Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2021; 9(2): 515-517

Received: 10-01-2021
Accepted: 12-02-2021

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Partial replacement of slow growing mrigal with common carp and amur carp: Its impact on fish yield and economics in composite fish culture system

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Abstract
An experiment was conducted in Mid-Central Table Land zone of Odisha to assess different stocking ratios of fish with partial replacement of slow growing mrigal by common carp and amur carp in composite fish culture system. In this experiment, five different treatments including farmers' practice was taken with four replications. The different stocking ratio taken with / without substitution of mrigal were: catla : rohu : mrigal = 3:4:3 (T_1), catla : rohu : mrigal : common carp = 3:4:1.5:1.5 (T_2), catla : rohu: mrigal : amur carp = 3:4:1.5:1.5 (T_3), catla : rohu : mrigal : common carp = 3:4:2:1 (T_4) and catla : rohu : mrigal : amur carp = 3:4:2:1 (T_5). Out of the five treatments, maximum yield, FCR, Net return, Net Present Value, BC ratio, Internal Rate of Return and minimum payback period was observed in case of T_3 followed by T_2. Minimum yield, FCR, Net return, Net Present Value, BC ratio, Internal Rate of Return and maximum payback period was found in case of T_1. Replacement of mrigal by common carp or amur carp showed more yield. Replacement by amur carp showed better result than that by common carp. Also 50% replacement showed better result than 33%.

Keywords: stocking ratio, net return, net present value, pay back period, benefit cost ratio and internal rate of return

Introduction
For ensuring optimum utilization of all ecological niches / resources / nutrients of a pond ecosystem with a view of increasing fish productivity, intensive culture of fast growing compatible species of fish of different feeding habits are stocked together in the same pond. These fishes are of different feeding habits and after being stocked together, they secure themselves in the most efficient manner i.e. as per the life requisites available in the pond. This is practiced without harming each other. This mode of fish culture is called composite fish culture or polyculture or mixed farming. Composite fish culture is to select and grow compatible fish species of different feeding habits, in order to exploit all types of food available in different region of the pond for maximizing fish productivity.

A pond water column can be divided into three distinct vertical zones
i. Upper surface zone
ii. Middle column zone
iii. Bottom zone

In case of monoculture, only one zone is being utilized and the other zones remain unutilized. Therefore, the entire ecological area is not optimally utilized resulting in poor productivity. For example, if only catla is cultured, the surface zone will be utilized and the other zones remain unexploited. If we exploit all the ecological niches of the pond, greater productivity is possible. In mixed culture, the stocked fish usually consist of both plankton feeders and macrophyte (waterweed) feeders. The nutrients applied to water are taken up by both phytoplankton and the macrophytic waterweeds. Unlike land plants, they may not grow at the same pace. One group may use up most of the nutrients leaving little for the other. While releasing fish fry / fingerlings, we try to maintain a balance by using both the phytoplankton feeders and the water-weed eaters.

Advantages of Composite Fish Culture

i. All available niches are utilized optimally.
ii. Compatible fish species do not harm each other.
iii. There is no competition among different species.
iv. The entire type / range of food available in the ecosystem is utilized.
v. Production becomes multi folded than that of monoculture.
vi. Fishes do have beneficial effect on each other.

With market led approach, carp farming in India is undergoing a lot of changes. Traditionally recommended six-species composite carp culture system could not be successful even with higher productivity. To suit the market demand and availability of water resources, fertilizers, feeds etc., investment capability of farmers, new strategies for carp culture have evolved in the country. Market demand for rohu is the highest, and this species is preferred in most parts of the country. Catla is also a preferred species in the carp farming community, owing to its fast-growing nature; In Odisha, stocking densities for catla, rohu and mrigal are kept at 3:4:3. Recently farmers are going for partial replacement of slow growing mrigal with common carp and amur carp. Role of Krishi Vigyan Kendras and Fisheries Deptt. in convincing farmers and promoting composite pisciculture along with other compartmental technologies is of paramount importance. The present study is to assess the optimum stocking ratio of rohu. Catla and mrigal with partial replacement of mrigal by common carp and amur carp so as to benefit the fish farmers.

Materials and Methods

The experiment was conducted in Dhenkanal and Angul districts under Mid-Central Table Land Zone of Odisha. In each district, two farmers were selected each having five small ponds of water area 0.5 acre. These ponds were dried, disinfected by liming @ 40kg/acre followed by application of fresh cow dung @ 1000 kg/acre for growth of both zoo and phytoplankton in the pond water. This was followed by application of inorganic fertilizer i.e. DAP @ 20 kg/acre before release of fingerlings. Then fingerlings were released to the ponds during July 2018 @ 7500/ha involving IMC in one pond with stocking ratio of 3:4:3 (T_1) where as in other four ponds mrigal was partially replaced either by common carp or amur carp as per the following treatments.

T_2: Stocking ratio of catla : rohu : mrigal : common carp = 3:4:1.5:1.5
T_3: Stocking ratio of catla : rohu : mrigal : amur carp = 3:4:1.5:1.5
T_4: Stocking ratio of catla : rohu : mrigal : common carp = 3:4:2:1
T_5: Stocking ratio of catla : rohu : mrigal : amur carp = 3:4:2:1

Cow dung was applied subsequently in 6 monthly installments @ 500 kg/acre/month. Similarly, DAP was applied in 6 monthly installments @ 5 kg/acre/month. Fish were fed twice a day at same time and same place with floating feed @ 2 to 1% body weight.

Fish was harvested from all the treatment ponds of farmers during March 2019. Fish yield (q/ha) was recorded and FCR value was calculated for each treatment pond. Data on fish yield and FCR for all the farmers were collected and analyzed. Economic analysis was conducted by taking the result of one year and Present Worth Analysis (PWA) was conducted taking information of all the treatments by calculating the future value of money in all the cases with the following assumptions.

Life of project : 20 years
Rate of inflation : 6%
Rate of bank interest : 11%

Net return, Net Present Value (NPV), Pay Back Period (PBP), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) were calculated for each treatment.

Results and Discussion

Fish yield and FCR values for all the treatment ponds of all the farmers were recorded. The mean values along with the statistical analysis result have been presented in Table-1.

Table 1: Yield and FCR for different treatments

Treatments	Stocking ratio	Yield (q/ha)	FCR
T_1	C:R:M = 3:4:3	35.62	1.66
T_2	C:R:M:CC = 3:4:1.5:1.5	48.24	1.25
T_3	C:R:M:AC = 3:4:1.5:1.5	50.32	1.21
T_4	C:R:M:CC = 3:4:2:1	38.75	1.54
T_5	C:R:M:AC = 3:4:2:1	42.54	1.41
	SEM	2.448	0.089
	$CD_{0.05}$	7.542	0.275

Yield in case of T_3 was found to be maximum (50.32 q/ha) where there was 50% substitution of mrigal by amur carp. This is followed by yield of T_2 (48.24 q/ha) where there is also 50% substitution of mrigal by common carp. Minimum fish yield has been observed in case of T_1, i.e. the farmers' practice where there is no substitution of mrigal. It seems that substitution of mrigal with common carp or amur carp has been more productive. Yield of amur carp is more than common carp and more substitution to the extent of 50% has given more yield.

Cost of production, gross return, net return and BC ratio were calculated for all the treatments basing on the result of one year. The results have been presented in Table-2.

Table 2: Economic Analysis

Treatments	Yield (q/ha)	Cost of production (Rs.)	Gross return (Rs.)	Net Return (Rs.)	Benefit-Cost ratio (B:C)
T_1	35.62	287375	498680	211305	1.73
T_2	48.24	293375	675360	381985	2.30
T_3	50.32	293375	704480	411105	2.40
T_4	38.75	290375	542500	252125	1.87
T_5	42.54	290375	595560	305185	2.05

In case of T_3, gross return, net return and BC ratio was found to be maximum followed by T_2. The fact may be due to more growth rate of amur carp than common carp and mrigal. The economic indicators have been found to be minimum in case of T_1, i.e. farmers' practice. This may be due to the poor rate of growth of mrigal. In all other treatments substitution of mrigal with amur carp and common carp might be the factor responsible for more yield.

The same information was also put to Present Worth Analysis. Life of the project has been assumed to be 20 years. Inflation rate and rate of bank interest has been assumed to be 6% and 11% respectively for this purpose. Cost of production,

Gross return, Net return, Present worth cash outflow, Present worth net return, Net Present Value (NPV), Pay Back Period (PBP), Benefit Cost Ratio (B:C) and Internal Rate of Return (IRR) have been calculated for each treatment and presented in Table-3.

Table 3: Economic Analysis (Present Worth Analysis)

Treatment	Cost of prdn. (Rs.)	Gross return (Rs.)	Net return (Rs.)	Present worth cash outflow (Rs.)	Present worth net return (Rs.)	Net Present Value (NPV), Rs.	Pay Back Period (PBP), Yr.	Benefit-Cost ratio (B:C)	Internal Rate of Return (IRR),%
T_1	5747500	9973600	4226100	1333762	2544985	1211223	8.23	1.91	22.84
T_2	5867500	13507200	7639700	1333762	4600677	3266915	4.17	3.45	39.68
T_3	5867500	14089600	8222100	1333762	4951402	3617640	3.84	3.71	42.46
T_4	5807500	10850000	5042500	1333762	3036626	1702864	6.67	2.28	27.03
T_5	5807500	11911200	6103700	1333762	3675688	2341925	5.35	2.76	32.28

It is observed that T_1 recorded minimum values of NPV, BCR, IRR and PBP (8.23 yrs.) is maximum in this case. BC ratio is 1.91 and IRR is 22.84% which is the lowest amongst all the treatments.

Conclusion

The experiment shows that growing catla, rohu and mrigal in pisciculture without replacement of mrigal may be less remunerative; hence replacement of mrigal with common carp or amur carp should be preferred. If we compare replacement of mrigal with common carp and that with amur carp, it is found that amur carp is giving more IRR, NPV and BC ratio. As regards stocking ratio, 50% replacement of mrigal has become remunerative than 33% replacement.

Acknowledgements

Financial support from ICAR-ATARI, Kolkata for conducting the trials is duly acknowledged. Guidance and encouragement of Dean, Extension Education, OUAT and co-operation of the farmers involved in conducting the experiment are also thankfully acknowledged.

References

1. Acosta BO, Gupta MV. The status of introduced carp species in Asia. In, Carp genetic resources for aquaculture in Asia. The World Fish Center, Penang. Malaysia 2005, 121-128.
2. Anantha PN, Sahoo PR, Dash AK, Pati BK, Jayashankar P, Singh SRK. A study on community based aquaculture promoted by KVK-Khordha, Odisha, India. Current World Environ 2014;9(3):947-951.
3. Chouhan P. Comparative study of fish production and earning from fish culture in two years in Barwani district, MP, India. Res J Anim Vety and Fishery Sci 2015;3(7):5-8.
4. Hussain O, Altaf, Farhanullah K, Jahanzeb F. The effect of various stock densities of bottom feeder fish *Cirrhinus mrigala* and *Cyprinus carpio* on growth performance and fish yield in polyculture system. African Journal of Fisheries Science 2011;2(9):155-161.
5. Kund GC, Mishra R, Sethi PK. An economic analysis of composite fish culture ponds in Sundergarh district, Orissa. Asian J Anim Sci 2010;5(2):139-141.
6. Lutz CC. Polyculture: principles, practices, problems and promise. Aquaculture Magazine 2003;29(2):34-39.
7. Mahapatra BK, Vinod K, Mandal BK, Bujarbaruah KM. Composite Fish Culture. Technical Bull. No. 20, ICAR-RC NEH, Barapani, Meghalaya 2006, 1-11.
8. Manjappa N, Patil R, Pavadi P. Potential use of village tanks and farm ponds for aquaculture in Karnataka, India – A case. Int J Res Applied, Natural and Social Sci 2017;5(10):45-50.
9. Rahman MM, Verdegem MCJ, Nagelkerke LAJ, Wahab MA, Milstein A, Verreth JAJ. Growth, production and food preference of rohu *Labeo rohita* (H.) in monoculture and in polyculture with common carp *Cyprinus carpio* (L.) under fed and non-fed ponds. Aquaculture research. 2006;257:359-372.
10. Rajeshkumar A, Balusamy M. The effect of different fish feeding methods on growth performance and fish yield in composite fish culture system. Journal of Entomology and Zoology Studies 2017;5(6):1514-1518.
11. Singh K. Economics and determinants of fish production and its effects on family income inequality in West Tripura District of Tripura. Indian J Agri Econ 2007;62(1):113-125.
12. Talukdar PK, Sontaki BS. Correlates of adoption of composite fish culture practices by Fish farmers of Assam, India. The J Agril Sci 2005;1(1):12-18.