

ICAR – Mahatma Gandhi Integrated Farming Research Institute

1. **Title of the project:** Development and assessment of goat based integrated farming models in wetland ecosystem
2. **Funding agency:** Institute (ICAR-MGIFRI)
3. **Total outlay:** ≈22 lakhs (excluding salary and wages)
4. **Duration:** 4 years (wef Oct, 2020 -2024 or continued till date as per the directives of the Council)
5. **Single/ Multi-institutional:** Single
6. **Lead Centre if multi-institutional**
7. **Cooperating Centre(s):**
8. **Principal Investigator:** Dr. P.K. Bharti
9. **Co-Investigators:** Dr. S.K. Purbey, Dr. Ravi Kumar
10. **Rationale:** Livestock resources are the key components in sustainable agriculture. India is having 512.1 million livestock population which provides livelihood to 2/3rd of the rural community and generates employment to about 8.8 % of the population of India (Dash, 2017). The livestock sector contributes 4.11 % GDP (Gross Domestic Production) and 25.6 % of total agriculture GDP. India is number one milk producer in the world with 146.3 million tons of milk. Similarly, it is producing 78.5 billion of eggs. Livestock is one of the most important integral components of mixed farming systems in India. The total livestock population in India as per the 20th census (536.76 million) has shown increasing trend @ 4.8 % over the previous census. Livestock based integrated farming system is a traditional practice in rural India among the small and marginal farmers. Due to over growing human population, there is pressure to produce more food and income sources through agriculture to sustain the livelihood of the farming community. However agricultural produces in isolated system cannot fulfil the daily needs of humans due to decreasing trend of land holding per farm family and hence the diversification of crop-based agriculture with dairy, goatery, fishery, poultry etc is necessary for increasing the income of farmers (Ray *et al.*, 2012). The major emphasis in the farming system is productive cycling of farm resources or wastes. Different components of farming system work together in integrated farming system resulting in higher total productivity than the sum of their individual production. The output from one enterprise, thus improving the resource use efficiency.

Bihar is one of the highest populated states of the country with highest population density among the states (Census, 2011). The land holding in Bihar consists predominantly of small and marginal farmers with a high degree of fragmentation. About 76.2 % of the farmers are small and marginal but sharing only 50 % of the land. The average size of the holding is 0.83 ha, with that of small and marginal farmers ranging from 0.32 to 0.5 ha (Planning commission, 2001). With the average size of land holding is shrinking as a result of increased fragmentation. Many marginal farmers are becoming economically non-viable and oriented towards subsistence. Due to failure of monsoon and unpredictable climatic conditions, farmers are forced to judicious mix up of agricultural enterprises like dairy, goatery, fishery and poultry etc. based on their land holding and economic conditions. Goatery plays a crucial role for improving the small and marginal region of the farmers in Bihar. The goat population of country is 148.88 million out of which Bihar shares 12.8 percent. The East Champaran district cropping system is rice-maize followed by the wheat. People of this region mostly rear cattle and buffalo for milk production whereas goat is mainly reared for meat purpose. Goat not only provides valuable livestock

meat (chevon) but has capacity to yield many other valuable products in form of milk, fibre and manure. The goat milk is known for medicinal values particularly in case of patients suffering from jaundice, peptic ulcers, dengue etc. Goat can easily be maintained on low land size and has potential to produce good quality meat to generate income to farm families. Goat farming can be integrated with different crops like rice, wheat, vegetables etc. The East Champaran region is also known for fishery production; thus, fish unit can also be integrated to utilize the waste materials from crop and goaterly to boost the economy of the small and marginal farmers of the region. Keeping in view the importance of goat, the present study has been proposed to develop and assess the feasibility of goat based integrated farming system models with crop and fishery components in wetland ecosystem of Bihar.

11. Research Gaps: Integrated farming is very essential to reduce the dependency of farmers on external sources of inputs. Agriculture in the present scenario cannot be sustained without integrating with livestock. Livestock not only produces the important nutrients to humans in terms of meat, milk but it is a potential source of manures to sustain the soil fertility in long run. Integrated livestock farming with cattle and buffalo is very common where the land holding size of the farmer is higher. However, for those having small and marginal farmers, goat could be one of the best livestock to start integrated farming system. The east Champaran region of Bihar falls under wetland ecosystem and partly rain fed agriculture. Goat meat (chevon) is one of the highest priced meats among the all-livestock species which is well accepted by almost all religions without any social taboos. The price of meat varies from Rs 400 to 1000 depending upon the age, breed and season or special occasion/ceremony. The goat not only produce quality meat to the people but also produce valuable milk which could be used for several ailments in humans like jaundice, liver diseases and some viral diseases like dengue etc. Goat manure is also rich in nitrogen, potash and phosphorous which can increase the soil fertility. Apart from these, goat has capacity to produce good quality fibre/hair which can be used for making brushes and fabric items. Goat can be easily maintained in small area or even in backyard system without much more investment as compared to large animals like cattle and buffaloes. The goat also relies on variety of tree leaves, horticultural waste, and crop residues apart from grazing on natural conditions. Most of the research works on IFS modules were focused on dairy or poultry-based enterprises. However, research works on goat based integrated farming system particularly in northern Bihar under wet land ecosystem has not been given special attention. The importance of this versatile species of livestock can be drawn attention as this one of the primary sources of animal protein in East Champaran region where its known as brand “Champaran meat”. Keeping in view the importance specially for small and marginal farmers, goat based integrated farming models with crop and fishery components need to be developed and assessed for its economic feasibility and further advancement in integrated farming research areas.

12. Objectives:

- To develop goat based integrated farming models with crop and fish components under wetland ecosystem
- To study the nutrient use efficiency and economic feasibility of goat-based IFS model under wetland ecosystem

13. Activities/ Details of experiments

- **Treatment details:** The project was aimed to develop and assess two models based on integration of goat enterprise with crop module (Model-I) and goat-crop with fishery opponents (Model-II). One acre

(approx. 4000 square meter) land area was allocated for each model under wetland ecosystem of East Champaran district of Bihar.

- The study was conducted at the institute research farm, ICAR-MGIFRI, Piprakothi, East Champaran, Bihar. The East Champaran district is situated between 26° 16' North to 27° 1' North latitude and the longitude between 84° 30' East to 85° 16' East. The Piprakothi is situated at latitude of 26° 54' North and longitude of 84° 93' East.
- Two IFS models viz Model-I (goat -crop integration) and Model –II (goat-crop-fish integration) were developed in waterlogged ecosystem of East Champaran district. The total area allocated for goat-crop integrated model was one acre. The area allocation for goat housing and its associated structure like open fencing, manure pits, fodder unit development was 20 percent of the total area allocated under this model. The remaining 80.0 percent (3200 sq.) was allotted for crop production which included field crop (45 percent of total) and vegetables (35 % of the total land under this model).
- IFS Model-II (Goat+ Crop+ Fish): The total area allocated for goat-crop integrated model was one acre. The area allocation for goat housing and its associated structure like open fencing, manure pits, fodder unit development was 20 percent of the total area allocated under this model. The area allotted for field crop production, vegetable and fish production was 35%, 25% and 20% of total area of project, respectively.
- Introduction of Black Bengal goat as animal resource in the IFS unit was done first time at institute research farm of ICAR-MGIFRI, Piprakothi. Low lying land was partially modified through land shaping and converted in to trenches (pond) and raised bed (grazing area) near the goat shed were accomplished. A total of three trenches (pond) and three raised bed structures were prepared for fish farming and availing fodder to goats, respectively.

14. Expected Output:

- It is expected that goat-crop with or without fish components of integrated farming models will be very suitable especially for low land holding farmers under wetland ecosystem.
- The developed models can further be adopted to improve the livelihood of the farmers through value addition in each component based on farmer's conveniences of the region.
- Soil fertility is expected to be increased which will be sustain productivity

15. Expected Outcome

- Goat-based IFS expected to recycle the bioresources easily in waterlogged condition for small and marginal farmers
- Better utilization of waterlogged areas in the region for optimum productivity
- Goat manure can be used as substitute to reduce external depends on chemical fertilizer
- Goat-crop-fish model can be utilized to boost the economy of the farmers