The Survival Foods And Gardening Section

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THE BACK YARD FISH FARM

The new series *of reader* research projects starts with an exciting plan to turn grass clippings into organic *fish*.

Dr. John H. Todd *with* Dr. William 0. McLarney*, Director of Aquaculture Studies for the New Alchemy Institute*

OVER THE PAST FOUR MONTHS in the series "Shaping an Organic America" I have dealt with the urgent need to create a science and biotechnology which will permit revitalization of the countryside along organic and ecological principles. It is my belief that if such a science is developed and its findings put into practice, an ecological crisis of saddening dimensions can be averted. I have also pointed out that there is no guarantee for the development of a truly ecological science by the scientific community alone. Most scientists simply are not trying to set examples for the future by living and working with the earth. Because of this, the recommendation was made that the science for the organic method should marshal the participation of many, many people from all walks of life arid particularly you who are already working with the land. If this were to happen, then a true restoration of the countryside might be possible. I know that this is a tall order and no doubt the concept will be scoffed at by many scientists. Yet, my confidence in the whole idea of the Readers' Research Program has been bolstered by the letters I have received following my article in the November issue of OGF. Several really ingenious and even brilliant ideas have been presented by a number of people. (In a future issue I would like to describe some of these exciting plans and discoveries which are not directly associated with the experiments outlined in this column.)

> EDITOR'S NOTE: An extensive bibliography of articles and books for more detailed information on fish farming has been prepared by Drs. McLarney and Todd. For a copy of the brochure of references and source materials, please send 50 cents to "Aquaculture Bibliography," Rodale Press, Inc., Emmaus, Pa. 18049. (*I left this paragraph in place just so it could be said that I posted this article in it's entirety. But since this work is 25+ years old, I doubt very seriously if you'll find any of it's references still viable.---Cary*)

In the entire history of man, there has probably never been a period quite like now when so many people feel a sense of despair and helplessness towards the future. I

think this can be changed if enough people are able to see even the slightest possibility of embarking upon a personal course of action which will truly benefit the planet as well as themselves.Organic gardening, farming and homesteading are among the most positive steps that can be taken in this direction. Involving ourselves in creating a science for tomorrow is a commitment upon which so much will depend. This month inaugurates the ***Readers' Research Program*** and for many of you working with us, it will be a way of beginning, in the words
of Bob Rodale, "1972 as the Year for Organic Action."

Introducing the Readers' Research Program

New Alchemy Institute scientists, with the support and collaboration of the editors of ORGANIC GARDENING

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And Farming magazine, will be working with you to organize a widespread, continuing research program to investigate many of the important organic concepts. As gardeners and homesteaders you will have the opportunity this year to become involved in any one of at least three scientific projects.

Besides the Back Yard Fish Farm research which is described in this article, the second project will involve a country-wide search for the most pest-resistant varieties of vegetables. At the present, this essential information is not widely available to the organic gardener.

The third Readers' Research project planed for 1972 will investigate ecological design in agriculture. Specifically, we will compare complex interplantings of vegetables in home gardens with single or monocrop plantings. Soil fertility, resistance to pests and a number of other variableswill be measured and the differences between the two approaches will be analyzed.

I would like to begin by describing the way in which the Readers' Research Program will be organized. Each of the research projects will be outlined in these pages. After you have read the articles outlining the projects, if you are seriously interested in working with us on a specific experiment, please inform us of your intent to become involved. The address is: The New Alchemy Institute, Box 432, Woods Hole, Mass. 02543. After you contact us we will send further instructions on how to set up the experiments, what equipment you will need, where to get it, and how much it will cost.

There is one point I would like to emphasize at this time. If the research program is going to succeed and be an important source of information, please do not ask us for project instruction booklets unless you honestly intend to carry out experiments with us, and have the space and facilities to do so. The booklets cost money, and replying

to casual inquiries takes up valuable time. Since we are operating this program on a relatively low budget, the time and money you save us will give us a greater opportunity to work toward the success of the program. All the information you need to make a decision about your participation can be made on the basis of what you read in this column. The booklets will only add the "how-to" details and outline some of the potential pitfalls that the investigator needs to know about.

The organization of the first project, the Back Yard Fish Farm, will be slightly different. It is possible that the number of people who would like to become involved will exceed the supply of brood stock which we have available. Thus, we will have to limit the study to match the supply of fish. The procedure for the Back Yard Fish Farm will be as follows: First, if you are seriously planning to get involved, contact us. Then, just prior to constructing the dome and installing the pool, you must contact us again to see if the fish are available. If we say yes, fish will be reserved for you. When the fish farm is built and a picture of it sent to us, we will ship the fish for the experiment.

Becoming involved in a research program may also provide a bonus that you may not have counted on; you will get to know the nearest organic gardener-scientist working on the same project. If at all possible, we will try and send you the address of the nearest participant, so that you can work together if you wish.

As the growing season proceeds you will continue to collect scientific data. At the end of the season your results will be sent to us for tabulation and be included with the findings of other investigators. Finally, we will describe the results in these pages and in research publications. Within a few years we will be able to make recommendations to you that have a large

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and meaningful body of knowledge to back them up. It is just possible that the Readers' Research Program will help create the wisdom that will guide those of us who are working with the land.

The Back Yard Fish Farm, A Revolutionary New Way To Raise Foods at Home

Dr. William 0. McLarney and I are working together to organize the Back Yard Fish Farm research. The project involves a totally revolutionary concept in agriculture. If it should prove successful, fish farming, on a small scale at least, could become a common practice throughout the country. We are proposing that you raise fish in a small pool inside a geodesic dome using intensive culture methods. You will create tiny fish farms which are organic and capable of producing foods of excellent quality. If you have ever enjoyed keeping an aquarium of tropical fishes, then I think you will receive the same pleasure as well as a food crop from the Back Yard

Fish Farm.

In the November issue of OGF, I described some of the thinking and theoretical concepts which went into our Back Yard Fish Farm prototype. I also outlined the reasons for choosing herbivorous fishes from the tropics and using the dome to create a suitable climate. I think it would be wise to reread that article, as space limitations prevent my repeating it. This research project will use the same methods and fish (tilapia) as we did in our prototype.

What I didn't point out in the November article is the necessity for developing organic methods in aquaculfure. It has become clear to us that organic fish products are desperately needed in this country. The area of Cape Cod in which Bill McLamey and I live is dotted by tiny lakes, many of which provide good fishing. Bill, an ardent fisherman, can be seen often casting for pickerel, perch or bluegills. His harvest is an important source of food for a number of us. Since fish are one of the most complete, health-giving foods, we usually jump at the chance to eat them — or at least did, until a pesticide-chemist friend examined our fish. The little pond in the woods, far away from industry and agriculture, is contaminated. The perch we were eating had up to 40 parts per million of DDT in their fatty tissues. This is far above the allowable limit for foods. We already knew that many marine fishes are contaminated with a variety of harmful substances, but the pond was the last straw. We had to start figuring out ways to grow fish organically and cheaply and we had to do it soon. Philosophically, we were committed to small-scale intensive systems, based upon ecological and organic principles. If the fish were to be relatively poison-free, their diet would have to consist of aquatic plants and algae; this would shorten the food chain and make the system more productive while less prone to accumulating harmful substances in the fish. The prototype we developed will act as a model for the initial OGF research project.

How To Do It

The first task of the experimenters in the Back Yard Fish Farm research will be to build an inexpensive geodesic dome which will house the pool for raising the tilapia. Tilapia are excellent and much revered tropical fish which will primarily eat the algae you grow right inside the pool. In order for the tilapia to grow to an edible size, which is about one-half pound, a growing season that's at least six-months long in water that is normally well above 70 degrees F. will be required. The dome provides these high temperatures by trapping the heat from the sun, which is stored in the pool and transformed into algae growth. The fish will die if the temperature drops much below 60 degrees F. Their vulnerability to cold
is one of the reasons we chose this

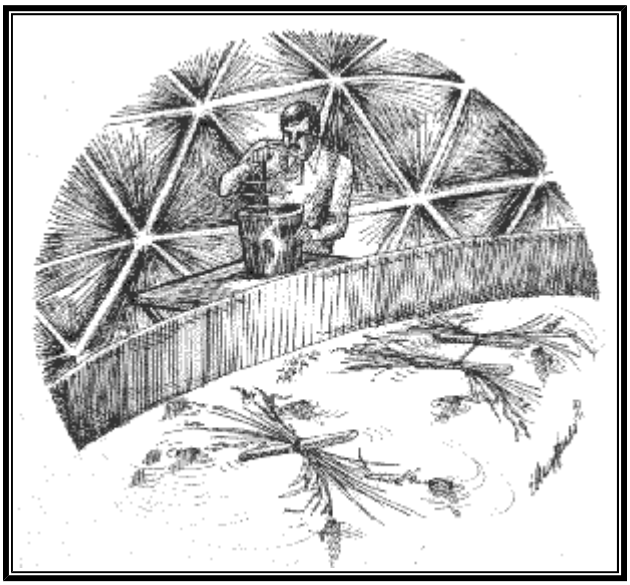
fish. If some careless person ever takes them out of the dome and puts them in a

local stream or lake they will not survive the winter to upset the natural ecosystems. This is not true for the Imperial Valley in California, parts of southern Florida and southern Texas. Although tilapia are now found wild in these areas, we do not plan to aggravate the problem of exotics by conducting experiments in these regions where they can survive outside the dome.

The dome is a very effective heat trap and the pool is quite an efficient heat retainer. At the time of this writing, which is late October, the water temperature in our prototype Tilapia-Dome is still in the 60s even though the outside temperatures have been dropping near freezing at night. With the addition of a little bit of heat, we have been able to push the temperatures up into the 70s during the cool days of fall. With design improve ments in the dome, we think that even in our climate, the addition of heat will not be necessary in the future.

Building the Dome

Building a geodesic dome is relatively easy and inexpensive. You should plan on two or three days to complete the task. Some of you living in the more southerly regions of the country will be able to build them for less than $50. More sophisticated structures, incorporating a double skin of clear greenhouse vinyl with an air layer in between to prevent heat loss, will last for a number of years but could run as high as $200 for materials to



Feeding time in the tilapia dome. Their main diet will be the algae which grow in the pool, but it should be enhanced with small amounts of insect larvae.

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Our prototype was a dome 18 feet in diameter, although we wished that it had been larger. One problem was that we couldn't move around the 15-by-10-foot pool inside. This was annoying as I had wanted to start some plants growing inside, and to do more insect-culturing research to provide new kinds of supplemental foods for the fish. The optimal size for domes to be used in the Back Yard Fish Farm would be 25 feet in diameter. This size should provide freedom to work inside while allowing a greenhouse area. All of our future research domes will be of the larger size. Costs begin to shoot up drastically when the diameter exceeds 25 feet. Our dome was built by Multi Fassett and Marsha Zilles of Earth House in Cambridge. The plans they used and strongly recommend for the Back Yard Fish Farm research can be obtained from Popular Science magazine, 355 Lexington

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Avenue, New York, N.Y. 10017. (Ask for the Sun-Dome Plans.) The plans and instructions cost $5 and include a license to build it from the inventor, Buckminster Fuller. You should also read Knight Starr's OGF article in the September 1971 issue on the geodesic greenhouse. Although this dome is too small for the fish experiments, he does provide a lot of valuable information. If any of you have access to a cheap supply of window glass, you may be able to build an experimental dome which will last for many years.

The Pool

The pool can be any type of children's swimming pool, which varies in price from about $40 to $100. We used a 15-by-10-by-4-foot-deep, almost rectangular pool with a 3,400-gallon capacity. We assumed that this shape would be more conducive to breeding fish, but this original supposition was not correct. A 12-to-14-foot-diameter pool, 3 feet deep would do just as well and cost much less. The volume of this pool would be close to that of the prototype since we only filled ours to a depth of three feet.

There is an alternative way of constructing a pool which would be less expensive: digging a pond in the ground, about three or four feet deep and 12 to 15 feet in diameter. Since we haven't tried this method, we don't know how well it will work. If your soil is heavy and contains clay, lining the pool to prevent water seepage will not be needed. One problem that we can foresee with the pond-pool is the loss of heat from the water into the surrounding soils. This might be minimized by the use of an inexpensive liner combined with a good insulating material.

Fish for the Back Yard Fish Farm

Tilapia, a tropical fish native to Africa and the Near East, will be used in the

experiment. They eat algae, the microscopic plants that color lakes green. This coloration is especially prevalent in the summer months. Because it is possible to grow algae in huge amounts and at almost no cost, algae-eating fish can be raised quite cheaply.

Each of the experimenters participating in the project will receive one pair of tilapia parents from us. The only cost to you will be shipping and handling fees, which might run as high as $25, depending on where you live. However, if they survive and breed, this will be the only investment in tilapia you will ever have to make. Once established, the parents will be capable of producing thousands of young per year. This will supply you with plenty of offspring and you will be able to pass them on to any friends who may be interested in starting their own Back Yard Fish Farm.

Place the adults you receive in the dome pond. As soon as the temperature climbs to the low 80s they will start to breed and lay eggs which they care for in their mouths. Don't panic at this stage; they are not eating their young. Tilapia are members of a group of fishes known as mouth-breeders. After the brood is hatched and swimming freely about the pool, the parents will breed again if conditions are right. This process should continue until an optimal population density for your experimental pool is reached. If, after sampling the population, you find that there are more than 500 fish in the pool, you should pull the parents out to prevent overpopulation and stunting of the residents.

After the first year's growing season is over, if the conditions have been favorable, you will have an excellent crop of edible fish. These can be frozen or stored live in aerated tanks for eating fresh as needed. The Malayan peoples in the Orient often store their live fish in rain barrels just outside the back door. Fish that are not of edible size can be held over the winter in warm tanks exposed to sunlight, or they can be fed to the chickens or

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pigs as an excellent high-protein organic feed. The idea of feeding livestock herbivorous fishes is not as crazy as it sounds. At present, we are experimenting with growing tiny herbivorous fish, to be cropped at a small size, as a future source of organic food for poultry — but more about that in a later issue. A small number of fish should be held over the winter. That way you will have brood stock the following spring.

Food for the Fish

The main diet of the tilapia will be the algae which will grow within the pool. After the pool is filled in the spring, one-gallon samples of water from a number of local ponds should be added. This makes it possible to seed your pool with a variety of algae species.

You will also have to provide fertilization. In our prototype we suspended a small burlap bag filled with horse manure. We estimated the algae growth by scooping the water into a tall glass and examining the color. If the water looked green enough, we shook the bag every few days. When the "bloom" began to wane, we replaced the used manure with fresh. Many of you will have cow, chicken or rabbit manure which can be used instead of horse manure. The weight and source of all fertilizer used must be recorded. It is very important not to overfertilize, as too many nutrients could deprive the water of its oxygen. Be careful!

Supplemental Feeds

Thousands of years ago the Chinese found that the growth and health of plant-eating fishes is enhanced by feeding them small amounts of animal matter in the form of insect larvae. This past season we raised our fish on a variety of insect larvae including mosquitos, midges, rat-tailed maggots and house fly larvae. Each experimenter should culture one or two types of insects or earthworms. The goal should be to produce one-half pound per day of these animals. Two productive and easy insects to culture are the ordinary house fly and the midge. If you have ever opened a garbage can that has rotten meat in it and seen the thousands of larvae or maggots crawling around, you have discovered how easy it is to raise fly larvae! Small garbage cans and a little waste meat might produce the supplemental food your fish need. Midges are cultured on trays in water fertilized with manure. The production of one pound of midges per day on a three-foot-square rearing tray has been achieved by fisheries scientists in Israel and Florida.

Apart from the algae and the insect larvae, your system should require few other food inputs. We have tied bunches of carrot tops and grasses to rafts as additional feed in the prototype Tilapia-Dome.

Collecting of Scientific Information

Intuition and common sense have played a large role in fish farming in the past. Science has hardly penetrated the domain of aquaculture. But scientific data is needed if we are to discover the best possible methods of fish farming. It is essential that the participants in the Readers' Research Program collect basic scientific information. At least half an hour per day should be spent caring for the Tilapia-Dome and collecting information. The first year's data will not be very difficult to collect. We
need:

1) Temperature profiles taken twice daily, including air temperature, temperature within the dome and in the water; also, a log of weather conditions.

2) Estimates of the population in the pool made at least twice; once at the end of the month following the first appearance of young fish and once at the end of the

season.

3) Measurements of fish growth taken each month from a selected sample of individuals.

4) Production calculations made at the end of the growing season by counting and weighing the total crop.

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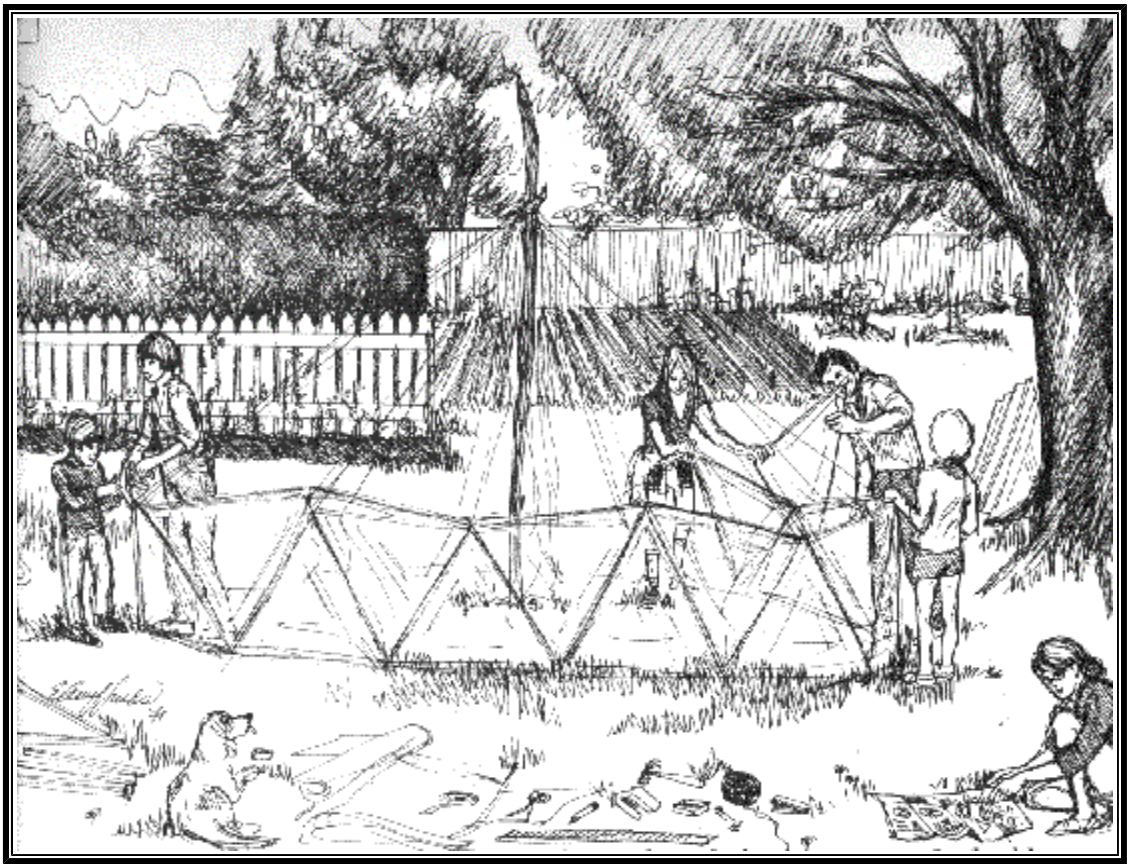

Building the geodexic dome is comparatively simple and inexpensive. It should take two or three days to complete the job. Costs can run from $50 to about $200. (Remember the bucks this article refers to are 1972 dollars!)

5) A description of the food used (worms, insect larvae, etc.) must be given with the amount listed in pounds.

6) A description of the amount of fertilizer and the source must be given, including the length of time between changes.

Hopefully we will be able to design a simple colorimetric test for you to estimate algae production on a weekly basis.

We do not know how successful the Back Yard Fish Farm idea will be. We have

indications from the prototype that it will work. In fact, some of you may produce edible organic fish at less than 20 cents per pound (exclusive of your labor), some may even set still-water fish culture records for this country. All of you will have fun and learn a lot.

The experiment is risky . . . you could also end up with fish only large enough to feed to the chickens.

This may not make you happy, but your scientific data will tell us what went wrong. Your Tilapia-Dome can be used as a greenhouse the following winter, or if you aie excited by aquaculture, you may decide to trap native fishes and fatten them in the dome in the winter. Thus, the experiment cannot really fail.

Bill McLarney wants to start a research project to find out if the dome can be used for two fish crops a year. During the winter he would like to try fattening bluegills, perch, crayfish and clams to be harvested before the tilapia experiments begin again in the spring. The majority of us here want to use the prototype dome for growing kale, spinach, Chinese cabbage and lettuce this winter. I suspect the cooks rather than the fisherman will win the first round.

I hope many of you will become involved in the OGF Reader's Research Program. It could become a potent force for a saner agriculture in this country.

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For you trivia fiends out there who feel the need to know about such things, each OGF page number in this article represents the block of text just above it. In this eleven page OGF article there were two two page advertising spreads which will explain the two rifts in the page numbers.

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