

The Use of Leguminous Leaves as Fish Pond Inputs

The following was the executive summary of a final report to USAID on a research project 'Use of leguminous leaves as fish pond inputs'. The authors of the report were David Little, Amararane Yakupitiyage, Alma Castanares and Peter Edwards of AT, and Leonard Lovshin of Auburn University.

The use of the leaves of four perennial leguminous tree species: *Cajanus cajan* (pigeon pea), *Gliricidia sepium*, *Leucaena leucocephala* and *Sesbania grandiflora* were studied for their value in aquaculture. A series of trials was designed to determine how such leaves could be used as on-farm inputs for fish ponds in the tropics where other inputs are unavailable or expensive. A series of experiments tested strategies to use the leaves directly as feeds or indirectly as fertilisers to enhance pond productivity. Their use as green manures or ruminant feeds, with subsequent use of ruminant excreta as pond inputs, was tested.

As fresh feed, the leaves were found to have negligible feeding value to four herbivorous fish species: Nile tilapia (*Oreochromis niloticus* L.), silver barb (*Puntius gonionotus*), grass carp (*Ctenopharyngodon idella*) and giant gourami (*Osphronemus gourami*). The presence of anti-nutritional factors was suspected to reduce palatability and intake but further research, after removal of the major anti-nutritional factors, suggested that poor digestibility was also a major factor.

The leaves may have some potential for use as green manure, although the labour requirements for leaf harvest will be a major constraint under many circumstances. Measurement of the amount and release rate of major nutrients (total nitrogen and phosphorus) in water indicated that 50% of nitrogen was released after a 25 day period. The relatively low nutrient density (high C:N) however, mean that the leaves cannot be used as a sole source of nitrogen in pond systems receiving optimum nitrogen levels (3 kg N/ha/d) as the dry matter loading required leads to high oxygen demand and increased levels of tannic acid which

decreases water transparency, fish survival and fish growth. Fish production comparable to inorganic fertilisation alone was achieved using legume leaf nitrogen to supply 50% of nutrients in both tank (*Oreochromis niloticus*) and earthen pond (*Oreochromis niloticus* and *Cirrhinus mrigala*) experiments. Potential exists for their seasonal use in multiple, lower input, carp-based polycultures.

The limited applicability of legume leaves as conventional feeds or green manures in ponds led to the study of the value of their nutrients after 'treatment' via a ruminant. Improvement of smallholder ruminant production in the tropics often involves upgrading the diet with legume leaves and its acceptability to farmers is proven. Previous research had demonstrated that faecal wastes are poor fertilisers but the current study showed that 100% of inorganic fertiliser-derived nitrogen can be substituted by goat liquid waste (urine plus floor washing). The main constraints to adoption are likely to be the relatively large numbers of ruminants and fodder required to provide significant inputs to the typical-sized fish pond. Up to 14 goats, and considerable labour and land, are required to provide optimal nitrogen levels for a single 200 m² pond for example. This approach will have most value in situations where the ruminant system has been intensified, waste re-use is sub-optimal and fish ponds are located close by. Smallholder dairy production is expanding in many parts of developing Asia and fish culture may be an ideal integrated activity.

Whole farm analysis compared scenarios for inclusion of legume leaves into a food production system including fish and suggested that the wood fuel value of legume twigs derived from leaf production may be an important product. Fuelwood typically constituted as much to simulated incomes of the systems as fish production.

Legume leaves could have a subsidiary role in increasing nutrient inputs and fish outputs from smallholder ponds, particularly if intensified ruminant production has already been adopted. A high demand for fish, a lack of alternative pond inputs and a scarcity of on-farm fuel would encourage the production of legume leaves and their use for ruminant-fish systems.