

The Nutritious Pond Project

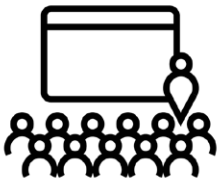
Newsletter #7, February 2018

Highlights - In this issue



2018 On farm trials: testing new type of carbohydrate and give more flexibility to farmers for carbohydrate application and feeding rate
Analysis of farmer's decision making: why do farmer's choose a specific stocking density, species and how they perceive diverse sources of risk

Lab. research: Testing different carbohydrate types, application method and frequency and how it influence the ecology of the pond.
 Omega-3 transfer in the pond - how much it can contribute to shrimp diet.



Project presence in past and up-coming international events: spreading the word about Nutritious Pond concept

Reflexive design and On-farm trials



In the previous issue, we summarized the results of trials in both extensive and semi-intensive systems. Those results were presented to the innovation platform members on October 4th 2017.

During this platform session, the different stakeholder groups provided feedback on the product design such as i) *the type of carbohydrate used, its form and frequency of application;* ii) *what type of pond management and water management is required when we apply carbohydrate;* and iii) *how to improve the monitoring system of the trials.*





The debate during the platform session were also fuelled with recent research results from PhD student Tran Huu Tinh who tested different C:N ratio in the pond at different stocking density. The results showed that at semi-intensive density, producers should aim for a C:N ratio of 12, for more efficient use of inputs. In 2018, the on farm trial protocol includes only on-farm trials in semi-intensive system (30 Pl/m²).

The platform provided the following feedback for the design of the new experiments in 2018

§ **Change of carbohydrate type** – cassava alone was not satisfactory, even though easier to apply than a mix of rice bran + cassava. The platform decided to test the use of **molasses as unique source of carbohydrate**, for faster mineralisation and ease of use. The use of molasses will facilitate multiple applications per day.

§ **Variable feed load:** shrimp grow and size at harvest were not satisfactory in previous trials. Feeding rate needed to be improved in 2018.

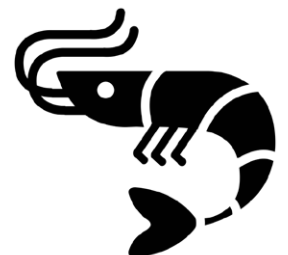
§ **The pond preparation**, using inorganic N and carbohydrate was validated by the platform and will be applied again in 2018

§ The platform decided to have a **progressive feed load**, with a reduction of the recommended feed load of 25% (from day 1 to day 25), then 15% reduction until day 45, followed by a reduction of 5% until day 60 and 10% reduction until harvest.

§ The platform decided to give more **flexibility** to farmers by adjusting feed load based on feeding tray monitoring (daily adjustment) and growth rate (weekly adjustment).

§ **Targets and monitoring:** The platform decided to increase the sampling frequency for bacterial monitoring in the pond (weekly) as well as water quality monitoring, including daily D.O monitoring to assess the effect of molasses addition.

The targeted yield is **3.7 tons/ha, achieved in 80 to 85 days of culture and a shrimp size of 80 pcs/kg.**



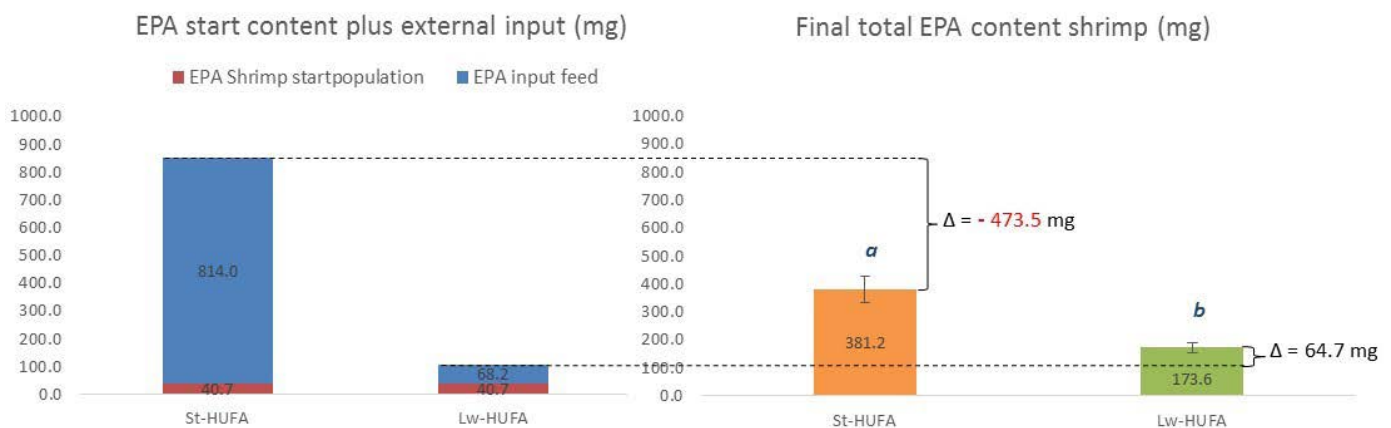
Fundamental Research

After conducting all her experiments, **Devi** is now analysing data and writing peer review articles for publication to complete her PhD.



The running title of her first publication is “ **Rearing marine shrimp (*Litopenaeus vannamei*) on omega-3 highly unsaturated fatty acid free diets in mesocosms results in animals low in essential fatty acids with minimal effect on production**”.

In this paper Devi's demonstrate that that the pond's primary production can provide shrimp additional dietary EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) two important omega-3 fatty acids. Shrimp without fish oil and fishmeal in their diet acquired 64.7 mg EPA from other sources than the formulated diet. **The shrimp acquired 41.85 mg EPA de novo**. This additional EPA gain must originate from primary production in the mesocosm. This means that shrimp without fish oil and fish meal sourced at least 31.5% of their total EPA-gain from the algal-based food web. Same calculations for DHA leads to **3.56 mg de novo DHA** that must have been sourced from the mesocosm directly, or indirectly via EPA derived from the mesocosm. This means that the shrimp sourced at least 6.2% of their total DHA-gain from the algal-based food web.



St-HUFA = shrimp fed standard commercial diet containing fish oil and fish meal

Lw-HUFA = shrimp fed diets without any fish oil and fish meal

Unfortunately, the pond cannot provide all sufficient amounts to reach desired shrimp EPA and DHA levels, meaning that **total exclusion of fish meal and fish oil of pelleted feed is not an option for shrimp farmers**. Meanwhile, Devi's research gives indications for further research to optimise feed formulation. **Pond's primary production can significantly contribute to the shrimp diet regarding Highly Unsaturated Fatty Acids (HUFA)source.**

Her research will now analyse HUFA content and the contribution of the different compartment of the pond to shrimp production.

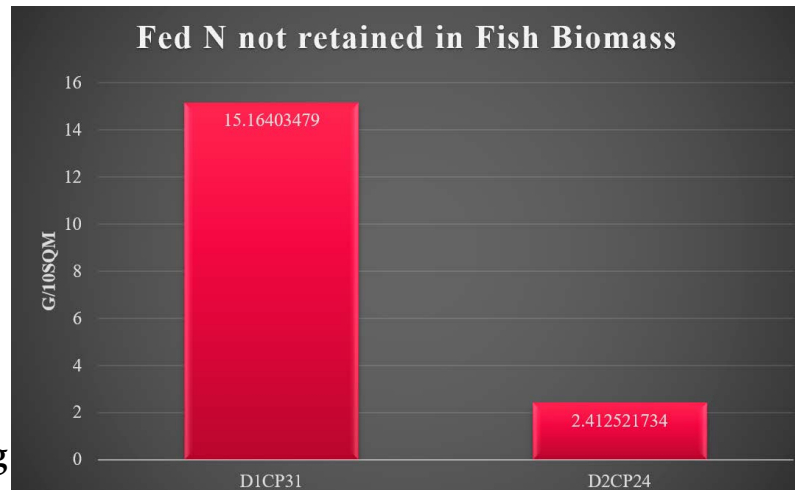




After several experiments, **Kabir** started the analysis and writing phase of his PhD. His research aims at quantifying the contribution of pelleted feed directly eaten and the different pond compartments (water column, benthos) to fish production. He uses tilapia culture systems in Bangladesh as a model.

Preliminary results shows that using diets with high crude protein content (313 g/kg dry matter), results in 10 folds higher nitrogen loss in the system, compare with low crude protein content (244 g/kg dry matter). Also, presence of natural food in the fish gut is higher for diet with higher carbohydrate content.

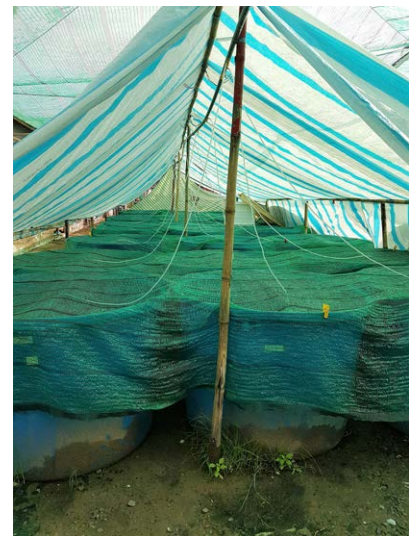
The research finding gives indications to formulate new diets for tilapia culture that increase profitability with more efficient nutrient use, reduce feed cost, while limiting the pressure on natural resources.



Tran Huu Tinh, Vietnam

Tinh is now starting a new phase of his research. After exploring the effect of different C:N ratio at different culture intensity, Tinh will conduct experiments in controlled environment to test the effect of different types of carbohydrates, differentiating simple carbohydrate such as starch and complex ones like molasses.

Tinh will monitor changes in stoichiometry in the different compartments of the pond and how the different sources of carbohydrate affect the production of algae, the structure and composition of biofloc and periphyton. The research is planned to be conducted during the first half of 2018.



The follow up experiment will explore another dimension of the nutritious pond system, looking at the effect of carbohydrate application on mineralisation process.

Tinh will test the effect of a carbohydrate of similar composition but applied under different format (powder, hydrolysis, or incorporated into feed pellets). Research outputs will provide insights on the format to delivers carbohydrate for the desirable outcome.

Farmer's behaviour research

Last year, we conducted a survey to explore farmer's decision making to understand how farmers make decision. The survey team visited 250 shrimp farms in the Mekong Delta, covering a wide range of farm types, from intensive to super intensive farms.

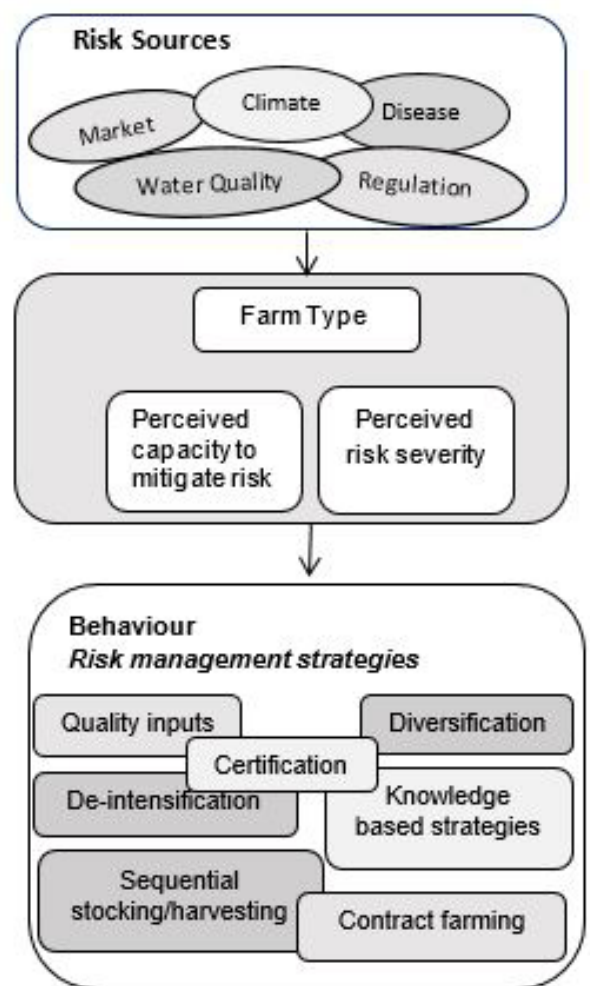
First, we looked at how farmers evaluate different stocking practices such as species choice and level of intensity (from extensive to super intensive), and how they evaluate different type of inputs (feed, post larvae, additives, anti-biotics) or infrastructures (liner, biosecurity measures). The questionnaire also explored how farmers estimate the severity of different risk sources (disease, climate, market, regulation, water quality) and their capacity to mitigate the risk. Finally, we also look at the adoption of different risk management strategies and what drivers is influencing the choice of those strategies.

Preliminary results show that key drivers not to culture *P. monodon* at high intensity (above 20 PL/m²) are farmer's perception of high cost and risk related to this practice. Meanwhile, adopters of intensive *P. monodon* culture found this type of culture technically easier to deploy than non-adopters.

There is a significant difference between farm types (extensive, semi-intensive and intensive) and their level of confidence in "Controlling disease", and "Selecting input", with an increasing confidence correlated with the level of intensification. Intensive farmers see "Market risk" as frequent and with high impact compared to other farm types. Their farming system performance is highly dependent on input price and shrimp market price fluctuations, while extensive farmers do not consider this type of risk as important.

Our analysis shows that that risk management strategies are significantly influenced by perceived market risk. This perception is driving the adoption of high quality inputs and technologies to reach higher productivity. Our analysis also highlight the absence of a market organization able to mitigate this source of risk.

This analysis will be presented in details in up-coming peer review paper.



Past and up-coming events & news

Olivier presented the reflexive design approach at the **First International Sustainable Agricultural Intensification and Nutrition (SAIN) Conference** held on January 10-13th in Phnom Penh. The title of the presentation was : “*A paradigm shift for sustainable intensification of aquaculture system: co-innovation for a Nutritious Pond System*”

Up coming events :

- On farm trials will start in April 2018 until July 2018
- New research experiments for Tinh in 2018 Quarter 1 and 2
- Olivier will give a presentation entitled: “*Is shrimp farming like gambling? A behavioural analysis of farmer’s decisions*” at The Asian-Pacific Aquaculture conference 2018 in Taipei (April 23-26th).

Next issue July 2018

- *More scientific outputs from PhD research*
- *Preliminary results from on-farm trials*
- *Additonal results on farmer’s behaviour*

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