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SHRIMP AQUACULTURE

Recovery • Revival • Renaissance



TARS 2014 Meeting Report

Recovery • Revival • Renaissance

At TARS 2014, shrimp aquaculture stakeholders discuss impact of diseases on production and marketing and solutions to mitigate diseases

The 2-day TARS 2014 (The Aquaculture Roundtable Series) recently concluded on 21 August in Phuket, Thailand. The theme for this edition in 2014 was **Shrimp Aquaculture: Recovery • Revival • Renaissance** and looked at impacts of diseases along the supply chain. It was attended by 196 participants with 16 presentations and 4 breakout themes.

This year, the presentation on the state of the shrimp industry set the scene at TARS 2014. The subsequent three presentations then gave different perspectives for market driven production (as opposed to production driven) at the global, country and farm levels.

State of the industry

With more than 30 years in the shrimp industry in Asia, **Dan Fegan**, Cargill Animal Nutrition, Thailand is the best candidate to summarise the state of the industry. Fegan said that the ‘game changer’ in Asia’s shrimp farming was the introduction of specific pathogen free (SPF) vannamei in the early 2000s. The combination of healthy shrimp stocks and Asian farmers’ intensive culture technology led to yields increasing by 3-4 times over those achieved with the monodon shrimp. In the last 20 years, global shrimp production grew to more than 3.5 million tonnes in 2011.

Since then Asian shrimp producers have enjoyed 10 years of fast growth although the year-on-year growth rates have been uneven; rapid growth interspersed with period of slower growth and period of negative growth associated with diseases. Fegan gave an overview of the industry status as per shrimp health, production systems, domestication and genetics, nutrition and feeding, markets, prices and customer and finally a swot analysis.

“After 10 years of growth with relatively few disease issues, we now face what is probably the most serious disease epidemic to date with early mortality syndrome or EMS. This experience clearly revealed weaknesses in how we deal with disease outbreaks as an industry and as governments in the region. Failure to recognise and inform on the EMS outbreaks at the beginning led to a two-year delay in response. Few people are trained in disease surveillance and as a result, we often do not get reports of new disease outbreaks until it is too late. We lack sufficient resources and capacity to effectively conduct epidemiological studies to support improved biosecurity. This is an area that requires good collaboration and coordination between industry and government to provide the appropriate level of resources and focus.”



Dan Fegan

“In hindsight, EMS was an accident waiting to happen. Looking back, the relative ease of vannamei culture led to a relaxation of standard procedures developed to cope with disease challenges in monodon. Ten years ago, we routinely tested for *Vibrio* bacteria at farm and hatchery levels but this is no longer widely practised. Given that the *Vibrio* that causes EMS shows as green colonies on TCBS agar, we might have identified the problem and taken action much earlier.”

The importance of good pond preparation has also been forgotten which may have exacerbated the problem. Fegan also reiterated that it is important to understand SPF (specific pathogen free) and SPR (specific pathogen resistant) technologies, and particularly that these alone do not guarantee success or replace the need for good management, site selection and biosecurity.

Although industry is enjoying high prices, this is a dynamic situation as these high prices mean that fewer people in the US are buying shrimp and restaurants are cutting back on shrimp in menus. “Asian producers need to understand their role and responsibility as part of the global food chain. We need to see ourselves as producers of food and focus on responsible production, food safety, environmental sustainability, traceability and as we have seen recently, worker and social rights. Despite the many improvements in farming technology, the outside perception of Asian shrimp farming needs to improve and so we need to find ways to work together and present ourselves better.

“Summing up, the Asian shrimp industry has come a long way but, as EMS has revealed, it is still fragile,” said Fegan. “As the pioneering generation of shrimp farmers reaches retirement, future success will depend on how we cope with competition for resources, including human



The team from Avanti Feeds, India, from left, Dr P. Srinivasa Rao, Konda Suresh, Dr Anuj Tyagi, Mohanty, K.V.Raju and B. Satyanarayana with Dhanunjaya Goud, Lallemand Animal Nutrition on the right.



From left: Panisuan Jammarnwej, Manoj Sharma and Tim Flegel



Industry from China, Taiwan, Vietnam and USA, Ju Peng (left), Dr Yang Yong (centre) and Benjamin Dong (right), Guangzhou Hinter Biotechnology, China, Cui Luo Sheng (second left) and Chuang Jie Cheng (third left), Sheng Long Bio-Tech International, Vietnam, Andy Pei, Cargill, USA (third right) and Allen Wu, Nutriad, Taiwan (second right).



Government and industry from Malaysia. From left, Mohammed Faizal, Malaysian Biotechnology Corporation, Ismail Abu Hassan, Department of Fisheries, Akazawa Noriaki, Agrobrest, Abu Bakar Ibrahim, Blue Archipelago, Abdul Basir V Kunhimohamed, Infofish, Ronnie Tan, Blue Archipelago and Kodi Isparan Kandasamy, Malaysian Biotechnology Corporation.

resources, challenges in health management, cost efficient production, globalisation and market demands. What this might mean for the independent small farmer is an open question since the pressures we face are driving towards greater integration. As an industry we face a time of great change and our mission should be to work together to build a modern food production sector to compete against beef, pork and chicken as alternative sources of animal protein.”

Perspectives on market driven production

Herve Lucien-Brun, consultant, France gave a global perspective on market driven production. He said that the local market could be a good option but is only an important market when it can absorb enough quantity each time. When producers have to look at export markets, they need to understand the characteristics of each market. It is important to target production to specific markets as each requires different products. The US mostly requires peeled deveined (PD) and other added value presentations (Easy Peel, PPD, etc), while premium markets in Europe demand for head on shell on (HOSO) and Japan requires headless shell on (HLSO) and peeled deveined tail on (PDTO). The exporters must also consider the needed organoleptic specifications for each market for each presentation.

The production cycle should cater for the high seasons when demand is highest. China is a new market but information is lacking on its preferences. Some recent changes in markets which are related to the high shrimp prices are that Japan is not importing as much shrimp because of the weak yen and Spain, the largest vannamei shrimp importer in Europe is actually buying more of the cheaper wild caught Argentinian shrimp. In France and Spain, the cooker market for HOSO shrimp is very exigent on stable quality. Value added shrimp imports are increasing in Japan too.

“To be profitable, producers should be aware of the seasonality when shrimp are in demand. In Japan, demand increase from June; in the EU 30% of demand is from Christmas to New Year. There is also the impact of shrimp size on price. In the early 1990s, when shrimp prices were high (USD 7/kg) size 80-100/kg was preferred. But when prices went down to USD 3.10/kg, the trend was larger shrimp which customers could afford. Now we are at USD 5-6/kg, so the size has shifted down again. Buyers love to buy from integrated operations for better control of the traceability, as consumers are now asking what the shrimp is eating. Usually, integration makes certification easier.”

Lucien-Brun said, “In the case of disease affecting supplies, when the shipment schedule is disrupted, buyers will lose confidence in the supplier. Each buyer works with the least possible inventories and

develops markets according to specific sizes. So it is really important to deliver on time and the correct size.

“Gradually certification has become a requirement for some markets but the producer is confronted with a jungle of certifications. Nevertheless, certification could be a good option to increase the value of the product only if the selected one is really adapted to the need and the demand of the client.”

Uncertainty with EMS

In his country perspective, **Dr Panisuan Jamnarnwej**, Thai Frozen Foods Association explained the consequences of EMS on marketing shrimp from Thailand. Since late 2011 to 2013, EMS brought down production in Thailand, once the leading producer and exporter of farmed shrimp to global markets. The problem created was ‘uncertainty’. Farmers decided to adopt the ‘take no risk approach’ and harvest as soon as shrimp has a price.

Jamnarnwej said that its shrimp industry had several adverse incidents affecting production and marketing, such as the flotation of the Thai Baht in 2002, it’s anti-dumping tariffs since 2004, and the tsunami occurrence in Japan in 2012. However, production and exports continued to rise until 2012. An impact of low production with EMS was the reduction of its share in the US market which was 35% in 2010. This gradually declined to 21% for the January-March period in 2013 and then 10% for the same period in 2014.

Thailand’s shrimp export sector was known for its ability to deliver large quantities of shrimp on time. With an annual production of 630,000 tonnes, the processing industry in Thailand had these selling points –availability, reliability and affordability. Today, with production reduced by more than 54% and less than 30% of processing plant output, exporters could not promise long term delivery and plan



From left; Dr Eduardo Leano, NACA and Dr Pikul Jiravanichpaisal, Fish Vet group, Thailand and R Natarajan, Avanti Feeds, India



Chu-Fang Lo

Han-Chin Wang

marketing activities. The processing sector shifted to products which could take more time to produce such as peeled shrimp and value added products.

Vannamei – the BT way

Dr Manoj Sharma, Mayank Aquaculture has a successful shrimp farming business, initially with the black tiger shrimp and more recently with the vannamei shrimp. He has moved to farming vannamei shrimp the black tiger (BT) way because he envisaged that the future of high stocking density as is practised by most large farms in India has its limits to growth. The outcome of their farm trials showed that stocking density of 15-20 PL/m² and producing 40-50 g shrimp was the most profitable and sustainable. The bigger the shrimp, the better the returns which can be as high as 107% above costs for size 21-25/kg. According to Manoj, “The BT way is to focus on one cycle, low stocking and large size. A single crop is low risk for a niche market. Post larvae requirement is less demanding and pond carrying capacity is maintained. Until we have optimum quality and quantity of post larvae, this should be the way for vannamei shrimp. We carried out different strategies in farms in five locations.”

The Indian shrimp farming industry has its limitations. “For the last 35 years, we have been producing the black tiger shrimp and when vannamei was allowed into the country in 2009, basically the infrastructure was for low density black tiger shrimp farming. The readiness to farm vannamei shrimp in higher density was lacking. India has never seen shrimp production over 100,000 tonnes until we produce vannamei shrimp. Now production is 90% vannamei shrimp. We were losing money with repeated failures of black tiger shrimp farming but we also had problems of overproduction of vannamei shrimp in year 2011 and 2012. At our farms we started farming vannamei at different stocking density and nobody believed that we could produce large size vannamei especially those with size 20/kg. In a single crop, we had better profits with big sizes and as a farmer, I need to farm shrimp for a profit.”



The State of Industry and Marketing round table

In his presentation, Manoj reiterated on the farming protocols and his message was, “The environment is most crucial for survival in shrimp farming.”

Living and surviving diseases

The plenary presentations in this session covered the challenging times and then moved into the future. The session was led by **Dr Tim Flegel** who at Centex Shrimp in Thailand continues to lead a team of researchers in disease in shrimp aquaculture. In the earlier days, it was white spot syndrome virus (WSSV) and more recently, it has been on acute hepatopancreatic necrosis disease (AHPND) or EMS. Flegel gave an overview of the situation with diseases in Asia. Flegel said that the decline in biosecurity in shrimp culture was due in large part to the complacency of the hatchery sector since the adoption of SPF-specific pathogen free vannamei broodstock. He referred to the feeding of live polychaetes to SPF broodstock by hatcheries just to get more nauplii production. Whereas for many years, broodstock have been fed frozen polychaetes.

“The rapid regional spread of AHPND and the simultaneous prevalence of the microsporidan *Enterocytozoon hepatopenaei* infections, caused by distinctly different pathogens, suggests that there is a currently a decrease in rigour in biosecurity measures in shrimp hatcheries and rearing ponds. Any decline in biosecurity leaves the industry extremely vulnerable to the emergence of new pathogens.”

Although EMS has taken centre stage in recent years, WSSV is still a clear and present danger. In her presentation on ‘identification of key host markers as anti WSSV genetic markers for a shrimp breeding program’, **Professor Chu-Fang Lo**, National Cheng Kung University, Taiwan said, “The WSSV is unique but has the fundamental objective of infection and replication. To better understand how the host might combat WSSV successfully, our research focussed on the genetic background of how the shrimp copes with WSSV infection. By increasing the capacity to conduct high throughput transcriptomic and proteomic analysis we have been able to make significant scientific advances that can be developed into practical anti-WSSV strategies. To date we have found that some individuals from populations have gene expression patterns that look like they might be ideal for use in a genetic breeding program.”

Lo and her team in Taiwan played a major role in the development of sequence code in the initial and subsequent PCR protocols for the detection of the AHPND causing strain of *Vibrio parahaemolyticus*. In her presentation, she discussed the study on the plasmid, speculated to be the source of toxicity in AHPND cases.

Contrary to the belief that shrimp have primitive immune system, **Dr Han-Chin Wang**, also from the National Cheng Kung University, Taiwan, suggested that there is some adaptive immunity in her presentation. Her pioneering work has led to the possibility that shrimp DSCAM (Down Syndrome Cell Adhesion Molecule) may be used to



Round table on Living and Surviving Diseases



Thomas Gitterle

Tim Goossens

stimulate specific pathogen resistance in conditioned or vaccinated shrimp. Wang has applied DSCAM, an antibody like molecule which can recognise and distinguish a very large number of antigen, and showed the responses after stimulation.

The future

In what can be strategies for the future, **Dr Thomas Gitterle**, SyAqua Siam, discussed 'developing a robust shrimp through genetic selection. He started by comparing the production targets by region. In the Americas, with large ponds and low stocking density, it is 70% disease resistance and 30% growth. Here in Asia with small ponds, high stocking density, it has been 30% resistance and 70% growth.

"In smaller ponds, it is easier to apply biosecurity measures to exclude pathogens. Before EMS, the selection pressure was on growth and after EMS, the target shifted to robustness. When diseases are difficult to eradicate, selection for host resistance or tolerance would be an attractive option. However, if the impact of disease is very low and the effort to make disease resistance is so high, too expensive or too complicated, the effect is reduced."

Gitterle discussed the theory in breeding for disease resistance and its actual practice. Natural selection when based on survival could be affected by the environment. Survival is a trait related to disease resistance and only a few diseases have been successfully improved by selection based on family means such as taura syndrome but not WSSV or yellowhead virus syndrome. Development of WSSV resistant populations has been an elusive goal with family based selection programs. Nevertheless WSSV resistant lines have been developed in South America using survivors and applying high selection pressures. Within each family, there are variations and the individual with the mutant genes that confer resistance can only be identified when strong infections are applied. However using survivors as breeding candidates also poses biosecurity risks.

"In cases like WSSV or AHPND resistance, that show very low heritabilities estimates, it is difficult to gain a significant resistance using only family means information. In such cases genes from small group of survivors should be introgressed into the breeding population



From left, Roeland Wouters, Pedro Encarnaçao and Fernando Garcia Abad

(by backcrossing) but reducing as much as possible any risk of cross contamination," said Gitterle.

Another strategy is fighting pathogens through a range of molecular mechanisms. **Dr Tim Goossens**, a molecular biologist at Nutriad Belgium looked at several classes of functional additives that have been demonstrated to have potential in reducing bacterial pathogenicity.

"EMS has highlighted the fact that bacterial infections remain a major challenge for the shrimp industry. It emphasises the need for a multifaceted sanitary program; combining biosecurity protocols at the hatchery to the farm and including the use of alternatives to antibiotics."

Goossens added that functional feed ingredients (FFIs) can be used to decrease dependence on antibiotics but their mechanisms are more complex. Their impact will depend on context and what is the most limiting optimal performance in a farm. He discussed some studies on immunomodulators, organic acids and phytochemicals. "Our vision of yeast cell walls, for example, is that it is more than just glucans and mos (mannan oligosaccharides). This is like reducing a car to just its wheels and engines. There are other components in yeast cell walls which can have immune stimulation system functions.

"The challenge is how to select bioactive ingredients for FFIs, suppressing bacterial pathogens. To do so, investigating their modes of action will be crucial, as this knowledge will help us in developing the appropriate assays to select the most performant compounds. At the moment, developing FFIs still comes with educated guessing, but by studying their molecular mechanisms, we can make this guess as educated as possible."

Culture technology and practices

Moving on, the meeting looked at culture technology and practices. Upstream at the hatchery level, **Roeland Wouters**, Inve Aquaculture, Belgium, looked at how hatchery management can be improved to obtain more robust post larvae (PL), and consequently how PL quality is linked to grow-out performance.

Wouters showed results from studies on the parameters that have been correlated to PL quality. On the effects on hatchery nutrition, a



Rudi Bijmens, Inve Aquaculture, Thailand



Nguyen Duy Hoa, Cargill Vietnam



S Santhana Krishnan, Marine Technologies, Thailand (middle) with A Octo Rachnalim, Global Gen, Indonesia (left) and Partha Bandyopadhyay, Biostadt India



Dr Puth Songsangjinda, Marine Shrimp Research and Development Institute, DOF, Thailand

Abu Bakar Ibrahim, Blue Archipelago Bhd, Malaysia

Herve Lucien-Brun

study evaluated the effect of different *Artemia* replacement levels, showing that hatchery managers should not replace *Artemia* totally to cut costs, because growth potential of PL that received no *Artemia* will be compromised. In addition, Wouters showed how nutraceuticals can increase disease resistance during transfer of PL to nursery and to grow-out ponds.

Without doubt, every production phase is influencing the next one - from maturation, larviculture and grow-out. The cost of PL production is about 20 times less than the costs of grow-out production. This means that producers should spend slightly more money on buying quality-tested PL rather than allow the hatchery to cut costs by using inferior feeds and poor health protocols. A hypothetical cost benefit on the effect of PL quality on shrimp grow-out gave a 37% difference, in favour of improved PL quality versus regular PL quality.

Wouters' message was, "Hatchery operators should not compromise on hatchery performance by cutting costs on essential feeds, health products and microbial management. They should invest from the start on high-quality PL and look at cost per million PL instead of total cost input. At the farm level, we need to better understand the link between PL quality and grow-out."

Nursery

Perhaps the biggest change the industry has seen recently is the use of a three phase culture system. A nursery phase is already a common practice among integrated groups in Latin America where grow-out production reduced by 20-30 days and feed conversion ratio (FCR) reduced by 10-30%, said **Dr Fernando Garcia Abad**, Epicore Bionetworks Inc, USA. In Asia this is a common strategy to mitigate EMS by stocking larger size shrimp in grow-out ponds.

"There are mixed results in farms in South-east Asia. The main bottleneck has been selecting the right transfer technique. Rather than reinventing the wheel, producers should adopt the Latin American methodology and refine it for Asia. In Mexico, attention is placed on the transfers of PL to grow-out facilities. Since 2012, transfers use pumps which reduce stress and mortality at transfers to only 3-5%. In 2013,

the maximum transfer distance was 3 km and transfer capacity was 15 kg/minute.

"The three phase system has its benefits for the whole supply chain. During the grow-out phase, the animal is acclimatised to the environment and this increases efficiency of production resulting in more crops a year. Hatcheries sell more PL, producers have more crops and the system also takes advantage of the compensatory growth on shrimp when shrimp are stocked into open ponds. This reduces cycle duration and improves FCR. In Mexico, growth of 7-8 g in the first 30 days was achieved with the three phase system as compared to 3-4 g with regular stocking."

Garcia's message was, "Farmers are now enjoying good prices and they should use this opportunity to invest in and use the proven new technology. In this way, we can move away from artisanal shrimp farming towards more controlled sustainable shrimp farming."

Grow-out

Since the outbreak of EMS there has been widespread use of probiotics. During TARS 2012 which focussed on the shrimp aquaculture industry too, **Dr Pedro Encarnaçao**, Biomin, Singapore, looked at whether probiotics worked in shrimp farming. At TARS 2014, Encarnacao concluded that there is enough evidence that probiotics are effective tools for aquaculture application (see article on pages 19-23).

"With the extensive research on probiotics, we now understand how they work. The success of probiotic application depends on the clear understanding of the bacterial strains, together with the use of its functions, concentration and management. It has been shown that well defined probiotic strains are able to reduce pathogenic bacteria, improve gut health, and prevent the degradation of the surrounding environment, thus enhancing performance and production efficiency."

The practical approach of managing and overcoming disease infection is through proactive management as described by **Soraphat Panakorn**, Novozymes Biologicals, Thailand. He said that his presentation not only covers the technology used in Thailand but also perspectives on culture practices. Farmers only realise the severity



The Nutrition and Health Interaction session with from left, Brett Glencross, Camilo Pohlenz and Kabir Chowdhury



Juadee Pongmaneerat, DOF, Thailand (middle) at a Nutrition and Health Interaction round table.



Round table on Culture Technology and Practices

Dang Quoc Tuan, Viet Uc, Vietnam (left) and John Diener, Soraphat Panakorn Gold Coin Group

of infections when shrimp mortality is high. Hence, the implementation of proactive management is critical to achieve success. To keep disease away, we have to start from the beginning and I recommend the following: evaluate the pond carrying capacity, provide sufficient oxygen for a whole crop, learn to manage organic matter, only stock clean and healthy PL, look for early signs of diseases, analyse daily and carry out future forecast for physical and biological parameters, manage labour well, learn to see the EMS and weather link and always obtain updates on current situation and increase knowledge on shrimp farming.

Panakorn also took the opportunity in his presentation to demonstrate some unique features of the industry in Thailand - the family based employment system and the support by industry leaders. In the former, he said that the whole family is usually employed at a farm. Housing for the whole family is provided and this allows the farm manager or technician to concentrate on the production and stay with the farm despite adversities. In the latter, there are several groups who have set up online chat groups to help farmers overcome problems. This is in addition to several publications by industry leaders such as Dr Chalor Limsuwan guiding farmers on best practices.

Soraphat's message was simply; *invest reactively = disaster, invest actively = losses, invest proactively = benefits*

Nutrition and Health Interaction

In other animal production industries, nutrition directly influences animal health and the same goes for the shrimp. **Dr Brett Glencross**, CSIRO Aquaculture program, Australia set the scene in this session by doing a gap analysis in developing the ideal feed for shrimp. Glencross said that the nutrient requirements are known for 38 out of the 45 required parameters for the monodon shrimp. While for the vannamei shrimp, only 19 out of 45. However, in a comparison of known requirements for amino acids, minerals, and other nutrients, it is clear that there are not big differences in the requirements between either shrimp species when considered at the same animal size.

"Now we need to focus on the known unknowns. Where are the gaps? The knowns are protein, energy, most of the amino acids and fatty acids. However, we still do not know on some amino acids, fatty acids and minerals and vitamins. Another emerging class of nutrients is the unknown unknowns. Examples of these are some of the bioactive factors in squid, crustacean, microbial and algal meals. On what will the future hold, Glencross said that this included the understanding of nutrient demand, future alternative ingredients and impacts of genotype effects.

"On nutrient demand, we should focus less on dose response and more on mechanistic demand. This is understanding the process that drives the demand of nutrients under certain culture conditions. There are increasing demands on selection for growth traits. In selected shrimp, feeding traditional diets will constrain growth. Diets must match the new demands such as the protein amount per day and the better conversion to growth."

In aquaculture, it is quite accepted that managing health in marine fish through nutrition is far ahead of shrimp. As the shrimp industry is spiralling downwards, it will be appropriate to look at what is done in the marine fish industry. **Dr Camilo Pohlenz**, BioMar, Costa Rica tells us that for both fish and shrimp, the establishment of a defense state triggered by disease is a costly metabolic process and involves a shift of nutrients to the immune system. Thus, the appropriate nutrition is not only for growth but to retain proper health. With a higher level of knowledge, disease management is easily implemented in fish which as vertebrate has adaptive immunity. He detailed out what the fish industry has learnt in this field and compared this to the shrimp.

However, he added that as the immune system of the shrimp is different, it will not be possible to translate the information from fish to the shrimp. The difficulty is also with the lack of information. Pohlenz showed some published research on the effects of beta-glucan and polysaccharides in shrimp health.

The shrimp industry has been at crossroads with NGOs for its wonton use of fishmeal and fish oil. As we look towards replacement of marine protein meals and getting the most from feed ingredients, we also have to look at enzymes. **Dr Kabir Chowdhury**, Jefo Nutrition Inc., Canada addressed the role of enzymes and also the skepticism of feed manufacturers on the viability of enzymes undergoing harsh manufacturing conditions in pelleting and extrusion.

"Most enzymes being used today are for improving digestibility of phosphorus and carbohydrates from plant protein sources. Apart from phytase for phosphorus, other minerals and some amino acids, carbohydrases such as cellulase, β -glucanase and xylanase are being tried in shrimp feed targeting different components of a plant ingredient. There is also a growing interest in the use of various alkaline proteases and lipase to improve protein and lipid digestibility, respectively, and for the latter, also to improve emulsification properties of fats and oils.

In his brief review of scarcely published articles, he showed that dietary protease significantly improve growth in vannamei shrimp fed low fish meal diets. "We know that enzymes are essential for physiological functions. However, environment, age or size, diets and moulting stage affect the content and composition of digestive enzymes that can be balanced by dietary enzymes. Dietary supplementation may have some positive effects but it depends on factors such as heat stability, dosage and whether they are multi or single enzymes. In addition, enzyme selection should be based on raw materials used, culture environment and species."

The theme of TARS 2015 will be **Aquafeeds 2.0: from farm to plate**. It will be held from 19-20 August 2015 and the venue will be announced soon. It will focus on the aquafeeds industry, the requirements and implications along the value chain; from breeding to processing, from farm to plate across all species.

Highlights of Breakout Session



State-of-the Industry and Marketing: On certification, harmonization of standards was suggested. Too many certification and complexity with certification may push producers to sell to countries not requiring any certification. Absence of industry voice from Asian on standards setting was raised. The need to integrate small farmers into the supply chain, specifically for food safety and certification was highlighted. One recommendation was to share costs more equitably down the supply chain. To move forward, industry requires accurate production data. Industry could be more effective in sharing information and pricing. Farm gate prices should be shared not only within the country but also across the region to allow farmers to make sensible harvesting decisions. Insurance and risk management was discussed but lack of data is a problem as the crop cannot be valued without better record keeping and traceability of stock. A reporting system is required for faster information flow between public and private sector. Producers should be prepared for trade with the ASEAN Economic Community.

Learning and Surviving Disease: The important points raised concerned a better understanding of the interactions between disease and several factors and parameters, the genetic improvements for resistance to various pathogens and growth. With EMS/AHPND, a fundamental point raised was that farmers should continue to focus on the fundamental best practices, e.g. pond preparation and routine checking of PL quality. In terms of genetic disease resistance, caution was raised on bringing white spot resistant strains to Asia to prevent the transfer of pathogens. The call was for general robustness rather than disease resistance. More cooperation between government and industry is key to advancing research and collaboration within Asia with research on epidemiology cited as a priority.

Culture Technology and Practices: To overcome shortage of SPF seedstock, nucleus breeding centres (NBCs) in producing countries was suggested. The costs and commercial viability was discussed. A three-phase culture system would reduce risks by shortening grow-out cycles to achieve stable and sustainable production at grow-out. The development of closed shrimp farming systems as a future strategy against diseases could become a reality in Asia in 5-10 years. More practical training among farmers in water quality management was recommended at the national level, to be followed by further dissemination of the expertise and education to the community. Data collection should not be limited to record keeping and extend to better understanding and analyses of the information to facilitate the best economical decision when it comes to harvesting the ponds.

Nutrition and Health Interactions: A general lack of knowledge on nutrition for genetically improved strains was identified. There is a need to revisit nutrition for wild strains and to identify the drivers for fast growing animals, including looking at key traits in breeding programs and nutritional parameters for selected genotypes. Assessing the results of nutritional intervention is not easy and a standardised method to identify indicators should be developed. Immunity indicators and tests to assess efficacy would help to better understand the questions 'do they work and how do they work?' The relationship between fishmeal and genetics was explored. Feed specifications need to be altered to accommodate the elevated need for nutrients in faster growing animals. Changes are also emerging with respect to the reliance on fishmeal. Nutritional invention with functional feeds against a disease outbreak is constrained by farmer dependence on information on better feed conversion ratio and growth rate instead of effects on immune resistance. More farmer education is needed, particularly on understanding the complementary or antagonism between immune modulation and growth.



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