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Economics of Livestock Integrated Farming System: A Case study of Pig-Based Integrated Farming System in Ri-Bhoi district of Meghalaya

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ABSTRACT: *Integrated Farming System is common to most part of north-eastern region of India because of the prepondence of small farm system which are backbone of the traditional agriculture. In north-eastern region of India farmers are generally practicing organic farming; therefore a farmer prefers to keep few livestock and fishery so that soil nutrient could be increased through animal excreta. Livestock Census 2003 reveals that NEH region is home for 210.32 lakh livestock and 364.62 lakh poultry which accounts for 4.34 per cent of the total livestock and 7.46 per cent of poultry birds in India (Table 2). Assam being the largest state have maximum (66% and 59%) of the total livestock and poultry resources of NE Regions and followed by Meghalaya (7% each) and Tripura (7% & 8%). Cattle population occupies 55 per cent of the total livestock of the NEH region. The per capita milk availability has increased from 7 per cent during 1998-99 and 2005-06 while during the same period national average has improved by 13 per cent. Amongst the NE states, in Nagaland the productivity of local cows is highest (2.2 litre/day) whereas in Assam, which is the major milk producing state in NEH region, it is lowest (0.92 litre per day). An integrated community based approach is best to bring about incremental changes in the production system to improve productivity and efficiency. Strengthening of local social institutions and use of the same for putting peer pressure and for service delivery is another way forward to make pig based farming system approach a success. Interventions need to be simple, cost effective, fully community driven and highly remunerative.*

INTRODUCTION

Integrated farming system is a simple term is combination of crop, livestock and fishery farming through which the resources are well managed economically in order to have more and steady income. This system is common to most part of north-eastern region of India because of the prepondence of small farm system which are backbone of the traditional agriculture. In north-eastern region of India farmers are generally practicing organic farming, therefore a farmer prefers to keep few livestock and fishery so that soil nutrient could be increased through animal excreta. Most of the people residing in this region are tribal and they are non-vegetarian in their dietary habits for which meat and fish products are very much in demand. The different research conducted at ICAR NEH region indicated that agriculture, horticulture, animal husbandry and fishery production system individually at subsistence level but incorporation of all this system proves that these systems are not competitive rather complementary to each other and farm profitability can be increased through practicing this. As NEH is a complex, diverse and risk prone region farmers are essentially practicing both raising of crops and rearing of livestock and fishery. The seven sisters Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim constitutes the North-Eastern Hill (NEH) region of India which occupies about eight per cent of total land area and 3.8 per cent of total population of the country. Agriculture is the major source of employment and livelihood for around 70 per cent of population in this region. The area is known as meat consuming zone of India. The most preferred meat is pork, followed by beef, chicken and others. Consumption of milk and milk products is lower in this part in comparison to Northern states of India due to food habit and less availability of milk but due to increase in per capita income and changes in life style demand for milk and milk products is also growing. Moreover, the area is poverty ridden and the issue of nutrition in the distant hills remains

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unresolved. Hence, enhancement of milk production especially in landless and marginal households may be of prime importance. About 30 per cent of landless and 48 per cent of marginal households keep livestock in the NEH region (NSSO, 2003). Livestock sector can also generate alternate livelihood to the marginal section of the society. Keeping in view about the potential of livestock sector vis-à-vis poverty alleviation, nutritional security and employment generation in hilly tracts of the NEH region, it is pertinent to study the status and performance of the livestock sector in the region. This paper is an attempt in that direction.

Share of Livestock in Agricultural State Domestic Product (SDP)

Over the years the share of agriculture and allied sector to the Gross Domestic Product (GDP) of India has started declining whereas the share of livestock sector to the agriculture GDP is increasing over the years but the trend is reverse in case of livestock sector in NE states (Table 1). Growth in both sectors has varied widely across states within the NEH region. However, the inter-state growth in the livestock sector has been more equitable than the crop sector (*Kumar et al.*, 2007).

Livestock and Poultry Population

According to Livestock Census 2003, NEH region is home for 210.32 lakh livestock and 364.62 lakh poultry which accounts for 4.34 per cent of the total livestock and 7.46 per cent of poultry birds in India (Table 2). Assam being the largest state have maximum (66% and 59%) of the total livestock and poultry resources of NE Regions and followed by Meghalaya (7% each) and Tripura (7% & 8%). Cattle population occupies 55 per cent of the total livestock of the NEH region. Goats and pig are the other major animals reared in the region with a share of 21 per cent and 18 per cent of the total livestock population.

Maximum of the cattle population is local cows, crossbreds (CB) being only 8 per cent which is much lower than the national average of 13 per cent. The proportion of crossbred animals to total population in Nagaland (54%), Sikkim (50%) and Manipur (17%) is higher than the national average. Nagaland has 26 per cent of the total CB population of the NEH Region, after Assam (47%). The region is also home tract of 91 percent of Mithun population of India and mainly concentrated in Arunachal Pradesh. Assam, Nagaland and Meghalaya are the major pig rearing states of NEH region. Twenty eight per cent of total pig population of India is found in the region. In case of poultry, Assam accounts for 59.42 per cent of the total poultry population of NEH region, followed by Tripura (8.38 %) and Manipur (8.07%).

The change in structure of livestock production is depicted in Table 3. In between 1997 and 2003, the population of cattle, buffalo and yak has declined in the region. Yak population has declined significantly (35%) in Arunachal Pradesh but the region has registered significant increase in sheep (51%) and pig (25%) population during the same period. The percentage increase in sheep, goat and CB population is higher in NEH region than the average national level increase. The region has experienced an increase of 13 per cent in poultry population. Maximum growth in CB population can be observed in Nagaland (58%) and Sikkim (54%) but decline can be observed in most of NE states in case of local cows. Only in Mizoram and Meghalaya the population of buffalo increased during the period of 1997-2003. Sheep population has jumped by 102 per cent and 100 per cent in Assam and Nagaland during the same period. Maximum growth in goat population can be observed in Arunachal Pradesh and Sikkim.

Production Trends

Milk production has increased from 1075 thousand tonnes in 1998-99 to 1169 thousands tonnes in 2005-06 which is an increase of 9 per cent but during the same period milk production of India has increased by 35 per cent (Table 4). Milk production has increased in all the NE states except Mizoram during the period of 1998-99 and 2005-06. Increase in milk production is higher than the national average only in two states, i.e., Nagaland and Sikkim. It is interesting to note that Assam which has the largest livestock resource in the region has the minimum growth in milk production which may be contributed to the fact that it has maximum of indigenous breed in total cattle population. The total milk production of the region is only 1.20 per cent of the total milk production of the country during 2005-06 which is a clear decline from 1.49 per cent during 1998-99.

The per capita milk availability is 100g/day during 2005-06 which is only 40 per cent of the national average of 241 g/day and much lower than the Indian Council of Medical Research (ICMR) recommendation level of milk consumption of 220 g/day for a person. The per capita milk availability has increased from 7 per cent during 1998-99 and 2005-06 while during the same period national average has improved by 13 per cent. Arunachal Pradesh, Assam

and Mizoram witnessed decline in per-capita availability of milk while in other states, it has increased.

In aggregate level in NEH states egg production is only two per cent of the total egg production level in the country during 2005-06 (Table 5). Assam is the highest (55%) producer of egg in the region, followed by Tripura (11%) and Nagaland (9%). Though the country has witnessed a huge leap in egg production during the 1998-99 and 2005-06 but it has been much slower in NEH region. A significant decline of 78 per cent can be observed in egg production in Arunachal Pradesh whereas Nagaland has witnessed highest (81%) increase in egg production in the region during the same period.

In NEH states per capita egg availability is 34 in comparison to national average of 42. The per capita availability of eggs is higher in Nagaland (41) followed by Manipur (40) and Meghalaya (39). All the states registered varying degree of increase in per capita egg availability except Sikkim, Mizoram and Tripura.

The meat production in recognized sector has also gone up by 63 per cent in NEH region between the period of 2000-01 and 2005-06 which is significantly higher than the increase in all India level (Table 6). Though all the states in the region have witnessed increase in meat production but the increase in Nagaland and Assam is significant which may be due to their large livestock base and people's preference for meat.

Productivity of Animals

From Table 7 it is clear that the average productivity of crossbred cattle in milk in NEH region is 6.37 litre per day which is slightly lower than the national average of 6.44 litre per day. The productivity of crossbreds in Meghalaya, Mizoram and Manipur is more than the national average. But the local cows which constitute more than 90 per cent of the total cattle population of the region are low yielder with productivity of 1.25 litre of milk per day only. Amongst the NE states, in Nagaland the productivity of local cows is highest (2.2 litre/day) whereas in Assam, which is the major milk producing state in NEH region, it is lowest (0.92 litre per day). Perusal of productivity of milk in case of buffalo shows that the buffaloes in the region are very low yielder in comparison to other parts of India. Similarly, the productivity of deshi and improved fowl is much lower than the national average. Deshi fowls of Arunachal Pradesh and Sikkim produces more than the rest of India whereas improved fowls of Sikkim, Nagaland and Arunachal Pradesh produces more than the rest of India.

Feed and Fodder

The quantum, the type and quality of feed resources also vary across the states in the region (Table 8). Crop residues and byproducts are used as animal feed in the region. The feed resources used by the farmers of the region are not balanced in terms of protein and energy to meet the nutrient requirement of the animal leading to poor performance. The gap between demand and availability is major challenge to the animal rears in the hills, especially in summer. The area under fodder is very minimal in NEH region as like whole India (Table 10). Farmers mainly depend on common property resources, viz., permanent pastures and grazing lands, wastelands, fallows etc. for grazing of animals. However, these resources have been dwindling over time (*Kumar et al.*, 2007). Gap in availability of concentrate is around 75 per cent (Gupta, 2007).

Table A
Socio-economic Profile of the Households

Particulars	*Results*	
	Before the project interventions	*After the project interventions*
Households rearing pigs for breeding purpose (for piglet production)	2 households	34 households
Interest, knowledge and confidence of the community members to rear breeding herd	Very poor	Confident
Availability of good quality cross bred piglets	Unavailable	Available
Households with cross bred pigs	4 households	34 households
Households with improved housing	4 households	34 households
Access to veterinary medicine, vaccine	Absent	Available
Practice of cleaning pig stys, utensils, pigs etc. & hygienic disposal farm manure	Absent	Present
Mortality of pigs	10-20%	Nil

ECONOMICS OF PIG BASED INTEGRATED FARMING SYSTEM

In Ri-bhoi district, farmers typically view their farms, whether large corporations or small subsistence units, as systems. Keeping in view of different farming condition, farming system research approach, which constituted an important step forward in agricultural research in northeast particularly in the hilly districts of Meghalaya, was studied in detail by ICAR research complex for NEH Region.

Table B
Economics of Pig-based Farming System

Component	*Before*	*After*
Households with breeding pig herd	2	34
Households with improved pigs	4	34
No. of units	34	34
Increase in production	30 kg/ annum or 4-8 piglets/ farrowing	70 kg/ annum or 8-11 piglets/ farrowing
Cost of production	Rs. 1,000	Rs.3263
Gross Income:	Rs. 4,000	Rs. 20,000
Net Income	Rs. 3,000	Rs. 16,737
Income enhancement		557%
Employment enhancement		6%

IMPACT

- Increased interest on pig keeping, especially for breeding purpose.
- Men were less involved in management of pigs but now they have become more interested.
- Learned about the importance of vaccination, deworming and quarantine measure to prevent diseases.
- Demonstrated activities are affordable and accessible to the community.
- Improved system is cost effective and does not put any additional burden on exiting household labour and feed resources.
- Increase in income from piggery by 557% compared to farmers practice.

Table C
Production and Economics of Activity Site

Components	*Area (ha)*	*Production (kg)*	*Cost (Rs)*	*Gross income (Rs)*	*Net income (Rs)*	*B:C ratio*
			Before			
Cereals	0.70	800	5,500	9,500	4,000	0.42
Vegetables	0.40	1380	6,500	12,500	6,000	0.92
Tubers*	0.10	5000	3,000	6,896	3,896	1.30
Total	1.20		15,000	28,896	13,896	
			After			
Cereals**	0.70	1900	6,000	13,200	7,200	1.20
Vegetables	0.40	2100	9,000	21,000	12,000	1.33
Tuber crops	0.10	5000	3,000	-	-	
Poultry***	10 x5 (0.005)	240	10,500	28,800	18,300	1.74
Pig***	10 x 3 (0.003)	200	12,400	32,000	19,600	1.58
Total	≈ 1.20		49,400	1,20,200	73,800	

* Tuber crops (*colocasia* and tapioca) were used for livestock feed instead of selling.
**Cereal mostly maize was used as feed for livestock
*** Pig and poultry were given place pond embankment

Table D
Economic Assessment of Fish cum Livestock (Pig and Poultry) based Farming System

Particulars	*Before*	*After*
Cost of cultivation (Rs/ha)	12,500	41,160*
Gross return (Rs/ha)	24,080	1,00,160
Net return (Rs/ha)	11,580	61,500
Additional income (Rs/ha)	-	49,920
B:C ratio	0.93	1.49
Man days required (man-days/ha/year)	220	405
Employment enhancement (%)	-	84.1
Cropping intensity (%)	100	250
Land use (days)	260	340
Land use efficiency (land use/365) (%)	71.2	93.1

*cost of cultivation includes construction of poultry and pig shed

CONCLUSION

Though there are different constraints in the rearing of crossbreeds, sheep, goat, pig and fishery breeds but they are proving good scope for the landless and marginal farmers in improving their socio- economic condition as being prolific and low input requirement. Pig rearing is very promising in this region which is helping farmers in diversifying their income source. The main thrust of livelihood 3Fs, food, fodder and fuel can be ensured through following integrated farming approach. An integrated community based approach is best to bring about incremental changes in the production system to improve productivity and efficiency. Strengthening of local social institutions and use of the same for putting peer pressure and for service delivery is another way forward to make pig based farming system approach a success. Interventions need to be simple, cost effective, fully community driven and highly remunerative. Hence, it is concluded that the livestock sector can play a good role not only in the issues of food security and nutritional security in the Meghalaya but also will be helpful in income and employment generation to the rural poor if proper policy initiatives are taken.

Table 1
Share of Livestock in Agricultural SDP and Compound Growth Rates in Agriculture, Crop and Livestock Sector (in %)

A. Share of livestock in agricultural SDP

States	*TE 1992-93*		*TE 2002-03*	
	Share of agriculture in SDP	*Share of livestock in agricultural VOP*	*Share of agriculture in SDP*	*Share of livestock in agricultural VOP*
NER	34.2	19.5	28.8	18.1
All India	29.2	24.1	21.4	27.6

B. Compound growth rate

States	*Agriculture*	*Crops*	*Livestock*
	1993-94 to 2004-05	*1992-93 to 2002-03*	*1992-93 to 2002-03*
NER	2.99	3.13	2.37
All India	2.48	2.09	3.51

Source: National Accounts Statistics (various years), CSO

Table 2
(in thousand)

States	Cattle			Buffalo	Sheep	Goats	Pigs	Yaks	Mithun	Total livestock	Total poultry
	CB	Local	Total								
Arunachal Pradesh	13	445	458	11	19	231	330	9	192	1257	1743
Assam	440	8000	8440	678	170	2987	1543			13829	21664
Manipur	69	349	418	77	6	33	415		20	971	2941
Meghalaya	23	744	767	18	18	327	419			1551	2821
Mizoram	9	27	36	6	1	17	218		2	280	1125
Nagaland	243	208	451	34	4	175	644		40	1349	2789
Sikkim	80	79	159	2	6	124	38	7		337	322
Tripura	57	702	759	14	3	472	209			1458	3057
NEH region	934 (3.78)	10554 (6.58)	11488 (6.20)	840 (0.86)	227 (0.37)	4366 (3.51)	3816 (28.23)	16 (24.62)	254 (91.37)	21032 (4.34)	36462 (7.46)
All India	24686	160495	185181	97922	61469	124358	13519	65	278	485002	489012

CB denotes crossbreed and Figures in parentheses indicate percentage of NEH region to all India
Source: Livestock Census (2003)

Table 3
Change in Livestock and Poultry Population: 1997-2003 (in %)

States	Cattle			Buffalo	Sheep	Goats	Pigs	Yaks	Mithun	Total livestock	Total poultry
	CB	Local	Total								
Arunachal Pradesh	18.18	1.14	1.55	-8.33	-29.63	50.00	32.53	-35.71	54.84	21.22	34.91
Assam	19.24	3.52	4.24	-6.87	102.38	9.94	42.61			8.72	18.97
Manipur	0.00	-20.50	-17.72	-18.95	-25.00	0.00	6.96		17.65	-7.61	-3.73
Meghalaya	35.29	0.68	1.46	5.88	5.88	16.79	19.37			8.92	31.09
Mizoram	12.50	8.00	9.09	20.00	0.00	13.33	33.74		-33.33	26.13	-13.93
Nagaland	57.79	-9.17	17.75	-5.56	100.00	8.70	12.78		21.21	13.55	14.12
Sikkim	53.85	-13.19	11.19	0.00	20.00	44.19	40.74	40.00		23.44	45.70
Tripura	-21.92	-39.22	-38.19	-22.22	-50.00	-26.13	-0.95			-30.74	-14.97
NEH region	24.04	-2.69	-0.96	-8.00	51.33	6.88	25.44	-15.79	43.50	5.05	12.97
All India	22.82	-10.23	-6.89	8.90	6.91	1.33	1.72	10.17	57.06	-0.08	40.68

Source: Livestock Census (1997 & 2003)

Table 4
Estimates of Milk Production and Per capita Milk Availability

States	Milk Production (in '000 tonnes)			Per capita milk availability (g/day)		
	1998-99	2005-06	% increase	1998-99	2005-06	% increase
Arunachal Pradesh	45	48	6.67	119	113	-5.04
Assam	725	747	3.03	79	72	-8.86
Manipur	65	77	18.46	87	92	5.75
Meghalaya	61	73	19.67	76	82	7.89
Mizoram	20	15	-25.00	65	43	-33.85
Nagaland	48	74	54.17	69	96	39.13
Sikkim	35	48	37.14	186	232	24.73
Tripura	76	87	14.47	69	70	1.45
NEH region	1075 (1.49)	1169 (1.20)	8.74 (25.29)	93.75 (44.01)	100 (41.49)	6.67 (50.71)
All India	72128	97066	34.57	213	241	13.15

Figures in parentheses indicate percentage of NEH region to all India
Source: Basic Animal Husbandry Statistics (2006)

Table 6
Estimate of Meat Production (in thousand tonnes)

States	*2000-01*	*2005-06*	*% increase*
Arunachal Pradesh	18.4	20	8.70
Assam	17.18	26.64	55.06
Manipur	20.95	23	9.79
Meghalaya	34.32	36.54	6.47
Mizoram	7.64	9.24	20.94
Nagaland	18.73	63.25	237.69
Sikkim	NA	0	
Tripura	NA	12.22	
NEH region	117.22	190.89	62.85
All India	1851	2310	24.80

NA indicates data not available

Source: Basic Animal Husbandry Statistics (2006)

Table 7
Milk Productivity Across Animals: 2005-06

States	*Milk (Kg/day)*			*Eggs (No/annum)*	
	Cross breed	*Local*	*Buffalo*	*Deshi*	*Improved*
Arunachal Pradesh	6.00	1.15	NA	184*	296.96*
Assam	3.52	0.92	1.75	93.2	180.25
Manipur	7.49	1.41	2.95	60.91	118.14
Meghalaya	8.93	0.74	1.87	104.01	216.1
Mizoram	8.12	1.1	1.76	74.1	205.88
Nagaland	6.39	2.21	2.51	144.95	290.66
Sikkim	NA	NA	NA	182.5*	337.42*
Tripura	4.12	1.19	2.71	98.85	165.13
NEH region	6.37	1.25	2.26	96.00	196.0267
All India	6.44	1.97	4.3	111.65	258.29

* data for 2003-04 and not included for calculation of productivity of egg of NEH region
NA indicates data not available
Source: Basic Animal Husbandry Statistics (2005)

Table 8
Average Fodder Availability Per Adult Bovine (kg/day) in North Eastern States

States	*Dry fodder*	*Green fodder (average of 1997-2002)*
Arunachal Pradesh	10.4	178.0
Assam	3.8	2.4
Manipur	4.4	7.6
Meghalaya	2.8	12.8
Mizoram	19.9	250.0

Source: Sirohi and Michaelowa, 2004

Table 9
Area Under Fodder Crops in NEH Region: 1998

States	*Percentage of total cropped area*
Arunachal Pradesh	0.04
Assam	0.15
Manipur	0.02
Meghalaya	0.03
Mizoram	0.07
Nagaland	0.36
Sikkim	2.58
Tripura	0.00
NEH region	0.16
All India	2.29

Source: NSSO, 54th Round (1998)

Table 10
Number of Veterinary Institutions in NEH Region: 2006

States	*Veterinary hospitals & polyclinics*	*Veterinary dispensaries*	*Veterinary aid centre (stockmen centres/ mobile dispensaries)*
Arunachal Pradesh	1	93	189
Assam	29	428	1213
Manipur	55	109	34
Meghalaya	4	70	151
Mizoram	5	35	103
Nagaland	4	27	127
Sikkim	12	25	58
Tripura	15	56	396
NEH region	125	843	2271
All India	8732	18830	25195

Source: Basic Animal Husbandry Statistics (2006)

REFERENCES

Khieu Borin and Preston T. R. (1995), Conserving biodiversity and the environment and improving the well being of poor farmers in Cambodia by promoting pig feeding systems using the juice of the sugar palm tree (*Borassus flabellifer*). Livestock Research for Rural Development. Volume 7, Number 2: 25-29

Keir Brenda, Preston T. R., Orskov E. R., Nguyen Thi Duyen and Dinh van Binh (1997), The nutritive value of tree leaves for goats. Livestock Research for Rural Development. Volume 9, Number 3 (in press).

Leng R. A., Stambolie J. H. and Bell R. (1995), Duckweed - a potential high-protein feed resource for domestic animals and fish. *Livestock Research for Rural Development.* Volume 7 Number 1, 36kB.

Nguyen Thi Loc, Preston T. R. and Ogle R. B. (1997), Protein supplementation of traditional diets for crossbred pigs under village conditions in Central Vietnam. *Livestock Research for Rural Development.* Volume 9, Number 2, 8-11.

Madalena F. E. (1989), Cattle breed resource utilization for dairy production in Brazil. Revista Brazilena de Genetica 12(2): 183-220 (Supplement).

Ocampo A. (1994), Utilizacion del fruto de palma africana como fuente de energia con niveles restringidos de proteina en la alimentacion de cerdos de engorde. *Livestock Research for Rural Development.* Volume 6, Number 1:1-7.

Preston T. R. (1995), Research, Extension and Training for Sustainable Farming Systems in the Tropics. *Livestock Research for Rural Development*, Volume 7, Number 2:1-8.

Preston T. R. and Murgueitio E. (1994), Strategy for Sustainable Livestock Production in the Tropics. 2nd Edition. CONDRIT Ltd. Cali, Colombia 89pp.

Pretty J. N. (1995), Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance. Earthscan Publications, London, England pp. 32.

Rodriguez Lylian and Preston T. R. (1996), Comparative parameters of digestion and N metabolism in Mong Cai and Mong Cai Large White cross piglets having free access to sugar cane juice and duck weed Livestock Research for Rural Development, Volume 8, number 1: 72-81.

Rodríguez Lylian, Preston T. R. and Dolberg F. (1996), Participatory Rural Development: Experiences in Binh Dien and Xuan Loc Villages in Central Vietnam. Livestock Research for Rural Development. Volume 8, Number 2: 1-39.

Rodríguez Lylian and Cuellar P. (1994), Evaluación de la Hacienda Arizona como Sistema Integrado de Producción. CIPAV: Cali, Colombia.

Sarria Patricia, Solano A. Y. Preston T. R. (1990), Utilizacion de jugo de cana y cachaza panelera en la alimentacion de cerdos. *Livestock Research for Rural Development* Voume 2, Number 2, pp. 92-99.