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Global GAP – Aquaculture issues

S. I. Yusufzai, A. Y. Desai, S. R. Lende and P. J. Mahida

College of Fisheries Science, Junagadh Agricultural University

Veraval 362 265 (Gujarat)

A Overview of global fish production

Aquaculture comprises diverse systems of farming plants and animals in inland, coastal and marine areas, using and producing a wide variety of animal and plant species. While it is usually advisable to use local species, introduced (or alien) species have significant social and economic impact. Genetic resources are the foundation on which species, stocks and genetically-improved strains are based. The culture of several important species still relies on the collection of brood stock or seed from natural populations. Aquaculture can be a very productive use of resources, with the amount of food produced per hectare considerably higher than with arable farming or livestock rearing. Resource availability and use have allowed a more than three times faster sector growth compared with terrestrial farm animal meat production. Aquaculture continues to be the fastest growing animal food-producing sector and to outpace population growth. Global fish production (including capture fisheries and aquaculture) was about 158 million tonnes in 2012 (FAO, 2014). Globally, aquaculture accounted for 90.4 million tonnes in 2012, which included 66.6 million tonnes of food fish. The contribution of aquaculture to the total world fish production continued to grow. The value of the world aquaculture harvest, excluding aquatic plants, is estimated at US$137.7 billion in 2012. World aquaculture is heavily dominated by the Asia–Pacific region, which accounts for 88 percent of production in terms of quantity and about 80 percent in terms of value. China alone accounted for 62 percent of global production in terms of quantity and about 50 percent by value. India stood at second position with 6.3 percent share in global aquaculture production, accounting for 4.2 million tonnes of produce.

B. Global outlook of Aquaculture

Aquaculture is developing, expanding and intensifying in almost all regions of the world, except in Sub-Saharan Africa, as the global population demand for aquatic food products is expected to increase. Globally, production from

capture fisheries has leveled off and most of the main fishing areas have reached their maximum potential. Sustaining fish supplies from capture fisheries will, therefore, not be able to meet the growing global demand for aquatic food. According to FAO projections, it is estimated that in order to maintain the current level of per capita consumption, global aquaculture production will need to reach 80 million tonnes by 2050. Aquaculture has the potential to make a significant contribution to this increasing demand for aquatic food in most regions of the world; however, in order to achieve this, the sector (and aqua-farmers) will face great challenges.

Aquaculture is making an important contribution to global production and a number of key development trends are taking place. It is apparent that the aquaculture sector continues to intensify and diversify, to use new species and modifying its systems and practices. Aquaculture is doing this with the growing awareness that it must be done through the responsible use of the resources upon which it depends and to society in general. Markets, trade and consumption preferences strongly influence the growth of the aquaculture sector, with clear demands for production of safe and quality products. As a consequence, increasing emphasis is placed on enhanced enforcement of regulation and better governance of the sector. It is increasingly realized that this cannot be achieved without the participation of the producers in decision making and regulation process, which has led to efforts to empower farmers and their associations and move towards increasing self-regulation. These factors are all contributing towards improving management of the sector, typically through promoting "best management" practices of producers.

C. Best Management Practices

Practices thought to be the most effective practical methods of reducing environmental impact levels to those compatible with resource management goals are called Best Management Practices (Hairston *et al*. 1995). The term practice refers to the activities needed to solve a resource management problem. In some situations, a single practice may solve the problem, but usually a collection of practices or a "system of BMPs" is needed to provide effective environmental and social management. These BMPs may also be called as "Good Aquaculture Practices" for the present discussion.

D. Culture techniques and issues of concern

(a) Shrimp

Culture methods for shrimp, fish, and other aquatic organisms are relatively similar. Small animals for stocking ponds usually are produced in hatcheries, but they sometimes are captured from the wild. Brood stock for hatcheries may be captured from the wild or produced on farms. Production facilities are stocked with a density of animals considered appropriate for the final production objective of animal size and harvest biomass.

Ponds may be limed and fertilizer applied to stimulate phytoplankton to serve as the base of the food chain. However, it is increasingly common to apply feed to increase production above that possible from natural productivity. Feed usually is applied one or more times per day. Feeding wastes cause dense phytoplankton blooms and water quality deterioration. Various water quality enhancers such as sodium chloride, sodium nitrate, copper sulfate, zeolite, bacterial cultures, and enzyme preparations are applied to improve the water quality. Antibiotics and other drugs are used for disease control in most types of aquaculture. Chloramphenicol and nitrofuran antibiotics are banned for use in food production in all countries. Other drugs and chemicals, such as antiobiotics, malachite green, heavy metals, parasiticides and hormones, may be banned in specific countries.

Advances have been made in penaeid shrimp technology using genetically improved animals within controlled growout systems to increase productivity. Shorter life cycles with good growth also drive down feed and energy costs. Recently there is a growing trend among shrimp farmers to shift over to the white legged shrimp *Litopenaeus vannamei* in place of *Penaeus monodon*, which demands entirely different management practices.

(b) Pangasius

In addition to social and environmental responsibility, the *Pangasius* farm standards encompass food safety and traceability. Biodiversity protection, effluent water quality maintenance and proper disposal of pond sludge are the major issues of concern. There is also a requirement for controlled use of chemical treatments and monitoring of feed ingredients from marine sources. Regular monitoring of water quality and effluents is also required. The high density *Pangasius* pond culture demands development of standards protecting the

safety of divers who clear sludge from pond bottoms during production. Some *Pangasius* farms have been sited in water bodies or on land to which farm owners do not have legal right. Such farms are usually found in undeveloped areas under government owner-ship where land use is poorly controlled. This land may be occupied by landless people or used by coastal communities for hunting, fishing and gathering. Water bodies can also have other important uses for domestic water supplies, irrigation, recreation or tourism. Unauthorized installation of farms can displace landless people and interfere with the use of resources by local communities.

(c) Tilapia

The tilapia farm standards share many points with other G.A.P standards, including conservation of biodiversity and closely controlled water, drug and chemical management. The issue of potential eutrophication in lakes and reservoirs with widely varying levels of circulation has particularly been associated with tilapia farming. Tilapia growout cages and net pens may be installed in lakes, reservoirs, streams, irrigation systems, ponds or estuaries. They do not discharge effluents, but uneaten feed, fish feces and metabolic excretions of fish enter the water bodies that contain the cages or net pens. Water bodies in which tilapia cages have been installed can be an important fishery for local people. These waters can also have other important uses for domes-tic water supplies, irrigation, recreation or tourism. Unauthorized installation of farms can displace landless people and interfere with the use of resources by local communities. Farm operations have the potential to alter aquatic ecosystems and cause a decline in biodiversity through wetland destruction, lethal predator control and eutrophication. Erosion and sedimentation at farm outfalls can have adverse impacts on benthic biodiversity.

In some locations, freshwater from underground aquifers is used to dilute salinity in brackish water ponds or as the main water supply for freshwater ponds. Farming can cause salinization if saline water from ponds infiltrates freshwater aquifers or is discharged into freshwater lakes or streams. Farms can potentially lower water tables and negatively affect groundwater availability. Where other suitable water sources are available, the use of well water is discouraged.

(d) Salmon

The major species of Salmon include Atlantic salmon, *Salmo salar*; chinook

salmon, *Onchorynchus tshawytscha*; coho salmon, *Onchorynchus kisutch*; and the rainbow trout, *Onchorynchus mykiss* which are cultured mainly in cage and net pen. Salmon farms have the potential to cause environmental harm due to sediment accumulation under farms. The causes include settlement of feces and uneaten food, detachment of fouling debris from nets, or sloughing of antifouling materials. Salmon facilities can also affect water quality near the farm due to excretion of metabolic wastes by the fish. The occurrence or severity of these effects varies greatly among locations and regions and sediment monitoring is the most practical means of detecting change. Water column and benthic effects can be caused by other aspects of farm operation, such as the use of medicines and chemicals to treat fish for parasites or diseases, careless waste disposal or spills of fuel and toxic chemicals. In addition to social and environmental responsibility, the salmon farm standards should encompass animal health and welfare, food safety and traceability. The standards should address biodiversity protection and encourage cooperation among neighboring farms. They also require controlled use of chemical treatments and close monitoring of feed ingredients from marine sources.

Salmon can escape from farms under a number of circumstances. Typically escapes occur when holes develop in nets due to wear and tear, collisions with boats, human error or attack by large predators. Damage can also occur during severe weather, which can tear nets and lead to substantial losses. Escapes sometimes happen when fish are removed from the water for grading or harvesting, or if net meshes are too large for the smallest fish stocked in the cages. Escapees can affect wild salmon and other wild fish by competing with them for food and/or habitat, or by transmission of disease. When the escaped fish are the same species as wild salmon in the area, they can interbreed and lead to changes in genetic population profile.

E. Forces driving the Good Aquaculture Practices movement

- Consumers are concerned with food safety and want food produced by environmentally- and socially-responsible methods
- Environmental groups seek to relieve pressure on natural fisheries through responsible aquaculture

- Developed nations are depending more on imported food and want to assure that good production practices are used in exporting nations
- Aquaculture industry wants to assure its markets
- Governments want to protect the environment and to promote exports.

F. Good Aquaculture Practices (G.A.P.)

(A) G.A.P. standards

The Good Aquaculture Practices standards are primarily designed to reassure consumers about how food is produced on the farm by minimizing detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare.

G.A.P offers several benefits to producers:

1. Reducing Food Safety risks in Global Primary Production
   - Clear risk assessed HACCP based reference standard serving the consumer and farmer
   - Commitment to continuous improvement and transparency through consultation and adoption of technical communication platforms across the entire food chain

2. Reducing Cost
   - Avoiding the proliferation of buyer requirements, committed G.A.P Retailer and Food Service Members will shift their supply to G.A.P approved sources over time
   - Avoid excess regulatory burden by pro-active adoption by industry
   - Achieving global harmonisation leading to a more level playing field
   - Farmers choose from certification bodies strictly regulated by G.A.P. regulatory agencies

3. Increasing the Integrity of Farm Assurance Schemes worldwide by
   - Defining and enforcing a common level of auditor competence
   - Defining and enforcing a common level of verification status report
   - Defining and enforcing a common level of action on non-compliances
   - Harmonising interpretation of compliance criteria

(B) G.A.P. Principles

These include strict provisions for the following:

Site management
Reproduction
Chemicals
Occupational health and safety
Fish welfare, management and husbandry
Harvesting
Sampling and testing
Feed management
Pest control
Environmental and biodiversity management
Water usage and disposal
Post harvest - mass balance and traceability
Post harvest - operations
Social criteria

(1) Site Management

Site management intends to ensure that the land, aquaculture sites, buildings and other facilities, which constitute the farm are properly managed to ascertain the safe and sustainable production of food.

(2) Chemicals

Chemicals are defined as: Fuel, Detergents, Pesticides, Fungicides, Chemical Treatments, Disinfectants, Drugs, Medicines (all medicines except Medicated Feeds) and other chemicals (paints, preservatives, anti-foulants, lubricants, battery acids, etc.) used in and around the premises. Hazardous chemical: One or a combination of chemicals that may be a health or physical hazard to humans or to the environment (e.g.: combustible / unstable / irritant / explosive / water reactive / corrosive / flammable / toxic) as indicated in the product and safety data sheet.

(3) Fish Welfare, Management and Husbandry

Animal welfare, management, and husbandry practices are all essential to a sound performance within aquaculture. Meeting the physical, nutritional, and environmental requirements of the fish will result in reduced mortality, improved growth and good fish health.

(4) Medicines

The key objectives are:

- Protect consumer health by ensuring the safety of food of animal origin
- Prevent or reduce the transfer of resistant micro-organisms from animals to humans and from animals to animals
- Comply with the ethical obligation and economic need to keep animals in good health
- Reduce unnecessary use of prophylactics

(5) Aquaculture Feed

Feed must meet the nutritional requirements of the aquaculture species and maintain the recognized human health benefits from the aquaculture species. Captured fish, if used, should come from fisheries that adhere to the FAO Code of Conduct for Responsible Fisheries and be independently verified. The efficient use of fish meal/oil should be maximized.

(6) Environmental and Biodiversity Management

This proposes to ensure good practice with regard to the management and protection of the direct environment and natural resources. Farms are to be built and managed in such a way that both environmental and ecological aspects are addressed in a responsible manner in ways that conserve biodiversity and existing ecosystem functions and recognize that other land uses, people and species depend upon these same ecosystems.

Environmental aspects are those impacts on the environment measurable by assessment of 'non biological indicators', either physical or chemical, e.g. discharge of chemicals, waste water and materials and the emission of noise, gases and heat; the use of energy and natural resources. Biodiversity aspects are those impacts on the environment measurable by assessment of 'biological indicators'; biomass and biodiversity. These may be the chance introduction of non-native species, the extinction of local species due to introduction of pathogens, or due to environmental impacts.

(7) Sampling and Testing Techniques

Fish must be sampled and tested to monitor food safety and legality for the species produced on the farm. This is a tool for the producer to demonstrate Good Aquaculture Practices are well implemented and producing a safe and legal aquaculture species.

(8) Hatcheries and Nurseries

Under G.A.P Certification, only fully domesticated livestock is recognized. This means that only forms of animal production may be certified where no genetic inputs derived from wild natural stocks is structurally required.

(9) Mangroves, Protected Areas and Other High Conservation Value Areas

New ponds, farms sites or related facilities are built according to national planning and legal frameworks in environmentally suitable locations, making efficient use of land and water resources and in ways that conserve biodiversity (including Protected Areas and RAMSAR sites), ecologically sensitive habitats (High Conservation

Value Areas) and ecosystem functions, recognizing other land uses, people and species depend upon these same ecosystems.

(C) Traceability

Traceability is an integral part of G.A.P. certification. It interconnects links in the aquaculture seafood production chain and allows each processed lot to be traced back to the pond and inputs of origin. Traceability assures purchasers that all steps in the production process were taken in compliance with environmental, social and food safety standards. All certified facilities must maintain internal electronic or paper-based records of the required data to document essential information and establish "one up, one down" traceability. Where facilities claim inputs from G.A.P. certified farms, hatcheries, feed mills or processing plants, a chain of custody audit is required to verify proper product segregation and record keeping.

G. Certification Systems

There is increasing interest in certification for aquaculture products, and an increasing number of schemes, covering ecolabeling, organic certification and recently fair trade. These schemes are based on concerns for sustainability and are driven by market requirements. Each scheme has a different emphasis, including aspects on food safety, food quality control, environmental management, social responsibility and animal welfare. However, consumers expect certification to provide useful decision-making information for their purchases and do not wish to be confused by a multitude of certificates providing certification for different aspects of shrimp products. The growing number of certification programs and possible competition amongst certification schemes has potential to result in confusion amongst buyers and consumers. Below is a list of existing certification programs and relevant web sites.

1) Accredited Fish Farm Scheme: A governmental scheme developed by the Agriculture, Fisheries and Conservation Department (AFCD), Hong Kong. The scheme is aiming to brand the local products and to increase consumer confidence in the fish quality. AFCD published series of Good Aquaculture Practices; Feed management, Environmental management (saltwater & freshwater) and Animal health management that registered farmers need to comply. The scheme provides

the transparency of production system by its farm registration, fry registration and quality assurance system at the both regular farm level monitoring and the pre-market product monitoring.

2) Alter-Trade Japan (ATJ): A Japanese company involved in fair trade with several commodities, including bananas, coffee and shrimp. The company was established by consumers' cooperatives and groups for direct trade between producers and consumers. The products form registered extensive shrimp farms in Indonesia following ATJ's own standards are labeled as "Eco-shrimps" and they are recognized as organic shrimp by Naturland in 2002. ATJ's local subsidiary in Indonesia initiated community based activities to strengthen the social aspects of the production since 2006.

3) Aquaculture Certification Council (ACC): A certification body of the Global Aquaculture Alliance (GAA). The founders and the board members of GAA and ACC are predominantly seafood and shrimp aquaculture industry representatives. GAA sets the Best Aquaculture Practices standards which address social, environmental and food safety of shrimp aquaculture. ACC certify the shrimp hatchery, farm and the processor based on the GAA standards. As a mean of a vertically integrated approach, three star label can be granted, when the products are from an ACC certified hatchery, farm and processor.

4) BioGro New Zealand: A not-for-profit organic producer and consumer organisation, actively working to grow organics in New Zealand since 1983. Bio-Gro organic standards include a section for Aquaculture (fish shellfish and crustacean). Their certification covers farms, processors, exporters, input manufacturers, distributors and retailers.

5) Bio Suisse: An umbrella association of organic farming organizations and farms based in Switzerland. According to their website, 11% of Swiss farming lands comply with Bio Suisse standards. BioSuisse organic standards apply to organic agriculture products that are designed for the Swiss market. The

farmed freshwater finfish has been included in the standard since 2001 and certifying the species such as carp, char, trout and perch.

6) Carrefour: The first retailer in Europe and second largest in the world. They are involved in fair-trade of Carrefour Quality Line shrimp produced in the country such as Brazil, Madagascar and Thailand. Carrefour Quality Line (CQL) aims to develop food products that are safe from farm to table and complying with international food safety standards.

7) CODEX alimentarius commission: Created in 1963 by FAO and World Health Organization (WHO) to develop food safety standards, guidelines and related texts for protecting health of the consumers, ensure fair trade practices in the food trade, and promote coordination of all food standards work undertaken by international governmental and non-governmental organizations. The Codex alimentarius system presents a unique opportunity for all countries to join the international community in formulating and harmonizing food standards and ensuring their global implementation.

8) Conseil des appellations agroalimentaires du Quebec (CAAQ): A non profit corporation under the Quebec Companies Act, Canada. The mission of CAAQ is to develop standards, provide accreditation to certification bodies, and make recommendations to the Minister regarding recognition of designations. The Quebec Organic Reference Standard includes a section on aquaculture, covering fish mollusks and crustacean commodities.

9) GLOBALG.A.P.: GLOBALG.A.P is a private sector body that sets voluntary standards for the certification of production processes of agricultural (including aquaculture) products around the globe. GLOBALG.A.P is a pre-farm-gate standard, which means that the certificate covers the process of the certified product from farm inputs like feed or seedlings and all the farming activities until the product leaves the farm. GLOBALG.A.P is a business-to-business label and is therefore not directly visible to consumers.

10) Fairtrade Labelling Organizations (FLO): The worldwide Fairtrade Standard setting and Certification organisation. It permits more than 800,000 producers and their dependants in more than 40 countries to benefit from labelled Fairtrade. FLO guarantees that products sold anywhere in the world with a Fairtrade label marketed by a National Initiative conform to Fairtrade Standards and contribute positively to disadvantaged producers.

11) Friend of the Sea: It is ecolabelling scheme for marine capture fisheries and aquaculture products. According to Friend of the Sea Criteria, a certification body, Bureau Veritas audit products' chain of custody and fisheries conformance. Their aquaculture products include Salmon, Halibut and Turbot and more are expected to be added with time.

12) International Federation of Organic Agriculture Movements (IFOAM): A global umbrella body for organic food and farming. IFOAM's goal is the worldwide adoption of ecologically, socially and economically sound systems that are based on the Principles of Organic Agriculture. IFOAM's Organic Guarantee System (OGS) is designed to facilitate the development of organic standards and third-party certification. IFOAM Certification bodies are accredited by the International Organic Accredation Service Inc. (IOAS) on the contract base.

13) International Standards Organization (ISO): ISO 14001:2004 is the standard for environmental management, not for a product, for minimising harmful effects on the environment caused by shrimp farming. ISO 9001:2000 is a quality management systems standards and ISO 22000:2005 for a food safety management system for facilities such as processors. ISO technical committee ISO/TC 234, Fisheries and aquaculture, was set up in February 2007 for standardization in the field of fisheries and aquaculture.

14) International Social and Environmental Accreditation and Labelling Alliance (ISEAL): Members set voluntary standards in sectors ranging forestry, agriculture, fisheries,

manufacturing and textiles. They operate programs that reward producers for social and environmental performance, and are backed by independent third party certification, enabling supply chain companies and end consumers to make more sustainable purchasing decisions. The ISEAL Alliance developed and complies with Code of Good Practice for Setting Social and Environmental Standards to strengthen the credibility of standard-setting procedure. Full member of the ISEAL Alliance include FLO, The Forest Stewardship Council (FSC), IFOAM, MAC, MSC, The Rainforest Alliance and Social Accountability International (SAI).

15) KRAV: KRAV (Sweden) together with Debio (Norway) has developed organic standards for aquaculture products produced in Sweden and Norway. Their standards apply exclusively for salmonid fish (salmon, trout, rainbow trout and char). KRAV has been also engaged in development of standards for sustainable capture fisheries in Scandinavian waters. They have drafted standards for eco-labelling of fish and fisheries.

16) Marine Aquarium Council (MAC): Aan international, not-for-profit organization that brings marine aquarium animal collectors, exporters, importers and retailers together with aquarium keepers, public aquariums, conservation organizations and government agencies. MAC's has developed the standards for 1) Ecosystem and Fishery Management (EFM), 2) Collection, Fishing and Holding (CFH) and 3) Handling, Husbandry and Transport (HHT) and recently 4) Mariculture and Aquaculture Management (MAM) Standard which covers all aquaculture segments from broodstock management to transport of cultured marine ornamentals.

17) Marine Stewardship Council (MSC): An independent, global, non-profit organization, working towards environmentally responsible fisheries through certification programmes. Based on the FAO Code of Conduct for Responsible Fisheries, MSC has developed an environmental standard for sustainable and well-managed fisheries and uses a product label to reward environmentally responsible fishery management and practices. An independent certification company,

which has been approved by the MSC, undertakes the assessment taking into account the views of stakeholders. MSC scheme is currently limited to capture fisheries products only.

18) Naturland: Has developed standards on several aquaculture commodities and issued its standards on organic shrimp production at the end of 1999. Naturland Standards for organic Aquaculture Jan/2005 version including specific section for pond culture of white shrimp. As well as their own standards, Naturland is one of the certification bodies for IFOAM organic standards.

19) Office international des epizooties (OIE): OIE develops norms for disease reporting and health standards for trade in both terrestrial and aquatic animals. In terms of aquatic animals, the OIE standards are published in the Aquatic Animal Health Code. The OIE is currently working on aquatic animal welfare that may be included in future in the Animal Health Code. The WTO Sanitary and Phytosanitary Measures (SPS) Agreement encourages member countries to base their aquatic animal health regulations on OIE international standards.

20) Quality Approved Scottish Salmon: Two industry associations namely the members of Scottish Quality Salmon and the Shetland Salmon Farmers Association have developed a Code of Practice for Scottish Finfish Aquaculture (CoGP). A quality Scottish salmon mark is a voluntary industry certification scheme, which is accredited by the Food Certification Scotland (FCS).

21) Swiss Import Promotion Programme (SIPPO): An import promotion and development agency under a support of the State Secretariat for the Economy of the Swiss government (SECO). The standards International Standards for Organic Aquaculture / Production of Shrimp has been published by SIPPO together with Naturland and IMO in 2002. SIPPO has been coordinating with Vietnamese Ministry of Fisheries, and developed organic certification of black tiger shrimp farmed in the Ca Mau province of Vietnam.

22) Safe Quality Food (SQF): A program under Food marketing institute (FMI) which is a representing food retailers and wholesalers. The certification standards SQF1000 is for production and SQF2000 is for processing plants certification system. SQF covers wide ranges of products around the world for various agricultural commodities including fish, molluscs and crustaceans.

23) Seafood Watch: A program by Monterey Bay Aquarium (MBA) is designed to raise consumer awareness, predominantly in USA, about the importance of buying seafood from sustainable sources. The program developed the recommendation criteria for aquaculture species.

24) Shrimp Seal of Quality (SSoQ): Bangladesh's national program to certify farmed shrimps, based on their certification standards. This standard targets shrimp farmers and processor. SSoQ is a voluntary process certification and certifies that the operator is deemed to have met the minimum requirements in the areas of food safety and quality assurance, traceability, environmental sustainability, labor practices, and social responsibility.

25) Soil Association: The UK's leading independent charity based and non-profit organization, campaigning and certifiying organic food and farming system. The soil association has prepared standards for organic aquaculture, mainly focused on salmon trout and shrimp farming. Soil Association Certification Ltd (SA Certification) is a wholly owned subsidiary of the Soil Association, approved by Advisory Committee on Organic Standards (ACOS) to offer organic certification to the Soil Association standards.

26) Thai Quality Shrimp: The Department of Fisheries of Thailand prepared the certification system for shrimp aquaculture, with the intention of producing shrimp under their Codes of Conduct (CoC). The guidelines are developed in accordance to CODEX, ISO14001/(EMS) and FAO CoC for responsible fisheries. The certification covers hatchery, farm, processing plant and distributor and promote the

products under the label Thai Quality Shrimp.

27) AquaGAP: This standard has been designed by Bio Foundation, Switzerland to be applied in a generic way. In other words, it applies to all farming/processing methods and species worldwide. This standard only applies to seafood from culture (not capture fisheries). Where the term fish is used in this standard, it applies to all seafood (including e.g. mussels, shrimps and crabs).

28) World Wildlife Fund: WWF is collaborating with producers, buyers, nonprofit organizations and other stakeholders to develop voluntary aquaculture standards geared toward minimising or eliminating the main environmental and social impacts caused by aquaculture, through several roundtables called "Dialogues". A number of dialogues are ongoing for high valued and highly demanded species such as salmon, shrimp, molluscs, tilapia and *Pangasius*.

Importance of Flax in cattle and poultry ration

S. Rajathi, V. Ramakrishnan and C. Suresh

Veterinary College and Research Institute, Tirunelveli

Flax is a glossy reddish-brown oil seed. Its biological name is *Linum usitatissimum.* Flax is crushed to produce linseed oil for paint and textile industry and the flax seed meal is used as a protein supplement in cattle diets. Flax contains approximately 20 % alpha linolenic acid, an essential omega-3 fatty acid which is a precursor for the formation of eicosanoids. Eicosanoids are hormone-like compounds which play an essential role in immune response. These are essential for cell membrane integrity, brain and eye health. Flax is also the richest source of the fibre, like – lignin precursor, secoisolariciresinol diglycoside. Rumen microorganism converts the secoisolariciresinol diglycoside to mammalian phytoestrogen. The phytoestrogen is used in hormone replacement therapies and cancer prevention. Cattle fed with flax will produce beef with increased levels of omega-3 fatty acids. So lot of interest is emerged in flax production and feeding it to cattle.

Nutritive value of flax

Composition of flax varies based on variety, environmental factors and method of analysis. It contains about 41 % oil, 20 % protein and 28 % dietary fibre. When compared to soyabean, sunflower and cotton seed meal, flax seed meal has high dry matter content, high crude protein ratio, high calcium and potassium ratios and high energy value. Flax is a rich source of the omega-3 fatty acid i.e., -polyunsaturated alpha-linolenic acid. This differs from soya bean, sunflower and cotton seed meals which are lower in omega-3 and higher in omega-6 polyunsaturated linolenic acids. It is lower in saturated fatty acids compared with other oil seeds. The vitamin and mineral content of flax seed is similar to soya bean with the exception that it is

lower in potassium and higher in magnesium.

Importance of flax meal

- Perfect combination of healthy fat and high fibre content
- Rich in most of the B vitamins, magnesium, and manganese.
- Rich in Omega-3 Fatty Acids.
- Immensely high in fibre – both soluble and insoluble, thereby enables proper functioning of the intestines.
- High in phytochemicals, including many antioxidants.

Uses of flax meal

- Omega-3 Fatty acids present in the flax meal fight against chronic diseases including heart disease, arthritis, asthma, diabetes and even some cancers.
- Protect the body against high blood pressure, inflammation, water retention, sticky platelets and lowered immune function.
- Shortens recovery time for fatigued muscles after exertion.
- Increases the production of energy and increases stamina.
- Accelerates the healing of sprains and bruises.
- Stimulates brown fat cells and increases the metabolic rate making it easier to burn off fat.
- Improves the absorption of Calcium
- Helpful in the treatment of Eczema, Psoriasis, and Dandruff

Flax as cattle feed

As flax is high in oil, it is used as a fat source in cattle feed. It is used to increase

energy density, reduce dust, eliminates fines and to aid in feed processing. Flax may be added at 12 to 14 % on dry matter basis to cattle diets. As it has high protein content, it is also a source of supplemental protein in cattle diets. Mainly flax is used in beef cattle as whole seed or processed flax. It increases weight gain in beef cattle. When flax is rolled or ground, weight gain efficiency increased compared with feeding whole flax. So processing flax is necessary to optimize gain and nutrient utilization.

Toxicity of flax seed

Raw flax seed is toxic as it contains a cyanide containing glucoside – linamarin which releases hydrogen cyanide under acidic condition in the presence of an enzyme linase. Linase in flax seed in acidic condition will convert linamarin to hydrogen cyanide which leads to cyanide poisoning in cattle. Under normal

processing conditions involving high temperature treatment, linase is destroyed. So there is no problem in feeding flax seed as flax seed meal in animals.

Milk Production

Flax fed cows produced milk with higher in protein. It alter fatty acid profiles of milk. When whole flax seed fed to lactating cows, long-chain fatty acids and poly unsaturated fatty acids including alpha linolenic acid level in milk is increased.

Immunity

Flax fed beef animals have high immunity when compared to animal fed with other oil seeds. Flax fed steer has higher blood levels of haptoglobin, an indicator of immune response. Flax seed meal has a role in modulating autoimmune disorders and decrease incidence of cancers.

Reproduction

As flax seed increase energy balance in cows, it increased conception rates, improved fertility and decreased calf mortality.

Meat quality

As flax meal is high in fat, it may be used to enhance quality grade meat production. Flax feeding improved marbling scores in beef lot cattle. To get improved quality grade meat flax can be fed to steer at the rate of 5 – 8 % as dry matter in cattle rations. Flax inclusions in feedlot diets will alter end product fatty-acid profiles positively. Muscle from steers fed diets that included flax has higher alpha linolenic acid (ALA) content. When 8 % flax in cattle diets will increase phospholipid and neutral lipid ALA fractions in meat and also increase phospholipid longer-chain omega-3 fatty acids. Flax fed beef when supplemented with vitamin E will produce meat with brighter shelf colour scores even with increase in unsaturated fatty acids. The flax fed steer produces juicy, tender and flavoured beef.

Flax seed as poultry diet

Flax in poultry diets has positive effects on broiler performance and egg fatty acid profiles. Flax fed chickens have less carcass fat and larger leg weights. Chicken fed with flax produce meat rich in omega-3 fatty acids. Flax fed broilers produce dark meat with higher levels of ALA. Flax inclusion in diets of laying hens increased ALA content in eggs. Flavour from eggs from flax fed layers will be desirable when compared with eggs from layers fed with other oil seeds. From the review, it can be concluded that, flax meal can serve as excellent source of nutrients for cattle and poultry industry. It is high in protein and an excellent source of energy and essential fatty acids. It can also be used to fortify foods with omega-3 fatty acids.

Fish Diversity of River Jehlum Srinagar, Kashmir

Shabir Ahmad Dar*[1], A. Y. Desai[2], A. N. Sayani[2], A. S. Sodhi[1], B. L. Gupta[1], Shabana Arjamand[3], Ashfaq M. Rather[2], and S. I. Yusufzai[2]

[1]Govt. Degree College Kathua, Jammu- 184 101
[2]College of Fisheries, Junagadh Agricultural University, Veraval Gujarat-362 265
[3]Govt. Degree College Bemina, Kashmir- 190 018
Corresponding author: shabirsamad585@gmail.com

The concerns for conservation measures to protect aquatic biodiversity have become need of the hour throughout the world. There are some 30,700 different known species of which 11,810 are marine and brackish water while nearly 8,411 are freshwater (Ayyappan, 2010). India itself is fortunate to possess 2358 species of fishes of which 1,368 are marine, 113 are brackish-water and 877 freshwater in their habitation. Increase in human population, indiscriminate fishing pollution, use of Agro-Chemicals, Siltation and Unawareness among the people have bled to the decline in this vast varied fish biodiversity. General survey of literature revealed that very less information is available on Icthyofauna of this river except some preliminary survey made by scholars of valley. Kashmir is situated in the heart of the western Himalayan between 32.00 to 37.00 latitude and 72.500 to 80.00 longitude. By virtue of it scenic beauty it is known as the "Paradise on the earth". The Valley of Kashmir is surrounded on all sides by mountains ranging from 300 to 3900 meters exept for a narrow gorge of River Jehlum down Baramulla town on the west. The varied nature of the environment has brought in varied faunal composition both on land and in water. As the Jehlum is the main river system into which all other streams and lakes e.g, Walur, Dal, Anchar lakes pour their volumes of water. River originates from Verinag spring at Ananatnag. The total length of the river from Verinag to Uri is about 239Kms and then it turns south wards to Muzzafarabad (POK). Total catchment area of the river is 10,100.6km2 (Drew Frederic, 1971).

Detailed ecological and fishery studies were conducted for a period of one year

from Jun-2007 to Spet-2008. Fishes were collected from different landing sties of the river during study period by local fisherman and fisherwomen. The main fishing gear operated in the river was gill net of varying mesh size, although cast net, rod and line, hook and line, drag nets and traditional gears commonly known as jal were used. The fishes soon after collection were cleaned and presented in 10% formalin. Most of the fishes available were identified on the spot themselves while the rest were brought to the laboratory for their proper identification following the descriptions given by Day (1878), Misra (1952), Jayaram (1981), Qureshi and Qureshi (1983), Srivastava (1984), Datta Munshi and Srivastava (1988), Talwar and Jhingran (1991) and Jhingran (1992).

FISH DIVERSITY

Fish plays an important role in the development of a nation. Besides being a cheap source of highly nutritive protein, it also contains essential nutrients required by the human body (Sikoki and Otobotekere). Fish forms an important item in the food of the Kashmiris, and those who dwell near the lakes; and the floating population of boatmen depend for a considerable part of their sustenance on the prey of their nets or lines. Jammu & Kashmir has enormous potential resources in the inland sector teeming with fish. The country is endowed with vast and varied resources possessing river ecological heritage and rich biodiversity. The valley of Kashmir is famous throughout the world for its fresh waters, and has tremendous potential for the development of fisheries especially in the cold water sector. The fish fauna of the Jhelum River is one of the earliest local fish faunas known to science. The first collection was made by the Austrian Carl Alexander Anselm von Hügel at the end of a long trip through Eurasia over the period 1831-1836, and deposited in the Naturhistorisches Museum in Vienna, Austria. Heckel (1838, 1844) published two well illustrated taxonomic accounts of the fish collection based on Hügel's specimens, summing to 16 species all of which he considered to be new to science. Ten of the species belong to the group of cyprinid fishes now commonly referred to as oreinins, schizothoracines, mountain barbels, snow trout, or snow

barbels. In the minds of ichthyologists and others interested in fisheries, the Kashmir Valley is forever The Snow Barbel Place. Several studies have been conducted in the past on the fish and fisheries of the Valley. Yousuf et al. reported 19 species of fish belonging to Cypriniformes, Siluriformes, Cyprinodoniformes and Salmoniformes from river Jhelum and its tributaries. There is need to have many more studies, so as to develop a strategy for the overall improvement of the fishery resources of the region. The present study provides an updated status of the fish fauna of River Jhelum so as to assess the possible management strategies that need to be implemented. The diversity of the fishes mainly depends upon the biotic and a biotic factor and types or the ecosystem (Lentic, lotic). Age of the water body, mean depth, water level fluctuations hydro biological features, bottom conditions and over all topography of the water body, all play an effective role in fisheries out put to a greater extent.

During the period of one year, investigations following thirteen fish species, belonging to 4 orders, 4 families were recorded.

Sr.no	***Order***	***Family***
A	Cypriniformes	Cyprinidae
1	Schizothorax curvifrons	
2	Schizothorax esocinus	
3	Schizothorax planifrons	
4	Schizothorax progastus	
5	Cyprinus carpio	
6	Carassius carassius	
7	Labeo dero	
8	Labeo dyocheilus	
B	Cobiididaeformes	cobitidae
1	Botia birdi	
C	Siluriformes	Sisoridae
1	Glyptothorax kashmirensis	

Out of all the given fish species recorded common carp and the Schizothracids (especially s. esocinus, s. curvifrons) constitute the important fisheries during the survey. All the species were found in all the stations except in some of the months of the year. The dominant species common carp and Schizothoracids were present at all

timeinevery station. The percentage, composition of other fish species during the tenure of study shows declining trend at all sites. The population of Schizothoracine fishes in the valley has considerably decreased over the years particularly after the introduction of common carp. The other principal factor which has possibly contributed to the decline in fish biodiversity in valley include the rapidly changing ecological scenario in the aquatic habitats. All the water bodies situated in close vicinity of human settlements.

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Role of Neonatal Behavior for Survival of Calf

Susavi Kumari[1*], Suman Kumari Joshi[1], Sanjay Kumar Ravi[2], Muzzamil Abdullah[1], Sreela L.[1], Utkarsh Tripathi[1]

[1]Livestock Production Management, National Dairy Research Institute, Karnal-132001, Haryana

[2]National Research Centre on Equines, Post Box No. 80, Bikaner-334001, Rajasthan, India

**Corresponding author: skaravilpm@gmail.com*

Neonatal period is the most critical step in the lifetime of a mammal. After parturition, expulsion of calf occurs to the entirely new environment where everything is new except some maternal feature such as voice and smell of amniotic fluid (Fraser and Broom, 1997). Neonatal survival relies to a great extent on an environment that is ecologically appropriate for the developmental stage of the neonate, and on optimum interactions with the mother.In the neonatal behavior there are five stages i.e. coordinating recumbency, elevation, ampulation, orientation and trophic initiation have been recognized during the formation of neonatal-maternal bond.

a) Coordinating recumbence - After expulsion the newborn lies in extension and soon raises its head and neck, flexes the forelegs, completes rotation of its sternum and flexes its hind limbs to rest on its sternum.

b) Elevation- The calf attempt to rise in a typical way. Many attempts are taking to stand upright equilibrium by the four feets. Calf and lamb raise their hindquarter before their forequarter but foals do apposite to it (Fraser and Broom, 1997).

c) Ampulation – After standing, the calf attempt to walk, this was followed as a typical four-step form of slow ampulation which was unsteadiness. This unsteady locomotion may stimulate maternal concern and promote maternal bonding (Fraser and broom, 1997).

d) Orientation – Activities which are exploratory by the calf is done by nosing with the head and neck, there action promote the learning of maternal and species characteristics. During searching when teat like protrusion is grasped than suckling occur.

e) Trophic initiation –The orientation of the calf towards the dam is directed towards

the mammary region and by trial-and-error they are able to locate the teat by their mouth. This stimulation by the suckling of the calf makes the let down milk and satisfies the ingestive behavior of the calf.

In short, after calving the dam licks vigorously to its newborn calf and also lifted partially from the ground by the tongue (Edwards and Broom, 1982). After about 30-60 min, newborn calf usually stands (Edwards, 1983; Jensen et al., 2011). Soon after that, teat sucking by the calf is most intense, for that the calf makes many attempt to locate the teats, the cow help the newborn by making appropriate position and also licks, nuzzle and nude the calf. And the dam nurses the calf. The calf mostly suckles from right or left sides and occasionally from rare side (Hafez, 1969) and it is common to occur first from a front teat (Edwards and Broom, 1997). Calves spent most time sniffing and tend to suckle the cow during the second hour (Jensen et al., 2011). But about one-fifth of apparent suckling episodes may involve no milk let-down (Fraser and Broom, 1997).

Imprinting

It was first described by Konrad Lorenz as "Imprinting is said to occur when innate behaviours are released in response to a learnt stimulus". Most imprinting promotes survival of newborn animals and shapes their future breeding activities. During imprinting, a young animal develops an attachment toward another animal or object. It occurs at a particular time (i.e. sensitive period) during early postnatal life and is not reversible. Imprinting is a rapid learning process that apparently occurs without reinforcement. Dominant sense involved in imprinting is sight, sound and olfaction. Imprinting is more important in precocial species, in which the offspring are less dependent on their mothers for food and warmth, than in altricial species which often confine their more vulnerable, and often hairless, young to nests. After imprinting there are two major categories of learning, *associative* and *non-associative*. In non-associative learning the animal is exposed to a single stimulus to which it can become habituated or sensitised, while in associative learning a relationship between at least two stimuli becomes established. There are two sub-divisions under the umbrella of associative learning. These are called classical conditioning and operant conditioning. The latter, as we will see, is important for animals to be able to solve novel problems in their environment. Et-epimeletic (care soliciting) behavior -

Calves do solicit maternal contact by vocalizing, and by nuzzling and butting the cow's udder. These signals are thought to provide some reliable or 'honest' information about the calf's need for maternal care, and empirical work has shown that hungrier calves call more (Thomas et al., 2001) and show increased contact with the cow's udder (de Passillé and Rushen, 2006) compared to calves that are better fed.

Pattern of suckling

The calf grasps the teat with its mouth and sucks vigorously without biting. It develops a negative pressure, by forming an air-tight compartment in the oral cavity by the tongue around the teat. The maximum negative pressure varies from 250-400 mmHg. While suckling, the calf vigorously butts the mother udder with its head, this may be due to reduced milk flow and it may help to increase flow rate (Hafez, 1969). Wagging of the tail also done in peaceful suckling. Vigorous tail-wagging together with butting may be the indication of frustration due to no or very less milk available in the udder (Selman et al., 1970). It appears that a calf stays on each teat until it dry, and then moves to another. Non-nutritional suckling also occurs when a calf licks himself, another calf, or a nearby objective may be penis, sheath, scrotum, udder and ear. It mostly seen in calves which are bucket-fed and are grouped together shortly after birth.

Rate and Frequency of suckling

After locating the teat the calf satisfy its appetite in 10-15 min (Hafez, 1969). The number of pulsation by suckling ranges from 57-102 (av.74) per min (Hafez, 1969). Calves on their dam suckled an average of 37-57 min per 24 hrs. whereas calves on Nursing rates average 16-42 min per 24 hrs. Newborn calves suckle their dams 5-8 times in each 24 hrs. And the average total time spend in suckling in the first 8 h after calving as 17 min (Selman et al., 1970). In the natural situation, a cow nurses her calf 5 to 11 times daily during the first few weeks, but the nursing frequency declines to 3 to 5 times per day during the following months. Calves born to heifers and female calves were generally more intelligent than calves born to cows and male calves, respectively. Female calves suckled an average of 1.5 h earlier than male calves and heifers' calves were suckling 2 h before cows' calves even though the heifers required more assistance and took longer to stand after birth (Houwing et al., 1990).

CONCLUSIONS

The time period just after birth is very crucial for the animals. Proper adaptation during this period by the animal is important for their survival and future life. Association with its mother and care from her in terms of colostrums by suckling is the foundation to immunity and survival.

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Surra in Domestic Animals - Zoonotic Diseases

Mamta Kumari, M. Chaudhari, Monika Rani, Preeti and J.Goyal

Ph. D Scholar, Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125004, Haryana (India)

Surra is caused by a parasitic protozoan *Trypanosoma evansi*. The disease affects mainly camels and horses, but buffaloes and cattle are also affected. Trypanosomes infect a variety of hosts and cause various diseases, including the fatal human diseases sleeping sickness, caused by *Trypanosoma brucei*, and Chagas disease, caused by *Trypanosoma cruzi*. The incidence of surra increases significantly during the rainy season when there are large biting fly populations. The losses are due to reduced productivity, mortality and cost of treatment.

Human Trypanosomiasis in India: Is it an emerging new zoonosis?

Trypanosomes are flagellated protozoan parasites infecting man (human trypanosomiasis) and a wide range of animals (animal trypanosomiasis). Human trypanosomiasis is confined to Sub-Saharan Africa and Latin America and exists in two forms: 1. Human African trypanosomiasis (HAT) (sleeping sickness) is endemic in Sub-Saharan Africa. It is a dreadful fatal disease and was responsible for devastating epidemics in 1920s, with resurgence in 1990s. It is caused by Trypanosoma brucei gambiense (chronic form) or Trypanosoma brucei rhodesiense (acute form) and 2. American trypanosomiasis (Chagas disease) caused by T. cruzi is endemic in Latin America. Both diseases are transmitted by vectors: Human African Trypanosomiasis by infected saliva of Tsetse fly, and chagas by infected feces of bugs. Though human infection by animal species is "not possible" because of a trypanolytic factor in human serum, there are several reports of atypical human infection caused by animal trypanosomes, such as T.evansi, T. lewisi and T. congolense, especially from India. A new form of human trypanosomiasis has emerged with the first human case in the world caused by T. evansi. T. evansi–identified for the first time in horses and camels in 1881 in the Punjab region (India) by Griffith Evans, an English veterinary surgeon–causes disease in animals called "surra" which is commonly found not only in livestock in India, but has a worldwide

distribution . Authors reported the first confirmed case of human trypanosomiasis caused by T. evansi in a farmer from Seoni village, near Nagpur in 2005. Nineteen atypical human cases of trypanosomiasis caused by animal trypanosomes are reported: 8 to T. lewisi, 5 to T. evansi and 4 of them are due to T. brucei, one to T. vivax, one to T. congolense and T. brucei species. All cases due to T. lewisi were observed in Asia. Out of 19 cases, 6 are infants and 8 are from India. Two more cases have very recently been detected in Puducherry (unpublished). Particularly in the State of Maharashtra the concern is more serious because one case of T. evansi and two cases of T. lewisi have been reported in a span of 3 years. The environmental conditions in India are conducive to the spread of the parasite from animals to human beings.

Animal trypanosomiasis

In contrast to human trypanosomiasis, animal trypano-somiasis has a worldwide distribution and is common in India. India has the unique distinction of being the country where the first two mammalian trypanosomes, i.e. Trypanosoma lewisi and T. evansi were discovered. T. lewisi is a natural parasite of rats while T. evansi is a pathogenic species of number of domesticated animals like cattle horses and causes a disease called “surra” in animals. High prevalence of these two animal trypanosomes in India is now a matter of concern.

Transmission

Mechanical transmission occurs most importantly by horse fly (*Tabanus* spp.), followed by stable fly (*Stomoxys* spp). Transmission is enhanced when horses or camels are closely tied up, when they have high numbers of parasites in their blood. Indigenous cattle, buffalo, and several species of wild life may act as reservoir of infection for horses and camels.

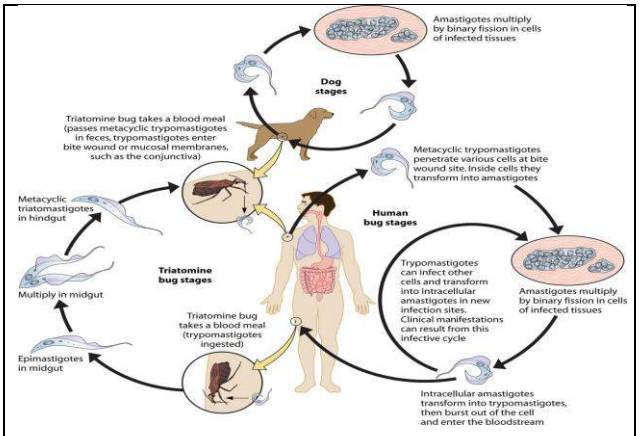


Fig.1. Life cycle of Trypanosoma cruzi.

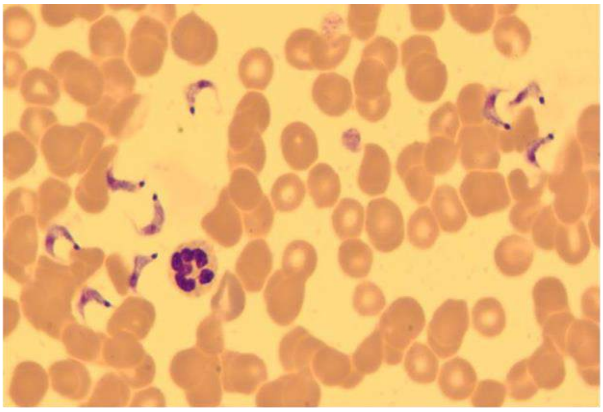
Clinical signs

The main clinical findings are intermittent fever, progressive anemia, edema of dependent parts of the body, urticaria, dullness, listlessness, loss of body condition despite a good appetite, disappearance of hump and atrophy of thigh muscles,

Figure 2: Infected camel showing emaciation, weakness, loss of hump and muscles.

Figure 3: Weak and emaciated horse

Figure 4: Weak and emaciated cattle



Trypomastigotes of *Trypanosoma cruzi* in a canine blood smear

weakness, and rough coat, nasal and ocular discharge, pin-point hemorrhages of the mucous membranes and often around the eyelids, nostrils and anus may be present. Terminally, nervous signs may be seen, like paraplegia, paralysis, delirium, and convulsion. Surra is invariably fatal in camels and horses, but camels may exhibit chronic signs for years. These signs include a reduction in milk yield and capacity for work, and a high abortion rate in pregnant females. Camels with chronic surra become more prone to infection with other diseases; it is usually associated with mange and pneumonia.

In endemic areas, cattle and buffalo usually have mild infections which may be exacerbated by stress from adverse climatic conditions, work, or inter current disease. Signs may include irregular estrus, abortion, and stillbirth in cows and poor semen quality in bulls. There may be enlarged lymph nodes and internal organs. Haemolytic anaemia is a characteristic sign.

A more severe disease in cattle is characterized by nervous signs and high mortality rate. The signs include circling, excitation, jumping, aggressive behavior, lateral recumbency, convulsion and finally death. In general, *T. evansi* is only slightly pathogenic for sheep, goats and pigs, although occasional outbreaks of disease may occur in pigs. Carnivores are highly susceptible to acute infection; the disease is characterized by well-marked edema, particularly in the scrotum, ears, and neck. Opacity of the cornea is frequently present, emaciation is rapid and death can occur within 2 weeks. Dogs occasionally exhibit nervous signs suggestive of rabies.

Lesions

- There are no pathognomonic gross and microscopic lesions.
- The carcass is emaciated, pale and may be icteric.
- Edema is evident, ascites and hydrothorax may be present.
- In acute, fatal cases, there may be extensive petechiation of the serosal membranes, especially in the peritoneal cavity.
- Enlargement of lymph nodes and spleen.
- Trypanosomes are detected in all tissues and body fluids of fresh carcass
- In chronic cases, swollen lymph nodes, serous atrophy of fat, and anemia are seen.
- Presence of blood in the cerebrospinal fluid (CSF) is evidence of CNS involvement.

Diagnosis

- A presumptive diagnosis is based on finding an anemic animal in poor condition in an endemic area.
- Confirmation depends on demonstrating trypanosomes in stained blood smears or wet mounts.
- In wet mounts, motile organisms may be visible in the buffy coat when a blood sample is centrifuged.
- Other infections that cause anemia and weight loss, such as babesiosis, anaplasmosis and haemonchosis, should be ruled out by examining a stained blood smear.
- Various serologic tests can be done to measure antibody to trypanosomes.

Treatment

- Consult veterinarian for treatment.
- Several drugs like Quinapyramine sulphate, Melarsomine dichlorhydrate and suramin can be used for treatment.
- Drug resistance can occur and should be considered in refractory cases.

Control Measures

- Fly control by aerial and ground spraying of insecticides on fly-breeding areas.
- Detection and treatment of infected animals, prophylactic treatment of susceptible animals and their protection from biting flies.
- Reduction of the reservoirs of infection.
- Drug resistance must be carefully monitored by frequent blood examinations for trypanosomes in treated animals.
- The use of breeds showing innate resistance to trypanosomosis should be considered.

CONCLUSION

It is imperative that the possibility of human infection by animal trypanosomes, which has the potential to emerge as a new zoonosis, needs to be taken seriously and given more attention. Further investigations in the field and laboratory are warranted. Livestock should also be handled with care to minimize accidental infection.

The Candidate Gene Approach in Genetics

Bhagwat Nawade[1] and Mayur S. Darvhankar[2]

[1]JRF DGR, Junagadh and [2] Ph.D. student Dept. of Genetics and Plant Breeding, College of Agriculture, JAU, Junagadh 362001

One of the main objectives of molecular genetics is to identify and isolate genes governing important traits. Three main approaches lead to the cloning of genes of interest. Classical methods such as positional cloning and insertional mutagenesis have been used with success to identify major genes. However, these methods are limited by genome size and by the lack of transposons in the species being studied. When assumptions can be made regarding the biological function of the gene of interest, a candidate gene (CG) approach is an alternative strategy. The idea is to propose previously sequenced genes of known function that could correspond to major loci (Mendelian trait loci, MTLs, or quantitative trait loci, QTLs). The CGs may be structural genes or genes involved in the regulation of a metabolic pathway. The working hypothesis assumes that a molecular polymorphism within the CG is related to phenotypic variation. The CG approach has been used with success in human and animal genetics (Rothschild and Soller 1997) and since the 1990s, in plant genetics (Byrne and Mc- Mullen 1996). Many traits of agricultural significance exhibit quantitative inheritance, which is often the result of multiple genes influenced by the environment. Because of the multiplicity of genes defining a complex trait, their partial effects on phenotypic variation and their imprecise localisation on genetic maps, the CG approach is more adapted to QTL characterization than positional cloning or insertional mutagenesis

This article presents the current state of CG analyses in genetics. It is divided into four sections. The first section deals with the choice of the CGs. The second section emphasizes the two strategies for finding the most accurate CGs. The third section presents experiments leading to verification of the role of a CG as the gene responsible for trait variation. The last section points out the theoretical and practical applications of the CG approach in genetics and breeding.

A. Choice of the candidate gene (CG)

When the biochemical and/or physiological pathways related to a trait of

interest are well known, the CGs may be chosen from among the cloned genes involved in this pathway. The choice is based on their role in the phenotypic variation. When neither gene nor cDNA sequences are available for the species of interest, sequence information from other species may be used to deduce consensus motifs and to design degenerate primers. High-throughput sequencing of model species genomes provides numerous sequences in databases. Construction of specific cDNA libraries corresponding to different organs, developmental stages or stress responses coupled to differential screening of these libraries fosters the isolation of CGs. Mutants exhibiting an extreme phenotype are other sources of CGs. Investigation of physiological disorders of mutants can lead to the identification of genes involved which are then proposed as CGs.

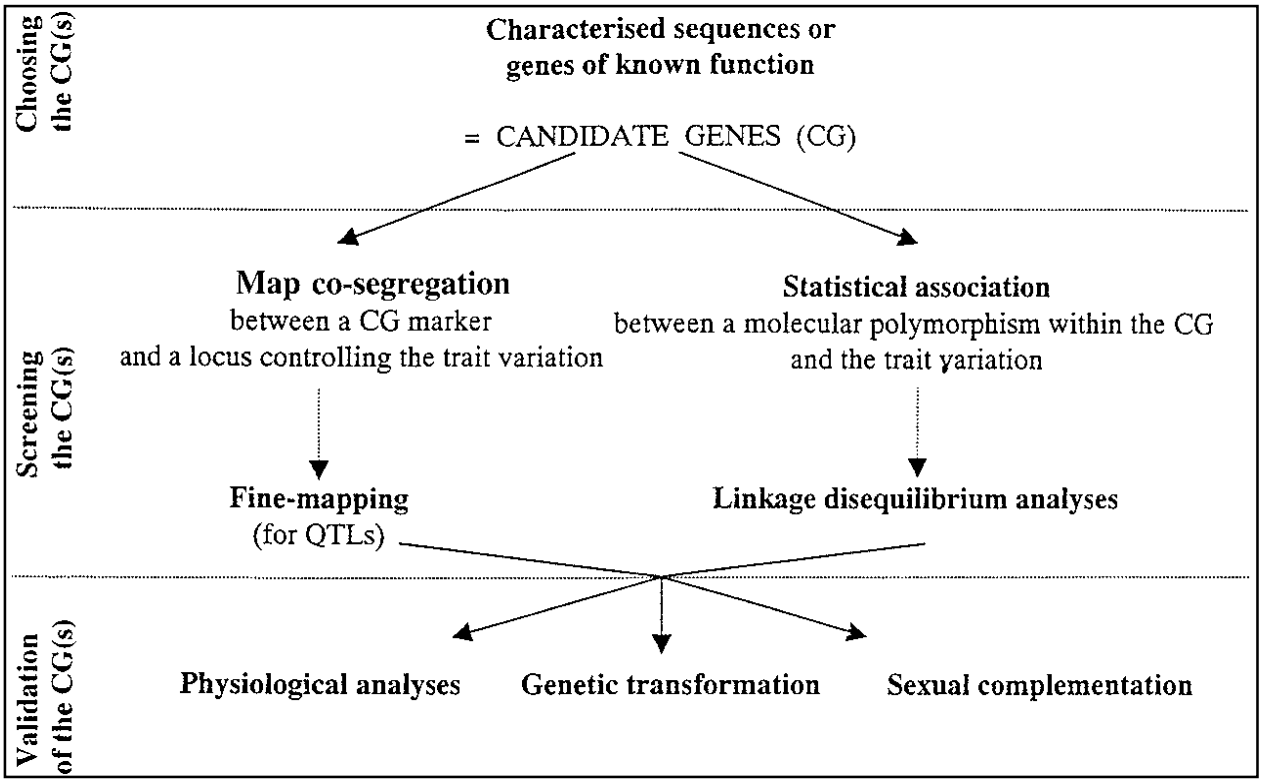


Figure 1. Overview of the candidate gene methodology.

B. Screening CGs

Once CGs have been chosen, association experiments should be performed to select the most likely CGs. Two strategies are currently being used (Figure 1). Genetic map positions of putative functional CGs and target loci involved in the studied trait can be compared. Fine-mapping experiments are necessary to locate precisely both CGs and the locus.

Simultaneously, correlation analyses between phenotypic variation and molecular polymorphisms within the CG can also be conducted in a set of genealogically unrelated individuals. These two strategies are not exclusive but complementary. The detection of tight genetic linkage between the CG and the target locus or of a statistical correlation between a molecular polymorphism within the CG and the phenotypic variation of the studied trait are convergent approaches. Nevertheless, they are not sufficient arguments to conclude that the CG is responsible for the phenotypic variation. Further analyses are needed to validate the implication of the CG in the studied phenotype.

C. Validation of CGs

Validation experiments are more or less complex according to the nature of the trait (mono- or polygenic). Physiological analyses provide arguments for or against the role of the CG. However, they do not provide undisputed evidence. Genetic transformation experiments can demonstrate conclusively if the CG is the gene determining the trait variation.

D. Applications of the CG approach

The validation of a CG has several practical and fundamental applications.

1. A validated CG may be used for identification of varieties as well as for marker assisted selection (MAS). For MTL, the CG approach provides markers of the gene itself
2. Numerous traits of agronomic importance are polygenically controlled and MAS programs for polygenic traits should increase breeding efficiency.
3. The importance of regulatory genes in the variation of a trait can now be evaluated using the CG approach.
4. The identification of disease resistance QTL functions will allow the understanding of biological mechanisms determining a partial and polygenically inherited resistance. It will contribute to understand the very subjective notion of durability of disease resistance.

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Association Mapping

M. S. Darvhankar and B. D. Nawade

[1]Ph.D. student Dept. of Genetics and Plant Breeding,
College of Agriculture, JAU, Junagadh and [2]JRF DGR, Junagadh

Most traits of agricultural or evolutionary importance are controlled by multiple quantitative trait loci (i.e. complex traits). Genetic mapping and molecular characterization of these functional loci facilitates genome-aided breeding for crop improvements such as disease resistance, efficiency of fertilizer use, and drought tolerance. Two of the most commonly used tools for dissecting complex traits are linkage analysis and association mapping. Linkage analysis exploits the shared inheritance of functional polymorphisms and adjacent markers within families or pedigrees of known ancestry. Linkage analysis in plants has been typically conducted with experimental populations that are derived from a bi-parental cross. Although based on the same fundamental principles of genetic recombination as linkage analysis, association mapping examines this shared inheritance for a collection of individuals often with unobserved ancestry.

ASSOCIATION MAPPING

Association mapping, a high-resolution method for mapping quantitative trait loci based on linkage disequilibrium, holds great promise for the dissection of complex genetic traits. Essentially, association mapping exploits historical and evolutionary recombination at the population level.

Association mapping refers to the significant association of a marker locus with a phenotype trait.

Association genetics is a relatively new approach to dissect complex traits that is based on the establishment of causal relationships between genotypes and phenotypes in natural or breeding populations.

HISTORY

Some of the first LD mapping studies in plants were done in maize (Zea mays) (Bar-Hen *et al.,* 1995), rice (Oryza sativa) (Virk *et al.,* 1996) and oat (Avena sativa) (Beer *et al.,* 1997). Bar- Hen *et al.* (1995) and Virk *et al.* (1996) predicted the association of quantitative traits using RAPD and

isozymes markers, respectively. Beer *et al*. (1997) associated 13 QTL with RFLP loci using 64 oat varieties and landraces. Aranzana *et al.* (2005) performed the first attempt at a genome wide association study (GWAS) in Arabidopsis, reporting previously known flowering time and three known pathogen-resistance genes.

APPLICATION

Linkage disequilibrium can be used for a variety of purposes in crop plant genomics research. One of the major current and future uses of LD in plants would be to study marker-trait association (without the use of a mapping population) followed by marker-assisted selection (MAS). Another important application is its use in the studies of population genetics and genetic diversity in natural populations and germplasm collections and in crop improvement programmes.

Genetic association mapping is a new approach which takes into account thousands of polymorphisms to evaluate for QTL effect and is more efficient as compared to linkage analysis because it does not require generation of segregating populations/large numbers of progeny (Oraguzie *et al.,* 2007; Belo *et al.,* 2008). However, association mapping is only capable of identifying phenotypic effects of alleles with reasonably high frequency in the population under investigation.

APPROACHES

Many methodologies have been developed and are widely used for AM in humans (Schulze & McMahon, 2002), and several are perfectly applicable without change or with case-to-case modifications for a wide range of organisms, including plants.

1. Multiparent Advanced Generation Intercross (MAGIC)
2. Case-control (CC),
3. Transmission Disequilibrium Test (TDT) and
4. other approaches that incorporate corrections for population structure such as genomic control (GC) and structured association (SA).

1. Multiparent Advanced Generation Intercross (MAGIC)

MAGIC is an extension of the advanced intercross method in which an intermated mapping population is created from multiple founder lines. A Recombinant Inbred Line (RIL) population is created from multiple founder lines, in which the genome of the founders are first mixed by several rounds of mating, and subsequently inbred to generate a stable panel of inbred lines. The larger number of parental accessions increases the allelic and

phenotypic diversity over traditional RILs, potentially increasing the number of QTL that segregate in the population. The successive rounds of recombination cause LD to decay, thereby increasing the precision of QTL location (Mackay & Powell, 2007).

2. Case-control (CC)

The classical methodology and design of AM is the "case and control" (CC) approach. If a mutation increases disease susceptibility, then we can expect it to be more frequent among affected individuals (cases) than among unaffected individuals (controls). The essential idea behind CC-based AM is that markers close to the disease mutation may also have allele frequency differences between cases and controls if there is LD between the marker locus and the "susceptibility" mutations (Schulze & McMahon, 2002). For accurate mapping, this design requires an equal number of unrelated and unstructured case-control samples.

3. Transmission Disequilibrium Test (TDT)

The ability to map QTL in collections of breeding lines, landraces or samples from natural populations has merit. In these populations, LD often decays more rapidly than in controlled crosses, enabling fine mapping. The challenge is to distinguish the effects of population subdivision from LD caused by linkage (syntenic LD). A robust method to test for this partitioning is the TDT (Spielman et al., 1993) that permits the detection of linkage in the presence of disequilibrium. Neither linkage alone nor disequilibrium alone (non
syntenic LD) will generate a positive result in a TDT.

4. Other approaches

Population structure arising from recent migration, population admixture and artificial selection will generate non syntenic LD. Assuming that such population structure has a similar effect on all loci, a random set of markers can be used to statistically assess the extent with which population structure is responsible for non syntenic LD (Stich & Melchinger, 2010). This is the basis of genomic control (GC). For example, for a case-control analysis of candidate genes, the GC approach computes $\chi 2$ test statistics for independence for both null (random) and candidate loci.

BENEFITS AM

1. The potential high resolution in localizing a QTL controlling a trait of interest is the primary advantage of AM as compared to linkage mapping.

2. AM has the potential to identify more and superior alleles and to provide detailed marker data in a large number of lines which could be of immediate application in breeding (Yu & Buckler, 2006).
3. Furthermore, AM uses breeding populations including diverse and important materials in which the most relevant genes should be segregating.
4. Complex interactions (epistasis) between alleles at several loci and genes of small effects can be identified, pinpointing the superior individuals in a breeding population (Tian et al., 2011).
5. Sample size and structure do not need to be as large as for linkage studies to obtain similar power of detection.
6. Finally, AM has the potential not only to identify and map QTL but also to identify causal polymorphisms within a gene that are responsible for the difference between two phenotypes (Palaisa et al., 2003).

LIMITATIONS OF AM

1. AM suffers from some limitations such as when the trait under consideration is strongly associated with population structure.
2. Most traits under local adaptation or in balancing selection in different populations may be thus affected (Stich & Melchinger, 2010).
3. When statistical methods to correct for population structure are applied, the differences between subpopulations are disregarded when searching for marker-trait associations.
4. Therefore, all polymorphisms responsible for the phenotypic differences between subpopulations remain undetected, thus under powering AM.

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Nutritional Diseases in Aquatic Animals

P. J. Mahida[1] *, S. R. Lende[1], S. I. Yusufzai[1], V. Shrivastava[2] & A. K. Jha[3]

[1]Department of Aquaculture, College of Fisheries,

Junagadh Agricultural University, Veraval (Gujarat)

[2]Central Institute of Fisheries Education Mumbai

[3]Central Institute of Fisheries Technology (CIFT) Veraval (Gujarat)

**Corresponding Author: parvezaalam89@gmail.com*

Nutritional diseases of fish could develop as a results of deficiency (under nutrition), excess (over nutrition), or imbalance (malnutrition) of nutrients present in their food. The disease typically develops step by step as a result of animals have body reserves that structure for nutritional deficiency up to a particular extent. Illness signs develop supply provide of any diet element falls below vital level. Once there is an excessive amount of food, the surplus that is regenerate to fat and deposited in fish tissues and organs, might severely have an effect on physiological functions of the fish. Several fishes suffer from biological process disorders as a result of a poor diet. Nutritional disorders are the foremost common reason for illness and death in aquarium, tank or fishpond fishes. During the past 20 years, there has been tremendous development in aquaculture. As aqua farming continues to expand worldwide, production strategies have shifted from ancient in depth to change in depth, semi-intensive and intensive systems utilizing modern facilities, equipment's and management practices aimed toward producing higher yields per unit area. Natural food constitutes a very important source of nutrients for in depth and improved in depth culture systems, whereas artificial feeds are needed for semi-intensive and intensive practices. In fish and crustacean aquaculture the feed conversion ratio (FCR) falls in between 0.5 and 2.0 and therefore feed represents the main expense, usually accounting for over 50% of total operating cost.

NUTRITIONAL DISEASES

The yield of shrimps is directly proportional to the amount and quality of feed consumed by them. The standard refers to the presence of all the nutrients and sub nutrients within the required quantity for growth and development of

the shrimps. Shrimps need six nutrients and concerning thirty sub/micronutrients. Sub nutrients are the individual amino acids, vitamins, minerals and also the fatty acids. All of them is extremely essential for the growth and development of shrimps. In the case of shrimps, being a really short term crop, any deficiency in anyone of the nutrients can seriously have an effect on the growth and development. At every stage each nutrient or sub nutrient needed should be in time. During a long term crop there's time to make up any nutritionary deficiency that will be occurring at a while or alternative throughout the growing period. Typically commercial feed manufacturers, being such a lot preoccupied with most profit with minimum expenditure, don't take enough care to form positive that all the nutrients and sub nutrients are present within the feed. Therefore during a commercial shrimp rearing pond under intensive and high density stocking conditions the probabilities of occurring nutritionary deficiency are very high.

Poorly fed shrimps can lose their normal full and strong appearance. The shell becomes thin and flexible. Molting is delayed and as a result the whole growth and development process is retarded. Besides certain specific diseases associated with poor nutrition appear. Protein deficiency is directly joined with the development of the muscles and flesh and also the proteins needed for the shrimps are made of ten amino acids that the shrimps are unable to synthesis and therefore they need to be supplied through the feed. Shrimps require very high proportion (35- 45 %) of protein within the field. Shrimps require phospholipids rich in posphotidyl choline and phosphotidyl choline for normal growth, moulting, metamorphosis and maturation. Consequently the spawning, hatchability of eggs and larval survival are affected. Soft shell disease is often seen among the juveniles and adults. The infected shrimp can have soft and thin exoskeleton that appears bluish. They exhibit larger cannibalistic tendencies. The sub nutrients directly liable for this disease are calcium, potassium and phosphorus. About twenty make the most the energy absorbed is used for the formation of exoskeleton. Thus shrimps require terribly high energy feed and if the energy is less the exoskeleton can become soft shelled. Vitamin A is needed for the health and well-being of the internal and external epithelial tissues. Vitamin B complex has several forms and they are all playing major role in one or other metabolic activities. Vitamin C is needed for the chitin formation. It also causes

reduced food intake, poor conversion of food and high incidence of post moult death. Vitamin D is concerned within the calcium metabolism and vitamin e acts as an anti-oxidant within the feed besides playing a major role within the reproductive cycle.

TYPE OF NUTRITION DISEASES

➢ NUTRITIONAL GILL DISEASE

A condition affecting the gills of fish causing a swelling (hyperplasia) of the proximal portions of the gill filaments. Typical gill disease bacteria or parasites are absent. Fish with this condition exhibit a loss of appetite, are less active. Fish tend to congregate near the water inlet and have "flared" operculum's (gill covers). This disease is caused due to pantothenic acid deficiencies in the diet. Dry pelleted feeds which have been stored for extended periods and exposed to high temperatures are to blame.

➢ SUN BURN

A condition found only in salmonids. Characterized by a peeling or sloughing of the outer layers of the skin. Lesions usually occur on the dorsal skin, between head and dorsal fin. Outbreaks occur when fish in clear water are subjected to high levels of UV light. Dietary deficiencies of niacin contribute to the disease. Place sunshades over ponds to eliminate the problem. Sun burn can be a "portal of entry" for invasive bacteria or fungal spores.

➢ AFLATOXICOSIS

Aflatoxicosis is caused by the contamination of feedstuffs by the fungus, Aspergillus flavus. The toxins produced by the fungus are collectively known as aflatoxins. The fungus is enhanced by moist conditions and warm temperatures. Aflatoxins have been known to produce liver hepatomas in trout. There are no early external signs of the disease. Tumors can be recognized as small gray-white or yellow nodular lesions within the liver. There are no treatments for affected fish. Remove damaged feed and keep feed sacks in cool, dry room.

➢ FATTY INFILTRATION OF THE LIVER

Feeding of high fat diets may result in this condition. The liver of trout with this condition are yellow to pale orange in color, swollen and sometimes greasy in appearance. Retention of body fluids often accompanies this condition and is due to altered liver functions. Histologically, there are intracellular fat droplets which are absent in normal trout livers. Treat condition by eliminating high dietary fat intakes, especially if they exceed 18-20% of the diet.

➢ LORDOSIS AND SCOLIOSIS

Curvature of the spinal column in trout and salmon. Condition is caused by a lack

of vitamin C in trout diets. Fish can survive with this condition in a hatchery environment; however once stocked survival decreases due to the erratic behavior of the fish. Increase vitamin C in the diet. Curvature of the spine is not reversible. It is best to destroy these fish than stock them in a stream or lake.

➢ CATARACTS

Cloudiness or opacity of the crystalline lens of the eye, often leading to blindness. This is due to a deficiency of vitamin B12. These fish lose the capacity to evaluate distance. As a result the fish lose the ability to attack prey or find food in the natural environment. May lose the ability to avoid predators. Fish lose weight and death is possible.

➢ ANEMIA

Anemia could be a heart and blood vessel condition that is recognized by the low number of red blood cells found within the animal. It will have an effect on many varieties of fishes, thus be observant of your pet and take your animal to the veterinarian if anemia is suspected.

➢ FISH SCURVY

Ascorbic acid deficiency is the primary cause of scurvy. Nutrient deficiency rarely occurs naturally when diets have been formulated and prepared based on the species' requirement. However, some commercially-available diets for another species may sometimes be used in the absence of a suitable formulation, resulting in deficiencies. Spinal deformity associated with ascorbic acid deficiency has been reported to occur naturally in Cromileptes altivelis postlarvae in Indonesia. Natural occurrence in grow-out farms has also been reported in Epinephelus tauvina and E. malabaricus in Thailand.

➢ LIPODOSIS

Feeding with rancid formulated feeds or with fatty or poorly stored trash fish can cause lipodosis. Lipodosis is a common nutritional disease among cultured food fish and various degrees of lipodosis have been observed in the liver of cage-cultured groupers including Epinephelus coioides, E. malabaricus and Cromileptes altivelis in Indonesia, Thailand and the Philippines.

➢ EFA DEFICIENCY

This condition is associated with low levels of essential fatty acids in live food. Deficiency in these fatty acids is associated with larval mortality known as "shock syndrome" in which the larvae display unusual sensitivity to stress. Any handling or disturbance (e.g., sorting, transfer, strong aeration) of grouper larvae with this condition invariably results in mortality. This disease has been reported in Epinephelus malabaricus in

Thailand and in E. tauvina and E. fuscoguttatus in Singapore.

Nutritional Myopathy Accompanying Ceroidosis

This disease is associated with diets containing rancid fat or polyunsaturated fatty acids and low contents of vitamin E. Lipid peroxidation can occur both in solution and in the cell because unsaturated fats are highly susceptible to oxidants. When peroxidation occurs in the cell membrane, cellular integrity is compromised that could lead to certain myopathies.

THIAMIN DEFICIENCY

Deficiency of vitamin B1 (thiamin) caused by thiaminase contained in sardine or anchovy as feed. Some species of fish belonging to the sardine and anchovy families contain enzymes that degrade thiamin contained in the trash fish itself. This is usually not a problem when trash fish are of mixed species or different species are fed alternately, but deficiency signs appear when single species are fed for extended periods.

REASONS AND PREVENTION OF DISEASES

1. ***Nutritional Imbalance In Commercial Food***

Fishes is either herbivores, carnivores or omnivores. And though commercial food is on the market for fishes, a nutritional disorder will still occur as a result of every species of fish features a completely different nutritional demand that is not perpetually fulfilled by the commercial food. Therefore, fishes can need quite one type of commercial food to satisfy their dietary demand.

2. ***Incorrectly Stored Food***

Improperly stored food is one more reason fishes acquire nutritionary disorders. Dry food should be stored in a cool, dry place and replaced after 2 months.

3. ***Vitamin Deficiency***

Nutritional disorders in fishes also can be due to a vitamin deficiency. Vitamin C deficiency results in Broken back disease – wherever the backbone of the affected fishes get bent (deformed). Vitamin B-complex (thiamin, biotin, niacin, and pyridoxine) deficiency will cause brain, spinal cord and nerve disorders in fishes. Unfortunately, vitamin deficiency is diagnosed only when the fish's death. Therefore, it is necessary to give vitamin-rich diet to the fish.

4. ***Infected Live Food***

Food that is alive and infected with microorganism, viruses, fungi and parasites will lead cause problem in your fishes. To stop such infectious diseases, get live food only from reputable sources.

5. ***Feed Toxicity***

Nutritional disorders caused by toxins found in food occur often in aquarium fishes. The foremost common of those is that the aflatoxin produced by the growth of the mold, aspergillus flavus, within the stored food. Aflatoxin causes tumors and is fatal in fishes. Store your fish food hygienically and replace it every 2 months, or once there appears to be mold in it.

PREVENTIVE TREATMENT

Treatment for any fish disorder or disease is difficult. Therefore, it is important you are careful storing food, and that you take any other preventative measures.

CONCLUSIONS

The subject of nutrition, immunological perform and disease resistance in fish and other aquatic animals is a vital area of analysis however clearly in its infancy. Investigations during this area holds great promise with respect to reducing the impact of diseases in aquatic animals. Recent reports on stimulatory effects of large doses of water-soluble vitamin and E are of practical interest for disease prevention, however, the value of those vitamins and usage of those results under farm conditions requires more analysis. Diets formulated to match the nutrient needs of fish may be used effectively with vaccines and chemotherapeutants to stop and probably eradicate infectious diseases. Use of prime quality feed ingredients free from contaminants, proper nutrient balance in feed formulation, prevention of micronutrients loss throughout feed processing, better handling, storage and feed management even have good potential to improve health of aquatic animals.

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Antimicrobial Finishes on Textiles

Neeta Singh* and Parveen Punia**

** Assistant Professor, Textiles and Apparel Designing Department, ASPEE, College Of Home Science and Nutrition, S.D.A.U, S.K Nagar*

*** Professor, I.C College of Home Science, CCS HAU, Hisar, Haryana*

Textiles have always played a central role in the evolution of human culture by being at the forefront of both technological and artistic development. The protective aspects of textile have provided the most textile ground for innovative developments. Hygiene has acquired importance in recent years. Odour has become an important factor. Unpleasant odour can arise from the acquisition of a variety of compounds produced in bodily fluids such as perspiration."Consumers are looking for solutions to odour and microbial problem and the unique benefits provided by antimicrobial finish". In recent years, great interest in the antibacterial finishing of fibres and fabrics for practical applications has been observed. Most textile materials currently used in hospitals and hotels are conducive to cross-infection or transmission of diseases caused by micro-organisms. Textiles for medical and hygienic use have become important areas in the textile industry. In general, antimicrobial properties can be imparted to textile materials by chemically or physically incorporating functional agents onto fibres or fabrics.

Necessity of antimicrobial finishes

Antimicrobial treatment for textile materials is necessary to fulfill the following objectives:

1. To avoid cross infection by pathogenic micro organisms.
2. To control the infestation by microbes.
3. To arrest metabolism in microbes in order to reduce the formation odour.
4. To safeguard the textile products from staining, discolouration and quality deterioration.

Requirements for Antimicrobial Finish

Textile materials in particular, the garments are more susceptible to wear and tear. It is important to take into account the impact of stress strain, thermal and mechanical effects on the finished substrates. The following requirements need to be satisfied to obtain maximum benefits out of the finish:

- Durability to washing, dry cleaning and hot pressing
- Selective activity to undesirable microorganisms
- Should not produce harmful effects to the manufacturer, user and the environment
- Should comply with the statutory requirements of regulating agencies
- Compatibility with the chemical processes
- Easy method of application
- No deterioration of fabric quality
- Resistant to body fluids
- Resistant to disinfections/sterilization.

Antimicrobial Finishing Methodologies

The antimicrobial agents can be applied to the textile substrates by exhaust, pad-dry-cure, coating, spray and foam techniques. The substances can also be applied by directly adding into the fibre spinning dope. It is claimed that the commercial agents can be applied online during the dyeing and finishing operations. Various methods for improving the durability of the finish include:

- Insolubilisation of the active substances in/on the fibre.
- Treating the fibre with resin, condensates or cross linking agents.
- Micro encapsulation of the antimicrobial agents with the fibre matrix.
- Coating the fibre surface.
- Chemical modification of the fibre by covalent bond formation.
- Use of graft polymers, homo polymers and/or co polymerization on to the fibre.

Mechanism of antimicrobial activity

Negative effect on the vitality of the micro organisms is generally referred to as antimicrobial. The degree of activity is differentiated by the term cidal, which indicates significant destruction of microbes and the term, static represents inhibition of microbial growth without much destruction. The activity, which affects the bacteria, is known as antibacterial and that of fungi is animistic. The antimicrobial substances function in different ways. In the conventional leaching type of finish, the species diffuse and poison the microbes to kill. This type of finish shows poor durability and may cause health problems. The non-leaching type or biostatic finish shows good durability and may not provoke any health problems. A large number of textiles with antimicrobial finish function by diffusion type. The rate of diffusion has a direct effect on the effectiveness of the finish. For example, in the ion exchange process, the release of the active substances

is at a slower rate compared to direct diffusion ad hence, has a weaker effect. Similarly, in the case of antimicrobial modifications where the active substances are not released from the fibre surface and so less effective. They are active only when they come in contact with micro organisms. These so-called new technologies have been developed by considering the medical, toxicological and ecological principles. The antimicrobial textiles can be classified into two categories, namely, passive and active based on their activity against micro organisms. Passive materials do not contain any active substances but their surface structure (Lotus effect) produces negative effect on the living conditions of micro organisms (Anti-adhesive effect). Materials containing active antimicrobial substances act upon either in or on the cell.

Benefits of antimicrobial textiles

A wide range textile product is now available for the benefit of the consumer. Initially, the primary objective of the finish was to protect textiles from being affected by microbes particularly fungi. Uniforms, tents, defence textiles and technical textiles, such as, geo-textiles have therefore all been finished using antimicrobial agents. Later, the home textiles, such as, curtains coverings, and bath mats came with antimicrobial finish. The application of the finish is now extended to textiles used for outdoor, healthcare sector, sports and leisure. Novel technologies in antimicrobial finishing are successfully employed in nonwoven sector especially in medical textiles. Textile fibres with built-in antimicrobial properties will also serve the purpose alone or in blends with other fibres. Bioactive fibre is a modified form of the finish, which includes chemotherapeutics in their structure, ie, synthetic drugs of bactericidal and fungicidal qualities. These fibres are not only used in medicine and health prophylaxis applications but also for manufacturing textile products of daily use and technical textiles. The field of application of the bioactive fibres includes sanitary materials, dressing materials, surgical threads, materials for filtration of gases and liquids, air conditioning and ventilation, constructional materials, special materials for food industry, pharmaceutical industry, footwear industry, clothing industry, automotive industry, etc.

Evaluation of antimicrobial finishes

The AATCC Technical Manual 12 has a number of test methods that are useful for evaluating antimicrobial finishes on textiles. These tests are summarised in Table 1. Two types of antimicrobial tests are dominant,

the agar-based zone of inhibition tests and the bacteria counting tests. The relatively new ISO/DIS 20645 and the corresponding EN ISO 20645 are based on the agar diffusion test and ISO 11721 is a burial test (part 1 for the determination of an antimicrobial finish and part 2 for the determination of the long-term resistance). The main difficulties of these tests are mostly poor reproducibility of the test results and often insufficient correlation between laboratory results and actual conditions in the field. Careful attention to detail and trained laboratory personnel are essential for accurate and repeatable results from these methods.(Schindler & Hauser, 2004). A more rapid test method, developed by the British Textile Technology Group in the late 1980s, is based on adenosine triphosphate (ATP) luminescence. The growth of microorganisms is assessed by firefly bioluminescent detection and ATP analysis.

Table 1. Comparison between different AATCC test methods

AATCC test method Comments	AATCC test method Comments
Antibacterial activity of textile materials: parallel streak method; test method 147(agar plate test)	antibacterial activity of treated textile materials against both Gram-positive and Gram-negative bacteria. Treated material is placed in nutrient agar that is streaked with test bacteria. Bacterial growth is determined visually after incubation. Antibacterial activity is demonstrated by zones of inhibition on and around the textile.
Antibacterial finishes on textile materials, assessment of: test method 100	Quantitative method for determining the degree of antimicrobial activity of treated textiles. The amount of bacterial growth in inoculated and incubated textiles is determined through serial dilutions and subsequent inoculations of sterile agar. Gram positive and Gram-negative bacteria are used.

Antifungal activity, assessment on textile materials: mildew and rot resistance of textiles; test method 30	Four methods for determining the antifungal assessment on textile properties of treated textiles. One method involves testing fabric properties after burial in soil that contains fungi. In a second method, cellulose fabric is textiles; exposed to *Chaetomium globosum* in an agar plate and the subsequent growth visually determined. The third method exposes textiles to *Aspergillus niger* in an agar plate and visually determines any fungal growth. The fourth method uses a humidity jar to expose textiles to mixture of fungi spores. Any growth on the textile is visually determined.
Antimicrobial activity assessment of carpets; test method 174	Methods are given for the qualitative and Quantitative determination of antibacterial activity and the qualitative evaluation of antifungal properties of carpet samples using procedures and materials similar to those in the above test methods.

CONCLUSION

With advent of new technologies, the growing needs of the consumer in the wake of health and hygiene can be fulfilled without compromising the issues related to safety, human health and environment. Taping new potential antimicrobial substances, such as, Chitosan from nature can considerably minimise the undesirable activities of the antimicrobial products. Scientists all over the globe are working in the area and a few of them reported to have used antimicrobial finishes and fluoro chemicals to make the fabric having antimicrobial as well as blood repellant properties. Chitosan and fluoro polymers are reported to be most suitable finishing agents for medical wears with barriers against micro organisms and blood. To carve a niche for textile materials, this kind of value adding finishes are the need of the hour.

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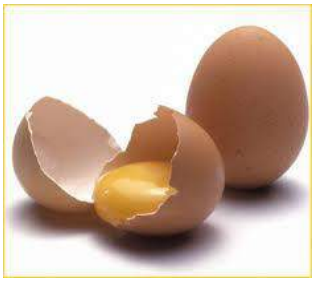
Decontamination of Egg shells using UV light- a promising technique

Anushree Y. Meshram[1] and A.P. Singh[2]

[1]Ph .D Scholar, DCB Division, National Dairy Research Institute

[2]Veterinary Officer, Sonbhadra district, Uttar Pradesh

Poultry is one of the fastest growing segments of the agricultural sector in India today. India is now the world's fifth largest egg producer and the eighteenth largest broilers producer. Eggs are an important and well-balanced source of essential nutrients. Egg yolks and whole eggs are a good source of protein and choline. Poor egg shell quality is a huge hidden cost to the egg producer. Estimates are that more than 10% of eggs produced in the hen house are uncollectible or break before intended use. The economic losses for the breeders will be even more due to reduced hatchability and chick livability. Therefore, every effort must be directed towards improving shell quality and reducing egg shell contamination. Decontamination of egg shells is required to improve the microbiological safety of the fresh hen eggs used for human consumption or for hatching. Conventional chemical decontamination methods involving quaternary ammonium disinfectant, sodium hydroxide, phenol, hydrogen peroxide or formaldehyde, leave residues on egg shells that may damage the cuticle layer. Therefore, new techniques of egg shells



decontamination, such as ultraviolet (UV) radiation, have been developed. Hence, the treatment with UV light has a competitive advantage in comparison with traditional egg shell sanitation treatments for decontamination.

Principles of UV light treatment

UV light is emitted by electric arcs and specialized lights such as mercury lamps and black light systems. These systems are designed to produce UV light with a specific wavelength range, in accordance with the proposed use. The range of UV wavelength is between 10 nm and 400 nm. Ultraviolet (UV) light is the unique technology. UV-light is electromagnetic radiation in the spectral region classified into the following wavelength ranges: UV-A (315-400 nm) are normally responsible for changes in melanin human skin called tanning, UV-B (280-315 nm) light is absorbed by the ozone layer in proportion of around 97%.

Table1: The range of UV wavelength

Name	Abbreviation	Wavelength range, in nm	Energy, in eV/ photon	Alternative names
Ultraviolet A	UV-A	315-400	3.10 - 3.94	Short wave, germicidal
Ultraviolet B	UV-B	280-315	3.94 - 4.43	Medium wave
Ultraviolet C	UV-C	200-280	3.10 - 3.94	Long wave, black light

A small portion of the light reaches the surface of the earth and may cause damage to the living microorganisms, UV-C (200-280 nm), and Vacuum-UV (100 nm-200nm) (International Ultraviolet Association, 2009). UV-C light possesses germicidal properties. It deactivates the DNA of bacteria, viruses, and other pathogens and, thus, destroys their ability to multiply and cause disease.

Advantages of UV light treatment

The importance of eggs for human consumption and hatching in conjunction with the high susceptibility of microbial contamination has led to the necessity of egg shell sanitation. Chemical sanitizers are prone to damage eggs cuticle layers and besides limited effectiveness in reducing pathogens the residues it could represent a chemical hazards to food safety. To avoid these negative aspects, new non- destructive, non- thermal methods were investigated.

1. UV light treatment achieved significantly greater reductions in bacterial population of clean and recently contaminated egg shells compared with methods in which chemical sanitizers were used
2. UV light treatment ensured significant reductions of Salmonella spp., the most frequently present pathogen reported in eggs
3. UV light treatment facilitates the hygiene control of the transportation system and enables rollers decontamination
4. It also allow elimination of microorganisms could be achieved at low temperatures and under relative dry conditions
5. UV light has at high intensities and low time periods has the potential to reduce APC of the egg shells
6. S. typhimurium treated with UV light on egg shells did not recover after subsequent incubation under dark or light conditions

7. UV light treatment of hatching eggs in a prototype cabinet can effectively reduce the aerobic and pathogenic bacteria on the eggshells without affecting either egg shell conductance or eggs hatchability
8. Salmonella was effectively inactivated on egg shells in a short time and at low temperature with the use of a combination of UV light and ozone treatment

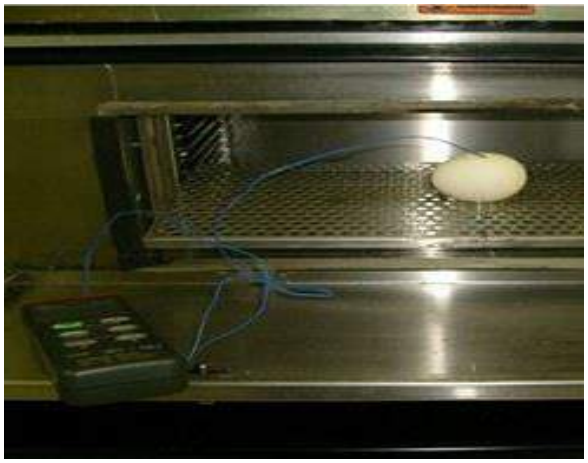
There are two basic methods of UV-light treatment: continuous UV light and pulsed UV-light. Continuous UV-light works with a mercury lamp which emits monochromatic light (XENON, 2005). This method requires long duration of exposure to UV light in order to ensure sufficient treatment.

1. UV light inactivation of microorganisms on egg shell

UV light is lethal to most microorganisms found in air, water or on hard surfaces. Cell inactivation is based on the damage of nucleic acids (DNA and RNA) under UV light. Nucleic acids absorb UV light from 200 to 310 nm. Absorbed UV light causes the breaking of some bonds and the formation of pyrimidine dimers, which are bonded to the adjacent pairs of thyamine or cytosine pyrimidines on the same RNA or DNA strand. These dimers prevent cells from replicating, so microorganisms become inactive and unable to proliferate (Koutchma *et al*., 2009).Exposing egg shells to a UV-C light intensity of 1.72mW/ cm^2 whilst rotating the eggs at one revolution per min resulted in aerobic bacteria, yeast and mould populations being significantly reduced.

2. Pulsed UV-light

Pulsed UV-light is a novel technology which is more efficient and faster than



conventional continuous UV-light method (Bialka, 2006). Pulsed UV-light is generated by a xenon gas lamp by using a modest energy input that can yield high peak power dissipation. The pulsed light lamp generates a continuum broadband spectrum from deep UV to the infrared, which is rich and efficient in the UV range (Demirci and Panico, 2008). The pulsed light flashes are created by compressing electrical energy into short pulses, which energize an inert Xenon gas lamp. The lamp emits an intense flash of light with

duration of a few hundred microseconds. Various studies have shown that this new technology can eliminate pathogenic and spoilage microorganisms on raw and minimally-processed foods such as egg shells. In 1999, FDA approved pulsed light treatment of foods (Federal Register, 1999). Pulsed UV-light is a non-chemical method and considered to be non-thermal for short treatment times. In addition, this novel technology can be an alternative to irradiation, which may cause ionization of small molecules in food components due to the very short wavelength (Dunn et al., 1995). Ionization of the molecules may introduce some chemical changes in the food. Since, UV-light does not involve very short wavelength ranges, it is not considered to cause ionization. Various researchers have investigated the effectiveness of pulsed light on the microbial loads of foods. Dunn (1996) studied the application of pulsed light to foods and eggs.

CONCLUSIONS

The UV light and pulsed light processing is a new concept and has many applications in the food industry as a non-thermal technique of egg shell preservation. While developing the applications of pulsed light processing, it is to be taken into consideration that the food to be processed, the microbial type and load affect the efficacy of the treatment. Though with some limitations, if complemented with other processing techniques this technology can help in better shell preservation with minimal effects on the egg shell quality.

Potential of Indigenous Technical Knowledge (ITK) In Livestock Production

Mridula Tiwari[1], Jayant Goyal[2], Mahavir Chaudhari[3] And Ranjana Sachan[2]

[1]Government Veterinary Officer, Uttarkashi, Uttarakhand
[2]PhD scholar, Division of Veterinary Extension Education, IVRI, Bareilly
[3]PhD scholar, Department of AGB, LUVAS, Hisar

In the recent past, the term 'indigenous technology' has gained momentum in every field of development including agriculture and livestock. Indigenous technical knowledge (ITK) refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area (Grenier, 1998). Local knowledge represents successful ways in which people dealt with their environments. It is the information base for a society which facilities communication and decision making. ITK is the basis of agriculture, livestock, health care, food preparation, education, environmental conservation and a host of other activities. ITK is shared and communicated orally, by specific examples and through culture. Now a days the policy makers, the scientific community and the extension workers started recognizing the value and importance of ITKs in agriculture.

Importance of ITK

The basic characteristics of ITK provide for conservation and efficient utilization of resources by being eco-friendly, less capital intensive, cost-effective, efficient bi-product and waste recycling and use. Most of the ITKs are location – specific, using locally available materials and are products of informal research. ITKs are found to be socially desirable, economically affordable, sustainable and involves minimum risk to users and widely believed to conserve resources. Thus, ITK provides basis for problem solving strategies for local communities. ITK is important not only for culture and society from which it emerges also from introduction of new technologies by extension workers by developing new technologies by scientists and for funding and technology oriented projects by research managers, administrators and planners. The success of a development program depends upon local participation and familiarity with the indigenous farm technology, which helps

the extension agents understand and communicate with the local people.

Documented ITKs for Promoting Sustainable Livestock Development

The intensive livestock farming resulted in depletion of nutritional status of soils, erosion of bio-diversity, natural habitats, forests and water resources. Indiscriminate use of chemical pesticides and fertilizers affected the agro-ecosystems, caused pollution of soil and water resulting in human and animal health hazards and contributed significantly to destabilize the traditional systems of agriculture. The traditional livestock management practices have been classical examples of non-exploitative and non- polluting methods of farming leading to sustainable development. A select list of such documented practices given below:

- Spices of mango pickles (afara) and neem leaves are fed to animal to cure bloat.
- Bael (wood fruit) used to check Diarrhoea in animals.
- For curing lesions of Foot and Mouth disease in cattle a bandage with jowar, kerosene and yellow soil is applied or the hooves and mouth are washed with warm salt solution, and the mixture of leather ash and Sesame oil is applied or groundnut oil is applied to affected area or animal is kept standing in mud for 5-6 hrs or 500 gm tulsi leaves extact is administered.
- Leaves of 'Dikkamani' (Gardenia resinifera) and seeds of 'Bendval' (Dendrophthoe falcata) plant mixture or oral administration of castor oil mixed with neem leaf or bark extract is fed to animal to cure the constipation within a day.
- To cure swelling of udder caused due to Mastitis, bites of poisonous insects or mechanical injury or improper milking, 200 grams of soil from the termite mounds is collected and boiled in water, and the boiled suspension is applied to the affected part to give relief to the animal within a day. This is very effective in summer, not so effective in monsoon season. Also 250 gm ghee + 150 gm jaggery + 250 gm black salt is also given to animal.
- Flatulence caused due to excessive grazing or feeding of green fodder which is common during the monsoon, can be cured by giving whey milk, onion and leaves of custard apple to the animal.
- For the animal suffering from gastric trouble, 10 grams of Hing (asaphoetida) is dissolved in 500 grams of edible oil and given to have a carminative action.

- For de-worming the young calves, a small quantity of curd or buttermilk is kept in a copper container overnight to get a blue-green colour, diluted and given. The effect is seen from the next day.
- Neem leaves and turmeric powder is used as a paste on external injuries to cure the wounds and other skin disorders.
- Hot fomentation with bags containing salt and boiled Tamarind leaves is used to relieve sprains and inflammation in cattle.

Fig. Various sources of ITK used in treating different ailments in livestock rearing

- ITK in wound management could be extract of brinjal leaves or juice from the leaves of ramban or 2-3 teaspoon cow ghee plus 1 teaspoon camphor powder.
- Fine paste from 100-200 gm *adsangal* plant or 200 gm turmeric + 500 gm human hair +oil is used to relieve bone fracture.

Merits and Limitations of ITK

ITKs play significant role in promoting sustainable livestock development. While, ITKs definitely have lot of potential in this regard, we must understand and appreciate their specific merits and limitations. This should guide us in selection of proper ITKs for blending with modern technology in the overall interest of sustainable livestock development.

Merits of ITK: ITKs are location specific and hence readily fit in to the scheme of sustainable development. They use the creative wisdom and intelligence of local rural masses. Hence, by fostering ITKs, we can enhance innovation ability of rural people. It also encourages judicious use of locally available inputs or resources. Thus, by promoting ITKs, we can reduce the pressure on use of external and costly resources and inputs. This will also help in protecting the environment from degradation and pollution.

Limitations of ITK: While ITK provides for initial self-belief and confidence needed to counter the fatalism of the poverty and leads to some form of self-development, it has its own limitations. ITK is from uniform distribution either within or across communities as distribution depends upon the capacity of the individuals to manage the knowledge, monopolization of knowledge and specific groups of economic stratification. Therefore, indigenous technology cannot be manipulated

independently of social, political, economic structures, it occurs.

CONCLUSION

ITK is a valuable resource for development. When the use of ITK in agriculture was studied, it was found that most of them are in use in complex diverse and risk prone areas, practiced mostly by small and marginal farmer in developing countries. These ITK have scientific parameters, and, the latest approach in the technology generation of scientific agriculture include ITKs integration into the research process by testing their scientific validity for providing comprehensive and effective location-specific solutions in agriculture. Yet ITK is still an underutilized resource in the development activities. It needs to be intensively and extensively studied and incorporated into formal research and extension practices in order to make rural development strategies more sustainable. Special efforts are needed to understand, document and disseminate ITK for preservation, transfer or adoption elsewhere.