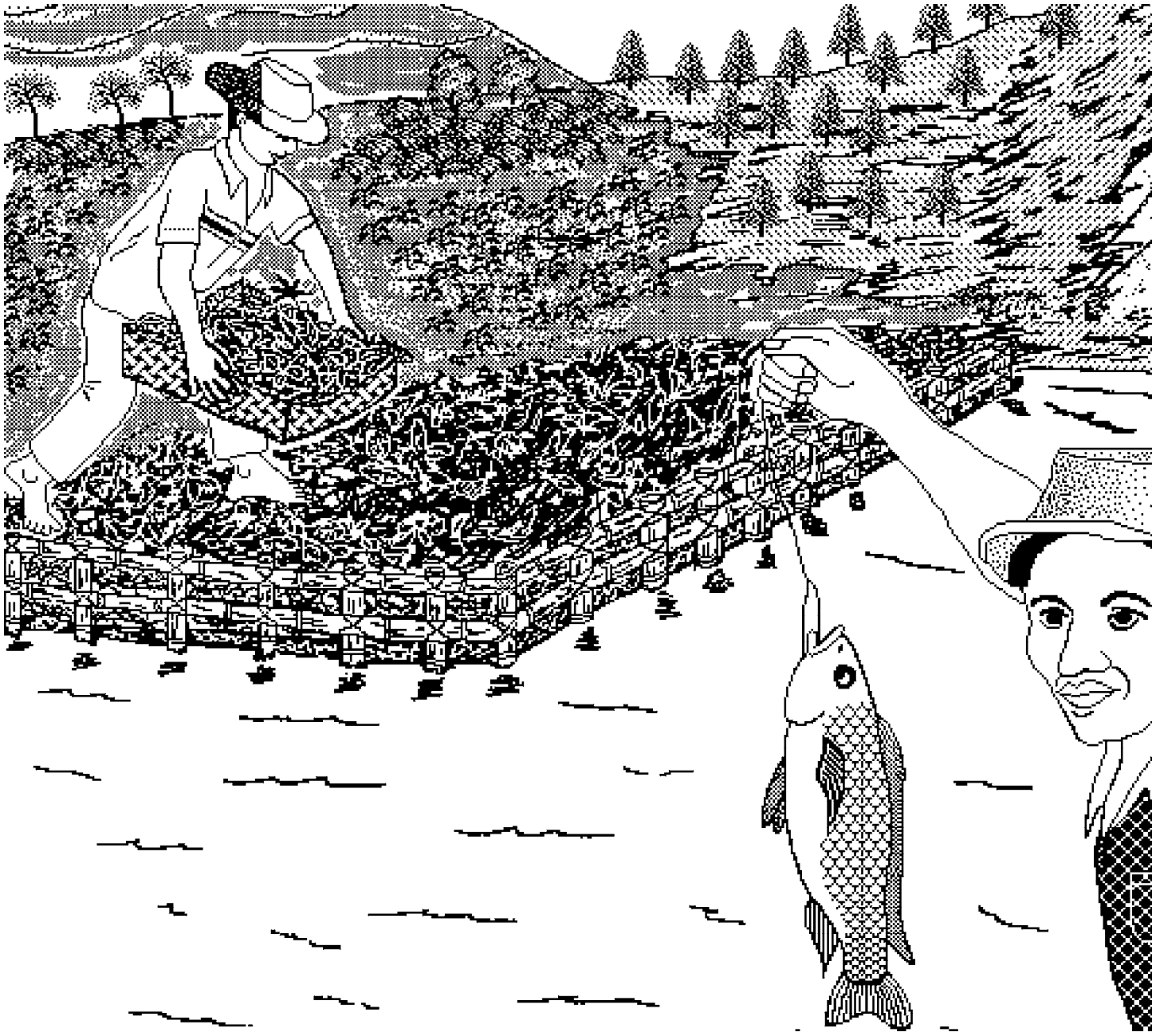
ORGANIC FERTILIZERS FOR FISH PONDS



INTERNATIONAL CENTER FOR AQUACULTURE
AND AQUATIC ENVIRONMENTS
AUBURN UNIVERSITY

INTRODUCTION

Organic fertilizers are usually animal manures or plant wastes and cuttings ("green manure"). Manure from chickens, goats, sheep, ducks, pigs, rabbits, cattle and horses are excellent fertilizers for fish ponds. Other examples of organic fertilizers suitable for ponds are digested sludge from biogas generators, molasses from sugar cane factories, composted vegetation, table scraps and waste water from animal slaughter houses. Examples of materials that are

NOT good organic fertilizers are rice hulls, sugar cane stalks, sawdust or other materials that require a long time to decay.

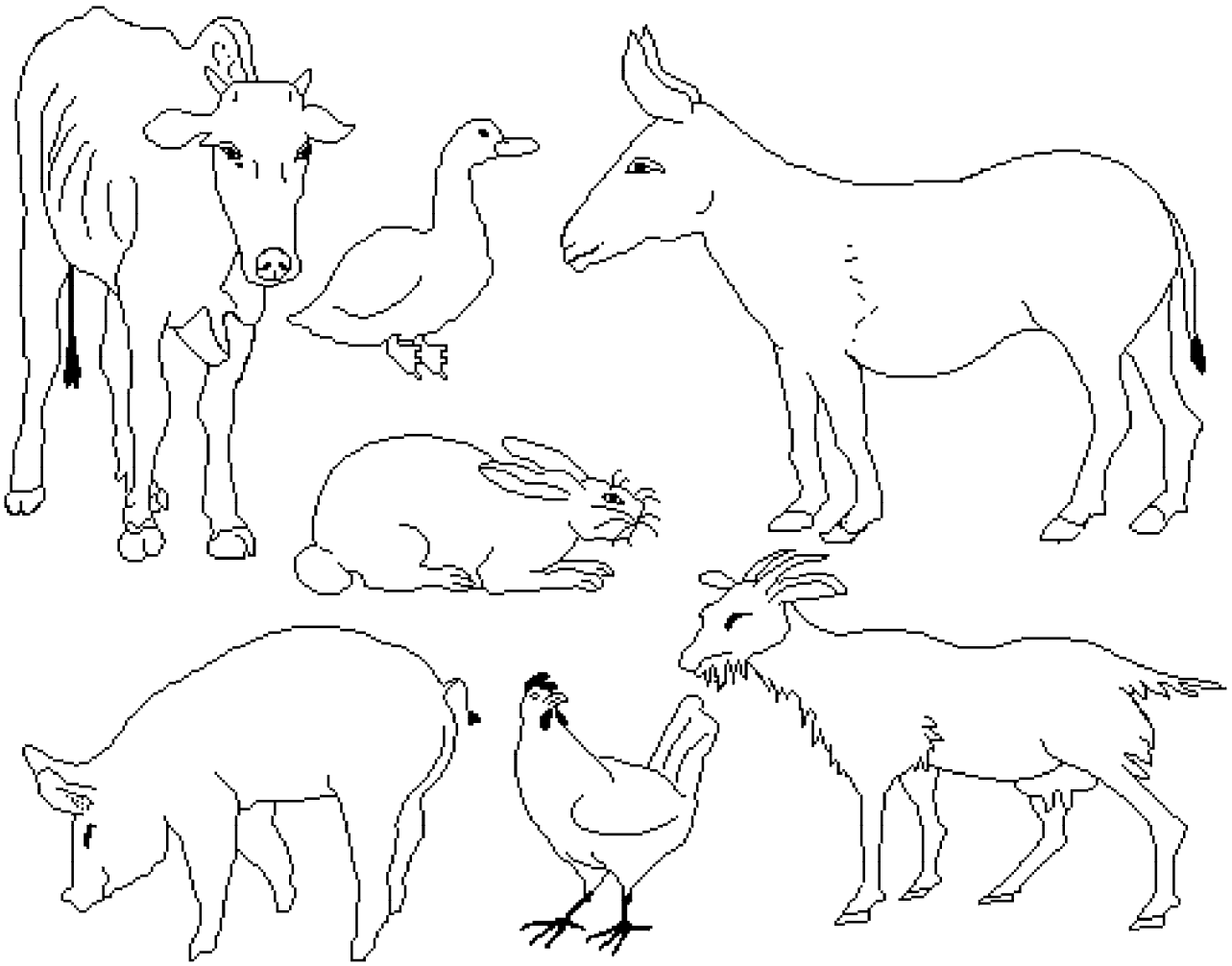


Figure 1: Animal manures make good fish pond fertilizers.

HOW DO ORGANIC FERTILIZERS WORK?

1) Organic fertilizers decompose and release nitrogen, phosphorous and potassium which are used by phytoplankton for growth and reproduction. In this way more natural food organisms are produced for fish to eat.

2) Organic fertilizers, especially animal manures, provide nutrients and attachment sites for bacteria and other microscopic organisms. These organisms provide nourishment for fish even though in some cases the manure itself may have no direct food value when eaten.

3) Many "green manures" and the undigested food in animal manures are digestible and provide direct nutrition when eaten by fish. This is in addition to their effect as fertilizers and attachment sites for fish food organisms as described above. The result is enhanced fish production.

HOW MUCH MANURE TO USE

1. Animal manures:

Manures vary in nutrient quality depending on the quality of food eaten by the animals. For example, animals like pigs and chickens which are given high quality commercial rations will have manure higher in nutrient quality than animals like horses and cattle which feed on grasses. The amount of pig or chicken manure needed for a pond is therefore less than the amount of cattle or horse manure to achieve equivalent results. The moisture content of the manure also affects its quality. Dry manure will have more of some chemical nutrients than an equal weight of wet manure because it is more concentrated, but the food value may be lower because bacteria and other organisms may have already removed much of the digestible material.

Animal manures are usually applied to ponds on the basis of weight per area of pond surface (kilograms of manure per hectare, per 100 square meters, etc.) or on an animal per area basis such as one pig per 100 square meters of pond surface area. Use Table 1 as a rule-of-thumb to determine approximately how many kilograms of manure or how many animals are needed for the desired effect. By dividing the weekly dose into daily applications, low oxygen problems will be less likely to occur and food in the manure will be more effectively utilized by fish. The amount of dissolved oxygen in the water and phytoplankton abundance as measured by the techniques described in the brochure entitled *Introduction to Fish Pond Fertilization* are the final indicators of how much is enough.

Table 1: Animal manure application rates and the number of animals needed to supply manure to 100 m^2 of pond.

MANURE SOURCE	APPLICATION RATE (KG/100m^2 /week)	NUMBER OF ANIMALS PER 100 m^2 OF POND
cattle	10	a) 0.3 (all day) b) 0.6 (night only)
chicken	6 - 8	10 - 15
duck	6 - 8	10 - 15
goat/sheep	10	a) 4 (all day) b) 8 (night only)
horse/donkey	10	0.5
pig	6 - 8	0.5 - 1

Chickens, pigs and ducks may be confined and fed a commercial ration. Chickens may be raised over pig pens which are built over fish ponds. Uneaten food and manure can then be washed or fall directly into fish ponds. The following diagrams illustrate two designs for integrating pig, chicken and duck raising with fish culture.

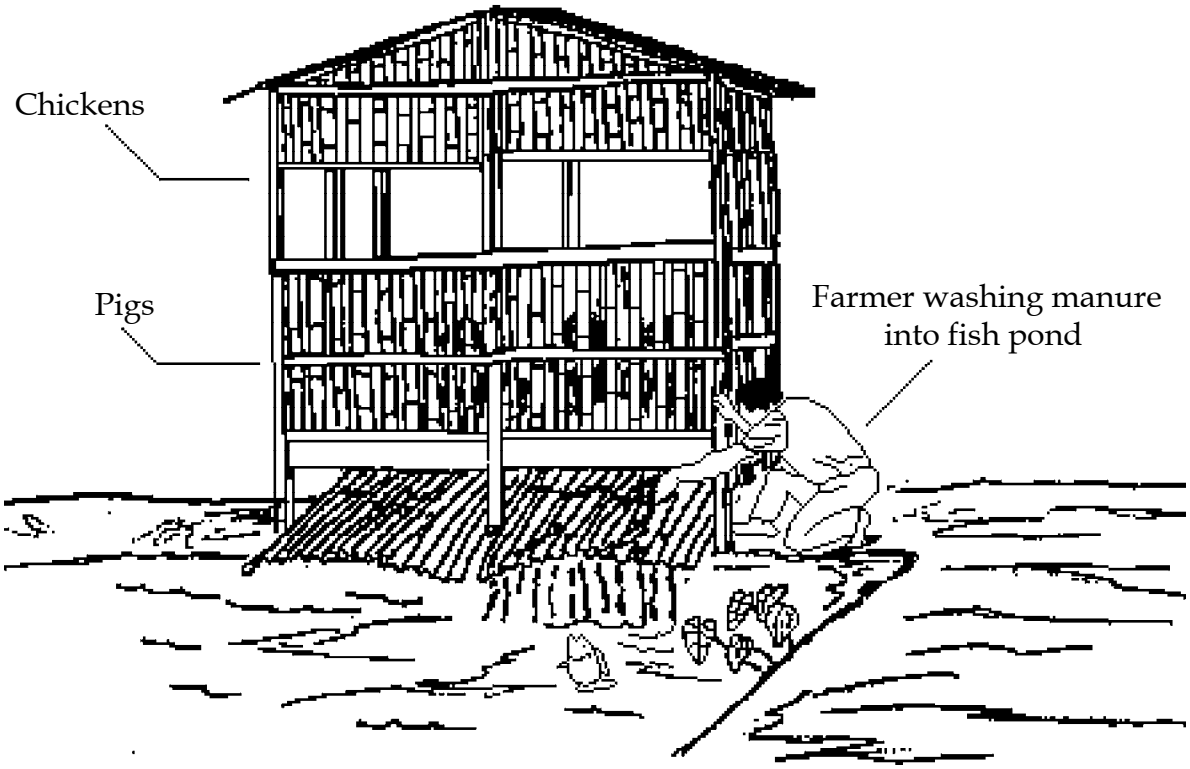


Figure 2: Galvanized iron sheets catch the manure and direct it to the pond.

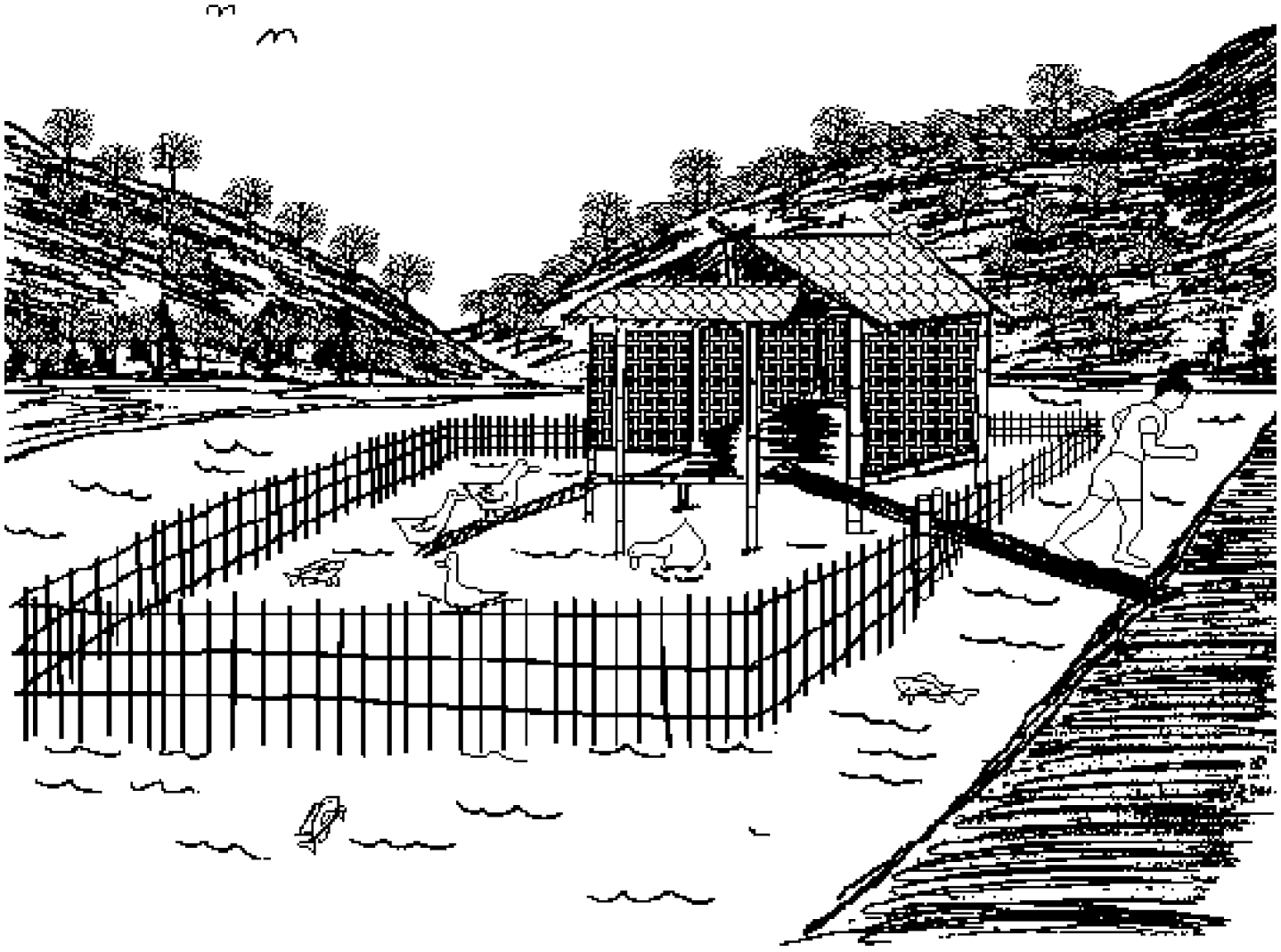


Figure 3: Duck house built over a fish pond.

Cattle, buffalo, sheep and goats are normally pasture-fed. Their manure falls in the fields where it is difficult to collect and apply to ponds. If these animals are corralled and fed near ponds, manure can be easily collected or flushed into ponds. Animals may be corralled constantly or only at night. Less manure will be available if the animals are confined only at night. More animals will therefore be needed per pond surface area than if constant confinement is used.

Large animals should not have unrestricted access to ponds because their hooves will break down pond dikes causing shallow weedy areas to develop. These areas become mosquito breeding grounds. Ponds should be protected with a fence and access of large animals limited to one small area of pond shoreline. Manure and urine will be concentrated there and flushed into the pond during rains. The following drawing illustrates these principles.

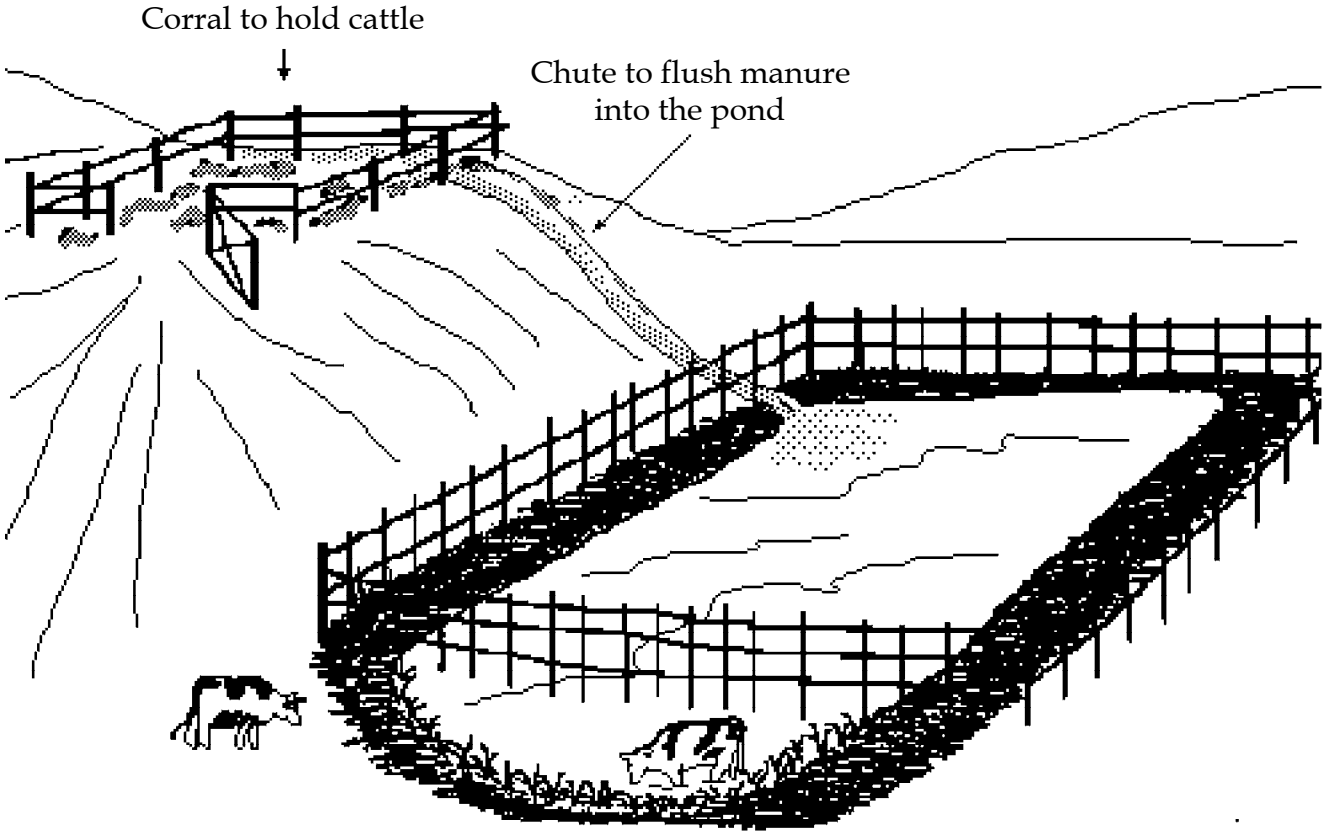


Figure 4: A pond fenced off to restrict access by cattle.

2. Plant or "green" manures

Vegetable matter, grasses, garden weeds, spoiled fruits and vegetables and other plant wastes can be used as fish pond fertilizer. They may be chopped into small pieces and mixed together into a compost pile. A mixture of animal and green manures provides a good fertilizer.
Compost should be kept moist, not saturated or dry, so it rots quickly. To control acidity 2.5 kg of finely ground lime may be mixed with 100 kg of compost material. Compost piles should be turned and mixed weekly to promote aeration and rapid decomposition. Compost piles shrink as the material decomposes.

Apply compost to fish ponds at rate of 20 to 25 kg/100 m^2 of pond surface area every ten days as a rule-of-thumb. In practice phytoplankton abundance, as measured by methods described in "Introduction to Fish Pond Fertilization" determines how much compost is actually applied. Compost is an effective fertilizer for small ponds. The size of pond that can be effectively fertilized depends upon the quantity of compost available.

Place compost material into corrals built of bamboo or wood measuring at least two meters long by one meter wide. Pile cut weeds, grasses and other soft plants and scraps inside the frame. Stir the pile weekly to promote continued decomposition. Compost can be withheld and/or removed from corrals if low oxygen develops until the problem is corrected.

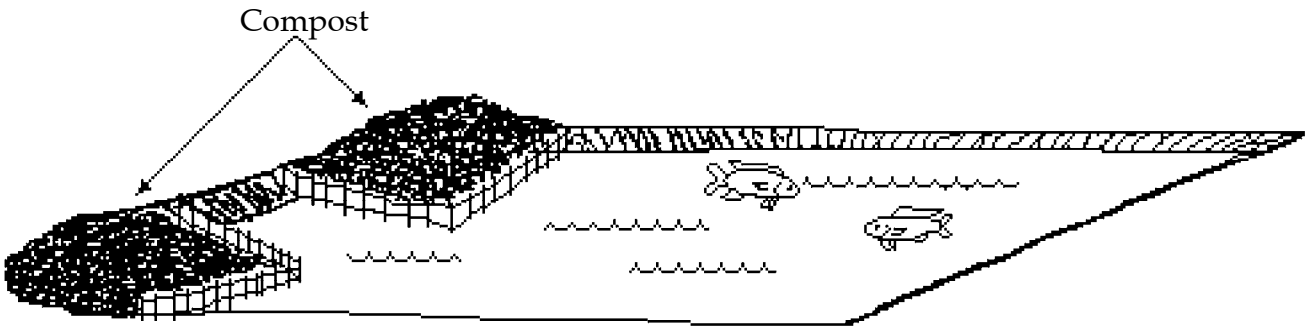


Figure 5: A fish pond with two compost corrals in the corners.

OXYGEN PROBLEMS CAUSED BY ORGANIC FERTILIZERS

Oxygen depletion frequently occurs after large doses of manure are added to a pond at irregular intervals. This is the most serious problem with using organic fertilizers. As manure decomposes oxygen is consumed from the water.

When oxygen is low fish come to the surface of the water and appear to be gulping air. They are trying to breath. This would be similar to a person who has been breathing under a cover for an extended time. Oxygen is used up and the cover must be removed to let in fresh air.

In ponds low oxygen usually occurs at night and is lowest just before dawn because phytoplankton have not produced oxygen during the night. Low oxygen can also become a serious problem when Secchi disk readings fall below 20 cm indicating that plankton are too abundant. See details on reading a Secchi disk in *Introduction to Fish Pond Fertilization*. Low oxygen can kill fish. If only a few fish die every day the problem may be disease. If large numbers die suddenly at night low oxygen is probably the cause. Even if fish do not die from low oxygen, they are weakened and more likely to become sick.

AVOIDING AND CORRECTING LOW OXYGEN PROBLEMS

1.) Suspend fertilizer application until the low-oxygen problem has been corrected and fish stop gulping at the water surface.

2.) Add fresh water to the pond immediately to revive the fish, and continue adding water until the fish stop gulping at the surface.

3.) While adding fresh water, drain some of the old water off the pond bottom. The bottom layers of water have the least oxygen.

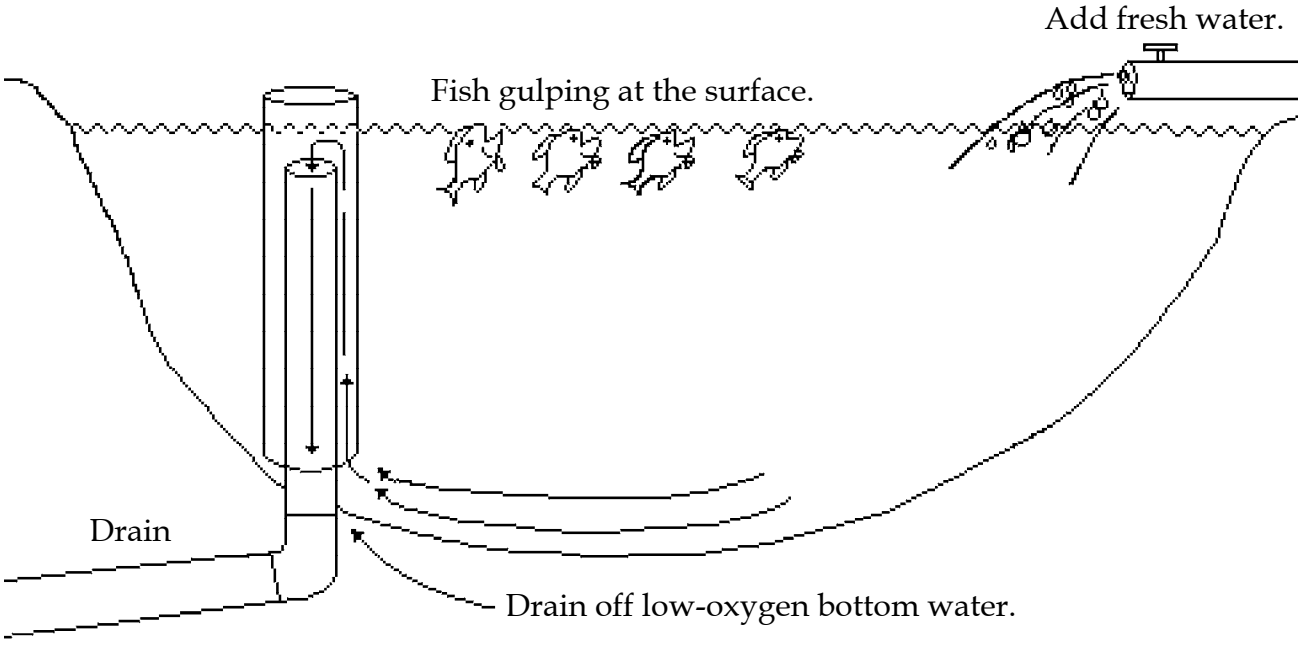


Figure 6: A fish pond with low oxygen.

APPLICATION RULES FOR ORGANIC FERTILIZERS

1.) The first application may be made two weeks prior to stocking fish to increase natural food abundance. When using manure provided by enclosed livestock, place the animals in their pens and begin feeding them two weeks prior to stocking fish. This is especially true if the pond was not previously manured.

2.) Do not overfertilize. Manure should be applied to ponds to keep plankton abundance within recommended limits. See *Introduction to Fish Pond Fertilization*.

3. Avoid adding large doses of manure at irregular intervals. Maintain a scheduled routine for adding manure based on observations of water quality. This allows decomposition to proceed at a slower rate and avoids oxygen depletion.

4.) Organic fertilizer can be used in combination with chemical fertilizers. If the pond is muddy add manure first to precipitate suspended soil particles. This will enhance the effectiveness of chemical fertilizers in increasing phytoplankton abundance.

5.) Keep Secchi disk readings of plankton abundance within the range of 20 to 30 cm and check the pond before sunrise to detect oxygen problems. Have fresh water available for flushing a pond if low oxygen develops. Suspend or reduce fertilization until the low oxygen problem is corrected.

6.) Remember that many organic fertilizers are also eaten by fish. Weekly amounts of manure can be divided into smaller daily doses to facilitate this. Daily doses are best applied at mid-morning to avoid creating oxygen problems.

GLOSSARY OF TERMS

assimilate - to take in and appropriate as nourishment.

chemical fertilizers - manufactured fertilizers containing nitrogen, phosphorous and potassium in varying proportions.

compost - organic material (especially plants) which has been decomposed and is suitable for use as fertilizer.

decomposition - the decay or breakdown of organic materials into simple compounds available for assimilation by phytoplankton.

dissolved oxygen - oxygen that is dissolved in water and which is respired by aquatic organisms.

fertilizer - a substance added to water to increase the production of natural fish food organisms.

food chain - the pathways through which nutrients added to a pond are converted into fish flesh.

green manure - manure composed of green plant matter.

manure/organic fertilizer - animal or plant matter used as fertilizer in ponds.

microscopic - invisible to the eye without the aid of a microscope or magnifying glass.

natural fish food organisms - plankton, insects and other aquatic organisms that fish eat.

nutrient quality - the amount and condition of nutrients (nitrogen, phosphorous and potassium) available in a given fertilizer.

organic fertilizers/manure - fertilizers composed of animal or plant materials which must be decomposed to release their minerals and nutrients.

oxygen depletion/low oxygen - a condition, normally occurring at night, in which oxygen dissolved in pond water has been depleted mainly because of the decomposition of organic matter and respiration of organisms in the pond.

phytoplankton - the plant component of plankton.
plankton - microscopic aquatic organisms (plants and animals) which are food for larger aquatic animals and fish.

Secchi disk - a circular disk measuring approximately 20 cm in diameter which is used to measure the abundance of plankton in water.

zooplankton - the animal component of plankton.

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Alex Bocek, Editor
International Center for Aquaculture and Aquatic Environments
Swingle Hall
Auburn University, Alabama 36849 -5419 USA

Suzanne Gray, Illustrator