Deutscher Tropentag, October 9-11, 2002, Witzenhausen

"Challenges to Organic Farming and Sustainable Land Use in the Tropics and Subtropics"

Perspectives in the Search for Future Fish Feed Ingredients

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Abstract

Aquaculture is an important weapon in the global fight against malnutrition and poverty, particularly in the developing countries (Tacon, 2001). Increase in human population in these countries, along with changing perceptions of healthy food in affluent regions, are set to increase the demand for food fish. The total fish catch from the world's fishing grounds have levelled off in the last decade with the majority of wild stocks being fully exploited. Aquaculture production seems to be responding to the increased fish demand and have exclusively increased the world fish production by 20 million tonnes (mt) in the past decade. By the year 2010 the world food fish production is set to increase to about 105 mt and the approximately 20 mt increase from the current levels would again have to come from aquaculture. In addition to being the fastest growing food production sector of the world aquaculture activities currently employ about 9 million people (FAO 2000).

The projected high growth in fish culture would demand a concomitant growth in the production of feeds. One projection puts the total production of aquafeeds in the year 2010 at 37 mt, which would further increase to about 68 mt in 2025, against an approximate production estimate of 13 mt in the year 2000 (see Hasan 2001). Fish meal is a favourite source of high quality protein in feeds. The proportion of global fish meal production used for fish feeds has increased from 10 to 35 % in the last fifteen years (Hardy, 2000). Predictions of fishmeal needs for aquaculture feeds in 2010 are 2.8 mt, approximately 44 % of the ten-year average global fishmeal production of 6.5 mt. This is in spite of the predicted decrease from current levels of the percentage of fish meal included in feeds of all major aquaculture species. Considering an average feed crude protein content of nearly 48 % for cold water fish and 30 % for warm water fish, high protein ingredients would have to contribute substantially to the rest of the quantity.

Two factors deserve consideration while discussing the question of future fish feed ingredients. The first is that approximately 90 % and 82.2 % of the total world aquaculture production in 1998 was produced within the developing countries (35.5 mt) and, in particular, within the low income food deficit countries or LIFDCs (32.4 mt; Tacon 2001). The second involves the spread of 'mad-cow' disease (BSE), and the resultant ban on the use of meat and bone meal in animal feeds. This induces a short to medium term uncertainty regarding the availability of these two animal by-product meals widely used as fishmeal substitutes in different parts of the world and its effects on prices of other viable ingredients.

The need for looking at new possible aqua-feed ingredients of the required high nutritional quality is therefore imperative. The importance of the development of non-human-food grade feed resources whose production growth can cope up with the projected and desired fast growth of the sector has been stressed (Tacon and Forster, 2001). Since

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the largest potential for aquaculture expansion is in the LIFDCs, capital inputs for feed-ingredient production may be limited. Given this scenario, coupling with remedial measures for other problems where international attention is focussed, to exploit synergies might have higher chances of success. Multifunctional plants that require low inputs and that are capable of surviving under poor soil conditions offer viable solutions to multiple problems. Products from these plants, taking their availability and potential for growth into account, could be considered as protein sources in feeds. Alongside potential production of feed ingredients, these can help in reclamation of degraded areas and therefore profit from national, international and private funding that is being channelled into wasteland reclamation. According to UN figures, more than 2 billion hectares of land are affected by degradation and loss of productivity. The largest area affected, about 550 million hectares, is in Asia and the Pacific, where over 90 % of the current aquaculture production occurs. In Africa
(having potential for expansion of aquaculture), an estimated 500 million hectares of land have been affected by soil degradation since about 1950 (UNEP/ISRIC 1991). China and India that together account for about 75 % of the total aquaculture production, have 180 million ha and 110 million ha of degraded land respectively (UNEP 1997). There exist therefore, possibilities for regional and local integration of feed ingredient production from wasteland and their use in fish feeds.

Plant species promoted internationally for multiple purposes include *Jatropha curcas*, *Moringa oleifera*, *Mucuna pruriens*, *Leucaena leucocephala*, *Sesbania aculeata*, *Sesbania bispinosa* and *Stylosanthes hamata* to name a few. These plants are capable of resisting adverse soil and climatic conditions and still sustain a reasonably high primary and secondary production. Research reports available on some of them indicate the potential to develop products of high nutritional quality (Francis et al. 2002). These products, however, also contain high levels of antinutritional, toxic principles that keep herbivores at bay. Utilisation of these plants as animal or fish feeds would therefore not only depend on their nutritional content, but also on the presence and level of various toxic principles and methods of detoxification. A challenge for tropical aquaculture research is therefore to identify products from these plants having the required nutritional quality and to develop viable treatment methods to make them suitable for addition to fish feeds (plant genetic improvement alone may not provide an adequate solution). This, along with improvement of the culture species and optimisation of semi-intensive culture techniques would provide the fuel for the sustainable growth of this important food production sector in LIFDCs.