WATER HARVESTING AND AQUACULTURE
FOR RURAL DEVELOPMENT

CHEMICAL FERTILIZERS FOR FISH PONDS

INTERNATIONAL CENTER FOR AQUACULTURE
AND AQUATIC ENVIRONMENTS
AUBURN UNIVERSITY

INTRODUCTION

Chemical fertilizers are normally used to improve soil fertility and increase agricultural crop yields. In fish ponds they stimulate phytoplankton production which increases fish yields. They contain inert filler material mixed with three important minerals, nitrogen (N), phosphorous (as P_2O_5) and potassium (as K_2O or potash) which are needed by phytoplankton in fish ponds. A commonly available chemical fertilizer is 12-24-12. It contains 12 percent nitrogen, 24 percent phosphorous and 12 percent potassium. This equals 48% fertilizer and 52% filler material by weight. Fertilizers high in phosphorous are especially good for phytoplankton production in freshwater ponds. New freshwater ponds and salt water ponds also require nitrogen. After several years, the organic content in the mud of these ponds will increase and may provide sufficient nitrogen for phytoplankton growth. Only phosphorous may be needed for increased production in aged ponds. Table 1 lists several chemical fertilizers used in fish ponds and their compositions. For more information on fertilizer application see *Introduction to Fish Pond Fertilization* and *Organic Fertilizers For Fish Ponds*.

Table 1. NPK composition of several fertilizers used in fish ponds

	Percent Composition		
	(N)	(P_2O_5)	(K_2O)
Ammonium nitrate	33 - 35	0	0
Ammonium sulphate	20 - 21	0	0
Ammonium phosphate	16	20	0
Calcium nitrate	15.5	0	0
Diammonium phosphate	18	48	0
Double superphosphate	0	32 - 40	0
Muriate of potash	0	0	50 - 62
Potassium nitrate	13	0	44
Potassium sulphate	0	0	50
Sodium nitrate	16	0	0
Superphosphate	0	18 - 20	0
Triple superphosphate	0	44 - 54	0
Urea	42 - 47	0	0

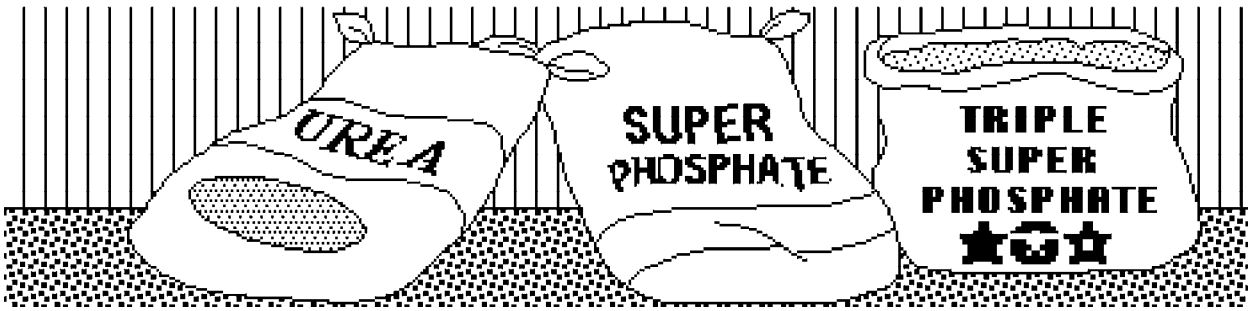


Figure 1: Sack or bagged fertilizer.

APPLYING CHEMICAL FERTILIZERS TO PONDS

Weekly application rates for chemical fertilizers may range from 1.25 to 1.75 grams of P_2O_5/m^2 of pond surface area. The amount of fertilizer needed can be calculated using information from Table 1. For example: to calculate the amount of superphosphate needed to give 1.25 grams of P_2O_5/m^2 in a 100 m^2 pond the following calculation is done.

$$\frac{1.25\ g/m^2}{0.20} \times 100\ m^2 = 0.625\ Kg/100\ m^2/week$$

In this calculation 0.20 (or 20%) is the percent P_2O_5 content from Table 1. The pond would receive an initial application of 0.625 kg of fertilizer. The weekly amount would then be increased or decreased as needed based on Secchi disk readings. See "Introduction to Fish Pond Fertilization" for details on making and using a Secchi disk.

Solid chemical fertilizers should not be thrown into a pond. They will sink to the bottom and nutrients will be lost in the mud. Chemical fertilizers can be applied in several ways to keep them out of the bottom mud.

1. Platform method:

A table or platform may be built of wood, bamboo or zinc sheets. The platform surface rests 30 cm below the water surface. Place a two-week dose of fertilizer on top of the platform. Wave action will distribute nutrients as they dissolve. Fertilizer is added as needed to maintain the desired phytoplankton abundance. This usually occurs when the water clears enough to allow the platform to be seen.

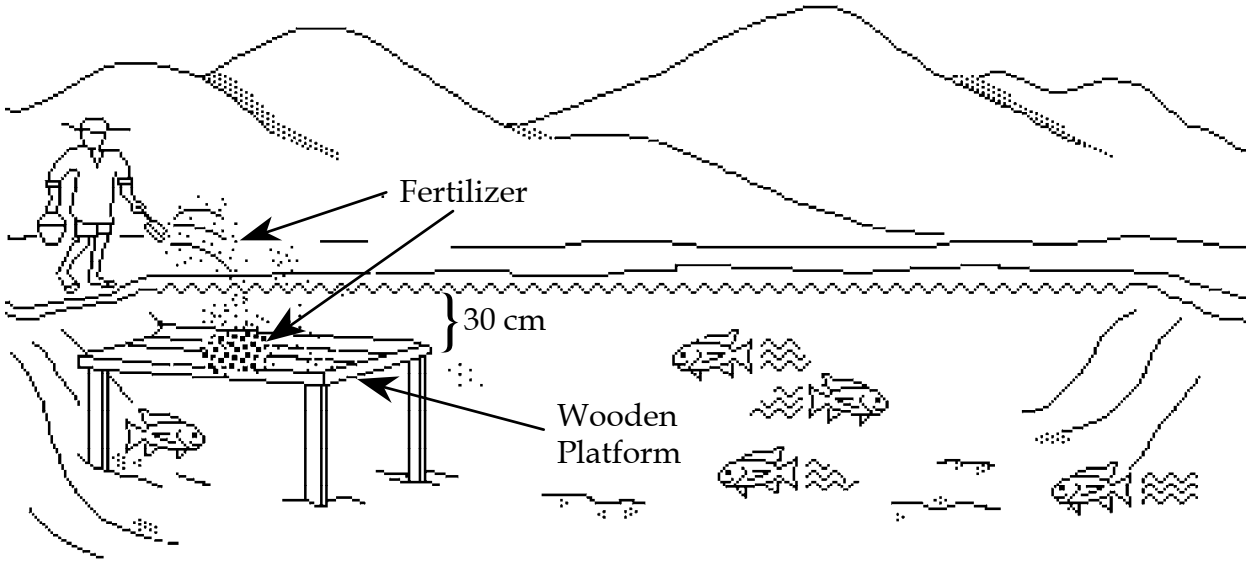


Figure 2: A platform for fertilizer application in a pond.

2. Nylon bag:

Nylon or cloth bags used to transport fertilizer, onions, rice or flour may be filled with the required dose of fertilizer and tied to a post below the water surface. Begin with a two-week dose of fertilizer. Dissolved nutrients pass through the bag into the water. More than one bag may be needed for large ponds. Add fresh fertilizer periodically and discard undissolved filler material left in the bag.

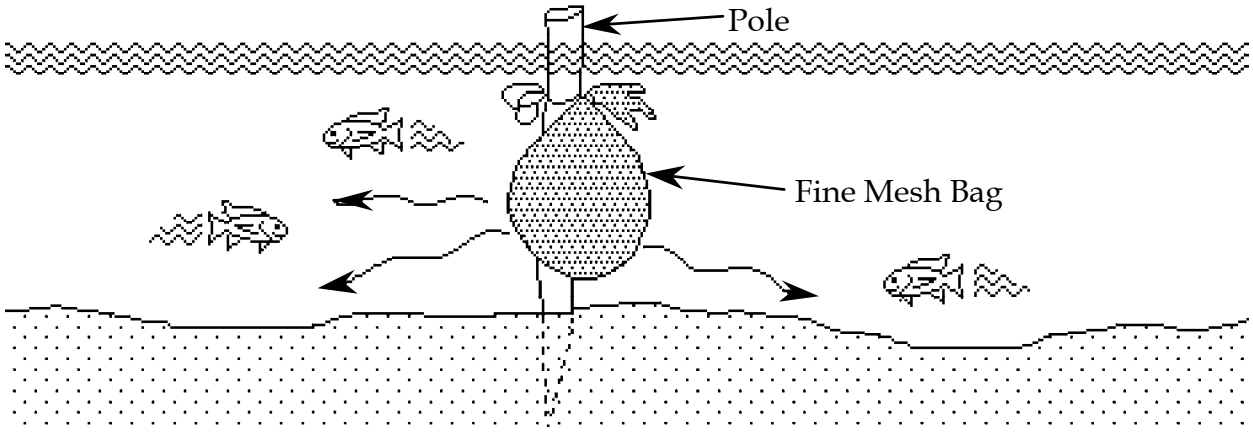
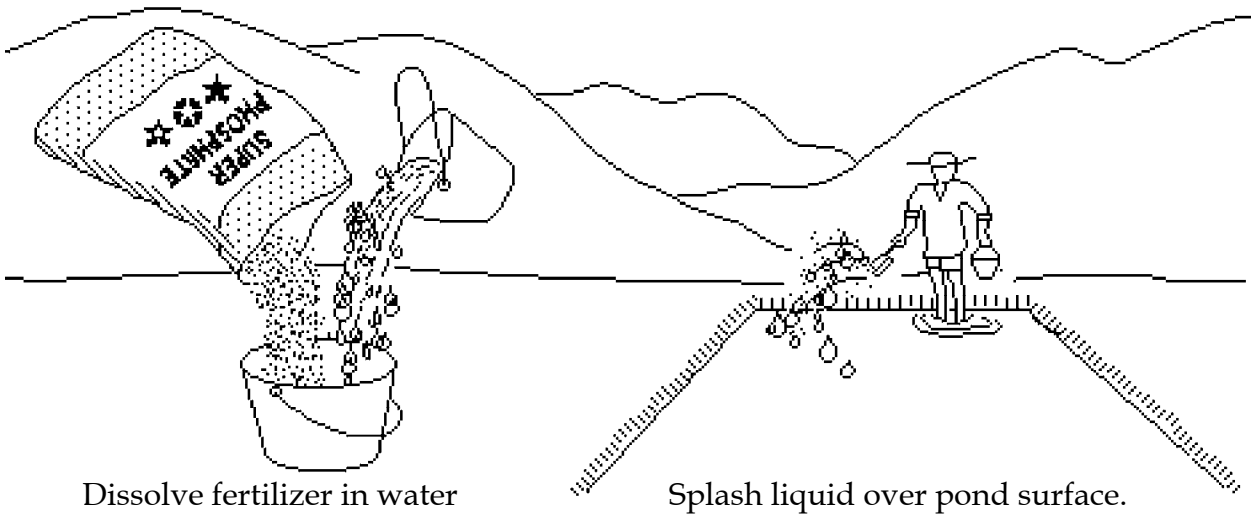


Figure 3: Fertilizer placed in a bag and tied to a pole.

3. Dissolved in water:

The quantity of fertilizer needed may be dissolved in buckets of water. Resulting "liquid fertilizer" is then dipped out of the bucket and splashed over the entire pond surface. This method disperses nutrients into the water column faster than other methods of fertilization and allows a phytoplankton response to be achieved quickly. Best results are obtained by adding liquid fertilizer in daily amounts. Farmers will visit their ponds daily to measure phytoplankton abundance and will be made aware of management needs.



Dissolve fertilizer in water Splash liquid over pond surface.

Figure 4: Fertilizer may be dissolved in water before application to a pond.

SOME REASONS FOR POOR RESPONSE TO CHEMICAL FERTILIZATION

A pond will respond to fertilization by turning green. This may happen within 24 hours. If a pond does not turn green within one to six weeks of fertilization one of the following factors may be responsible.

1. Muddy water:

When mud particles are suspended in pond water and sunlight penetration is reduced phytoplankton growth will be inhibited in spite of fertilization. Control the problem by correcting its cause.

a) Plant grass on newly constructed pond dikes to control erosion.
b) Keep the surrounding watershed planted to prevent and control erosion.
c) Channel muddy water away from ponds by building diversion ditches.
d) Do not fill a pond with muddy water.
e) Muddy ponds can sometimes be cleared by adding organic matter and fertilizer to the water. It may take several weeks for organic matter to effectively remove suspended mud particles. Once water clears to a depth of 20 to 30 cm fertilization may be attempted. Some recommendations include:

1) Make two to three applications of animal manure at 20 kg/100 m^2 of pond.
2) Make one or more applications of 20 to 40 kg/100 m^2 of hay or straw.
3) Add 0.75 kg of cottonseed meal plus 0.25 kg of superphosphate/100 m^2 at 2-3 week intervals.

2. Too much shade:

Phytoplankton are green plants and need sunlight for growth. A fish pond shaded from sunlight will not respond to fertilization. Prevent tall plants and trees from shading your pond. Routine branch trimming and dike cleaning are necessary.

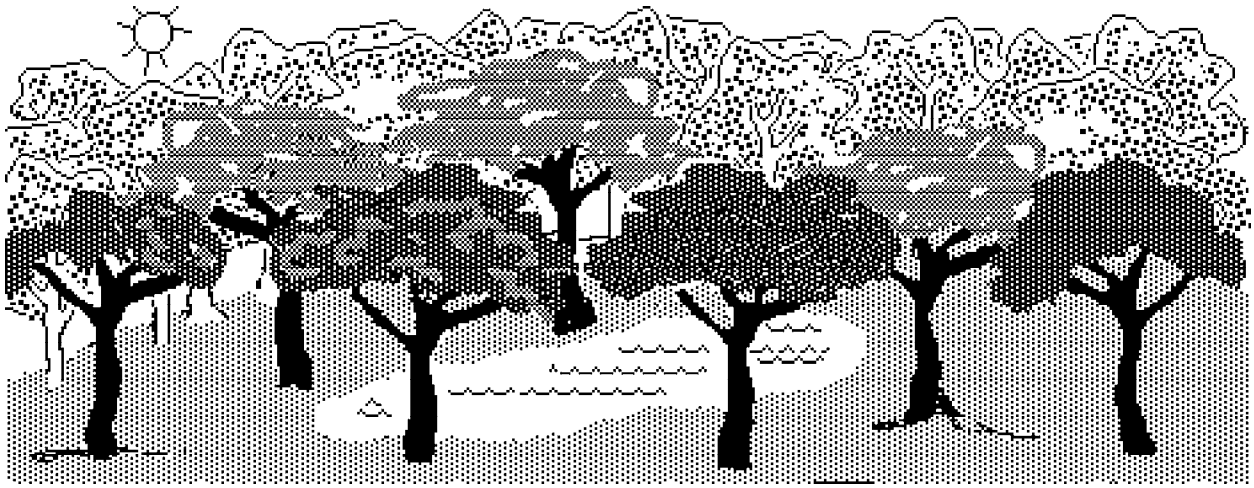


Figure 5: A shaded pond.

3. Water weeds:

DO NOT FERTILIZE WEEDY PONDS! Fertilizer is added to fish ponds to provide nutrients for phytoplankton. If your pond is full of weeds, adding fertilizer will only make the weeds grow faster. Once weeds are established they steal nutrients from the phytoplankton. Weeds also shade the water surface and prevent sunlight penetration which is essential for phytoplankton growth. Remove weeds before fertilizing.

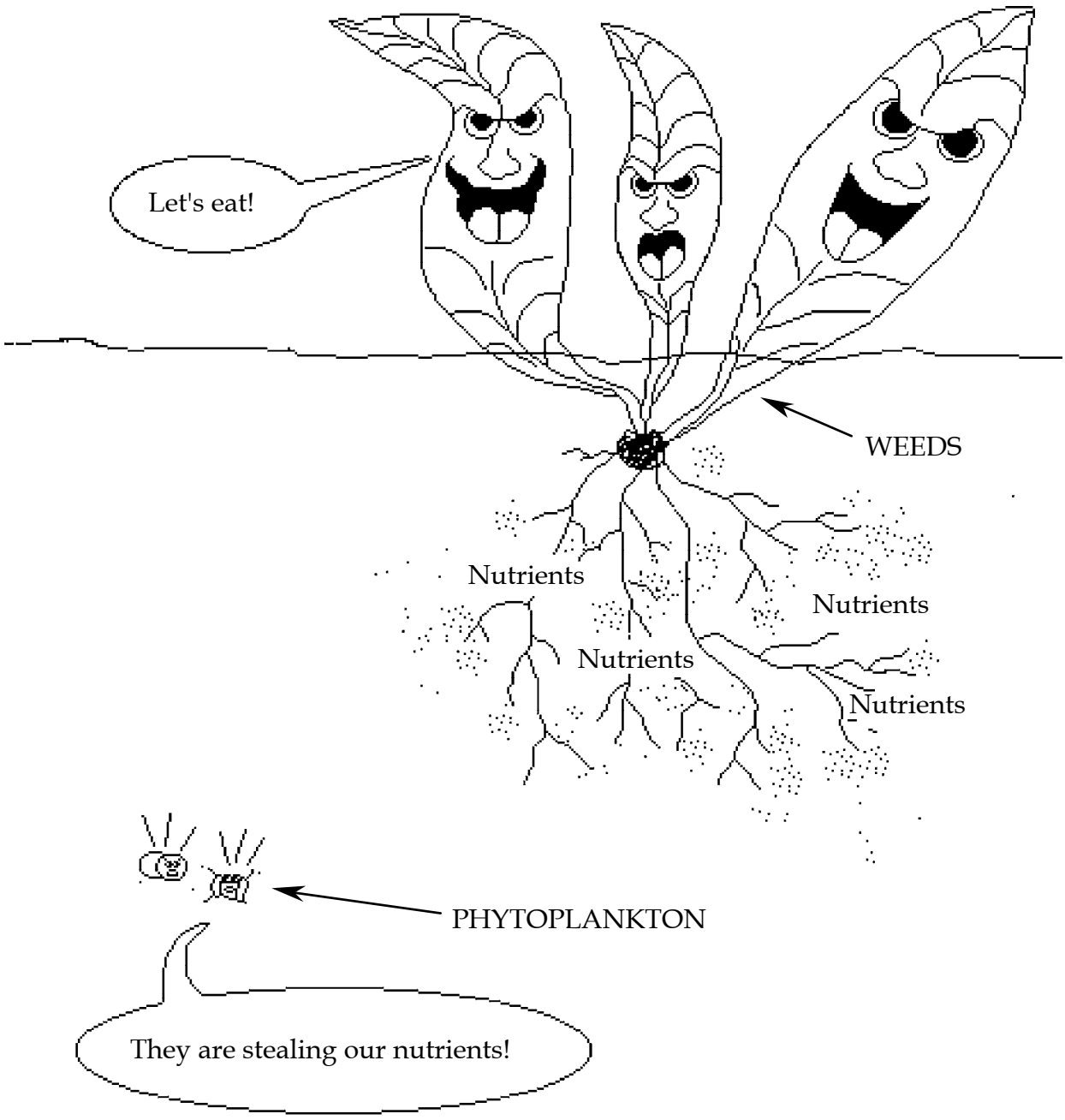


Figure 6: Weeds use nutrients intended for phytoplankton.

4. Excess water flow:

People not familiar with fish culture often think fish should be cultured in constantly flowing water. Flushing water through a pond may help remedy situations where fish are under stress or appear sick, but this action can also flush fertilizers and nutrients out of a pond. This inhibits phytoplankton growth. To avoid this do not allow a continuous flow of water through the pond. Add only enough water to replace evaporation and seepage, or correct problems. Control excessive water flow by using the following measures as appropriate.

1) Build diversion ditches to channel excess water around the pond.
2) Enlarge the existing pond and/or construct another pond above the existing one in terrace fashion.
3) Build inlet control structures such as valves, flood gates, etc.

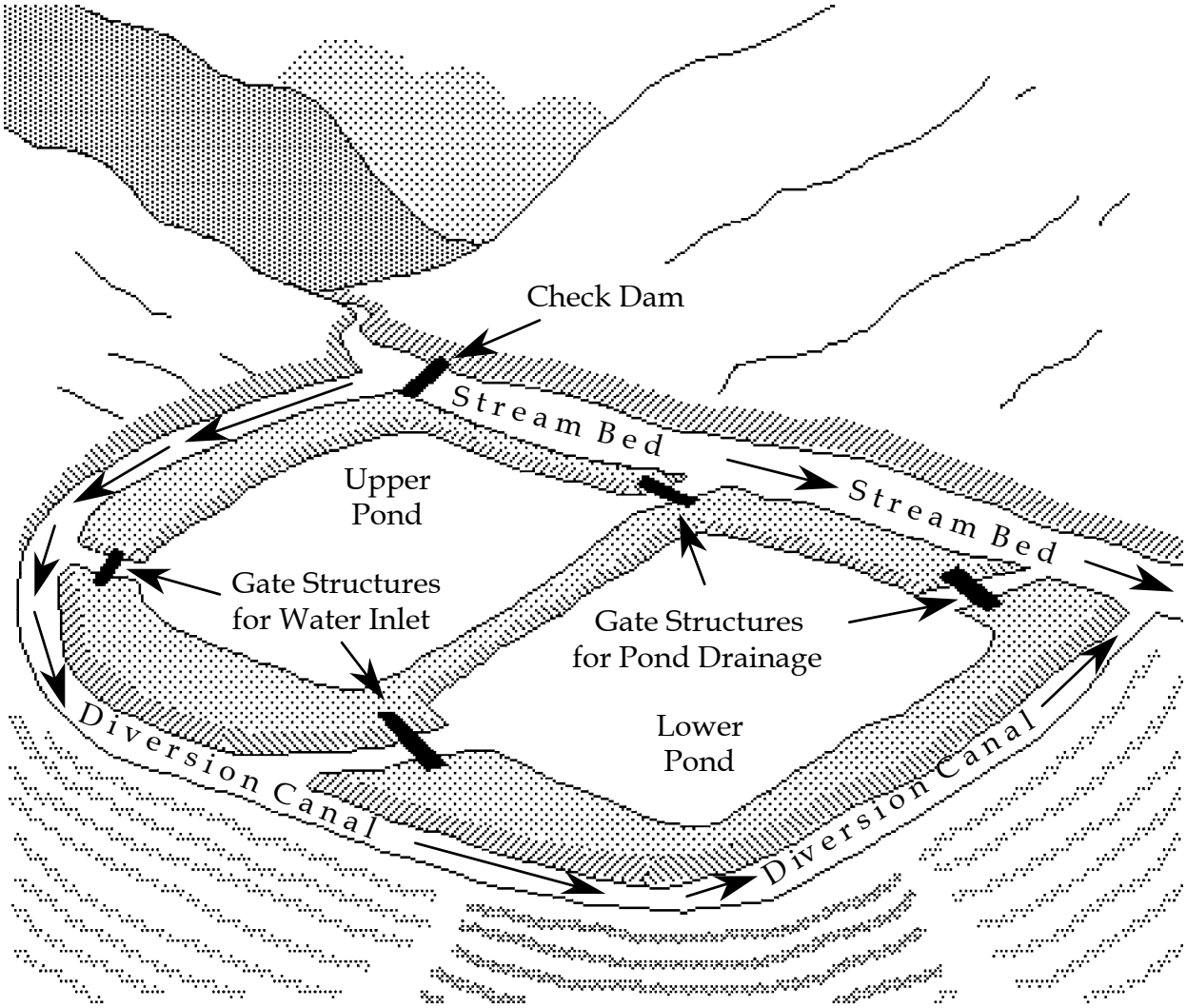


Figure 7: Diversion canals carry excess stream flow around terraced ponds during floods.

5. Lime may be needed:

In many areas the only water source for ponds is rain that runs off the surrounding watershed. This water may be acidic. Fish may not survive or grow well in ponds which are filled with this water unless lime is applied to neutralize the acidity. Liming will promote phytoplankton growth and increase fish production.

When applying lime to a pond, spread the required amount evenly over the dry bottom before filling it with water. If a pond is already full, lime may be spread over the surface with a shovel. In large ponds, a boat may be used to spread lime evenly over the surface. Ponds requiring lime should be limed after each draining if lime is available at a reasonable price. If pond soil has a pH above 6.5, lime is not needed. The previously mentioned factors inhibiting response to fertilizer must be corrected before liming can enhance the effect of fertilization.

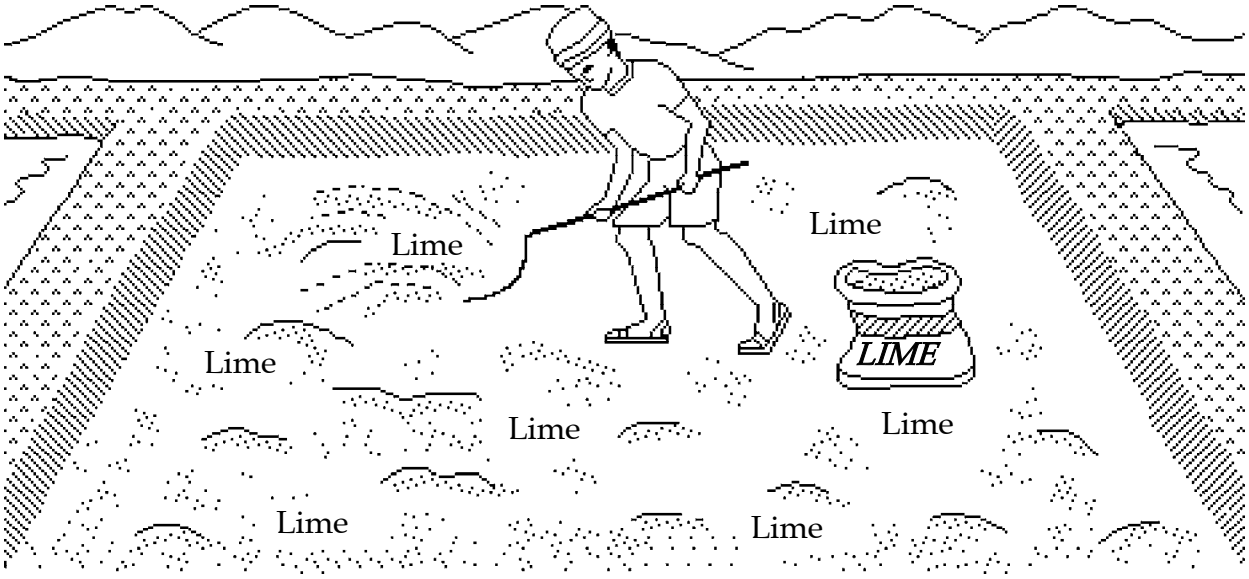


Figure 8: Spread lime evenly over the pond bottom.

The amount of lime added to a pond depends on the soil acidity. Soil testing laboratories equipped to measure acidity of pond bottom soils can make specific recommendations on the amount of lime required to neutralize acidity. In the absence of such assistance, a rule-of-thumb is that 1000 to 2000 kg of agricultural lime/ha (this is 10 to 20 kg/100 m^2) will neutralize soil acidity under most conditions. There are several forms of lime, but finely ground agricultural limestone is best. Quicklime is dangerous. It burns if it is inhaled or touches the skin. Farmers using quicklime should exercise extreme care. Application rates for different liming materials are given below, and may be used where soil testing is not available.

1. Coarsely ground agricultural lime: 1000 to 2000 kg/ha
2. Finely ground agricultural limestone: 1000 to 1200 kg/ha
3. Hydrated (builders or slaked) lime: 600 to 1000 kg/ha
4. Quicklime: 500 to 800 kg/ha

It will not hurt to add lime if the reason for poor fertilizer response is not clear. Agricultural lime is safe to apply while fish are still in the pond. Applying excess quicklime or hydrated lime can kill fish. Quick or hydrated lime should be applied before stocking fish. If several applications of lime fail to increase production of phytoplankton other actions may be necessary to improve conditions in the pond.

6. Not enough fertilizer:

Sometimes the amount of fertilizer applied is insufficient to stimulate phytoplankton response. If this is suspected increase the amount and/or frequency of application.

STORING CHEMICAL FERTILIZER

Do not store chemical fertilizer longer than necessary. If storage is required place chemical fertilizers in a dry, well protected location. Excess humidity can damage the fertilizer. Bags of fertilizer can be stored on simple wooden or bamboo platforms elevated above ground.

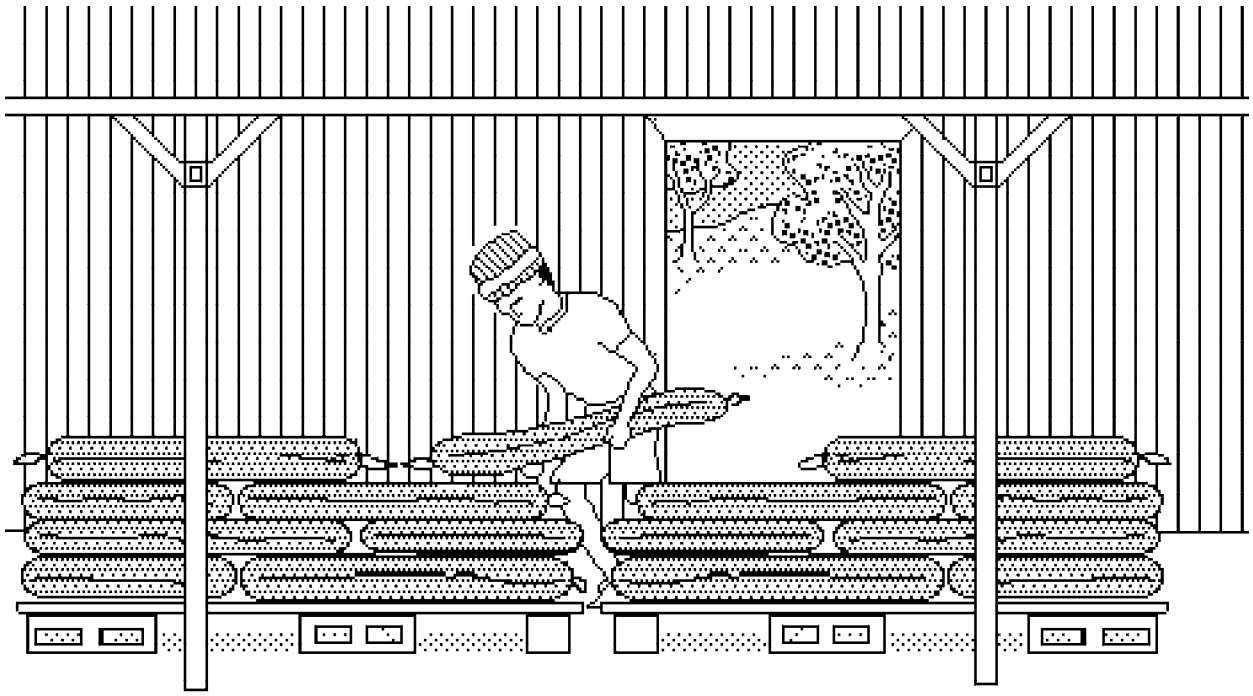


Figure 9: Store the fertilizer in a dry place.

SOME GENERAL CONSIDERATIONS

1) Buy the fertilizer you need. Some companies sell a variety of fertilizers. Inquire from extensionists and other farmers which fertilizers they recommend for fish ponds. Fertilizer grades are usually marked on the bag or box containing the fertilizer. Some companies guarantee this analysis. For example, a 20-20-5 grade should mean that the fertilizer contains 20% nitrogen, 20% phosphorous and 5% potassium by weight. Buy chemical fertilizer from a reputable dealer.

2) It is difficult to determine when chemical fertilizer is no longer usable. Nitrogen in chemical fertilizer can volatilize when it comes in contact with moisture. The container holding the fertilizer becomes wet if this happens. Other nutrients may be leached out during this process. Fertilizer bags and boxes usually have an inner plastic liner to guard against damage from moisture. Do not buy fertilizer in containers which appear wet or which have been stored in a damp area.

GLOSSARY OF TERMS

aquatic weeds - unwanted plants which grow in ponds.

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.

diversion ditch/canal - a ditch or canal which is dug to channel excess water away from a pond, especially during heavy rains.

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

leach out - to be drawn out due to the presence of moisture.

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 - the mostly microscopic aquatic plants and animals that serve as food for larger aquatic animals.

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

volatilize - to turn into a gas and escape into the atmosphere.

watershed - an area from which water drains to a single point.

zooplankton - the animal component of plankton.

Funding for this technical series was provided by the United States Agency for International Development. Communications regarding this and other technical brochures on water harvesting and aquaculture should be sent to:

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

Suzanne Gray, Illustrator

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