Delivering better quality tilapia seed to farmers

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Scope of the presentation

• Strategies that result in high quality seed
  - becoming and then...
  - remaining available to farmers
• Perceptions of quality
• Approaches to upgrading quality of seed
• Important roles in the process towards better seed
• Centralized or more decentralized seed production
• Issues around promoting mono-sex/mixed sex seed
When does seed quality become an issue?

• Satisfied with current quality?
• Improving quality...no end point...a process
• Delivery of seed-the key issues
• When demand profile changes
Impacts of poor seed quality

• Poorer production i.e. lower survival or slower growth
• High proportion of harvest not reaching optimal marketable size
• Less fish to sell or eat
• Poorer appearance-fewer customers
Resulting in….

- Reluctance to risk further investment
- Reduced interest in continuing aquaculture
- Higher production costs leading to...
- Higher prices for consumers
Technical options...Rhetoric or reality?

• Review of research suggests a range of attractive approaches
• What actually works and who can adopt what methods and where?
• Different contexts require different solutions
• What directions is tilapia culture going?
• What constraints mean new ideas remain ideas?
Leaps v increments improving quality

- One-off actions or incremental?
- Ones-offs e.g. hybridisation, SRT or GMT
- Incremental through improved management, selective breeding
- In practice—an integrated approach
Quality – a matter of perception?

- **Hatchery operator**: high survival few abnormal first-feeding fry;
- **Nursery operator**: low mortalities to predation and cannibalism
- **Trader**: fry/fingerlings that tolerate stress during handling/transport
- **Food fish farmer**: fish that survive well and give harvest of predictable value
- **Processor**: high fillet percentage
- **Retailer**: retain colour on ice
- **Consumer**: fish that have desirable colour, shape, texture and taste
Trade-offs?

• Hatchery need for high seed output/female
• Grower requirement for sex control
• Working from the consumer backwards
• Tilapia seed needs change over time
Broiler chicken as a model?

- Fast growing strains responsive to intensive management and feeding
- Urban demand led
- Value addition
Vertical integration

• An important, and rapidly growing part of tilapia production globally
• Model most appropriate where local consumption of freshwater fish is low
• Trends towards other traits—colour, fillet yield, tolerance to intensification, late maturation
Where fish is everyday food

- Small freshwater fish are everyday food not feast food
- Lower trophic feeding niche of tilapia compared to chicken
- Tilapias may be established or have high potential
Diverse production systems

• Compared to trends in broiler chicken
  - Less intensive and more diverse production systems will remain important
  - Demand will be less driven by urban and export markets
• This has implications for seed strategies
Genetic improvements

- Transfers
  - Immediate and radical (e.g. Thailand, Brazil)
  - Intermediate (e.g. Philippines and Vietnam)
  - Constrained (e.g. Bangladesh)

- Transfers alone insufficient to ensure sustained availability of quality seed
Institutional support-context

- Formal e.g. Thailand
  - sustained delivery of high quality *Chitralada* strain of Nile tilapia
  - Central repository of high quality fish
  - Sustained crowding out of poorer strains
- Informal
- eg local organisations - the church
Private-public linkages

- No official support
  - E.g. Kolkata, West Bengal
  - Transfers by competitive, mobile private sector

- Brazil and elsewhere
  - Private sector – research organisation collaboration
Application of technologies

• Hybridisation
• Selective breeding
• Genetic manipulation
• Major issue - are the ‘improved’ fish available?
Hybridisation

• Little gain through heterosis
• Benefits through combinations of positive characteristics e.g. *O. aureus/O. niloticus* that enhanced cold tolerance
• GIFT
• Problems maintaining separate lines
• Hatchery benefit-intraspecific hybrids e.g. Chitralada x GIFT
Genetic manipulation

• Tested 'in the market' - GMT
• Over a decade but practical constraints
  - Performs poorly compared to SRT
  - Lack of availability
• Management complexity
  - Cost of tagging
  - Organic fish market????
Selective breeding

• Early attempts undermined by low genetic variability of introduced stocks
• GIFT- enhancing the ‘poor’ mans fish
• Synthetic strain to base national breeding programmes
Uptake and adoption

- Successful... but uneven success
- Uptake at institutional-NARS level high
- Availability to private sector very variable
- Should the poor wait for 'better' strains?
Little difference in performance between 3 strains

Dan and Little, 2000
Avg for two Replicates in Growth Trials of 4 O. niloticus strains in Chiang Mai

Bevis, 2003
Access to improved fish seed

- Fish produced in 'centres'
- Impacts of multiplication
- Local breeding programmes—untested on a wider scale for tilapia
- Opportunities for cross-sectoral learning
Non-genetic issues

• How
  - changing demand
  - management of production and delivery

• can affect seed quality
Seasonality

- Mismatches in supply and demand
- High demand for seed following hot season with poor seed production
- Disease incidence
- High seed inventories—low demand—prolonged holding
- Can’t keep eggs in the fridge!
Overwintering

• Cool season followed by high demand
• Overwinterer
  - broodstock for early seed production or
  - juveniles
• Impacts on farmers’ production?
New Season Seed

Dan and Little, 2000
Over-wintered

Dan and Little, 2000
Improved strains? Mono-sex?

• Young, mixed sex fish of a quality strain can perform well, especially in intensive systems
• Ex-hatchery management is often more important than strain or mono/mix
• Mono-sex contributes other benefits, especially size consistency and predictability
Husbandry

- Batch production for same age, same size—critical for SRT
- Continuous production—implications for productivity and quality of seed
- Grading
- Level, quality of feeding
- Water quality
Increasing availability of improved tilapias

- Pond-based systems suffer from low output and contamination
- Commercialising hapa-based systems
- Egg removal and
- 2-stage incubation
Transportation

- Tilapia producers reliant on seed produced around HCM City have poorer results than those nearer the source of production.
- Poor post transportation survival, especially larger seed.
- Open rather closed systems?

![Bar graph showing fry survival at arrival and after 72 hours for tanks and plastic bags.](Alcocer-Hartley, 2002)
Monitoring quality
Stress challenge tests

- Developed for MT tilapia
- Salinity test - 24 ppt, cheap, practical
- 2HPM strongly correlated to total length
- Can identify ‘weak’ batches
- Used for improving marketing decisions

% mortality after 2 hours

Mean length (cm)

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<th>2HPM in saline</th>
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<tr>
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R = -0.743
P < 0.001
Monitoring quality
Effects of underfeeding/overstocking

• 2HPM closely related to feeding rate, especially at high density

Note: 30, 18, 9 refer to feeding rates (% of biomass)

Bourhill, 2000
Monitoring quality
- behavioural indicators

For pre/post transportation quality:

- Feeding response to small ration &
- 72-hr post transportation survival

are the best indicators of overall quality!

(Hartley-Alcocer, 2001)
Causes of poor quality—complex and dynamic

- lack of institutional capacity to service entrepreneurs and adapt to change
- producer organizations
- information exchange
- research and development agendas
Improving quality—the role of promoters

- Increasing private sector role
- Large commercial hatcheries—increasing independence
- Role of Gov. to maintain and upgrade stocks varies
Government support

- Towards larger players, export promotion
- Driven by high demand in export markets
- Relative advantage? Globally competitive?
- Needs of domestic market?
- Linkages with all sectors?
- Regulation-certification of quality?
- What impacts can improved strains and mono-sex have?
Clusters of seed producers – hatcheries and nurseries

Promoter

- Initial broodstock
- Improved broodstock
- On-going support

Government Institution

NGO

Entrepreneur

Intermediary

Growers

- Extension work?
- Traders?
Hatcheries only

Promoter

Intermediary

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Local nursing

- Local advanced nursing in hapa-in-ponds
- Increased benefits to hatcheries and local nurseries
- Improved access to high quality seed for dispersed farmers
Local Seed Production

- Promoter

- Brood stock?
- On-going support
Ricefields for decentralised seed

- Small numbers of GIFT broodfish stocked in spring irrigated ricefields
- Promoted as part of farmer field schools
- Follow-up analysis of adoption and benefits
Large seed

- Large size of seed
- Produced at the right time
- Close to farmers wanting to purchase
- Reducing risk to traders buying and selling
Promoting ideas through networks

- 3 years after 4 farmers in one village received 16 fish each
- 120 farmers in 20 communities
How the approach is developing

• Role of the better off and traders
  – Better-off have more perennial water-broodfish suppliers
  – Traders move brood, seed and knowledge
• Works best where tubewell water abundant and alternative cash orientated activities undeveloped
• Measurable benefits to producer, trader and consumer livelihoods
Challenges

• Servicing highly dispersed seed producers-new germplasm
• Reducing deterioration in quality
• Learning lessons from other sectors
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