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SUMMARY OF FINAL PROGRESS REPORT

Title

LOCAL FRESHWATER FISH CULTURE IN POND

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Abstract: The present study deals with the composite fish culture in fresh water pond. The water spread area of tank is 48square metre with a depth of 0.2 to 1.25 metre. Four major carps namely, *Labeo rohita, Catla catla, Cirrhina mrigala* and *cyprinus carpio* are selected for culture. The fingerlings of major carps are stocked and reared for six months in the said pond. Only raw cattle dung was applied during the culture period, initially at the rate 3000kg/ha proportionally before the stocking of the seed and 1000kg/ha after the three months of stocking respectively. Monthly growth of fishes is analyzed. Growth rate of *C carpio* is found to be more, while the survival rate of was found more in case of *Labeo rohita.* The survival rate ranges from 39.21 % to 51.34% and the total production of said pond was 10.36 kg/m^2/6 months of fish obtained.

Introduction:

Fish is an important food component for populations of many countries. For food fish, over a quarter of total world supply is derived from aquaculture and contribution of the latter increases quickly. Several types of fish culture can be distinguished, according to their degree of intensification, or depending on the fish feeding: mostly natural food or exogenous high protein feed. But pond production remains the most used as it permits a multipurpose production (fry, fingerlings, adults) with a wide spectrum of utilization (from extensive to hyper-intensive). The main cultivated freshwater species belong to carps (Indian and Chinese carps) and tilapia. Their biological characteristics are reviewed. Management and improvement of environmental factors can achieve fish reproduction in captivity, but most frequently, it is done using hormonal treatment: pituitary extracts, gonadotropin or GNRH with or without antagonists-inhibitors.

Fish nutrition requires high levels of protein, but expensive fishmeal can be partially replaced by vegetal protein for some herbivorous species (tilapia), or by lipids and carbohydrates as many proteins are used as an energy source. But the most important factor in many aqua cultural farms is the management of the pond ecosystem and the definition of adequate stocking. Natural feed for fish can be stimulated by fertilization. Mineral fertilizers stimulate the autotrophic-based food chain, whereas organic manures improve both the autotrophic and heterotrophic food chain, thus allowing higher fish crops. Pond stocking must be defined in order to be as close as possible to the bio-technical-economic optimum. When too low, natural productivity is under-exploited and yield is low. When to high, fish growth decreases quickly and use of an expensive artificial feed become necessary. Another way of improving pond productivity consists in breeding several species with complementary feeding regimes. This is polyculture and several examples practiced around the world are given. Finally, some fish farming systems are considered from the economical point of view. Integrated systems have a higher profitability and systems that associate aquaculture to livestock breeding may show a contribution of fish to net income higher than 50%. These trends are encountered in several areas worldwide.

Freshwater aquaculture is the most ancient aquatic living resource production system known in the world. It strikes root in more than 2500 years of history. Fish is the main, if not the only, component of freshwater aquaculture and earthen pond is historically the first and still the most utilized aquaculture production facility (contribution for more than 80–85% of the total freshwater production).

Freshwater aquaculture differs from other aquaculture systems by some characteristics. It allows a strong integration to the agricultural production systems (crops and livestock) at different levels: water use, wastes recycling into the fishponds as fertilizers, agricultural by-products as fish feed. Freshwater aquaculture production is mainly based on the culture of short food chain fish (carps, tilapias) and differs basically from marine fish culture based on carnivorous fish (salmon, Japanese amberjack). Freshwater aquaculture is mainly based on extensive and semi-intensive aquaculture production systems where polyculture, fertilization, and supplementary are the key points.

In 1995, freshwater aquaculture accounted for 65% of the total aquaculture production, if aquatic plants are excluded. Asian countries are the main aquaculture producers and in these countries, freshwater fish culture plays a major role: China, India and Indonesia (67%, 6.7%, and 3.1% of the total world aquaculture production respectively).

In the last decades, major bio-technical innovations have had a strategic impact on the freshwater aquaculture development: artificial breeding, use of supplementary feeding and artificial feed, genetic improvement, introduction of exotic species to many countries for aquaculture purposes. Despite all the scientific studies carried out in this field, the pond as a culture environment remains a black box where fish feeds at many levels of the food web and fish species interact actively.

The progresses in pond fish culture management practices have mainly been obtained by a trial and error process. This contribution aims at presenting the main available data concerning scientific and technical bases, and practices in the field of freshwater aquaculture.

Material and Methods:

Firstly the site for ponds selected in low lying area in the College premises. Accordingly pond excavated, its vertical walls are constructed. Then its bottom or bed prepared so that it was approximately free from aquatic plants, grass and suitable for producing natural fish food i.e. zooplankton, phytoplankton etc. for cultured fish species. Pond administered with manure, liming for better growth and flourish of fish food. The physic-chemical parameters of pond water was timely checked (APHA-2005), the growth of aquatic weeds ,aquatic insect kept under control so that it does not show adverse effect on cultured fish species.

The fish seed of Indian major carp and exotic carp was purchased from Govt. of Maharashtra fish hatchary center, Baslapur ,Dist Amravati and brought to the fish culture pond in college premises. After checking physic-chemical parameters of pond water, during morning hours fish seeds were released in pond for Polyculture.

A major drawback in trials to relate the primary production to fish production is the diverse methodology used to measure the plant photosynthesis in water. It was measured ^{14}C or oxygen changes inside the dark and light bottles with short incubation time (Melack, 1976; Noreiga-Curtis, 1979) or sometimes as long incubation as a day (Liang et al., 1981). Another approach is the direct measurement of diet changes of oxygen concentration in the whole water body (McConnell et al., 1977). These methods approximate the gross and net primary productions. In the hypertrophic, highly productive fish-rearing ecosystems, the light and dark bottle method, especially with a long incubation time, underestimates the primary production. In these waters, the most suitable approach is the direct measurement of the diel oxygen concentrations. In the present study, this in situ method of measuring the concentration with an oxygen electrode was used. The mean magnitudes of primary production were calculated using an earlier developed model with seven-measuring points during a diel cycle (Olah et al., 1978). In the case of 18 undrainable rural fish ponds, diurnal variations of dissolved oxygen were monitored with three measuring points and the McConnell (1962) equation was used to calculate the primary production.

Pond Management

Pond Management plays a very important role in fish farming before and after the stocking of fish seed. Various measures that are required to be undertaken in pre and post stocking practices are tabulated below:

a) Prestocking:

In case of new ponds, pre stocking operations starts with liming and filling of the pond with water. However, the first step for existing pond requiring development deals with clearing the pond of unwanted weeds and fishes either by manual, mechanical or chemical means. Different methods are employed for this.

i) Removal of weeds by Manual/Mechanical or through Chemical means.

ii) Removal of unwanted and predatory fishes and other animals by repeated netting or using mahua oil cake @ 2500 kg/ha metre or by sun drying the pond bed.

iii) Liming - The soils/ tanks which are acidic in nature are less productive than alkaline ponds. Lime is used to bring the pH to the desired level. In addition lime also has the following effects -

a) Increases the pH.

b) Acts as buffer and avoids fluctuations of pH.

c) It increases the resistance of soil to parasites.

d) Its toxic effect kills the parasites; and

e) It hastens organic decomposition.

The normal doses of the lime desired ranges from 200 to 250 Kg/ha.

Species combination (ratio)

Species	3-species	4-species	6-species
Catla	4.0	3.0	1.5
Rohu	3.0	3.0	2.0
Mrigal	3.0	2.0	1.5
Silver Carp	-	-	1.5
Grass Carp	-	-	1.5
Common Carp	-	2.0	2.0

Since the market demand for Indian major carps are very good especially that of Catla and Rohu, the model is prepared based on the stocking of Indian major carps alone in the stocking density mentioned above.

RESULTS

Monthly growth of fishes is analyzed. Growth rate of *C carpio* is found to be more, while the survival rate of was found more in case of *Labeo rohita*. The survival rate ranges from 39.21 % to 51.34% and the total production of said pond was 10.36 kg/m^2/6 months of fish obtained.

DISCUSSION

Production efficiency levels computed in fish ponds during the present study were compared with the published results from various sources, covering the temperate and tropical lakes and reservoirs . Among the 54 fish ponds tested in the present survey, those with stocking and inorganic fertilization and others with oxidized liquid pig manure exhibited stable primary production levels in the high ranges of 5.29 to 6.49 gC $m^{-2}d^{-1}$. The average primary production in the tropical undrainable rural ponds was low, but the range of variations was wide being 1.76 to 12.3 gC $m^{-2}d^{-1}$, the latter in pond 1 which is very near the theoretical upper limit of primary production for standing waters. The variation is a result of the differences in organic load, age, size and management practices.

The fish production in 27 water bodies of the temperate zone change between three orders of magnitude, the low values of 2.75 and 2.83 g $ha^{-1}d^{-1}$being in Lakes Superior and Huron (Oglesby, 1977) and the largest value of 3.9 kg $ha^{-1}d^{-1}$ in Lake Dalneye (Krohun, 1969). The range of variations in the tropical water bodies was smaller and the average fish production remained at a rather constant level in managed ponds except rural fish ponds (2.8 to 15.8 kg $ha^{-1}d^{-1}$).These values were 3.5 kg $ha^{-1}d^{-1}$ in simply stocked ponds, 10.4 in the stocked and inorganic fertilized ponds, 11.0 in the stocked and domestic sewage fed ponds, 18.0 in the liquid pig manured ponds and 28.1 in the stocked, inorganic fertilized and supplementary fed ponds.

The fish production efficiency varied over a wide range in both the temperate and tropical lakes and reservoirs. The mean value was larger for water bodies in the temperate zone. By applying the simple management of stocking, the efficiency increased more than ten times and the range was narrow. At the level of inorganic fertilization with stocking, primary and fish productions were high, but the efficiency decreased. High efficiency was obtained for both types of organic fertilized fish ponds. The high efficiency was, however, the result of the bacterial food chain which has great importance in these organic loaded systems. The highest efficiency was observed in fish ponds with supplementary feeding. Even with supplementary feeding, it may be emphasized that the natural food contributes considerably to a proper nutrition as well as utilization of the lowprotein feed applied.

SUMMARY

1. With higher levels of management practices, fish production seemed to depend to a lesser degree on the magnitudes of primary production. The latter however, sustained the higher trophic levels to the requirement and regulated the utilization of inputs. A universal relation between primary and fish productions could not be established.
2. There are many constraints in evolving a model describing the relation between primary production and fish production, including the methodologies employed and a variety of factors influencing the correlation, such as fish species, stocking density, nature of fertilization and feeding intensity.

Conclusion and Prospects

Although the total production of finfish from capture fisheries amounted to 92 million mt in 1995, only 61 million mt (live weight) or 66% was available for direct human consumption as "food fish". The remainder (31 million mt) was reduced into fishmeal and fish oil for use in animal feeding or for industrial purposes. Between 1984 and 1995, the volume of capture fisheries grew at an annual rate of 1.5%.

On another hand, aquaculture has been the world's fastest growing food production system with food fish production increasing at an annual rate of 10.9% over the same period, compared with 3.1% for terrestrial livestock meat production. Aquaculture's contribution to total world food fish landings has increased more than two fold between 1984 (11.5%) and 1995 (25.6%). Contribution of aquaculture to world total finfish production in 1995 reached 23% (70% of total freshwater finfish, 37% of total diadromous finfish and only 1.3% of total marine finfish). In terms of food supply, aquaculture produced 6.2% of the total world farmed animal meat production, ranking fourth in terms of global meat production (pig: 37.6%, beef and veal: 24%, and chicken meat: 20.9%).

Over 85% of total aquaculture food fish production came from developing countries and particularly from low-income food deficit countries, which supplied over 76% of total food fish output from aquaculture. In these countries, per capita aquaculture fish production increased from 1.2 to 4.5 kg between 1984 and 1995. The contribution of aquaculture (and particularly freshwater finfish aquaculture) to rural food security in developing countries is most probably much greater than reported in official country statistics because self-consumption by fish farmers and their families is not recorded.

In most leading aquaculture-producing countries in Asia, food fish plays a major role in human protein nutrition by supplying more than one third in the total animal protein intake: 35% in Vietnam, 41.1% in Thailand, 51.5% in the Philippines and up to 65.2% in Koran DPR. In Africa, although the continent had the lowest contribution to world's aquaculture production (below 0.4%), food fish play an essential role in supplying over 30% of the total animal protein intake of populations in countries such as Ghana (58.6%), Congo (45.3%), Malawi (44.2%), Senegal (37.8%), and Cote d'Ivoire (36.0%) among many others. This strong tradition of fish consumption should help aquaculture to develop in the forthcoming years. In Latin America, a specific characteristic of aquaculture is that it is mainly export oriented (shrimp and salmon) and freshwater fish culture accounts for only less than 20% by volume of total aquaculture production in 1995. By contrast, the bull of aquaculture food fish production in developed countries is generally restricted to the production of higher value food fish species for luxury or export markets, and concerns mainly marine or diadromons fish and shrimp.

For the future, it is expected that freshwater aquaculture will continue to provide the major part of output. The main species will most probably be the lower-value herbivorous and omnivorous finfish (and shellfish) that feed low in the aquatic food chain. These species are grown mostly in ecologically efficient and environmentally benign polyculture systems, less demanding in terms of inputs, widely integrated into the agriculture production system. This form of aquaculture will continue to supply substantial quantities of fish protein for large segments of the population in many developing countries and will be, most probably, the primary area of development for lower cost production.

In terms of fish biodiversity used for aquaculture purposes, the number of cultured fish species (taxa), increased by 34% between 1984 and 1994. However, freshwater fish culture production remains largely dominated by only 9 species, which account for 78% of the total production. All these species are herbivorous or omnivorous and feed low in the food chain. For example, in Latin America, in countries belonging to the Amazon River basin, in spite of the enormous existing genetic resources potential, very few native freshwater fish are being culture. Two trends seem to emerge at the beginning of third millennium: the look for fish species diversification requested by most fish farmers around the world and the need to improve the majority of farm-raised aquatic animals that are still very similar to their wild forms. Differently expressed, what will prevail in the future: will emphasis be put on genetic improvement of already cultivated species for which culture technologies are mastered or on domestication of “new” species of aquaculture interest among the 25 000 existing fish species. The limited existing research potential will need to choose for priorities, knowing that both processes have their controversial issues. Genetic improvement by means of gene manipulation and gene transfer is perceived as having a high level of risk for wild species and global environment as well as for consumers. The emergence of newly domesticated species may lead to increasing introductions outside of their natural range into countries willing to diversify their fish production.

In terms of fish feeding, it appears that most commercially available aqua feeds for extensive and semi-intensive pond farming systems are over-formulated irrespective of the potential natural food availability. Therefore, tremendous research work is still required to understand the mechanisms prevailing in fish culture ponds in terms of food web leading to fish production, fish interactions within polyculture and stocking rates with regard to optimal inputs aiming at minimizing feed wastage then reducing production costs, and maximizing benefits.

In terms of sustainable development, emphasis should be laid in the future on farming systems than can contribute positively to environmental improvement. Recycling of nutrients and organic matter as well as many types of wastes through integrated farming systems are long recognized as being environmentally sound. Rice-fish culture can help farmers reduce use of environmentally dangerous pesticides; waste-water-fed freshwater aquaculture can be used to recover excess nutrients from livestock sewage, night soil or agricultural by-products and wastes. Freshwater aquaculture thereby contributes reducing risks of eutrophication and pollution. Negative effects of aquaculture on the environment have been mainly associated with high-input, high-output intensive systems.