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Integrated Crop-Livestock Farming System and Its Impact on Livelihood and Sustainability of Poor Farmers in Bulandshahr District, U.P.

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Absttract

Integrated crop-livestock farming System (ICLFS) has been traditionally practiced in India since antiquity. It plays a pivotal role in generation of employment and livelihood, improving health and nutrition intake. This system is beneficial for maintaining sustainable agriculture through mutual utilization of waste products from livestock to cultivation of crops and crop residues to livestock husbandry. ICLFS helps in reducing the greenhouse gases through plant growth along with livestock husbandry. The study aims to understand the mechanism of crop-livestock integration, degree of livelihood generation, economics of crop-livestock integrated farming system and its impact on socio-economic development in Bulandshahr district of Uttar Pradesh, India. Data were collected from published records as well as through filed survey of sampled villages. Arbitrary choice method has been used to identify the principal crops grown in association with livestock, thus, total 5 ICLFS recognized that are practiced in study area. The result of the study shows that The income and employment generated through ICLFS have been found to be more beneficial to poor farmers like land less, marginal and small farmers, livestock husbandry in combination provides some partial jobs to the household members especially during off farm season, ICLFS is the important tools or means for improving farmers income, poverty alleviation, soil ecology equilibrium and economic empowerment of women in the study area particular and in the country general.

Keywords: Pivotal, Sustainability, livelihood, integrated, equilibrium, women empowerment and marginal and small farmers.

Introduction

The livestock-cropping integrated or mixed farming system has been prevailing in India since antiquity. It is a very sustainable, long experienced, farming system in which crop by-products like crop residue, feed grain are used for feeding animals and animal by-products like manures used for enriching the soils (Sakeran, U. et.al.2021, Lal, R.2020, Melinda Noer, M. et.al.2018, Lemaire, G. et al. 2014). It provides permanent as well as temporary employment, especially to women during the off-farm season through involvement in various operations i.e. rearing, cleaning, milking, collection, processing, and marketing of livestock husbandry process, assisting to achieve U.N. Sustainable development Goals (SDGs) of removing poverty and zero hunger SDG (FAO 1995, 1996, Delgado, E.M.et.al. 1999, Hoffman, e. et.al. 2003, Lal, R.2020, FAO 2017). Income generation is improved as an extra income from selling milk, dung cake, and livestock kids from big ruminants like cattle and buffalo. Small ruminants like goats

and sheep provide cash income every year to the rearers through selling their adult kids for meat purposes (F.A.O.2017, Khan, N. & Parashari, A.K.2022). They are called ATMs of poor and women as they are mainly kept by marginalized groups of the population like landless and marginal farmers, women, and poor Muslims on account of small capital requirements. Goat in India is described by Hindu women as girls 'Lakshmi'. *Laxmi* in the Hindu religion is the Goddess of money. They are saving money earned from selling them for girls' dowry in marriage (Khan, N., et al.. 2011).

The demand for livestock-derived products, as well as food, would have been steadily increasing due to positive dynamics of the population both in terms of quantity and quality. Human population rose up from 2.56 billion in 1950 to 7.80 billion in 2020 and it is projected to reach a level of 9.80 billion in 2050 and 11.20 billion by end of 21st century of (UN 2019). Despite a bumper production of food crops animal products, 2 billion population is suffering from malnutrition and malnourishment because of deficiency of protein, micronutrients and vitamins in consumed food by poor and vulnerable group of population especially in developing countries (Richic & Roser 2019). Livestock products i.e. milk, meat, eggs and cream could compensate the nutrient deficiency in food which called upon a livestock revolution mainly in tropical countries of Africa and South Asia. Global demand for animal-derived products is estimated to be doubled by 2050 (Herrera et.al. 2009). It is further projected by the United Nations Organization that such products would be increasing to 529 million tonnes to 465 million tonnes of meat; from 580 million tonnes to 1043 million tonnes of milk from 2000 t0 2050(FAO 2006, Steinfeld et.al. 2006). Livestock and crop integrating farming systems have promising potential to supply such value-added food to enhance the urban population as well as to rural communities whose purchasing power improved over the decades. The involvement of people especially poor and marginal farmers as well as deprived and marginalized populations like women and agricultural labourers in such an integrated farming system would increase the employment and income and other challenges of socio-economic transformation.

At the global level, *there* are 698 million (about 9.2 % of the world human population) people hungry and living in extreme poverty, and 75% of them as well as other less poor but vulnerable people live in rural areas and depend on farming for their livelihoods, with the majority relying on small scale crop-livestock systems (Sekaran, U. et al. 2021), including those that are integrated with long haul pastoral systems in the world. Demand for livestock food products - red and white meat, dairy products, eggs - is expected to grow significantly, thus offering opportunities for income and employment generation for the small-scale producers in crop-livestock systems as well as from the specialized producers, both small and large intensive and extensive systems, of livestock products (Delgado, et.al. 1999, Steinfield, 2006, Khan, N., et al.2010, Alan, F. 2007, Allana, I., 2005, Leonard, D. K., 2006). The need for the introduction, adaptation, and implementation of good farming practices with associated enabling environments and to address environmental and health issues linked to agriculture has never been greater due to the sheer scale of livestock-related agriculture that would have been required to maintain local and international food security and to provide livelihoods in sustainable ways. Integrated crop-livestock farming is considered a sustainable system (Sule, M.R. Binjamin, F., Traey 2006, Thomton, P.K. & Herrera, and M.2001). Environmental sustainability and economic viability of farmers in response to livestock revolution could have a promising effect (Kulshereshtra, L.R. 2010, Khan, N.2010, Ray, A.H. 1999, Rint Boun, D.1994). F.A.O (2006) in a report Livestock's Long Shadow very strongly highlighted that emission of GHGs could be reduced and managed through the adaption of an integrated farming system. The generation of methane and other greenhouse gases is a very sensitive and critical challenge for a strategy to control global

warming. About 18percent of global greenhouse gases as CO2, CH4 and N2O **are** added to our environment from livestock husbandry (FAO 2006, Sejian, V. et.al. 2015). They use 30% of the land surface as permanent pasture and 1/3rd of global arable land is also used for the production of feed to livestock(FAO 2006). The environmental impact of livestock development is felt at a strong scale (Smith, et. al.2013, Palletler and Tyedmer 2011). It could be absorbed and reduced through green coverage in the form of cropping, tree plantation, and production of bio fertilizer after integrating livestock and crops with the plantation of trees (Janzen2011, Mukhlis et.al. 2018). Some scholars on the basis of their extensive study suggested that sustainable agricultural development can be achieved through development of organic farming, integrating farming system, low external input farming system and integrated pest management(Salikim, A.K.2003, Ehsanul, H.M.D. 2016,Deshora, L.N. and Singh ,H.2014) It can improve soil quality , efficiency of land use, reduce the dependency of external inputs, conservation of bio-diversity and food security (Kathleen,H.2011) .The UN Sustainable Development Goal #13 for controlling climate change had been looked at by scholars for achievement through livestock and crops integration (Thompton et al. 2009).

The traditional form of agricultural practices in several countries including India are badly, in terms of sustainability, affected by the introduction of the Green Revolution during the 1960s, and mechanization, as well as commercialization later on led to the development of intensive specialized monocrop and livestock farming system to achieve the target of bumper production in food crops and animal, derived products for meeting the demand in enhancing urban population and rural areas in response to change in food habits from vegetarian to non-vegetarian and improvement in disposable income(Martin, G. et.al. 2016, Khan, N. and Parashari, A.K. 2021) . Integrated livestock crop farming system, once strongly existed, is threatened and weekend turning into exclusive crop cultivation and livestock husbandry. Draft animals' numbers declined after the mechanization of agriculture operations, which resulted in the loss of manures to be used in the cropping system and also discouraged dairy farming at the farm level and the release of labourers from agriculture.

Intensification of crop and livestock production, in smallholder crop-livestock systems as well as in other intensive or extensive systems, is essential to mitigate human suffering and providing time for needed social and economic changes. Harnessing the potential of the well-integrated crop and livestock systems at various levels of scale (on-farm and area wide), and that often have agro-forestry and forestry inputs, is one of the powerful entry points to address such needs, issues and opportunities. The integration of crop and livestock production systems increases the diversity, along with environmental sustainability, of both sectors. At the same time it provides opportunities for increasing overall production and economics of farming. This would reduce the preference for specialized livestock production systems, in view of their problems with environmental and economic sustainability.

Aims of Study

The present work aims to

1. Understand the mechanism and pattern of crop-livestock integration practiced by farmers.
2. Assess the quantum and degree of livelihood generated through crop-livestock integrated farming system.
3. Evaluate the economics of crop-livestock farming system practiced in various forms by the farmers
4. Assess socio-economic impact of crop-livestock integrated farming system on poor farmers.

Research Questions or Hypothesis

Researchers have tested following hypothesis

1. Integrated crop-livestock practice is an economically viable farming system for marginal and small farmers.
2. Integrated crop-livestock farming system is highly potential source of employment and income for rural population
3. Integrated crop-livestock system is key to poverty alleviation, and to strengthen environment and farming sustainability.

Research Methodology

The present work of research is based on both primary and secondary sources of data. The primary data played a dominant role in investigation and analysis of various objectives as the information regarding crop-livestock integration/interaction was not available in documented form. For field survey of area regarding required information about various indicators, the work is completed in three steps. Firstly, the study area was divided into different livestock, crop-combination and crop-livestock integrated regions on the basis of secondary data on distribution of different crops grown and the various species of livestock reared in the study region. Secondary data were obtained from published official records like District statistical magazine, livestock census as well as published books and reports.

Two villages from each developed blocks were selected on the basis of various criteria i.e. distance from town, road, milk and meat processing industries as well as size of population, thus, the study has been carried out in total 32 villages. Respondents for interview from selected villages were sorted out on the basis of size of land holding, social strata and income.10 percent households representing land less, marginal, small and big farmers from each sampled village will be selected following stratified sampling technique. Information regarding size of holding, number and species wise composition of livestock reared in farm, sources of feed grains, fodder, use of livestock by products in cropping, number of household members and working hours per day, pattern of livelihood, gender wise employment, input cost, price of products i.e. milk, dung, manures, fodder, feed grains, and so on were collected through field survey. People's perception survey was also conducted to understand farmer's opinions on about benefit of crop-livestock integrated farming system especially with reference to economic viability and environmental

Study Area

For the present proposal, the researcher has selected a micro level area from Upper Ganga plain of western Uttar Pradesh. The selected region, Bulandshahr, is one of the important agriculturally developed district of U.P. It covers an area of 4512 sq km inhabitation 3498507 persons. 63 % of population is related to agricultural occupation. Total cropped area under various crops like wheat, rice, sugarcane, barley, millet, pulses vegetables and horticultural product is 298714 hectares. The district is also well developed in livestock husbandry mainly dairy farming, goat rearing and poultry. Meat industry is also developing due to increasing demand of meat in national and international markets. Area reared 213374 heads of cattle, 1190466 heads of buffalo, 192490 heads of goat and 2817sheep during 2012. Farmers are following mixed farming system with integration of crops and different species of livestock. The study area is divided into 7 sub-divisions, 16 development blocks and 1246 villages for administrative convenience. Majority of farmers' practices integrated livestock cropping system at traditional level.

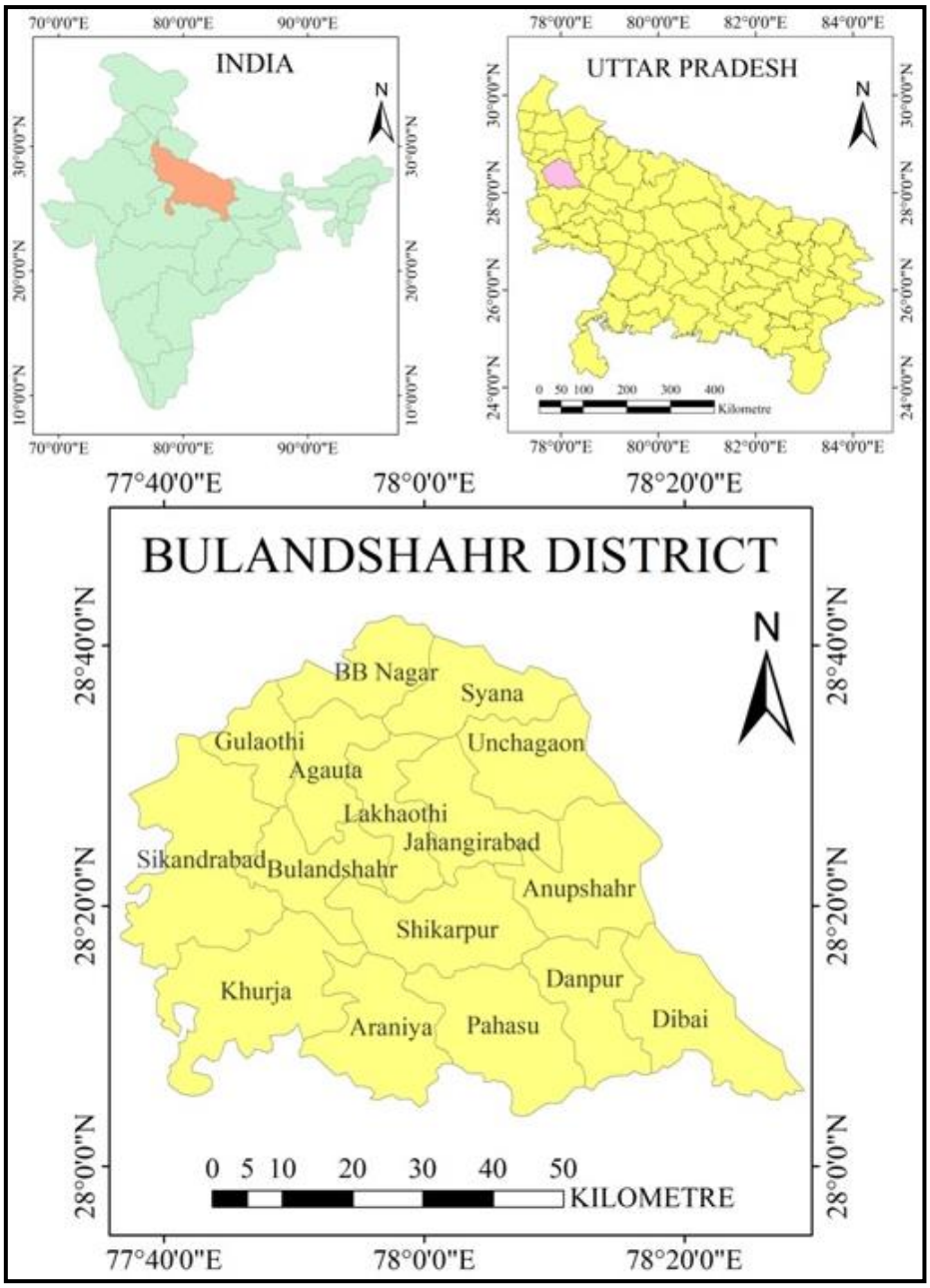

Fig. 1

Discussion and Analysis

The integrated farming system approach introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. The farm wastes are better recycled for productive purposes in the integrated system. A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers would bring prosperity in the farming. Crops, livestock, birds and trees are the major components of any IFS. Crop may have subsystem like monocrop, mixed/inter-crop, multi-tier crops of cereals, legumes (pulses), oilseeds, forage etc. Livestock components may be milch cow, buffalo, goat, sheep, poultry, and bees. Tree components may include timber, fuel, and fodder and fruit trees.

The Bulandshahr district witnessed high level of agricultural growth over the last ten decades. Agricultural land use pattern and crop combination are usually same but little variation is observed in

response to diversity in soils, geomorphologic features, water availability, and size of operational holding of land, religion and castes in the study area. Geographical spatial variation including physical and socio-economic profile of regions also reflected the differences in species of livestock reared. Such variation in agricultural profile led to variation in forms of integrated farming systems. The researcher identified 05 major forms of integrated farming system (IFS)

1. Crop Livestock Farming System
2. Crop Livestock Fishery Farming System
3. Crop Livestock poultry Fishery Farming System
4. Crop Livestock Fishery Vermicomposting Farming System
5. Crop Livestock Forestry Farming System

Crop livestock farming system refers the integration of various crops and varieties of livestock in a particular region. The components of integration are wheat, rice, sugarcane, oilseeds, pulses and horticulture from cropping groups; buffalo, cattle, goat, sheep, poultry and fish from livestock family and forestry, orchards from plant family. Integrated Crop livestock farming system (ICLFS) is subdivided into following four groups] on the basis of combination of crops and animals in the area.

1. Integrated Wheat Rice Buffalo Farming System (IWRBFS),
2. Integrated wheat Rice Sugarcane Buffalo Farming System (IWRSBFS),
3. Integrated Wheat Rice Sugarcane Pulses Buffalo Farming System (IWRPBFS)
4. Integrated Wheat Rice Sugarcane Vegetables Buffalo Farming System(IWRSVBFS) and
5. Integrated Rice Wheat Sugarcane Maize Cattle Buffalo farming System(IRWSMCBFS)

The economic analysis through estimation of production cost and price of output and the resultant income from various forms of farming systems in the study area indicated that exclusive livestock husbandry is generating highest net profit in absolute value in all cases but its percentage of income over the amount spent for production, is rather low. The highest percentage of income from exclusive livestock farming system in the case of small farmer is attributed to household members who worked as unpaid workers for different operations like caring the livestock, cleaning the sheds, feeding, grazing, milking etc. The cost of production is normally reduced, which results in higher percentage of income contrary to big farmer who hires in paid labours for almost all operations of livestock husbandry, consequently percentage of income over cost reduced. The marginal farmer ranks second with 160.36 percent income over the cost incurred due to also same reason as for small farmers.

The integrated Cropping Livestock farming system is also a potential source of livelihood and employment. Livestock husbandry in combination provides some partial jobs to the household members especially during off farm season. Rearing, caring, grazing, milking, marketing are the important livestock operations in which household's members and rented labours. The data reveals that exclusive cropping as well as livestock husbandry have generated rather less man days (450 and 560) than any form ICLFS. It is also reflected through table that the man day's employment generated varies from one form to another form. IWRBFS generated highest number of man days per annum i.e.680 which is equal to 8.5 workers full employment for one year. It is followed by IWRSHBFS, IRWSMCFS, IWRSBFS and IWRSPBFS in descending order as shown in the table. Rice, sugarcane and horticulture offer rather high rate of employment (man Days equal to 7.5 full workers per annum) next to IWRBFS. Rice needs more labour

for transplanting saplings, weeding out unwanted plants, as well as reaping and thrashing. Similar sugarcane cultivation need more labours for sowing, weeding, and preparing sugarcane for marketing. The quantum of employment generated through various farming systems are affected by gender. Females' participation plays pivotal roles as all indoor or at farms activities have been performed by females securing 36.84 percent. It is rather high, more than 26.44 percent in the case of non ICLFS.

Livestock husbandry especially dairy farming and goat rearing offer higher female participation due to domination of indoor or house attached operations. Male participations are usually for outdoor works like ploughing, irrigation, harvesting, marketing and dispute resolution. Female participation / employment varies from village to village between 25 percent in Jasar and 47 percent Arania Kurd .The variation in the women employment has been attributed to social and economic profile of the village. Higher proportion of SC and OBC resulted in higher female employment and vice versa Similarly, females participation in non ICLFS, though less than ICLFS, varies among the sampled 32 villages , ranging from 25 percent in Bharkau, Kurena, Barari, Chhapravat, Nizampur, Samaspur, Fatehpur, Barthana to 30 percent in TeliaNagla, Maua Khera, Atta Nikhob, Karauthi proportion of employment (table 1).

Table 1 Proportion (%) of Farmers involved in Various Forms of Integrated Cropping Livestock Farming System in Bulandshahr District

Name of The Village	Name of Block	No. sampled House Holds involved in ICLFS	IWRBFS	IWRSBFS	%IWRSPBFS	%IWRSVBFS	IRWSMCBFS
Bharkau	Unchagaon	52	17.31	21.15	15.385	11.538	34.62
Maua Khera		37	18.92	16.22	10.811	21.622	32.43
Total		**89**	**17.98**	**19.10**	**13.483**	**15.730**	**33.71**
TeliaNagla	Anupshahr	28	10.71	14.29	17.857	21.429	35.71
AharBangar		120	11.67	9.17	13.333	39.167	26.67
Total		**148**	**11.49**	**10.14**	**14.189**	**35.811**	**28.38**
Kurena	Jahangirabad	31	22.58	41.94	19.355	6.452	9.68
Jasar		76	26.32	38.16	23.684	3.947	7.89
Total		**107**	**25.23**	**39.25**	**22.430**	**4.673**	**8.41**
Poth	Lakhaothi	25	32.00	44.00	16.000	4.000	4.00
Mursana		58	44.83	34.48	12.069	5.172	3.45
Total		**83**	**40.96**	**37.35**	**13.253**	**4.819**	**3.61**
A.Pur Raina	Agauta	32	37.50	43.75	9.375	3.125	6.25
Barari		26	34.62	46.15	7.692	7.692	3.85
Total		**58**	**36.21**	**44.83**	**8.621**	**5.172**	**5.17**
Atta	B.B. Nagar	40	47.50	35.00	7.500	2.500	7.50
Nikhob		36	41.67	30.56	11.111	5.556	11.11
Total		**76**	**44.74**	**32.89**	**9.211**	**3.947**	**9.21**
Utsara	Gulaothi	27	44.44	37.04	14.815	0.000	3.70
Chhapravat		57	38.60	35.09	10.526	3.509	12.28

Total		**84**	**40.48**	**35.71**	**11.905**	**2.381**	**9.52**
Bhundasi	Pahasu	51	43.14	37.25	9.804	3.922	5.88
Samaspur		24	37.50	41.67	8.333	4.167	8.33
Total		**75**	**41.33**	**38.67**	**9.333**	**4.000**	**6.67**
Yavapur	Danpur	28	42.86	39.29	10.714	3.571	3.57
Rahmapur		46	45.65	36.96	8.696	2.174	6.52
Total		**74**	**44.59**	**37.84**	**9.459**	**2.703**	**5.41**
Karansinghpur	Dibai	19	10.53	15.79	21.053	15.789	36.84
Dharkpur		49	24.49	32.65	16.327	8.163	18.37
Total		**68**	**20.59**	**27.94**	**17.647**	**10.294**	**23.53**
Salempur	Shikarpur	100	34.00	39.00	13.000	5.000	9.00
R .R.Alipur		16	25.00	43.75	18.750	0.000	12.50
Total		**116**	**32.76**	**39.66**	**13.793**	**4.310**	**9.48**
Pala	Araniya	34	32.35	50.00	5.882	2.941	8.82
ArniaKhurd		35	34.29	40.00	8.571	5.714	11.43
Total		**69**	**33.33**	**44.93**	**7.246**	**4.348**	**10.14**
Chiti	Khurja	16	31.25	43.75	18.750	0.000	6.25
Nizampur		17	17.65	47.06	23.529	0.000	11.76
Total		**33**	**24.24**	**45.45**	**21.212**	**0.000**	**9.09**
Kiryawali	Bulandshahr	20	15.00	30.00	15.000	35.000	5.00
Dariapur		73	19.18	26.03	6.849	41.096	6.85
Total		**93**	**18.28**	**26.88**	**8.602**	**39.785**	**6.45**
Faridpur	Sikandrabad	50	38.00	36.00	8.000	14.000	4.00
Fatehpur		23	43.48	30.43	13.043	0.000	13.04
Total		**73**	**39.73**	**34.25**	**9.589**	**9.589**	**6.85**
Barhana	Syana	61	19.67	27.87	39.344	4.918	8.20
Karauthi		21	28.57	23.81	38.095	9.524	0.00
Total		**82**	**21.95**	**26.83**	**39.024**	**6.098**	**6.10**
Total District		**1328**	**29.67**	**32.08**	**14.383**	**11.521**	**12.35**

Source: Field Survey, 2020-21

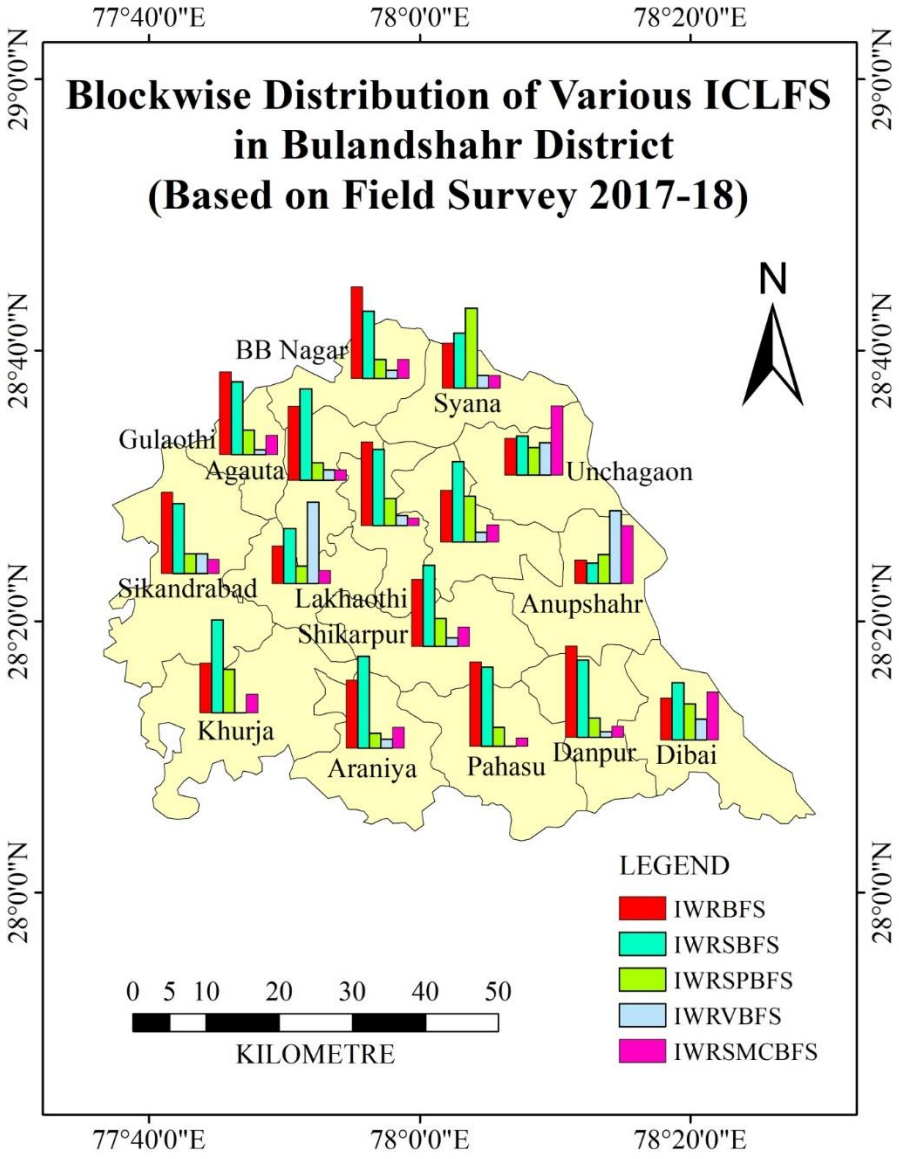

Fig. 2

Integrated Cropping Livestock Farming System (ICLFS) is also the function of social stratification in the study area. Other Backward Castes (OBC) showed their participation and employment as workers in the discussed farming system to the top level, securing on an average with 65 percent (table 2). Their population, in fact, is the highest in the study area as well as in the country, so highest participation is not wonder. This group of social strata has been well trained in various operations of agricultural practices and livestock husbandry. There is no social taboos for women participation in the field works and they do work right from preparing seed to transplantation, weeding out, reaping, packaging, harvesting, collecting grains, cleaning sugarcane for mill, rearing, caring, milking, and grazing the livestock. OBC's farmers usually do not hire in labours but most of the works are done by household members. Above discussed facts are attributed to highest rate of employment in ICLFS as shown in the table.

Scheduled castes are the second social group who represented as workers next to OBC involved in ICLFS. One fourth of total employment generated is secured by SC on an average in the study area. They are generally land less and working as agricultural labours in the farms of both OBC and high cates. Some

of them are cultivators but on rented land taken from land lords either as cropping sharer or payment in both cash and kind. Besides, they do not hire in labours but all works are done by their household members.

Moreover, the big farmers played little role as workers in ICLFS and they are employed by 10 percent in the study area. They cultivate the land and rear the livestock but almost all works are done by hired labours or machines. The household members especially females treat agricultural operations below their social status. They prefer white colour jobs or business or politics.

Table 2 Social Stratification of ICLFS farmers in Bulandshahr District, 2020-21 (% to Total ICLFS Farmers)

Blocks	No. of HH (Sampled)	S.C/S.T	Other Backward Caste	High Caste
Unchagaon	89	5	75	20
Anupshahr	148	9	77	14
Jahangirabad	107	6	75	19
Lakhaoti	83	7	79	12
Agoto	58	8	77	15
Bhawan Bahadur Nagar	76	9	74	17
Gulaothi	84	7	77	16
Pahasu	75	6	76	18
Danpur	74	4	77	19
Dibai	68	8	76	16
Shikarpur	116	5	79	16
Arania	69	6	77	17
Khurja	33	8	76	16
Bulandshahr	93	9	75	16
Sikandrabad	73	5	77	18
Syana	82	8	77	14
Total	1328	7	76	17

Source: Field Survey, 2020-21

The rural employment and livelihood are very important challenge before the country. Mechanization of agriculture reduced the labour absorption capacity in traditional food grain producing farming system. The ICLFS appears an important farming system to absorb rural working force. The capacity of employment, as estimated through field survey, varies between 5.4 and 8.5 persons per annum in different forms of discussed system. It is rather higher than exclusive farming system. Livestock husbandry integration with cropping resulted in demand for more workers even in off farm season. It is expected that the study area would have a large size of employment after taking into consideration of result of module of one acre, two buffalo and two goats with reference to different forms of ICLFS.

The income and employment generated through ICLFS have been found to be more beneficial to poor farmers like land less, marginal and small farmers. The table 3 revealed that 65 percent and 25 percent of employed persons in ICLFS are belonging to Other Backward Castes and scheduled Caste respectively. Further it is reflected the domination of small, marginal and landless in the employed persons in discussed

system. Women empowerment through employment in various operations of ICLFS has improved. 36.84 percent of total employed is controlled by women as compared to 26.22 percent for non ICLFS. The perception survey also verified the fact and 64.59 percent of respondents answered yes for question regarding women empowerment. Moreover, the ICLFS is pro poor farmers, poverty alleviation and sustainable agricultural development in the study area. It is proved through the perception survey .The data generated through perception survey in the sampled villages of the study area, is shown in table 4.7. Increase in income, employment generation, soil fertility preservation, profit improved and women empowerment are the important questions were asked to respondents. All queries are responded by more than 60 percent positively. 71 percent answered yes for increase in income, 64.58 percent for employment generation, 80.63 percent for soil fertility preservation, 67.78 percent profit improved and 64.59 percent for women empowerment as shown in the table. Study reveals that the ICLFS is the important tools or means for improving farmers income, poverty alleviation, soil ecology equilibrium and economic empowerment of women in the study area particular and in the country general.

Table: 3 Economic Structure of ICLFS Farmers in Bulandshahr District 2020-21(% to total ICLFS farmers)

Blocks	**No. of HH (Sampled)**	**Marginal (Less than one hectare)**	**Small (1-5 Hectares)**	**Big (More than 5 hectares)**
Unchagaon	89	20	65	15
Anupshahr	148	23	64	13
Jahangirabad	107	18	65	17
Lakhaoti	83	23	65	12
Agoto	58	22	63	15
Bhawan Bahadur Nagar	76	19	68	13
Gulaothi	84	20	64	16
Pahasu	75	19	68	13
Danpur	74	21	65	14
Dibai	68	23	67	10
Shikarpur	116	20	64	16
Arania	69	18	70	12
Khurja	33	18	67	15
Bulandshahr	93	17	70	13
Sikandrabad	73	15	63	12
Syana	82	20	67	13
Total	**1328**	**20**	**66**	**14**

Source: Field Survey, 2020-21

Suggestions and Recommendations

The present study reflected most of the important positive features of the Integrated Crop-livestock Farming System related to income, employment, livelihood, women economic empowerment, soil

ecology, and sustainability of farmers and farming system. All the benefits found through the observation and analyses of data are not to satisfactory level due to improper and unscientific methods of agricultural practices adopted by farmers. Most of them follow traditional and subsistence approach of production. Unawareness about different agricultural policies, technological innovation, credit facilities, market accessibility and methods of value addition to their products have been observed as important hindrance and obstacles to achieve maximum level of potential of the aforesaid farming system. On the basis of field observation by research team, there are some important suggestions and measures are recommended for betterment of this high potential farming system with a view to improve economic conditions of farmers and rural development in the study area as well as in the nation as whole. Such suggestions are given below.

1. There is need of micro level of data on different components of Integrated Farming System and allied aspects like socio economic condition of farmers, geographical attributes i.e. climates, soils, humidity, water bodies, underground water for a scientific planning of different forms of integrated farming system in any given area of the country as well as in study area. Such data could be generated through application of Remote Sensing and GIS techniques.
2. Generally farmers in the study are not in trouble due to lack of technology but market problem which discouraged the farmers for getting due price for their products. Post-harvest distress sale for both crops products as well animal products especially milk has been very common phenomena. Farmers are not fixing price for their products but government declares Minimum Support Price (MSP) for some crops, factory and government determine sugarcane price unlike the manufacturers fixed themselves MRP for their products taking into consideration of all kinds of expenses incurred before reaching to retailers. So there should be an efficient agro marketing system linking the local village markets to the national and international market network.
3. Agro processing units like rice mill, flour mills, chips making mill, dairy processing, meat processing units, gur / khandsari making unit, and so on based on crop-livestock products produced in the area concerned should be established and developed. This will not only adding value and price to the farmers raw products but also generate the employment and livelihoods for rural population by involving them into non-farm activities. Consequently, rural urban migration would be also checked.
4. Credit with low interest rate should be provided at the time of need especially during sowing period of crops and purchasing animals for milk. Goat rearing, poultry, fish rearing with integration of various values added crops should be also encouraged for increasing the income of farmers. Insurance of crops and animals should be encouraged, if it exists, should be streamlined and be accessible to the farmers.
5. Indian farmers are usually illiterate and untrained. They are fully utilizing the technological and innovative measures available and also unaware about different government‘s incentive policies to them. There should be strong link of extension service for motivate and trained the farmers for adopting distinct agricultural innovations as diversification of farming system, development of market oriented agriculture, marketing facilities and amenities, credit and insurance schemes and demand and supply network of various agricultural products in local, regional, national and international markets.
6. The politicization of farming and farmers should be minimized and they must be treated as an important asset of the country with respect to socio economic development of the country, not as vote bank. Waiving of loan is not permanent solution but our farming system should be made more economically viable and profitable. Contract farming is one of the best solutions for development of profitable agriculture. But it needs a careful planning that the farmers should be given due share in

whole chain of agribusiness according to their investment in the form of land and labour. They must be given share in the profit incurred in proportion to their share in capital investment. Private- Farmers-Participation (PFP) system should be followed.

7. Any agricultural development policy should be designed on the basis of proper research conducted at grassroots level dealt with various aspects of farming and farmers. In India first policy is made and research is done later on as compared to developed countries where research is made first and policy is designed later on. Indigenous agricultural practices, which had been developed in the past, should be also taken into consideration at the time of formulating agricultural development policies in the country

Conclusion

The present study and derived results and findings are important base of designing any strategy for farmers and rural development in the country. It will also help the farmers in decision making process for adoption of distinct farming system especially Integrated Crop livestock farming system. Their income may be upgraded and enhanced through this more productive and profitable as well as eco-friendly farming system. Indirectly, political stability could be developed by increasing income of farmers. It would be also helpful in maintenance of balance of payment by exporting different products, if the recommended suggestions are incorporated in policies for development of market oriented farming and diversification of farming system. Besides, the present study will be also helpful in academic life for further research regarding socio economic development of farmers and rural areas through development of agriculture.

Reference

1. Sakeran, U.K., David, L.L., Ussiri, A, N., Kumar, S. & Clay Sheron (2021)Role of Integrated Crop Livestock System in Improving Agricultural Production and Addressing Food Security: A Review, Journal of Agriculture and Food Research, Vol.5, 100190
2. Lal, R. (2020) Integrated Animal Husbandry with Crops and Trees, Frontiers in Sustainable Food System, Vol.29, July 2020
3. Lemaire G., Franzuluebbers, A. & Dedieu, B. (2014) Integrated Crop Livestock System: Strategy to Achieve Synergy Between Agricultural Production and Environmental Quality, Agriculture Ecosystem and Environment, Vol.190, pp.4-8
4. Mukhlis, Noer, M., Nafialidi, & Mahdi (2018) Integrated Farming System of Crop and Livestock: A review of Rice and Cattle Integration Farming, International Journal of Science, Basic and Applied Research(IJSBAR) Vol.42, No.3, pp.68-82
5. Ehsanul, H.M.D. (2016) Sustainable Integrated Crop Livestock Production System in Char Area of Bangladesh, Journal of Fisheries and Livestock Production, Vol.4, 156
6. Dashera, L.N. & Singh,H. (2014) Integrated Farming System – Need of Today, International Journal of Applied Life Science and Engineering, Vol. 1, No.1, pp.28-37
7. Kathleen, H. (2011) Integrated Crop Livestock Agriculture in the United States, A Review Journal of Sustainable Agriculture, Vol.35, No.4, pp.376-393
8. Martin, G. Morain, M. Ryschawy, J., Angelina, M.M., Masayasu, A., Sarthaou, J.P., Duru, M., and Theorond, O. (2016) Crop Livestock Integration Beyond the Farm Level: A Review, Agron. Sustainable Development, Vol. 26, No.53, pp.2-21

9. Srjian, V., Bhatt, R., Malik, P.K., Madiajagan, B., Hasni, Y. Sulvan, M. & Gaughan, J.B. (2015) Livestock as Source of Green House Gases and Its Significance to Climate Change, in Green House Gases(edit) Bernardo Liamas Maya and Juan Pous, Intech Open Book Series, doi 105772/62135
10. FAO (2006) Livestock Long Shadow: Environmental Issues and Option, Food & Agricultural Organization, Rome, Italy
11. Khan, N. & Parashri, A.K. (2015) Dynamics of Livestock Sector and Challenges of Water Resource in India, International Journal of Livestock Research, Vol. 5, No. 6, pp.34-45
12. Khan, N. &Parashari, A.K. (2022) Goat Husbandry: An Opportunity to Strengthen Rural Economy in Devipatan Region (Trans-Ghaghara) of Uttar Pradesh. *Economics.* Vol. 11, No. 1, 2022, pp. 9-17. ISSN: 2376-659X (Print); ISSN: 2376-6603 (Online), doi: 10.11648/j.eco.20221101.12
13. Khan, N, et al. (2011) Livestock Husbandry in Rural Urban Fringe of Aligarh Town: Environmental Sustainability, Advanced Journal of Geographical World, Vol.1, No.2,pp.18-27.
14. Salikin A.K, (2003) Sustainable Agriculture System, Kanisius," Jogyakarta, 2003.
15. Sasikala V, Tiwari R and Saravanan, M. (2015) A Review on Integrated Farming Systems, Journal of International Academic Research for Multidisciplinary, Volume 3, Issue 7, pp. 319-328.
16. Ryschawy J, Liebig M.A., Kronberg S.L., Archer D.W., and Hendrickson J. R., "Integrated Crop-Livestock Management Effects Soil Quality Dynamics in a Semiarid Region: A Typology of Soil Change Over Time, HINDAWI, Applied and Environmental Soil Science, Article ID 3597416, pp. 1-10, 2017.
17. Delgado, C.M. et al.(1999) Livestock 2020: Next Food Revolution, Food Agriculture and Environment Discussion paper 28, International Food Policy Institute (IFPRI), Washington,D.C., U.S.A 22-Drechsel, P. et al. (2002) Increasing Use of poultry Manure in Ghana, Urban agriculture magazine, vol.1, no.2.
18. Alan, F.(2007) Soil Physical Aspects of Integrated Livestock –Cropping System, Proceeding of Symposium on Integrated Crop- Livstock System,August,13-17, Curitiba, Brazil, 2007
19. Allana, I. (2005) Current Scenario and Growth Prospects for Meat and Rising India's Share in Global Markets, Paper presented at the Agriculture Summit, Vigyan Bhavan, New Delhi, 9th and 10th April, 2005
20. F.A.O. (1996) Environmental Impact of Animal manure Management, edited by P. J. Brandjes, J.D. Wits, Report for Livestock and Environment Study, Rome.
21. Leonard, D.K.et.al.(2006) Political Economy of International Development And Pro Poor Livestock Policies: A comparative assessment, Paper No.35, FAO
22. Ray, A. N. (1999) Livestock Production and Environment, New Zealand Trade, Consortium Paper, New Zealand Institute ofeconomic Research, Wellington , New Zealand
23. Steinfield,H.et.al (2006) Livestock's Long Shadow: Environmental Issues and Options LEAD/FAO p.407
24. Sulc, R.M. &Benjamin, F.T. (2006) Integrated Crop Livestock system in USA Cotton Belt,Agronomy Journal, Vol.99, No.2, PP.35-345
25. Thompton, P.K. &Herrero, M.(2001) Integrated Crop –Livestock Simulation Model for Scenario Analysis and impact Assessment, agricultural System, Vol.70, issue2-3,pp.581-602
26. Kulshreshtra, L.R. and Gogia, J. (2010) Sustainable Dairy Development and Women Employment - Need and Strategies (with Special Reference to Agra District, U.P.), the Socioscan, Vol, 2 (374), pp. 49-52.

27. Hoffman (1999) Asian Livestock to the Year 2000 and Beyond. FAO-RAP Working paper series.
28. Wint and Baurn, D.(1994) An Anthropogenic and Environmental Correlates of Livestock Distributionin Sub-Saharan Africa, Oxford, U.K. Oxford Environmental Research Group
29. Herrero, M., Thornton, P. K., Gerber, P., and Reid, R. S. (2009). Livestock, livelihoods and the environment: understanding the trade-offs. *Current Opinion in Environmental Sustainability, Vol.* 1,No.2 pp. 111–120. DOI: 10.1016/j.cosust.2009.10.003
30. Ritchie, H., and Roser, M. (2019). *Micronutrient Deficiency. Our World Data*. Available online at: https://ourworldindata.org/micronutrient-deficiency?utm_medium=syndication&utm_source=scribd (accessed April 27 2020)
31. . FAO (2006). *Livestock's Long Shadow: U.N. Report. Rome: Food and Agriculture Organization of the United Nations (FAO)*. Available online at: https://awellfedworld.org/long-shadow
32. Janzen, H. H. (2011). What place for livestock on re-greening earth? *Animal Feed Science Technology*. Vol. pp. 166–167, 783–796. DOI: 10.1016/j.anifeedsci.2011.04.055
33. Pelletier, N., and Tyedmers, P. (2010). Forecasting potential global environmental costs of livestock production 2000-2050. Proc. Natl. Acad. Sci. (PNAS) U.S.A. Vol. 107, pp. 18371–18374. DOI: 10.1073/pnas.1004659107
34. Smith, P., Haberl, H., Popp, A., Erb, K. H., Lauk, C., Harper, R., et al. (2013). How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals? Global Change. Bioenergy. Vol. 19, pp.2285–2302. doi: 10.1111/gcb.12160
35. Thornton, P. K., van de Steeg, J., Notenbaert, A., and Herrero, M. (2009). The impacts of Climate Change on livestock and livestock Systems in Developing Countries: A review of what we know and what we need to know. Agricultural System, Vol. 101, 113–127. DOI: 10.1016/j.agsy.2009.05.002
36. UN (2019). *World Population Prospects 2019: Highlights (ST/ESA/SER.A/423). Rome: United Nations, Department of Economic and Social Affairs, Population Division*. Available online at: https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf