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RESEARCH ARTICLE

FARMING SYSTEM MODULESA BETTER WAY FOR LIVELIHOOD SECURITY

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ABSTRACT

In the present scenario, the farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers. In this contest, it is imperative to evolve suitable strategy for augmenting the income of a farm. Integration of various agricultural enterprises *viz*., cropping, animal husbandry, fishery, forestry etc. have great potentialities in the agricultural economy. These enterprises not only supplement the income of the farmers but also help in increasing the family labour employment. The integrated farming system approach introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. The farm wastes are better recycled for productive purposes in the integrated system. A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers would bring prosperity in the farming.

INTRODUCTION

Indian agriculture has challenge of providing national as well as house hold food and nutritional security to its teeming millions in a scenario of plateauing genetic potential in all major crops. Declining productivity in vast tracts ofrainfed/ dry land areas constituting approximately 44.2% of net cultivated area. Wide-spread occurrence of ill-effects of green revolution technologies in all intensively cultivated areas is threatening the sustainability of the important agricultural production systems and national food security. The human population of India has increased to 1210.2 million at a growth rate of 1.76 per cent in 2011 and is estimated to increase further to 1530 million by 2030.On the other hand our national food grain production for past 3-4 years is hovering around 234 million tonnes. There are projections that demand for food grains would increase from 234 million tonnes to 345 million tonnes in 2030.The average size of the landholding has declined to 1.21 ha during 2009-10 from 2.30 ha in 1970-71

In the present scenario, it is hardly difficult to meet out the ever increasing requirement for the ever rising population in India. Unfortunately, In India the food producing enterprises like agriculture and its allied activities namely livestock farming, horticulture, floriculture, aquaculture *etc*. have been dominated by the small and marginal farmers. Hence, they are unable to invest more capital for doing intensive farming activities to produce more and meet the requirement. In this situation, Integrated Farming System (IFS) plays an imperial role for maximizing their profit and production to meet the nutritional requirement with food security with less investment. Further in IFS it is more advantageous that the farmers can able to produce more by using optimal resource utilization and recycling of waste materials and family labour employment.

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Concept of Integrated Farming System (IFS)

Integrated farming system is one where more than one agricultural activity is practiced in the same farm unit; the activities are being interrelated and competes for the same set of available resources in the farm. Integrated farming integration various agricultural enterprises *viz*., cropping, animal husbandry, fishery, forestry *etc*. have great potentialities in the agricultural economy. These enterprises not only supplement the income of the farmers but also help in increasing the family labour employment. Okigbo (1995) defines IFS as a mixed farming system that consists of at least two separate but logically interdependent parts of a crop and livestock enterprises. Edwards (1997) and Jitsanguan (2001) defined the IFS as an aquaculture system that is integrated

with livestock and in which fresh animal waste is used to feed fish and also reported that there are synergies and complementarity between enterprises that comprise a crop and animal component that form the basis of the concept of IFS. According to this concept, integration usually occurs when outputs (usually by-products) of one enterprise are used as inputs by another within the context of the farming system. Jayanthi *et al.* (2000) describes the IFS as a mixed animal crop system where the animal component is often raised on agricultural waste products while the animal is used to cultivate the soil and provide manure to be used as fertilizer and fuel. Radhamani *et al.* (2003) described IFS as a component of farming systems which takes into account the concepts of minimizing risk, increasing production and profits whilst improving the utilization of organic wastes and crop residues. Agbonlabor *et al.* (2003) defined the IFS as a type of mixed farming system that combines crop and livestock enterprises in a supplementary and / or complementary manner. Jayanthi (2006) stated that IFS is a component of Farming System Research (FSR), introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. Singh and Ratan (2009) defined the IFS is an integrated set of elements / components and activities that farmers perform in their farms under their resources and circumstances to maximize the productivity and net farm income on a sustainable basis. Panke *et al*. (2010) stated that the integration is made in such a way that the product *i.e.* output of one enterprise / component should be the input for the other enterprises with high degree of complementarity effects. Similarly the authors stated that the rationale of IFS is to minimize the wastes from the various sub systems on the farm and thus it improves employment opportunities, nutritional security and income of the rural people. Bahire *et al.* (2010) defined the IFS as an integrated mixed farming system is the practice of raising different yet dependent enterprises and when different enterprises are dependent they are primarily complementary and supplementary to each other.

Need for Integated Farming System

IFS is very much needed for progressive economic growth, employment opportunities, family nutritional requirements, optimal utilization of resources of the farming enterprises, overcome adverse effect of weather etc.

Major difference between the mixed and integrated farming

Integrated Farming Systems a component of farming system research introduces a change in farming techniques for maximum production in a cropping pattern and take care of optimal utilization of resources. It focused round a few selected, inter-dependent, inter-related and often inter-linking production systems based on few crops, animals and related subsidiary professions. The major difference between mixed farming and integrated faring is that enterprises are integrated farming system are mutually supportive and depend on each other. Mixed farming system consists of components such as crops and livestock that coexist independently from each other. In this farming integrating crops and livestock serves primarily to minimize the risk and not to recycle resources. Whereas in an IFS, crops and livestock interact to create a synergy, with recycling allowing the maximum use of available resources. Crop residues can also be used for animal feed, while livestock and livestock byproduct 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 (FAO, 2001). Tipraqsa (2006) concluded that the distinction between the integrated farming system and the commercial farming system is not absolute, but is rather a matter of degree of integration of resources in the farm system.

Integrated Farming System Components

Important components of integrated farming system includes field cropscrop production,vegetables fruit cultivation, poultry farming, livestock, integrationduckery, aquacultureagro forestry, bee- keeping, mushroom cultivation, composting, bio-gas plant etc. The marginal and small holdings invariably keep bovines, cattle and or buffalo (1-2) along with desi(local) fowls (10 -20) in the family backyard or ducks in areas which are coastal or have sufficient water bodies and also reported that sheep are the rare component in mixed farming systems (Chawla*et al*., 2004). Thamizoli *et al*. (2006) revealed the introduction of tree components with agriculture along with the farm based allied enterprises like dairy, goat rearing, apiculture *etc*. as a risk management strategy to cope up with disasters, helps to overcome the adverse weather conditions like long drought season and heavy flood. Mohanty *et al*. (2010) identified the IFS model consists of field crops (Rice, groundnut, maize, pigeon, pea and ragi), horticultural crops (Yam, banana, tapioca and vegetables), vermin-composting and poultry (Vanaraja breed) in Gajapati district of Orissa. Tripathi and Rathi (2011) stated that various prevailing farming system models in Uttarkhand namely., crop + dairy, crop + dairy + goats + horticulture, crop + horticulture +goats, crop +dairy + vegetables, horticulture + dairy + vegetables, vegetables + dairy and crop + dairy + companion animals are the major components in IFS. Manivannan *et al*. (2011) reported that the respondents from Erode district of Tamilnadu were having goat +crop, goat +dairy + crop, goat + dairy and goat +dairy +crop systems as the main components in IFS. Vision 2030 (2011d) suggested that the integration of mono - crop agriculture with agro forestry, pisciculture and animal husbandry as an important components for resource utilization, enhancing farm income and livelihood security of farmers. Vision 2020 (2011) suggested that the integrated fish farming is a diversified and coordinated system of producing fish and agricultural/livestock produce in fish farms with fish as the main component for maximal utilization of land/water through recycling of wastes and by - products, reduced application of fertilizers and feeds and maintenance of a balanced ecosystem.

Steps in preparation of ifs model for specific situation

- Assessment of available resources
- Identifying the existing cropping system
- Identifying components to be integrated
- Fixing the size of the individual components
- Working out the requirement of components
- Modifying the existing cropping system to suit the requirements of the components

- Working out the economics of individual components and for the system as whole
- Identifying constraints and remedy measures for technical feasibility, economic viability and practical utility.

Farming system models for different situations

Wetland: Rice + Fish + Azolla + Poultry/Duck + Mushroom+ Pigeon
Irrigated upland: Cropping + Dairy + Biogas +Mushroom + Fish
Dryland: Cropping + pigeon + goat + buffalo + agroforestry + farm pond

Major Impact of ifs on Socio - Economic Conditions of Farmers

IFS having a greater impact on socio-economic condition of farmers mainly by increasing the income level of farmers and source of money from various components. Nageswaran *et al*. (2009) reported that majority of the IFS following farmers (47.3 %) were marginal farmers (with land holdings below 2.5 acres) and 29.4 per cent of them were small farmers (with land holdings between 2.5 to 5.0 acres). Then remaining 27.8 per cent of the farmers were large (with more than 5.1 acres of land). Bhalerao *et al*. (2010) found that the livestock based farming system in Konkan has been taken up mainly by middle age farmers having high school education and medium size of family and also reported that they were possessing medium level of farming experience. Mahadik *et al*. (2010) observed that majority of the farmers (68 per cent) of rice and backyard poultry farming were middle aged, 36.8 per cent of them were educated up to secondary level, 60 per cent of them were having low annual income and also they were having good mass media exposure and extension agency contact.

Advantages of Ifs

Productivity: IFS provides an opportunity to increase economic yield per unit area per unit time by virtue of intensification of crop and allied enterprises.

Profitability: Use waste material of one component at the least cost. Thus reduction of cost of production and form the linkage of utilization of waste material, elimination of middleman interference in most input used. Working out net profit B/ C ratio is increased.

Potentiality or Sustainability: Organic supplementation through effective utilization of byproducts of linked component is done thus providing an opportunity to sustain the potentiality of production base for much longer periods.

Balanced Food: We link components of varied nature enabling to produce different sources of nutrition.

Environmental Safety: In IFFS waste materials are effectively recycled by linking appropriate components, thus minimize environment pollution.

Recycling: Effective recycling of waste material in IFFS.

Income Rounds the year: Due to interaction of enterprises with crops, eggs, milk, mushroom, honey, cocoons silkworm. Provides flow of money to the farmer round the year.

Adoption of New Technology: Resources farmer (big farmer) fully utilize technology. IFS farmers, linkage of dairy / mushroom / sericulture / vegetable. Money flow round the year gives an inducement to the small/ original farmers to go for the adoption technologies.

Saving Energy: To identify an alternative source to reduce our dependence on fossil energy source within short time. Effective recycling technique the organic wastes available in the system can be utilized to generate biogas. Energy crisis can be postponed to the later period.

Meeting Fodder crisis: Every piece of land area is effectively utilized. Plantation of perennial legume fodder trees on field borders and also fixing the atmospheric nitrogen. These practices will greatly relieve the problem of non – availability of quality fodder to the animal component linked.

Solving Fuel and Timber Crisis: Linking agro- forestry appropriately the production level of fuel and industrial wood can be enhanced without determining effect on crop. This will also greatly reduce deforestation, preserving our natural ecosystem.

Employment Generation: Combing crop with livestock enterprises would increase the labour requirement significantly and would help in reducing the problems of under employment to a great extent IFS provide enough scope to employ family labour round the year.

Agro – industries: When one of produce linked in IFS are increased to commercial level there is surplus value adoption leading to development of allied agro – industries.

Increasing Input Efficiency: IFS provide good scope to use inputs in different component greater efficiency and benefit cost ratio.

Rangasamy*et al*. (1996) concluded the integration of poultry, fish and mushroom with rice cultivation over a five-year period increases the net farm income and on-farm labour when compared with the conventional rice cropping system and also the comparative analysis suggested that diversification and integration of resource management can be productive, profitable and manageable, given access to labour and secure tenure. Itnal *et al*. (1999) stated that integration of two or more appropriate combination of enterprises like crop, dairy, piggery, fishery, poultry, bee keeping *etc*. for each farm according to the availability of resources helps to sustain and satisfy the necessities of the farmer. Ashby (2001) indicated that the reliance upon a few crops in combination with a high risk of crop failure due to a range of factors like disease, drought etc. exposes farmers to a high degree of variability with respect to yields and income and therefore risk. Thamrongwarangkul (2001) and van Brakel *et al*. (2003) reported that the diversification of farming activities should invariably improve the utilization of labour, reduce unemployment in areas where there is a surplus of underutilized labour and provide a source of living for those households that operate their farm as a full time occupation.

Radhamani *et al*. (2003) reviewed several studies on the financial viability of IFS and concluded that they positively influenced the economic viability of the IFS. Bosma *et al*. (2005) and Phong *et al*. (2008) identified that the farmers who have transformed their rice mono-culture to rice based farming systems including rice, upland crops, livestock and aquaculture on the same farm, allowing better use of farm resources, thereby improving farm income as well as safeguarding the environment. Tipraqsa*et al*. (2007) revealed the advantages of IFS like increased productivity, capital saving, family labour employment and income generation. Prein (2002) and Nhan*et al*. (2007) concluded that the integration of 2 bullocks + 1 cow + 1 buffalo and 10 goats along with other subsidiaries like poultry and duck is the most beneficial system which can supplement the income of tribal people to improve their socio-economic status. Nageswaran *et al.* (2009) reported the average annual net revenue per acre of IFS was more than 2.5 times than that of CFS in Cuddalore district of Tamilnadu. And also in the event of failure of any crop due to delay or heavy rainfall, other enterprises in IFS would tend to compensate and which is absent in conventional farming. Channabasavanna *et al*. (2009) found that the integration of crop with fish, poultry and goat resulted in higher productivity than conventional rice-rice alone and also 26.3 per cent higher productivity was reported in IFS while compared to conventional rice-rice system. Biswas (2010) reported that the farming system revolves around better utilization of time, money, resources and family labour and also the farm family gets scope for gainful employment round the year thereby ensuring good income and higher standard of living even from the small holdings.

Economic Importance of ifs

Integrating livestock into a crop based farming through increased financial benefits and a better use of intermediate farm resources such as manure, draft power, and crop residues (Ngambeki *et al*., 1992). Jayanthi *et al*. (2003) and Ravishankar *et al*. (2007) revealed the findings of net returns obtained from all the components was Rs. 22,887 with an increase of 32.3 per cent higher returns than conventional rice-rice system. Ramrao *et al*. (2005) developed a crop-livestock mixed farming model of 1.5 acre small scale holders with the employment generation of 571 man days, net income of Rs. 58,456 per year against crop farming alone with employment generation of 385 man days and net returns of Rs. 18,300 per year only. Ramrao *et al*. (2006) noticed that the mixed farming of 2 bullocks+ 1 cow+ 1buffalo + 10 goats+ 10 poultry and 10 ducks gave a net rreturn of Rs 33,076 compared to Rs 7843 from arable farming. Veerabhadraiah (2007) reported that the crop and animal integrated farmers were getting higher returns i.e. a farmer with 2.5 acres of irrigated land, HF and Buffaloes were earning Rs. 1, 04,321 and a farmer with 3.5 acres of irrigated land with 2 cows and 4 sheep earning 78,867 and a farmer with one acre of irrigated land with 4 HF cows were getting Rs. 1, 32,000. Ramasamy *et al*. (2008) reported that the income from integrated crop+ livestock + goat + poultry was Rs. 98,270 than Rs. 28,600 in traditional farming system. Similarly income of Rs. 99,209 in IFS with the crop +livestock +goat + poultry than conventional farming system. Nageswaran *et al*. (2009) found that the annual net revenue per acre is higher for IFS as compared to CFS: the average net annual revenues per acre of IFS and CFS are Rs. 11,662. 57 and Rs.4, 553.31 respectively. Annual employment per acre is turned out to be 185.78 person days in IFS and that of CFS 89.3 persons respectively. Ray (2009) reported that the IFS with cropping, fisheries, poultry, mushroom provided a net additional income of Rs. 12,500 /ha /year and created an additional employment of 550 man days / year as compared to conventional cropping system. Channabasavanna *et al*. (2009) found the benefit cost ratio of 1.97 in IFS than conventional system which is of 1.64. Among the various components of Palladam district of goat recorded the highest benefit cost ratio (2.75) followed by fish (2.23), vegetables (2.00) whereas poultry showed the lowest benefit cost ratio (1.13) as a result of high cost of maintenance. Tripathi*et al*. (2010) reported that the integration of 7 different enterprises namely, crop+ fish+ goat+ Vermicompost+ fruit production+ spice production+ agro forestry obtained the net return to the tune of Rs. 2,30,329 annually with the Benefit Cost Ratio (BCR) of 1.07:1 and also reported the maximum per cent contribution of the enterprise is the fish production (68.53 per cent) followed by vermicomposting (9.90 per cent), spices (8.46 per cent) and animal production (7.40 per cent). The BCR was found to be highest for the spice production (1.83:1) after fishery (2.25:1) followed by the vermicomposting (1.45:1).

Major Constraints in Integrated Farming System

Integration of components is very important in the farming system model major contains exist in terms of competition for resources and allotment capital for different components. Banerjee *et al*. (1990) revealed that the limited amount of capital is the main constraint in IFS. Ngambeki *et al*. (1992) reported that the lack of animal feed throughout the year and unavailability of labour in needy times are the major production constraints in IFS. Thamrongwarangkul (2001) reported that resource-poor farmers are not able to invest more capital as initial investment as a constraint since there is need of immediate economic returns to meet their food requirements, schools, medical treatments and loan-repayment. Tipraqsa *et al*. (2007) concluded that the high start-up costs may constrain farmers from switching to integrated farming and from exploiting the benefits of resource integration. Nageswaran *et al*. (2009) identified the constraints as of procuring the improved breeds of livestock, timely availability of fish seed and feed, low cost energy efficient pumping machine, information on government schemes and credit support from financial institutions.

Conclusion

It is being concluded that the by selecting the right and economically sound integrated farming system (IFS) modelhelps in increasing the economic level, employment opportunities, family nutritional requirements, optimal utilization of resources of the farming enterprises, better livelihood security etc. Future research should focus on developing the better farming system models under different agro-climatic condition and variable resources to help the farming community and thus farmers can overcome the adverse situations along with improving their living standers.

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