Comparative Pond Performance Evaluation of GenoMar Supreme Tilapia™ (GST) GST1 and GST3 Groups

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Research and Development of GenoMar Supreme Philippines

- **Genetic Gain Research Project**
- **Development of Salt Tolerant GenoMar Supreme Tilapia variety.**
- **Breeder Line Testing and Pond Performance Evaluation**
- **Development of high fillet yield GST**

GSP Operations and Activities

- Commercial Hatchery Operations
- Global Support to GenoMar Partner Hatcheries
- Local Partner Hatchery Operations
- Research and Development Programs
- Fredskorpset Training Program (STEP1)

OBJECTIVE OF THIS STUDY

To determine the benefits in terms of growth and survival rate of two distinct GST generations under a world-typical commercial scale grow-out operation in order to access the impact of new GST generations in ponds (production and economic).

MATERIAL AND METHODS

Two groups of GenoMar Supreme Tilapia™ (GST), GST1 and GST3, from different non-consecutive generations were evaluated on their pond performance.

Source: GenoMar Breeding Program, GenoMar Supreme Philippines (GSP) R&D facilities in Lubao, Pampanga, Philippines.

Evaluated parameters:
- growth rate,
- survival rate, and
- food conversion ratio (FCR).

This study was undertaken in six earthen ponds (3 replicates per generation group), at Prado B Station.

Weight Sampler

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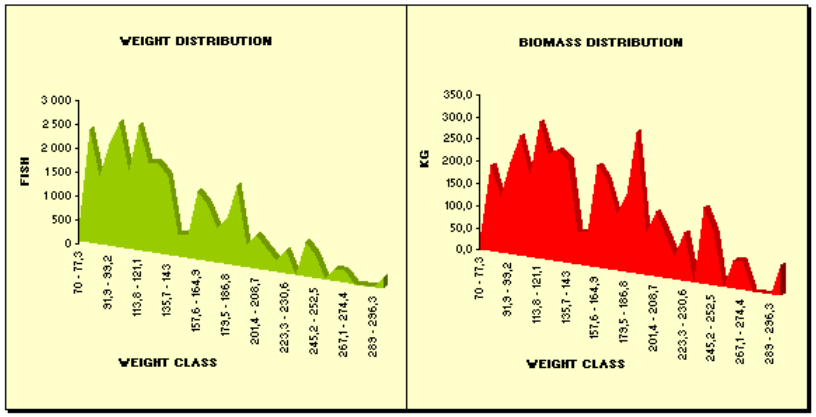
Fish	Weight (g)
1	136
2	94
3	130
4	102
5	302
6	184
7	126
8	190
9	102
10	190
11	120
12	164
13	134
14	140
15	92
16	158
17	110
18	106
19	84
20	126
21	116
22	114
23	90
24	162
25	270
26	180
27	222
28	188
29	180
30	110
31	116
32	158
33	194
34	98

Summary	
Pond/Tank Nr	0
Batch Nr	0
Stocking Date	00.jan.00
Sampling Date	01.mai.04
Days From Stocking	38108
Stocked Tilapias	0
Current Tilapias in Pond	30 000
Current Biomass	**4 223 kg**

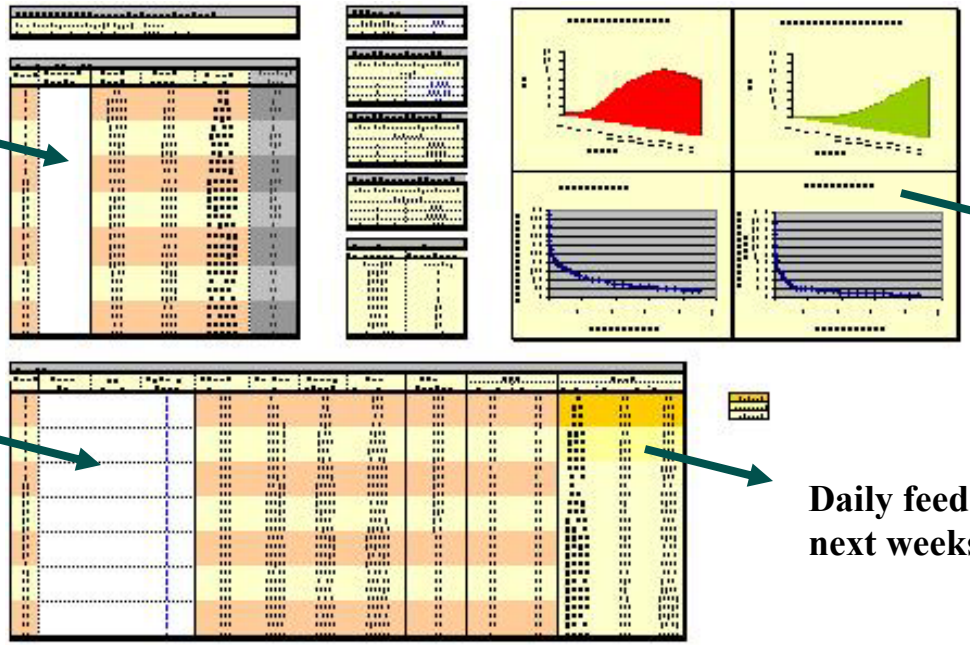
Statistical Results	
Sampling Size	126
Minimum	70 g
Maximum	302 g
Range	232 g
Average Weight	140,8 g
Standard Deviation	49,6 g



Sampling Result								Population Projection		
Weight Class	Weight Interval (g)	Number of Fish			Biomass			Number of Fish	Biomass (kg)	Biomass Accum.
		Absolute	Relative	Accum.	Kg	Relative	Accum.			
1	70 - 77,3	2	1,59 %	1,59 %	0,15	0,83 %	0,83 %	476	35,1	35,1
2	77,3 - 84,6	10	7,94 %	9,52 %	0,81	4,56 %	5,39 %	2 381	192,7	227,8
3	84,6 - 91,9	6	4,76 %	14,29 %	0,53	2,98 %	8,38 %	1 429	126,1	353,8
4	91,9 - 99,2	9	7,14 %	21,43 %	0,86	4,85 %	13,23 %	2 143	204,7	558,5
5	99,2 - 106,5	11	8,73 %	30,16 %	1,13	6,38 %	19,60 %	2 619	269,3	827,9
6	106,5 - 113,8	7	5,56 %	35,71 %	0,77	4,35 %	23,95 %	1667	183,6	1 011,4
7	113,8 - 121,1	11	8,73 %	44,44 %	1,29	7,28 %	31,23 %	2 619	307,6	1 319,0
8	121,1 - 128,4	8	6,35 %	50,79 %	1,00	5,63 %	36,86 %	1905	237,6	1 556,6
9	128,4 - 135,7	8	6,35 %	57,14 %	1,06	5,95 %	42,81 %	1905	251,5	1808,1
10	135,7 - 143	7	5,56 %	62,70 %	0,98	5,50 %	48,31 %	1667	232,2	2 040,3
11	143 - 150,3	2	1,59 %	64,29 %	0,29	1,65 %	49,96 %	476	69,8	2 110,1
12	150,3 - 157,6	2	1,59 %	65,87 %	0,31	1,74 %	51,70 %	476	73,3	2 183,4

The total harvest based on the number of fish in the pond and the weight distribution. The weight sampler estimates the distribution of the weight of fish based on a random sample.

Feed Planner



The feed planner calculates daily feed based on the optimal feeding curve and the expected growth rate. Regular measurements are needed to adjust the curves to unexpected variations in growth at each farm. Variations may be the result of poor water quality, extreme temperatures or other factors.

GenoMar has also developed the "GeneBoost" Server that is being currently used for breeding value calculations of GST5.

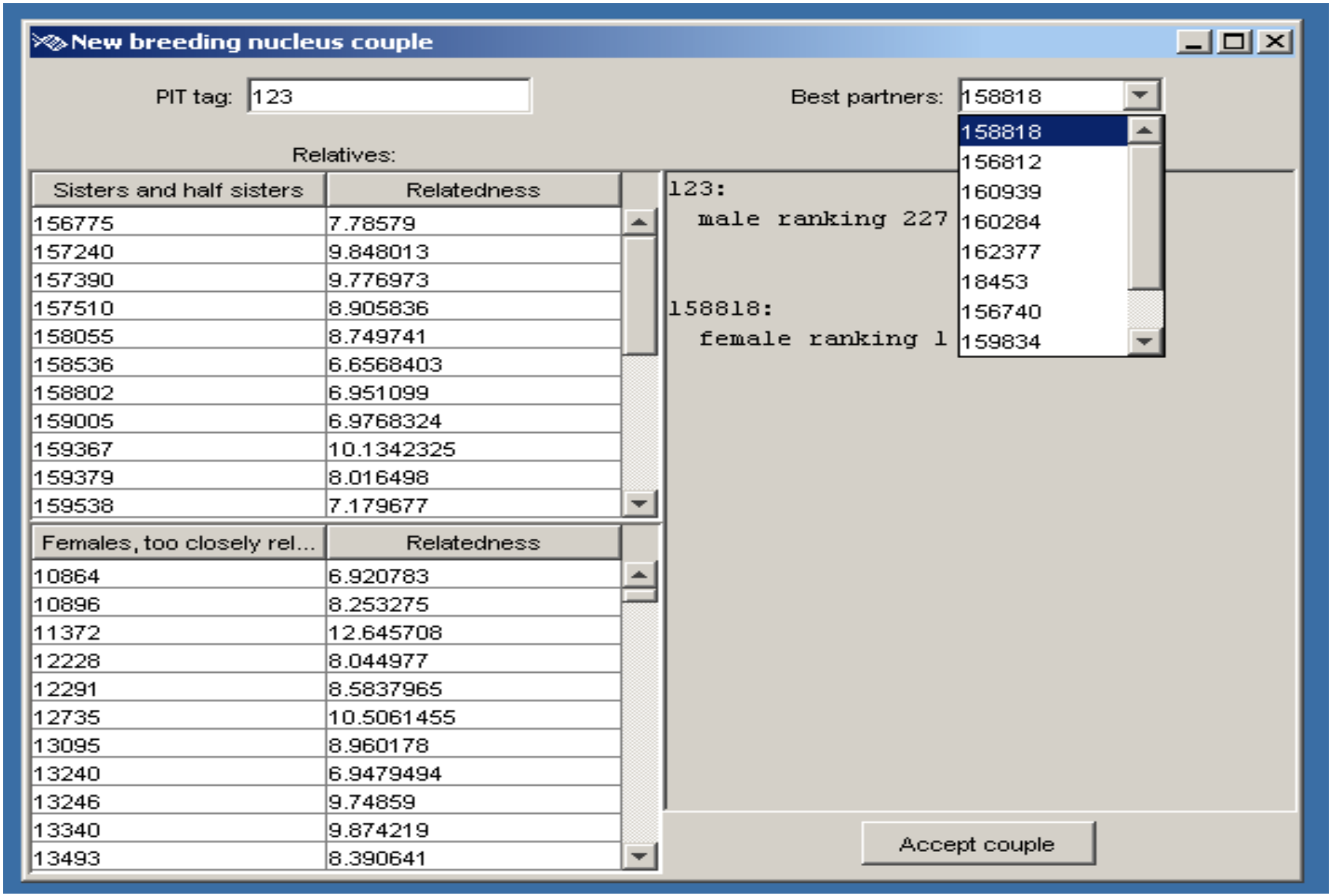
It was imported growth data and pedigree data from GST2, GST3 and GST4, a total of 14,000 animals into the database. The growth data has been successfully normalized within a total of 53 environments, two groups for each batch.

The program Variance Component Estimation (VCE) was used to estimate the variance components for the growth trait, taking into account the effects generation, age, sex, environment, and animal.

GeneBoost Server

GenoMar
SAFE SUSTAINABLE SEA HARVEST

- ***Optimized Multi Trait Breeding***
- ***One server handles several breeding programs***
- ***Modern GUI and database architecture***
- ***Stores phenotypes, genotypes and pedigree***
- ***Paternity test based on genotypes***
- ***Intelligent scaling and normalization of data***
- ***Seamless integration with external REML and BLUP packages***


New breeding nucleus couple
PIT tag: 123
Best partners: 158818
158818
156812
160939
160284
162377
18453
156740
159834
Relatives:
Sisters and half sisters
Relatedness
156775 7.78579
157240 9.848013
157390 9.776973
157510 8.905836
158055 8.749741
158536 6.6568403
158802 6.951099
159005 6.9768324
159367 10.1342325
159379 8.016498
159538 7.179677
Females, too closely rel...
Relatedness
10864 6.920783
10896 8.253275
11372 12.645708
12228 8.044977
12291 8.5837965
12735 10.5061455
13095 8.960178
13240 6.9479494
13246 9.74859
13340 9.874219
13493 8.390641
123:
male ranking 227
158818:
female ranking 1
Accept couple

Mating Mate

GenoMar
SAFE SUSTAINABLE SEA HARVEST

- ***Practical tool for dynamic and optimal mating***
- ***Finds best partner of selected animal***
- ***Individual and family quotas enforced***
- ***Inbreeding avoided based on pedigree and genetic relatednes***
- ***Modern windows based GUI***
- ***Seamless integration with the GeneBoost Server***

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Females, alphabetical

PIT tag	Ranking	Breeding	Production	Reserved
10864	136			no
10896	710		1	no
11372	626			no
12228	221			no
12291	197		1	no
12390				
12735				
13095				
13240				
13246				
13340				
13493				
13585				
13979				
14012				
14734				
14751				
14991				
156592				
156593				
156594				

Males, alphabetical

PIT tag	Ranking	Breeding	Production	Reserved
1	65	2	1	no
10	371		1	no
100	199	1		no
101	32			no
103	374			no
104	73			no
106	54			no
107	327			no
108	296			no
109	250			no
11	144	1	1	no
110	212	1		no
111	161			no
112	96			no
113	81			no
114	112			no

In this trial, the stocking density was maintained at 4/m^2 in all treatments.

A standard water quality bio-manipulation technique developed at GenoMar (C:N:P ratios) was applied throughout the entire grow-out period in order to optimize natural productivity and standardize water quality parameters.

During the trial the major water quality parameters did not show significant differences.

RESULTS: After 7 weeks…

GST1: 9 fish/kg - **116g** per fish

GST3: 6 fish/kg – **170g** per fish

↓

46.5 % faster genetic gains in 2 generations

RESULTS

Results showed that there was a significant growth rate difference between these two groups at the end of the 7-weeks growing period.

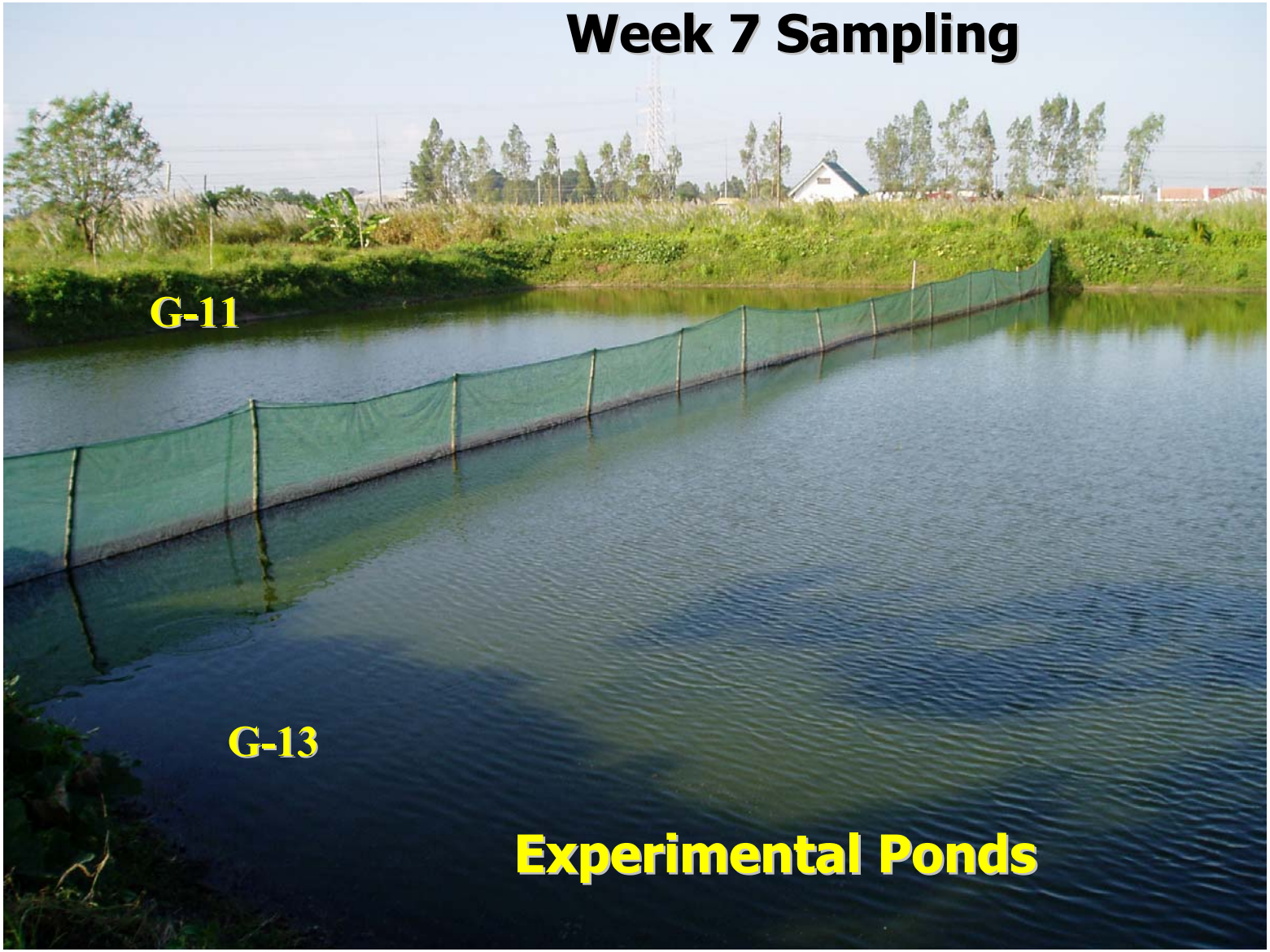
The GST1 and GST3 populations have indicated an average body weight (ABW) of 116 and 170 grams, respectively.

This indicates that the GST3 population grew by as much as 46.5% bigger than the GST1 during the same period of time in the same pond.

Similarly, there was a very significant difference of about 15.8% from these 2 groups survival rate, with the GST3 showing a survival of 80.8% compared with GST1's 69.0% survival rate.

It should be emphasized that this study was conducted from the period of November 2003 to March 2004, which is basically the colder period in the Philippines when the growth of the tilapia is not optimal.

Genetic Gain Research



Comparative Growth Evaluation of GST1 & GST3 – Philippino reality

GenoMar
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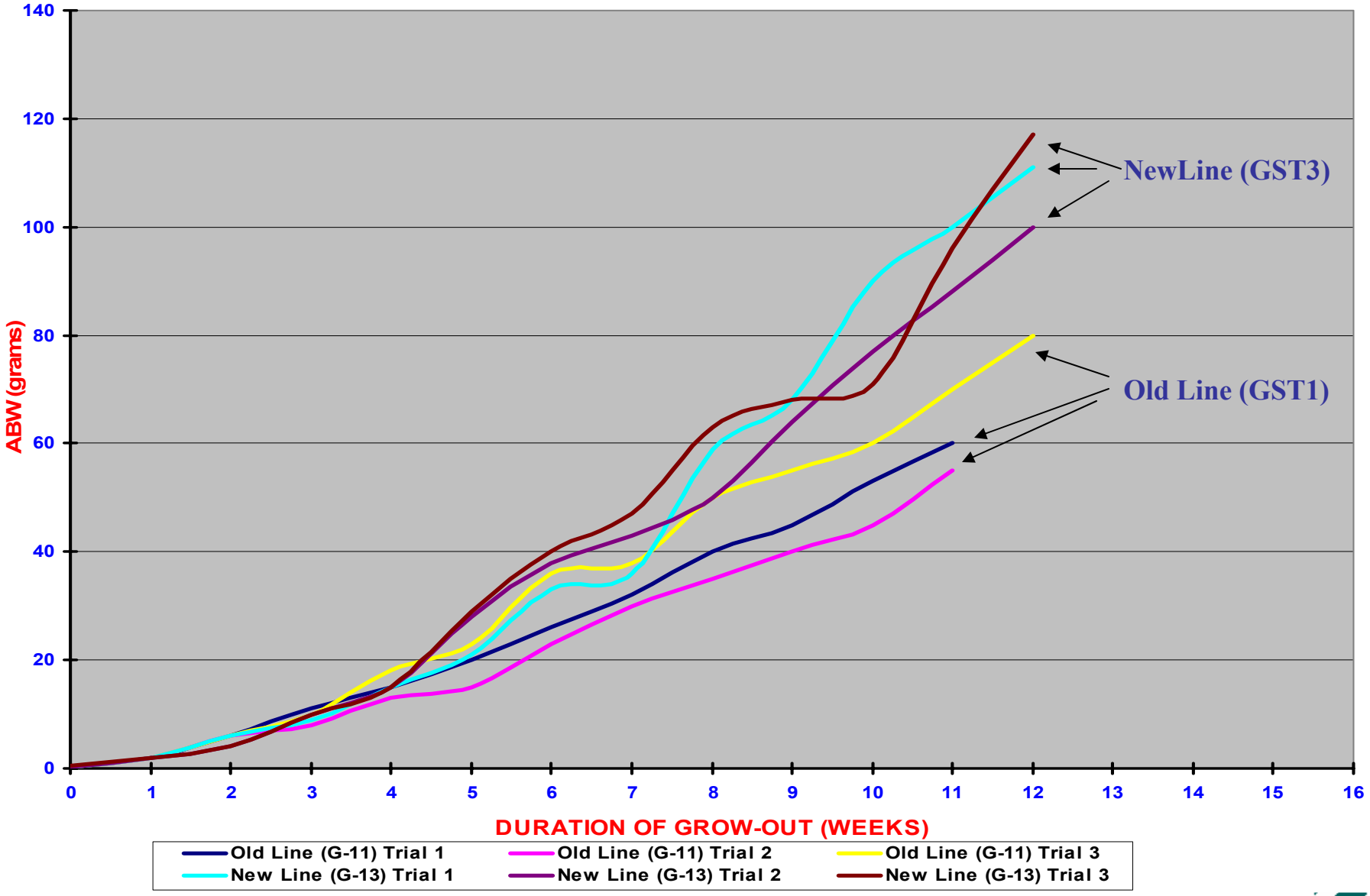

Genetic Gain Research

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Old Line

Week 7

New Line

CONCLUSIONS

Results of both studies indicated that a broad genetic platform has been kept intact, with great gains in growth and survival, and those gains will be reflected soon in the commercial production (a big part of GenoMar hatcheries still operates with GST1).

h^2 estimates of 0.54-0.63 may be somewhat inflated due to "selection of the data".

Only the best off-spring has been recorded, thus, for the model seems like the heritability/response is larger than it "really is".

This means that GenoMar breeding program data is not really suited for this kind of parameter estimation.

The best estimator for GenoMar genetic gain at this moment is probably the growth trials such as the one shown in this study.

NEXT STEPS

A new study of similar design and objective will be done during this summer period so that these growth performance indicators of these two GST groups can be evaluated under these two climatic conditions.

Later, GST5 will also be evaluated against GST3 before release to the hatchery partners worldwide.

Tilapia Strategy

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Grow-out in different systems and countries

- It was collected information on several culture systems:

- extensive,
- semi-extensive,
- semi-intensive,
- intensive, and
- super-intensive)

- countries studied: Philippines, China, Mexico, Ecuador, Colombia, and Brazil

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THE NEW DRIVING FORCES IN THE TILAPIA EXPORT INDUSTRY
COMPARATIVE ANALISIS OF THE PRODUCTION COSTS – May 2003

Country	Production costs (US$/kg)	System
Brazil	0.40-0.70	Pond
Colombia	0.45-0.80	Pond/cage
Vietnam	0.50-0.85	pond/cage
China	0.55-0.85	Pond
Thailand	0.65-0.90	Pond
Philippines	0.75-0.95	Pond
Costa Rica	0.75-0.95	pond/raceway
Mexico	0.80-1.10	concrete pond
Taiwan	0.85-1.25	concrete pond
Ecuador	0.90-1.15	extensive pond
Indonesia	0.90-1.15	Cage
Honduras	0.95-1.20	Cage

Tilapia Strategy

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Grow-out production costs of major components (as %) in different culture systems

System/Costs	Fry	Feed	Fertilizer	Electricity	Diesel	Labor
Extensive	50	-	-	-	-	50
S.Extensive	30	30	10	-	-	30
S.Intensive	10	60	5	10	5	10
Intensive	8	65	2	15	2	8
"V-Shape"	20	35	10	20	5	10
Raceway	5	75	-	-	-	20
Cage	5	80	-	-	-	15

Densities, Productivities and Production Costs of several Tilapia Culture Systems in Philippines – May 2004

	Density (nr./area)	Productivity	Cost (US$/kg)
Extensive	500-1.000/ha	150-500 kg/ha/yr	0.25-0.65
Semi-extensive	1.000-5.000/ha	500-2.500 kg/ha/yr	0.45-0.75
Semi-intensive	5.000-25.000/ha	2.500-12.500 kg/ha*	0.65-0.95
Intensive	25.000-100.000/ha	12.500-50.000 kg/ha**	0.75-1.05
Superintensive			
raceways	20-80/m^3	10-40 kg/m^3**	0.95-1.25
irrigation channels	40-100/m^3	20-50 kg/m^3**	0.95-1.25
aquaponics	50-200/m^3	25-100 kg/m^3**	1.15-1.35
cages	100-600/m^3	50-300 kg/m^3**	0.75-1.15

* - per crop period, 4-10 months;
**- per crop period, 3-6 months, when nursery is available.

Tilapia Production Costs (US$/kg) in different Culture Systems in Selected Countries May 2004

Culture System	Brasil/Colombia	Ecuador/Mexico	China/Philippines
Extensive	0.15-0.55	0.65-0.85	0.25-0.65
Semi-extensive	0.35-0.65	0.75-0.95	0.45-0.75
Semi-intensive	0.45-0.90	0.80-1.15	0.55-0.95
Intensive	0.55-1.05	0.95-1.25	0.65-1.05
Superintensive			
"v-shape ponds"	0.35-0.55	-	-
raceways	0.75-1.25	0.95-1.35	0.85-1.25
irrigation channels	0.75-1.25	0.95-1.45	0.85-1.25
aquaponics	0.85-1.35	0.95-1.35	0.95-1.35
cages	0.65-1.15	0.85-1.25	0.75-1.25
Feed cost/kg (32%)	0.28-0.38	0.38-0.58	0.42-0.64

* - per crop period, 4-10 months;
**- per crop period, 3-6 months, when nursery is available.


WELCOME
TO
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PHILIPPINES
The home of
GenoMar Supreme Tilapia™