Indian Farming **68**(01): 13–16; January 2018

Selected integrated farming system models

for enhanced income

A. P. Srivastava[1]

Former National Co-ordinator (NAIP),
Krishi Anusandhan Bhavan II, New Delhi 110 012

Under National Agricultural Innovation Project (NAIP), supported by The World Bank and implemented by the Indian Council of Agricultural Research (2006-14), an effort was made to enhance income of the rural people living in selected disadvantaged regions through technology-led innovation systems. Very often emphasis on one component in rural areas, particularly among those people whose livelihood is threatened can not lead to overall livelihood improvement of a household. Accordingly, interventions in IFS mode (crop-livestock-aquaculture) were planned and demonstrated, keeping in view the overall need of the area, available technological options, market accessibility both for input and produce etc.

Key words: Income, Integrated farming system, Models

SOME of the Integrated Farming System models demonstrated with success are discussed here. These are *integrated rice–fish-poultry farming system* in 12 villages of Cuddalore, Villupuram, Nagapattinam and Thiruvannamalai districts of Tamil Nadu at Annamalai University; *Integrated rice-fish farming model* at Asom Agricultural University in Lakhimpur, Kokrajhar and Karbi Anglong districts; *Makhana* was integrated with fish and water chestnut to enhance farmers income as compared to *makhana* alone at ICAR Reseach Complex for Eastern Region, Patna; *Integrated pig/ poultry-fish-vegetable farming system model* in Lakhimpur, Kokrajhar and Karbianglong districts of Assam under Assam Agricultural University, Jorhat etc.

Integrated rice–fish–poultry farming system

Annamalai University demonstrated integrated rice–fish-poultry farming system on 430 farm holdings in 12 villages of Cuddalore, Villupuram, Nagapattinam and Thiruvannamalai districts of Tamil Nadu (Fig. 1). The intervention included transplanted rice in 200 m^2 area, 20 poultry birds kept in cages of size 1.8 m × 1.2 m × 1 m and 100 fingerlings (Rohu, Mrigal, Catla, Common Carp) in trench of 20 m^2 area. The results indicated annual increase in net return per household by ₹ 33,000/- to ₹ 50,500/ha/year for two and three crops, respectively. Poultry manure addition due to poultry dropping was 11.4 to 19.6 tonne/ha and also pest suppression ranged from 17 to 27%.

Fig. 1. Integrated rice-fish-poultry model

Integrated rice-fish-vegetable model

Integrated rice-fish farming model followed by vegetable crops, utilizing the residual moisture and nutrients added by activities of fish, was promoted in a total area of 160 ha by Assam Agricultural University in Lakhimpur, Kokrajhar and Karbi Anglong districts (Fig. 2). A unit area of 2,800 m^2 was put under this system. Major emphasis was on

Fig. 2. Integrated rice-fish vegetable model at Jalkuwari

Fig. 3. Integrated pig-poultry-fish-vegetable system

replacing the existing low yielding rice varieties with high-yielding varieties like Ranjit, Gitesh, Jalashree Trenches were made on the sides of rice field with a depth of 0.6 m and 0.6 m width to accommodate the fish species (Rohu, Mrigal, Catla, Common carp and Silver carp). After harvesting rice crop, vegetables (french bean, chilli and knolkhol) were cultivated in the field. Net economic benefit per household per annum from this intervention was ₹ 29,000.00. Rice production increased from 2.97 tonne/ha (baseline value) to 4.6 tonne/ha. Besides, beneficiary farmers got an average of 41 kg fish and 1.7 tonnes vegetable from 2,800 m^2 rice fields.

Integration of *makhana* with fish and *singhara* (water chestnut)

Makhana was integrated with fish and water chestnut to enhance farmers income as compared to *makhana* alone at ICAR Reseach Complex for Eastern Region, Patna (Fig. 4). The technology was demonstrated in an area of 50 ha with 96 beneficiaries in Darbhanga Sadar Block. The results revealed that *makhana* gave a total net profit of ₹ 7,90,636 with an employment generation of 9,437 man-days per year; fish showed an additional net income of ₹ 4,65,677 with an employment generation of 889 man-days/year whereas water chestnut generated an additional net income of ₹ 25,010 with an employment generation of 335 mandays/year.

Integrated pig/ poultry-fish-vegetable farming system model

About 98% of total population of backward districts of Asom lives in the rural areas. Pig rearing is one of the alternative livelihood options for most of the people. However, they are mostly rearing local breed in the backyard with poor condition. As a result, income from pig rearing is less. Integrated farming system with cross breed pigs/poultry, fish and horticulture as well as improved method of rearing was demonstrated for enhanced income, by Asom Agricultural University, Jorhat in Lakhimpur, Kokrajhar and Karbianglong districts of Asom (Fig. 3). The results indicated that on an average a farmer can get an income of ₹ 54,500/ and ₹ 90,000 from poultry- fish- vegetable and pig-fish- vegetable system, respectively.

Redgram-based integrated farming system for Bidar, Karnataka

Redgram or pigeon pea (*Cajanus cajan*) is popularly known as *Tur* or *Arahar* in India. It is one of the major pulse crop of northern Karnataka. It is one of the most important commercial crops of dryland farmers. Bidar district is considered as pulse bowl of Karnataka where in pulses like blackgram, greengram, redgram and Bengalgram are major crops cultivated in an area of 206,717 ha. Among these pulses, the share of redgram is to the extent of 65,642 ha. As estimated, the potential and present yield of redgram in Bidar district are 2,700 kg/ha and 829 kg/ ha respectively. To bridge this yield gap (1,871 kg/ha) redgram transplanting was considered an viable option. To further add to the income, an Integration Farming System model of Redgram (BSMR-736) and Bengalgram (JG-11) crop with vermi-composting, *Azolla* cultivation and poultry was developed and demonstrated in Bidar district of Karnataka. Integrated model was productive and profitable as it has generated an average income of ₹ 1,53,200/HH/year to 240 households (H H) against an average pre intervention income of ₹ 63,700.

Specialized integrated farming system model

The Specialized Integrated Farming System (SIFS) is 'Practice of integrated farming system in which, while each component is interdependent but perform to its optimum level and one or more components can be raised to the level where it serves the level of self-employment venture'. Based on studies conducted in Barabanki and Raebareilly district in Uttar Pradesh, a different model each for landless, small landholders and marginal farmers was recommended.

Enhanced income through high value poultry race 'Kadaknath'

An Indian poultry breed,

Fig. 4. Integrated makhana-fish-singhara system

The models and estimated income were as follows:

Category	Model	Input cost (₹/annum)	Output (₹/annum)
Landless/sub-marginal farmers	Poultry (300 chicks × 4 cycles), Bovine (3-5 no.), *Azolla*, Fodder on rented/waste land	21,000	255,000
Small landholders (1 acre)	Banana (300 seedling), Poultry (200×4 cycle), Fodder, Gladiolus/veg, Dairy (6-8 adult), *Azolla*	36,600	380,000
Landholding (1 ha)	Banana (460 seedling), Poultry (200×4 cycle), Guava (60 plants) Goats (30), Gladiolus/veg. Dairy (20 adult), *Azolla*	504,000	1,125,000

'Kadaknath' is native to Jhabua district of Madhya Pradesh. This breed is famous for its meat quality, texture, and flavour and has special medicinal value in homeopathy. Due to its meat and alleged medicinal properties, it fetches high price and is in high demand in Madhya Pradesh and adjoining states. However, it was observed that the population of this bird was declining rapidly and it was under threat of extinction and genetic erosion. An attempt was therefore made for conservation and promotion of this high value Indian poultry race under NAIP by RVSKVV, Gwalior. A suitably designed low cost shed and one hundred poultry chicks of ten days old were made available to each beneficiary (Fig. 5). The farmers were educated on technologies for scientific poultry production, balance feeding, handling of feeder and drinkers, health management and marketing. This new Kadaknath production technology reduced the mortality rate from more than 50% to 10-12%. The birds gained the body weight in faster way and attained saleable weight of 1.10 kg in 105-120 days. On an average, an individual beneficiary got the net income of ₹ 90,000 to 1,00,000 / beneficiary/ year. Due to success of this intervention, number of low cost poultry sheds have increased to 162 and are further increasing. A hatchery was further supported by NAIP to ensure supply of chicks.

Fig. 5. Conservation of *Kadaknath* poultry

Impact of CSR-BIO on increasing the profitability of horticultural crops

The CSR-BIO is a product developed using consortia of effective synergistic microbes in combination with dynamic patented media and dynamic substrate to cater the growth requirement of commercial crops in soils of pH 9.0 to 9.35. CSR BIO, developed under NAIP by consortia led by Indian Veterinary Research Institute, Izatnagar, was evaluated for its profitability and reduced use of chemicals in commercial crops like tomato and banana with adopters and non-adopters. The studies were conducted in two major banana and tomato growing areas of the Barabanki district (Trivediganj and Haidergarh).

Results showed an overall increase in yield up to 22.43 and 15.62% in the adopters of tomato and banana which simultaneously increased the gross profitability to 20.11 and 17.39%, respectively. The use of plant-protection chemicals was 47.33 and 33.36% lower than the non-adopters in tomato and banana, respectively. Adopters gained an average gross income of ₹ 2.78 lakh from one acre while the non-adopters obtained a gross profit of ₹ 2.36 lakh from one acre of crop. Adopters sprayed their crops with pesticide / fungicide combination only for 7.333 times while the non-adopters used chemical sprays for 11.067 times.

Introduction of high value vegetable cultivation under three tier system

Under this system, three models were introduced in backward districts of Bihar by ICAR Research Complex for Eastern Region, Patna and farmers were able to grow three different vegetables on the same piece of land at a time. The cost benefit ratio of the three models was 1:3.78, 1:3.22 and 1:2.53 respectively. The economics of the three tier models is given in Table 1.

The intervention has made a big impact in and around Vaishali district. The area under three tier system increased from 72 NAIP supported household to 220

Table 1. Income from three tier vegetable system in Vaishali (Bihar)

Model	Upper	Middle	Lower	Net Income, Rs/year
1	Bitter gourd (Cv. Palee)	Cowpea (Pusa Komal)	Elephant foot yam	3,60,000
2	Pointed gourd (Cv. Dandari)	Okra (Parbhani Kranti)	Cucumber (Kareena)	2,29,000
3	Pointed gourd (cv. Dandari)	Okra (Okra Anamika)	Amranthus	2,25,000

additional household. This intervention was also demonstrated in north Bengal and NEH area by respective consortia.

Off-site benefits : These benefits include the construction of terraced portion and sunken ponds has reduced the runoff movement and soil erosion process in the fields in the valley portion tremendously; the lower fields are getting sufficient moisture as the runoff water retained in the treated area gets percolate and recharge the soil moisture profile and moves downward to be retained and available in the soil profile for longer time in the fields located in the valley portions; reduced downstream flash flood due to *in-situ* water conservation; increased stream flow in dry season; and reduced downstream siltation. Thus, it is a simple technology, which only requires de-silting of the sunken ponds after few seasons.

SUMMARY

The interventions in Integrated Farming System mode covering crop-livestock-aquaculture were planned and demonstrated, considering the overall need of the area, available technological options, market accessibility both for input and produce etc. These resulted in increased percolation; reduced evaporation due to subsurface storage; low risk of breaching/ damage in heavy rain; the natural drainage line is not disturbed and further development of washes, gullies stopped due to controlled runoff movement; low-cost as compared to check dam and simple technology easily understood by farmers.

[1]Residence: 142/GH-13, Paschim Vihar, Delhi 110087. Corresponding authors' e mail: srivastava_ap@rediffmail.com

National Mission for Sustainable Agriculture

The National Mission For Sustainable Agriculture **(**NMSA) is one of the eight Missions outlined under National Action Plan on Climate Change. The strategies and programme of action outlined in the Mission Document, that was accorded 'in principle' approval by Prime Minister's Council on Climate Change, aim at promoting sustainable agriculture through seventeen deliverables focusing on ten key dimensions of Indian agriculture. During XII Five-Year Plan, these measures are being embedded and mainstreamed onto on-going/proposed Missions/ Progammes/ Schemes of Department of Agriculture and Cooperation through a process of restructuring and convergence. The NMSA as a restructured Mission for XII Plan shall cater to 5 Mission Deliverables. Remaining Mission Deliverables are being addressed through other Missions/ Schemes including those by DARE and DAHD&F. The NMSA has been conceptualized by subsuming Rainfed Area Development programme, National Mission on Micro-Irrigation, National Project on Organic Farming, National Project on Management of Soil-health and Fertility and Soil and Land Use Survey of India under its domain. NMSA will accord special focus for development of rainfed areas, resource conservation, water use efficiency and soil health management. NMSA will also replicate the learning of the National Initiatives of Climate Resilient Agriculture being implemented by ICAR in select blocks on pilot basis. The proposal is being processed for consideration of Cabinet Committee on Economic Affairs.

Programme components:

(i) **Rainfed Area Development**: This component has been formulated in a 'watershed plus framework', i.e., to explore potential utilization of natural resources base/assets available/created through watershed development and soil conservation activities /interventions under MGNREGA, RKVY, IWMP etc. It will rely on Integrated Farming System (IFS) for enhancing productivity and minimizing risks associated with climatic variabilities.

(ii) **On Farm Water Management:** This will focus primarily on enhancing water use efficiency by promoting efficient on-farm water management technologies and equipment.

(iii) **Soil-health Management**: The soil-health management will aim at promoting location as well as crop specific sustainable soil-health management including residue management, organic farming practices by way of creating and linking soil fertility maps with macro- , micro- nutrient management, appropriate land use based on land type, judicious application of fertilizers and minimizing soil erosion.

(iv) **Climate Change and Sustainable Agriculture: Monitoring, Modelling and Networking**

This networking will provide creation and dissemination of climate change related information and knowledge by way of piloting climate change adaptation/ mitigation research/model projects in the domain of climate smart sustainable management practices and integrated farming systems suitable to local agro-climatic conditions.

Programme implementation

NMSA will have a three tier structure for planning, implementation and monitoring of various components. At national level, National Advisory Committee (NAC) under Chairmanship of Secretary (A&C) will provide overall guidance for planning. Project Sanctioning Committee (PSC) chaired by Mission Director, NMSA will prioritize and approve projects under NMSA. Standing Technical Committee (STC) will provide knowledge support and technical feed back to the PSC and NAC to decide the policy content or change in any component if required. CRIDA, CAZRI, ICAR Research Complex for NEH Region and selected SAUs will be represented in the STC. At State level, State Level Committee will oversee planning and implementation of the Mission. States may set up an autonomous State Mission for Sustainable Agriculture for implementation of NMSA. At district level, District Mission Committee will be entrusted with project formulation, implementation and monitoring of NMSA. NMSA envisages concerted mechanism for monitoring and evaluation with involvement of scientific institutions and implementing agencies including line departments. Information and communication technology will be deployed extensively for ensuring transparency in the implementation process and effective monitoring of the Mission.

OUTCOME

NMSA is expected to transform Indian agriculture into a climate resilient production system through suitable adaptation and mitigation measures in the domains of both crop husbandry and animal husbandry. These measures will help in absorption of improved technology and best practices and promote suitable coping mechanisms for climatic and non-climatic stresses.

While primary focus of NMSA will be on conservation and sustainable use of natural resources for food and livelihood security, it will also expand its coverage primarily to rainfed areas by integrating farming systems with livestock and fisheries, so that agricultural production continues to grow in a sustainable manner.