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Improving livelihood in tribal region of Chhattisgarh through integrated fish farming systems

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Abstract

This research work explains some of the in-station and on-farm research on livestock-fish or livestock-fish-crops integration in Bastar and some plain region of Chhattisgarh. The adoption of this technique however, depends on social acceptance coupled with the availability of such land situations and introduction of new formulated rations. The planktophagous species such as the Indian Major Carps directly gets benefits from the integration by filtering the bacteria-laden particulate matter from the livestock/poultry faeces. Other omnivorous species benefit indirectly by the increased feed availability of macrophytes and filamentous algae. Nevertheless, it is critical that the organic loading of the water be judiciously monitored to avoid adverse physico-chemical (such as deficit of dissolved oxygen, increase in ammonia concentration) and biological (blooms of blue green algae such as *Microcystis* spp and flagellates such as *Euglena* spp) environments for the cultured fish. In addition to fish livestock integration, rice fish integration was also considered in Bastar region as the terrain is undulating in Bastar which can be agro-ecologically classified in to upland (Marhan), sloppy midland (Tikra), midland (Mal) and lowland (Gabhar). However, it was found to be unsuitable in Chhattisgarh plains. The low lying segment gets flooded with the first monsoon rains in the month of June. This low land segment covers approximately 20% of the cultivable land. The soil is clayey and water logging is the main feature. Here mixed or synchronous farming, where rice and fish are grown together were taken for the study. Various designs of pond / trench refuse have been tried along with various percentage covered area of refuse with depth and size of trench, the population and size of fish also have an impact on the production potential from this farming system. Wild duck (Naghans) cum fish farming were also done at Village-Bolbola, Dist-Kondagaon, Bastar @ 300-350 birds/ha. 1200 kg of duck meat and 2600 kg of fish were produced during entire culture period. Pig cum fish farming with 40 piglets of improved T&D variety/ha pond.

Keywords: Rice, duck, integrated fish farming, livelihood security, polyculture, conservation of water

Introduction

Chhattisgarh consists of three agro-ecological situations consisting of Plains, Bastar plateau and the northern hills. Farming of live stock *viz.*, pigs, ducks, poultry birds, cattle rearing and fish farming is common in Bastar plateau and their integration is very popular in the tribal population. Integrated farming system is uncommon in Chhattisgarh plains, wherein the Indian Magur, *Clarias batrachus* and the common carp (*Cyprinus carpio*), have been polycultured and traditionally integrated with paddy crop. Fish cum livestock namely pigs and poultry (especially ducks and at times chicken) is popular in Bastar. Owing to the planktophagous nature of the Indian major carps (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) grass carp (*Ctenopharyngodon idella*) and the benthophagic nature of the common carp (*Cyprinus carpio*) are the preferred fish species. This approach of farming is continued to be adopted. However, in Bastar the integrated approach is boosting up production of agricultural yield per unit area, which is economically feasible and optimises the utilisation of farm resources. It has been proven beyond doubt that integrated livestock-fish-crops are not only technically feasible but economically viable.

Materials and Methods

The study on duck fish integration was done in four villages of Rajim area, Raipur, Chhattisgarh. Result shows that 300-350 ducks was the best carrying capacity found in one hectare of pond. Treatments incorporating chicken seemed to give more favorable response for this fish. Being an omnivore and voracious feeder, *common carp* could have consumed the faeces directly. This fish could have also consumed the feeds which were spilled from the poultry coops. The final weight still demonstrates the superiority of the waste-fed ponds in comparison with the control. Furthermore, the ammoniacal-N level in the integrated ponds was higher and in all cases reached critical levels as compared to that of the control. It was done to demonstrate the improved production of fish in village tanks through duck farming and to supply nutrient rich diet at villager's doorstep as fish, duck eggs, duck meat and vegetables. It also helped in providing secondary occupation to the primary agricultural farmer for additional income generation. It kept the farmer occupationally busy during the lean season so that migration was checked by improving micro-economics of the farmer and village, which is a major social problem in Chhattisgarh. It is expected that owing to the different composition of the different livestock and

poultry wastes different physico-chemical responses in the pond water and bottom soil were seen. As such, the productivity of the ponds and hence fish yields, was accordingly affected. However in all cases, the autotrophic and the heterotrophic food chains predominate in waste-fed pond. The stocking rate of livestock and poultry and also the fish have been based on some empirical experience from India and overseas. This recommended stocking rate (300-350 ducks/ha) takes into consideration the effects of different densities of ducks on the economic viability, physico-chemical qualities of the water and also the fish productivity.

In the experiment, the mean biological and physico-chemical parameters, conductivity, alkalinity, hardness, Secchi disc, turbidity, dissolved oxygen, ammonical-nitrogen, nitrate-nitrogen, nitrite-nitrogen, total nitrogen, organic-nitrogen, ortho-phosphate, total phosphate, dry matter, biochemical oxygen demand (BOD), primary productivity, zooplankton and phytoplankton counts were significantly different amongst treatments. Overall the waste-fed ponds had higher primary productivity, more phytoplankton and zooplankton counts as compared to the control pond. The integrated farming system resulted in different specific growth rates, survival rates and final bulk weights for different fish species. The zooplankton feeder (*Labeo rohita)* benefited greatly by the higher zooplankton population in the waste-fed ponds. The possibility of the Common carp feeding on allocthonous detritus cannot be ruled out. As indicated by the dry matter which represents the total suspended matter in the water, the waste-fed ponds have significantly higher dry matter values. The detritus was an important food source for fish. Bacteria constituted at least 1–5% of the dry weight and provided a protein rich food for the fish. Aggregates from 6–20 μm can be trapped by zooplankton and the larger by fish. The site for rice fish studies were at Village Bolbola, District Bastar, Chhattisgarh and the farm premises of Zonal Agricultural Research Station, Jagdalpur itself, reported by Tiwari *et al.* (1999) [5]. Perimeter type of rice fish had various fish trenches (size 2x1m, 1x1m, 1.5x1m) out of which roughly 10% of the total plot area was the best fit method found out of various 05,10,15 and 20% area also chosen for the experimentation reported by Das *et al.* (2000) [1]. The trench served as a shelter for fish during dry period. This was done in Peripheral designs of the fields wherein plain topography was available. Surrounding the plot a peripheral dyke was dug out which created a confinement for fish. Sloppy lands were utilized by lateral system of trenching wherein again not more than 10% area was dug out up to 1m deep. Central pool system had deeper area in the centre. Natural ecosystem has such areas in the fields which are being used for fish cultivation, dyke prevented entry of water and unwanted organisms from outside and also helps in preventing the escaping of cultured fish from the area. Such model also described by Hora Sl (1952) [3]. Application of manure as raw cow dung @ 1,000 kg/ha, SSP 62 kg/ha and MOP- 16 kg/ha were applied. Feeding was done twice daily @ 2-3% of body weight (rice bran: mustard oil cake at the ratio 700:300. Growth of fish and health of fishes were observed during the culture period. No chemical pesticides were applied for the pest control. Observations of physico chemical parameters were recorded at every week interval.

Results and Discussion

The average growth of Grass carp, Common carp and Magur were obtained up to 570 g, 430 g and 85 g respectively. Increasing productivity of paddy up to 4.3tonnes/ha that increased additional income of Rs. 38,229/- from 0.19ha plot area during the culture periods. The growth was better of grass carp followed by common carp and Magur 570 g, 430 g and 85 g respectively. The total production of fish was 678.9 kg fish/ha and increased productivity of paddy up to 4.3 tonnes/ha that increased additional income of Rs. 38,229/-. In the other agro climatic zone, Chhattisgarh plains trenches were more of lateral design having 1m deep as fish refuge. The Indian catfish (*Clarias batrachus*) was stocked in such fields. The results are not encouraging which disapproves its extension in the Chhattisgarh plains. Despite the technical feasibility and economic viability of the integrated farming approach involving livestock, fish and also crops, the adoption of this technology is not widespread and is confined to the small farmers only. The management required for a bi or tricommodity enterprise is more complicated as opposed to single commodity enterprise. The bi or tricommodity enterprises would definitely require the involvement of farmers with wide experiences of the commodities involvement reported by FAO (1958) [2]. A farmer owning waste-fed fish ponds has even to acquire the basic knowledge on fish etiology because of the extremely delicate biological and physico-chemical dynamics of the pond water. Duck cum fish farming were practiced at Village- Bolbola, Dist-Kondagaon, where wild duck (Naghans) were introduced @ 300-350 birds/ha. Peculiar parental care was observed of building nest to incubate about 12-15 eggs by the female. Faster growth rate was found in male which grew up to 3.5 kg with in 24 weeks than female which grew up to 2.0 kg in the same period. 1200 kg of duck meat and 2600 kg of fish were produced during entire culture period. Pig cum fish farming is also popular in Bastar region of Chhattisgarh. About 40 piglets of improved T&D variety were introduced which were sufficient to fertilize 1 ha pond. One litter produced 8-12 piglets within six months reported by Tiwari *et al.* (1999) [5]. Pigsties were constructed on the pond dyke (1.5m^2/pig). In house feeding was done with balanced feed (pig mash) @ 1.5 kg/ pig/ day, 3 times a day along with green grasses, Eichhornia, etc and mineral mixture, ‘Sod’. It is also reported by Woynarovich E (1979) [6]. Within 10 months grass carp and silver carp grew to 1.5 kg and 1.2 kg respectively while pigs weighed up to 70 kg.

Table 1: Economics from different components

Rice Fish Farming	Fish (kg/ha)	Paddy (kg/ha)	Total Income (Rs/ha)	Cost/Benefit ratio
Gross yield	679	6,530	38,229	1:1.2
Duck Fish Farming		Duck	36,000	1:2.5
Gross yield	2,600	1,200		
Pig Fish Farming		Pig	35,000	1:2.7
Gross yield	2,500	2,800		

Conclusions

Integrated livestock-fish-crop is not only technically feasible but is also economically viable. Nevertheless, based on socioeconomic considerations, this approach is appropriate for the smallholders where diversification becomes necessary as to increase food production per unit area. Micha *et al*. (1985) [4] suggested that research based on the system approach need to be done in order to fully understand the intricate dynamics of waste loading from the livestock, the physico-chemical and biological environments of the water and soil and more importantly both the livestock and pond production. This type of fish culture has several advantages such as (a) economical utilisation of land, (b) little extra efforts, (c) savings on labour cost towards weeding and supplemental feeding, (d) enhanced rice yield and (e) additional income and diversified harvest such as fish and rice from water and cultivation of fruits and vegetables i.e. Pumpkin, Bottle gourd, pineapple, Karonda, sweet potato on bunds from dyke forming. Rice-fish, duck-fish, pig-fish, pond dyke farming contribute to household income and to food security and nutrition.

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