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A REPORT ON THE USE OF KARMEX TO CONTROL FILAMENTOUS ALGAE IN FISH PONDS

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ABSTRACT

Several chemicals that have been used in fish culture for the control of filamentous algae are discussed. Their effects on fish and fish-food organisms in ponds are reviewed.

Results obtained from applications of Karmex to 26 ponds are presented. Data show that Karmax was effective against several forms of filamentous algae at rates above one-half pound per surface acre. Rates up to three pounds per surface acre had no adverse effects on fish or fish-food organisms.

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INTRODUCTION

Filamentous algae often appear in ponds regardless of management practices used. Not only do dense algal growths starve plankton algae, they present serious problems during harvesting of a fish crop. Since phytoplankton blooms will help prevent the establishment of growths of filamentous algae, commercial fertilizers are frequently added to ponds to encourage such bloom. Unfortunately, recommended fertilization practices often encourage the growth of filamentous algae rather than prevent it. When this occurs, chemical treatment becomes necessary in order to prevent a serious decline in pond production.

Numerous chemicals have been used as algacides with varying degrees of success and acceptance. To date, not one has evolved which is completely effective against filamentous algae. Two of the more widely used algacides in fish ponds are copper sulfate and sodium arsenite. A third that received prominence for a period of time is Delrad (dehydroabietylamine acetate), but due to its toxicity to young fish and the cost of necessary repeated treatments, it has not enjoyed the acceptance of the other two.

Copper sulfate is an effective and economical chemical for control of cold water filamentous algae in relatively soft waters. Montgomery and Zeller (1958) reported good control of *Spirogyra, Chara, Oedegonium, Rhizoclonium,* and *Cladophora* with one p.p.m. copper sulfate in pond waters having less than 50 p.p.m. total hardness. Snow (1956) experienced difficulty in controlling *Pithophora* with copper sulfate and felt also that repeated treatments reduced blue-gill production due to its toxicity to both zooplankton and phytoplankton.

Sodium arsenite has been used for control of most types of submersed aquatic plants. Surber (1932 and 1961) recommended its use for control of rooted plants as well as filamentous algae. Lawrence (1957) reported erratic results with sodium arsenite for control of *Pithorphora* and *Hydrodictyon* and experienced a substantial reduction in bluegill production. He attributed the low production, at least in part, to the complete kill of microcrustaceae with one treatment of 4.0 p.p.m. Bottom organisms in test ponds treated with 4.0 and 8.0 p.p.m. sodium arsenite were also substantially reduced. Snow (1956) reported no control of *Pithophora* with the normally recommended treatments of 4.0 to 8.0 p.p.m. sodium arsenite, and did not get a complete kill with a concentration of 16 p.p.m. Five consecutive weekly treatments of 8.0 p.p.m. resulted in reduction of only 50 per cent of the *Pithophora* in one of his ponds.

Snow (1956) reported limited control of *Pithophora* with Delrad, but experienced heavy mortalities of bluegill and bass fry in ponds treated with 4.0 p.p.m. He further noted that bluegill spawning was delayed for a period of two to four weeks. Montgomery and Zeller (1958) found Delrad to be generally unsatisfactory for control of *Pithophora* in Georgia farm ponds. Lawrence (1954) obtained control of *Pithophora* with repeated applications of Delrad, but cautioned against over-treatment because of acute toxicity to small fish.

Materials and Methods

Karmex is the trade name for the chemical 3-(3,4-dichlorophenyl)-1,1-dimethylurea, manufactured by the E. I. DuPont de Nemours Co. Its common name is diuron. Karmex is formulated as an 80 per cent wettable powder or as a 28 per cent water suspension (2.8 pounds diuron per gallon). The 80 per cent wtttable powder was used to comduct fish toxicity tests. The 28 per cent water suspension later became available and was used for pond tests because of the ease of making volumetric measurements with this formulation.

Toxicity tests were conducted in 15 liter aquaria on three to five inch channed catfish (*Ictalurus punctatus*), one to two inch green sunfish (*Lepomis cyanellus*), two to three inch golden shiners (*Notemigonus crysoleucas*), and one to two inch fathead minnows (*Pimephales promelas*). For each species, tests were run using two fish in 10 liters of each test solution with no aeration. Three concentrations of diuron were used: 25, 50, and 75 p.p.m., and each concentration was replicated four times. Controls were used with each test without loss. Chemical properties of the water used were the same as the well water used in pond tests, and the temperature of the test solutions was 60 to 63° F. Twenty-four and 48 hour mortality counts were made.

Test ponds were of three sizes and depths; one acre averaging 4.5 feet in depth; one-fourth acre—3.5 feet; and one-tenth acre—2.5 feet deep. Application rates of active material used were 0.5, 0.75, 1, 2, and 3 pounds per surface acre. These rates gave water concentrations .05, .07, .10, .25 and .38 p.m. diuron. The chemical was prepared for application by diluting the measured amount with water in a pail, and was then hand-spread over the pond from the windward side. Preliminary tests indicated that complete coverage of the pond surface at time of treatment was not necessary. Four ponds were treated at each of the five rates and an additional six ponds were treated at the three-pound rate. A total of 26 ponds received applications of Karmex.

The ponds were filled from either well or surface water sources. A typical analysis taken from a pond filled with well water was: pH-7.5, total alkalinity—250 p.p.m. as $CaCO_3$, calcium—49 p.p.m., magnesium—30 p.p.m., and specific conductance—700 micromhos to 25°C. A typical analysis of the surface water was: pH-7.1, total alkalinity—85 p.p.m., calcium—15 p.p.m., magnesium—8 p.p.m., and specific conductances—250 micromhos at 25°C.

Biweekly zooplankton and bottom organism counts were made on three ponds treated at the highest level and on three untreated ponds receiving similar cultural practices. Plankton samples were collected by pouring a measured quanity of pond water through a standard plankton net. Counts were made on duplicate one milliliter portions of the concentrated sample in a Sedgwick-Rafter counting cell.

Bottom organisms were collected from a composite of two samples taken with an Eckman dredge from different areas of the pond. The composite sample was screened through a number 30 standard sieve, and the retained organisms counted.

RESULTS

Tests conducted at the Fish Farming Experimental Station indicate that Karmex is relatively non-toxic to fish. The most susceptible of four species tested was the channel catfish. Slightly less than a 50 per cent mortality occurred during 24 hours in a concentration of 75 p.p.m. diuron. During the 48 hour test, the same per cent loss occurred in a 25 p.p.m. concentration. Green sunfish, golden shiners, and fathead minnows were not affected in concentrations below 75 p.p.m. At 75 p.p.m., a 25 per cent loss was recorded by the end of the 48 hour period. Since these tests established the relative safety of this chemical for pond use, further testing to establish exact LC levels was not undertaken at this time.

Preliminary aquarium tests indicated that no toxic effects to fish food organisms should be experienced following applications of Karmex to ponds. Nevertheless, plankton and benthos sampling was carried out on ponds treated with the highest level of chemical. Biweekly zooplankton and bottom organism counts were made on three treated and three adjacent untreated ponds. Four major groups of plankton organisms and four groups of benthic organisms were selected for enumeration. Groups of zooplankton organisms counted in each sample were copepods, nauplii, cladocera, and rotifers. Bottom organisms counted were *Tendipes, Choborus, Enallagma* and *Sparganophilus.*

Numbers of zooplankton organisms showed normal flucuations during the 16 week test, but there were no detectable alterations that could be attributed to the application of Karmex. The early summer build-up of zooplankton populations was found in both the treated and untreated ponds. Both sets of ponds followed the same pattern of zooplankton decline during the hottest period of the summer and showed a general increase toward the end of the test period when the weather moderated. The average number of zooplankton organisms per liter for the treated and untreated ponds during the 16 week test period is shown in figure 1.

Phytoplankton was eliminated from all ponds treated, but in all instances regrowth occurred after fertilization. The length of time required for pond blooms to reappear varied from two to four weeks. Differences in response were attributed to different treatment levels

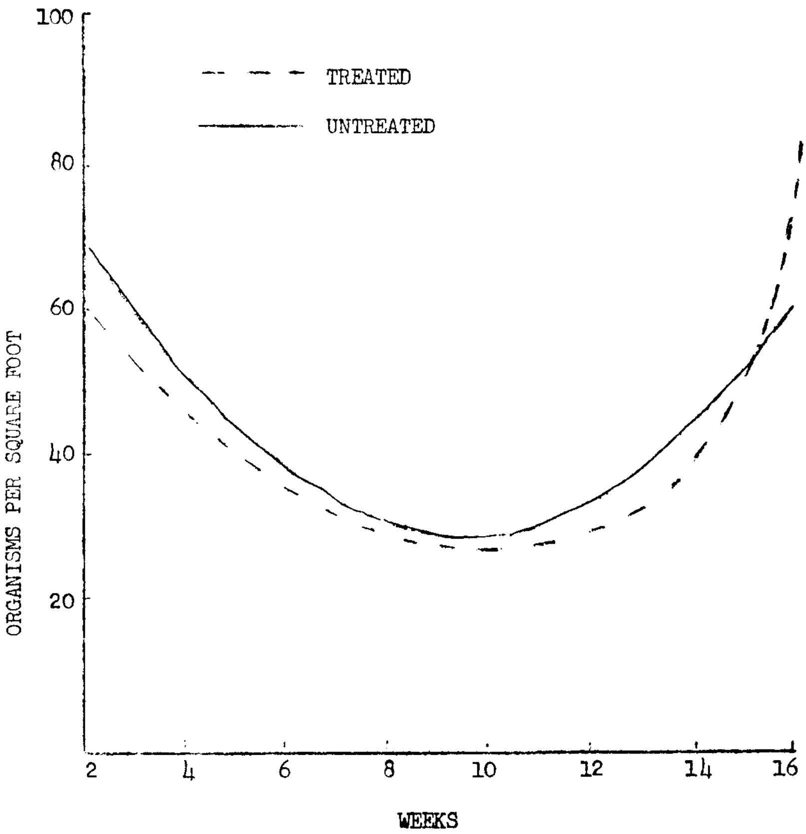

Figure 2 - Abundance of bottom organisms found in Karmex treated and untreated ponds.

of herbicide since regrowth was slowest at the highest treatment level.

Bottom organisms showed the same general pattern as the zooplankton. Individual ponds showed wide variations in specific organisms, but the average of all ponds in each set was very similar. See figure 2.

Between April 15 and June 1, 1964, 26 ponds were treated at five different rates of Karmex. At time of treatment, all ponds were infested with various types of filamentous algae consisting of *Spirogyra, Oedegonium, Cladophora,* and *Pithophora.* With the exception of *Pithophora,* all species were eliminated at all treatment levels. In the four ponds treated at the rate of one-half pound Karmex per acre, three were not cleared of *Pithophora* by the end of three weeks. All other ponds became free of filamentous algae and remained so until September 1, 1964. Since then, small clumps of *Pithophora* have reappeared near the edges of a few ponds, but no blanket coverage has been encountered. It does not appear likely that *Pithophora* will become a problem during the remainder of this year in any of the ponds treated with more than one-half pound per acre.

Four of the test ponds contained isolated spots of *Najas* spp. at time of treatment. These growths occurred in ponds which were treat-

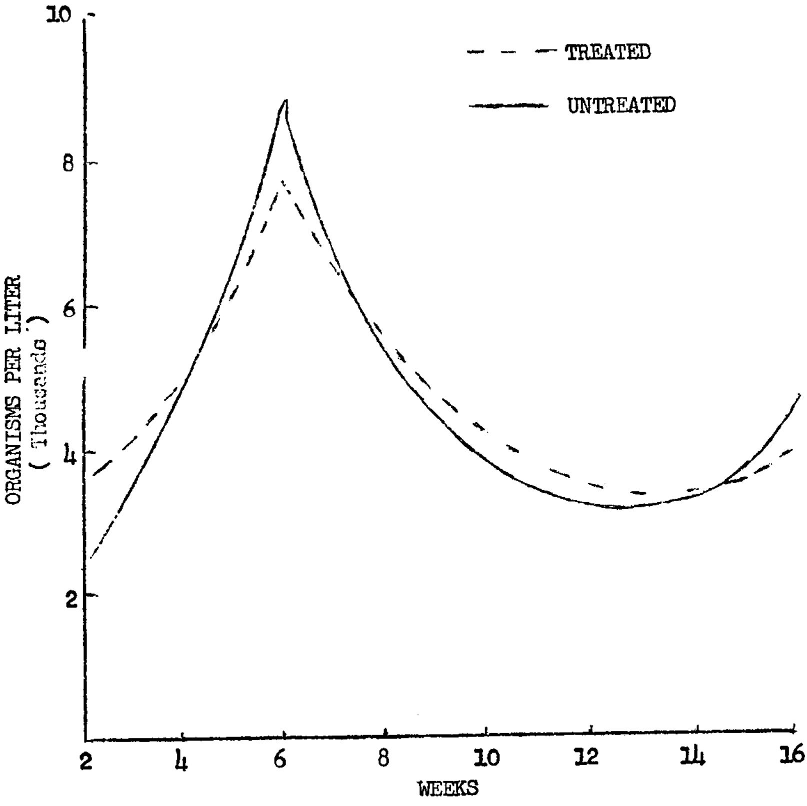

Figure 1 - Abundance of zooplankton organisms found in Karmex treated and untreated ponds.

ed at the rates of three-fourths and one pound per acre. The *Najas* was eliminated from these ponds and no regrowth occurred.

Although *Najas* was the only rooted aquatic plant encountered at the time of treatment, it should be pointed out that no other rooted aquatic plants appeared in any of the ponds during the entire test period.

DISCUSSION

One of the major factors which has limited the use of herbicides in the fish culture has been the cost of the chemicals. Certain chemicals used by fishery workers cost upwards of $20.00 per acre per application. At the rate of one pound per acre, Karmex has been shown to effectively control filamentous algae for an entire season. Current market price of this chemical is aproximately $3.50 per pound. This low cost chemical should prove very useful to those who have been economically restricted from chemical weed control.

SUMMARY

1. Karmex controlled all species of filamentous algae encountered in 26 ponds at the Fish Farming Experimental Station for a 16 week period.
2. No deterimental effects on the fish food organisms were noted following applications of up to three pounds per surface acre of Karmex.
3. At levels required for the effective control of several forms of filamentous algae, no toxicity to four species of fishes was encountered.
4. Properly applied, Karmex should provide an effective and economical method for the control of troublesome filamentous algae in fish ponds.

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