THE INFLUENCE OF GENETIC IMPROVEMENTS ON TILAPIA MARKETING

BY

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For 28 years I have been working on the improvement of various gene lines of pure tilapia. Some improvements have more influence on marketing in general and others have more influence in marketing in specific market areas.

For Instance, the first gene line that I began to improve was the Tilapia mossambica pure gene line. In this gene line I was able to find withing the pure mossambica gene line a single fish which had a mutation in the genes which influence the manufacturing of colors including black, the mutation apparently involved a set of genes which caused the production of red displaying chromataphores, and simultaneously a group of genes which suppressed or did not allow the production of melanin, which is

responsible for the black color displayed when tilapia mossambica are raised in a dark background or when the males are in full breeding color.

At first the red facilitation gene mutation only affected a few spots scattered around various areas of the fish predominantly on the head and upper back and the rest of the fish displayed mixed black and white areas.

I began a selection program designed to select for more red in each new generation and to select against black so that within five or six generations which took around a year and a half and approximatly 30,000 tilapia from which the best were selected for each characteristic, I was able to produce a single male that was almost completly white over 95% of his body and had a red spot on his head and a streak down his back and a few streaks of red in his fins, and a single black spot located over the pituatary gland on his forhead.

This development of the white tilapia with red markings immediatly changed the market demand for hybrid fingerlings which I was then selling by crossing these "white mossambica" with t. hornorum which produced around 85-90% male f-1 hybrids which we copywrited the name "Goldent Hybrid" . At the time we were successfully producing all male hybrids with normal colored t. mossambica and the Hornorum cross. However the market I was selling fingerlings too was much more concerned about color than about the idea of having all male hybrids, as at that time those growers who were just getting into the business were more excited about the color than they were about the idea of all male hybrids. Now after 20 years all male hybrids or GMT tilapia are finally getting the attention they deserve, however from a different market than I was addressing 20 years ago.

I made it a goal to have or force the tilapia mossambica in my Red development gene line to grow fast

at 90 degrees f. around 30 C and to produce at least 5,000 withing each selection group to achieve at least finding one fish each generation that had a small bit of improvement over the previous generation. Either more deep red color or better color distribution and of course during this period I made sure that all the fingerlings selected for the red beauty contest had little or no black or melanization.

The idea was that by having at least 5,000 in each generation I could count on at least one mistake when the seperation of the chromosomes that form either the sperm or the egg where a small amount of genetic material crossed over and went with the already red determinination chromosomes. In general I was able to get at least one improved red mossambica tilapia each generation and I was able to produce at least four generations a year of over 5,000 fingerlings from which to sort out these improvements.

By the 15th generation we had a few of my best

breeders which were beginning to resemble Red Snapper or Pargo, and at that point I applied for a Copyrite from the U.S Burea of Patents, and based on my development of the red tilapia I was granted the Registration of my Logo **Cherry Snapper®** I have since been granted lifetime ownership of this Registered Trademark and have expanded it's use to any of the improved varieties of hybrid f-1 tilapia that we are developing. After all, there are red cherries, white cherries, black cherries, etc.

I invented a new name to describe the process of producing enough pure line tilapias each generation to virtually assure at least one crossing over event that creates an improvement in the trait being selected for. I call this method "Gene Assembly" because generation after generation piece by piece we are assembling a new kind of fish within the confines of the pure gene line in which we are working.

The "Gene Assembly's" withing each pure line can then be used to produce f-1 hybrids which have the benefit

of each combined "Gene Assembly" being included in the strong points of the f-1 hybrid produced from this cross.

The development of the **Cherry Snapper®** began a new period of market development in which the f-1 hybrids of the red mossambica and the t. hornoum, or of t. aurea or t. nilotica produce red hybrids in which the red genes were dominant and produced a high percentage of red or pink hybrids all of which grew rapidly to market size regardless of whether they were male or female. Subsequent generations of hybrids I sold to many different people in many different countries have been back crossed or inbred to produce various lines such as the Jamaica Red or the Florida Red both of which came out of the backcrossed hybrids I originally sold which carried the name "The Sipe fish".

The development of the various red strains of Hybrid tilapias then created a new market which is strong and still growing in many Central and South American markets and in the Carribean, however due to the mixed heritage

caused by the backcrossing and inbreeding necessary to bring out the best red or pink colors many growers are now seeking ways to improve the growth characteristics of these strains to help reduce the production cost of fingerlings and production fish.

The sex reversed Jamaican Reds or Florida Reds do grow well but compared to the new strains or GMT hybrids produced by our Supermale t. hornorum they can only produce one crop in the time it takes our growers top produce 2 or 3 crops of our PennyFish or our Chocolate hybrid. Both of these hybrids are true f-1 hybrid crosses because each of the parents used to perform the cross is 100% pure from the species it is selected from to be come the hybrid production breeding stock. None of these fingerlings are the result of a backcross or any inbreeding and they can grow in good conditions from 10 grams to 800 grams in under six months and almost no sorting needs to be done for each new batch of hybrids stocked in a grow out tank or pond as they all reach market size within a

couple of weeks of each other.

The sex reversed niloticas, aureas, Jamaican Reds, aureas, Florida Reds, all require 10 -14 months for all of the fingerlings to reach 800 grams and many of them never make it. With these inbred and inconsistent growing tilapia fingerlings there is a high cost of both production and handling and in the use of fixed resources such as tanks, ponds, people.

These inbred fingerlings also have a higher cost of interest to run an operation since the cash flow is 3 times slower. For instance if a farmer invest $5,000 in a crop of pure f-1 Supermale hybrids all of his money is back and reinvestable within six months but with the weaker fingerlings it takes a year or more for the invested capitol input to be returned to the farmer to be used to create more production and expansion. With the high cost of interest in almost all of the areas where the red tilapias are grown this is a major factor in the profitability or lack of profitablity.

The Red tilapia then as a genetic development

produced a major expansion of tilapia production in almost all of Central and South America and in the Carribean, but has had very little success in creation of a profitable export due to the high cost of production and management of these fish.

In the near and the long run, the major influence of our new genetic improvements of tilapia will be in the market for Tilapia where the cost of production is important, and where the most tilapia products will be sold.

This is because ultimatly those improvements which get the best quality of nutrition to the most people for the lowest price are the ones which will build the really giant Aquaculture Industries needed to meet the expanded demands for high quality nutrition on this Planet.

Price is the ultimate power that runs markets. The low cost and high nutrient value of Chicken has driven the industry in the United States to exceed 40 billion pounds per year and compared to this all aquaculture products were under five hundred million in the United States. That

is only slightly over 1% of the amount of chicken produced and sold, so the market for high quality protein is here.

Price is the engine and the fuel for the creation of a tilapia industry and the propulsion of that industry into reaching the far reaches of our expanding human population.

While many other qualities of tilapia such as color or fillet ratio, fast growth, or sex ratio, may make the tilapias which have these traits more attractive to certain cultural groups, or to certain growers, in the major rivers of commerce only price can behave like concrete and sway the direction of the movement to the oceans of humans desperatly reaching for a better quality of life within their means.

What makes each day worth waking up to, and living, is it the sunshine or the rain or the people we love or is it all of this plus feeling good because we are well fed and

healthy from consuming a healthy diet that helps us to grow and maintain the glow of life and health.

Various traits of tilapia can be improved and each new trait may have significant immediate effects on certain cultural values that determine who will buy and who will not buy.

I have in addition to the development of the Red pure line t. mossambica also developed a pure gene line of t. hornorum show here that also adds considerably to the percentage of fillets that are produced from the F-1 Supermale hybrid tilapias they father. the average increase in fillet as a result of using these males exceeds 4% of the total weight of the fish. Each additional percentage of fillet for a fillet production operation directly raises the profit margin since all the money has already been spent to produce the total weight of the hybrids. This improvement in and of itself only impacts those markets where skinless boneless fillets are the primary product.

The production of a reliable all male f-1 hybrid that grows to as much as 2 pounds in six months and all come to market at nearly the same time however is the most important factor which I believe will eventually lead to greater markets for tilapia because this directly influences the cost of production more than any other single factor.

The Pennyfish shown here has recently been grown to over 2.1 pounds each in under six months in excellent water quality conditions.

Only these factors that lead to lower cost and ultimatly lower price to the people who need the nutrition while maintaining profit or improving profit can drive the price down to reach the buyers who must live in the real world on real budgets.

The history of my attempts to improve the tilapia that were available to me began with what I could see stimulated the people around me and the people I came in contact with to become more and more excited about the future of tilapia aquaculture and to become more and more

involved in it.

As a student in a class I took on Human motivation I was told that the only measure of motivation was to see and measure what people do no matter what they say they will do.

When I first became involved in the production of tilapia is was to carry on the work of C. F. Hickling who authored an article I read in May of 1963, on the cultivation of tilapia. In this article Dr. Hickling portrayed the production of all male hybrids as the breakthrough in aquaculture that would bring the possiblity of supplying desperatly needed fish protein to many people in the world by making possible the production of a pound of fish for under a penny in cost.

The way he said we could do this was by production of an all male hybrid he had discovered by following a program layed out to discover a fish that could be cultivated in any country under a variety of conditions and be fed a variety of feeds and still produce a viable crop.

His first choice was to examine the tilapia species in an attempt to gather together in one place in properly maintained seperation to avoid gene mixing, and then proceeding to cross each species with each of the other species in an attempt to produce a mule that would not be fertile. What he discoved instead though he did not know it at the time was the first SuperMale tilapia (called the Zanzibar strain of t. mossambica) which had homozygous genes called ZZ in the male so it could only produce male determining sperm when it was bred with another species (t. mossambica) which had the opposite characteristic in the female so that each female only had XX genes. As it turned out any XX female bred with any ZZ male always produced nearly 100% male hybrid offspring so long as their was no mixing in the areas where the pure gene lines were being preserved and bred to produce new generations of production breeders.

In the last 10 or 15 years newer methods have become avilable which can take the techniques we have

already learned to use so successfully and vastly speed up our ability to plan and execute improvements in tilapia genetics. These methods include Oogenisis, Androgenisis, gene surgury, and others, However none of these methods can completely overcome the major mistakes being made in the production of tilapia fingerlings. This is the mistake of trying to take a backcrossed hybrid tilapia and to use those fish to run experiments which can not be repeated because no two generations are identical, and of then trying to select for improvements and or create genetic alterations using these already genetically degenerate fish, can not lead to anywhere near the quality of the production fingerlings that the use of genetically improved pure lines of tilapia which are then used to hybridize to produce an f-1 hybrid with two pure gene lines coming from vastly different evolutionar histories.

These hybrid fingerlings can be reproduced at will each time a new experiment to test one thing or another needs to be done or whenever one needs to be repeated

because the pure lines are being kept pure and each time a new hybrid is needed the gene lines are still going to be pure and therefore virtually identical so that the hybrids produced from them can also be identical to those used to run the original experiment.

The general effect of controled and properly directed genetic improvments of tilapia can not be overestimated so long as the improvements continue to lower the farming cost of the hybrid tilapias produced from these improved gene lines.

A $5.00 per pound whole fish can be afforded by 5 or 10 percent of the population in most countries each day, but a $1,00 per pound tilapia can be afforded by 60 to 70% of most countries populations, and a 50 cent per pound tilapia can be afforded to improve the general nutrition level and feeling of well being in most people in nearly any World population.

In addition the spreading of the knowledge of how to produce and grow tilapia can bring additional economic

growth in almost all levels of commerce in all countries, but all of these benefits and improvements in the numbers of tilapia which can be marketed depend directly on those genetic improvements that create reductions in cost and in price to the people who need this nutrition.

Thank You for your attention,
Sincerely,
Mike Sipe