

UTILIZATION OF LOCAL FEED INGREDIENTS FOR TILAPIA AND PACU PRODUCTION

Sustainable Feed Technology/ Activity/ 07SFT04UA

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ABSTRACT

The focus of this investigation was an effort to work with fish farmers and a feed mill operator to develop a list of potential fish feed ingredients available on local markets in Guyana and to design a practical diet based on these ingredients. A primary focus was to reduce or eliminate the use of expensive imported ingredients including fishmeal and soybean oil meal. The design of a practical diet incorporates nutritional balance, pellet stability and homogeneity, and economic feasibility. To accomplish this, we collected samples of local ingredients, submitted the samples for proximate analyses, and compared the results to published reference ingredient analyses. We then used feed formulation software to develop a diet that met the criteria for protein content, fat level, protein to energy ratio, caloric value and price that would meet the nutritional demands for tilapia and pacu on a commercial basis.

INTRODUCTION

Objectives:

- a. To discuss semi-intensive culture of Tilapia and Pacu, with a focus on nutritional requirements
- b. To identify and examine local ingredients suitable for use in formulation of Tilapia and Pacu Feed
- c. To examine simple feed formulation techniques using identified ingredients

Significance:

Tilapia and pacu aquaculture has been practiced for starting in the 1980's in Guyana. In recent years the growers have organized into a farmer's cooperative, the National Aquaculture Association of Guyana. With the assistance of the Ministry of Agriculture and the USAID/GTIS Program, the farmers have begun to develop local markets and were able to participate in the 7th International Symposium on Tilapia in Aquaculture. The Mon Repos Aquaculture station has worked with the farmers to provide technical assistance and training.

In Guyana, aquaculture is now starting to emerge as an industry. Maharaja Mills, an existing feed and oil manufacturer has been willing to engage in fish feed manufacture. However, they require assistance in suitable ingredient identification, feed formulation, manufacture of low cost feed, production with existing machinery, and training in aquatic feed production techniques. Development of economic diets utilizing locally available ingredients was a central focus point. The pacu and tilapia producers have several advantages over regional producers that they feel will allow them to compete effectively in local markets as well as in North American markets. There is an abundance of high quality water with ideal temperatures, a stable government and economic system, a native English-speaking workforce and a local population that has already proven the acceptance of tilapia and other fish as a staple in the diet.

Sustainability has been identified as a priority for the aquaculture producers. Utilization of local feed ingredients, minimizing the use of fish meal, and increasing the efficiency of the feed that is input to the system are immediate targets.

The fish farmer's group (NAAG) had several dozen of their management and staff attend the workshops. They reported that the training and instruction would allow them to operate in a more efficient manner and improve both profitability and environmental sustainability. Specifically, they wanted to receive advice and guidance on locally available ingredients that could be substituted into practical feeds and how to process them into usable pellets utilizing existing feedmill infrastructure. It was important that this should be done in a cooperative manner with both the farmers, who have concerns of cost and quality and the feedmill operators who have concerns over expenses and operational characteristics. Of course both groups were also interested in aspects of shelf life of the feed, % of fines in the products and other details. Another area of interest was operational characteristics of feeding and especially the Best Management Practices associated with feeding practices. There was considerable confusion regarding the certification programs from the Aquaculture Certification Council, Global GAP, NaturLand and World Wildlife Fund. The farmers report that they would like to incorporate BMP's both for their own farm improvement, but also as a step towards certification of their product as being more sustainable and capable of receiving a higher price on international markets. However, working through the plethora of competing standards is overwhelming at this stage. We determined to focus on the common aspects of all the BMP's and teach the basics that will allow the farmers to address certification processes in the near future as the programs develop and offer this option to the farmers.

RESULTS

a. *To discuss semi-intensive culture of Tilapia and Pacu, with a focus on nutritional requirements*

A series of workshops were held in August 2008 at the Mon Repos Aquaculture station and the Maharaja Mill. The workshops brought together farmers, feedmill operators and staff, government researchers and potential investors. We also met with several government leaders including the Ministers of Agriculture and Business Development and even a brief introduction to the Prime Minister. During the initial visit we also

visited several farms, the National Agricultural Research Station, and the University of Guyana Experiment Station.

In July 2009 a second series of workshops were conducted at the Maharaja Mill and the Mon Repos station. In these workshops we reviewed the results of the ingredient analyses and provided copies of the Least Cost Feed Formulation software that we were using to evaluate the diet formulations. We also worked with the farmers and feedmill operators to input additional parameters into the database utilized by the software. During the second series of workshops we also reviewed the basics of Best Management Practices and the current state of competing certification groups. In September 2009 we met with our host country PI, Pamela Ramotar, at the World Aquaculture meetings in Mexico to review progress and analyze data from the feeding trials based on the initial research in this investigation.

July 2008 Workshop Details

Locations: Mon Repos Aquaculture Station and Maharaja Oil Mill
(with contributions from:)

- i. Mon Repos Aquaculture Station (facilities, equipment, personnel)
- ii. Maharaja Oil Mill (facilities, equipment, personnel)
- iii. NAAG (transportation, accommodation)
- iv. USAID/GTIS: Training materials and curriculum preparation

Participants; Tilapia and Pacu farmers, Feed producers, Fish Processors, Government Representatives, Kevin Fitzsimmons, University of Arizona (Presenter)

The presentations included an overview of the tilapia industry covering producing countries, major production systems and processing and marketing. Then we covered more detailed sections with breaks and lunches included.

1. Aquaculture Theory: pond design, water quality, Tilapia biology, feeding, fingerling production, grow-out, health and disease etc.)
2. Practical Aquaculture: Plankton examination, male and female Tilapia ID, Tilapia dissection, transportation, acclimatization, pond fertilization etc.
3. Feed Ingredient ID: examining local feed materials, and determining suitable ones for feed ingredients
4. Feed Formulation Theory: calculation of protein and other nutrient content, balancing of ingredients, etc.
5. Practical Feed Formulations: Preparation and mixing of ingredients, mixing, pelletizing and drying of feed.

An associated opportunity included in the project was an investment opportunity for a large-scale project to be funded by Goldman-Sachs Sustainable Investment Fund. Several members of the Fund invited Fitzsimmons to meet with them during a vacation stop in London. Fitzsimmons reviewed the opportunity for sustainable integrated tilapia production with tropical irrigated agriculture in Guyana and other locations. One member of the Goldman Sachs team met with Fitzsimmons on his August 2008 mission and participated in the workshops, government agency meetings and the farm tours.

Goldman Sachs closed the Fund during the financial crises, but a spin off operation, Integrated Agriculture Ventures is still pursuing a potential investment in Guyana.

b. *To identify and examine local ingredients suitable for use in formulation of Tilapia and Pacu Feed*

Ingredients were collected during the visit to Guyana from a number of sources including the Maharaja Mill, a fish meal plant, poultry farm/feed operation, and various farms. The samples were brought back to the US and submitted to lab for proximate analyses. The results were compared to published values found in the peer reviewed literature to check accuracy. The Guyana ingredients were in general accord with published values, but in some cases were close to higher or lower limits, which needed to be accounted for in diet formulations. This information was shared with farmers some of whom had decided to develop their own on-farm formulations. One of the farmers had purchased a low cost hammer mill to grind grains and fish carcasses and a simple pellet mill. During the July 2009 visit one day was spent working at this farm to train the staff on the proper selection, processing and blending of the ingredients to formulate an on-farm diet. We also trained the staff on the operational aspects of the hammer mill and pelletizer. Several operating “tricks” were shared with the staff, which protected the equipment and improved the pellet stability.

Proximate composition of local Guyana ingredients and/or reference ingredients

Feedstuff	Dry Matter	Crude Protein	Crude Fat	Crude Fiber	Ash	NFE	Ca	P	Reference
Banana meal (fruit, dehydrated)	87.00	3.90	2.70	4.70	4.60	71.04	0.11	0.15	6
Brewer's spent grains, dried	92.00	18.50	4.30	18.30	4.30	46.17	0.3	0.5	6
Cassava flour	95.56	12.45	7.06	6.53	5.21	67.49	0.03	0.61	2
Cassava leaf meal	86.50	30.40	7.60	9.80	6.30	32.40	-	-	4
Cassava meal, unpeeled	93.00	2.40	0.80	3.60	2.70	83.82	0.12	0.10	3
Copra meal cake	92.40	19.20	12.20	11.50	5.40	47.00	-	-	4
Copra Meal cake GUYANA	92	25.1	7.0		5.5	Carbs 54%			
Copra meal, expeller process	89.72	19.32	4.51	11.88	6.75	46.20	0.08	0.60	1
Corn, yellow, USA	87.00	8.30	3.80	2.40	1.20	71.30	-	-	4
Corn meal, white	86.51	7.31	0.45	0.74	0.51	76.59	0.01	0.06	1
Corn meal, yellow	88.19	8.37	2.10	1.00	0.73	73.82	0.02	0.12	1
Corn bran, coarse, white	85.89	10.64	7.41	5.51	4.77	57.57	0.04	1.03	1
Corn bran, fine, white	85.20	10.57	7.26	5.07	3.93	57.76	0.04	0.80	1

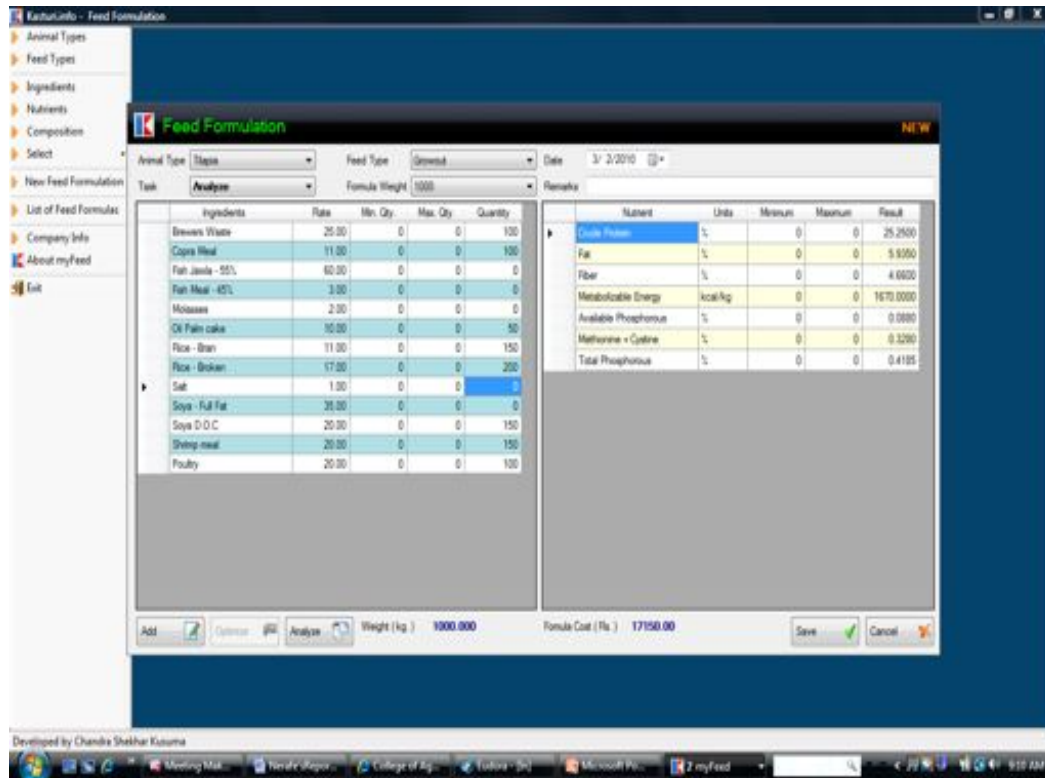
Fish Meal GUYANA	92	52	13.5		26.2	Carbs <1%			
Molasses, cane	79.25	1.86	2.50	0.02	5.90	68.88	0.45	0.14	6
Oil palm cake, GUYANA	88	<1	73.4		15	Carb <1 %			
Palm Kernal Meal, Malaysia	93	15-19	5-8	13-20	3-12	40.88	0.11	0.64	1
Palm nut whole	93	7	42	11	16.19	39.70	0.09	0.46	1
Rice broken GUYANA	87	6.6	2.7		0.5	Carbs 77%			
Rice bran, GUYANA	90	12.9	1.15.2		6	Carbs 56%			
Rice middlings, cono	85.29	9.69	2.66	2.97	3.33	66.73	0.04	0.55	1
Rice bran, D1	88.00	11.80	11.30	8.80	9.70	46.20	0.8	1.7	6
Sorghum, grain	87.92	9.29	2.54	2.46	1.59	72.09	0.05	0.33	1
Soybean meal, Brazil	88.00	42.30	5.60	4.50	5.30	30.30	-	-	4
Soybean meal, GUYANA	88	47	2.2		6.3	Carb 33%			
Wheat bran, soft	88.65	11.32	2.12	7.53	3.90	63.78	0.19	0.98	2
Wheat flour	88.63	16.27	1.76	1.36	1.01	79.70	0.04	0.24	2
Wheat bran, hard	89.14	15.44	3.11	10.07	4.90	55.61	0.12	0.95	1
Wheat pollard, soft	88.32	12.95	4.51	7.38	5.98	58.22	0.12	0.73	1
Fry feed, GUYANA	91	36.5	10.8		10.8	Carbs 33%			
Fingerling Feed GUYANA	91	39.1	13.35		13.7	Carbs 25%			
Growout Feed GUYANA	90.6	32.3	6.7		9.6	Carbs 42%			

Source:

- 1 - Gerpacio and Castillo (1979)
- 2 - SEAFDEC Central Analytical Laboratory (unpublished data)
- 3 - Philippine Society of Animal Nutritionists (1990)
- 4 - Yamazaki, Lopez and Kaku (1988)
- 5 - Manufacturer's/supplier's product brochure
- 6 - PCARRD (1984)

c. *To examine simple feed formulation techniques using identified ingredients*

Several feed formulation software packages were evaluated.



The software selected has proven to be simple but covers all pertinent aspects for the project. Copies were provided to our host country Principal Investigator, the Maharaja Mill manager/owner, and to several of the farmers who have expressed interest in developing their own on-farm diets. A number of diet simulations were developed and evaluated for nutritional values. A couple of the most promising were shared with the Mill owner to test with the local ingredients to determine if the equipment would process the mixture into workable pellets. A couple formulations were discarded as the mixture just did not have sufficient binding characteristics and would not bind into a pellet.

CONCLUSIONS

The project successfully identified a suite of potential ingredients that are locally produced and available in Guyana. The series of workshops and farm visits also served to encourage and assist the farmers and potential farmers to advance their plans and/or operating fish farms. Governmental officials in the Fisheries Department and the Ministry of Agriculture have professed additional support for aquaculture development and have included aquaculture as a preferred sector within the national sustainable development plan. The ingredients identified were then utilized in the follow-up investigation with positive results.