

Using Rotenone To Renovate Fish Populations In Farm Ponds

The ultimate fate of many farm ponds in Mississippi is an unbalanced fish population that is undesirable to fishermen, and, therefore, has little recreational fishing value. Once a fish population reaches such a condition, the best alternative is usually to eliminate the resident fish completely and to restock with a desirable combination of fish at recommended rates. Consult a fisheries biologist to determine the condition of your pond and the possible need for a complete fish population renovation.

Antimycin and rotenone are two pesticides registered by the Environmental Protection Agency for eradication of fish. Only rotenone is economically feasible for eradicating complete fish populations and is the more commonly used compound. Antimycin can be used to kill scaled fish selectively from catfish ponds, but treatment is usually expensive.

What is Rotenone?

Rotenone is a naturally occurring substance found in the roots and stems of several tropical plants. Jewel vine (*Derris* spp.), Lacepod (*Lonchocarpus* spp.), and hoary pea (*Tephrosia* spp.) are the more common plants from which rotenone is derived. Rotenone has many common and brand names, including Cube, Derris, Fish-Tox, Nox-Fish, Prentox, Nusyn Nox-Fish, rotenone dust, and Chem-Fish. It has other uses, including use as a garden dust to control insects and as an insecticide for use on cattle, dogs, and sheep.

Rotenone works by inhibiting a biochemical process in the fish cells, resulting in an inability of fish to use oxygen in the release of energy during normal body processes. In effect, the fish suffocate due to lack of oxygen. But, contrary to popular belief, rotenone does not remove oxygen from the water. Fish treated with rotenone move to the shallow water or to the surface of deeper water, gasping for oxygen within a few minutes of exposure to the chemical. Different species of fish respond variously to rotenone, and it is a good idea to know what species are in the pond before treatment ([Table 1](#)).

Rotenone is an unstable compound that breaks down when exposed to the environment. It is ultimately converted to carbon dioxide and water. The breakdown process is rapid and is affected by temperature, light, oxygen, and alkalinity. At 80 degrees Fahrenheit, treated water will detoxify in about 4 days. In cooler water, the breakdown process is slower; at 45 °F, it can take 30 to 35 days for rotenone to detoxify. Most waters are safe for restocking within 5 to 6 weeks. In general, the cooler the water, the longer rotenone persists.

Rotenone is available at most farm and chemical supply stores. It is classified as a "restricted use pesticide" and cannot be purchased without a private pesticide applicator's certificate. These certificates can be obtained by contacting your county Extension agent.

Table 1. Tolerance of fish species to rotenone

Arranged from lowest tolerance to highest tolerance:

- Gizzard Shad
- Walleye
- Northern Pike
- Rainbow Trout
- Carp
- Yellow Perch
- Bluegill
- Largemouth Bass
- Channel Catfish
- Black Bullhead

Preparing The Pond

Ponds of any size can be treated with rotenone, but it can be difficult to achieve an even distribution of rotenone for an effective fish kill in larger ponds or lakes. It is also expensive to treat large volumes of water. For these two reasons, it is advisable to reduce the water area and volume as much as possible before treating. This can be accomplished by draining the pond as low as possible with a built-in standpipe, by a pump, or by a siphon device. The less water you treat, the more cost-effective the treatment.

A simple siphon can be constructed to drain any pond where the ground level behind the dam is lower than the water level inside the pond. This device is constructed of PVC sewer pipe and duct tape. A diameter of 3 inches is easiest to handle, but larger diameters drain the pond more quickly. Two or more drain pipes can be used to decrease draining time. The technique is simple. Glue or tape several joints of pipe together, and install a female adaptor and male clean-out plug on one end. On the opposite end of the pipe, tie a gallon jug onto a 12- to 18-inch string attached to the pipe, then tie a 1/2- to 1-pound weight to the pipe. Locate the pipe in the center of the dam or levee, or at the point where the ground level behind the dam is lowest. Push the pipe assembly into the pond (float and weight end first) perpendicular to the dam. The weight will suspend the suction end about 12 to 18 inches below the float at the surface. Remove the plug from the near end. Allow the pipe to fill completely with pond water. When the pipe is filled, insert the clean-out plug to seal the water inside the pipe. Pick up the plug end of the pipe and carry up and over the dam to the back side at the lowest point (be sure the pipe assembly is long enough). Once the plug end is at the lowest point behind the dam, unscrew the plug and allow water to flow out, creating a siphon that will drain the pond to the level of the outside end of the pipe. If you have made good, airtight connections, the siphon will flow smoothly and continuously, until the water in the pond is lowered to the level of the outlet on the back side of the dam.

How To Apply Rotenone

Rotenone is available in a wettable powder or a liquid formulation. Liquids are easier to get into solution and provide the more reliable application for total fish kills. The liquid

formulations typically contain 5 percent rotenone, although some contain 2.5 percent in a synergized form.

All formulations must be diluted with water and evenly distributed throughout the water column. The chemical can be sprayed over the pond surface or dripped into the prop wash of an outboard motor. The key consideration is to attain an even distribution; otherwise, fish may find "safe" areas and escape being killed. Application in a random "S" pattern throughout the pond will maximize even coverage.

The best time to eradicate fish from a pond for restocking is late summer or early fall. Water temperatures are at their highest at this time, and the weather is usually dry, allowing easy draining. Killing the fish at this time reduces the time between the kill and the restocking, which minimizes the chance the pond will be contaminated by unwanted fish before restocking. This is an important consideration, since the entry of unwanted species can defeat the purpose for the renovation.

Treatment rates will range from 0.5 to 3.0 parts per million, depending upon the species being killed ([Table 2](#)).

If there are any puddles or pools in the upper portion of the pond after draining, it is critical that these also be treated to kill any fish therein. Many small fish can survive in these pools, puddles, or stump holes for long periods. These must be killed to accomplish a successful renovation. Otherwise, these surviving fish can represent contamination of the new fish population, and the renovation will have been for nothing.

Table 2. Rotenone concentration for selected applications

Purpose	Number acre-feet treated with 1 gallon 5%	Concentration (ppm)	
		Active rotenone	5% Formulation
Normal pond renovation; no bullheads, carp, bowfin, etc.	6.0 - 3.0	0.025 - 0.050	0.50 - 1.0
Ponds with carp and/or bullheads	3.0 - 1.5	0.050 - 0.10	1.0 - 2.0
Ponds with bowfin, gar, etc.	1.5 - 1.0	0.10 - 0.150	2.0 - 3.0

When To Restock

It is important to wait until the rotenone dissipates before restocking. If the kill is conducted in early fall, the rotenone should be detoxified by the time winter rains have occurred to partially refill the pond. A good general rule of thumb is to wait 1 month. A simple test can help determine when it is safe to restock. A few fish (bream, goldfish, minnows) can be placed in a small cage in the pond or in a container with water from the pond. If the fish survive 24 to 36 hours, it is safe to restock the pond.

Another reason to renovate the pond in late summer/early fall is that it coincides conveniently with the availability of fingerling bream from hatcheries.

Common Questions

There are questions that commonly arise regarding rotenone and its use. Some of these questions include:

1. **Is rotenone toxic to humans?** No. The toxicity of rotenone is extremely low, but, as with any pesticide, it is a good idea to handle rotenone with care to minimize contact. The rotenone formulation contains petroleum products that may be harmful. Wear protective clothing, including rubber gloves and goggles. Be sure to shower or bathe immediately after handling rotenone, and thoroughly wash your clothes before wearing them again. The label prohibits swimming in treated water until after the application has been completed.
2. **Is rotenone toxic to livestock?** Rotenone is safe for all livestock except swine, which are sensitive to the compound. Livestock (except swine) and pets can enter the treated pond and even drink the water with no effect. For example, a 22-pound dog would have to drink 4.2 gallons of water treated with the maximum amount of rotenone to ingest the minimum safe level. EPA has stated that there is no reason to exclude livestock (other than swine) from rotenone-treated waters. As an added safety precaution, however, try to minimize livestock or pet activity in the treated water.
3. **Are the fish safe to eat after being killed by rotenone?** Although rotenone is considered nontoxic to humans at levels that would be found in a treated pond or fish, EPA and FDA have not established the maximum acceptable residue level permitted in fish for human consumption. Therefore, human consumption of fish killed by rotenone cannot be recommended.
4. **What about ducks, birds, raccoons, or other animals that may eat the fish?** This is no problem. Scavengers cannot eat enough of the treated fish, if rotenone is applied according to label instructions, to ingest enough rotenone to be harmful.
5. **What if the rotenone leaves the pond?** If rotenone is washed out or otherwise escapes the pond and enters any other body of water, it can kill fish. This is a danger of rotenone application, and it is against label recommendations to apply rotenone in situations where it can enter nontarget waters. However, the rapid breakdown of rotenone minimizes the likelihood of toxic effects downstream if applied properly in a drained pond.
6. **Can treated water be used for irrigating crops?** Rotenone has been used as an agricultural insecticide and poses no threat to crops or other vegetation. However, label directions warn against use of treated water for irrigation.
7. **Can rotenone be neutralized?** Yes. Potassium permanganate or chlorine can be used at a 1:1 or 2:1 ratio with the concentration of rotenone applied. Additionally, if fish are removed from treated waters quickly enough, they can often be revived by placing them in fresh water.

Adapted from "Better fishing through management: How rotenone is used to help manage our fishery resources more effectively," by R.J. Sousa, F.P. Meyer, and R.A. Schnick. USFWS.