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Protein source: a world challenge

Feed industry has already initiated some deep changes in formulation

BY KEVIN WONG

THE WORLD IS facing a critical challenge for the coming decades: feed an ever increasing population.

Finding new protein sources is one of the most critical points. Not only the demography is an issue but the feeding habit has been evolving quickly in all new growing economies where demand of animal protein explodes with the increasing living standards. Livestock farming, taking all species together, experiences a colossal boom to meet this ever increasing protein demand.

Forecasts in population growth and wealthier economies in developing countries will translate in a steady growth in animal protein demand.

Further growth in livestock production, which is about 200 millions tons now and which should double by 2050, will add important pressure on cereal and protein-rich by-products.

On the other hand, any growth in seafood production, which is estimated between 30 to 60 millions tons by year by 2050, can only be supported by aquaculture; improvement in catches in unlikely to happen when over 80% of the fishery stocks are already fully exploited, recovering, depleted or overexploited.

This huge expected growth in animal protein demand will require important improvement in supply in feedstuffs, from cereal to protein-based products.

Today, animal compound feed strongly rely on two major source of protein: soybean and fishmeal (issued from wild captures).

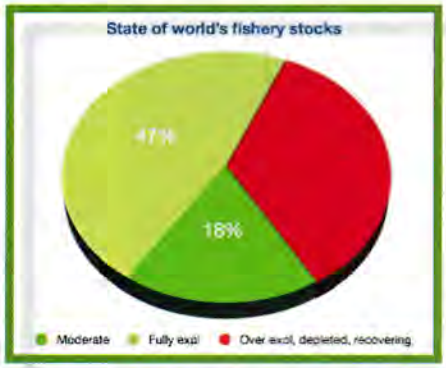
EntoFood Malaysia President Frederic Viala said there had been a drop in the fishmeal protein source as the fishmeal comes from wild catch fish in the ocean and this fish stock was now depleting.

"At the same time, it is also the increasing demands of fishmeal due to the development of aquaculture," said Viala.

"The fish-farmers are already looking for new fishmeal protein alternative because the fishmeal price is now too high and the offer is decreasing."

The feed industry has already initiated some deep changes in formulation due to the market changes, by reducing drastically the use of fishmeal in livestock feed which have been replaced by plant-based protein.

Further increase in plant-based protein production can be achieved by expanding cultivated lands and increasing yields. Agriculture production dedicated to livestock feed will compete more and more with direct human use of crops, increasing concerns for forest and biodiversity conservation programs, development of infrastructures and urbanization, growing non-food crop production (biodiesel) and eventually production is some regions are limited due to soil degradation and increasing water scarcity.



Viala added: "For a few years the industry has been looking for alternative proteins in insect, algae and single cell. Insect has the lowest production cost and the insect farming technology is ready to go. The insect protein is very close to the fishmeal quality. Insects are a common and natural food for wild fish like salmon, trout, turbot, catfish and etc."

Increasing scarcity of natural resources, agricultural land and water together with the oil price volatility and a sustained demand led to a constant increase of commodity price during the last decade.

To be able to keep up with the growing protein demand the world feed industry is urged to seek new sources of protein which could replace fishmeal. Tremendous scientific and financial efforts are being dedicated to it from both private and public entities.

Waste situation

Based on the latest published figure, Malaysia generated approximately 33,000 tonnes of MSW daily in 2012, exceeding the projected waste generation of 30,000 tonnes by 2020. This is an alarming figure because 33,000 tonnes of daily waste production is equaled to 12 million tonnes of waste per year.

In addition, 52% of the total (33,000 tonnes/day) MSW consisted of organic fractions (i.e. food waste). This is an important factor in designing the suitable waste management strategy which has a direct implication on the cost of (waste) management and its environmental impact.

In the EU, MSW composition is dominated by packaging material or inorganic waste. Their organic fraction represents only about 25% of the total MSW generated. So, waste management strategies developed in EU are mainly relied on incineration and recycling.

In contrast, the MSW profile in Malaysia has high percentage of organic fraction which jeopardises the efficiency and/or cost-effectiveness of incineration technology (mostly developed by the more developed nations to handle their waste profiles).

Today, few incinerators have been built in Malaysia but all have failed to achieve its full potential, due to the high organic content in Malaysia's waste profile.

Viala said: "The problem with the Malaysian waste is the organic fraction represents 50 % of the waste and is very wet. That means the wastes are not burnable. By segregating the organic fraction for insect bioconversion, the waste, mainly inorganic, become easily burnable."

As such, landfilling is the available option of waste management practice in Malaysia as it is an easier and cheaper method. Nevertheless, such practice is not sustainable and environmental unfriendly.

Malaysia had committed to reducing its greenhouse gas emission by 40 percent of the country gross domestic product by 2020. Government is interested to see the adoption of waste management technologies that have minimal environmental impact and cost effective. Furthermore, the country could not depend on landfills anymore due to scarcity of land and its negative impact on the environment.

Wastes should no longer be considered a burden but as an opportunity.

The 21st century will be driven by biotechnologies which will play a key role in generating wealth, source of development and solving environmental problem. These will, in turn, offer better future for the next generations.

Industry relying more on new protein sources

Entofood has mastered insect mass-culture

Stakes

SUSTAINABLE aquaculture growth is facing a major challenge: access to new sustainable source of protein. Aquaculture has been the fastest-growing animal based food sector during the past decade. Forecasts indicate that shortly fish for human consumption originating from aquaculture are expected to surpass those from capture fisheries. By 2050, the aquaculture production is foreseen to increase by 4 folds from the present 50 MMT.

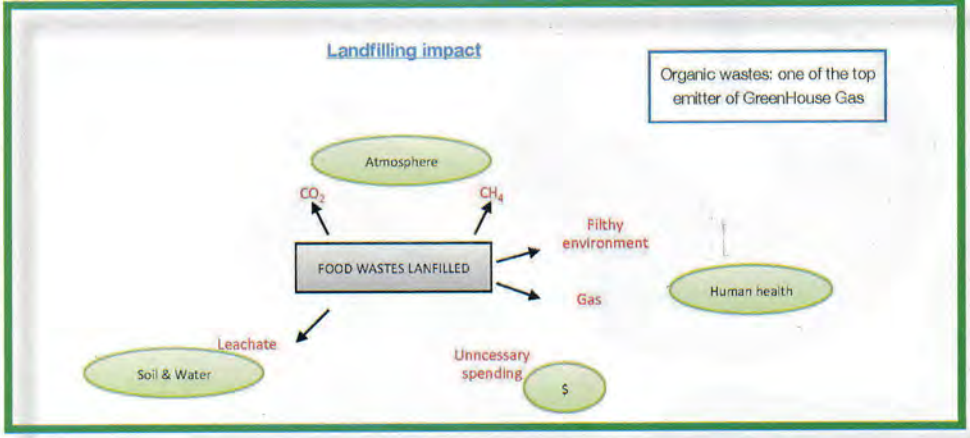
To enable such growth, the industry will have to rely more and more on new sources of protein which will have to be economically and environmentally sustainable.

Increasing scarcity of fishmeal and volatile price of soybean meal put the economic sustainability of the industry at risk.

Alternative source of protein will grow in the short future, such as algae and single cell protein. Entofood has mastered insect mass-culture which will bring an economic and environmental new alternative of protein for aquaculture diets.

Entofood Activity

Entofood initiated an R&D programme in 2010 on the life-cycle and



bioconversion capacity of Hermetia illucens, a Diptera belonging to the Stratiomyidae family. The choice of this species was driven by biological and economical considerations. A worldwide distribution of the species, its non-pest status, high fecundity, fast larval development and a very wide feeding regime are among the most important characteristics of this species.

Since, Entofood mastered reproduction in artificial environment, mass production of eggs and feeding models which enable development of industrial scale insect production.

Hermetia illucens, which is a detritivorous species, can feed on a very wide range of organic products from manure to carrions or food wastes.

Targeting the supply of a sustainable and economical source of protein for compound feed, Entofood chose to focus on clean source of organic products to guarantee the sanitary quality of its finished product. Plus, as an ethical value Entofood decided to avoid using in its business model raw material which could be used directly for livestock or human consumption.

Today, Entofood has built a pilot production unit in Malaysia which will produce 1MT of insect meal per month. This pre-industrial phase will be destined to test the zootechnical performance of its insect meal in various farm-raised species and to develop specific machinery to enable a fast and economical industrial development.

In 2013 Entofood will initiate the construction of a first industrial module with a targeted monthly output of 100MT of meal. From there, based on demand, production facilities could be developed for much higher volumes.

Raw Material Choice

To feed the insect larvae Entofood strictly use fresh food wastes issued from wholesale market and collectivity restaurants. The diet given to the insects is then composed of fruits and vegetables discarded at wholesale market and cooked food unused from restaurants. Food wastes are collected on a daily basis to guarantee freshness and ration are calculated to enable total consumption by the insects within the same day. This process enable to maintain good sanitary condition of the living substrate of the animals.

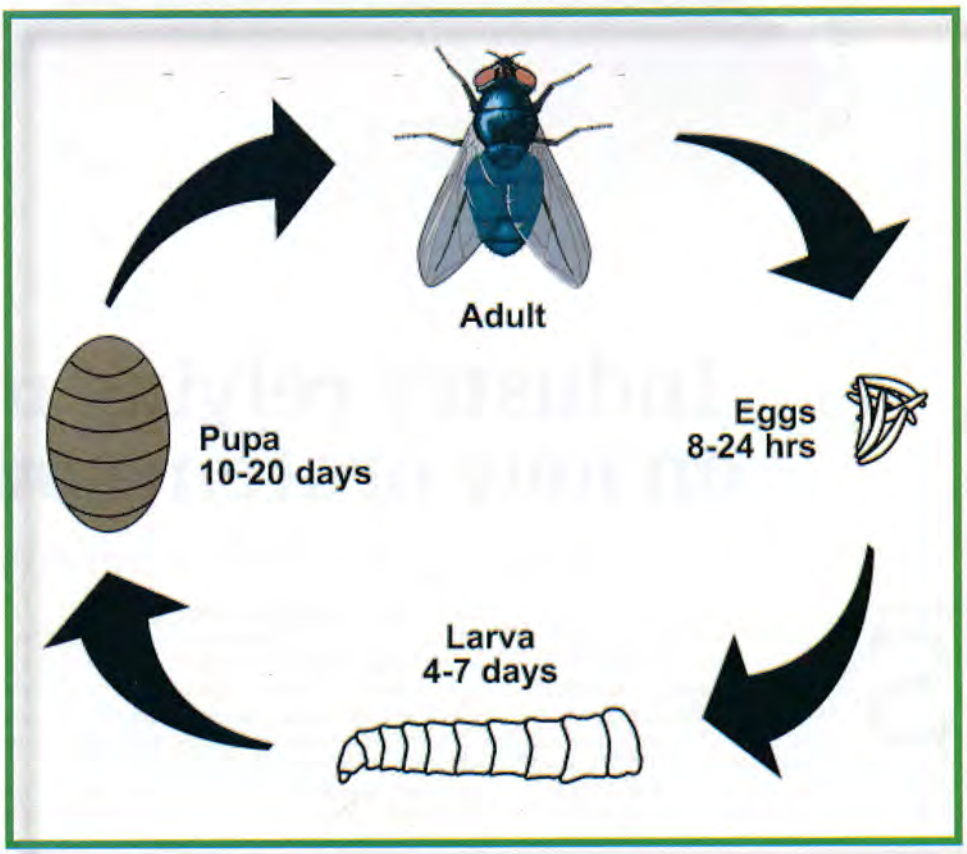
Insect Meal

Only larval stage is used to make the meal. In this species the imago are not feeding and only live on their reserve. During their development larvae will accumulate protein and lipids to enable completion of the metamorphosis into adult and build up reserve for the reproductive cycle.

Once larvae have completed their cycle, they are harvested and will go through a processing line where they will be sieved, washed, dried at low temperature and grinded into meal.

The quality of the meal obtained from the maggots has a high profat value (70%) with protein and fat content of 40% and 30% respectively.

Research programs on Hermetia



illucens meal incorporated in compound feed indicate good zootechnical performances in rainbow trout, tilapia, catfish and turbot.

More applied trials need to be conducted to define the best inclusion rate, and therefore the fishmeal substitution level, per commercial feed.

Environmental Benefit

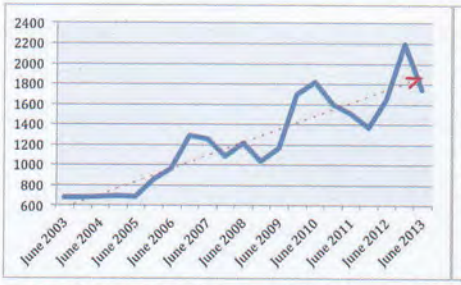
The insect meal produced by Entofood offers a sustainable and environmental friendly solution as protein source.

In the model developed by Entofood, the product issued from the digestion of the food wastes by the insect larvae can be valorized as an organic fertilizer which provide a complete recycling of the nutrients and avoid environmental impact of organic wastes.

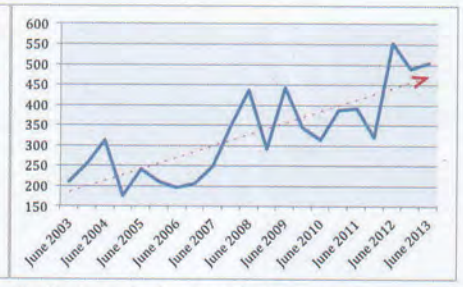
Organic wastes are presently among the most polluting fraction of Municipal wastes when landfilled in unsanitary facilities, which is the most common practice in wastes management. Organic wastes generate leachate which contaminate soil and underground water, filthy environment and large amount of greenhouse gas (CO2 and CH4). By diverting these wastes from landfilling practices, the insects bioconversion alleviate environmental burden related to their management.

WHEN ORGANIC WASTES LEAD TO FOOD SECURITY

MALAYSIA ORGANICS WASTES PRODUCTION	EQUIVALENT RECOVERED INSECT MEAL	MALAYSIAN IMPORTATION FISH MEAL
5.5 millions tons/ year	475 000 Tons	25 000 Tons
If only 2% organic wastes converted	10 000 Tons	=40 % importation fisch meal
If 5% organic wastes converted	24 000 Tons	=96 % importation fisch meal FOOD SECURITY
If 10% organic wastes converted	48 000 Tons	Malaysia develop aquaculture & export insect meal



Fishmeal price trend (Peruvian, 65%. Index mundi)



Soybean meal price trend (Index mundi)

Technology Rollout

Hermetia illucens is present all around the world in tropical and temperate zones. Its presence worldwide and its ability to degrade a large range of organic products will enable in the future to develop production facilities closer to the feed manufacturer improving by that mean self-sufficiency of key raw material and reducing transport cost and carbon footprint of the compound feeds.

Once the first industrial module will be operational and complete automation system developed, Entofood can consider technology rollout in other production areas.