



Livestock based integrated farming systems for livelihood improvement of farmers: A review

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ARTICLE INFO	ABSTRACT
<p>Original Review Article Received on April 07, 2025 Revised on April 12, 2025 Accepted on May 02, 2025 Published on May 07, 2025</p> <p>Article Authors Pramod Prabhakar, Rajesh Kumar, Amratan Gautam, Anand Kumar Singh</p> <p>Corresponding Author Email ppmbac@gmail.com</p>	<p>Small and marginal farmers can increase their economic yield per unit area per unit time by using livestock-based integrated farming systems, which also reduce environmental pollution by effectively recycling waste materials by connecting appropriate components. The sustainability of the farming system is attributed to the recycling of products, byproducts, and waste materials in integrated farming systems. The production of eggs, meat, and milk, which are produced by integrating various livestock components with crops, gives farmers year-round income generation and nutritional security. Combining crop and livestock enterprises would significantly increase labour requirements and significantly reduce the issues of underemployment. IFS provide ample opportunity to engage family labour throughout the year. The main concerns of sustainable agriculture are environmental preservation, natural resource management, and nutritional security. Integrating livestock is the best strategy to encourage sustainable resource use and environmental preservation for economic expansion. An integrated agricultural system increases revenue, diversifies farm output, enhances nutritional security, and encourages nutrient recycling.</p>
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Overview millions of people in rural India benefit from India's vast and diverse livestock resources. The most important elements of sustainable agriculture are livestock resources. There are 535.78 million animals in India. According to the 20th Livestock census, India has the largest number of buffalo (109.85 million), followed by cattle (190.9 million) and goats (148.88 million), and sheep (74.26 million). Two-thirds of rural communities in India depend on livestock for their livelihood, and it creates jobs for around 8.8% of the population (Dash, 2017).

The cattle industry accounts for 25.6% of all agricultural GDP and 4.11% of GDP (gross domestic production). With 146.3 million tonnes of milk produced annually, India is the world's largest milk producer. In a same vein, it produces around 48.1 kg of wool and 78.5 billion eggs. Additionally, the livestock helps provide valuable leather, pelts, and dung. Small and marginal farmers in rural India have long used livestock-based integrated agricultural systems. To increase farmers' incomes, crop-based agriculture must be diversified with dairy, goatery, fisheries, poultry, duckery etc. (Ray *et al.*, 2012).

According to (Birtal and Rao, 2002), farmers own livestock more evenly than they do land. The farming system's primary focus is on the efficient recycling of agricultural waste. When several agricultural system components collaborate, the overall productivity of the system is larger than the sum of its individual production. The efficiency of resource utilization is increased when the output of one business is used as the input of another. In order to increase farming's profitability and dependability, land-based businesses such as fisheries, poultry, duckeries, apiaries, field and horticultural crops, etc., must be integrated into farmers' biophysical and socioeconomic conditions due to the fragmentation of their land holdings (Behera *et al.*, 2004). Through the selling of milk, the livestock industry gives farmers a steady income and jobs during hard times. In times of adversity, livestock act as assets and movable banks that give farmers financial stability. Livestock is an essential source of dietary protein, a coping mechanism for livelihood shocks, a source of cash, and insurance against crop output hazards. For five to six months of the year, agriculture offers seasonal jobs, while during lean times, livestock rearing provide jobs.

Additionally, the livestock industry gives farmers access to nutritious products like milk, meat, and eggs. When farmers own exceptional animals like pedigreed bulls and high-yielding dairy animals, it boosts their self-esteem. Valuable farm yard manure is created when cow dung and other fodder wastes break down. Livestock act as assets and movable banks, giving farmers financial stability in times of adversity. In addition to being an essential source of dietary protein, livestock can be used as a coping strategy for livelihood shocks, a source of cash, and insurance against crop output hazards. Livestock raising creates jobs during lean times, and agriculture offers seasonal jobs for five to six months of the year. Farmers are also given nutritional security through the animal industry (milk, meat, and eggs). Having premium livestock, such as pedigreed bulls and high-yielding dairy cows, boosts farmers' self-esteem. The decomposition of cow dung and other feed wastes produces excellent farm yard manure. Camel, horse, donkey, poney, mule, mithun, and other pack animals facilitate the movement of goods throughout the nation's hilly regions. Livestock are utilized as biological weed controllers in a variety of crops.

Table 1. Trend in livestock population (Millions)

Species	1951	1982	1992	2003	2007	2012	2019
cattle	155.3	192.5	204.6	185.2	199.1	190.9	192.49
Buffalo	43.4	69.8	84.2	97.9	105.3	108.7	109.85
Sheep	39.1	48.8	50.8	61.5	71.6	65.1	74.26
Goat	47.2	95.3	115.3	124.4	140.5	135.2	148.88
Horse and Ponies	1.5	0.9	0.8	0.8	0.6	0.6	0.34
Camel	0.6	1.1	1.0	0.6	0.5	0.4	0.25
Pigs	4.4	10.1	12.8	13.5	11.1	10.3	9.06
Mule	0.1	0.1	0.2	0.2	0.1	0.2	0.84
Donkey	1.3	1.0	1.0	0.7	0.4	0.3	0.23
Yaks	0.1	0.1	0.1	0.1	0.1	0.1	0.58
Poultry	73.5	207.7	307.1	489.0	648.8	729.2	851.81

Source: Department of Animal Husbandry, Dairying and Fisheries, GoI

Livestock based Farming Systems Livestock + Crop based Farming System

In the majority of India, the livestock plus crop agricultural system is the most common farming system. Combining crops and cattle on the same property allows smallholder farmers to create jobs and diversify their revenue streams.

Livestock and crops are complementary because they both benefit from one other. Animals in livestock + crop systems are frequently raised on agricultural waste products, and they help cultivate the land and produce manure that can be utilized as fuel and fertilizer (Jayanthi *et al.*, 2000). In order to sustain the crop, animals are crucial in progressively enriching the soil and increasing its organic content.

While grain offers supplemental feed for productive animals and crop leftovers provide fodder for livestock, agricultural operations rely on the draft power of animals. Manure and other animal waste are also produced by animals. Cow manure contributes to the farming system's overall sustainability. The macro and micronutrients found in dung are necessary to increase crop development and soil fertility. Biogas is produced from the excrement of cows.

According to (Godi *et al.*, 2013), biogas is a sustainable, alternative, and renewable energy source. According to (Venkatadri *et al.*, 2008), 98 percent of farmers believed that raising livestock reduced vulnerability in drought years, 97 percent of sample respondents said that farmer suicides were lower in dairy-developed areas, and commercial agriculture increased the rate of suicides in Andhra Pradesh (96 percent). An integrated farming system with six buffaloes generated 904-man days of employment compared to 400-man days in crop alone. A tonne of manure contains 8 kg of nitrogen, 4 kg of phosphorus, and 16 kg of potassium. Applying manure improves soil fertility and water-holding capacity and lowers the cost of weeds where livestock grazed under plantations.

Livestock + Crop + Fish based Farming System

It is possible to follow livestock + crop + fish farming systems by integrating fish with livestock + crop farming systems, raising fish in fish ponds using accessible livestock manure, and raising fish without the use of additional feed. By diversifying crops, integrated livestock + crop + fish farming can lower risk and maximize returns from a small land area (Korikantimath *et al.*, 2008). Throughout the year, there should be a sufficient supply of clean, fresh water to maintain the water level for fish management. In a fish pond, the nutrients in cow dung will support the growth of zooplankton and phytoplankton. Aquaculture can make use of livestock byproducts. Livestock faeces are frequently applied directly. Manure, urine, and spilt feed are examples of cattle by-products. Every year, the adult cattle produce between 3,500–4,000 liters of pee and 4,000–5,000 kg of manure. Five to six adult cattle can supply enough manure for a pond that is one hectare in size.

This technique may yield between 3,000 and 4,000 kg of fish per hectare annually in addition to 9,000 kg of milk. This technique will reduce the amount of work required to lift the cow poo. The crop component will provide the 9–10 and 2–2.2 tonnes of green and dry feed that mature cattle require, respectively. The purpose of the manure is to increase the soil's fertility.

Poultry + Fish based Farming System

The cost of fertilizers and feeds for fish farming can be decreased by integrating poultry and fish farming systems. Poultry can be raised over or next to a fish pond and their waste will fall straight into the fish pond and be recycled. Poultry are raised in this system using a deep litter system. Litter made from poultry droppings includes 3% nitrogen, 2% phosphate, and 2% potash. In fish ponds, poultry droppings serve as a good supply of fertilizer that aids in the production of phytoplankton and zooplankton, which are fish feed. The best water quality for fish survival and growth was found by (Njoku and Ejiogu, 1999) when 1000 chickens were combined with a one-hectare fish pond. They also found that the excreta load was 3600 kg ha⁻¹ month⁻¹, the water pH was 8.6, the total alkalinity was 65.0 mg L⁻¹, the dissolved oxygen was 8.0 mg L⁻¹, the biochemical oxygen demand (BOD) was 2.0 mg L⁻¹, the ammonia was 0.02 mg L⁻¹, and the total phosphates were 10.0 mg L⁻¹. The range of fish productivity is 4000–5000 kg/ha/year. Integration of poultry and fish improves resource efficiency, space utilization, and environmental friendliness.

According to (Gangwar *et al.*, 2013), integrated poultry-fish farming created 45–50 man days of employment and added Rs. 4000–5000 in annual revenue. According to (Sahoo and Singh, 2015), a fish-poultry farming system with a B: C ratio of 1.09 might yield a maximum profit of Rs. 33664.06 per 0.025 hectare yr⁻¹. A farmer who combined poultry, fish, and horticulture made Rs. 40,000 from poultry, Rs. 25,000 from fish, and Rs. 6000 from vegetables grown on pond bunds, according to (Bezbaruah, 2012). According to (Kalita *et al.*, 2016), a 1.0 ha fish pond with no additional feed generated 4500–5000 kg of fish, 70,000 eggs, and 1000 kg (live weight) of chicken meat per year with Fish + Poultry integration.

Crop + Livestock + Poultry in the backyard rural residents rely heavily on backyard poultry to provide for their families' nutritional security and revenue (Mandal *et al.*, 2006). Backyard chicken farming combined with livestock + crop cultivation will boost farmers' incomes and enhance nutritional security. According to (Devendra and Pezo, 2002), backyard livestock, which includes sheep, goats, pigs, and poultry, offer families emergency sources of income. Birds feed on the threshing wastes in the fields and the undigested grains in faeces. Additionally, the insects and pests that cause crop illnesses are predated by backyard fowl. Additional feeding of the birds does not require separate inputs. For the farm family, eggs and poultry are a reliable source of revenue and a decent source of protein. Improved backyard poultry as a scientific intervention increased household income, according to (Nirmala *et al.*, 2012). Farm revenue was replaced as a secondary source of income by backyard poultry as a secondary occupation. The majority of women (51%) made 6-10% of the maximum household income from backyard poultry, while just 7% of women made 21-30%. The highest incomes (11-20%) came from 28% of women.

Small Ruminant + Crop + Horticulture based Farming System

The economy of the nation's tiny, marginal, and landless farmers depends heavily on small ruminants. According to (Balusamy M., 2003), Combining these businesses can boost overall output while preserving environmental harmony and financial viability. In addition to giving farmers cash, an integrated farming system based on small ruminants will increase soil fertility, reduce crop disease incidence, and allow goats to use weeds as food. According to (Senthilvel *et al.*, 1998), small and marginal farmers in Tamil Nadu's Southern Zone saw a significant boost in revenue when crops, fruit trees, and goats were integrated into dry land. Trees and shrubs can be directly grazed by small ruminants. This system will therefore save labour. Small ruminants in this system have 1-2 week grazing intervals, followed by 3-6 week recovery periods. The recovery time may need to be extended in arid conditions. Under this approach, tiny ruminants will be able to wander across horticulture plantations, and during lean times, they will be able to find food on boundary plantations.

Fruits from horticulture trees will generate revenue and offer tiny ruminants with high-quality leaf fodder.

Conclusion

For small and marginal farmers, an integrated livestock-based agricultural system offers the chance to increase economic yield per unit area per unit time. Waste materials are efficiently recycled in this system by connecting the right parts. Consequently, reduce the contamination of the environment. The sustainability of an integrated farming system is largely dependent on the recycling of waste, byproducts, and products. Because various livestock components are integrated with crops, the production of eggs, meat, and milk gives farmers year-round income creation and nutritional security. Combining agricultural and livestock businesses would greatly enhance the need for labour and greatly lessen the issues associated with underemployment. IFS have ample opportunity to use family work all year long. The main concerns of sustainable agriculture are environmental preservation, natural resource management, and nutritional security. Integrating livestock is the best strategy to encourage sustainable resource use and environmental preservation for economic expansion. An integrated agricultural system increases revenue, diversifies farm output, enhances nutritional security, and encourages nutrient recycling.

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