
Content of Agricultural Life Skills for Teacher Training Centers

Part 2 Fish Raising

2013

Unofficial translation

Content of Agricultural Life Skills for Teacher Training Centers

Part 2 Fish Raising

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Preface

Implementation of life skills in agriculture is currently very attractive in the educational sector globally.

Starting from this context, strengthening life skills in agriculture related to daily livelihood is truly essential for student teachers and students in the present and future.

Therefore, in order to understand life skills, teachers who teach agricultural life skills should:

1. Understand the content and objectives, and know how to use materials.
2. Prepare adequate materials for each recommended activity.
3. Pre-practice by themselves before teaching in classes.

I hope all teachers will pay attention to use these materials for teaching and learning in order to improve education.

On behalf of the Ministry of Education, Youth and Sport, I profoundly thank the working group and VVOB's project technical assistance for compiling all documents.

Phnom Penh, 17 June 2013
Minister of Education, Youth and Sport

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The Household Fish Raising Manual is prepared in cooperation with the Ministry of Education, Youth and Sport and VVOB.

This book is prepared in order to explain about fish raising techniques by natural methods. It covers theories and practices in each lesson. The book will make fish raising easier and it requires less money, furthermore it is promoting quality of health and environment education in our country.

Even though agriculture experts provided technical assistance and materials and a big effort was made to do research of relating documents for this manual, the content may not be complete for teachers to teach their students. However, this manual is a guide for teachers to do more research and prepare lesson plans to fit the actual needs. We hope that this document will enable teachers to prepare teaching materials more effectively. We look forward to seeing your constructive comments and suggestions.

Authors Group

Note

This is the translation of ឯកសារការអប់រំបំណិនជីវិតស្តីពីកសិកម្ម ផ្នែកទី ២ ការចិញ្ចឹមត្រី (the training manual Content of Agricultural Life Skills for Teacher Training Centers Part 2 Fish Raising) which was issued in 2013 by the Ministry of Education, Youth and Sport (MoEYS). This translation was made by VVOB (the Flemish Association for Development Cooperation and Technical Assistance and is not an official translation. We hope it may be useful to External Development Partners of MoEYS and Teacher Training Centers who wish to consult the original Khmer manual in English.

INTRODUCTION TO CONTENT MANUAL OF AGRICULTURAL LIFE SKILLS

This Agricultural Life Skills Content Manual is a tool to provide future teachers background information that can be used to teach agricultural life skills.

The manual consist of three parts:

- Part 1 Chicken raising
- Part 2 Fish raising
- Part 3 Organic gardening.

Together with the Agricultural Life Skills Teaching Manual and accompanying teaching aids, this set provides you with a range of ideas and methods that are suitable for your agriculture lessons. The lessons in this book provide ideas to practice skills of fish raising. By using hands-on practice and experiential based learning as the main methodology, student

Definition of Life Skills

'The intellectual, personal, interpersonal and vocational skills that enable informed decision-making, effective communication, and coping and self-management skills that contribute to a healthy and productive life to ensure successfully solving daily problems'.

Policy for Curriculum Development 2005 – 2009,
MoEYS

teachers learn how to apply these methodologies with students in their future primary schools. The lessons promote a deeper understanding of issues related to family scale fish raising, develop skills for problem solving, decision making, persuading and critical thinking. They also provide opportunities for raising awareness of the existence of agricultural problems and ideas for actions which can lead to behaviour change to avoid these problems, for example changing to raising fish on natural ways, both in pond and plastic hole by using available natural food in the community, applying natural ways of preventing diseases.

Objectives of agricultural education

According to the training-program for primary-level teachers, taken from the MoEYS curriculum, agricultural education aims for students to:

- Obtain knowledge and life skills for daily livelihood; for example, skills in planting crops and farming animals to enhance families' living standards.
- Grasp skills and methodologies to impart them to primary school students through practice and experimentation
- Change attitudes and address social and economic challenges through life skills, problems solving skills, thinking skills, decision making skills, cooperation and accountability.

Some guiding principles for agricultural education

To meet the above mentioned objectives, we propose a number of guiding principles that should be taken into account in agricultural education:

- Installation of a garden, a fish pond and chicken houses in the PTTC is strongly encouraged, because student teachers will benefit most when they are asked to practice what they learn in a real situation.
- Agricultural education should encourage natural ways of growing crops, reducing the use of chemical pesticides and chemical fertilizer.
- In chicken and fish raising natural ways of feeding, natural ways of prevention and treatment of diseases should also be encouraged as much as possible.

Definition of Life Skills Education

"Life Skills based education is used to empower young people in challenging situations. It involves an interactive process of teaching and learning, which enables learners to acquire knowledge and develop attitudes and skills to support the adoption of healthy behaviours."

UNICEF

- The methodology used should focus on action-oriented, project-centered and participatory processes leading to self-confidence, positive attitudes and personal commitment. The process should be implemented through an interdisciplinary approach. This means it should be integrated in a different range of subjects (Science, social study, agriculture, general knowledge,...) and through extra-curricular learning opportunities such as project work, Green Clubs, Local Life Skills projects (LLSP) for primary and secondary education.
- For curriculum based lessons as LLSP, the relationship between school and the communities is very important for agricultural Life Skills. The community is a valuable resource for teaching about agricultural issues and involvement of the community by projects that aim to improve the environment in the community is essential.

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CHAPTER 1 FAMILY SCALE FISH RAISING

1.1 INTRODUCTION

Cambodia is rich in natural fishery resources, available in rivers, lakes, streams, and canals. Changes in the natural environment and population growth have currently resulted in a growing demand for fish that the natural fish stock cannot meet.

Most Cambodian people have the habit of digging a pond for storing water and using the dugout earth for other purposes. The encouragement of family or small-scale fish farming will provide many benefits for them.

There are many illegal activities such as:

- illegal fishing during the season when fishing is banned
- catching fish with explosive devices, toxic substances and electrical shocks from batteries
- pumping water out of the lakes

as well as other illegal equipment which pollutes the environment and destroys ecosystem. By clearing flooded forest for farming and filling soil into fish habitat can make fish become extinct. Human population growth then gradually increases fish demand, while the quantity of natural fish cannot supply these demands.

Since most people habitually dig ponds for soil and keep the pond water for use they can also catch natural fish from the ponds at the end of dry season. For these reasons, it is easy to encourage family-scale fish raising using simple techniques. These include cleaning ponds, selecting fish species, feeding extra feed, and creating a good environment for fish refuge so fish can grow faster which is more beneficial to each family.

1.2 THE ADVANTAGES OF FAMILY SCALE FISH RAISING

The benefits of family or small-scale fish raising are as follows:

- It generates a job apart from doing simply farming;
- Reduces the expense of buying fish from a market and can use fish as daily food;
- Provides protein and nutrient for human health;
- Increases families' income;
- Reduces fishing from natural water;
- Increases local natural fish stock;
- Reduces the work far away from home;
- Reduces fish importing
- Provides water sources for watering vegetables
- Saves and cleans the environment.

1.3 THE FORMS OF AQUACULTURE

A) Low-intensive aquaculture

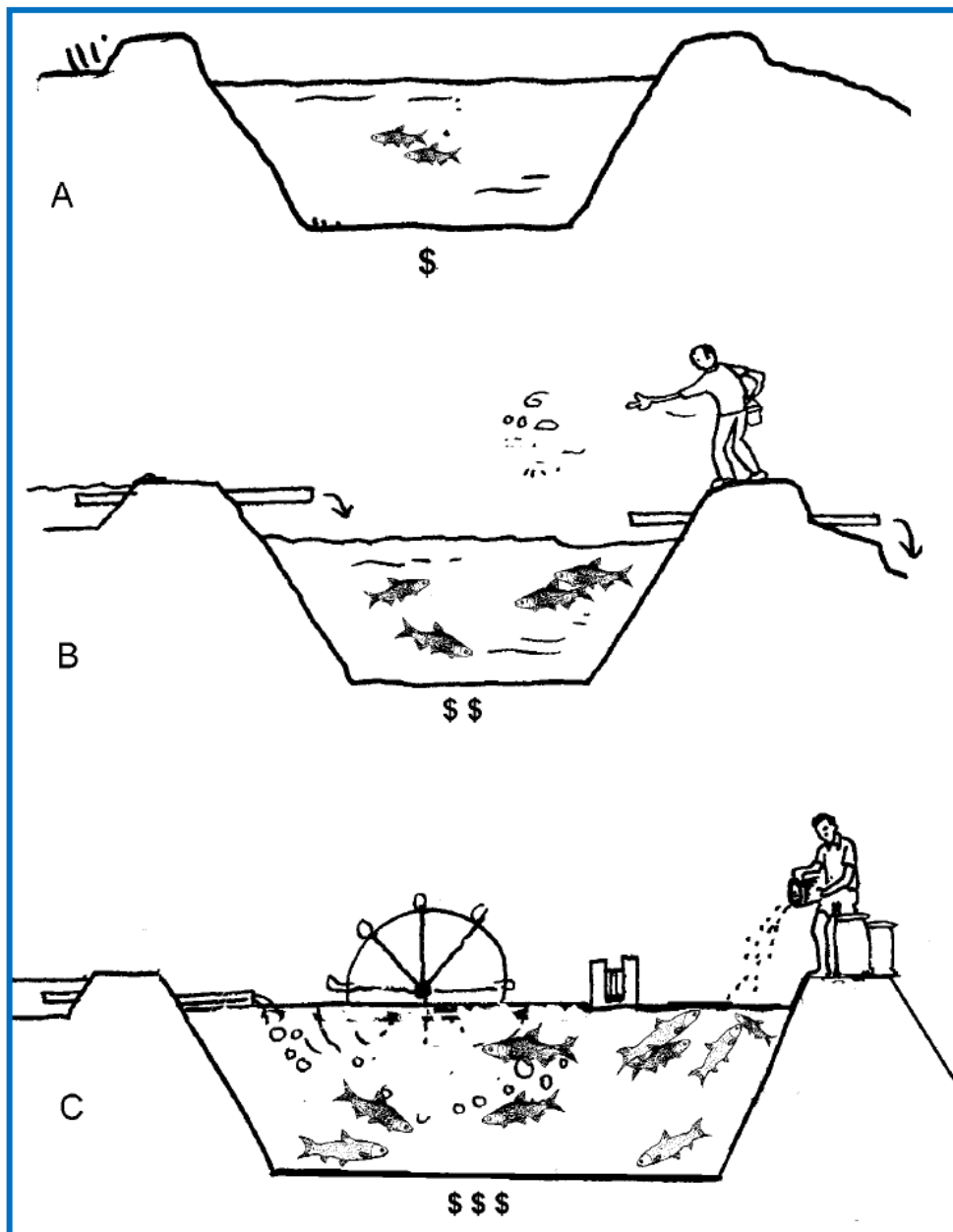
- Micro or family sized farming;
- Dependence on natural feed;
- You can raise one species of fish in different ages or several species of fish in one pond at the same time.
- Low yield.

B) Semi-intensive aquaculture

- Low density fish culture;
- Many species of fish are raised, but they are fed on different natural feeds;
- Produces less or insufficient amount of feed during the breeding season;
- Medium yield.

C) Intensive aquaculture

- High density fish culture;
- Spread manure and create natural feed;
- Raise many mixed species of fish;
- Provide sufficient amount of feed for the entire season;
- High cost; b
- High yield, high price.



Picture 1 A-Low-intensive Culture B-Semi-intensive Culture C-Intensive/Industrial Culture

Source: Agromisa, Agrodok 15, Small scale freshwater fish farming

1.4 THE SPECIES OF FISH AND ITS BIO-LIVING

A. Goldfin Tinfoil Barb (“Chhpin”)

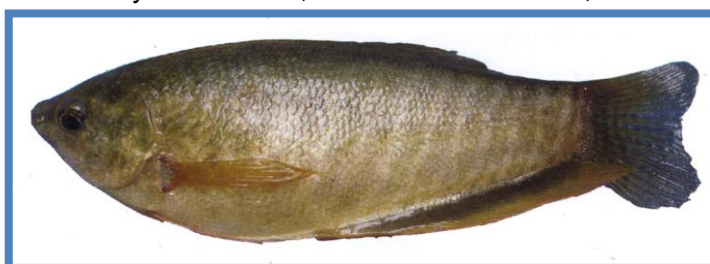
- A species which lives in rivers, streams, and lakes;
- When they are young, they consume plankton and plankton plants, such as seaweed, besides this they also eat insects such as termites;
- When they grow up, they consume the wastes of vegetable and leaves of duckweed and bindweed;
- They consume supplementary food such as rice bran, broken rice, maize, bean, and food wastes;
- They like to live in the upper and middle layers of water and are resistant to diseases;
- They live in the water of pH 6.5-7.5 and at the temperature of 20-30 degree Celsius;
- They weight 0.20 – 0.50 kg after one year of cultivation if they are controlled; A dace can start to reproduce at the age of 8 months and over, particularly at the place where water flows



Picture 2 Goldfin Tinfoil Barb Copyright © CEDAC 2010

B. Snakeskin gourami or Siamese gourami (“Kanthor”)

- A species which has high economic value and lives in rivers, streams, and lakes;
- It likes to consume many kinds of food such as vegetables, plant leaves, duckweed, and insects such as termites and particularly plankton;
- They consume supplementary food such as rice bran, broken rice, maize, bean, and food wastes;
- They like to live in the upper and middle layers of water, resistant to diseases;
- They live in water of pH 6,5 - 8 and at the temperature of 20-30 degree Celcius;
- They weight 0.050 – 0.10 kg after one year of cultivating fish in a pond;
- Reproduce at the age of 7 months and over.



Picture 3 Snakeskin gourami Copyright © CEDAC 2010

C. White Carp (“Carp Sor”)

- An exotic species which is native to China and lives in freshwater habitats;
- They are easy to raise because they live in the low oxygen level water.
- They like consuming insects when they are young and plankton when they grow up.
- They consume supplementary food such as rice bran, broken rice, maize, bean, and food wastes;
- They can live in the water with a pH level of 4 – 9 at the temperature of 14 -40 degree Celsius;

- They like to live in all layers of water and they are resistant to diseases;
- It can weigh between 200 and 500 grams after 8 months of cultivating fish;
- They are adult after 4 months.
- They can easily lay eggs and reproduce in the natural pond.
- This fish gets frightened easily.



Picture 4 White carp Copyright © CEDAC 2010

D. Tilapia

- An exotic species which is native to North Africa and lives in freshwater habitats;
- They are easy to raise because they live in water with a low level of oxygen;
- They like to consume many kinds of food such as vegetable, plant leaves, duckweed, and insects such as termites, and so on;
- They consume supplementary food such as rice bran, broken rice, maize, bean, and food wastes;
- They live in the water of pH 4 – 9, at the temperature of 14-40 degree Celsius;
- They like to live in all layers of water, and are resistant to diseases;
- They weigh 0.20 – 0.50 kg after 8 months of cultivating fish;
- They mature at 4 months.
- They can easily lay eggs and reproduce in the natural pond.
- They get easily frightened.



Picture 5 Tilapia Copyright © CEDAC 2010

E. Ordinary carp (“Carp Samanh”)

- An exotic species which inhabits freshwater habitats;
- They are easy to cultivate as they inhabit water with a low level of oxygen;
- They consume many kinds of food such as vegetable, plant leaves, duckweed, and insects such as termites, and so on;
- They consume supplementary food such as rice bran, broken rice, maize, bean, and food wastes;
- They live in water of pH 5.5 – 8.5, at the temperature of 20-30 degree Celsius;
- They like to live in the bottom layer of water, and they are resistant to diseases;
- They weight 0.5 – 1 kg after one year of cultivation;
- They are adult after 4 months
- They can reproduce in a pond.



Picture 6 Ordinary Carp (Copyright © CEDAC 2010)

F. Indian carp (“Carp India”)

- An exotic species which inhabits freshwater habitats, and it is easy to cultivate;
- They consume vegetables, plant leaves, duckweed, and insects such as termites, and so on;
- They consume supplementary food such as bran, broken rice, maize, bean, and food wastes;
- They live in water of pH 5.5 – 8.5, at the temperature of 20-30 degree Celsius;
- They like to live in the bottom layer of water, and are resistant to diseases;
- Weigh 0.5 – 0.7 kg for one year of cultivation;
- They are adult at age of 1.5 years



Picture 7 Indian carp Copyright © CEDAC 2010

G. Basa catfish (“Pra”)

- They consume many kinds of food such as vegetable, plant leaves, duckweed, and insects such as termites, and so on;
- They consume supplementary food such as rice bran, broken rice, maize, bean, and food wastes;
- They are resistant to diseases and tolerant of many habitats;
- They like to live in the bottom and middle layers of water;
- They live in water of pH 4 – 9, at the temperature of 20-30 degree Celsius;
- They weight 0.8 – 1.2 kg after one year of cultivation;
- They cannot spawn eggs in a pond.



Picture 8 Basa catfish Copyright © CEDAC 2010

H. Broad head catfish (“Andeng”)

- They consume many kinds of food such as vegetables, plant leaves, duckweed, and insects such as termites, and rice bran, broken rice, maize, bean, and food wastes, and so on;
- The depth of water suitable for walking catfish is 0.5 – 1.5 m;
- They inhabit and find food at the bottom of the pond;
- They are resistant to habitats and diseases;
- They weight 0.20 – 0.50 kg after 7 months of cultivation;
- They can spawn eggs in a pond.



Picture 9 Broadhead catfish Copyright © CEDAC 2010

CHAPTER 2 POND AND PLASTIC HOLE PREPARATION

2.1 FISH POND PREPARATION

A. Pond location selection

- Make sure it is close to your house for easy management at anytime
- It should be flat land which ideally does not flood during rainy season or at least where flooding is minimal
- The soil should be capable of holding water for a long time;
- It should be close to a water source (if any), the pond next to rice fields is better because it has useful living conditions for ordinary carp and Indian carp.
- It should be isolated from areas where chemical poisons and other poisoned sources are used.
- It should be a place which has enough sunlight for the water plant to photosynthesise.



Picture 10 Preparing slopes of new fish pond (Copyright © CEDAC 2010)

B. Testing Soil Quality

Soil that is suitable for digging ponds does not absorb water. This can be tested with the following methods:

1. Throw a squeezed handful of soil up and catch it. If the soil does not break, that soil is suitable for digging ponds.
2. Repeat the above step with soil taken progressively deeper until at least one meter depth.

Note: If the thrown soil drops and breaks, that kind of soil cannot store water for a long time. It is a kind of sand or rock.



Picture 11 How to test soil quality Copyright © CEDAC 2010

C. How to test pond water quality

Before releasing fish into the pond, check the quality of water first using the following methods:

- Use betel and areca nuts juice and drop it into a sample of the pond water. If the water remains red, the water is good. If the water is black, the water is not good and cannot be used to raise fish (sour water).
- Pour the water from the pond into an iron bowl with soap and stir it with your fingers. If there are a lot of bubbles and then the bubbles disappear, the water is good. Water with few bubbles that quickly disappear is identified as sour water and cannot be used to raise fish because the yield will be low.
- Use tournesol paper to put into the iron bowl with the pond water. If the water becomes red, it is sour water. If it is blue, the water can be used to raise fish. You can also check the values of pH on that paper and then compare it with the pH degrees of fish to be raised.
- Soak pH equipment in the pond water and then check its values and compare them with the pH degrees of the fish of fish to be raised.

D. How to dig out the pond

- Before digging out the pond make sure that the quality of soil has been checked;
- Dig out the pond in the form of a rectangle; the width should not exceed 30 meters;
- The pond surface is 100-3,000 m², 1.5-2.5 meters in depth;
- The pond height is 60-80 cm, the pond wall should include slopes;
- The bottom of the pond is flat and even;
- Dig the upper layer of soil from rice fields to set up a pond wall around the pond while the clay is for the bottom of the pond.
- If it is an old pond, rearrange the bottom, walls and inclined bank of pond as described above.
- A pipe should be installed in the pond bank to transfer water into the pond.
- The pond should be surrounded by a small dam to protect erosion and useless things.

✓ Old pond preparation

- First, pump all the water out of the pond.
- Clear grass or vegetation that grows around the pond edge.
- Repair the dam, the wall and the bottom of the pond to strengthen the pond.
- Clean the pond bottom by removing crabs, snails, frogs, and carnivorous fish (ex: snake-head fish) from the pond. Then remove most of the mud but keeping 0.2 to 0.3 meter thick of old mud at the pond bottom.
- Then broadcast 5 to 10 kilos of white lime per 100 square meters.
- Dry the pond bottom for 1 to 2 days or 1 week to reduce the sourness or saltiness in order to kill germs so that the water becomes clear and produces natural feed easily.
- Lay animal manures such as cattle, buffalo, chicken manures and vegetation such as Siam weed (the quantity of these fertilizers is used similarly to new pond preparation).
- After laying the fertilizers on the pond bottom, fill the pond with water to a depth of 0.5 meter and then keep the water for 3 to 5 days or 1 week.
- Finally, fill the pond with more water as required. If you see that the water colour becomes green after 4 and 5 days, it means that the natural feeds have grown. At this time you can release your fingerlings into the pond.

Quality fertilizers to be used in the fish pond

- If chemical fertilizers are used: Chemical fertilizers to be used include Urea and DAP fertilizers and should be used before the water becomes very green. Mix 0.7 kilo of Urea with 0.3 kilo of DAP per each 100-square-meter area of the pond. For most effective use, the mixed fertilizers should be broadcasted over the pond when it is very sunny.
- Note: The purpose of putting manures into the pond is to increase tiny plants and tiny animals in the water, including plants plankton and animal plankton because these two kinds of feeds are very important to fish.

✓ New pond preparation

- First, apply the top layer soil on the pond bottom and then fill it up with water and keep the water for 3 to 4 days so that the soil becomes mud. This produces natural feed easily, after manures and green vegetation are put in the pond.
- After that, pump the water out of the pond and immediately broadcast 10 to 15 kilos of white lime for each 100-square-meter area of the pond so that the lime reacts with mud.
- Dry the pond bottom for 1 or 2 days to reduce sourness or saltiness in the pond so that the water becomes clear and produces natural feed easily.
- After that, lay manures and green vegetation on the pond bottom as below:
 - Cattle manures: 30 to 40 kilos per 100 square meters.
 - Chicken manures (if available): 2 to 3 kilos per 100 square meters.
 - Siam weed (tied in bunches): 20 to 30 kilos per 100 square meters.
- After laying fertilizers on the pond bottom, flood the pond bottom to a depth of 5 meters and keep the water for 3 to 5 days or 1 week so that it produces natural feed.
- Finally, fill the pond with more water as required. If you see that the water colour becomes green after 4 and 5 days, it means that the natural feeds have grown. At this time you can release your fingerlings into the pond.
- Set nets and bamboo bars around the pond to prevent carnivorous fish from entering the pond to eat your fingerlings.

Table of amount of fertilizers to be used in the fish pond

Descriptions	Old pond (100 m ²)	New pond (100 m ²)
Agricultural lime	5-10 kg	5-10 kg
Cow/buffalo dung	60-80 kg	80-100 kg
Pig dung	20-35 kg	25-40 kg
Poultry manures	10-15 kg	15-20 kg
Fresh Siam weed leaves	20-30 kg	30-40 kg
DAP	0.3 kg	1 kg
Urea	0.7 kg	2 kg

E. Pond preparation before releasing fingerlings

- Allow the bottom of the empty pond to dry for 3-5 days to reduce sour substances and disinfect the soil;
- Mix agricultural lime with water, and spread onto the pond surface in order to disinfect the soil and kill piscivorous species (5-10 kg/100m²) based on the real situation of water and soil;
- Lay the bottom of the fish pond with natural pond mud, 10-centimeter thick, mixed with 0.5 kg/m² of animal dung.

F. Checking colour of pond water

- Light green water means that the water is producing natural fish food.
- Dark green water means that there is too much natural fish food. Therefore, you should stop using fertilizers for a while because it can poison or kill your fish.
- In muddy water there are no natural fish foods. As a result, your fish grow slowly.
- Too clear water means that the water is poor in natural foods. Therefore, you need to add more manure similar to the above amounts.

2.2 PLASTIC HOLE PREPARATION

A. Location selection

- It should be close to a water source (pond, ditch or well) for easy adding or changing water;
- It should be isolated from big trees because there might be some impact such as tree leaves falling into the pond or the plastic bag might be perforated by the tree roots;
- It should not be flooded during rainy season, dig on high and flat even land;
- It should be close to your house for easy maintenance;
- The soil should not contain rock bits or tree branches that could puncture the plastic.



Picture 12 Preparing slopes for plastic hole Copyright © CEDAC 2010

B. How to dig out the pit and lay plastic

- Design and measure the rectangular plan of the pit;
- Calculate the surface for laying the plastic bag,
- Use 8 posts (4 posts are set up at the bottom of the hole, and the other 4 are for the banks of the pit);
- Dig out the pit in the form of a rectangle with 2.5 m – 3 m wide by 5 m – 6 m long and 0.8 m – 1 m deep. The size of the bottom should be smaller than the surface size to avoid erosion.
- Check the plastic bag in case it is perforated and then lay it out as flat as possible;
- Set up a dike around the pit over the plastic edges to prevent rain water from flowing into the pit;
- Grow grass around the pit;
- Make a protective fence using cheesecloth, net or bamboo twigs around the pit.



Picture 13 How to install plastic into the hole.

C. How to install raised pit

- A raised pit is installed on top of the soil;
- It is usually installed in areas which have a lot of rocks and stones in the ground, where it is difficult to dig;
- You don't need to dig out a pit, just set up a dike around the pit made with gravel, stone or sand;
- It lasts longer than dug pit as the banks of the pit cannot be eroded easily;
- The surface of the pit is 3-6 m² and the depth is 0.8-1 meter.

D. Plastic hole preparation before releasing fingerlings

- Lay the bottom of the fish pond with natural pond mud, 10-centimeter thick, mixed with 0.5 kg/m² of animals dung;
- Use white lime mixes with water to throw into the hole to kill virus and other harmful living things as well as to make the clear water. The amount of white lime is 5 – 10 kg/100 m² or depending on the real situation.
- After transferring water into the hole, keep it empty for at least 3 – 5 days.
- After that grow water hyacinth in the pit, to cover approximately 1/3 of the water surface, to make a shelter for the fish.

2.3 FINGERLINGS SPECIES SELECTION

The fingerlings currently cultivated by farmers come from different sources. They are caught from nature and bought from the breeding ground.

The characteristics of the species of fish that are good to select for breeding are as follows:

- They are available everywhere, easy to raise and grow quickly.
- They are resistant to diseases, and accept new environments such as pond, plastic hole and rice fields; It is important if they can get used a place where there is speedy water flow.
- They can eat natural food or supplementary food which can be produced in the local area;
- They have a market price, or are liked by people.
- They are fish types which are allowed by fishery administration.

2.4 RAISING PROCEDURE

A. Season of releasing fingerlings

Release your fingerlings in early rainy season. If this is done late, the chance of losing your fingerlings will be high. In early rainy season certain rice fields and ponds are good for raising fish.

Releasing fingerlings in early rainy season will reduce their losses because at this time there are not many enemies yet such as carnivorous fish, eels, crabs and frogs. We should take into account the points as mentioned below before releasing the fingerlings.

B. How to train fingerlings

To reduce the mortality rate of fingerlings during the transportation and release into a pond, we should follow the steps as below:

Step 1: Before collecting fingerlings:

- Train fingerlings for a period of 2-3 days beforehand.
- Train fingerlings once a day by using a big fishing net to move them to the pond side when the water is cool in the evening;
- Do not feed the fingerlings 2-3 days before collecting into the container.

Step 2:

- Collect the fingerlings and store them in a big net in a corner of the pond for 10 to 20 minutes. Then we let the net and fingerlings sink.
- Collect and move fingerlings into a very big net in the pond with clean water.
- Before transporting them, store fingerlings into the hatching material for at least 24 hours so that they get into the habit of excreting wastes and to ensure that the fingerlings will not get poisoned or die.

C. How to package fingerlings with plastic bags

- Ensure that the 0.6 x 1-meter plastic bags are not pierced;
- For transporting fingerlings long distances, place them into a double plastic bag place these in a cardboard box;
- Deflate the plastic bag, twist the tail of the plastic bag, and tie it with one or several rubber rings;

- Fill the plastic bag with one third of clean water;
- Select fingerlings that are 3 – 5 cm
- Count and put fingerlings into the plastic bag and pump oxygen into the plastic bag;
- Tie the plastic bag with the rubber rings and don't keep it open.

D. How to transport fingerlings

There are two ways to transport fingerlings with enclosed and open containers:

- To prevent the plastic bags of fingerlings from being exposed to sun, cover them with water hyacinth and cloth soaked in water;
- The duration of transportation should not exceed 3-5 hours; For longer periods change the water and pump the oxygen again;
- Fingerlings can be transported in open containers such as plastic buckets or in enclosed containers such as barrels;
- The density of fingerlings in a plastic bag can be 500-600 fingerlings if it is one cm in length; 300-400 fingerlings if it is 3-4 centimetres; 200-300 fingerlings if it is 4-6 centimetres.

Picture 14 Plastic bag for storing fingerlings during transportation



E. Time of releasing fingerlings

- When the pond water is green, it means that it is time to release the fingerlings.
- Release fingerlings when the weather is cool (at 8-9 am or 4-5 pm);
- The density of fingerling in the pond is 3-5 fingerlings/1m² and in the plastic hole is 40 – 50 fingerlings/1m².
- Before releasing fingerlings into the pond, put the plastic bag into the pond for 15-20 minutes to make the temperature similar and relax the fingerlings;
- Take fingerlings from the plastic bag and put them into an iron pan of 10 litres mixed with 0.03 kg of salt for 5-10 minutes to clean (disinfect) them;
- Turn the pan gradually to one side and let fingerlings swim into the pond.
- Do not release your fingerlings when it is raining because the rain water on the surface layer of pond water consists of acid which makes the fingerlings die.
- Release the fingerlings after the rained has stopped for 2 to 3 hours because then the pond water has mixed with rain water and the acid level is reduced so the fingerlings can resist the new water.
- When scooping fingerlings from the plastic bag for cleaning, make sure that you count them and note the number carefully.
- Let the fingerlings eat their feed 24 hours after release so that they return to normal condition. The fingerlings are toxic after they are transported from suppliers.



Picture 15 How to release fingerlings



Picture 16 How fingerlings get used to new environment

CHAPTER 3 FISH RAISING TECHNIQUES

3.1 HOW TO RAISE FISH IN A POND

To get a high yield, you need to consider the species and sizes of fish that can be raised in the pond such as tilapia, Sutchi river catfish, walking catfish, barb, tiger oscar and kissing gourami, common carp, bighead carp, grass carp. Moreover, the density of fingerlings to be raised in the pond should be suitable for the techniques used. Generally the density of fingerlings to be raised in the pond is 3-5 heads/m². Besides, you need to select fingerlings that are healthy, active and have no diseases. In order to achieve efficient utilization of feed in the pond, you should raise at least 3 species of fingerlings. The percentage of fingerlings species to be raised is shown below:

Table of fish density to raise in the pond

Fingerlings Species	Gold fin tinfoil barb	Tilapia	White Carp	Ordinary/Indian Carp
Gold fin tinfoil barb as majority	40%	30%	20%	10%
Tilapia as majority	30%	40%	20%	10%
3 species only		50%	40%	10%

For example: A pond is 100 m² then release 3 fingerlings/1m² so the total number of fingerlings is 300:

- Chhpin 40% = 120 fingerlings
- Tilapia 30 % = 90 fingerlings
- White Carp 20% = 60 fingerlings
- Ordinary Carp 10% = 30 fingerlings

A. Food and how to feed

There are 2 types of feeds: natural feed, and supplementary feed. These include rice bran, broken rice, seaweed, water spinach, duck weed, algae, vegetables, plant leaves, cereal grains, insects, including termites, large red ants, worms, earthworms, food wastes and compost fertilizer and so on. For supplementary are bran, broken rice, Azolla and morning glory. Adding water plant and animal dung 1 to 2 times per month sum up with 30% - 40% of total amount of first pond preparation based on the pond water quality.

Each food type is important for the growth of fish. To make the fish grow quickly, it is important to make food with ingredients such as bran 50%, broken rice 14%, soybean 14% and salt 2 % of total amount of food. The fish food should be properly cooked before feeding because the fish like eating such kind of food and it will grow quickly.

Table of fish food quantity

Fish weight	Quantity (percentage of total fish weight)
50-100 g/head	4-5%
100-300 g/head	3-4%
over 300 g/head	3%

Amount of feed fish consume per day = Total fish weight in the pond x 3%

Example:

Total number of fish in the pond is 300. 1 fish weights 0.3 kg in average.

Total amount of food per day: $(300 \text{ fingerlings} \times 0.3) \times 0.03 \text{ (3\%)} = 2.7 \text{ kg of food}$

- Feeding place: To feed effectively, feeders should be located at each corner of the pond. This makes it easy to feed the fingerlings. Feeders can be made of wooden frames, or baskets made of narrow-mesh net which can be lifted up and put down by one string. The said frames or baskets make it easy to monitor the feed utilized by fingerlings as well as their number and health. These frames or baskets can be removed to other areas in the pond.
- Time to feed fish: Feed your fish regularly in the morning and in the evening because at that time the pond water is cool which does not affect the digestion and breathing of your fish. More important is that you should not feed your fish when it is raining because they will not eat the food. In order to determine the proper amount of feed for daily feeding, you need to check the feed in the frames or baskets after an hour. If you see that there is no feed left, this means that the feed you put in the frames is not enough. But if you see that there is feed left in the frames, you need to reduce the amount of feed to put in the frames.
- Do not leave feed in the frames for more than one day because it can harm the quality of pond water. In addition, fish manure in the feeding frames pollutes the water. So you need to clean the feeding frames daily.

B. Water quality management

- Always maintain the quality of the water to keep a green colour;
- Put fresh plants into the pond to increase the quality of water;
- Exchange the water 1 – 2 times per raising cycle when the pH has increased.
- Prevent cows, buffalos, pigs or other activities from making the water muddy;
- Do not immerse palm leaves, woods, bamboo or other plants which make the water in the pond poisonous;
- Do not use poisonous substances such as agricultural insecticides or detergent in and around the pond;
- Dig a pit nearby the pond at the size of 1-1.5-square meters, 0.5-meter depth, with small ditch or pipe for flowing fertilized water into the pond. The bottom level of the pit must be higher than water surface level in the pond. Replace fertilizer every 20-30 days;
- Put in 3 portions of animals dung and 1 portion of Siam weed in the pond to generate plankton (hang a sack at 0.3-meter depth below the water surface for 1 week based on the quality of water).
- Take excess water plants out and remove all leaves that fall in.
- Add more fertilizers, fresh plants and dry animals dung 1-2 times/month according to the plan;

C. Follow up and maintenance

- Use bamboo twigs or nets around the pond margin to prevent snakehead murrel, eels or snakes from entering to eat the fingerlings. If they exist in the pond, you must catch them;
- Set up a dike high enough to prevent rain water from flowing into the pond;
- If you see sick fish or dead animals in the pond you need to catch them immediately;
- After 2-3 months you need to check the growth rate and number of fish left in the pond when you feed the fish or use a seine to catch your fish;

- If the fish are poisoned, reduce the fertilizer and postpone feeding for 1-2 days. Exchange the old water with new water in order to produce oxygen in the water, or put Dolemite (kind of lime) in the pond;
- Hang an oil lamp or a purple electric lamp above the water surface to attract insects which fall into the water and become feed for the fish;
- In the morning, if you see fish emerging out of the water showing strange activities (not panic) this indicates that there is insufficient air for your fish to breathe or that they are poisoned. In this case, you need to make the water move or pump new water into the pond and postpone feeding and fertilizer for a period of time.
- You should check the water plants, certain types of Azolla contain poisoned substances.
- You should keep the level of the pond water from 1.5 m to 2 m.
- When transferring water into the pond, always use a net to filter out the dangerous living things which can kill the fish.

3.2 HOW TO RAISE FISH IN A PLASTIC HOLE

To get high yield, you need to consider the species, sizes and densities of fish to be raised in the plastic hole. The density of fingerlings to be raised in the plastic hole is 3-5 heads/m². Also you need to select fingerlings that are healthy, active and have no diseases. In plastic-laid holes, only one species of fish is raised.



Picture 17 Put grass to protect from erosion

A. Natural food and how to feed

Feeding fingerlings raised in a plastic hole is not different from those in a pond. Before feeding your fingerlings, beat the water as a sign for them to notice the place and time of feeding. Feed the fingerlings regularly to avoid wasting food and to make them grow effectively. Vary the places in the hole that they are fed. Put the feed in baskets and immerse these to 0.2-0.3-meter depth below the surface of the water.

How to feed fingerlings with termites: Firstly, break the termites mound into small bits. Then use a basket to sift [termite mound bits] in order to separate the termites from the bits of mound. Next pour the termites into a large pot of water and use your hand to stir until the termites float on the water. Pull the termites out of the water and then take them to feed your fingerlings (by doing this the water in the pit is not made muddy).

B. Water quality management

- Add more water frequently;
- Always maintain the quality of water to be a green colour;
- Put in fresh plants to help increase the quality of water;
- Put in 3 portions of animal dung and 1 portion of Siam weed in the pond to generate plankton (hang a sack at 0.3-meter depth below the water surface for 1 week based on the quality of water).

C. Follow up and maintenance

Maintenance is the most important factor for getting high yield. You need to consider the following factors:

- Feed the fish at different places in the pit, adequately and regularly;
- Check that the plastic bag is not torn,
- Prevent dogs or cats from entering and stepping on the plastic bag;
- Maintain the protection dike whenever there is a heavy rain in case the fish can get out of the pit;
- Check that not too much grass grows on the dike and no plant leaves fall into the pit;
- Do not let children or your neighbors scoop the fish [to look at them] too often because the fish will eat less after being scooped out of water;
- Change 30-50% of water in the pit every 7-10 days;
- After 2-3 months you need to check the growing rate and number of fish left in the pond when you feed the fish or use a seine to catch your fish;
- If the fish are poisoned, reduce fertilizer and postpone feeding for 1-2 days, pump out the old water or pump new water into the pond, or make water moves;
- Hang an oil lamp or purple electric lamp above the water surface to attract insects which fall into the water and become feed for the fish;

3.3 FISH YIELD COLLECTION

- Fish harvesting should be done when the fish price in the market is high and when the water in the pond is nearly drained dry.
- When harvesting your fish, make sure that the fish are kept alive.
- In areas where water sources are available all seasons you can collect fish at any time. Bigger fish should be collected first to provide more space for the remaining smaller fish so they can grow more.

CHAPTER 4 DISEASES AND PREVENTION

4.1 DISEASES

Fish raised in a plastic hole and pond can have some problems caused by management factors. If you do not pay enough attention when raising your fish, they might get sick easily.



Picture 18 Coagulated blood disease



Picture 19 Fungus fish disease

A. Major fish diseases

Types of diseases	Signs	Prevention	Treatment
1) Infected wound	<ul style="list-style-type: none"> signs of burns and wounds on skin, scales, nose pits, dorsal fin, caudal fin (tail) of the fish 	<ul style="list-style-type: none"> always maintain quality of water; raise at appropriate fish density; check fingerlings before raising; 	<ul style="list-style-type: none"> for 100 m² pond, use 1-2 kgs of salt or lime mixed with 30 liters of water, spread out around the pond banks for 4-5 days consecutively;
2) Parasites	<ul style="list-style-type: none"> attach themselves to the skin, scales, fins of the fish; fish swims without direction; the fish body become swollen and red appearance 	<ul style="list-style-type: none"> disinfect the pond before putting in the fingerlings and maintain the quality of the water 	<ul style="list-style-type: none"> chop 0.5 kg of neem leaves and put it in cloth bags; 4-5 bags/100m²; 4-5 days consecutively; change [neem leaves] every 3 days.
3) Coagulated blood	<ul style="list-style-type: none"> signs of burns or blood coagulation on the skin; the fish is itchy, swimming without direction and towards the pit banks 	<ul style="list-style-type: none"> disinfect the pond before putting in the fingerlings and maintain the quality of water 	<ul style="list-style-type: none"> mix 1 kg of salt with 1 liter of water, or mix 1 kg of lime with 30 liters of water and then spread it out on the surface of water in the pit (once a day, at 9 am, for 4-5 days) Mash 20-40 heads of live crab mixed with 1 kg of rice bran and then feed the fish for 4-5 days.
4) Fungal infections	<ul style="list-style-type: none"> Caused by fungus Fish skin has burns and white bumps and wounds and on the nose, back, tail and gills. Skin is oily grey and has bad smell and is swimming without direction. 	<ul style="list-style-type: none"> Clean fingerlings with salty water before releasing them to the hole Take dead fish out immediately Renew the old water 	<ul style="list-style-type: none"> no treatment possible

B. Causes of diseases

- Bad quality of water, rich in poisons;
- Too many fingerlings are released into one pond (too high density);
- Overfeeding or insufficient feeding;
- The pond is not disinfected before releasing fingerlings into it;
- The quality of fingerlings is not checked before releasing;
- The pond, which is not disinfected, is rich in bacteria, fungi, viruses and so on.
- The fingerlings were diseased at the hatchery.
- The pond does not receive enough sunlight.

4.2 PREVENTION

Because fish live in water, it is difficult to cure them whenever they get sick. Therefore, prevention and maintenance are better than treatment. Fish diseases can best be avoided by the following measures:

- Ensuring that the water is good, clean and has no chemical substances (poisonous drugs or pesticides) flowing into the pond.
- If the pond water is drained dry in dry season then all wastes and garbage should be collected from the pond bottom. After that lime is broadcast over the bottom of the pond to kill off germs and parasites and a dike is built around the pond to prevent rotten wastes from flowing into it.
- Frequently collect and remove any tree leaves or garbage and do not soak sheets of palm leaves, bamboos or wood in the pond.
- At the end of rainy season (from the 11th to 12th lunar month), do not put tree branches or tree roots into the fish refuge system because it spoils the water and encourages germs (the fish will suffer contagious diseases).
- If the fish pond management is not carried out then the fish will face problems such as toxicity, diseases, etc. in the season when the wind blows from the north.

4.3 TREATMENT OF FISH DISEASES

Sick fish usually swim slowly, float on the surface or swim furtively along the banks of the pond, opening their mouth to breathe air and stop eating. Normally if there is a strange activity fish will dive in the water for a while and then return to the surface. Sick fish don't. Once identified we need to treat fish diseases as shown below:

- Neem leaves: chop neem leaves and put them in a cloth bag. After that put the bag at the bottom of the pond or tie it together with feeding frames.
- Mix 1 to 2 Kgs of lime with 30 liters of water for 100-square-meter pond; broadcast it around the banks of the pond for 4 to 5 days (once/day).
- Mix 1 to 2 Kgs of salt with 30 liters of water for 100-square-meter pond; broadcast it around the banks of the pond for 4 days (once/day at noon).

Some key points for family-scale fish raising

- ❖ Cleaning the pond before releasing the fish is a major factor for successful fish raising.
- ❖ If there is a snakehead ("phatuk" or "rors") in the pond, you need to take it out immediately because it will eat your fingerlings in a short time.
- ❖ Regular fertilizing to maintain the green colour of pond water is a very important factor for fish to grow fast.
- ❖ Unobstructed light is also an important factor which makes natural feed or plankton grow better after fertilizing.
- ❖ Raising fish in a pond with a channel connected to rice field is a good method which helps fish to grow fast. This can minimize the costs on feed as well.

LIST OF PICTURES

Picture	Title	Source
Picture 1	A-Low-intensive B-Semi-intensive and C-Intensive/Industrial Culture	Agromisa, Agrodok 15, Small scale freshwater fish farming
Picture 2	Goldfin Tinfoil Barb	Copyright © CEDAC 2010
Picture 3	Snakeskin gourami	Copyright © CEDAC 2010
Picture 4	White carp	Copyright © CEDAC 2010
Picture 5	Tilapia	Copyright © CEDAC 2010
Picture 6	Ordinary carp	Copyright © CEDAC 2010
Picture 7	Indian carp	Copyright © CEDAC 2010
Picture 8	Basa catfish	Copyright © CEDAC 2010
Picture 9	Broadhead catfish	Copyright © CEDAC 2010
Picture 10	Preparing slopes for new fish pond	Copyright © CEDAC 2010
Picture 11	How to test soil quality	Copyright © CEDAC 2010
Picture 12	Preparing slopes for plastic hole	Copyright © CEDAC 2010
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Picture 17	Putting grass to protect from erosion	VVOB SEAL 2011
Picture 18	Coagulated blood disease	Copyright © CEDAC 2010
Picture 19	Fungus fish disease	Copyright © CEDAC 2010

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