Two-Year Growth of Sunfish Hybrids in Missouri

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FIGURE 1. *Structures placed in ponds for spawning bluegill and sunfish hybrids.*

FIGURE 2. *Nests consisting of a plastic basin with gravel were placed in spawning structures for bluegill and hybrid sunfish production.*

FIGURE 3. *Indoor recirculating system for overwintering sunfish hybrids.*

Bluegill and other sunfish are an important and abundant fish in the US. Traditionally private lakes and ponds are stocked with bluegill in combination with largemouth bass and channel catfish. There are over 200 farms in the US that produce sunfish for a variety of markets (USDA 2006).

Bluegill are produced and sold as 1-2 inch fingerlings for initial pond stocking and as 6-8 inch sub-adults for corrective stocking and to accelerate the availability of fish suitable for angling in a sportfish pond. In addition, bluegill and other sunfish are grown to larger sizes (1/2-pound and larger) for corrective sportfish pond stocking, as bait for angling for trophy-size fish, and for food-fish markets. Total sales are in excess of $5.3 million (USDA 2006).

In the north-central US, bluegill and their hybrids with other sunfish have been identified as a priority for development of food-fish production. Hybrids of some sunfish crosses have increased growth rates, are more readily trained to consume prepared diets, and have efficient feed conversion.

Bluegill Spawning

The bluegill is a reproductive machine that, once water temperature reaches 70 F (21 C), spawns multiple times through summer. Male bluegill excavate a shallow nest and court a female for spawning. One male will often spawn with multiple females. Females release about one-third of the eggs at each spawning site. The male guards fertilized eggs and defends hatched fry for about three days until they swim up, start feeding, and leave the nest. Although the male bluegill is a fierce competitor, spawning occurs in close proximity to other males, which are part of a large group or colony of spawning adults.

Growing Hybrid Sunfish

Culturing hybrid sunfish adds product diversity in markets and solves the problem of multiple spawns that are characteristic of bluegill. Hybrid sunfish are often stocked in recreational fishing ponds to provide another species of "panfish" for anglers to catch and consume. Usually hybrids are stocked in combination with bluegill so that the reproductive potential will not be reduced excessively by stocking hybrids. Some advantages of stocking hybrids include providing another angling opportunity, reducing the overall reproductive rate, and adding a fish that grows faster due to hybrid vigor.

The most popular hybrids are crosses between green sunfish or redear sunfish females and bluegill males. The common green sunfish × bluegill hybrid results in populations dominated by fast-growing males, often as high as 90 to 97 percent of the population, that limit reproduction and reduce overcrowding and stunting. The redear × bluegill hybrid is also desirable, with rapid growth and limited reproductive capacity. The potential for rapid growth is a desirable characteristic to growers targeting food-fish markets. Redear sunfish will spawn only once during the reproductive season and hybrids retain this trait. Limited reproduction can be expected and excellent growth provides a harvestable fish for the food-fish market or stocking in recreational sportfish ponds.

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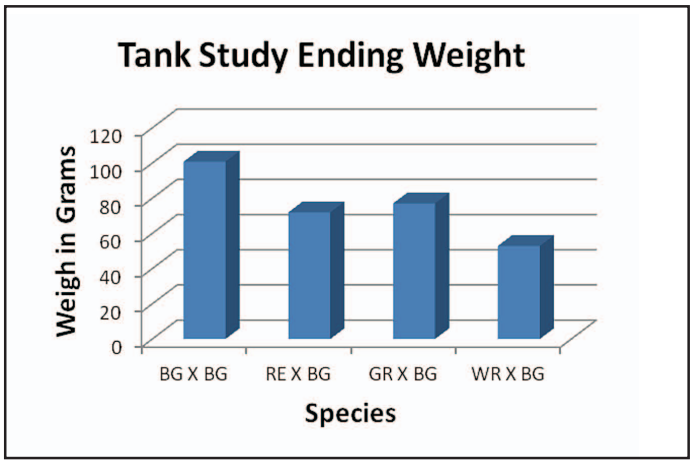

FIGURE 4. *Final weight of sunfish hybrids cultured in indoor recirculating systems. These fish were then stocked in ponds for second-year grow-out.*

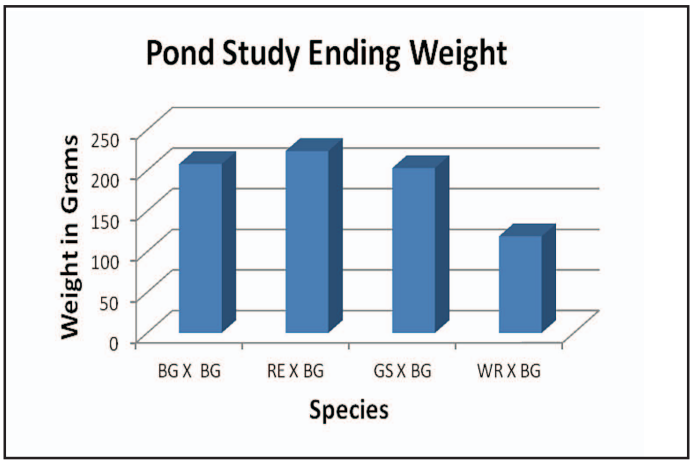

FIGURE 5. *Final weight of sunfish hybrids after second-year pond harvest.*

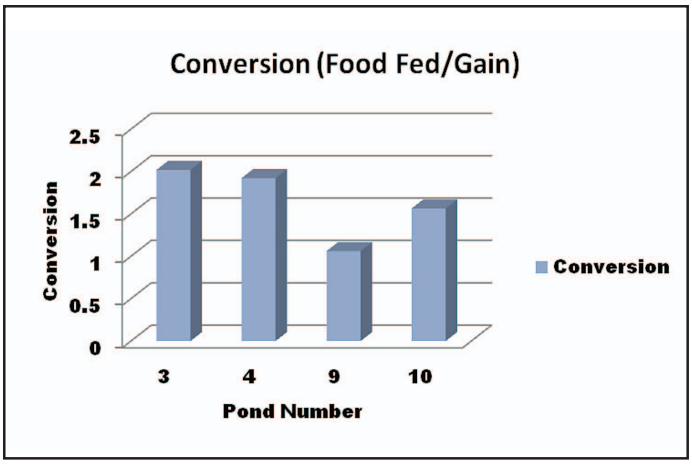

FIGURE 6. *Feed conversion ratio by aggregate populations of sunfish hybrids in four 100-m² ponds.*

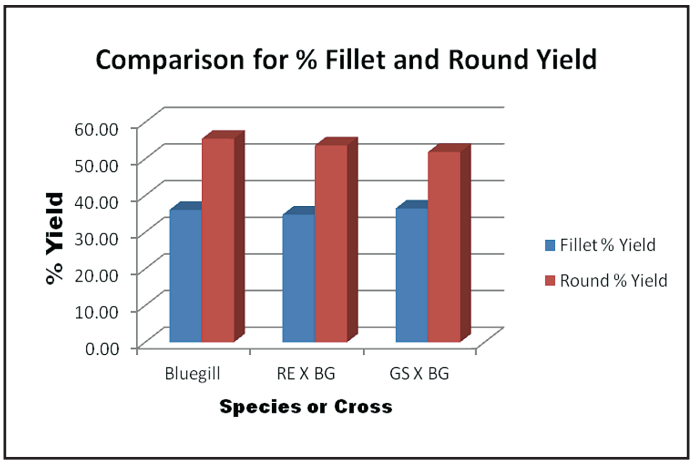

FIGURE 7. *Fillet yield and dress-out percentage in bluegill and sunfish hybrids.*

Evaluating Hybrid Sunfish Production at Lincoln University

At Lincoln University in Jefferson City, MO, we investigated methods for producing food-size bluegill and compared the growth of hybrids with bluegills. Studies comparing bluegill with a green sunfish ♀ × bluegill ♂ sunfish hybrid are limited. A study was designed to compare the following crosses (female × male): bluegill × bluegill (control), redear sunfish × bluegill, green sunfish × bluegill and warmouth × bluegill. The objectives were to measure performance over the entire life-cycle of the fish, from breeding to maturity (two-year fish).

First-Year Pond Phase

Four 0.10-ha ponds were fertilized with alfalfa meal and triple superphosphate. Spawning structures (Fig. 1) were placed in each pond with five nests in each structure (Fig. 2). Nests were made with plastic tubs that were about 8 in in diameter and 4 in deep. Nests were half-filled with small (¼ to ½ in) washed gravel or rocks.

We used crosses that occur in nature because male bluegill can spawn with any sunfish. However, a bluegill female will not spawn naturally with a redear male. Ten females and five males of each cross (one cross per pond) were stocked into each spawning structure on the same day. Nests were inspected each day and, when successful spawns were observed, adults were removed from the structure. When fry left the nests, spawning structures were removed from ponds. Two weeks after swim-up we began feeding a crumbled diet for fry (Silver Cup® Granulated) with 52 percent protein and 16 percent lipid. Feed particle sizes were increased through the summer as fish grew. Fish were fed *ad libitum* twice daily.

Overwinter in RAS Phase

All fish were harvested from each pond in late October and placed in an indoor recirculating system (Fig. 3) for continued grow-out, which is particularly important in northern climates where growth in nature stops. The duration of the indoor phase was 150 days.

The recirculating system at Lincoln University consists of 24 794-L tanks, a UV-light system, two 3-m³ partially submerged

biofilters with about 1 m^3 of bio-balls, and a rotating drum filter for solids removal. Each tank received water at a rate to provide a complete change every 30 minutes. Equal numbers of each hybrid cross and bluegill were stocked in each tank and there were six replicates of each cross. Fish were maintained on a 16-h light and 8-h dark cycle.

Fish were fed daily using a belt feeder. Feeding rate was adjusted by observing feeding behavior of fish and estimating the amount of feed remaining in a tank each morning. When the indoor test was terminated, each fish was weighed and measured (Fig. 4). The weight of bluegill was 23 percent greater than that of the green sunfish hybrid, 29 percent greater than that of the redear hybrid, and 47 percent greater than that of the warmouth hybrid.

Second-Year Pond Phase

The study continued through the second-year pond grow-out phase. In April, about 256 of each cross were stocked in each of four 100-m^2 ponds. Feed was placed into feeding rings twice daily (early morning and late afternoon) and the same ration was used through the summer. Dissolved oxygen, water temperature, pH, ammonia, and nitrite did not exceed normal limits at any time during the pond evaluation. A ½-hp, vertical pump aerator was placed in each pond and activated when dissolved oxygen concentration fell below 5 mg/L. All fish were harvested in late September, 2010. There was little difference in growth among the hybrids and bluegill, except for the warmouth × bluegill hybrid, which were much smaller than fish of other crosses (Fig. 5).

Fish feed represents over half the cost of raising fish and unfortunately this expense has been increasing dramatically the past few years, mostly due to rapid increases in commodity grain prices. Making a profit is related directly to how efficiently the fish use feed and how efficient the fish culturist is in feeding the fish. Because different species or crosses were stocked together, it was not possible to calculate conversion rates for each cross, but we determined the conversion rates for the aggregate group of hybrid sunfish in each pond (Fig. 6). All feed conversion ratios were less than two, indicating that feeding efficiencies were acceptable.

Sources of Mortality

Fish were lost to predators such as fish-eating birds, otters, and turtles. Sunfish are especially vulnerable to predators because of their relatively small size and tendency to remain in shallow water, especially at night. In the study comparing hybrids, survival ranged from 71 to 80 percent. Mortalities are not always observed by the fish culturist and may result in overfeeding. Careful hand feeding can minimize over or under feeding because the feeder can determine when fish activity stops.

Hybrid Sunfish Dress-Out

Sunfish dress-out percentage is important because the bottom line of price and revenue are directly affected. For example, if average dress-out is 35 percent and the cost to raise sunfish is $0.91/kg, then the cost to produce fillets is $2.60/kg ($0.91/0.35=$2.60/kg). This cost does not include processing expenses. Harvested fish were dressed; half were filleted and half were scaled, gutted, and the head removed, which is considered "in the round" processing. There was little difference in dress-out among the crosses (Fig. 7) and there was very little difference among crosses in fillet yield relative to fish size. Although fillets are often in greater demand than fish in the round, producers may market dressed fish to enhance profitability. Yield of fish in the round is greater and processing costs are less.

All three hybrids performed

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well, except for the warmouth × bluegill. Stocking the different hybrids and bluegill together did not affect performance (Fig. 8). The relatively poor performance of the warmouth hybrid was probably related to their inability to compete for food and space in the presence of more competitive fish. The warmouth is also normally a bottom feeder and may not have consumed much floating feed. All three of the best-performing groups – bluegill, redear × bluegill, and green sunfish × bluegill – can be produced to food-size fish within a reasonable time in temperate environments if proper methods are used. These methods include outdoor and indoor rearing phases. Rearing sunfish in warmer climates could provide an economic advantage because the cost of the indoor rearing phase is greater than pond rearing. Present pond-bank prices (US$2.50-3.50/kg) for live fish warrant a closer look at these species and crosses as possibilities for supplemental income for producers and farmers with private ponds suitable for raising fish.

FIGURE 8. *A visual comparison of sunfish from each cross at harvest after two years of culture. Top left: Warmouth X Bluegill; Top right: Bluegill X Bluegill; Bottom left: Green sunfish X Bluegill; Bottom right: Redear X Bluegill*

Notes

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