

Livestock based

Integrated Farming System

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The Indian economy is predominantly agriculture oriented and livestock rearing forms an integral part of rural living. Livestock is important part of agriculture diversification and income enhancement, and crucial for nutrition enhancement. The modern and high input agriculture, along with providing many advantages, also created some problems such as, replacement of system approach with component approach which dismantled the balance between agriculture and livestock and created a big gap between animal feed requirement and availability. Despite the enormous contribution to the national economy and remarkable growth in milk production in last few decades, the productivity of our animals is low due to improper nutrition, health care and management. The availability of quality feed and fodder is one of the main reasons for poor performance of livestock. The present availability of feeds in the country is estimated to be only 40% of the total requirement of these animals. National commission of agriculture came up with a recommendation that a minimum 10% of the net arable area in the country should be under improved forage crops to meet the forage needs of the livestock population. However, it is estimated that the area under forage crops is about 5.23% only, leaving a wide gap between supply and demand. One of the major constraints for less availability of fodder is 'component approach' of modern agriculture where commercial and monoculture farming practices are replacing traditional fodder production areas gradually. Hence, it is the need of hour to adopt such farming practices which are based on system approach. Integrated farming system (IFS) is one of the system based approach which enables the farmers to devote some part of land for fodder crops along with the food and horticultural crops.

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Integrated farming system (IFS)

IFS represent multiple crops (*eg.* cereals, legumes, fodder crops, tree crops and vegetables) and multiple enterprises (*eg.* livestock, apiary, mushroom and biogas) on a single farm in an integrated manner. The IFS approach is holistic, multidisciplinary, problem solving, location specific, and farmer oriented. IFS can play a vital role in enhancing economic situation and livelihood. An IFS involves the utilization of primary and secondary produce of one system as basic inputs to the other systems, thus making them mutually integrated as one whole unit.

Components of integrated farming system

Integrated farming system is an approach which imitates nature's principle, where not only crops but, varied types of plants, animals, birds, fish and other aquatic flora and fauna are utilized for production. These are combined in such a way and proportion that each element helps the other and the waste of one is recycled as resource for the other through integration. Component structure for livestock based IFS under different situations can be as following:

- Food crops
- Livestock

- Fodder crops
Annual- Jowar, Bajra, Maize, Oat, Barley, Berseem, Cowpea *etc.*
Perennial- BN Hybrid, Guinea grass, TSH grass, Dinanath grass, stylo grass *etc.*
- Tree fodders- Subabul, *Moringa*, *Sesbania*, Deshi babool, *Hardwickia binate*, *Prosopis juliflora*, *Albizia lebbeck*
- Vegetables- Potato, Cabbage, Cauliflower, Tomato, Brinjal, Chilli, Bhindi, Garden peas, Cucurbits, Raddish, Carrot, Leafy vegetables.
- Fruit crops- Guava, Papaya, Kinnow, Lemon, Ber, Aonla, Mango, Jamun, Mulberry, Jamun, Khirni.



Components of Integrated Farming System

- **Flower crops-** Rose, Marigold, *Chrysanthemum*, Xenia, Sunflower, Portulaca and Kochia.
- **Commercial crops-** Mentha, Safed Musli, Ginger, Turmeric.
- **Boundary/bund plantation:** Subabul, Bamboo, Moringa, Neem, Ber, Karonda, Lemon, Cactus, BN Hybrid, Babool.
- **Complementary enterprises:** Poultry, Duckery, Piggery, Vermicomposting, Mushroom, Apiculture, Bio-gas, Green house, Hydroponics, Nursery.
- **Agro-processing activities:** Hay, Silage, Leaf meal, Feed block, Feed pellets, Jam, Jelly, Pickle, Murabba, Squash, Milk products, Fruits and Vegetables canning.

Models of Integrated farming system

Concept of designing IFS models is situation and location specific which is based on certain factors *viz.* size of farm holding, natural resource base, farm mechanisation, market availability and socio-economic status

of farmer. Different types of IFS models are as follows:

1. Crop-livestock farming system
2. Crop-livestock-poultry farming system
3. Crop-livestock-poultry-fishery farming system
4. Crop-livestock-poultry-fishery-duckery farming system
5. Agri-pasture-mushroom-vermicomposting
6. Agri-silvi-horti-pasture

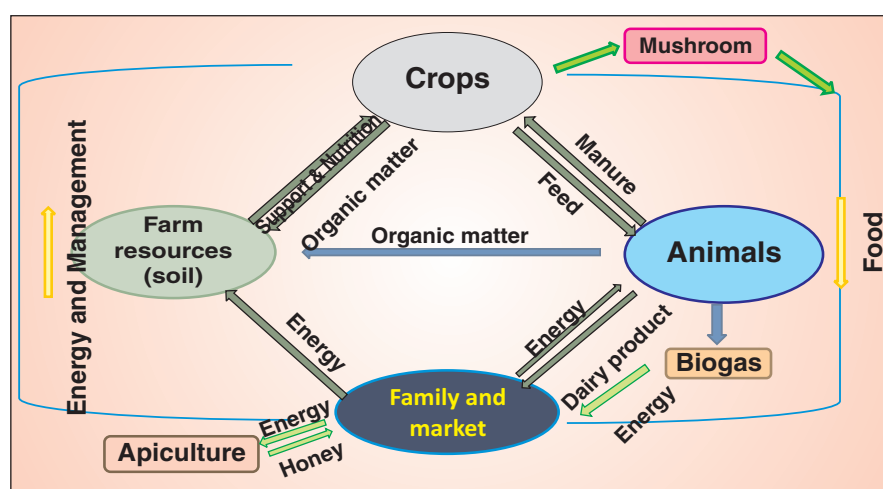
Principle of enterprise integration and resource flow of IFS

IFS models are designed in such a way that it matches with the resource base of farm and there should be appropriate integration and recycling. In agriculture, crop husbandry is the main activity. The income obtained from the cropping is hardly sufficient to sustain the farm family throughout the year. Therefore, judicious integration of different enterprises is necessary in order to optimize resource utilization and income

generation throughout the year. Livestock is the best complementary enterprise with cropping. The main product of animals such as milk, meat, wool can be encashed and bi-products *viz.* dung, urine can be recycled through biogas plant and vermicomposting unit. Prepared compost can be utilized as manure for the soil fertility and health management. Crop component provides food for the farmer family and fodder for animals.

Management of integrated farming system

A system implies the set of components that interact among themselves and have some inter-relationship. Management of the IFS system is as much as important as the designing. Management involves the proper resource allocation to the component enterprises and timely care of the resource flow to ensure optimum integration. Selection of appropriate enterprises, animal



Enterprise integration and resource flow of IFS

breeds, crop varieties, natural resource management and marketing are some of the important factors of a good management plan.

Natural resource management

Soil, water and plant nutrients are major natural resources concerned with crop and animal production. Optimum utilization of these resources through rational approach is necessary to make the natural resources sustainable. A good soil management program includes proper care of top fertile layer of soil through different agronomic and mechanical soil conservation measures, conservation tillage, addition of soil organic matter, balanced nutrient mining *etc.* A proper soil testing is required to access and amend soil health. Water is another important natural resource which is indispensable and precious. Water harvesting, conservation and efficient utilization are three main aspects of successful water management. Other than soil and water, plant nutrients are one of the important factors of production. A successful nutrient management program includes the aspects like soil testing, site specific nutrient management, use of green and organic manures, crop rotation, residue recycling, balance fertilizers, soil amendments *etc.*

Crop production and management

The selection of enterprises and their level of extent are important for successful IFS. Selection of crops under IFS must be made by taking

into consideration the local agro climatic conditions, soil factors, resources available, socio-economic situations, market facility, demand of produce and raw material availability *etc.* Under the water stress condition, stress hardy and semi-arid crops such as barley, chickpea, sesame, cowpea, mung, urd, arhar, wheat should be selected. Selection of crops which requires more water like rice should be done by taking care of ground water table of region. Package and practices of the crops such as seed treatment, proper and timely sowing, irrigation scheduling, integrated weed, nutrient, pest and diseases management should be scientific and improved.

Livestock production and management

Adoption of livestock as IFS component is significant for providing round the year income and employment. Selection of improved breeds of animals, hygienic animal yard, quality feed and fodder, mineral mixtures, feed concentrates, feed pellets, deworming, vaccination, artificial insemination (AI), animal insurance are some of the important aspects of ideal animal husbandry. Processing and storage facilities for milk can help in getting extra and secured income. Recycling of bi-products viz. dung, litter, urine can be done as FYM, compost, biogas, fuel *etc.*

Fodder production and management

Fodder production strategies under integrated farming system plays vital role for providing qualitative and sufficient feed and

fodder to animals. Strategies may vary for different agro climatic situations of irrigated and rainfed regions. Under irrigated situations, major crops during *kharif* season are guinea grass, setaria, bajra-napier hybrid, deenanath grass, fodder maize, sorghum, pearl millet, teosinte, cowpea, rice bean, guar; and during *rabi* season crops like oat, berseem, Lucerne are grown under cultivated condition. Adoption of multiple cropping systems consisting of intercropping, mixed cropping and sequential cropping systems can provide succulent green fodder for round the year. Multiple crop sequences like sorghum + cowpea-berseem + mustard, NB Hybrid+ (cowpea-berseem-mustard), NB Hybrid + (cowpea-berseem) are promising round the year fodder production systems under irrigated conditions. Fodder production can be done under agri-pasture, agri-horti-pasture and agri-silvi-pasture system. Under rainfed conditions, perennial fodder production systems are more suitable over the seasonal fodder crops. Suitable fodder crop species for silvi-pasture system are cenchrus grass, marvel grass, Rat-tail grass, Dhau grass, blue panic grass, speargrass, *Desmodium*, purple bush-bean, *Stylosanthes*, *Lablab bean*.

Fruits and vegetables production management

Inclusion of fruits and vegetable crops under IFS becomes important since fruits and vegetables provide nutritional security, high yield, higher and regular income and employment. Fruits and vegetables can be grown under horti-pasture, agri-horti-pasture and silvi-horti-pasture system. Improved package and practices should be adopted which includes healthy nursery raising, improved varieties/hybrids resistant to pest and diseases, integrated weed, nutrient, pest and diseases management, pre and post harvesting management *etc.*

Poultry management

Poultry birds can be reared under extensive and intensive management systems. In extensive system, birds are allowed to be exposed to open field for feeding and shelter area for

sleeping. However, intensive system of poultry management's characterised by rearing of poultry under well-equipped confinement with high quality balanced ration. Backyard poultry is another system that can be adopted as component under IFS system for small scale production of meat and eggs. Poultry-cum-fish farming is the system of integration where overhead poultry shelter house is erected on the fishing pond. This overhead poultry house generated excreta in the pond that can be used by fish as feed. Poultry manure is a nutritious feed for fish as it contains around 26% crude protein, 1.7% crude fat, 13% crude cellulose and 16% minerals. These poultry droppings can also be collected and applied to the pond @ 50 kg/ha/day during morning time.

Bee-keeping management

Bee-keeping is a vital component under IFS system that can make agriculture sustainable, enrich natural biodiversity, enhance crop productivity and supplement additional income with minimum expenditure. Honeybees are natural gifts which not only pollinate the crops but also provide honey, wax etc. In India, four main species of honeybees are *Apis indica*, *Apis mellifera*, *Apis dorsata* and *Apis florae*.

Bee-keeping management practices

- To establish bee colonies, bees can be obtained by transferring a wild nesting colony to a hive or attract a passing swarm of bees to occupy it.
- Feed the hived swarm for a few weeks by diluting a half cup of white sugar in half a cup of hot water as this will also help in building the comb along with the bars rapidly.
- Observe the colonies regularly for the presence of healthy queen, brood development, storage of honey and pollen, presence of queen cells, bee strength and growth of drones.
- Provide sugar syrup (1:1) @ 200 g sugar per colony per week for Indian bees.
- Harvest the honey by smoking the bees off the parts which needs to be harvested and cut the combs carefully. Harvests are normally

possible during and shortly after the two main flowering seasons, namely October/November and February-June.

Composting management

Integrated farming system involving food, fodder and horticultural crops generates huge amount of agricultural wastes such as crop residues, tree leaves etc. Farmers generally burn this precious resource which causes air and soil pollution. Therefore, crop residue recycling and management is necessary component of an IFS system which ensures nutrient recycling and maintenance of soil health. In order to manage and recycle crop residues and animal wastes, composting is proving as innovative and successful technology.

Vermicomposting

Vermicomposting can be done by two methods i.e. bed method and pit method. Bed composting is done of cemented or kachcha floor by making bed of (6×2×2 feet) of organic mixture. Under pit method, pits of 2×1×0.75 meter size can be made as per convenience. Interconnected series of pits can also be made to facilitate easy harvest of compost by allowing the earthworms to move from the matured pit to fresh pit where all the ambient conditions of worms are available to survive.

Preparation of vermicompost

- Vermibed (earthworm bedding) is the layer of 15-20 cm thickness made up of moist soil mixed with sands.
- Earthworms are introduced in this vermicomposting @150 number/pit.
- Now fresh cattle dung is placed over the earthworm mixed vermicomposting layer up to the top of pit.
- The pit covered by making 5 cm layer of dry leaves or straw. Avoid covering by plastic sheets as it will trap heat.
- For the next 30 days pit is kept moist by watering whenever necessary. Moisture level in the pit should not exceed 40-50%.
- The compost is ready to harvest when it becomes loose, granular, light weight and dark brown in colour. It generally takes 75-90 days

to become compost ready to harvest. Stop watering the pit 2-3 days before the harvest of compost to allow the earthworms to go down in the bottom of the pit.

Post-harvest management and value addition

A country-wide study measuring crop losses revealed that 3.9%-6% cereals, 4.3%-6.1% pulses, 2.8%-10.1% oilseeds, 5.8%-18.1% fruits, and 6.9%-13% vegetables are lost during post-harvest activities, handling and storage. At the All-India level, the proportions of the produce that farmers are unable to sell in the market are 34%, 44.6% for fruits and vegetables respectively, finds the committee on Doubling of Farmers' Income. Indian farmers are afraid of growing high value and cash crops due the less access to organized markets and improper transportation and storage facilities of agro-produce. Hence, aim of doubling farmer's income by 2022 can only be realised if proper post-harvest management facilities are provided to farmers.

Critical steps to reduce post-harvest losses

- Pre-harvest sprays of growth hormones to reduce post-harvest losses in different fruits and vegetables.
- Maturity standards should be followed for harvesting of different crops. Fruits harvested before optimum maturity may not ripen adequately and may not develop adequate flavour, while crops harvested late (over mature) will have a shorter postharvest life and will deteriorate easily.
- Pre-cooling, systematic grading, appropriate packaging and storage of harvested horticultural produce can be done for enhancing their shelf life and value.
- Post-harvest management options for fodder crops includes preparation of feed block, pelleting, leaf meal, addition of molasses in wheat straw, hay, silage, haylage etc.

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