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AQUACULTURE IN SEASONAL PONDS IN KALAHANDI DISTRICT OF ORISSA, INDIA TOWARDS ENSURING NUTRITIONAL SECURITY

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With an objective of disseminating the technology of freshwater aquaculture through skill training and on-farm demonstration, the present work was carried out in Kalahandi district of Orissa under Jai Vigyan National Science and Technology Mission. Thirty one ponds covering 18 ha water area were adopted during first year for dissemination of the technology of carp polyculture. As many as 206 beneficiaries were included under the programme in the district covering three blocks, *viz.*, Koksara, Dharmagarh and Junagarh. Technology of carp polyculture was demonstrated in all the adopted ponds. With maximum of 2.45 tonnes/ha, the mean fish production level of 0.49 tonnes/ha was achieved in adopted ponds during culture period of 6-8 months. Production levels recorded were 2-4 times higher than those recorded during pre-adoption period, in spite of several inherent constraints like low water retention, adverse climatic condition, social restriction for use of manures and fertiliser and above all the short-term culture for 6-8 months. Besides, this has contributed to the nutritional security in terms of regular supply of fish protein, which otherwise were not available in such quantity for them and also in the locality.

INTRODUCTION

Despite four fold increase in food production in post-independence era, about one fifth of the population is still undernourished. The economic access to food continues to be a limitation, hindering much needed food and nutrition security. This problem is further compounded by fragile and harsh climatic conditions and other constraints prevailing in tribal hilly and backward areas. Orissa possesses rich water resources in terms of ponds and tanks, amounting to a total area of about 113,634 ha. It is observed that bulk of the aquaculture produce in the country is obtained mainly from the coastal and adjacent districts. Besides possessing locational advantages such as plain land, good soil quality leading to higher productivity, these areas often receive support from Government through implementation of several developmental projects. It may be stated that locational disadvantages like greater distance from the capital, non-availability of infrastructure facilities like roads etc. often hinder in implementation of the development projects in case of interior hilly districts, which result in depriving the people of the area,

the fruits of scientific and technological development. Seasonal tanks, which hold water for 6-8 months or even less, are presently not utilized scientifically. David and Rao (1976) and Mohanty and Pattnaik (1984) have reported successful fish farming in village ponds and seasonal tanks. Short duration culture with appropriate management measures would go a long way in providing nutrition security to people in fur flung areas. Recognising this, the Central Institute of Freshwater Aquaculture, Bhubaneswar operated a project in one of the remotest and most backward districts of Orissa i.e., Kalahandi with the objective of disseminating freshwater aquaculture technologies through skill training and on farm demonstration to ensure food and nutrition security of the tribal people. This was carried out under the auspices of the Jai Vigyan National Science and Technology Mission during 2000-2004.

METHODOLOGY

Pre-adoption survey was carried out in different blocks of Kalahandi district of Orissa for selection of potential area of freshwater aquaculture to be included under the project. For the survey a core team comprising Scientists and technical officers of disciplines *viz.,* aquaculture, aquaculture extension, soil and water chemistry and fish health management were involved. The selection of beneficiaries was done based on the availability of resources in the form of ponds in the area, interest of the targeted beneficiaries belonging to SC/ST population with due consultation among the villagers, representatives of gram panchayat and officials of the State Fisheries Departments. Preference was given for selection of non-productive ponds over productive ones in order to demonstrate the impact of scientific farming practices. The adoption of the ponds for carp farming was in phases with an objective of covering maximum area under the scientific fish farming. As many as 206 beneficiaries were included under the programme in the district covering three blocks, *viz.,* Koksara, Dharmagarh and Junagarh.

Taking into consideration the inherent water quality and soil conditions, schedules were prepared for each pond and management was done accordingly. For the first crop the ponds were stocked with advanced fry of Indian major carp species like catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) and the exotic common carp (*Cyprinus carpio*) species by the 1st week of August, 2000. The stocking densities followed in different ponds were in the range of 5000-8000/ha depending on the status of the pond. The regular pond management includes intermittent fertilization with both organic and inorganic fertilizers. However, owing to the social constraint, application of cow dung was avoided in most of the adopted ponds as the water is used for domestic purposes as well as for other livestock. Rice bran and groundnut oil cake were provided as supplementary feed.

Similarly for the second crop, all the adopted ponds were stocked with catla, rohu, mrigal and common carp species during the month of September, 2001. The severe flood that occurred during July-August, 2001 resulted in delay of stocking the ponds. During this year some additional ponds were also included, as given in Table 2. All the ponds were provided with lime, fertilizers and supplementary feed ingredients. The culture progressed till the end of March, 2002.

During the year 2002, the arrival of monsoon in Orissa was quite late, resulting in late stocking of ponds for the third crop. Stocking was undertaken during 1st week of September, 2002. Ponds were stocked with fingerlings of Indian three major carps *viz.*, catla, rohu and mrigal and common carp at the rate of 5,000 nos per hectare. The mean size of the fingerlings stocked was in the range of 61-80 mm. The seed were procured from the Havaspur fish seed farm. Only ponds having water level above 80 cm were stocked. By the end of February 2003, most of the ponds started drying up, forcing the farmers to harvest the fish.

During the year 2003 as many as 26 ponds was adopted under the programme covering a total water area of 20.86 hectare. This includes five new ponds with a total water area of 5.3 hectare, under which 34 beneficiaries were adopted. Advanced fish fry obtained from Havaspur hatchery and seed farm were stocked in the adopted ponds. As earlier crops, the culture trials in the adopted ponds progressed until early summer.

On-farm training and demonstration on all relevant packages of practices with regard to carp polyculture, *viz.*, stocking of carp seed, fertilization, supplementary feeding and diseases control measures were given to the participating farmers. Information with regard to optimum density, ratio of different species, stocking size, fertilizer source, dosages and frequency of application of both organic and inorganic fertilizers, supplementary feed ingredients, feed ration and method of provision, intermittent liming, combating disease like EUS, etc. were imparted to the beneficiaries from time to time. Harvesting of the fishes was done by repeated netting when water levels in the ponds reduced to a great extent, which in general were within six to eight months of culture in most of the ponds. The production figures presented in these cases, however, represent only the production and sale of major carps and do not include weed fishes and other species used for household consumption.

RESULTS AND DISCUSSION

With maximum of 2.45 tonnes/ha, the mean fish production level in first year of adoption was 575.56 kg/ha during culture period of 6-8 months with regulated fertilization and supplementary feeding (Table 1). The fish production levels recorded at the end of culture period is given in Table 2. The production levels recorded in second

year were in the range of 462-2225 kg/ha. During third year the production levels, recorded in all the adopted ponds were much lower than the preceding two years due to draught condition prevailed not only at the project centres but also in entire state. The production details are given in Table 2, showing a mean production of only 272.8 kg/ha. Apart from the late monsoon and scarcity of water in Kalahandi District, the center also experienced severe winter from mid December, 2002 to end of January, 2003 recording water temperature as low as 10°C. However, the fourth year recorded improved production levels with mean production of 512.5 kg/ha in 6-8 months culture period.

Table 1. Details of stocking and harvesting attributes in the adopted ponds during 2001-2004.

Year	Species stocked	Density (nos./ha)	Initial size of stocking (mm)	Highest production (kg/ha/6-8 months)	Mean yield (kg/ha/6-8 months)
2001	Rohu, catla, mrigal, common carp	5000-8000	25-30	2450	575.56
2002	Rohu, catla, mrigal, common carp	5000	25-30	2225	600.65
2003	Rohu, catla, mrigal, common carp	5000	60-80	1287	272.80
2004	Rohu, catla, mrigal, common carp	5000-8000	25-30	2150	512.52

The mean yield of all the four crops was 490.4 kg against the pre-adoption production level of 176.7 kg, indicating an increase of nearly three times. Considering prevailing low-water level, regulated fertilization owing to the use of water for domestic use, limited provision of feeding, smaller stocking size of the seed due to their unavailability in the region, adverse climatic condition including unfavourably low water temperature and above all intermittent consumption of fish by the beneficiaries thereby report of lower production levels, the mean production levels in all the years except that of third year found to be encouraging. Further, the contribution of weedfishes, not included in the present production, were also substantially improved their household level of consumption of fish. Jhingran (1967) reported a production of 600 kg/ha/yr in seasonal tanks by conventional culture technique. However, very high production of 3158 kg/ha/yr with application of manure and feed and 1053 kg/ha/yr without manure and feed were reported by Ahmed (1984). David and Rao (1976) reported a production of 179 kg/ha/10 months from a seasonal tank in Mysore without artificial feeding and manure. Piska (2000) reported a production of 977.75 kg/ha/6 months from a seasonal pond in Andhra Pradesh.

Table 2. Production details of adopted ponds in Kalahandi District during the project implementation period

Village	Pond name	Area (ha)	Pre-adopted pond-wise production (kg/ha)	Pond-wise production in 2001 (kg/ha)	Pond-wise production in 2002 (kg/ha)	Pond-wise production in 2003 (kg/ha)	Pond-wise production in 2004 (kg/ha)
District: Kalahandi							
Block: Dharmagarh							
Behera	G. P. Tank	0.3	100 (333)	140 (466)	415 (1383)	125 (416)	-
	Mahadev tank	0.4	100 (250)	300 (750)	438 (1095)	174 (435)	-
	Banua Tank	0.6	300 (500)	400 (666)	615 (1025)	217 (362)	690 (1150)
	Nunpani upper bandh	0.5	200 (400)	615 (1230)	485 (970)	244 (488)	-
	Nunpani Khajuri bandh	0.6	200 (333)	745 (1241)	818 (1363)	-	-
	Bohoruamunda bandh	0.6	200 (333)	915 (1525)	915 (1525)	-	-
	Potabandh	1.0	100 (100)	-	-	310 (310)	410 (410)
	Palsaparabandh	0.4	Nil	-	-	68 (170)	470 (1175)
	Talabandh	1.0	Nil	-	-	94 (94)	-
	Sahoobandh	0.7	100 (142)	-	-	-	540 (771)
	Amgachia	0.8	Nil	-	-	-	520 (660)
	Charakutia bandh	0.8	100 (125)	-	-	-	465 (581)
Gointiapara	Gointia bandh	0.8	400 (500)	1025 (1281)	1070 (1337)	425 (531)	1215 (1519)
Sankendgud	Dengra bandh	0.8	400 (500)	1260 (1575)	780 (975)	-	-
Block: Junagarh							
Balichara	Bada bandh	2.0	400 (200)	1989 (994)	925 (462)	730 (365)	870 (435)
	Khajuri bandh	0.6	400 (666)	705 (1175)	1335 (2225)	-	-
	Charkutia bandh	1.0	100 (100)	-	-	115 (115)	446 (446)
Block: Koksara							
Negiguda	Budhi bandh	1.5	500 (370)	1520 (1013)	890 (593)	672 (448)	-
	Charkutia band	0.5	100 (200)	280 (558)	605 (1210)	132 (264)	-
Sanpadguda	Budhi bandh	0.8	250 (310)	550 (687)	570 (712)	117 (146)	-
	Khalia bandh	0.8	80 (100)	470 (587)	810 (1012)	155 (194)	-
	Coloney bandh	0.2	100 (500)	480 (2400)	370 (1850)	70 (350)	-
	Chotigantiani	0.4	Nil	20 (50)	215 (537)	-	-
Kulerguda	Darlibandh	0.6	300 (500)	670 (1116)	612 (1020)	230 (383)	720 (1200)

Dengaguda	Pond.1	0.1	50 (500)	220 (2200)	205 (2050)	68 (680)	215 (2150)
	Pond.2	0.1	40 (400)	208 (2080)	115 (1150)	40 (400)	105 (1050)
	Pond.3	0.15	50 (333)	210 (1400)	108 (720)	50 (500)	230 (1533)
	Pond.4	0.1	50 (500)	245 (2450)	75 (750)	64 (640)	180 (1800)
Chiliguda	Adkata bandh	0.6	100 (166)	590 (983)	535 (891)	-	468 (780)
	Suru bandh	0.8	50 (62)	680 (850)	860 (1075)	328 (410)	315 (394)
Pipaljhapar	Majhi bandh	0.8	500 (625)	700 (875)	-	-	-
	Upperbandh	0.15	50 (333)	200 (1333)	-	-	-
	Khajuri bandh	0.6	200 (333)	600 (1000)	-	-	-
Chornidwar	Funnel bandh	0.4	200 (500)	680 (1700)	-	-	-
	Kanakpura	0.6	100 (166)	540 (900)	-	-	-
	Darlibandh	0.6	400 (666)	830 (1383)	-	-	-
	Khalia bandh	0.4	50 (125)	380 (950)	-	-	-
Ampani	Bada bundh	0.8	100 (125)	--	575 (719)	470 (588)	780 (975)
	Nua bundh	0.2	50 (250)	--	308 (1540)	155 (775)	605* (1210) *area increased to 0.5 ha
	Dhobe bundh	0.4	100 (250)	--	370 (925)	-	210 (525)
Jhariguda	Gudali pond	0.8	200 (250)	--	605 (756)	430 (538)	
	Khajuri pond	0.8	100 (125)	-	470 (587)	-	-
Dangriguda	Jhankar Katta	1.2	500 (417)	-	1325 (1104)	580 (483)	1019 (849)
	Dangribandh	1.0	50 (50)	-	-	-	618 (618)
	Khalibandh	0.8	50 (62.5)	-	-	-	335 (419)
Koksora	Khaliakata	0.8	80 (100)	-	-	1030 (1287)	435 (543)
	Khajuribandh	1.0	100 (100)	-	-	-	482 (482)
Temra	Beherakatta	1.0	Nil	-	-	-	470 (470)

Note: Figure in parentheses indicates production per ha. The production figure represents only the production and sale of major carp species

Constraints analysis

During the course of work several constraints have been encountered, the details of which are discussed hereunder.

Non-availability of carp seed of desired species and size

Seed of desired species and size are prime requisite of any culture operation. The hatchery at Havaspur, Kalahandi is one, which supplies the fish seed materials only in the form of spawn and fry to most of the farms in Kalahandi and other adjacent districts. As fry of only three Indian major carps *viz.,* catla, rohu and mrigal and exotic common carp are available in the hatchery, the stocking in all the project ponds of the center were restricted to these four species in the form of fry only, due to non-availability of

fingerlings. De and Saha (2005) also reported smaller size and high mortality of seed as constraints to adoption of scientific carp culture.

Low water retention in the ponds

The water retention in most of the ponds were only for a duration of 6-8 months, which reduced to a very low level during summer months and some cases it dried up too. Thus, fish culture in such ponds was possible only for a short duration.

Adverse climatic condition

Kalahandi experiences most adverse climatic condition with very hot summer, low rainfall and cold winter. During winter the water temperature was recorded to be as low as 10^{o}C, leading to ceased growth and also heavy morality of the fish species as experienced in third year. Further, inadequate rainfall in most of the years restricted the culture period to only 6-8 months.

Multi purpose use of pond water

Most of the ponds adopted under the programme were village community ponds and the water was used for all domestic purposes including source of drinking water for domestic animals, bathing for surrounding population and other domestic chores. For the same, application of organic manure in the form of cowdung had to be avoided in all most all the ponds, minimizing the productivity. Further, in such water bodies scientific pond preparation was not possible for eradication of predatory fishes. Multiplicity of ownership, absence of long-term leasing policy, paucity of credit, non-recognition of aquaculture as a land-based activity is among the major constraints in Asia (Dey *et al.*, 2001)

CONCLUSION

The project has greatly helped in improving the socio-economic status of the people by providing them additional income through sale of fish and also improving their nutritional status through their own consumption. Further, the nutritional status of the area was also enhanced owing to the availability of adequate quantities of fish in the adopted localities. The knowledge gained and also the technical skills developed during the project implementation would definitely help the farmers for practicing the scientific farming in coming years. In fact these participatory approach and demonstration was the first of its kind to them, which could provide some concepts, first hand knowledge and confidence. The project has improved the technical skills of the beneficiaries with regards to all relevant packages of practices on freshwater aquaculture, which definitely would help in continuing the activity of fish farming by the farmers in coming years. The multiplier effect have already been seen in certain areas, with several neighbouring farmers of the adopted area initiating scientific fish culture.

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