Popular Article

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Sustainability of Integrated Livestock Farming System &Economic Importance

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What is sustainable integrated livestock farming?

Sustainable development is development that meets the requirements of the present without compromising the ability of future generations to meet their own needs and necessities. Definition to the livestock production field, sustainable agriculture is "the efficient production of safe, high quality agricultural products, in a way that protects and improves the natural environment, the social and economic conditions of farmers, their employees and local communities, and safeguards the health and welfare of all farmed species".

Approach to farm management is based on a continuous commitment to improvement, that means performance gaps are identified and addressed, while recognizing that actions taken must maintain an appropriate balance among the three interdependent pillars of sustainability.

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The integration of crop and animal production is well developed in the smallholder farming systems of India. Some 70–95% of ruminant livestock are found on mixed farms in rain-fed areas in the different countries. There is marked balance in resource use in these systems, with inputs from one sector being supplied to others, such as using draught animal power and manure for crop production and crop residues as feeds. The benefits of crop–livestock interactions are many. Animal traction can improve the quality and timeliness of farming operations, thus raising crop yields and incomes. The transfer of nutrients from grazing lands to croplands through manure contributes considerably to the maintenance of soil fertility and the sustainability of the farming systems.

Crop–animal interactions

1. **Animal traction**:

Draught animal power has a very long history of use in smallholder farming systems in India. Large ruminants provide power for land preparation, soil conservation practices and haulage. Draught animal power is especially important in farming systems that are isolated from infrastructure and have a high land to population ratio. In India, very little research on draught power has been conducted in South Asia. The use of mechanical power is increasing but, given the multi-purpose role played by ruminants in traditional agriculture in the region, increased resources to improve the contribution of large ruminants to draught power are still required.

Draught animals can assist farmers to improve soil tillage and introduce soil conservation practices such as terracing, ridging and the broad-bed/furrow system; operations that are unlikely to be undertaken with hand-cultivation. Improved tillage requires extra power, for which resources of hand-labour are presently inadequate. Animals can provide this power. The lower compaction resulting from land preparation using animal traction, compared with tractor ploughing, also reduces the erosion hazard. In Asia, hillsides have been levelled into terraces for rice fields initially, and then re-levelled using draught animal power annually, to ensure even spread of water and its redistribution to lower paddies. Without such a system, erosion of rice fields would make farming unsustainable within a few years. Heavy textured problem soils, such as vertisols, have a high water-storage capacity and become waterlogged during much of the growing season. To tap the inherent fertility of these soils, draught animal power can be harnessed to shape broad-beds and improve surface drainage. In India, (Kampen et al.,1981) found that water run-off from a broad-bed/furrow system was 44% lower than that from fallowed land during 3 months of the cropping season.

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2. **Animal feeds from crops**

Crops provides a different range of residues and agro-industrial by-products (AIBP) that can be utilized effectively by ruminants and non-ruminants. These include cereal straws (e.g. rice and maize), sugarcane tops, grain legume haulms (e.g. groundnut and cowpea), root crop tops and vines (e.g. cassava and sweet potato), oilseed cakes and meals (e.g. oil palm kernel cake, cottonseed cake and copra cake), rice bran and bagasse. In Asia, rice straw is the principal fibrous residue fed to over 90% of the ruminants. Devendra (1997) has calculated that 30.4% of rice straw is used for feed in Southeast Asia. Wanapat (1995), for example, has calculated that 75% of rice straw from rain-fed upland farms and 82% from lowland farms are collected for use as feed.

Non-conventional feed resources (NCFR) are identified separately and those include the products that have not been used traditionally in animal feeding. It has been estimated that the total availability of feed (other than grasses) from traditional sources and NCFR in the region is 199 million tonnes, with NCFR forming about 47% of this value (Devendra, 1992). Approximately 80% of the total feed available is potentially best suited for feeding to ruminants.

3. **Introduction of improved forages**

The introduction of improved forage species especially for ruminants can promote the sustainability of cropping systems. In addition to their feeding value, which is well documented, improved forages (particularly legumes) can make an important contribution to erosion control by providing cover, and increased soil fertility by enhancing nutrient and organic matter levels.

4. **Manure**

Both ruminants and non-ruminants provide manure for the maintenance and improvement of soil fertility. Manure is used widely throughout India everywhere. Soil fertility depletion is a major constraint to agriculture, particularly in the humid and sub-humid climates. Even when inorganic fertilizers are applied, crop yields may not be maintained under continuous cultivation on nutrient-poor sandy soils with a low buffering capacity. Manure and manure-based composts are also used widely throughout the India. Even under arid conditions the application of manure play an important role in increasing crop yields, improving the utilization of inorganic fertilizer and enhancing soil fertility (Agarwal and Kumar, 1996). It is relevant to mention here the role of organic manure crops naturally (green manure) in maintaining soil productivity. Now, there is renewed interest in green manures because of increasing fertilizer costs and a deterioration in soil physical properties (Devendra et al., 2000).

Although AIBP and NCFR contribute <10% to ruminant feed, a considerable amount of research has been undertaken with these feeds (Punj, 1988), and their use for the supplementation of low quality roughages (Girdhar et al., 1991; Rai et al.,1995). Clearly, there is much potential in India for a greater and more efficient use of AIBP and NCFR for livestock.

Livestock provides a least cost, labor-efficient route to intensification through their role in nutrient cycling. Keeping animals on the farm provides a use for other resources such as crop residues, which might be wasted in the absence of animals. A systems approach requires attention to detail and adopting innovative practices to move farm businesses towards delivering better on sustainability goals.

Conventional agriculture is known to cause soil and pasture degradation because it involves intensive tillage, in particular if practiced in areas of marginal productivity. An integrated crop-livestock farming system represents a key solution for enhancing livestock production and safeguarding the environment through prudent and efficient resource use.

The increasing pressure on land and the growing demand for livestock products makes it more and more important to ensure the effective use of feed resources, including crop residues. An integrated farming system consists of a range of resource-saving practices that aim to achieve acceptable profits and high and sustained production levels, while minimizing the negative effects of intensive farming and preserving the environment.

Based on the principle of enhancing natural biological processes, the integrated system is the combination that

(a) Reduces erosion;

(b) Increases crop yields, soil biological activity and nutrient recycling;

(c) Intensifies land use, improving profits; and

(d) Can therefore help reduce poverty and malnutrition and strengthen environmental sustainability.

The input of one component serves as a resource for the other. For example, manure is used to enhance crop production; crop residues and by-products feed the animals, supplementing often inadequate feed supplies, thus contributing to improved animal nutrition and productivity. Integrating crops and livestock serves primarily to minimize risk and not to recycle resources. In an integrated system, crops and livestock interact to create a synergy, with recycling allowing the maximum use of available resources. Crop residues can be used for animal feed, while livestock and livestock by-product production and processing can enhance agricultural productivity by intensifying nutrients that improve soil fertility, reducing the use of chemical fertilizers.

A high integration of crops and livestock is often considered as a step forward, but small farmers need to have sufficient access to knowledge, assets and inputs to manage this system in a way that is economically and environmentally sustainable over the long term.

It has been accepted by everyone across the globe that sustainable development is the only way to promote rational utilization of resources and environmental protection without hampering economic growth. Developing countries around the world are promoting sustainable development through sustainable agricultural practices which will help them in addressing socioeconomic as well as environmental issues simultaneously. Moreover, the system help poor small farmers, who have very small land holding for crop production and a few heads of livestock to diversify farm production, increase cash income, improve quality and quantity of food produced and exploitation of unutilized resources.

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Major success to these farming systems is effective crop–livestock integration involving the recycling of nutrients within the system. A particular challenge facing farmers is to minimize nutrient losses through good management, improved feed production, quality, availability, and more efficient feeding systems; new ways to capture and conserve nutrients excreted by livestock; improved manure spreading techniques; and cropping systems that reduce nutrient losses and can improve livestock impacts on the soil environment.

Key principles

Cyclic: The farming system is essentially cyclic (organic resources – livestock – land – crops). Therefore, management decisions related to one component may affect the others.

Rational: Using crop residues more rationally is an important route out of poverty. For resource-poor farmers, the correct management of crop residues, together with an optimal allocation of scarce resources, leads to sustainable production.

Ecologically sustainable: Combining ecological sustainability and economic viability, the integrated livestock-farming system maintains and improves agricultural productivity while also reducing negative environmental impacts.

The maintenance of an integrated crop livestock system is dependent on the availability of adequate nutrients to sustain animals and plants and to maintain soil fertility. Animal manure alone cannot meet crop requirements, even if it does contain the kind of nutrients needed. This is because of its relatively low nutrient density and the limited quantity available to small-scale farmers. Alternative sources for the nutrients need to be found.

Growing fodder legumes and using them as a supplement to crop residue is the most practical and cost-effective method for improving the nutritional value of crop residues. This combination is also effective in reducing weight loss in animals, particularly during dry periods;

Challenges

• Develop strategies and promote crop livestock synergies and interactions that aim to

(a) Integrate crops and livestock effectively with careful land use

(b) Raise the productivity of specific mixed crop livestock systems

(c) Facilitate expansion of food production and

(d) Simultaneously safeguard the environment with prudent and efficient use of natural resources.

• Devise measures (for instance, facilitating largescale dissemination of bio-digesters) to implement a more efficient use of biomass, reducing pressures on natural resources; and develop a sustainable livestock manure management system to control environmental losses and contaminant spreading.

The challenge for development practitioners is to ensure that poor small farmers can increase the productivity of traditional farming systems, adopting an effective integrated system that produces usable biomass while conserving natural resources, and can therefore be sustainable in the long term.

Opportunities

- Intensification of agriculture which is currently occurring in most farming systems favours crop–livestock integration.
- Poor soil fertility, unavailability or increases in prices of fertilizers, and labour shortages, have forced farmers to rely on alternatives such as manure and traction.
- Farmers can grow crop in the wet season and engage in livestock enterprises in the dry season.
- Livestock enterprises are more profitable than crop farming so it is advantageous to integrate livestock into farm activities.
- Many indigenous, emerging, and developed technologies are available to support sustainable crop–livestock integration. These include improved cereal and grain legume varieties, cropping systems, weed and nutrient management strategies, the eradication of most livestock diseases, and the development of modeling and all-year-round feed packages for animals.

Establishing effective input (e.g., fertilizer) and support services (e.g., veterinary delivery systems) and establishing infrastructure (e.g., roads, processing, and marketing facilities); are important. An appropriate strategy would be to select technologies with the highest potential impact from the above areas, in order to form a holistic package for testing and dissemination with a view to maximizing total productivity at the farm level. This holistic approach should be supported by socioeconomic information such as determinants of farmers decision making for certain technologies as well as the development of tools to assess whole farm impacts of new interventions.

Conclusion

The increase in demand for livestock products presents opportunities for small farmers who can increase livestock production and benefit from related income. Sustainable development is the only way to promote rational utilization of resources and environmental protection without hampering economic growth and integrated Farming Systems hold special position in this system because nothing is wasted, the by-product of one system becomes the input for other. India has a considerable livestock, poultry population and crop wastes. The highly improved integrated crop-livestock system can guarantee more sustainable production and therefore constitutes a valid new approach.

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