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INTEGRATED FARMING SYSTEM: A ROADMAP FOR INDIA

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Profitability and sustainability of agricultural sector in India is encountering numerous and complex hindrances such as maintenance of sustainability of our natural resources, adverse impact of climate change, declining factor productivity, nutrient mining and multiple nutrient deficiencies, overexploitation of groundwater resources, soil degradation due to intensive tillage practices, and decreased soil organic carbon (SOC) as well as diminishing trend in size of landholding which are expected to become drastic with the passage of time and these are some of the common concerns over wide range in most parts of the country resulting in stagnation in productivity of the system. Agriculture in our country is at crossroads in terms of obtaining sustainability primarily on three grounds; (a) the region is finding it troublesome to originate sufficient income and employment for its vast farming population, (b) failing to achieve environmental and energy security at the farm level, and (c) failing to confront or cope up with the climate change (Behera and France, 2016). Such types of concerns and problems posed by modern-day agriculture have given birth to new concepts *viz.* organic farming, natural farming, bio-dynamic agriculture, do-nothing agriculture, eco-farming, integrated farming system *etc*. The essence of such farming practices simply implies, back to nature to maintain the long-run productivity of the soil-plant-animal continuum. Faced with this circumstances, such agricultural strategies need to be explored that can increase productivity and generate adequate income and employment for the smallholder farmers, as well as produce renewable energy on the farm, and stop the erosion of biodiversity and offset carbon emissions (Behera *et al*., 2015). In order to keep pace with the burgeoning food requirements of such a large population pressure, there is an immediate requirement to accelerate all aspects of agricultural food production with due consideration to restoration and conservation of natural resources, which can only be accomplished through sustainable resource management and adoption of farmer participatory holistic strategies. In view of the decline in per capita land

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availability, it is obligatory to develop approaches and improved agricultural technologies that enable enough employment opportunities and income generation, especially for the smallholders having < 2.0 ha land who constitute the gigantic majority of the farming community in the developing world. No single farm enterprise, such as a typical monocropping system, is likely to be able to sustain the smallholder farmers. Integrated farming systems (IFS) are less hazardous if controlled effectively, as they get advantages from synergisms among several enterprises, diversification in produce, and environmental soundness. On this basis, IFS has been recommended for the development of small and marginal farms, and researchers have developed various strategies which have benefitted smallholder farmers by contributing supplementary income and employment as well as curtailing risk.

Integrated Farming System

The integrated farming system approach is recognized as a resource management strategy to obtain economic and sustained productivity that encounters the diversified requirements of the farm household whilst conserving the resource base and maintaining a high level of environmental quality (Lal and Miller, 1990). IFS is an entire complex of development, management and allocation of resources as well as decisions and activities, within an operational farm unit, or combinations of units, that results in agricultural production, processing and marketing of the products. It is a whole farm administration strategy that incorporates the ecological attention of a diverse and healthy environment with the economic demands of agriculture to ensure a continuing supply of wholesome and affordable food. The integrated farming system, on the other hand, is a dynamic concept which must have the flexibility to be relevant on any farm, in any country, and it must always be receptive to change and technological advances. Above all, IFS is a practical way forward for agriculture that will benefit society, not just those who practice it. IFS can be defined as a positive interaction of two or more components of different nature like field and horticultural crops, livestock, aquaculture or fishery, poultry, duckery, apiculture, sericulture, mushroom cultivation, biogas production, silviculture *etc*. within the biophysical and socio-economic environment of the farmers to enhance productivity and profitability in a sustainable and environmentally friendly way (Behera *et al*., 2004, Rautaray *et al*., 2005). A judicious mixture of two or more of these farm enterprises with advanced agronomic management tools may complement the farm income together with the help in recycling the farm residues. The

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selection of enterprises must be based on the cardinal principles of minimizing the competition and maximizing the complementarity between the enterprises.

Advantages of IFS

The benefits of IFS, a strategy to ensure sustainable use of the natural resources for the benefit of present and future generations, include pooling and sharing of resources/inputs, efficient use of family labour, conservation, preservation and utilization of farm biomass including non-conventional feed and fodder resources, effective use of manure/animal waste, regulation of soil fertility and health, improved space utilization, diversified products, income and employment generation for many people and increase economic resources.

The important advantages of implementing IFS are listed below.

(a) Productivity, increased food supply and nutritional security: The significance of IFS approach lies in its ability to provide an opportunity to enhance the system's productivity or economic yield per unit area per unit time by virtue of intensification of crop and allied enterprises to meet the demand for food, feed and fuel for ever-increasing human and animal population. Horticultural and vegetable crops can provide 2-3 times more calories than cereal crops from the same piece of land. Inclusion of beekeeping, fisheries, sericulture, mushroom cultivation under two or three-tier system of integrated farming gives substantial additional high energy food without affecting the production of food grains.

(b) Profitability: IFS improves land productivity and profitability by reducing production costs through recycling wastes and by-products of one enterprise as inputs to other enterprises.

(c) Sustainability: IFS gives emphasis on optimal and effective utilization of wastes and by-products of linked components and achieving agro-ecological equilibrium through the reduced build-up of pests and diseases.

(d) Balanced food: Different components are interlinked with each other to produce several types of products, which serve to provide a balanced diet for the farm family.

(e) Environmental safety: In IFS approach waste materials as well as nutrients are effectively recycled, resources are utilized efficiently by linking appropriate enterprises and components, and makes farming less dependent on external inputs, thereby minimizing environmental pollution occurring due to heavy use of external inputs.

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(f) Resource recycling: Effective recycling of waste materials and by-products like crop residues and livestock wastes is performed in IFS. Therefore, there is less reliance on outside inputs (*e.g.* fertilizers, agrochemicals, feeds, energy) which leads to a more stable production system. Restoration of soil fertility is possible through organic manuring, biomass recycling, use of legumes in cropping system *etc*. Use of crop residue and plant biomass as input is observed for other enterprises, *e.g.* its use in mushroom cultivation, as mulch, a substrate in vermicomposting, feed block *etc*.

(g) Year-round income: Integrated farming system provides a flow of money to the farmers throughout the year by means of the sale of diversified farm produce *viz.* milk, egg, mushroom, vegetables, fruits, food grains *etc*.

(h) Risk minimization: IFS provides a stable and sustainable production system through diversified crops and enterprises, which helps in risk minimization and resilience to climate change.

(i) Use of marginal and wastelands: Combination of forestry, fishery, poultry, dairying, mushroom and beekeeping can be combined with crop production, and all of these activities can be undertaken on marginal & wastelands too.

(j) Increased employment: There is a 200 to 400 per cent increase in gainful employment and additional income to farm families, increasing their standard of living.

The integration of farm enterprises depends upon many factors such as availability of resources; soil and climatic features of the selected area; the present level of utilization of resources; land, labour, capital and skills; economics of the proposed integrated farming system, returns from the existing farming system and managerial skill of the farmer.

Sustainability of IFS Models:

The following features should be integral to the farming systems to become sustainable.

a) The model should be self input generating, seeking minimum requirement of external resources from the market.

b) The model should be able to generate year-round employment and perennial income in contrast to the seasonal nature of income.

c) Waste of one component should be wealth for another component, implying that complementarity should exist between/among the various components.

d) The model should be energy efficient, economically viable and socially acceptable.

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e) Rationality should be maintained among economic, ecological and social dimensions of IFS models.

f) The model should be capable of sustaining the farm family's nutritional needs as recommended by the Indian Council of Medical Research (ICMR).

g) While designing the IFS Models, ecosystem services should be taking into consideration.

h) The model should effectively reduce greenhouse gas emission and check soil and nutrient erosions.

i) IFS model is more likely to sustain when it is built over traditional systems, where due importance is given to indigenous crops and bio-diversity.

Conclusion

Adoption of an individual farm enterprise in isolation cannot sustain the farm family, but the IFS approach holds the promise of addressing the issues of sustainable economic growth of Indian farming communities. The integrated farming system is considered as a powerful tool for natural and human resource management as well as very effective in solving the problems of small and marginal farmers in developing countries including India. This multidisciplinary whole-farm approach aims at increasing income and employment from smallholdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself. The traditional monoculture and disciplinary approach are unable to meet the growing and changing food demand and improve the livelihood of these smallholders on a sustainable basis. Therefore, an integrated farming approach to research/extension and development is recognized as a critical implement for management of the vast natural resources, and to sustain agricultural production, maintain farm incomes, safeguard the environment and respond to consumer concern about food quality issues, to meet multiple demands, *e.g*. supporting livelihood, conserving biodiversity, off-setting emissions, adapting to climate change *etc*. It provides scope for exploring synergistic interactions of the components of farming systems and to enhance resource use efficiency. For this reason, various IFS models have been suggested by several workers for developing small and marginal farms across the country.

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