. Feed fish daily at 5% of the total body weight. Adjust daily feeding ration monthly, based on the latest sampling of the fish stock conducted after every thirty days.
iv. To maintain the growth of plankton and other natural food for the fish present in the water, apply fertilization into the pond at a rate of 50 kg of animal manure per 100 m² every two weeks, or 0.6 kg of inorganic fertilizer per 100 m² per week.
v. Remove floating and submerged weeds growing inside the pond, as they compete with the stocked fish for space and nutrients necessary for production of natural food in the water.
vi. To prevent poaching of cultured fish, stakes or barbed wires can be installed underwater inside the pond.
vii. Grow and maintain crawling grass on top and slope of the dikes to help in maintaining compaction and preventing soil erosion.
viii. Always repair any damaged to the dike, such as leakages or seepages, before it becomes big and causes serious damage to the pond.
ix. Check for any foreign objects in the screens of the pond pipes and clean regularly to avoid screens from becoming clogged.

WEEK 14- FISH HARVESTING

Background:

Fish stocks are ready for harvest as soon as they reach marketable sizes. Usually fishes are harvested after six to eight months, if cultured in a pond. In rice-fish culture, fishes are harvested about one month to one week ahead of rice harvest. If they have not yet attained marketable size at this time, they can then be cultured further inside the pond adjacent to the rice field. Harvesting of fish cultured in the rice-fish plot is effected by gradually draining out water in the rice-fish field, allowing the fish to find their way back into the pond through the trench constructed at the center.

Objective:

To know the different methods of harvesting cultured fish.

Time:

Lecture and discussions - 15 minutes; actual field fish harvesting activity - half day.

Resources Needed:

A fishpond stocked with marketable size of fish, cast net, seine, scoop nets, buckets, and happa net

Activities to be done for fish harvesting:

i. In partial or selective harvesting, partially drain the water and use nets to catch the desired amount of fish needed.
ii. In total harvesting, drain the pond water totally by pumping out water (if the pond is not drainable by gravity). Collect the market size fish by using scoop net, and put into fish container or bucket. Collect undersize fish produced and put inside a happa net to be restocked back into the just harvested pond later after its pond preparation.

WEEK 15- POST HARVEST TECHNOLOGY

Background:

Fish spoilage begins as soon as the fish dies, and results from a series of deteriorative changes which are broadly classified into: autolysis, bacterial and chemical. Because the price of fish depends largely on its quality, it is important to handle it properly to be able to deliver or sell high quality fish, which can command a high price and at the same time, satisfy the consumers.

Objectives:

i. To know why fish spoils.
ii. To be able to differentiate fresh from spoiled fish.
iii. To know how to handle or process fish right after harvest to prevent its early spoilage.

Time:

30 minutes demonstration including discussion.

Resources Needed:

Knife, cutting board, bucket, fresh fish, spoiled or stale fish, ice.

Procedures in determining spoiled fish:

i. Secure two fishes: one fresh and another spoiled.
ii. Dissect the two fishes applying the same method of cutting, starting from the back part down to the belly part.
iii. Compare the flesh appearance: fresh flesh is reddish with traces of fresh blood while spoiled fish looks pale with blood starting to clot.

Other characteristics used to determine fresh from spoiled fish are the following:

	Fresh fish	Spoiled fish
Eyes	• bright, bulging • Pupil, velvet black; • Cornea, transparent	• dull, wrinkled, sunken; • pupil, dull black; • cornea, opaque
Gills	• bright red, covered with Slime; • odor under gill covers fresh	• dull brown or gray; slime cloudy; • odor under gill covers sour and offensive
Flesh	• firm; body is stiff; impression made by fingers does not remain • Slime present is clear	• soft and flabby; impression made by fingers remains
Body	• stiff	• limp
Belly walls	• intact	• often ruptured, with viscera protruding
Muscle tissue	• whitish	• pinkish, especially around backbone
Vent	• pink not protruding	• brown, protruding
Odor	• fresh, fishy odor	• stale, sour or putrid
Color	• bright	• faded

The three important ways of preventing fish from spoiling too quickly are: care, cleanliness and cooling.

Care in handling is essential because unnecessary damage can provide access, through cuts and wounds, for the spoiling bacteria, thus hastening their effect on the flesh
All surfaces with which the fish may come into contact should be scrubbed clean and kept as free as possible from bacteria-laden materials. Natural sources of bacteria can be removed soon after the fish is captured / harvested by taking out the guts and washing off the slime from the surface of the fish.

The higher the temperature, the faster the bacteria multiply, and the lower the temperature, the slower the bacterial and enzymatic activities. Therefore, the most important step to slow down these activities is to lower the temperature of the fish as quickly as possible.

WEEK 16- COST AND RETURN ANALYSIS OF RICE-FISH CULTURE

Background:

The primary purpose of culturing fish with rice is to get additional income derived from fish, as secondary crop, in addition to rice, which is the main crop. However, in order for fish to live in harmony with the rice, there needs to be an additional input for the construction of ponds with higher and stronger dikes to keep fish at certain period of time, before they are released into the rice field, and for heightening of the rice field perimeter dikes. With all the expenses entailed in developing the rice-fish culture site, coupled with operating and maintenance expenses, it is important to analyze its cost of production and return of investment after one year operation to be able to know whether the rice-fish farming venture is giving the farmer his desired profit or not.

Objectives:

i. To be able to know how much has been spent to produce both rice and fish in a given cropping season per year.
ii. To be able to know the production and income of rice and fish in a given cropping season per year.
iii. To be able to know the return of investment in rice and fish culture.

Time needed:

Recording of expenses start from pond and rice field construction until selling of harvested fish.

Cost and return analysis presentation with farmers - about 15 minutes.

Resources Needed:

Record book, calculator.

Procedure:

i. List all items under fixed assets investment and their corresponding total costs.
ii. List all items under operating expenses and their corresponding total costs. Add 10% as contingencies to the total cost.
iii. Get the total of annual depreciation costs of all fixed assets listed above.
iv. Compute the Gross Sales by multiplying harvest volume x price / kg x number of crops in a year. Subtract Gross Sales by the operating expenses to get Gross Income. Subtract marketing cost (5% of gross sales) and depreciation expenses from the Gross Income to get the Net Income.
v. Financial analysis. Compute the Return of Investment by dividing the Net Income by Operating Expenses plus Depreciation Expenses per Year and multiply its result by 100%.