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Review Article

Integrated Farming System-Need of Today

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Abstract

IFS is a multidisciplinary whole farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holding by integrating various farm enterprises and recycling crop residues and by products within the farm itself. The farmers need to be assured of regular income for living at least above poverty line. The progress in production or steady growth in output is necessary to face the challenges posed by present economic, political and technological environment. In this context, farming system approach is one of the important solutions to face this peculiar situation as in this approach the different enterprises can be carefully undertaken and the location specific systems are developed based on available resources which will result into sustainable development.

Key words- Integrated farming system, sustainable development, resource base, nutrient recycling, diversification, natural resources and conventional system.

Introduction

Indian agriculture currently faces a host of diverse challenges and fresh constraints due to the ever growing population, increasing food and fodder needs, natural resources degradation, higher cost of inputs & concerns of climate change. A phenomenal increase in food grain production from 51 mt. in 1950-51 to a record production of 251 mt. in the year 2011-12 could be achieved using improved technology including integrated farming systems.

The country's population is expected to reach 1660 million by the year 2050 and for which 349 million tones of food grains will be required. It is anticipated that land area available in 2050 would be 137 million hectares. To meet this requirement there is urgent need to double the productivity of agricultural crops from the existing level. Since there is no further scope for horizontal expansion of land for cultivation of farm enterprises, the emphasis should be on vertical expansion by increasing the productivity using the available resources properly and choosing the best enterprises. The income from cropping alone is hardly sufficient to sustain the farmer's family in case of small and marginal farmers; those constitute 80.3 per cent of agricultural population with only 36 per cent of area operated. With decline in farm size due to explosion of population, it would be increasingly difficult to produce enough food for the family by the end of 21st century. The farmers need to be assured of regular income for living at least above poverty line. The progress in production or steady growth in output is necessary to face the challenges posed by present economic, political and technological environment. In this context, farming system approach is one of the important solutions to face this peculiar situation as in farming system approach the different enterprises can be carefully undertaken and the location specific systems are developed based on available resources which will result into sustainable development.

It is also a fact that highly productive lands have been diverted from agriculture to infrastructural development, urbanization and other related activities. Under these circumstances the only option is to

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increase the productivity vertically. In view of these situations, Integrated Farming System is the only way through which the target could be achieved.

Research findings

Integrated Farming System is the result of complex interaction among a number of interdependent components, where an individual farmer allocates certain quantities and qualities of four factors of production, namely land, labour, capital and management to which he has access[1]. IFS is a multidisciplinary whole farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holding by integrating various farm enterprises and recycling crop residues and by products within the farm itself [2,3]

Goswamy[4] attempted to develop optimum farm plans for the Garo hill areas where shifting cultivation was practiced for augmenting the incomes of the hill farmers by eliminating shifting cultivation. He used linear programming model to maximize farm business income under the prevailing level of resources, with capital borrowing and simultaneous hiring of capital and human labour. He indicated that the systematic farm planning was a paying proposition under the existing technology and with the existing resource base on the hill farms.

Naik[5] conducted study in Uttara Kannada district of Karnataka with an overall objective of identifying and analyzing the optimality under different situations for different farming systems. He concluded that, with the introduction of new technology, the net farm return would increase in the range of 25 to 150 per cent over existing plan. Further, with the availability of additional resources for inclusion of new technologies, the net farm return would enhance by 40 to 170 per cent.

Sheokand *et. al.*,[6] conducted a study during 1996-97 involving 300 landless (no land), marginal (0.1-1.0 ha), medium (2.1-3.0 ha), and large (>3.0ha) farmers in Haryana, to compare the economics of different farming systems in a rice-wheat cropping sequence. Expenditure and income of arable farming, buffalo rearing, and mixed farming units were determined. The results showed net returns of Rs. 6326, Rs 3904 and Rs. 89966/ha, respectively. The net return per Rs.1000 invested was Rs. 223, Rs. 241and Rs.250, respectively. The percentage net returns over gross expenditure were 22.29, 24.10 and 24.99%, while the percentage returns over other variable costs were 39.69, 33.87 and 39.99%, respectively. The expenses incurred on labour were 12.90, 18.99 and 25.36% of the total expenditure, respectively. The results showed higher gross and net returns per 1000 invested, as well as higher per cent return over gross investment, in mixed farming compared with other farming systems. Mixed farming also generated more income and human labour employment than arable and dairy farming.

Ganesh[7] classified the problems faced by the farmers in Integrated Farming System under four groups' *viz.*, production, financial, infrastructural and marketing problems in Gazani lands of Karnataka. With respect to the production problems, majority of the farmers complained of non availability of better variety seeds and fingerlings. Regarding financial problems, lack of funds for purchase of improved inputs was the major problem. Extension problems included non availability of package of practices. The important problem was absence of market regulation and information.

Vyas and Patel[8] studied constraints faced by milk producers in adoption of dairy technology revealed that non availability of loan facilities for purchase of milch animals and fodder, non availability of artificial insemination and milk marketing facilities, lack of knowledge of scientific animal feeding as well as preservation practices and no pasture land were the main constraints in adoption of dairy industry.

Chandrashekar *et al*.[9] listed production constraints faced by growers in Integrated Farming System in the order of importance. They were lacking in technical guidance, more pests and diseases, high cost of fertilizers, high cost of plant protection chemicals, non-availability of seed materials and non-availability of

fertilizer in time.

Gavisiddappa *et al*.[10] identified the problems in Gherkin production and trade in Haveri district of Karnataka. The sample farmers were unanimous and cent per cent in their opinion with respect to non-availability of seeds, unawareness of potentiality of the crop, lack of irrigation facilities, problem of pests and diseases, lack of cheap labour, no market in India and no storage facilities of refrigerated rooms. Irregular payment made by the company (30 per cent) and lack of research support regarding the crop (34 per cent) were some other problems.

Rajkumar and Hari Singh[11] studied problems in vegetable production. The problems reported in Integrated Farming System were, poor quality seeds (42.2%), insufficient availability of seed (40%), high cost of seed (31%) and non-availability of seed at appropriate time (12.2%). The other problems noticed were high cost of fertilizer, poor state of fertilizer and plant protection delivery system in the district. High wages and shortage of labour was also one of the constraints.

Basavaraj and Kunnal[12] identified the constraints in production, marketing and processing of soybean in Belgaum district. It was observed that severe problems faced by growers in Integrated Farming System was rust disease leading to heavy loss, high labour wages and non availability of quality seeds in the production front. In marketing, farmers experience problem of price fluctuation, low price for the produce, problem of transportation and delayed payment of sale when produce was sold out to co-operative society. The other problems were inadequate power supply and non-availability of labour at times faced by the processor.

Wadear[13] pointed out the problems faced by the sample farmers in production of different crops in selected zones of northern Karnataka. It was observed that problems like price fluctuation, lack of storage facility and incidence of pests and diseases were reported as severe problems under Farming System-I (green gram, jowar, tur, black gram, paddy, sunflower, and groundnut in *Kharif ;* Bengal gram and jowar in *rabi* and sugarcane and dairy animals) in Zone-I. Lack of knowledge about source of availability of seeds and incidence of pests and diseases were the severe constraint in sunflower production under Farming System-I (green gram, tur, sunflower, chili and groundnut in *Kharif;* Bengal gram and jowar in *rabi* and dairy animals) in Zone-II, constraints in Bengal gram production, followed by the non availability of seeds in time under both the farming systems in both Zone-I and Zone-II. Problems like non-availability of seeds in time, lack of storage facility, pest and disease incidence, price fluctuation were severe in many crops. In milk production problem on non availability of credit, non-availability of pasture land, lack of artificial insemination facility and improved breeds, lack of knowledge of scientific feeding, inefficient marketing facility and higher cost of feed materials were severely confronted, which need immediate attention.

Nagaraju and Gopal[14] surveyed in West Godavari district of Andhra Pradesh to study constraints among Koyas in adoption of improved dairy farming practices. There were serious constraints in adoption of improved dairy farming practices were non-existence of milk cooperatives in the village, lack of sufficient knowledge in different areas of improved dairy farming practices, exploitation by middlemen, distant location of Artificial Insemination centre or veterinary hospital, lack of good transportation facilities, followed by other problems in the order of severity.

Naik[15] conducted a linear programming study by including different livestock enterprises with chili based crop activity and developed optimum plans under existing and improved technology levels. The author concluded that the return per farm over the existing plan was highest for large farmers of Farming System-I (crop production + dairy enterprise) as compared to Farming System-II (crop production + poultry) and Farming System-III (crop production + sheep enterprises).

Murugan and Kathiresan[16] revealed that among the different farming enterprises compared for integration along with lowland transplanted rice, viz. fish culture, rabbit rearing, and poultry rearing performed significantly superior. Positive interactions among these enterprises resulted in higher crop yield, economic indices and soil fertility status. The highest net return of Rs 1, 55,920/ha and Rs.2, 28,090/ha during the first and second season, respectively were obtained with integrated rice + fish + poultry farming systems. The same system also recorded the highest grain yield of rice (5.67 and 5.25 t/ha during first and second season, respectively). The highest post-harvest soil nutrient status with regard to N, P and K was also observed with rice + fish + poultry farming system.

Ramrao *et.al*[17], studied crop-livestock integrated farming system for the marginal farmers in rainfed regions of Chhattisgarh in Central India" investigations were carried out in Durg district to find out a sustainable mixed farming modal which is economically viable integrating the different component like crop, livestock, poultry and duck on 1.5 acre land holding. Different viable modules viz.(T1) arable,(T2) crop + 2 bullocks + 1 cow, (T3) crop + 2 bullocks + 1 buffaloes, (T4) crop + 2 bullocks + 1 cow + 1 buffalo, (T5) crop + 2 bollocks +1 cow + 1 buffaloes + 10 goats and (T6) crop + 2 bullocks +1 cow + 1 buffaloes + 10 goats + 10 poultry + 10 ducks were developed to find out the best package on the land holding of 1.5 acre suitable for the tribal region. A model having 2 bullocks + 1 cow + 1 buffaloes + 10 goats + 10 poultry + 10 ducks along with crop cultivation was the best with a net income of Rs.33076 per year against arable farming (crop farming) alone (7843 per year) with a cost returns of 1:2.238 and employment generation of 316 days.

Singh et al.[18], in their efforts to develop sustainable integrated farming system models for irrigated agro-ecosystem of eastern Uttar Pradesh of north-eastern plain zone revealed that rice-pea-okra was the most remunerative cropping sequence with highest rice equivalent yield of 17.88t/ha and net returns than the conventional rice-wheat sequence. The rice based integrated farming system comprising of crop components, dairy, poultry and fishery was the most suitable and efficient farming system model giving the highest system productivity and ensured the multiple uses of water. This model generated significantly higher levels of employment than rice-wheat system.

Singh *et al.*[19] , reported that the major income source of farmers in the western Uttar Pradesh has been found sugarcane (58 per cent), followed by livestock and cereal crops. The study had revealed that marginal farmers take highest credit, while large farmers take minimum credit. It had also been observed that facility of Kisan Credit Card (KCC) was availed by only 21 per cent farmers. Farming activity – wise analysis had revealed that sugarcane provides maximum employment, followed by livestock and wheat. In term of income, the study had observed that a family worker earn Rs. 41,270 per year in the study area, which was much lower than that in Punjab (Rs. 74,080/ year). The study had suggested that a combination of technology, policy and institutional innovations was needed for improvement in productivity and profitability of crops and livestock in the area.

Singh and Joshi[20], worked out economic analysis of crop production and dairy farming for marginal and small farmers in Punjab for the year 2003-2004 and found that a majority of the farm household were not able to meet their requirement from their income from crops and dairy farming. Further dairy farming had emerged as a major allied enterprise for supplementing the income of marginal and small farmers in Punjab. Income from off-farm sources had been identified another important factor contributing significantly to the disposable income of these farm households. The study had suggested that the potential of off-farm sources towards meeting the domestic expenditure. Also, the technical efficiency of crops and dairy farming should be improved to provide more income to farmers.

Singh *et al.*[21], found that sugarcane; livestock, cereals and fodder were the major system being followed by

a majority of the farmers amongst 38 farming system prevalent in the western Uttar Pradesh region. The major income source of farmers in the area was sugarcane (58 per cent), followed by livestock and cereal crops. The study has revealed that marginal farmers take highest credit, while large farmers take minimum credit. It has also been observed that facility of Kisan Credit Card (KCC) is being availed by only 21 per cent farmers. Farming activity-wise analysis has revealed that sugarcane provides maximum employment, followed by livestock and wheat.

Singh *et al.*[22] , analyzed farming systems of household in the western Uttar Pradesh based on the primary data collected through a sample of 197 farmers in 2004-05. The sugarcane based farming system had been found predominant in the study area. Livestock, vegetable, cereals, and sugarcane had been observed to be the main sources of farm income. Credit has significant impact on farm income and credit requirement of about 86 per cent farmers were met by the institutional sources.

Toor *et al.*[23], conducted a study in a cluster of four villages in Phagwara Development Block, Kapurthala district, under the ICAR-funded adhoc project entitled " System Approach towards Income Enhancement" during 2003-06. A set of 11 different Integrated farming systems was developed and implemented in the farms of selected farmers with 1.5-ha holdings. The results of the study indicated that all the Integrated farming systems, involving crops (rice, wheat, and *Aloe vera*) and livestock (dairy animals, pigs, poultry, fish, rabbits and honey bees), proved more profitable than crops alone (rice-wheat system) in terms of net returns. Further, integrated systems resulted in better utilization of land, water input and human resources compared to arable farming alone and also increased employment generation.

Kiresur *et al.*[24] , conducted a study in Hilly Zone of Karnataka to assess the sustainability of different farming system using the primary data collected from the 60 farmers selected using the multistage random sampling technique during the year 2001-02. Results of the study indicated that farmers incurred total cost of Rs. 1, 07,677 under FS-1 (Field crops + dairy animals+ draught animals) as a whole and realized a net return of Rs. 68,388. The total cost comprised of variable cost to the tune of Rs. 84,226 and fixed cost to the tune of Rs. 23,450. Milk production (1.74) activity was found to be more remunerative than the crop production (1.62).In the case of FS-IV (Horticultural crops + Dairy animals) farmers realized a net return of Rs. 8, 23,023 over total costs (Rs. 322015). In total costs, variable costs, fixed costs and apportioned establishment cost amounted to Rs. 2, 25,350, Rs. 74,523 and Rs. 22,143 were estimated. Returns per rupee of investment (3.56) under FS-IV were very high than under FS-I (1.64). Production function analysis revealed that bullock labour, seed and FYM were the important variables influencing paddy production whereas plant nutrients as an input was the most significant variable in cotton production . In the zone, milk production was very much influenced by the use of concentrates and green fodder. Human labour coefficient was also found to significant.

Singh and Gangwar[25], conducted a study entitled "Farming system diversification in semi arid Agriculture of Uttar Pradesh". The study was based on a survey of 108 farm household in the south west semi arid plain of Uttar Pradesh. In all 24 farming systems were prevailing in the zones. Cropping intensity was higher in cereal based farming systems were prevailing in the zones. Cropping intensity was higher in cereal based farming system followed by live stock based farming system and lowest in sugarcane based farming system. Bajra – wheat was the major cropping system and lowest in sugarcane based farming system. Bajra – wheat was the major cropping system in the area. Fifty eight percent farmers adopted high degree of crop diversification. Vegetable component provided highest net return in vegetable based farming system (Rs 137112) followed by sugarcane (Rs 60634) in sugarcane based farming system. B/C ratio for all

farming systems expect sugarcane based was high. The results call for proper combination of livestock including sheep, goat, poultry, fisheries etc. for higher income. Constraints prioritization was a necessary condition for farming systems diversification, planning and programmes.

Singh *et al.*[26] , in the pilot area of model Watershed, Rendhar, Jalaun, U.P., India under financial assistance of Ministry of Water Resources, Government of India carried out by one descript breed of buffalo 'Murrah' which was provided under each system.(Watershed is a topographically delineated area that is drained by a stream system and a hydrological unit that is often used as a physical-biological unit as well as a socio-economic-political unit for planning and management of natural resources. Watershed management is the process of guiding and organizing the use of land and other resources on a watershed to provide desired goods and services without harming soil and water resources.) The seven selected cropping systems were diversified with companion crops of *rabi* season. Further, each sequence was integrated with one 'Murrah' buffalo for maintaining cash flow of resource poor farm families of Bundelkhand reeling below poverty line (BPL). Sesame- pea + mustard + one 'Murrah' buffalo; sesame-wheat + mustard + one 'Murrah' buffalo; sesame-lentil + mustard + one 'Murrah' buffalo; sesame-linseed + mustard + one 'Murrah' buffalo; sesame-lentil + linseed + one 'Murrah' buffalo sesame gram + mustard + one 'Murrah' buffalo and sesame gram + linseed + one 'Murrah' buffalo integrated farming system were tested on ravines affected farmers fields. Among the tested integrated farming systems, the maximum net income (Rs. 65819/ha) was obtained from sesame-lentil + mustard + one 'Murrah' buffalo and was closely followed by sesame-lentil + linseed (Rs. 64004/ha) in ravines degraded soils of Bundel khand. The lowest net returns of Rs 35999/ha was recorded from sesame-wheat + mustard + one 'Murrah' buffalo farming.

An Integrated FishFarming model involving fishery, poultry and vegetable farming was developed and evaluated by Bisht 2011[27] , for two consecutive years on participatory approach at farmer's field in Indian Central Himalaya. Fast growing hybrid *layer* broiler were housed beside fish pond (264 m2) at 3000 birds/ ha. Fingerlings of Chinese carps were stocked at a density of 30,000/ha. Combination of silver carp 45%, grass carp 35% and common carp 20% were stocked. The fish were not given any supplemental feed and the ponds were not fertilized except for the split bird feed and chicken manure. On an average 98 gm dropping/bird/day was recycled into the pond. Chick birds were fed with a feed formulated from locally available ingredients such as corn, ragi, soybean etc. After one year fish were harvested. Composite carp culture yielded an average of 120 kg, which corresponded to 4545 kg/ha/yr. Grass carp registered the best growth followed by silver carp. Average egg production per female bird was 143 eggs/bird/yr. Chick birds grown up to 2.5 kg within a year, an average of 118.5 kg chicken (live weight) was obtained annually. Besides, 2115 kg vegetables were produced annually on the associated fields (600 m2), generating handsome amount of Rs 20,958/-. Beside protein rich food for household consumption, an average net gain of Rs 36,823 was obtained annually from IFF with investment of Rs 11,925 by the farmer. Economic analysis of technology clearly showed advantage over conventional system of cropping under rain fed conditions. A net profit of about 200% of the total cost indicates the economic viability of the technology. It has considerable potential to provide food security, nutritional benefits, employment generation and providing additional income to resource poor small farmers.

Sarma et al.[28] , had undertaken the project to study the impact of training on aquaculture under DBT's Women Bio-resource Complex in terms of extent of adoption of integrated rice fish farming practices by women farmers. The Assam Agricultural University, Jorhat in collaboration with the Department of Biotechnology (DBT), Govt. of India, New Delhi had

launched the Women Bioresource Complex project in three selected villages of Jorhat district of Assam. Under the project, training on integrated rice fish farming was given to women farmers during July, 2007. A total sample of 150 women farmers, consisting of 75 trained and 75 untrained, women farmers was selected for the study. The purposive cum proportionate random sampling method was followed for selecting the respondents. The findings indicate that only few of the trained respondents had adopted the recommended practices. None of the untrained respondents were found to adopt the recommended practices. Study further revealed that majority of the adopter women had medium level of adoption of recommended practices. The findings of the correlation analysis revealed that extent of adoption of recommended practices had positive and significant relationship with operational land holding, mass media exposure and availability of fish pond, while in case of age, educational level and contact with project staff, it was positive but not significant. It can be inferred from the study that extension agencies should be geared up and should continue their efforts in accelerating the rate of adoption of different practices. The positive and significant relationship between extent of adoption of recommended practices with size of operational land holding, mass media exposure and availability of fish pond ensures the possibility of manipulating these crucial factors in order to bring about desirable changes in the adoption behaviour of women farmers.

Sanjeev Kumar et al.[29], developed seven integrated farming systems for efficient utilization of available farm resources and to increase the income per unit of land, different combinations of crop, animal, fish and bird were evaluated at three locations of Eastern India, *viz*. Patna, Vaishali and Munger districts, to sustain productivity, profitability, employment generation and nutrient recycling for lowland situations from 2007-2008 to 2009-10. Among the tested different Integrated Farming System (IFS) models, *viz.* (i) crop + fish + poultry, (ii) crop + fish + duck, (iii) crop + fish + goat, (iv) crop + fish + duck + goat, (v) crop + fish + cattle, (vi) crop + fish + mushroom and (vii) crop alone, crop + fish +cattle model recorded higher rice (*Oryza sativa* L.) grain equivalent yield (RGEY) (18.76 t/ha) than any other combinations, but in terms of economics, crop + fish + duck + goat model supersedes over all other combinations. The highest average net returns (USD 2655/yr) were recorded from crop + fish + duck + goat system over all other systems tested here. Higher average employment of 656 man-days/ year were also recorded from crop + fish + duck + goat system because of better involvement of farm family labours throughout the year. Based on a sustainability index (SI) derived from different models, crop + fish + duck + goat system was found superior with a maximum sustainability for net returns (73.1%), apart from the addition of appreciable quality of nitrogen, phosphorus and potassium into the system in the form of recycled animal and plant wastes. The wastes/by- products of crop/animals were used as input for another component to increase the nutrient efficiency at the farm level through nutrient recycling. Results on integration of different components with crop depending upon sustainability and preferences were found encouraging, and to enhance the productivity, economic returns, generating employment for farm families and maintaining soil health of the farm, the crop + fish + duck + goat combination could be adopted in the eastern part of India than cultivating the crop alone on the same piece of land under irrigated conditions. Addition of organic residues in the form of animal and plant wastes could also help in improving the soil – health and thereby productivity over a longer period of time with lesser environmental hazards. The livelihoods of small and marginal farmers could be improved by their adoption of IFS technologies on a larger scale, as they provide scope to employ more labour year-round.

Dadhwal *et al.*[30], reported that North-western Himalayan region of India is blessed with vast natural resources, yet confronted with poor quality of life. Agriculture in the region is very subsistence in nature mainly to meet the livelihood and food requirements

of the households. The agriculture productivity in the region is very low due to a variety of reasons including rainfed farming and low input usage. In the region, farming systems onintegrated watershed management basis can be promoted for diversification, improving livelihood, soil quality and food security. Besides, it can also be helpful in soil amelioration, stabilization of degraded lands and mitigation of the impacts of climate.

Singh *et al.*[31], has undertaken Integrated farming (IFS) comprising the components like crop, dairy, fishery, horticulture and apiary rearing at the Project Directorate on Farming System Research, Modipuram, Meerut, Uttar Pradesh, India, during 2004-05 to 2009-10. The Integrated farming system approach recorded higher productivity, profitability and employment generation. Among the components evaluated, the relative share of different component in the order of merit were from dairy (48%), crop (41%), horticulture (6%) followed by fish (3.0%) and apiary (2%) The net returns obtained from different components were Rs.87029, Rs.74435, Rs.10263, Rs.4947, Rs.4204, respectively of which total return from IFS unit per year (1.4 ha) was Rs.135826. The employment generation mandays ha^{-1} $year^{-1}$ through crop, dairy, horticulture, fishery and apiary was to the tune of 315, 189, 100, 42 and 38, respectively resulting employment generation of 684 mandays $year^{-1}$. Efficient nutrient recycling made the model sustainable and eco-friendly.

Sanjeev Kumar *et al.*[32], conducted a field experiment at main farm of ICAR Research Complex for Eastern Region, Patna during 2007-10 to study resource recycling from different IFS models and to identify a suitable combination of components for maximum returns and employment generation under lowland situation of Bihar. Different combination of crop, animals, fishes and birds were examined in form of seven integrated farming systems (IFS) models. Among different IFS models crop + fish + duck + goat emerged as the best Integrated farming system in terms of productivity, sustainability index (0.80%), net return (Rs 1,59,485/year) and employment generation (752 man-days/year) apart from addition of appreciable quantity of N, P_2O_5 and K_2O into the system in form of recycled animal and plant wastes. Crop + fish + duck + goat and crop + fish + cattle integration recorded nearly equal amount of rice-grain-equivalent yield. (21.20 and 21.18 tones /ha, respectively) but in terms of economics crop + fish + duck + goat supersedes by Rs 30 870. The waste material/by products of crops and animals were recycled and used as inputs for other components of Integrated farming system. Crop + fish + cattle model added higher quantity of N P and K overall other models.

Summary

IFS model crop + fish + duck + goat is the best for Eastern region in terms of productivity, sustainability index (0.80%), net return (Rs 1,59,485/year) and employment generation (752 man-days/year) apart from addition of appreciable quantity of N, P_2O_5 and K_2O into the system in form of recycled animal and plant wastes. Addition of organic residues in the form of animal and plant wastes could also help in improving the soil – health and thereby productivity over a longer period of time with lesser environmental hazards.

IFS model comprising of crop components, dairy, poultry and fishery is the most suitable and efficient farming system model giving the highest system productivity for irrigated agro-ecosystem of North-eastern plain zone.

Suitable IFS model for Indian Central Himalaya region is fishery+ poultry + vegetable farming which has considerable potential to provide food security, nutritional benefits, employment generation and providing additional income to resource poor small farmers.

Studies in Hilly Zone of Karnataka reveal that field crops + dairy animals+ a draught animal is the most suitable IFS model. In the zone, milk production was very much influenced by the use of concentrates and

green fodder & human labour coefficient was also found to significant.

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