http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 8 (3): 405-412, 2005
ISSN 1028-8880

Resource Interdependence and Enterprise Combination of Integrated Farming in Some Selected Areas of Bangladesh

Mohammad Taj Uddin and Hiroyuki Takeya
Laboratory of Socioeconomic Science of Food Production, Graduate School of Bioagricultural Sciences, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan

Abstract: The purpose of the study was to analyze the resource interdependence among different agricultural enterprises and to quantify how and how much the product, by-product and waste of one enterprise were used as input for another enterprise and to explore the nature of enterprise combination. It is found that the interdependence of resources was higher in landless, marginal and small farmers compared to medium and large farmers. However, land topography, soil composition and availability of different inputs along with the environmental factors influence the farmers in choosing different enterprises. It is revealed that insertion of vegetables into rice-based cropping pattern, cropping pattern with green manuring and rice with fish farming not only change the rice-based conventional farming but also enhance the soil fertility which in turn leads total production and income. Landless, marginal, small and medium farmers' return from integrated farming was higher and integrated farming was viable over conventional farming.

Key words: Resource interdependence, enterprise combination, integrated farming, Bangladesh

INTRODUCTION

Bangladesh rural economy is mainly considered to be crop economy, which is dominated by rice production. To increase the income from farming, production of multiple enterprises along with crop cultivation is being encouraged under various development plans like diversified and integrated farming. Diversified farming is the effort to increase the range of agricultural crops and products and also a shift from less profitable crop or enterprise to more profitable crop or enterprise.

Under diversified farming, rich farmers specialize in a few enterprises or grow some crops other than rice crops for market because they are less constrained by subsistence needs. It is pointed out that the landless, marginal and small farmers face disadvantages in terms of their limited resource base, limited knowledge and small-scale operations for producing of diversified crops. The small and marginal farmers cannot adopt capital intensive technology[1]. Under this circumstance, the integrated farming has been developed by the farmers themselves recycling their resources among different enterprises and is still largely aimed at fulfilling their needs.

Integration occurs when product or by-product of one enterprise is used as input for another with a view to reduce the costs of production and to increase the farm income. Integrated farming is one strategy that can be adopted by small farmers in many developing countries to increase farm returns from per unit area of land[2]. The rationale behind integrated farming is to minimize wastes or to add value to the products of the various enterprises on the farm. By introducing integrated farming, farmers can produce most of the necessary nutrients within their farm unit and thereby improve their nutrition.

Integrated farming is a way to supply necessary commodities to the households and to maximize and stabilize farm income with the integration of crop and non-crop agricultural enterprises. It is practiced in accordance with the households' goals, preferences and resources availability. A typical farmer in Bangladesh produces neither specialized crops nor only rice crops, but combines other enterprises such as cattle, poultry and fish along with non-agricultural enterprises.

Integrated farming is a relatively new approach. Therefore, little systematic research on integrated farming has been performed. Cerbito *et al.*[3] described a goat-crop-fodder integrated farming approach in the Philippines. This uplands farming scheme allowed the maximum utilization and conservation of available resources on the farm. Behera and Mahapatra[4] undertook a study on a pond-based farming system

Corresponding Author: Mohammad Taj Uddin, Laboratory of Socioeconomic Science of Food Production, Graduate School of Bioagricultural Sciences, Nagoya University, Furocho, Chikusa, Nagoya 464-8601, Japan Tel: 052 703 0630 Fax: 052 789 4042 E-mail: tajbau@yahoo.com

comprising poultry, duck and mushroom enterprises. Rangasamy *et al.*[5] concluded that in the irrigated lowlands of Tamil Nadu, a rice-poultry-fish-mushroom system was the most successful and could be adopted to yield higher net returns and increase productivity. Yap[6] outlines the farming technology of fish production in integrated aquaculture-livestock farming systems and defines ways to attain high fish production. However, no researcher has measured resource interdependence on the basis of farm size (i.e., landless, marginal, small, medium and large) and the nature of enterprise combination to form the integrated farming. Therefore, more research is required to enhance empirical knowledge and the understanding of integrated farming. The study aims to show how the farm households inter-relate their resources among different enterprises and how they combine different agricultural enterprises to yield the higher income.

MATERIALS AND METHODS

This study was done for a sample of 110 farmers practicing multiple enterprises in the different villages of three districts (i.e., Mymensingh, Kishoregonj and Netrokona) in Bangladesh. A stratified random sampling was employed for this study. Farmers were categorized as landless (below 0.20 ha), marginal (0.21 to 0.60 ha), small (0.61 to 1.0 ha), medium (1.1 to 3.0 ha) and large (more than 3.0 ha) based on their cultivated land. Primary data were collected for one year of operation of farms beginning from April 2002 to March 2003 by directly interviewing the selected farmers. This time period covered three crop seasons namely Kharif I (mid March to mid July), Kharif II (mid July to mid Nov.) and Rabi (mid Nov. to mid March). The survey data were collected during the months of May and June 2003. This study covered rice and cash crops, vegetables, cattle, poultry, fish, homestead enterprises and other non-agricultural enterprises. Tabular technique was used to show the interrelationship of resources among different enterprises and the enterprise combination of different categories of farmers.

RESULTS

Interdependence of resources: Farmers in Bangladesh are engaged in more than one enterprise to optimize use of resources and supplement income because of their small farming. The product or by-product of one enterprise is directly used for production of another enterprise (Fig. 1). It is found that marginal and large farmers provide a little portion of their labor for different agricultural activities (Table 1). Landless, marginal and small farmers use their entire crop product for self-consumption whereas medium and large farmers sell 20 and 40% of their crop product, respectively after fulfilling self consumption. Landless, marginal and small farmers rent 20% of their draught power for cash income. Medium and large farmers consume proportionately high amount of milk, meat, egg, fish, vegetables and fruits. Landless, marginal and small farmers sell higher quantities of vegetables, fruits and wood compared to the other categories of farmers. It was revealed that although their volume of production is low, they are forced to sell these non-rice products curtailing

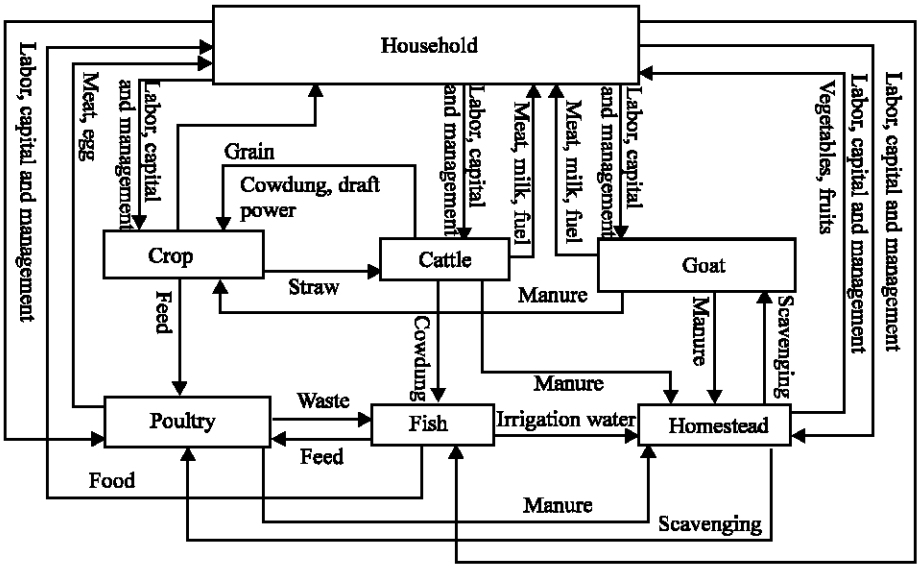

Fig. 1: Resource interdependences among different enterprises

Table 1: Resource interflow among different enterprises for different categories of farmers

	Outflow						
Inflow	Self consumption	Homestead cultivation	Crop production	Livestock rearing	Poultry rearing	Fish production	Sale for capital
Household :							
Labor and management		(10,5,5) {5,0}	(30,30,35) {10, 0}	(20,25,20) {15,0}		(0,10,15) {5,5}	(40,30,25) {70, 95}
Crop :							
Product	(100,100,100) {80,60}						(0,0,0) {20,40}
By-product	(10,10,10) {0,0}		(10,10,10) {0,0}	(80,80,80) {100,100}			
Livestock :							
Draftpower			(80,80,80) {100,100}				(20,20,20) {0,0}
Cowdung	(20,10,0) {0,0}	(5,5,5) {0,0}	(75,85,95) {100,100}				
Meat	(10,10,10) {90,100}						(90,90,90) {10,0}
Milk	(20,15,25) {100,100}						(80,85,75) {0,0}
Poultry :							
Meat	(10,10,10) {90,100}						(90,90,90) {10,0}
Egg	(20,15,25) {100,100}						(80,85,75) {0,0}
Droppings		(50,50,50) {0,0}				(50,50,50) {0,0}	
Fish	(5,10,20) {75,85}				(5,5,5) {0,0}		(90,85,75) {25,15}
Vegetables	(40,50,60) {80,100}						(60,50,40) {20,0}
Fruits	(35,40,60) {80,100}						(65,60,40) {20,0}
Wood+bamboo	(15,20,20) {80,85}						(85,80,80) {20,15}
Capital from sale	(70,40,10) {30,15}	(5,5,5) {0,0}	(15,20,35) {45,50}	(10,20,25) {10,20}		(0,15,25) {15,15}	

Source: Field survey, 2003,

Note: Numerals inside the () indicate the percentage values for landless, marginal and small farmers while numerals inside the {}indicate the percentage values for medium and large farmers, respectively.

Table 2: Sources of resources used for different categories of farmers

	Sources of resources used (%)				
Resources	Landless	Marginal	Small	Medium	Large
Human labor	100 (0)	100 (0)	100 (0)	30 (70)	5 (95)
Animal labor	100 (0)	100 (0)	100 (0)	40 (60)	5 (95)
Seed	60 (40)	70 (30)	80 (20)	50 (50)	30 (70)
Cowdung	100 (0)	100 (0)	100 (0)	80 (20)	15 (85)
Irrigation	25 (75)	25 (75)	25 (75)	0 (100)	0 (100)
Cattle feed	100 (0)	100 (0)	100 (0)	35 (65)	5 (95)
Poultry feed	100 (0)	100 (0)	100 (0)	45 (55)	25 (75)
Fish feed	100 (0)	100 (0)	100 (0)	70 (30)	10 (90)

Source: Field survey, 2003

Note: Figures outside and inside the parentheses indicate the source of resources namely internal i.e., self or home supplied and external i.e., hired or purchased, respectively.

their consumption to buy essentials and to pay back their loans.

Medium and large farmers sell their products after meeting household requirements to earn cash income in order to purchase inputs for production of different enterprises or commodities for home consumption. In that way, an inter-relationship among the enterprises prevails by providing and receiving cash and kind.

Table 2 indicates that landless, marginal and small farmers' level of resources interrelating and recycling among different enterprises is higher than that of medium and large farmers. The dependence on external inputs is lower for landless, marginal and small farmers compared to that of medium and large farmers. Integration of different agricultural enterprises provides ways to recycle products and by-products of one component as

input through another linked component, which reduces the cost of production and thus raises the total income of the farm.

Combination of agricultural enterprises: Bangladesh agriculture is dominated by rice mono-crop culture, which occupies about 73% of the total cropped area and yield of rice is also subjected to vagaries of nature. With a view to mitigate the risks and uncertainties of income from rice crop enterprises, it is essential for farmers to include such non-rice crops in their cropping pattern that yield regular and evenly distributed income throughout the year.

Inclusion of vegetables into rice based cropping pattern: Bangladesh is endowed with a favorable climate and soil for the production of variety of vegetables all the year round. The winter brings country beans, amaranth, spinach, pumpkin, cabbages, cauliflower, radish, egg plant, tomato, bottle gourd, etc; while the summer includes lady's finger, tindori, bitter gourd, cowpea, Indian spinach, egg plant, ridge gourd, arum, taro, etc. Summer vegetables in kharif I season and winter vegetables in Rabi season can be introduced into rice based cropping patterns to earn the maximum return. Since rice is the only crop in the Aman season, farmers have no alternative to choose the other crops at that period.

In terms of shares in total cultivated area, positions of the vegetative crops differ seasonally (Table 3). Farmers get more net return by inclusion of vegetables into rice based cropping patterns in both the seasons. Moreover, farmers can change the continuous rice mono cropping and also avoid the risk of decrease in rice yield.

It is found from the field survey that although vegetables production is profitable, landless, marginal and small farmers are not able to convert more land into vegetables production, as they need to be allocated a fixed amount of land depending on their needs to produce subsistence crops. In spite of having fallow land in both the seasons, medium and large farmers cannot bring all the fallow lands for vegetables production due to some constraints like topography of the land, availability of hired labor and irrigation water. Another important issue raised by all the farmers which is the fluctuation of vegetables prices and they can not store this products for high price as it is very much perishable.

Cropping pattern with green manuring: In Bangladesh, depletion of soil fertility is mainly due to depletion of organic matter caused by intensive cropping in the same

Table 3: Crop enterprise combination under different seasons (in ha)

	Kharif I season (mid March to mid July)						
						Impacts on net return (Tk.)	
Farmers' category	Cultivated area	Aus rice	Summer vegetables	Other crops	Seasonal fallow	Rice without vegetables	Rice with vegetables
Landless	0.15	0.08	0.05	0.02	-	195	708
Marginal	0.30	0.12	0.08	0.07	0.03	580	1214
Small	0.66	0.26	0.15	0.12	0.13	723	1744
Medium	1.30	0.40	0.28	0.25	0.37	4320	4964
Large	3.53	1.00	0.42	0.66	1.45	7696	8929
	Rabi season (mid November to mid March)						
						Impacts on net return (Tk.)	
Farmers' category	Cultivated area	Boro rice	Summer vegetables	Other crops	Seasonal fallow	Rice without vegetables	Rice with vegetables
Landless	0.15	0.12	0.01	0.02	-	822	940
Marginal	0.30	0.20	0.09	0.01	-	2185	2527
Small	0.66	0.49	0.12	0.05	-	3999	4938
Medium	1.30	1.10	0.20	0.04	0.06	14642	14750
Large	3.53	2.00	0.35	0.73	0.45	20394	20894

Source: Calculated by the authors

Table 4: Effects of green manure (GM) on the succeeding crops

	Before cultivation of GM (kg ha^{-1})		After cultivation of GM (kg ha^{-1})		Impacts on increase in yield (kg ha^{-1})	
Crops	Product	By-product	Product	By-product	Product	By-product
Aman	2371	1121	2851	1250	480	100
Boro	3597	2000	3721	2053	124	53

	Area under cultivation of GM	
Farmers' category	Area (ha)	% of the following farmers
Marginal	0.03	10
Small	0.13	30
Medium	0.25	40

Source: Calculated by the authors

Table 5: Economics of integrated farming

	Rice-Rice farming			Rice with fish farming					
Particulars	Aman	Boro	Total	Rice	Fish	Total	Live-stock	Poultry	Pondfish
Yield (kg ha^{-1})	2371	3897	5968	2370	1157	-			
Straw (kg ha^{-1})	1120	2000	3120	1120	-	-			
Gross return (Tk./unit)	19430	30978	50407	19430	28925	48355	6015	174	102256
Gross costs (Tk./unit)	17448	24467	41915	15258	21280	36538	4250	130	57596
Net Return (Tk./unit)	1982	6511	8492	5172	7645	11817	1765	44	44660
Net return per Taka invested		0.20			0.32		0.42	0.34	0.76

Economics of integrated farming in comparison with conventional farming

Farmers' category	Gross return (Tk.)	Gross cost (Tk.)	Net return (Tk.)	Benefit: cost ratio (BCR)
Integrated farming				
Landless	20810	6243	14567	3.33 (1.56)
Marginal	32709	8859	23878	3.70 (1.89)
Small	55023	18158	36865	3.03 (1.89)
Medium	118683	53407	65276	2.22 (1.92)
Large	182846	106051	76795	1.72 (1.45)
Conventional farming				
Landless	14567	5827	8740	2.50 (1.54)
Marginal	21915	9818	12097	2.23 (1.43)
Small	35765	15379	20386	2.33 (1.49)
Medium	74770	48601	26170	1.54 (1.14)
Large	109708	76795	32912	1.43 (1.16)

Figures in the parentheses indicate BCR on the basis of full cost consideration.

land year after year without proper soil management practices. The situation is more graver in areas where high yielding varieties are being cultivated using low and unbalanced doses of mineral fertilizers with little or no organic recycling[7]. To sustain productivity, soils must be enriched with organic fertilizers producing green manure periodically, especially in continuous cropping areas.

Green manure is grown in the period between Boro harvest and transplanting of Aman rice. It adds nitrogen and organic matter to the soil. It is revealed that organic matter content from green manuring was 3100 kg ha^{-1}. The present green manuring shows a yield increase of 480 kg ha^{-1} of the succeeding transplanted Aman rice with 100 kg ha^{-1} of by-product and 124 kg ha^{-1} of the succeeding transplanted Boro rice with 53 kg ha^{-1} of by-product, compared to plots where green manuring is not practiced (Table 4). The data also indicates that rotating rice with adopting green manures improves the productivity compared to rice-rice mono cropping.

The farmers of the survey areas mentioned that practicing of green manuring is certainly an innovative practice for them to increase the soil fertility and increases the crop production. Although large farmers have a big size of cultivated land and also keep a good size of fallow land seasonally, none of them practice green manuring because of difficulties for them to produce and manage green manure between the harvest of Boro and transplant of Aman rice as the time gap is very short.

Rice with fish farming: The integrated culture of fish into rice fields in the study areas is a technology for increasing the income of farmers. The rice fields inundated for 3-4 months during rainy season were developed to culture fish along with transplant Aman rice. After three weeks, once the rice seedlings are well established, the fish of different densities and species combinations are let into the rice fields. In this method, farmers release short-cycle species/fingerlings such as carpio, catla, mrigala, rohita, tilapia, idella, etc. at the stocking densities about 6700 numbers ha^{-1}. The plots were then fertilized with 50 kg of urea, 30 kg of potash and 300 kg of manure per ha. Fish were harvested 70-90 days after rice. The amount of yield was 1157 kg of fish along with 2370 kg of Aman rice (Table 5).

Table 5 indicates that cost of production of Aman rice decreases (Tk. 17448 to 15258) in the rice-fish farming as there is some recycling of resources among rice and fish cultivation. The data also revealed that if the farmers continue to rear fish in the rice field by sacrificing the next crop (i.e., Boro rice), the net return is higher (Tk. 11817) than producing Boro after harvesting of Aman rice without fish (Tk. 6511). Net return per Taka invested is higher in rice-fish farming than that of rice-rice farming. Farmers also informed that they use low amount of chemical fertilizers in rice cum fish integrated farming, which is also a positive aspects of maintaining soil fertility. Although rice cum fish integrated farming changes the cropping pattern and brings higher return, only 10% marginal, 30% small and 20% medium farmers practice this farming because of risk of non-availability of irrigation water in the dry season and threat of theft. It is also found that 40% landless, 44% marginal, 70% small,

Table 6: Annual income from non-agricultural enterprises for different categories of farmers

Farmers' category	Total income (Tk.)	Trading (Tk.)	Service/remittance (Tk.)	Rickshaw (Tk.)	Handicraft (Tk.)	Wage earning (Tk.)
Landless	15203	-	-	4458	5202	5543
	(15319)			(7270)	(2975)	(5074)
Marginal	16151	-	-	4666	7508	3977
	(19278)			(7474)	(3213)	(8591)
Small	14013	2544	3952	1641	3960	1915
	(16605)	(-)	(5973)	(5066)	(3665)	(1901)
Medium	15929	4753	11176	-	-	-
	(53783)	(8752)	(45031)	-	-	-
Large	17767	1454	16313	-	-	-
	(110142)	(20454)	(89688)			

Source: Field survey, 2003

Figures in the parentheses indicate the income of farmers from conventional farming.

Table 7: Combination of crop, non-crop and non-agricultural enterprises

Farmers' category	Combination of crop, non-crop and non-agricultural enterprises	No. of farmer
Landless	(I) Multiple crop + vegetables+ homestead+ livestock + poultry + fish+ rickshaw	12 (40)
	(ii) Homestead + livestock + poultry + rickshaw + handicrafts	10 (33)
	(iii) Rice crop + homestead + rickshaw + wage earning	8 (27)
Marginal	(I) Multiple crop + vegetables + homestead + livestock + poultry + fish + wage earning	13 (44)
	(ii) Rice crop+ vegetables + homestead + livestock + poultry + richshaw + handicrafts	10 (33)
	(iii) Rice crop + homestead + richshaw	7 (23)
Small	(I) Multiple crop + vegetables+ homestead + livestock + poultry + fish + rickshaw	8 (40)
	(ii) Rice crop+ vegetables + homestead + poultry + fish + trading + wage earning	6 (30)
	(iii) Rice crop + homestead + rickshaw + handicrafts	6 (30)
Medium	(I) Multiple crop + vegetables + homestead + livestock + poultry + fish	7 (35)
	(ii) Rice crop + vegetables + homestead + livestock + fish + trading	8 (40)
	(iii) Rice crop + homestead + mechanical work	5 (25)
Large	(I) Multiple crop + vegetables + homestead + livestock + poultry + fish	2 (20)
	(ii) Rice crop + homestead + poultry + fish + trading	2 (20)
	(iii) Rice crop + homestead + service	6 (60)

Source: Field Survey, 2003

Note: Figures in the parentheses indicate percentage. Homestead includes fruits, wood, bamboo and home surrounding vegetables. Multiple crops include rice, wheat, jute, oilseed, mustard, pulses, sugarcane, etc.

Table 8: Contributions of different enterprises in total household income

		Contribution of enterprises to total household income (%)					
Farm size group	Total annual household income (Tk.)	Rice crop	Vegetables	Other crops	Non- crop	Homestead cultivation	Non-agricultural enterprises
Landless	36013	21.5	5	4.2	20.3	6.7	42.2
	(31886)	(35.5)	(0.0)	(0.0)	(0.0)	(16.5)	(48.0)
Marginal	54860	26.6	8.9	5.3	19.2	10.6	29.4
	(41261)	(36.5)	(0.0)	(0.0)	(0.0)	(16.7)	(46.7)
Small	69036	28.2	10.1	7	20.8	13.6	20.3
	(52370)	(38.5)	(0.0)	(0.0)	(0.0)	(29.8)	(31.7)
Medium	134610	42.8	10.5	5.7	21.4	7.7	11.8
	(128553)	(52.2)	(0.0)	(0.0)	(0.0)	(6.0)	(41.8)
Large	200613	54.1	11.5	4.4	13.9	7.3	8.9
	(219850)	(48.0)	(0.0)	(0.0)	(0.0)	(1.9)	(50.1)

Source: Field Survey, 2003

Figures in the parentheses indicate the contribution of conventional farming in total household income.

75% medium and 40% large farmers have pond fish farming.

The economics of the integrated farming is compared with conventional farming. It is revealed that the net returns and benefit cost ratio of the integrated farming are more than the conventional farming. The landless, marginal and small farmers earn more compared to other categories of farmers on the basis of cash cost consideration. The reasons behind it that they are recycling resources more among different enterprises, which leads them to less dependence on external inputs and decrease the cost of production. It is found from the field survey that 32% of the sampled farmers practice conventional farming and the other farmers follow integrated farming i.e., multiple crops or only rice with other non-crop enterprises.

Non-agricultural enterprises: The major portion of the labor force in Bangladesh depends on agriculture for their livelihood, although farm family labor is not completely utilized in agricultural enterprises. Most of the landless, marginal and small farmers use to sell their labor in slack

seasons within and outside the area. Based on the seasonal demand of agriculture, members of the poor family involve themselves in rickshaw pulling, handicrafts, etc. Some people are engaged in grocer's shop, tailoring, carpentry, petty trading and a few members are doing jobs in inside and outside of the country. Table 6 shows that income from non-agricultural enterprises is higher for farmers in conventional farming compared to those of integrated farming in respect of farm size.

Combination of crop, non-crop and non-agricultural enterprises: An attempt was made to identify the combination of crop, non-crop and non-agricultural enterprises practiced by different categories of farmers following their own resource interdependence. As would be evident from the Table 7, landless, marginal and small farmers practice more non-agricultural enterprises than medium or large farmers. On the other hand, medium and large farmers practice more crop and non-crop enterprises than landless, marginal and small farmers. It appears that apart from crop and non-crop enterprises, rickshaw pulling is the common practice for landless, marginal and small households. Among the non-crop agricultural enterprises, poultry and pond fish culture are common for all categories of farmers. It is also found that around 70-76% of the total landless, marginal and small farmers practice integrated farming i.e., multiple crops or only rice with non-crop and non-agricultural enterprises whereas the percent of the farmers of medium and large groups is 40-50 for such farming. Residual 24-30% of the landless, marginal and small farmers and 50-60% of the medium and large farmers follow conventional farming i.e., rice mono cropping with homestead and other non-agricultural enterprises.

Contribution of different enterprises in total household income: There is a substantial income gap exists in total household income and income structure among the farm categories (Table 8). It is observed that the share of non-agricultural enterprises to total household income decreases with the increase in farm size whereas it is different for medium and large farmers in conventional farming. Within agricultural enterprises, the highest income is obtained from rice crop followed by non-crop and vegetables production in integrated farming. Income generation from non-crop enterprises for different categories of farmers in integrated farming is more or less the same. For landless and marginal farmers, the highest contribution to household income in integrated farming resulted from non-agricultural enterprises. In medium and large farmers, rice crop enterprises in both types of farming constituted around 42.8 to 54.1% of their total income. Income from integrated farming is higher for all categories of farmers compared to conventional farming except the large farmers as they earn a good amount of remittances from outside the country. The income rise seems to be quite encouraging for landless, marginal and small farmers in integrated farming.

DISCUSSION

This study has been done on the basis of farm size, enterprise combination and farming method. The results demonstrate that farm size is a very important factor in analyses of integrated farming because the different size farmers has different resource endowments, restrictions and preferences. Analyzing enterprise combination by farm size and farming method is also necessary for identifying the profitable method and recipient farmers' group. The results imply which category of farmers is being more benefited from which type of farming and enterprise combination within their circumstances. Landless, marginal and small farmers in integrated farming use less amount of external inputs and thereby increase the income from agricultural enterprises compared to farmers in conventional farming. Integrated farming consisting of crop(s), cattle, poultry, fish, homestead is more profitable and viable over conventional farming comprising of rice and homestead enterprises which is different from the study of Ganesan *et al.*[8] where they found that rice farming with duck-cum-fish culture is more profitable than existing rice-rice-pulse farming. Integrated farming can bring beneficial change for the landless, marginal and small farmers, who are around 80% of the total farm households in Bangladesh. As it is labor-intensive technology, they can afford this farming and augment their income. Even farmers having no land or capital can be involved themselves in integrated farming with homestead, cattle and poultry enterprises if institutional or non-institutional credit along with logistic supports such as extension services are made available for them on easy terms and condition. Finally it can be concluded that any intervention in integrated farming, landless, marginal and small farmers will be major beneficiaries which will have direct impact on poverty alleviation in developing countries.

REFERENCES

1. Jodha, N.S., 1986. Research and technology for dryland farming in India: Some issues for the future strategy. J. Agric. Econ., 41: 234-247.
2. Amarasinghe, O., 1991. Some economic aspects of integrated livestock-fish farming in Sri Lanka. Paper Presented at the International Workshop on Integrated Livestock-Fish Production Systems held on 16-20 December, 1991 at the Institute of Advanced Studies, University of Malaya, Kuala Lumpur.

3. Cerbito, W.A., E.C. Villar, K. Sato, F. Quero, C.R. Balagapo and P.S. Faylon, 1995. Goat-crop-fodder integrated farming system at village level. Indian J. Ani. Sci., 65: 218-221.
4. Behera, U.K. and I.C. Mahapatra, 1999. Income and employment generation for small and marginal farmers through integrated farming systems. Indian J. Agron., 44: 431-439.
5. Rangasamy, A., R. Venkitaswamy, S. Purushothaman and Sp. Palaiappan, 1996. Rice-poultry-fish-mushroom integrated farming systems for lowlands of Tamil Nadu. Indian J. Agron., 41: 344-348.
6. Yap Siaw-Yang, 1991. Fish production in integrated farming system. Paper Presented at the International Workshop on Integrated Livestock-fish Production Systems. Held on 16-20 December 1991 at the Institute of Advanced Studies. University of Malaya, Kuala Lumpur.
7. Bangladesh Agricultural Research Council, 1999. Land Degradation Situation in Bangladesh, Soil Division, BARC, Dhaka, Bangladesh.
8. Ganesan, S., K.N. Chinnaswami, B. Chandrasekaran, M.N. Budhar and M.J.P. Jayaseelan, 1991. Duck-cum-fish culture in rice farming system in cauvery delta region of Tamil Nadu: The aduhurai experiment. J. Agric. Econ., 46: 180-185.