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1. Integration of Livestock Farming in Agriculture Practices for Sustainable Rural Livelihood

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Abstract:

Livestock farming is a part of animal husbandry. Livestock often includes cows, buffalo, ox, poultry, and goat. Sustainable livelihood produces almost all kinds of food needs itself. The concept of sustainable rural livelihood amalgamates livestock farming with agriculture farming. The livestock mainly provides milk (cow, buffalo, and goat) and meat (goat and poultry). The livestock i.e., ox and buffalo utilized for ploughing and transporting.

The manure of live stocks, especially cow, acts as rich mineral fertilizer e.g., nitrogen, phosphorus, and potassium, and also nourish agricultural soil microbes. Manure has also a diverse group of microbiota used for agriculture fertility and produces fuels such as methane biogas. Non-agriculture land produces fodder for livestock as a payoff and mitigates the environmental footprint of livestock diet and unwanted grazing.

The literature claimed that the Green House Gas i.e., CH_4 and N_2O, emissions from livestock farming can be diminished by livestock integration with farming. Hence the integration of livestock farming with agriculture practices serves milk, meat, agricultural crop products, fertilizer, biogas, ploughing, and transportation.

Keywords:

Livestock farming, Agriculture practices, Sustainable rural livelihood, Greenhouse gas, environmental footprint, and manure

1.1 Introduction:

The appropriate food production is needed to fulfil physiological needs.

The quality food is sold at higher prices, thereby the farmers should aware of the quality of food production by using quality seeds from recognized vendors or agricultural units or preparing themselves. As the global population has increased day by day, food security come up as a prime concern globally (Lemaire et al., 2015).

It is estimated that the population would be about 9.7 billion by 2050 (UN, 2019). Each member of the population has the right to get sufficient quality food.

Hence, the farmer has to be ensured the maximum yield from agricultural land for both society and their monetary benefits. The World Bank datasheet stated that India is a Lower Middle-Income Country along with other 55 countries (Lower Middle Income | Data).

India, Indonesia, Bangladesh, and Vietnam are contributed around 53% of global food needs (Samberg, 2016). The crops and foods are the major sources of food in ancient India but for the last 50 years, animal protein are in higher demand. The demand for animal protein boosts livestock farming (WHO, 2003; McLeod, 2011).

The quality lifestyle concept is also subsidizing the natural resources depletion and environmental pollution that cause climate change, as result, the environmental change decreases crop yields.

Some insect's play an important role in the pollination of fruit and vegetable flora and due to environmental degradation, the insects are affected which reduces the yields.

The IFPs can cope with up abovementioned issues that arose in the last three decades. The farmers are not aware of the value of their crops and other products. Corporate societies and dealers are generating plenty of revenue from farmer's products.

The problematic situation is that the farmers are getting poor and the consumers are paying much higher for food.

Therefore, if the farmers produce and process the food and directly sell the product to the consumer then the farmers and consumers both are getting benefited.

The integration of livestock farming in agriculture has several advantages but some complexities are also associated.

To overcome such complexities, the farmers need to be educated in livestock management along with agriculture.

Thereby, the Government agricultural universities are promoting farmers to join training programs developed for farmer entrepreneurship. These initiatives serve the farmers with notable success (Muttanna et al., 2018).

The Department of Agricultural Research and Education (DARE) was established by the Ministry of Agriculture in 1973 to promote agricultural research and education and also launched the Krishi Vigyan Kendra (KVK) in agriculture institutions where the agricultural experts provide training to farmers and institutional professors help farmers to solve agricultural problems arise in fields.

The KVK provides comprehensive training in advanced techniques associated with agriculture i.e., horticulture, floriculture, pomology, and other relevant areas.

The vermicomposting, Vermiwash, Vermiculture, Mushroom cultivation, Azola pond, Bio floc fish culture and microbial biofertilizer i.e., *Rhizobium*, Phosphate solubilizing bacteria, Iron oxidizing bacteria and other Plant growth promoting microbes, bio pesticides i.e., *Trichoderma* and *Bacillus thuringiensis* mushroom cultivation and other related training are offered to farmers at KVK.

1.1.1 Background:

The farmers of the country often seek stable financial conditions due to the least knowledge about integrated farming practices and agricultural advancement. Integrated Farming practices (IFPs) include interdependent and interrelated farming in agricultural fields.

The crops are often integrated with animal husbandry i.e., livestock farming, and further, the products are processed and stored by the farmer themselves.

These practices ensure the extreme possible utilization of available nutrients at various levels of feeding or fortification to crops and livestock and generate a sustainable ecosystem i.e., zero waste concept, in the agricultural land.

As an example, the livestock is fed with the waste of agricultural biomass, and the crops are fertilized by livestock waste i.e., cow dung or excretion of other livestock, and the crop yield and livestock milk and meat are the finished products of integrated farming that generates revenue for farmers (Figure.1.1).

Even they, produce all necessary food products i.e., rice, pulses, fruits, oils, milk, and meat. Above all, it is environmentally benign and hence this practice would reduce environmental degradation.

1.2 Need of IFPS For Sustainability and Environmental Health:

The labour-intensive cropping, quick crop rotations, grazing, excessive use of synthetic harmful chemicals as biocide and fertilizer, and large machinery for agricultural practices cause environmental pollution (such as soil, water, and atmospheric pollution), erosion of soil, microbial and insect biodiversity loss and introduction of resistance insect and microbial strains (Walia and Walia, 2015; Tilman, 1999; WHO, 2017; Liebman and Schulte-Moore, 2015). The harmful chemical fertilizer encourages the resistance development in insect and microbial strains that cause harm to crops and reduce yields. Moreover, hazardous chemicals are causing serious health hazards i.e., mental and physical disorders (Sharma and Singhvi, 2017) and a variety of cancer (Bassil et al., 2017). Aforesaid practices are an expensive and serious threat to environmental pollution and degradation.

The IFP includes optimum utilization of available resources by nutrient cycling within farmyard, use of draught animals for transportation and plow, livestock farming (includes beef cattle, dairy cows, buffalo, poultry, sheep, and goats), earthworms farming and vermicomposting, fish ponds and bio-floc, a diverse range of cropping pattern (such as rice, wheat, pulses, oil seeds, fruits, vegetables, and animal fodders). The IFPs are a sustainable zero waste eco-friendly approach.

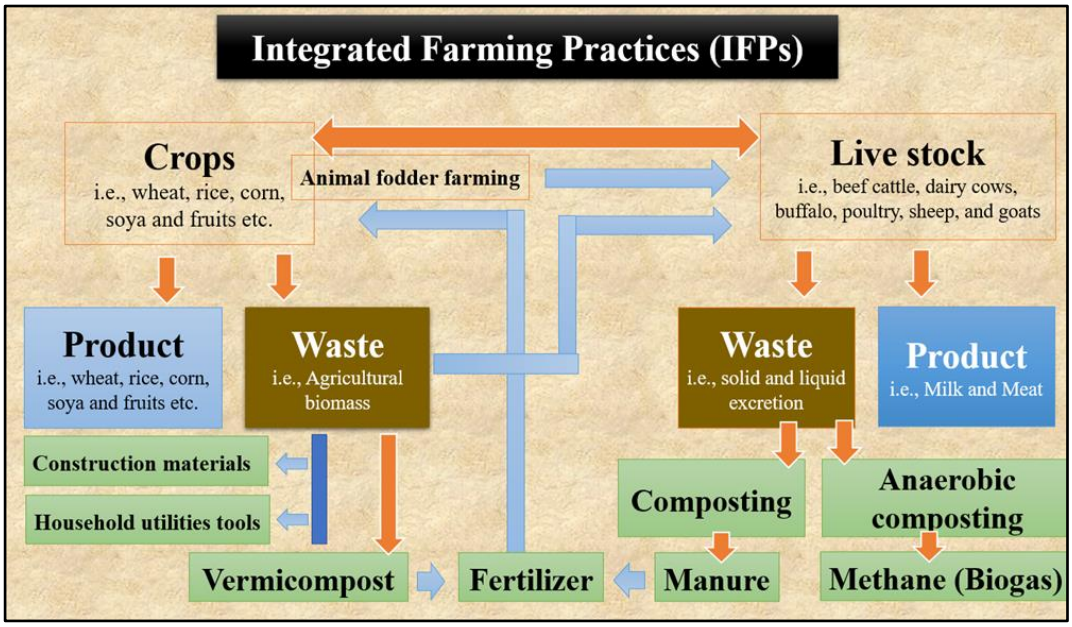

Figure 1.1: Overview of Integrated Farming Practices

Advantages and Associated Complexities of IFPs

The agricultural sector is seeking higher yields and quality food without harming the environment. The IFPs open a way to do so. A customized IFPs need to implement by amelioration of agriculture with livestock farming for higher yield and quality food (Franzluebbers, 2007; Lemaire et al., 2014; Russelle et al., 2007).

IFPs ensure agriculture sustainability in an eco-friendly manner. The sole use of organic fertilizers in agricultural land is considered organic farming and the crop produced are free from harmful chemicals, thereby suitable for human health. Hence, it has a higher market price. The IFP boosts agricultural diversification.

The advantages and certain complexities are associated with IFPs (Figure 1.2). The advantageous part of IFPs includes high return, and stable income throughout the year, organic farming products are often costly but under IFPs organic farming is cost-effective, due to diversified products, the IFPs improved nutrition by plant and animal-derived food and helps to increase soil health and soil biodiversity that reduced greenhouse gas emission.

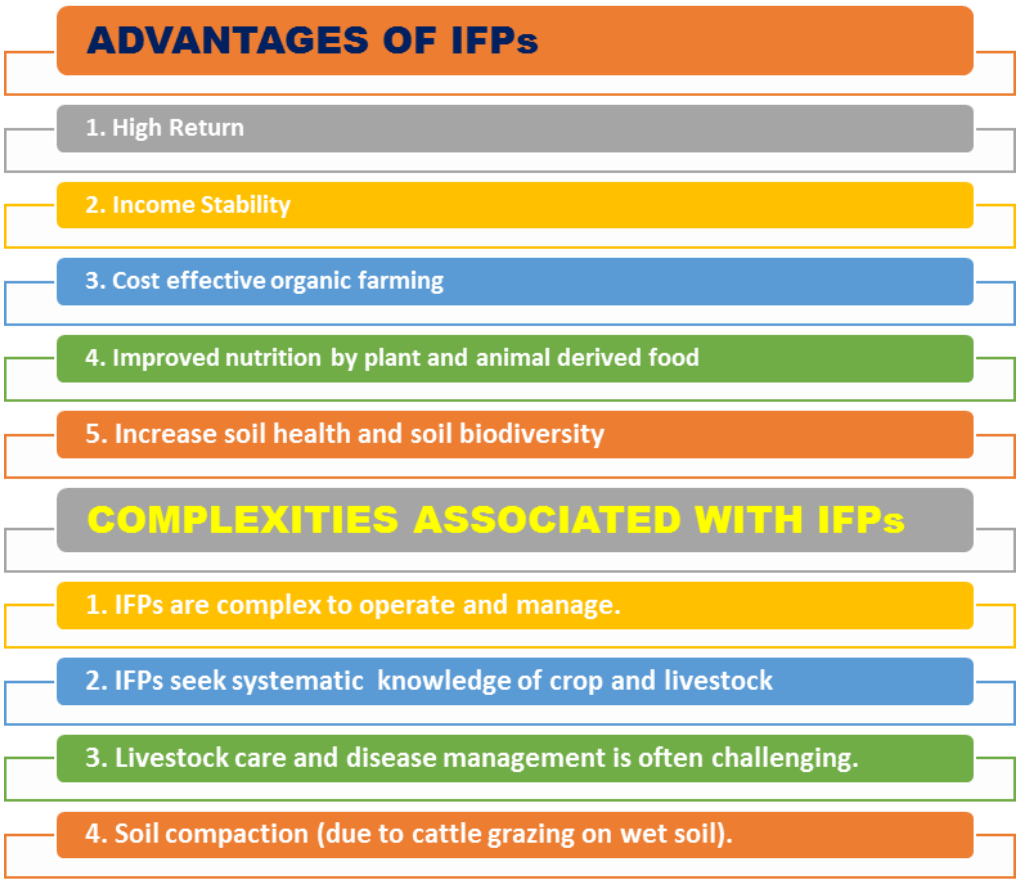

Figure 1.2: Advantages and Associated Complexities of IFPs

Along beneficial aspects, some complexity associated with IFPs are

a. it is complex to operate and manage due to diverse groups of crop and livestock;
b. IFPs seek systematic knowledge of crop and livestock to manage and utilize them effectively;
c. Livestock care and disease management is often challenging;
d. Soil compaction caused due to cattle grazing on wet soil and this reduces crop yields.

1.3 Conclusions:

The implementation of IFPs, an amelioration of crop and livestock in the farmyard, assure the substantial income of farmers throughout the year.

The diversified food production provides stable income to the farmers. The efficient utilization of natural resources with zero waste generation ensures sustainability and eco-friendly farming.

Additionally, IFPs offer cost-effective organic farming for farmer's livelihood. However, the IFPs demand depth knowledge about crop rotation, crop combination, livestock farming, disease management, and other relevant information. The significant participation of women's self-help groups could help to effective implementation of IFPs.

The IFPs also contribute to the purchasing power of farmers for quality lifestyle and help to overcome food security. To encourage the IFPs, The Ministry of Agriculture & Farmers Welfare, initiate various subsidized activities to strengthen farmer's communities by monetary subsidies for infrastructure for small and marginal farmers, on-field demonstrations of advanced agriculture techniques, and supply of genetically modified diseases resistance quality seeds.

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