Fish-Duck and Dyke Vegetable Cultivation Practices in Rural Integrated Farming System

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ABSTRACT

Integrated farming is a sustainable and effective tool for improving rural economy due to its cumulative cost effectiveness, low investment and higher profitability. It optimises the farm productivity per unit area through incorporation of recycling wastes and residues from one farming system to the other with due environmental consideration. Considering the efficacy of this viable production system, the study was conducted by the Dakshin Dinajpur Krishi vigyan Kendra, Uttar Banga Krishi Viswavidyalaya, W.B. in purposively selected Dakshin Dinajpur district of West Bengal as On Farm Trial (OFT). The trial was conducted in 03 different treatment options and in each option minimum seven (07) replications were taken under farm field condition. The system components fishery and animal Husbandry (Duckery) are complementary in which duck droppings act as nutrient source for Fish culture. Vegetable growing in the trellis and dykes is an additional component which helps in maximising profit from unit area. The data were collected from each treatment for consecutively 03 years to judge the economic profitability and sustainability of the practice. The generated data were computed and analysed through statistical tools and overall economic return in terms of productivity of the fishery, duckery and vegetable cultivation practices, their gross return, net return and ultimate B:C ratio. It was observed that better production and sustainable economic return can be achieved through crossbred duckery and fish culture along with dyke vegetable cultivation in pond based integrated farming practices.

Key words: *Integrated farming; Sustainable; Profitability; Duckery; Fish; Dyke vegetables;*

Association of two or more farming components that become part of entire system is termed as integrated farming. Out of many farming systems involving fish with agri-horticulture, modern trend now-a-days is integration of livestock with fishery. Integrated farming has immense potentiality to emerge out as an effective tool for improvement of rural economy due to low investment and high profitability *(Nanda and Bandopadhyay, 2011)*. Demand of food is increasing constantly with increase in population. Food security is presently the major concern of developing countries like India. In this context, sustainable integrated farming can be a very good option for achieving optimum productivity with due environmental consideration. It maximises production per unit area through incorporation of recycling wastes and residues from one farming system to the other. India being an agrarian economy produces huge quantities of plant and animal residues, the former to the tune of 320 million metric tonnes and later 1000 million metric tonnes on an amount basis *(Chand & Goswami, 2005)*. Hence, integrated farming holds great promise and potentiality for augmenting production and betterment of economic status of poor rural grassroot stakeholders. Pond based Integrated farming with low investment is economically sound, ecologically feasible and socially acceptable. Compared with the simple technology of extensive farming and expansive higher technology of intensive farming, integrated farming is a viable and intermediate option for rural entrepreneurs giving relatively high yield with fairly low input cost. Keeping this fact in mind a trial was conducted by the Dakshin Dinajpur Krishi Vigyan Kendra under Uttar Banga Krishi Viswavidyalaya to implement in field level of the Dakshin Dinajpur district of west Bengal since 2007-08. The study was conducted to evaluate the performance of integrated farming system for 03 years.

METHODOLOGY

The study was conducted in purposively selected Dakshin Dinajpur district of West Bengal where the KVK, a district level institute for transfer of technology established by ICAR, MOA, Govt. of India is functioning. The integration of fish with livestock has emerged as an effective alternative, highly sustainable farming system with maximum reduction of production cost. Pond was an essential and viable component of the trial with variable assembling of livestock and vegetable production system. Though, different livestock components either individually or combinedly may act as profit maximisation venture in this integrated farming system, but in this study, only duck was taken as animal husbandry component as the pond was principal criteria in the study and duck has multiple and positive interactive effect with the existing aquaculture practice. Regarding agri-horticultural component, though several options prevail in field level only those horticultural practices suited in the dyke of pond were considered in the trial as. The trial was formulated in terms of 03 treatments in which the first treatment or technology option was stakeholders' scattered or disintegrated farming practices i.e. fish culture with irregular duck grazing and no systematic utilisation of dyke without appropriate combination of vegetables round the year (Farmers Practice). The Integrated technology option-I was fish culture and Khaki Campbell ducks @ 300 nos./ha along with round the year vegetables on trellis and on ground. The Integrated technology option-II was fish culture (Stocking density is 7500/ha, lime on the basis of soil pH) and crossbred duck @ 300 nos./ha along with round the year dyke vegetables on trellis and on ground. Bitter gourd & ridge gourd in the trellis and cucumber, pumpkin and gourd were cultivated as dyke vegetables. The Khaki Campbell drake, Khaki Campbell ducklings, lime and vegetable seeds were given as onetime critical input after selecting minimum 07 numbers of farmers as replica in each of 03 treatment options. The data were collected in regular interval on the monitoring indicators, such as –plankton population, growth rate of fish and duck, egg, meat, fish and vegetable production, overall management return and farmers' assessment for consecutive 03 years. The data, thus generated, were computed and analysed by statistical tools for better interpretation of results. Details of various components of on-farm trial on integrated farming are given in Table 1.

RESULTS AND DISCUSSION

The Present study was conducted under seasonal domestic pond based small farming situation where the income efficiency of the stakeholders was very poor due to disintegrated production system having fish, Duckery and vegetables being the separate components. Integration of these 03 components in rural production system definitely increases the overall productivity and economic return along with sustainable environmental friendly production system.

Table 2 describes the data on fishery component under integrated farming system. In the integrated technology option II & III no external fertilizer or manures were supplemented. Droppings of ducks contributed as the nutrient production sources for fishery culture. The data were collected throughout the experimental period for 03 different trials under field condition on different parameters of fishery along with gross economic return of the system. The data on weight (g)

Table 1. Details of on-farm trial on integrated farming:

Crop/ enterprise	:	Fish-Duck-Vegetables
Farming situation	:	Seasonal domestic pond based small farming situation.
Problem Diagnosed	:	Poor farm income efficiency from pond based farming situation under Old alluvial zone in Dakshin Dinajpur district.
Title of OFT	:	Studies on the Integrated Fish–duck–dyke vegetables production technology
No. of trials*	:	7
Technology options	:	Farmers' practice (fish culture with irregular duck grazing and no systematic utilization of dykes with appropriate combination of vegetables round the year)
		Integrated Production Technology option-I = Fish culture* + Khaki Campbell @ 300/ha + round the year dyke vegetables on trellis and on ground.
		Integrated Production Technology option-II = Fish culture* + Cross bred duckery @ 300/ha + round the year dyke vegetables on trellis and on ground. dyke vegetable pointed gourd in the trellis and pumpkin followed by frenchbean and tomato.

*Stocking density -7500/ha, Lime on the basis of soil pH

Table2. Data on individual fishery component in 03 different technology option under OFT

Parameters of assessment	Data on the parameter (Fishery)									Gross return	Prod-ction	Net Return	B:C ratio
	Initial Weight (g)			Final (10 months) Weight (g)			Growth rate (g)/day						
	C	R	M	C	R	M	C	R	M				
Farmers' practice**	20	15	10	330	240	205	1.4	1.3	1.2	0.7	17.5	0.41	2.41:1
IPT option-I	20	15	10	525	415	375	3.0	2.8	2.3	1.71	28.5	1.39	5.34 : 1
IPT option-II	20	15	10	530	405	390	3.1	2.6	2.5	1.73	28.8	1.41	5.4 : 1
CD at 5%				12.67	9.4	8.6	0.45	0.18	0.19				

Gross return= In lakh/ ha (in 10 month)Production=per unit (q/ha) (in 10 monthNet Return=(Rs. in lakh /ha)

Table3. Data on Duckery) & Vegetable component of 03 different trials under field condition

Technology Assessed / Refined	Growth Rate & Weight			Age of 1st laying (wks)	Egg production (No.)/duck up-to 72 wks	Gross return (Lakh/ha)	Net Return in (lakh/ha)	B:C ratio
	gain (kg) Day old	24 weeks	72 week					
Farmers' practice	20	0.90	1.60	28	55	1.40	0.49	0.55:1
IPT option-I	30	1.20	2.50	25	170	2.43	1.08	1.07:1
IPT option-II	28	1.40	2.75	27	120	1.98	1.31	1.93:1
CD at 5%	3.70	0.33	0.47	1.15	26.74	-	-	-

Technology Assessed / Refined	Data on the parameter (Vegetables) Production /unit (q/ha) Data on different crops					Gross return (Rs. in lakh /ha)	Net Return in lakh /ha)	B:C Ratio
	Pumpkin*	Gourd*	Bitter gourd*	Ridge gourd*	Cucumber*			
Farmers' practice	142.5	124.5	45.0	79.0	82.0	0.245	0.1089	1. 8 : 1
IPT option-I	198.5	148.0	74.5	105.0	112.0	0.7356	0.3732	2.03 : 1
IPT option-II	204.0	155.0	76.0	112.0	116.0	0.7577	0.3881	2.05 : 1

* In farmers' practice, no farmer cultivates all the crops systematically round the year. Rather, they grown1 0r 2 crops discretely.

and growth rate (g/day) of 03 different types of fish (Catla, Rohu and Mrigel) were collected initially and finally after 10 months of the experiment. The result showed that in initial stage weight of all species of fish was same in all the trials as the fish seed was incorporated from same source. After 10 months of trial, the data revealed a significant change in weight and growth rate of all the species of fish due to integrated multiplication factor. The weight and growth of Catla and Mrigel fish were significantly better in integrated production technology option-II than farmers' disintegrated practice and integrated production technology option-I. But, in case of Rohu fish, better performance was observed in integrated technology option–I than other two trials. The gross return (Rs. in lakh/ha), production of fish per unit (q/ha), net return in terms of profit (Rs. in lakh/ha) and B:C ratio showed significantly better results in integrated production technology option–II than farmers' practice and Integrated Production technology option-I under the trials. Though the Rohu fish reflected better performance in integrated production technology option-I, but ultimately integrated production system-II revealed significantly efficient result due to Catla and Mrigel performance and may be due to combined effect of other two components of Integrated farming system. The results were in agreement with the findings of *Nanda and Nayak (2008).*

Table 3 revealed the data on animal husbandry (Duckery) component under trial. Data were gathered throughout the investigation period for 03 different trials under field situation on various parameters of duckery along with gross return of the system. The data on growth rate (g), weight gain, age of 1st laying (week) and egg production up to 72 weeks of age, net return, and B:C ratio were collected throughout the trial period i.e. consecutively for 03 years. It was observed that the growth and weight gain of ducks were significantly higher in IPT option-II than farmers' practice and IPT option-I. Similarly, age of 1st laying was lowest in IPT

Table 4. Data on overall economic benefit of all component in o3 different trials under field condition

Parameters of assessment	Gross return (Rs. in lakh/ha)	Net return (Rs. in lakh/ha)	B: C ratio
Farmers' practice	2.345	1.0089	1. 76: 1 .
Technology assessed			
IPT option-I	4.8756	2.8432	2.40: 1
IPT option-II	4.4677	3.1881	3.49: 1
Result of assessment	It is evident from the result that Integrated Technology Option-2 showed maximum growth rate, higher yield and more cost effective as compared to integrated production Tech. Option-1 and Farmers' practice. This result is once again justified through significant variation in treatment and in days when analyzed statistically. It may be concluded that for better productive and economic performance through Cross bred duck @ 300/ha, dyke vegetables along with fish is a better technology option in comparison to the Tech. option with pure KC ducks.		
Feedback from the farmers	Better production and economic return can be achieved by cross breed duckery with fish culture along with dyke vegetable		

option-I and IPT option-II than farmers' practice, which may be due to higher production potentiality of Khaki Campbell duck than other two production systems. The egg production up to 72 weeks and gross return were also higher in IPT option-I than IPT option-II and farmers' practice. But, in contrary, the net return was significantly higher in IPT option-II than IPT option-I and farmers' practice which may be due to higher management cost specially feed cost of Khaki Campbell duck under extensive farming practice in IPT option-I than IPT option-II. As a result, the B: C ratio was higher in IPT option-II than IPT option-I trial under field condition. The result found support from the works reported by *Sharma (1996)*.

Table 3 depicted the data on horticulture (vegetables) component under integrated farming practice. The data were assembled throughout the trial period for 03 years on production parameters of various vegetables, i.e., pumpkin, bitter gourd, ridge gourd and cucumber round the year under the dyke vegetables cultivation practices. The results showed that all the vegetables production in IPT option-II was significantly better than IPT option-I and farmers' practice. The gross return, net return and B:C ratio were also higher in IPT option-II than other to trials in field condition for consecutively 03 years. The result was in agreement with the findings of *Ziauddin and Goswami (2005) and Barscha et. al.(1982*.

Table 4 depicted the overall economic benefit of integrated farming practice under 03 trials through fish-duck-dyke vegetables cultivation scientifically. The combined effect of 03 components has revealed that the gross return was higher in IPT option-I than IPT option-II and farmers' practice but the net return and B:C ratio were significantly higher in IPT option -II than other two trials which was obviously due to higher management cost specially feeding and lower return under extensive farming in IPT option–I @ and disintegrated system under farmers' practice. It is observed that integrated combination of IPT option-II showed maximum growth rate, higher yield and more cost effective as compared to IPT option–I and farmers' practice. *Mahapatra (2006)* revealed same fact in his study also. This is once again justified through significant variation in treatments when analysed statistically. So, it may be concluded from the study that better production and sustainable economic return can be achieved through crossbred duckery with fish culture along with dyke vegetable cultivation and this is the best recommended practice under pond based sustainable rural integrated farming system.

CONCLUSION

Rural farming system in our country is quite scattered in nature. To achieve optimum production with cost effective low investment recycling of wastes and residues from one farming to other system with due environmental consideration is very much necessary. Sustainable integrated farming practice is a very good option. This is a viable option for augmenting overall farm productivity and better economic return of rural pond based farming community. There are lots of options in integrated farming system, but as in West Bengal scenario, huge numbers of water bodies i.e., ponds are

available here and there in case of almost 70-80% of small farmers. So, pond based integrated farming practice may be one of the significant, efficient and viable option. The study proves the fact through different combined options in which IPT option-II revealed significantly better interpretative results. Scientific adoption of this integrated farming practice surrounding the seasonal pond based small farming situation will fetch cost effective, eco-friendly, sustainable but higher economic return for the farmers.

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REFERENCES

Barscha, H., Plannik, I. and Moov, R. (1982). Integration of duck & fish farming: Experimental results. *Aquaculture*, **27:**129-140.

Chand, B.K. and Goswami, A. (2005). Duck –fish integrated farming practice. Paper presented in National Seminar in Reunion of BCKV, BVC & WBUAFSC, 10th Jan, 2005. WBUAFSc, Kolkata, Pp.92-95.

Mahapatra, B.K. (2006). Integrated livestock fish culture: A subsidiary income generation to farmers. Winter school on 'complementary role of livestock & fisheries in sustainable Hill farming. PP. 35-44, 09-29th August, 2006.

Nanda, P.K. and Nayak, S.K. (2008). Integrated Livestock-cum-fish farming in India. *Aqua-International*. **16** (4):36-38.

Nanda, P.K. and Bandopadhyay, U.K. (2011). Recent advances in integrated livestock cum fish farming in India. Training manual of short course on advances in production of livestock management practices. IVRI, ERS, Belgachia, Kolkata-37.

Nanda, P.K. and Nayak, S.K. (2008). Poultry cum fish & duck cum fish farming in India-An overview. *Aquatech*, **7**(5):72-73.

Sharma, B.K. (1986). Development of fish cum duck farming in India. In training programme on integrated farming held at CIFA, Bhubaneswar from 02-12 July, 1996.

Ziauddin, G. and Goswami, A. (2005). Integrated fish farming. *Fishing chimes*, **24** (11):13-16.

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