COOPERATIVE EXTENSION PROGRAM • COLLEGE OF AGRICULTURE, FOOD SCIENCE, AND SUSTAINABLE SYSTEMS

Kentucky Aquatic Farming

A Newsletter for Improving Fish and Shellfish Production, and Pond Management

Volume 27, Number 1, Winter 2013 - 2014

On The Inside:

2014 Pesticide Applicators Training Session: Aquatic Plant and Algae Control for Kentucky Commercial Pesticide Applicators for 3 Specific Credits (Category 5) and 2 General Credits (Categories 10 and 12)

10:00 am – 4:00 pm on **Friday, March 21, 2014** in Princeton, Kentucky at the University of Kentucky Research and Extension Center, 1205 Hopkinsville Street. A Pond Management Workshop will be held the following day, Saturday March 22 at the same location.

10:00 am – 4:00 pm on **Friday April 11, 2014** at the Franklin County Extension Office, 101 Lakeview Ct., Frankfort, KY 40601-8750; phone (502) 695-9035; email DL_CES_FRANKLIN@EMAIL.UKY.EDU Also, a Pond Management Workshop will be held the following day, Saturday April 12 at the same location.

For more information, please contact *Forrest Wynne, State Extension Specialist for Aquaculture, Kentucky State University Cooperative Extension Program, Graves County Extension Office, Mayfield, KY*

2014 Pond Management: Farm, Recreation and Production Workshop in March at Princeton, KY and April in Frankfort KY

On Saturday March 22, 2014, the Pond Management: Farm, Recreation and Production Workshop will be held in Princeton, Kentucky at the University of Kentucky Research Center and Extension Center.

And on Saturday April 12, 2014, the Pond Management: Farm, Recreation and Production Workshop will be held at the Franklin County Extension Office, 101 Lakeview Ct., Frankfort, KY 40601-8750; phone (502) 695-9035; email DL_CES_FRANKLIN@EMAIL.UKY.EDU

For more information, please contact Dr. Bill Wurts, State Extension Specialist for Aquaculture, Kentucky State University Cooperative Extension Program, University of Kentucky Research and Extension Center, 1205 Hopkinsville Street, Princeton, KY 42445; Phone 270-365-7541; email william.wurts@uky.edu

The following article was distributed nationally by Gary Jensen, National Aquaculture Program Leader, USDA - National Institute of Food and Agriculture (NIFA).
It is written by Max Holtzman, Senior Advisor to the United States Secretary of Agriculture:

Aquaculture is Agriculture, Exports and Jobs

The United States imports nearly 90% of the seafood we consume, over half of which is produced through aquaculture (farm raised seafood products). While the unparalleled success of our terrestrial growers, ranchers and producers facilitated U.S. exports which resulted in an estimated U.S. agricultural trade surplus of over $32 billion for FY 2012, there was a trade deficit approaching $11 billion for seafood products in 2011. Why is this important? We know empirically that every $1 billion in agricultural exports supports approximately 7,800 jobs here at home. President Obama directed this Administration to double its exports by 2015 and we are well on our way to doing that. Aquaculture has the potential to effectively contribute to increasing U.S. exports over the next decade, providing new jobs and economic opportunities for those in rural America.

The opportunities for growth and domestic demand generated in aquaculture are real. There is an evolving shift in dynamics affecting exports from the Asian region to the United States. First, as populations and incomes in Asian countries rise and improve, there is a corresponding increase in demand for proteins. This translates to more aquaculture products staying in the Asian region to meet domestic demand. Second, dynamics of the “value of the dollar” deem it less attractive to export to the United States. Finally, there is an almost insatiable demand for U.S. agricultural products for several reasons: We produce the safest, highest quality products in the world and the reliability of our supply is second to none. The soybean industry is seeing rapid growth and opportunity in more plant-based aqua-feeds, and is making important domestic investments in this space. The combination of these dynamics presents an incredible opportunity for growth in the domestic aquaculture industry and new economic opportunities for those in rural America.

Aquaculture also plays a critical role in nourishing a rapidly growing world population. As the world population just tipped the 7 billion mark with estimates of reaching 9 billion in the next few decades, we must find economically and environmentally sustainable ways to produce more food. Current estimates show we must produce a shocking 60-70% more food than we produce on earth today just to feed this expansion in population, while we currently fight to properly nourish the 870 million children, women and men that go to sleep hungry every night. The conversion efficiency and long-term sustainability of protein production through modern aquaculture are important factors in this effort to combat what is perhaps one of the greatest challenges facing the global community today.

So what is inhibiting this growth domestically and what can we do about it? First, there must be an understanding and acceptance that start-up of an aquaculture operation is treated no differently than any other beginning agriculture enterprise. Second, multi-disciplinary research in aquaculture should be expanded to improve production efficiency, economic viability and long-term sustainability through new transformational advances in genetics, nutrition, health and technology. Third, when a natural disaster occurs that affects aquaculture growers, these growers should have access to disaster assistance programs as others in agriculture. Finally, and perhaps most importantly, there must be a streamlining of regulations and permitting by government agencies that are science-based and recognize the unique aspects of successfully integrating aquaculture operations into our diverse aquatic environments. The USDA, Department of Commerce, Department of Interior, Army Corps of Engineers, and Environmental Protection Agency have taken the first important steps in this area working closely with the aquaculture industry, but much work remains to be done.

Although I'm not one to wager, I know this: Never bet against the American farmer. The genius, ingenuity, passion and just plain hard work of the American farmer are responsible for making the United States the most productive agriculture economy in the world. There is no reason it should be any different for the aquaculture industry.

RECTANGULAR AIRLIFT PUMP DESIGN

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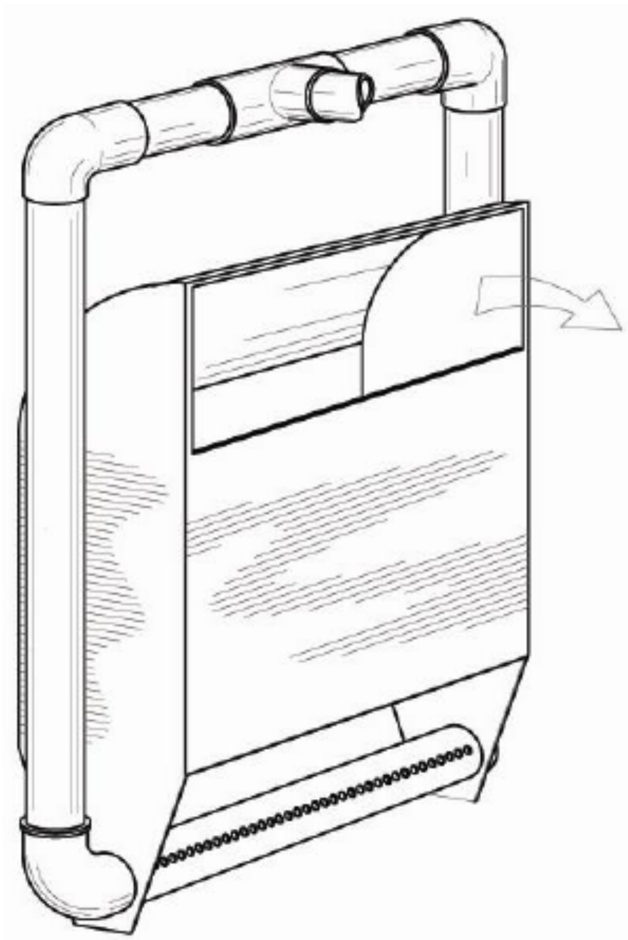

http://www.ca.uky.edu/wkrec/Wurtspage.htm

Documented examples of rectangular airlift pumps appeared in the early 1970s (e.g. Salser and Mock, 1973). These designs used single horizontal air injectors: either air stones/diffusers or a cylinder with perforations around the perimeter. Recent rectangular airlifts have used injection grids fabricated with fine-pore diffusers or cylinders with multiple perforations. Shortcomings of these grids are air-flow limitations and injector spacing constraints. System air pressures must be increased to deliver high volumes of air flow. Fine-pore diffuser fouling with bacteria, fungi and other micro-organisms also limits air flow.

In late 2006 and early 2007, Wurts designed and Herron built a prototype rectangular airlift pump. It was submitted to the USPTO as a provisional patent (Wurts and Herron, 2008) and again as a non-provisional patent application with new design elements/improvements added by Wurts (Wurts and Herron, 2009). The designs employed either single- or dual-cylinder, horizontal air injector elements. Air was injected through portals (circular apertures) in the cylinder walls. Unlike earlier documented designs, the air-injector portals were placed in bilateral single or double rows, just above the mid-lines of the injector cylinder. The lower-most air portals were tangential to the top of the injection cylinder's mid-lines. The bilateral configuration of air portals provided symmetrical airstream distribution, more precise injection depths and air-stream exposures to equal volumes of water – both sides of the air streams.

Rectangular airlifts can be substantially more compact and space efficient than single or multiple configurations of cylindrical airlifts. A single, compact rectangular airlift (Wurts and Herron, 2008 and 2009) can handle the total air output of one or two regenerative/centrifugal blowers. The rectangular airlift pump can generate high volume water-flow rates at relatively low static air pressures. *Air Pump* software (Reinemann and Timmons, 1988) indicates a single rectangular airlift should pump water volumes of 9538-11960 Lpm/kw, with an air flow of 2284 Lpm/kw and riser volume from 0.18-0.21 cubic meters (1890-2370 gpm/hp, air flow 60.5 cfm/hp and riser volume from 6.38-7.35 cubic feet)

Side view of single and dual-cylinder air injector configurations for rectangular airlifts.

References

Salser, B.R. and C.R. Mock. 1973. An airlift circulator for algal culture tanks. Proceedings of the annual workshop – *World Mariculture Society*, 4: 295–298.

Reinemann, D.J. and M.B. Timmons. 1988. Airpump version 1.0. Airlift Pumping and Aeration Design Program. Cornell University Agricultural Engineering Department, Ithaca, NY.

Wurts, W. A., S. G. McNeill and D. G. Overhults. 1994. Performance and design characteristics of airlift pumps for field applications. *World Aquaculture*, 25(4): 51-54.

Wurts, W.A. and R.G. Herrron. 2008. Airlift pump. Provisional patent, USPTO 61/072,198. *Proceedings of the 9th International Conference on Recirculating Aquaculture, 08/24/2012*

Pond test of the Wurts-Herron rectangular airlift prototype in April 2007.

Wurts, W.A. and R.G. Herrron. 2009. Airlift pump. Non-provisional patent application, USPTO 12/383,779 (publication suppressed).

Wurts, W.A. 2012. Rectangular airlift pump design outperforms cylindrical units. Global Aquaculture Advocate, 15(6): 77-78.

Fish Disease Cases Diagnosed at the Kentucky State University Fish Disease Diagnostic Laboratory in 2012

Robert M. Durborow, Ph.D., Professor and State Extension Aquaculture Specialist, Aquaculture Research Center, 103 Athletic Road, K.S.U., Frankfort, KY 40601
Jiashuo Ma and Catherine Frederick

The Kentucky State University Fish Disease Diagnostic Laboratory diagnosed 50 cases in 2012 submitted from Kentucky, Ohio, Tennessee and Texas. Samples were tested for bacterial, parasitic, and water quality causes of fish mortality. The following tabulates species examined, identity of the pathogens contributing to mortality, and antibiotic resistance.

Fish Species	**Number of Cases**
Largemouth Bass	14
Brown Trout	1
Bluegill	5
Koi	4
Tilapia	2
Yellow Perch	2
Paddlefish	5
Channel Catfish	5
Rosy Red Minnows	1
Common Carp	1
Channel x Blue Catfish Hybrids	10
Black Bullhead	1
Freshwater Prawns	1
Goldfish	1

Bacterial Species contributing to mortality	**Number of Cases**
Aeromonas hydrophila	10
Flavobacterium columnare (external columnaris)	4
Pseudomonas sp.	1
Plesiomonas shigelloides	1
Edwardsiella tarda	1
Leucothrix mucor	1
Unidentified bacteria	2
Edwardsiella ictaluri	1
Vibrio sp.	1
Aeromonas salmonicida	1

Number of cases involving internal bacteria 19
Number of internal bacterial isolates 22

Resistance of bacteria to antibiotics:
Isolates resistant to Terramycin 6
Isolates resistant to Romet-30 1
Isolates resistant to Aquaflor 0

Parasite species contributing to mortality	**Number of Cases**
Ich (*Ichthyophthirius multifiliis*)	5
Gill Monogenes (gill flukes)	2
External Fungus (saprolegniasis)	5
Trichodina sp.	3
Lernaea sp. (anchor parasite) larvae	1
Proliferative Gill Disease	1
Ambiphrya sp.	1
Epistylis sp.	1
Apiosoma sp.	1

Miscellaneous	**Number of Cases**
Routine Check	11
Unknown	7
Inadequate Sample	3

Clientele Base	**Number of Cases**
Private Fish Owners	24
University and Government	22

Origin of Disease Case	**Number of Cases**
Kentucky	31
Ohio	14
Tennessee	1
Texas	2

Furunculosis on Brown Trout

Yellow Grub on Rosy Reds

Fish Farming Taking Off?

BRITISH TROUT ASSOCIATION

The British Trout Association is delighted that farmed fish production is overtaking beef rearing for the first time in the UK. A recent article published by The Times newspaper highlights that aquaculture overtook beef rearing by 3 million tonnes in output. This shift coincides with a change in diet trends which sees people turning more and more toward fish products instead of meat.

Consumers are becoming more health conscious and British farmed trout is a good option for those watching their waistlines, being lower in calories than other, perhaps more traditional, oily fish choices.

Eating farmed fish guarantees it's origin and helps you know whether it was farmed ethically and responsibly.   British farmed trout has been given a green light by the Marine Conservation Society, meaning it is a sustainable choice. When buying fish, there is no disguising what you are purchasing. Eating fish , preferably oily fish is known to have health benefits. Our British Trout, along with Mackerel, Salmon or sardines, are rich in Omega 3 and essential fatty acids, known to lower blood pressure and cholesterol.

Eating a portion of fish twice a week will also help with vitamin D intake and could be the solution to a glowing skin, so why not check out our website to try all new easy-to-follow Trout recipes fit for the summer?

FROM: http://www.britishtrout.co.uk/uncategorized/fish-farming-taking-off/

The Use of Liquid or Pelleted Lime in Ponds?

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Ponds are limed to neutralize the acidity of bottom soils and to improve productivity. "Liming" refers to the application of various acid-neutralizing compounds of calcium or calcium and magnesium. The material most commonly used to lime ponds is finely crushed agricultural limestone (agricultural lime). Liming ponds has three important benefits. Liming may enhance the effect of fertilization. Liming helps prevent wide swings in pH. Liming also adds calcium and magnesium, which are important in animal physiology.

There has been some interest in the potential use of pelleted lime and liquid lime products for liming ponds. Pelletized lime and "liquid lime" (lime suspensions) have been available for farm and home use for many years. Typically higher quality, finely ground agriculture limestone (ag lime) is used to make both. To form pellets, the lime particles are held together with lignosulfonates (less than 10%). Liquid lime is formulated by suspending finely ground lime particles in water with a small amount of clay and dispersant added to the mixture. Sufficient quantities of either product must be used to match the acid neutralizing effectiveness of a bulk agricultural lime application.

Neutralizing Value of Agricultural Lime

Commercial liming materials vary in their ability to neutralize soil acidity – their neutralizing value (NV). Liming rates are dependent on neutralizing value, which is dependent on purity and particle size. Pure calcium carbonate is the standard used for assigning relative neutralizing values to each of the liming compounds. Calcium carbonate is considered to have an acid neutralizing value of 100 percent. Agricultural limestone may have NV values between 85 and 109 percent depending on its specific chemical composition (calcium carbonate vs. calcium magnesium carbonate).

Finely crushed agricultural limestone is composed of different sizes of particles. Small particles react faster and dissolve more rapidly and completely than large particles. Therefore, the neutralizing efficiency (NE) of agricultural limestone depends on the fineness of the mixture. The particle fineness and associated neutralizing efficiency are determined by passing limestone through a series of sieves. Particles that pass through a 20-mesh sieve but that are retained by a 60-mesh sieve have a NE of 52.2 percent. Those passing through a 60-mesh sieve have a NE of 100 percent. The various quantities of each particle size grouping and their associated NE values must be averaged to arrive at an overall NE rating.

Liquid Lime Suspensions

A minimum quality dry agricultural lime could have approximately 90% of the particles pass through a 10 mesh sieve and only 50% pass through a 60 mesh sieve. However, in liquid lime, greater than 90% of the limestone particles will pass through a 200 mesh sieve. These finer particles react faster to neutralize soil acidity more quickly. But suspending very fine lime particles in water does not necessarily make them more effective. The particles are suspended, not dissolved, and will settle out over time. These particles must be distributed evenly over the soil surface to be treated. This requires specialized spreading equipment that could be too expensive and cumbersome for distributing liquid lime over the entire surface of a pond.

The particles in liquid lime are much finer, react more quickly with soil acid and their neutralizing value is high. Because of this, many assume less liquid lime is required to achieve the same results as coarser dry agricultural limestone. However, this is not true if the liquid suspension contains close to 50 percent water. A liquid lime suspension that is 50 percent water cannot contain more than 50% lime. The neutralizing value of a liquid suspension that is only 50 percent lime is reduced by half (NV = 100 x 0.5 = 50). If the neutralizing value of a dry agricultural lime application is 85, (85/50) 1.7 times more liquid lime is needed than the dry agricultural lime to effectively neutralize soil acidity.

Pelleted vs. Agricultural Lime

As the neutralizing value of an agricultural lime source increases , less lime is needed to achieve the desired soil pH. The average neutralizing value of agricultural lime in Kentucky, for all quarries, is 67. This value is used for making liming recommendations in Kentucky. Information about the neutralizing value of pelleted lime should be printed on the bag. If the neutralizing value of pelletized lime his higher (e.g. 85) than agricultural lime, less should be needed to achieve the desired results. For a neutralizing value of 85, 78% less pelleted lime would be needed than the bulk agricultural lime recommendation. Divide the average neutralizing value of Kentucky quarry lime by the neutralizing value of the pelleted lime (67/85). If the recommended application of agricultural lime is 4000 lb, then 3,120 lb of pelleted lime would be needed. While less pelleted lime is required, the rate reduction is not substantially lower.

Pellets and Liquid Suspensions or Finely Crushed Agricultural Lime?

Pelletized lime may be easier to distribute than agricultural lime over small areas – especially if spread by hand for ponds already filled with water. But because the fine lime particles are combined with a lignosulfonate binder and spread as pellets, pelletized lime is no more effective for reducing soil acidity than ag lime. The particle binder must break down before the lime particles are available to neutralize acidity. When the pellets break down, the lime particles are concentrated in small circles rather than evenly dispersed.

Liquid lime suspensions can react with soil acidity more quickly because of the finer particle size. However, for terrestrial use, research has shown more frequent applications may be needed to maintain desired ph/alkalinity. Liquid lime suspensions can contain as much as 50% water and require specialized mixing and spreading equipment. Distributing lime suspensions evenly over the surface of a pond could pose a daunting challenge. Furthermore, because the fine lime particles are suspended and not in solution they will settle out of the water carrier if allowed to sit for too long. Both pelletized lime and lime suspensions are typically much more expensive to use than good quality agricultural lime with an equivalent neutralizing effectiveness.

Reference

Wurts, W.A and M.P. Masser. 2013. Liming ponds for aquaculture. *Southern Regional Aquaculture Center,* Publication 4100.

Management Calendar for Recreational Ponds in Kentucky

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January

When ponds freeze - Ice covering a pond will only endanger fish if a blanket of snow prevents sunlight from penetrating the ice for a prolonged period of time. Aquatic plants and algae may die causing a dissolved oxygen depletion which may kill fish. Due to potential thin ice, no attempts should be made to remove Ice or snow from the pond.

February

Potential for ice (and snow) covering ponds.

March

Begin algae and aquatic plant management programs if surface water temperatures reach 60 degrees F, or greater. Stock triploid grass carp to control soft-stemmed, vascular plants and branched algae. Average lake temperature is 50 degrees F.

April

Begin algae and aquatic plant management programs. Begin pond fertilization program[+] every two weeks when water temperature reaches 60 to 65 degrees F, if maximum fish production is desired and the pond is to be heavily fished. Do not fertilize ponds where filamentous algae or aquatic vegetation control is a problem. Pond fertilization programs must be maintained every year thereafter. Average lake temperature is 62 degrees F.

May

Continue algae and aquatic plant management programs. Continue pond fertilization program every two weeks when water transparency is greater than two feet. Largemouth bass, bluegill and channel catfish may begin spawning. Average lake temperature is 71 degrees F.

June

Continue algae and aquatic plant management programs. Assess the pond's fish population "balance" by test seining for the presence of young of year largemouth bass and bluegill. The number of intermediate size (3 to 5 inches long) bluegill will determine the status of the pond's predator - prey relationship. Largemouth bass continue to spawn. Bluegill will spawn multiple times for the rest of the summer.

Stock 120 largemouth bass fingerlings and 50 channel catfish fingerlings (2 inches in length, or of equal size) per surface acre in new or reclaimed ponds only if bluegill were stocked the previous fall. Lakes and ponds will begin to stratify or develop warm water layers near the surface. Average lake temperature is 79 degrees F.

July

Continue algae and aquatic plant management programs. Assess the pond fish population "balance" by test seining. Average lake temperature is 84 degrees F.

August

Continue algae and aquatic plant management programs. Assess fish population balance by test seining. Begin plans to construct new ponds or repair/renovate established ponds with the onset of dry weather. Average lake temperature is 82 degrees F.

September

Add agricultural limestone* if total alkalinity of the pond's water is less than 30 mg/l and the pond has less than 13 water exchanges per year or liming may be ineffective. Continue algae and aquatic plant management programs.

Pond "turnover" and resulting dissolved oxygen depletions are likely to occur in "fertile" or deep ponds. This is the result of cooling surface waters mixing with large volumes of deep water that is low in dissolved oxygen. Dissolved oxygen depletions often result in fish kills.

Dry weather allows new pond construction and repair/renovation of established ponds. Pond drawdown may be used to increase bluegill predation by largemouth bass by reducing shallow water habitat where bluegill can escape from the bass.

Undesirable fish populations may be eliminated from ponds by the use of rotenone, a restricted use pesticide and chemical toxic to fish. Fish spawning should be completed before chemical application. Contact the local fisheries biologist, conservation officer or aquaculture extension specialist before applying the chemical. This is the last month to apply for the Kentucky Department of Fish and Wildlife Resources pond stocking program.
Average lake temperature is 77 degrees F.

October

Continue algae and aquatic plant management programs.

Pond fish populations may be reclaimed with rotenone.

Add agricultural limestone to ponds with waters low in total alkalinity (below 30 mg/l). The pond's water volume should not exchange more than 13 times per year or liming may be ineffective.

New ponds may be constructed and established ponds repaired/renovated before the onset of wet, winter weather.

For new or reclaimed ponds stock 400 bluegill fingerlings (1 inch in length) per surface acre. If desired, red ear sunfish (shell crackers) may replace about 25% of the bluegill to be stocked.

October has the least amount of average rainfall for any month in Kentucky. Pond water volumes and flows from springs should be at their lowest.

Average lake temperature is 70 degrees F.

November

Add agricultural limestone to ponds with waters low in total alkalinity (below 30 mg/l). The pond's water volume should not exchange more than 13 times per year or liming may be ineffective.

December

Drawdown pond water level to expose 5 to 10 feet of shoreline to help control aquatic vegetation by subjecting it to freezing weather.

Pond surfaces may freeze.

Save old Christmas trees for brush "fish" attractors.

* Agricultural limestone may be added to ponds at any time. However, application during the fall months allows the lime to react with the pond's bottom mud freeing available nutrients in time for the spring growing season. Fall is typically when the ground is most dry and best allows heavy trucks and other equipment near the pond.

+ The amount of pond fertilizer used depends on the chemical composition of the fertilizer. A County Extension Agent, Fisheries Biologist or an Aquaculture Extension Specialists can provide application rates for various fertilizers.

Evaluation of Plant and Animal Protein Sources as Partial or Total Replacement of Fish Meal in Diets for Juvenile Nile Tilapia

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Introduction

Nile tilapia (*Oreochromis niloticus*) are tropical fish endemic to freshwater in Africa, Jordan, and Israel and due to their rapid growth rates, good quality flesh, disease resistance, adaptability to a wide range of environmental conditions, ability to grow and reproduce in captivity, and feed on low trophic levels, tilapia have become an excellent choice for aquaculture, especially in tropical and subtropical environments. Since tilapia are primarily produced in intensive production systems, it has become necessary to evaluate practical diets that are economically and environmentally-sustainable, as well as nutritionally-complete. Fish meal (FM) has customarily been used as a major animal protein source in aquaculture diets and traditionally, FM has been the main source of protein in diets for tilapia fry and juveniles. However, FM is the single most expensive macro-feed ingredient ($US1100-1400 per ton) and is highly desired by other livestock industries. Thus, special attention has been given to tilapia nutrition with emphasis on replacement of FM by less expensive vegetable and animal protein sources.

While there have been many studies conducted to evaluate the replacement of FM in practical diets for tilapia with less expensive, locally available plant and animal-derived protein sources, further research is necessary for expansion of other plant and animal protein sources to replace FM. It has been stated that combining plant and animal source proteins with complementary amino acid profiles may help avoid any deficiency or limitation that could negatively impact fish performance. Hence, a feeding trial was conducted with Nile tilapia juvenile stages to evaluate the replacement of FM using alternative protein sources which includes soybean meal (SBM), soybean protein concentrate (SPC), and poultry by-product meal (PBM) feed-grade fed either singly or in combinations.

Methods

Experimental diets. Nile tilapia juveniles were fed six practical diets containing protein primarily from either SBM, SPC, PBM, or a combination, with four of those diets having no FM. All diets were formulated to contain 35% protein (as fed basis) and isoenergetic (available energy [AE] = 4.0 kcal/g of diet) with no amino acid supplementation. Diets were formulated on a digestible protein basis for ingredients SPC, SBM, FM, wheat, PBM, and wheat

Table 1. Ingredient Composition (%)

Ingredients	Diet 1 (control)	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
SBM (52%)	25.0	39.3	52.0	24.0	0.0	0.0
SPC (66%)	0.0	0.0	0.0	0.0	36.0	20.0
Menhaden FM (64%)	20.0	10.0	0.0	0.0	0.0	0.0
PBM (57%)	0.0	0.0	0.0	24.0	0.0	20.0
Wheat flour (12%)	44.6	39.5	36.1	43.9	51.9	51.2
Other	10.4	11.2	11.9	8.1	12.1	8.8

SBM and 20% menhaden FM; diet 2 contained 39.3% SBM and 10% FM; diet 3 contained 52% SBM and 0% FM; diet 4 contained 24% SBM , 24% PBM and 0% FM; diet 5 contained 36% SPC and 0% FM; and diet 6 contained 20% SPC, 20% PBM and 0% FM.

Experimental system, stocking and feeding. The feeding trial was conducted in twenty-four 110-L glass aquaria. Dechlorinated city (tap) water was recirculated through a mechanical and biological filtration system. Each aquarium was supplied with water at a rate of 4 liters per minute and cleaned daily. Continuous illumination was supplied by fluorescent ceiling lights. Water temperature was maintained and water quality parameters checked. During the study, water quality parameters averaged (±S.E.): water temperature, 29.8 ± 0.9 ºC; dissolved oxygen, 5.71 ± 0.34 mg/L; total ammonia nitrogen, 0.21 ± 0.15 mg/L; nitrite, 0.05 ± 0.03 mg/L; total alkalinity, 67.4 ± 57.0 mg/L; chloride, 67.6 ± 21.2 mg/L; pH, 8.06 ± 0.78. All parameters were within acceptable limits for fish growth and health.

Thirty juvenile Nile tilapia (mean individual weight of 2.84 g) were randomly stocked into each aquarium with four replications per treatment. For 7 weeks, fish were fed three times daily (07:30, 11:30, and 15:30 hours) all the diet they would consume in 30 min.

Results

Growth Performance and Feed Efficiency. After 7 weeks, mean final weight (g/fish; Figure 1), percent weight gain (PWG; Figure 2), and diet fed (g/fish; Figure 3) of juvenile Nile tilapia fed diets 1 and 6 were significantly higher ($\underline{P} < 0.05$) compared with juveniles fed all other treatments. Juvenile tilapia fed diet 5 had significantly higher Feed Conversation Ratio (FCR) values compared with those in all other treatments and poorer growth than four other diets (Figure 4). Overall, no significant ($\underline{P} > 0.05$) difference was found in percent survival among all six diets.

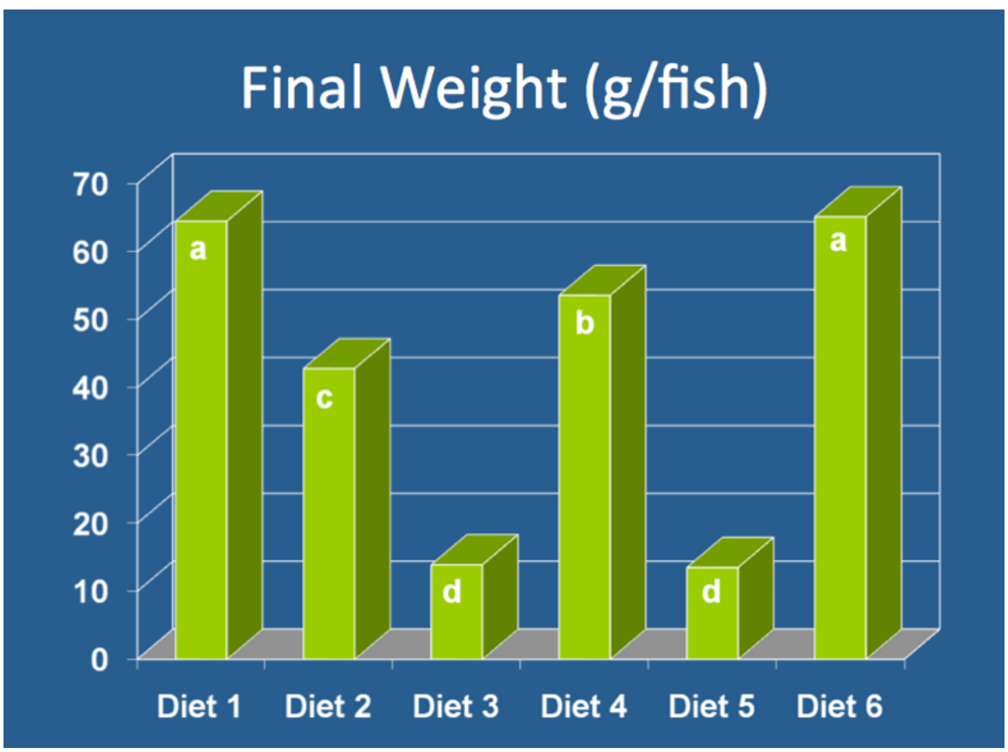

Figure 1. Final weights (in grams) of tilapia fed the 6 diets. Tilapia receiving diet 6 (with poultry by-product meal and soybean protein concentrate grew as well as those receiving the control diet (diet 1) with 20% fishmeal. The bars marked “a” show a significantly higher weight than bars marked “b”, “c” or “d”.

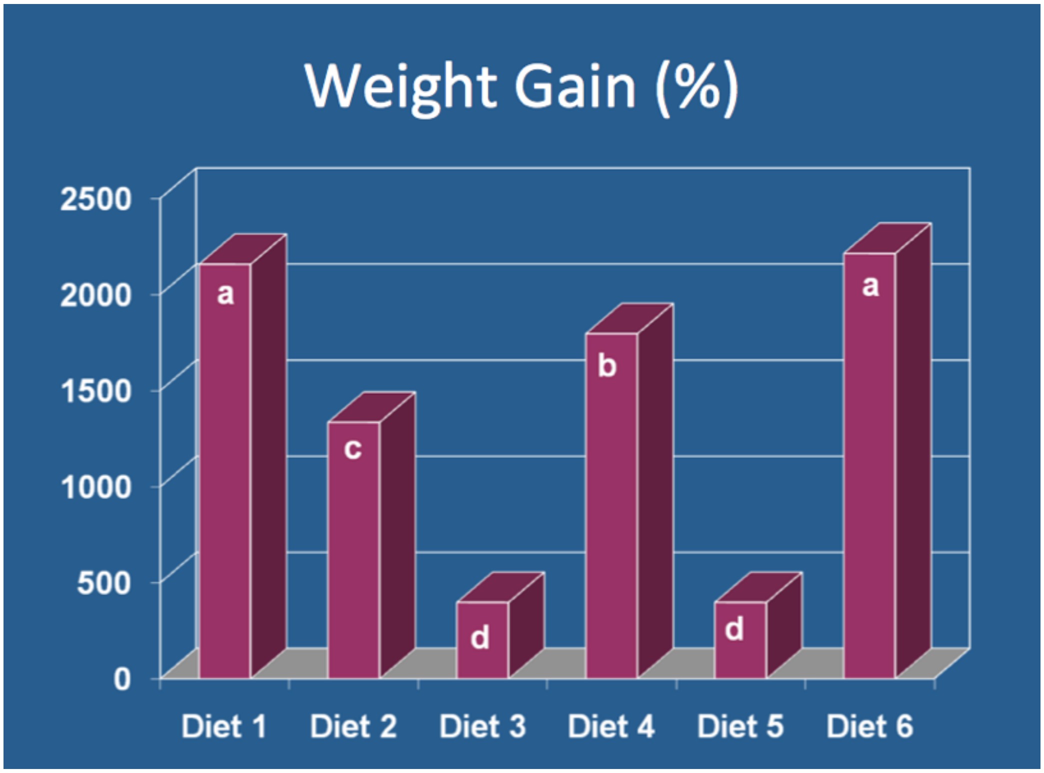

Figure 2. Weight gains (%) of tilapia fed the 6 diets. Tilapia receiving diet 6 (with poultry by-product meal and soybean protein concentrate grew as well as those receiving the control diet (diet 1) with 20% fishmeal. The bars marked “a” show a significantly higher weight than bars marked “b”, “c” or “d”.

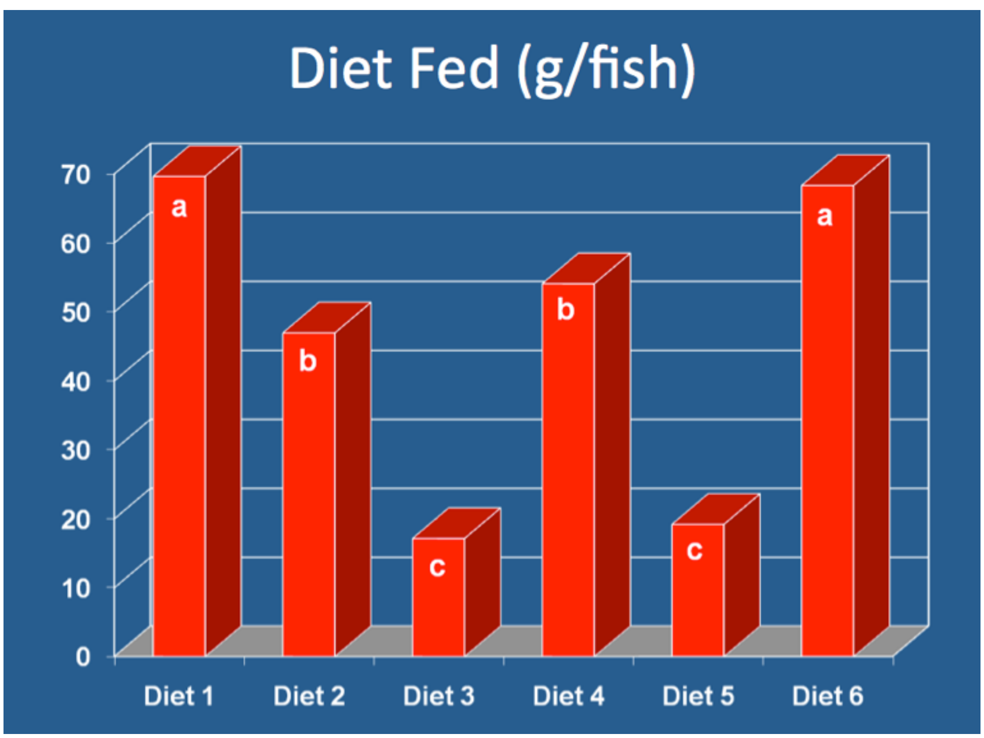

Figure 3. Fish receiving diets 1 and 6 consumed more feed that was offered to them than fish receiving the other 4 diets. The bars marked “a” show that fish fed diet 1 and 6 did not differ from each other in the amount of feed that they ate (compared to bars marked “b” or “c”). Fish ate as much feed containing poultry by-products and soybean protein concentrate (diet 6) as the feed containing fish meal (diet 1).

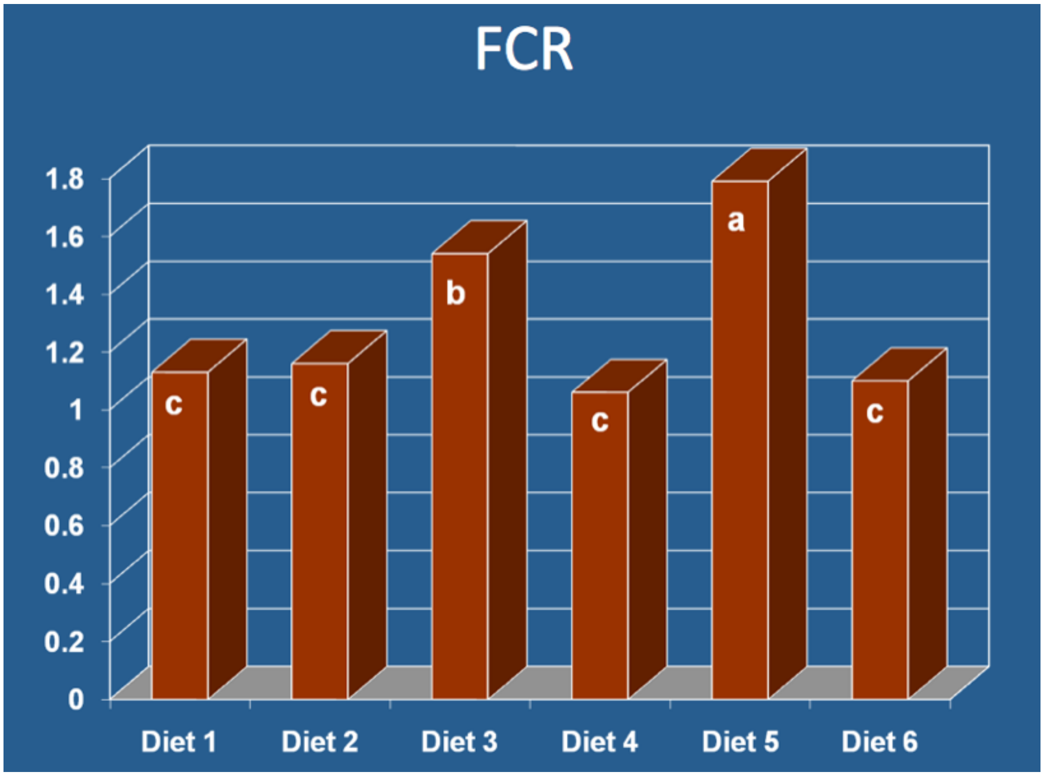

Figure 4. Feed conversion ratio (FCR; the pounds of feed that the fish had to eat to gain one pound in weight) was most efficient for fish consuming diets 1, 2, 4 and 6 (all marked "c") compared to FCR for fish eating diet 3 (bar marked "b") and especially compared to fish eating diet 5 (bar marked "c").

Discussion

Results demonstrated that juvenile Nile tilapia fed a diet containing 20% Soybean Protein Concentrate and 20% feed-grade Poultry By-Product Meal had similar growth performance as fish fed the control containing 20% Fish Meal but higher than in fish fed the other four diets with or without an animal protein source. While juvenile tilapia were purposely fed more restrictedly, results showed that juvenile tilapia fed the control diet and the SPC + PBM diet had significantly higher amount of diet fed (69.7 and 68.3 g/fish, respectively) compared with the other four diets. Basically the fish ate more of these diets; the fish chose to consume less of the other diets(all fish were allowed to eat as much as they wanted in 30 min). Soybean protein concentrate performed better than Soybean meal (diet 6 did better than diet 4). Further, FCR values ranged from 1.06-1.79 and significant differences were detected between the treatments. The highest FCR (worst feed conversion rate) was found in fish fed a diet containing SPC as the primary protein source with no animal protein source (Diet 5, FCR = 1.79) and was 69% higher than the lowest FCR (Diet 4, FCR = 1.06). Notably, juvenile tilapia fed diets 3 and 5 containing SBM as the primary protein ingredient with no animal protein, had significantly the poorest fish performance among all diets fed. Hence, this study indicates that growth is improved when an animal protein source is combined with a plant-derived protein source at a crude protein (CP) level of 35%. In addition, no palatability problems occurred based upon diet consumption, lack of feed wastage after feeding, and overall growth performance. Results suggest that ingredient usage can be shifted to a combination of animal-based and plant-based feedstuffs if the proper proportion and quality of ingredients are used in juvenile Nile tilapia.

Conclusions

Results from this feeding trial indicated that adequate essential amino acid levels in practical diets for juvenile-staged Nile tilapia can be achieved without amino acid supplementation, and it is feasible to formulate diets containing 0% FM, 20% SPC and 20% feed-grade PBM based upon growth performance. Juvenile tilapia growth was improved when an animal protein source was combined with a plant-derived protein source at a CP level of 35% and no palatability problems occurred. Further research is needed on FM replacement across life stages of Nile tilapia and the potential limitations observed in the present trial, as fish mature, associated with shifting from animal-based protein ingredients to more plant-based protein feedstuffs.

Shuckman's Fish Company in Louisville Plans to Market Asian Carp for Food

Lewis Shuckman, owner of Shuckman's Fish Company and Smokery, Inc., Louisville, KY, is planning to work on a collaborative project with Dr. Bob Durborow, State Aquaculture Extension Specialist at Kentucky State University, developing markets for Asian carp (bighead and silver carp), the exotic fish that have been overpopulating many of our country's rivers in recent years. Mr. Shuckman would like to investigate recipes and markets for Italian sausage, bratwurst, breakfast sausage, and smoked fish salad (think chicken salad or tuna salad) as well as other smoked products using Asian carp.

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Kentucky UNBRIDLED SPIRIT

KENTUCKY AQUACULTURE ASSOCIATION

Membership Application

Do you give permission to display the following information in an Agricultural Directory? ☐ **Yes** ☐ **No**

AQUACULTURE BACKGROUND *(check more than one where appropriate):*

☐ Producer ☐ Live Hauler ☐ Processor ☐ Pay Lake Owner
☐ Feed Mill ☐ Extension/Research
☐ Other *(explain)* ____________________

SPECIES

☐ Trout ☐ Minnows ☐ Largemouth Bass ☐ Catfish ☐ Bluegill
☐ Hybrid Striped Bass ☐ Freshwater Shrimp ☐ Red Claw Crayfish
☐Paddlefish
☐ Other *(explain)* ____________________

WATER SOURCE *(if applicable):*

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Number of ponds or raceways: __________
Total acreage (if ponds) __________
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Kentucky Aquaculture Association Dues: $25.00
Student KAA Dues: $5.00 School: __________
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Please return this application to the address listed below:

Kentucky Aquaculture Association
c/o Angela Caporelli, Aquaculture Coordinator and Marketing Specialist
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Frankfort, KY 40601
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