International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 17, 2019, pp.-8958-8963.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

PROBLEMS AND PROSPECTS OF FARMING SYSTEMS IN UPPER BRAHMAPUTRA VALLEY ZONE OF ASSAM

GOGOI B.*[1], BORAH M.[1], HAZARIKA J.[1], RAJBONGSHI A.[2], BORAH A.[3], BORAH B.[1], SHARMA K.K.[1] AND BAISHYA A.[4]

[1]Integrated Farming Systems, Assam Agricultural University, Jorhat, 785013, Assam, India
[2]ICAR-Krishi Vigyan Kendra, Nalbari, 781 337, Assam Agricultural University, Jorhat, 785013, Assam, India
[3]Livestock Research Station, Mandira, Kamrup (Rural), 781 127, Assam Agricultural University, Jorhat, 785013, Assam, India
[4]Director of Post-Graduate Studies, Assam Agricultural University, Jorhat, 785013, Assam, India
*Corresponding Author: Email - bg100777@yahoo.co.uk

Received: August 19, 2019; Revised: September 12, 2019; Accepted: September 13, 2019; Published: September 15, 2019

Abstract: The survey was conducted during 2013-14 in Jorhat and Sibsagar district of Upper Brahmaputra Valley Zone in the state of Assam with a view to characterize the existing farming systems of the zone and to analyse the problems and prospects related to farming systems in the zone. Data generated from the survey indicated that, farming systems on the sample farms comprised of crop, livestock, poultry, duckery, fishery and apiary component. The findings showed that the major farming system prevailing in Jorhat district was crop + livestock + poultry, while the same in Sibsagar district was crops+ livestock+ poultry+ fishery. The data also revealed that the contribution of crop component towards farm income was highest in both Jorhat district (46%) and Sibsagar district (45%). Among the bio-physical constraints faced by the respondent farmers, irregular supply of water/erratic rainfall was most important, which was faced by 98 and 95% of the farmers in Jorhat and Sibsagar district respectively. Among the socio-economic constraints, non-availability of suitable infrastructure ranked first in both the districts.

Keywords: *Integrated farming, Cropping system, Socio-economic status, Characterization, Diversification, Intervention*

Citation: Gogoi B., *et al*., (2019) Problems and Prospects of Farming Systems in Upper Brahmaputra Valley Zone of Assam. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 17, pp.- 8958-8963.

Academic Editor / Reviewer: Dr Santosh Kumar Jha

Introduction

Assam is an important state of the North Eastern Region of India, where agriculture acts as a mainstay of the state economy. The agriculture sector continues to support more than 75% population of the state directly or indirectly providing livelihood to more than 53% of the state's total working force. The average per capita operational holding in the state is 1.10 ha and over 25% of the total operational holding in the state is marginal. Small and marginal farmers constitute more than 85% of the total farm families [1,2]. Survival and sustainability of a large section of the state's population particularly in rural areas depends on the success and viability of agriculture. Unfortunately, agriculture in the state is handicapped by a lot of problems like recurrent floods, draught, lack of irrigation facilities and infrastructural weaknesses besides its subsistence nature with mass fragmentation. Due to economically unviable small farm size and lack of assured irrigation facilities, possibilities of increasing income by vertical expansion through multiple cropping is not so feasible in the state. Besides, single crop/commodity adopted in small holding is not sufficient for the survival of the small and marginal farmers. In this situation, diversification of crops with livestock, poultry, duckery, fishery, apiary, plantation crops *etc*. in an appropriate, planned and scientific manner can provide an answer to the problem of economic viability of the small farm holders of the state [3]. Farming system aims for increased productivity, profitability along with sustainability, balanced food, clean environment, exploring synergy among interacting enterprises through recycling farm wastes, and by-products, generating family income & employment round the year, solving energy, fuel and fodder crisis, increased input efficiency, enhanced opportunity for agriculture oriented industries and ultimately improved standard of living of the farmers [4]. In most of the cases, an ordinary small holder farmer in Assam has a homestead with some fruits and vegetable crops, a pond and a few animals and birds to fulfil his daily food requirement apart from his tiny farm holding.

Thus, the state is endowed with a variety of farming systems although in an unorganized and unscientific manner. Farming system varies from farm to farm, place to place and land situation to land situation and agro-climatic zone to agro-climatic zone depending upon many factors like resource endowment of the farmer, environmental condition, socio-religious taboos and other agro-climatic and socio-economic factors besides, the suitability, adaptability, marketability and ability of the components included in the system to satisfy farm family requirements. Therefore, a study on the types of farming systems prevailing in different agro climatic zones of a state and their impact on farm income would have strong bearing on identification of economically viable systems for enhancement of farm income on sustainable basis. Besides, improper allocation and inefficient utilization of limited farm resources coupled with inappropriate enterprise mix hinders achieving expected result from adopting farming system approach. In other words, mere adoption of a number of enterprises does not guarantee enhanced returns to the farmers. Thus, it will be meaningful if the farmers concentrate on high income generating, profitable enterprise mix. Therefore, it is important to study the types of prevailing farming systems of a state in different agro-climatic zones so as to identify those which are economically viable across farm size and agro-climatic situation. Besides, such study will open up new areas for policy makers for improvement in the existing farming systems and would help to formulate appropriate strategies and plans for development of the agricultural economy of the region. Again, first major step in farming system research methodology is characterization of prevailing on-farm farming systems of the region/area and thereafter bridging yield gaps by minimizing production constraints through adoption of latest viable production technologies and maximization of farm production & profits by diversification of prevailing on-farm farming systems through integration of economically viable but socially accepted low cost/ cost effective farm enterprises [5].

Assam is divided into six agro-climatic zones each characterized by various types of agro-ecological situations from high rainfall to rain shadow, hills to plains, relatively flood free to flood prone areas. In tune with the diverse agro-ecological situations, different forms of farming systems exist varying from situation to situation. Present study attempts to identify the major farming systems prevailing in two districts namely Jorhat and Sibsagar of Upper Brahmaputra Valley Zone of Assam. Like any other agricultural systems, farming system has its own characteristics and each component enterprises have their own peculiar constraints. The study also attempts to focus on the specific constraints related to farming systems and its subsystems in the study area, so as to recommend suitable policy prescriptions.

Materials and Methods

A survey was conducted in two districts of Upper Brahmaputra Valley Zone (UBVZ) of Assam during the year 2013-14 for collection of information related to different aspects of farming system. The sampling design followed for the study was three stages stratified random sampling design (Block, Gaon Panchayat and farmer), details of which presented in [Fig-1]. Two districts of UBVZ of Assam namely Jorhat and Sibsagar were selected for the survey as representative of higher productivity and lower productivity district respectively for the concerned zone. Within the districts one block each were selected at random and from each block three Gaon Panchayats were selected randomly. Again, from each Gaon Panchayats, 6 farmers in the ratio 2:2:2 (marginal: small: medium/large) were selected at random. Thus, 18 farmers from each block and district comprising a total of 36 farmers from the zone were selected for the study [Table-1]. The relevant primary data were collected from the selected farmers of the sample farms with the help of specially designed schedules and through personal interview with the respondent farmers. The data thus collected were compiled and tabulated for the purpose of analysis.

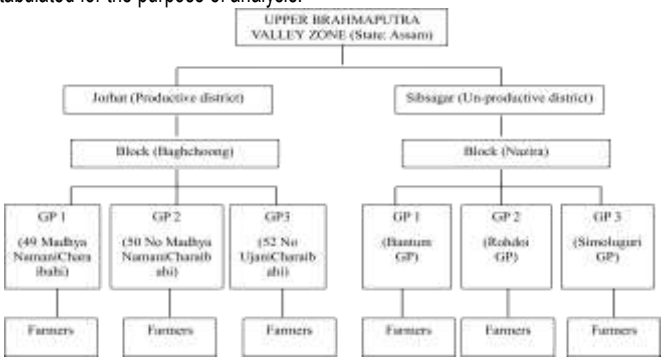

Fig-1 A schematic view of sample selection for farming system characterization survey in UBVZ of Assam

Table-1 Category wise sample farmers in Jorhat and Sibsagar districts of UBVZ of Assam

District	Category wise number of farmers			
	Marginal	Small	Medium/Large	Total
Jorhat	6	6	6	18
Sibsagar	6	6	6	18
Total	12	12	12	36

Results and Discussion

Salient Features of the Study Area

Climate and Soil

Being situated in sub-tropics, the climate of the study area (both Jorhat &Sibsagar district) is characterized by moderate climate with hot &humid summer and cold & foggy winter. The average annual rainfall was recorded as 2227.18 mm and 1321.5 mm in Jorhat & Sibsagar district respectively. The soils of the districts studied were moderately acidic, sandy loam and alluvium soil.

Land Use Pattern

Land use pattern of the districts under study (Jorhat & Sibsagar) is taken from Statistical handbook of Assam, 2011.

Cropping pattern

Major cropping pattern adopted in Jorhat district were Winter Rice- Toria, Winter Rice- Pulses and Winter Rice -Fallow -Rabi vegetables; while that of Sibsagar district were Autumn Rice-Winter Rice-Vegetables, Winter Rice- Rape/Mustard and Winter Rice- Potato.

Category-Wise Distribution of Farm Households

Both Jorhat and Sibsagar districts were characterized by small holder farmers. More than 80% of the farmers in both districts were small and marginal. Out of a total of 120543 numbers of farm households, 76786 were marginal, 25917 were small, 13983 were medium and 3857 were large in Jorhat district. Similarly, in Sibsagar district, marginal, small, medium and large categories of farm households comprised of 49576, 29038, 18475 and 1418 numbers respectively.

Livestock Population

Commonly reared livestock in the study area were cattle, buffalo, goat & pig. The population of cattle, buffalo, goat & pig in Jorhat district were 50809, 31111, 182395 and 90396 numbers respectively and the same in Sibsagar district were 413355, 25422, 172055 and 325885 numbers respectively. Data revealed that-goat population was more in Jorhat district whereas cattle population was more in Sibsagar district of Assam which was followed by pig population as compared to other livestock under study.

Socio-Economic Characteristics of Sample Households

Socio-economic characteristics of the sample household are shown in [Table-2]. The table reveals that as a whole average holding size of the sample household in Jorhat district was 1.77 ha and the same in Sibsagar district was 1.75 ha. Average educational qualification of the respondent farmers in the sample household was ninth standard for both the districts and similarly average number of family members was six in both the districts studied.

Cropping Pattern in the Sample Household

Cropping pattern in the sample household in both the districts was dominated by winter rice. On an average 81.74% and 89.83% of operational holding of the sample as a whole in Jorhat and Sibsagar district respectively were occupied by rice cultivation. Rabi vegetables are the second most dominating crop grown by the sample in both the districts. Apart from rice and vegetables, oilseed mainly toria and pulses like green gram, black gram also constitute a part of the cropping pattern of the sample studied though to a limited extent. Monocropping of rice was found to be prevalent mostly among the farmers of the sample studied. Cropping pattern in the sample household is presented in [Table-3].

Dairy Animals and Milk Production on Sample Farms

Average number of dairy animals and milk production on sample farms is shown in [Table-4]. It can be viewed from the table that on an average a sample household had 2 and 3 number of cows in Jorhat and Sibsagar district respectively. None of the household in the sample studied had buffalo as dairy animal. On average total milk production in the sample households of Jorhat districts was 403 litres of milk per annum and thereby average income from livestock was Rs. 16,120.00 per household per annum. In Sibsagar district, overall total milk production was found to be 133 litres per annum and thus average income from livestock was Rs. 15,000.00 per annum. The table also reveals that there is an increasing trend in terms of number of cows, milk production per animal per annum and thus income from livestock with an increase in the size of holding i.e. from marginal to medium/large farmers in both the districts.

Farm Income on Sample Farms

Average farm income obtained by the sample farms from different sources is shown in [Table-5] and share of different enterprises in farm income on the sample farms is shown in [Table-6]. On an average, total income from different activities per annum across the categories was found to be Rs. 54,670.00 in Jorhat district and Rs. 49,050.00 in Sibsagar district.

Table-2 *Socio-economic characteristics of sample households of Jorhat & Sibsagar district of UBVZ of Assam*

Category	No. of sample farmers	Jorhat district				Sibsagar district			
		Average holding size (ha.)	Age(Yrs.)	Education (Yrs.)	Family size(No.)	Average holding size(ha.)	Age (Yrs.)	Education (Yrs.)	Family size (No.)
Marginal	6	0.84	39	7	5	0.80	40	5	6
Small	6	1.38	41	8	5	1.24	40	10	6
Medium/ Large	6	3.09	36	12	7	3.20	38	15	7
Overall	18	1.77	39	9	6	1.75	40	9	6

Table-3 *Cropping pattern in the sample household of Jorhat & Sibsagar district of UBVZ of Assam*

Category	Jorhat district				Sibsagar district			
	Winter Rice	Oilseed (Toria)	Pulses (Greengram/ blackgram)	Rabi vegetables	Winter Rice	Oilseed (Toria)	Pulses (Greengram/blackgram)	Rabi vegetables
Marginal	80.59%	4.40%	3.17%	11.48%	91.50%	2.88%	1.05%	4.18%
Small	81.42%	6.96%	3.05%	8.48%	87.49%	3.50%	0.70%	8.57%
Medium/Large	79.22%	7.26%	4.48%	8.89%	90.32%	1.86%	3.30%	4.66%
Overall	81.74%	6.68%	2.17%	9.24%	89.83%	2.43%	2.30%	5.53%

Table-4 *Average number of dairy animals and milk production of the sample farms*

Category	Jorhat district				Sibsagar district			
	Average number of cows (No)	Milk production/ Animal / Annum (Lit.)	Total milk production (Lit/ annum)	Income from livestock (Rs./ annum)	Average number of cows (No)	Milk production / Animal / Annum (Lit.)	Total milk production (Lit / annum)	Income from livestock (Rs./ annum)
Marginal	2	97	194	7760	1	85	85	3400
Small	1	205	205	8200	2	110	220	8800
Medium/ Large	3	270	810	32400	4	205	820	32800
Overall	2	191	403	16120	3	133	375	15000

The table reveals a direct relationship between farm income and size of holding in both the districts, *i.e.*, medium/large sized farms had highest income from all the sources in both the districts, while marginal category of farmers had lowest income from all the sources. Regarding share of different major enterprises in farm income, it can be viewed from [Table-6] that on an average for all categories of farmers, crop enterprise contributed highest proportion of income (45%), which was followed by livestock (31%) and other sources (25%). The share of crop enterprise in farm income was relatively higher in case of marginal farmers (50%), while the share from livestock component was higher in case of small farmers (35%) as compared to other categories of farmers. Integrated farming system (IFS) undertaken in Karnataka, India by Channabasavanna *et al*. (2009) recorded 26.30 and 32.30% higher productivity and profitability, respectively over conventional rice-rice system. Among the components evaluated, the highest net returns were obtained from crop (63.80%), followed by goat (30.90%), fish (4.00%) and poultry (1.30%), respectively [5]. Integration of different agriculturally related enterprises with crops always provides ways to recycle products and by-products of one component as input of another linked component which reduce the cost of production and thus raises the total income of the farm [6].

Existing Farming Systems in the Zone

Existing farming systems prevailing in Jorhat and Sibsagar district of Upper Brahmaputra valley zone are depicted in [Table-7]. Data from the table indicated that, farming systems on the sample farms comprised of crop, livestock, poultry, duckery, fishery and apiary. Crop component included field, horticultural as well as plantation crops and livestock component included cattle, goat and pig. The table reveals that, crop + livestock + poultry was the major farming system adopted by 38.89% of the sample farmers in Jorhat district, which was followed by crops+ livestock+ poultry+ fishery, adopted by 27.78% of the total farmers. Among the marginal farmers of Jorhat district crop + livestock + poultry was the most dominant farming system, while the same in case of large/medium farmers was crops+ livestock+ poultry+ fishery. In case of small farmers of the district, three farming systems namely crops+ livestock, crops+ livestock+ poultry and crops+ livestock+ poultry+ fishery, were adopted by equal proportion of the farmers. Apiary component was also found to be adopted by a small proportion (5.56%) of the farmers along with other major components i.e. crops, livestock, poultry and fishery in different combinations. In Sibsagar district of Upper Brahmaputra Valley Zone, a majority (22.22%) of the farmers followed crops+ livestock+ poultry+ fishery farming system, while 16.67% of the farmers followed crops+ livestock, crops+ livestock + poultry and crops+ livestock + poultry + duckery farming system. Crops+ livestock+ fishery as a farming system was followed by 11.11% of the total farmers of the district. Among the large farmers, crops+ livestock+ poultry+ fishery was the most dominant farming system, while among the small category of farmers, crops+ livestock and crops+ livestock+ poultry were relatively more dominant than other farming systems. Marginal farmers followed all types of farming systems mentioned in [Table-7] in equal proportion except crops+ livestock and crops+ livestock+ fishery. On an average for both the districts, crops+ livestock+ poultry was the most dominant farming system, and the second most dominant farming system was found to be crops+ livestock+ poultry+ fishery.

Problems and Prospects of Existing Farming Systems on Sample Farms

The sample farmers surveyed had to face a number of problems while adopting agriculture as a source of livelihood. The constraints faced by the farmers were segregated as biophysical constraints and socio-economic constraints. Among those, the major constraints faced by the farmers are listed in [Table-8]. Among the bio-physical constraints, irregular supply of water/erratic rainfall was the most important constraint as perceived by the sample farmers in both the district. In Jorhat district, 98% of the farmers and in Sibsagar district 95% of the farmers faced the problem of irregular supply of water. This problem hinders the farmers in adopting multiple cropping and it also stands away in achieving higher yield from the crop component. Pest and disease problem, small size of holding, natural calamities, inferior quality of seed/planting materials were other biophysical constraints which ranked 2nd, 3rd, 4th and 5th respectively in terms of importance for the farmers in both the districts. Due to pest and diseases and inferior quality seeds and planting material, the farmers were not getting the yield from crops as expected. Small size of holding hinders the farmers to take up cultivation of crops and adoption of other enterprises on large scale. Among the socio-economic constraints, non-availability of suitable infrastructure ranked first in both the districts. Due to lack of suitable infrastructure, the farmers could not adopt allied enterprises on a scientific manner and lack of proper irrigation infrastructure restricts farmers to go for diversified cropping. Lack of modern facilities for artificial insemination for animals, balanced feeding for animals and fishes, hatchery facilities for fisheries and proper medical facilities *etc*. were impediments that stands in the way of getting higher production and income for the farm households.

Table-5 *Average annual farm income of sample farms of Jorhat & Sibsagar district of UBVZ of Assam*

Category	Jorhat district				Sibsagar district			
	Income from farming (crops) (Rs)	Income from livestock (Rs)	Income from other sources (wages, petty business, etc.) (Rs)	Total farm income (Rs/ annum)	Income from farming (crops) (Rs)	Income from livestock (Rs)	Income from other sources (wages, petty business, etc.) (Rs)	Total farm income (Rs/annum)
Marginal	12910	9037	3873	25820	11375	6825	4550	22750
Small	20470	18196	6824	45490	15400	13475	9625	38500
Medium/Large	41715	27810	23175	92700	38655	25770	21475	85900
Overall	25032	18348	11290	54670	21810	15357	11883	49050

Table-6 *Share of different enterprises in farm income of the sample farms of Jorhat & Sibsagar district of UBVZ of Assam*

Category	Jorhat district			Sibsagar district		
	Crops	Crops+ Livestock	Crops + Livestock + Others	Crops	Crops+ Livestock	Crops + Livestock + Others
Marginal	50%	50% +35%	50% +35% +15%	50%	50%+ 30%	50% + 30% +20%
Small	45%	45% +40%	45% +40% +15%	40%	40% +35%	40% +35% +25%
Medium/Large	45%	45% +30%	45% +30% +25%	45%	45% + 30%	45% + 30% +25%
Overall	46%	46%+34%	46%+34%+21%	45%	45% +31%	45% +31% +24%

Table-7 *Existing farming systems of the sample farms of Jorhat & Sibsagar district of UBVZ of Assam*

Farming systems	Category of the farmer			Overall
	Marginal	Small	Medium/Large	
Jorhat district				
Crops+ Livestock	0	2(33.33%)	1(16.67%)	3(16.67%)
Crops+ Livestock+ Fishery	1(16.67%)	0	0	1(5.56%)
Crops+ Livestock+ Poultry	4(66.67%)	2(33.33%)	1(16.67%)	7(38.89%)
Crops+ Livestock+ Poultry+ Fishery	1(16.67%)	2(33.33%)	2(33.33%)	5(27.78%)
Crops+ Livestock+ Poultry+ Apiary	0	0	1(16.67%)	1(5.56%)
Crops+ Livestock+ Poultry+ Fishery + Apiary	0	0	1(16.67%)	1(5.56%)
Sibsagar district				
Crops+ Livestock	1(16.67%)	2(33.33%)	0	3(16.67%)
Crops+ Poultry	0	0	1(16.67%)	1(5.56%)
Crops+ Livestock+ Fishery	0	1(16.67%)	1(16.67%)	2(11.11%)
Crops+ Livestock+ Poultry	1(16.67%)	2(33.33%)	0	3(16.67%)
Crops+ Poultry + Fishery	1(16.67%)	0	0	1(5.56%)
Crops+ Livestock+ Poultry+ Fishery	1(16.67%)	0	3(50.00%)	4(22.22%)
Crops+ Livestock+ Poultry+ Duckery	1(16.67%)	1(16.67%)	1(16.67%)	3(16.67%)
Crops+ Livestock+ Poultry+Duckery + Fishery	1(16.67%)	0	0	1(5.56%)

** Figures in parenthesis indicate percentage to total*

Table-8 *Major constraints faced by farmers in existing farming systems on sample farms*

Constraints	Category-wise percentage of farmers facing constraints			Overall
	Marginal	Small	Medium/Large	
Jorhat district:				
Biophysical constraints:				
1. Irregular supply of water/erratic rainfall	98%	100%	95%	98%
2. Pest & disease problem	95%	90%	85%	90%
3.Small size of holding	98%	85%	55%	79%
4. Natural calamities like flood	80%	82%	60%	74%
5. Inferior quality seeds/ planting material	85%	78%	50%	71%
Socio-economic constraints				
1. Non availability of suitable infrastructure	97%	89%	65%	84%
2. Lack of technical knowledge	70%	72%	40%	61%
3. Scarcity of labour	40%	55%	70%	55%
4. Social/caste factor	5%	8%	12%	8%
Sibsagar district:				
Biophysical constraints:				
1. Irregular supply of water/erratic rainfall	100%	95%	90%	95%
2. Pest & disease problem	96%	90%	88%	91%
3.Small size of holding	97%	83%	50%	77%
4. Natural calamities like flood	78%	80%	62%	73%
5. Inferior quality seeds/ planting material	80%	78%	53%	70%
Socio-economic constraints				
1. Non availability of suitable infrastructure	95%	83%	60%	79%
2. Lack of technical knowledge	75%	70%	45%	63%
3. Scarcity of labour	45%	56%	77%	59%
4. Social/caste factor	6%	5%	10%	7%

Lack of technical knowledge, particularly, lack of knowledge on improved package of practices for crops, imbalanced use of fertilizers, lack of knowledge on artificial insemination, balanced feeding, medical facilities *etc.* for livestock rendered these enterprises un-remunerative and thereby they offered reduced income for the farm households. Scarcity of labour and social/caste factor in adopting some particular enterprises were other socio-economic problems faced by the sample farmers. Earlier researchers also reported regarding such production constraints in case of IFS [6,7]. Tokrishna (1992) pointed out that a farmer who wishes to expand his area under integrated farm in Thailand faces the problems of adequate water supply, animal feed and market outlets [8]. Although, the sample farmers surveyed were facing a number of problems, however, there exists sufficient opportunities in making farming system approach quite successful with proper technological intervention and policy prescriptions. Since, a variety of farming systems are already in existence in the zone, though in an unorganized, unscientific and unplanned manner, there are possibilities to make them economical and remunerative with proper interventions. The probable interventions for higher returns from different enterprises/ components of farming systems suggested are as below:

1. Inclusion of fishery in existing farming system which may also act as a water harvesting structure may help in supplying water to the crops during dry periods. Besides, proper emphasis from concerned agricultural department regarding setting up irrigation infrastructure on a need-based way may offer a solution for the water supply problem. Moreover, selection of crop component may be done in such a way that, their combination includes both high waters requiring and low water requiring crops in a proper ratio. In general, crop, livestock and fishery in an Integrated Farming System (IFS) can be very profitable for the farmers [9]. Besides, it is also evident that integration of 2 bullocks + 1 cow + 1 buffalo and 10 goats along with other subsidiaries like poultry and duck is the most beneficial system which can supplement the income of tribal people to improve their socio-economic status [10,11].
2. Need based trainings and village level demonstrations on balanced use of fertilizer, package of practices and pest & disease control measures, artificial insemination, balanced feed for livestock and fish, establishment of fish hatchery and other related subjects may go a long way in helping the farmers earning higher income from farming. Besides trainings on advantages of adopting farming system approach and selection of remunerative enterprises based on suitability may also help in solving the problem of wide spread poverty of the farming community.
3. Small holder farmers need to be encouraged to adopt diversified farming that includes low-cost, quick return, high income generating enterprises taking into consideration the relationship among the enterprises, marketing possibility and existing farming systems. The continuous flow of money from one or other component system minimizes the financial burden on the farmers [3].
4. Resource recycling through vermicomposting, biogas preparation, liquid manure production *etc.* within the enterprises of farming systems would generate added income and minimize dependence on purchased farm inputs.
5. Plantation of fruit tree from nutritional point of view and inclusion of sericulture component from economic point of view particularly in the urban as well as semi-urban area of the zone also appears to be promising.
6. Suggested alternate cropping systems for farming system in the zone are Rice-Rabi vegetables-Summer vegetables and Rice-Toria-Summer pulses.

Thus, through integrated farming system (IFS) it will be possible to meet the continuous increase in demand for food, stability of income and diverse requirements of food grains, vegetables, milk, egg, meat *etc*., thereby improving the nutrition of the small and marginal farmers with limited resources.

Conclusion

Present study conducted in Jorhat and Sibsagar district of Upper Brahmaputra Valley Zone of Assam reveal that most of the farmers in the study area were resource poor with small per capita average operational holding. Farming is of subsistence nature and the farmers mainly follow traditional method of cultivation because of lack of suitable infrastructure, capital and knowledge of modern method of cultivation. Scientific management of Livestock, Apiary, Fishery and other allied enterprises was not followed and Farmers were unaware about bio-waste and its recycling techniques within farming systems. A variety of farming systems were observed to be existence in the study area, but in an unorganized, unscientific and unplanned manner and thus they are uneconomical. In this situation, diversification of crops with livestock, poultry, duckery, fishery, plantation crops, agro-forestry *etc.* in an appropriately planned and scientific manner appears to be promising in boosting up the rural economy of the area. Resource recycling through vermicomposting, biogas preparation, liquid manure production *etc.* would also generate added income and minimize dependence on purchased farm inputs.

Application of research: Plantation of fruit tree from nutritional point of view and inclusion of sericulture component from economic point of view, particularly in the urban as well as semi-urban area of the zone also may help in sustaining farm income and generating employment opportunities. As integrated farming is economically and environmentally sound, the motivation for integration in a scientific way with a holistic approach would appear to be of vital course of action for diversification and for increase agricultural production in Sibsagar and Jorhat district of Upper Brahmaputra Valley Zone of Assam.

Research Category: Integrated Farming Systems

Acknowledgement / Funding: Authors are thankful to ICAR-Indian Institute of Farming System Research, Modipuram, Meerut, UP, India for providing the financial support to carry-out the works. Authors are also thankful to Integrated Farming Systems, Assam Agricultural University, Jorhat, 785013, Assam, India

***Principal Investigator or Chairperson of research: Dr Bhabesh Gogoi**
University: Assam Agricultural University, Jorhat, 785013, Assam, India
Research project name or number: Research station trials

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Upper Brahmaputra Valley Zone(UBVZ), Assam

Cultivar / Variety / Breed name: Nil

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Economic Survey of Assam (2013-14) *Directorate of Economics and Statistics, Assam Planning and Development Department, Govt. of Assam.*
[2] Baishya A., Borah M., Das A.K., Gogoi Bhabesh, Hazarika J. and Bora A.S. (2017) *Editions universities europeennes, Bahnhofstrabe 28, 66111 Saarbrucken, Deutschland/German*
[3] Baishya A., Sutradhar P., Borah M., Gogoi Bhabesh, Hazarika J., Bora A.S., Borah B. and Ekka S. (2017) *Indian Journal of Ecology*, 44(4), 813-820
[4] Mahapatra B.S., Sharma K.C. and Sharma C.L. (1987) *IRRI Newsletter*, 12(1),32.
[5] Channabasavanna A.S., Biradar D.P., Prabhudev K.N. and Hegde M. (2009) *J. Agric. Sci*., 22(1),25-27.
[6] Singh J.P., Gangwar B., Singh P. and Pandey D.K. (2010)) *J. Farming System Research & Development*, 16(1&2), 1-18.

[7] Baishya A., Bora A.S., Gogoi Bhabesh, Hazarika J., Borah M., Rajbongshi A., Deori P. and Sutradhar P. (2015) *In, Farming Systems Research Success stories (Series 1) (Eds. N. Ravisankar, B. Gangwar, Kamata Prasad, Raghuveer Singh & Rajbir Singh). Published by, ICAR- IIFSR, Modipuram UP, India.*

[8] Tokrishna R. (1992) *Integrated livestock-fish farmingsystems I Thailand. In, Mukherjee, T.K., Moi, P.S., Panadam, J.M., and Yang, Y.S. (Eds.). Proceedings of the FAO/IPT Workshop on Integrated Livestock-Fish Production Systems, 16- 20 December, 1991. Institute of Advanced Studies, University of Malaya, Kuala Lumpur, Malaysia*.

[9] Ugwumba C.O.A., Okah R.N., Ike P.C., Nnabuife E.L.C. and Orji E.C. (2010) *Journal of Agriculture and Environmental Science*, 8(1), 1-6.

[10] Prein M. (2002) Agricultural System, 71, 127-146.

[11] Nhan D.K., Phong L.T., Verdegem M.J.C., Duong L.T., Bosma R. H. and Little D.C. (2007) *Agricultural System*, 94, 445-458.