Integrated Farming Systems for Doubling Farmers' Income in NEH Region of India

ICAR-Agricultural Technology Application Research Institute
Umiam, Meghalaya –793103
(An ISO 9001:2015 certified organization)

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PREFACE

Greetings from Team ICAR-ATARI, Umiam!

THE North Eastern states of the country possess abundant flora and fauna with extensive availability of dense forests and abundant rainfall. The region is also blessed with magnificent natural beauty through magnificent hills, twinning rivers that attract visitors from all over the globe. About 77 percent of the working population of the region is engaged in agricultural operation. However, the said beauty is contrasted by widespread poverty, low per capita income, low agricultural productivity, poor marketing facilities and so on. One of the major problems related to agriculture production in the hilly states of the region is the practise of shifting (*Jhum*) cultivation and this is where Integrated Farming System comes into action to solve maximum of the problems faced, if not fully.

Integrated farming system or integrated farming is the type of farming in which various types of agricultural production activities or agricultural enterprises take place simultaneously. It delivers more sustainable agriculture, provides a dynamic approach and can be applied to any faming in the world. The benefits and goals of integrated farming aim at enhancing productivity per unit area, profitability, proper waste management, soil health management, livelihood improvement, fight against deforestation and overall environmental safety. The practise of integrated farming also leads to promotion of agro-forestry, increase input efficiency, cost minimization, employment generation, energy saving and continuous income round the year to name a few.

This publication documents the details of Integrated Farming Systems practised in some parts of the region and how it has impacted the farming community of the region. The learning from the publication can be used for further spread of Integrated Farming System technologies for the purpose of shaping out a more sustainable form of farming in the region and across the nation as a whole.

I take this opportunity to gratefully acknowledge the constant guidance and support received from Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR); Dr. A.K. Singh, DDG (AE) and all the scientists of SMD and ATARI, Umiam. I also gratefully acknowledge the concerned KVK staffs of the contributing KVKs and Mr. Azriel Mervin Tariang, SRF, ATARI for helping us in preparing this document.

(Bidyut C. Deka)
Director

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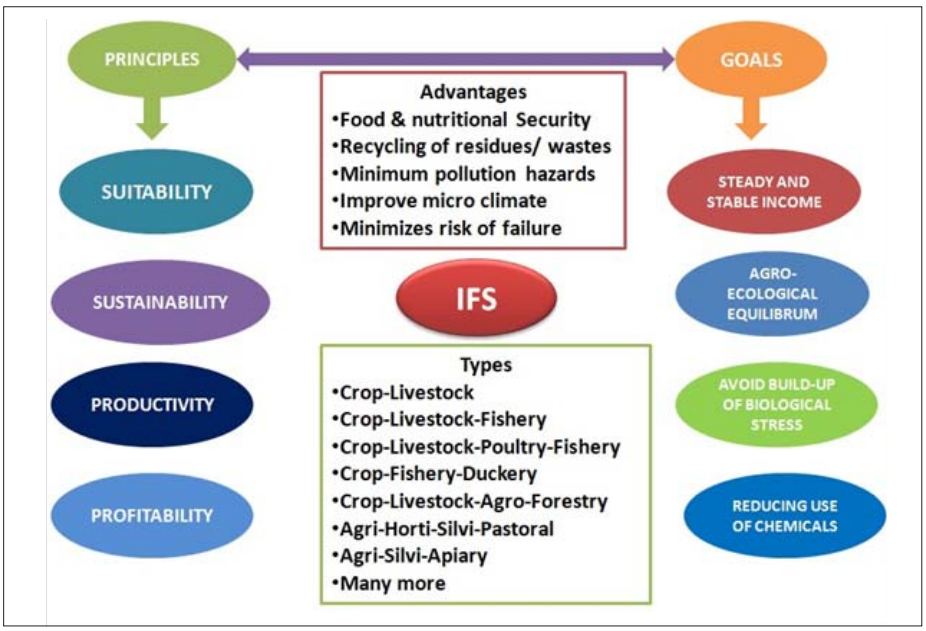
Introduction

Integrated Farming System (IFS) is an interdependent, interrelated often interlocking production systems based on few crops, animals and related subsidiary enterprises in such a way that maximize the utilization of nutrients of each system and minimize the negative effects of these enterprises on environment. The interrelated, inter-dependent-interlocking nature of IFS involves the utilization of primary produce and secondary produce of one system, as basic input of the other system, thus making them mutually integrated as one whole unit. The main purpose of integrated farming is that the farming components support one another, hence, reducing external inputs. It is based on the concept that 'there is no waste' and 'waste is only a misplaced resource' which becomes a valuable material for another product.

Sustainable agriculture, an integrated approach to increasing the farm yield and managing resources in order to address all three critical aspect of sustainability: economic, environmental and social. The IFS approach has multiple objectives of sustainability, food security and poverty reduction. It involves the use of outputs of one enterprises component as inputs for other related enterprises wherever feasible, for example, cattle dung mixed with crop residues and farm waste can be converted into nutrient rich vermicompost.

Scope of IFS



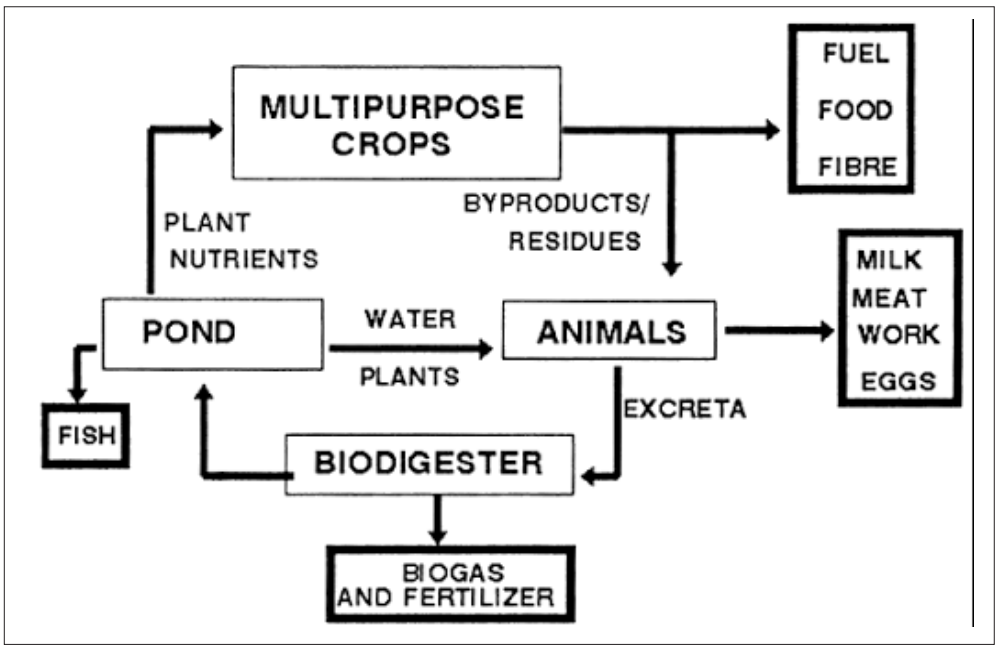
Principles and goals of IFS

In general farmers work hard but do not make profit, due to high cost of production and inputs. However, the emergence of Integrated Farming Systems (IFS) has enabled the feasibility of small sized farming operations in relation to larger ones. Integrated farming system is a commonly and broadly used word to explain a more integrated approach to farming as compared to monoculture approaches. It refers to agricultural systems that integrate livestock and crop production or integrate fish and livestock and may sometimes be known as Integrated Bio systems. In this system, an inter-related set of enterprises is used so that the "waste" from one component becomes an input for another part of the system, which reduces cost and improves production and/or income.

So, why integrated farming?

IFS involves two or more production systems to function together on parallel footing

- Enhanced productivity
- Recycling of resources
- Reduction in production cost
- Enhanced efficiency in resource utilization
- Reduced investment risk through diversification of crops.
- Sustainability
- Increased income
- Improve standard of living



Ideal model for IFS

1 Integrated Farming System
Thingkah Village Lawngtlai, Mizoram

Introduction

Agriculture is the principal occupation of the rural people of Lawngtlai District, Mizoram. Almost 80% of the people directly depend on agriculture. Piggery, poultry and dairying are the major livestock farming practices in the district in addition to agriculture. People take up animal rearing mainly to supplement their meager income from agriculture. Since agriculture is mostly seasonal, there is a possibility of finding employment throughout the year through integrated farming. Integrated farming system with horticulture and livestock not only enhanced the income of the farmers but also help in occupation in terms of family labour employment. The manures from animals provide a good source of organic matter for improving soil fertility and crop yields in the farm.

Mr. K. Lalengliana, a resident of Thingkah village, Lawngtlai District, Mizoram started integrated farming since 2006. Land holding of the farmer is 5 hectare and he is expanding the components of the farm by cultivating more crops in his farm and his income is increasing every year through integrated farming.

Details of the IFS

Since the total land holding area of the farmer is about 5 ha, agricultural enterprises have been conducted in separate blocks so that future expansion may be done in a systematic manner.

I. **Water harvesting structure:** Water harvesting structure was constructed at the upper part of the farm for use in irrigation and other purposes.

II. **Pulse/Oilseeds based farming system:** The border of lower part of the farm is utilized for cultivating field crops *viz.*, rajmah and soybean so as to increase farm income and sustain soil fertility. Cereals occupy most of the farm land and are one of the main components of the farm.

i. **Rajmah plot:** He started cultivating rajmah from the year 2016 till date occupying 1 hectare of his farm. He had harvested 1.8 quintals of rajmah from one hectare and had sold it for Rs 120 per kg. His total income from rajmah was Rs 2,16,000/- per year.

ii. **Soybean plot:** Soybean is being cultivated in 1 hectare land since 2016. The produce from this soybean plot was 28 quintals per hectare. An income of Rs 1,87,600/- per year was earned from soybean cultivation.

III. Horticulture based farming system

i. **Vegetable plot:** The central part of the farm is being used for cultivating five different vegetables *viz.,* brinjal, tomato, chilli, roselle and winged beans covering an area of 1 hectare. He has followed this mix cropping system since the year 2012. The income/year from the sale of vegetables was Rs. 2,87,500/.

ii. **Banana block:** Cultivation of banana was started in the year 2015 occupying an area of 1 hectare of land. 973 nos. of plants were planted at the lower border of the farm. He harvested 16-18 tonnes of banana per year with an earning of Rs. 3,20,000/- per year from the sale of banana.

IV. Piggery

KVK Lawngtlai District introduced two improved pig breeds: Large white Yorkshire and Hampshire to Mr. K. Lalengliana Pig Farm in the year 2016. During the year 2018-19, he reared 10 Sows, 2 Boars, 5 Fatteners/Growers and 104 Piglets. The average annual income from the sale of piglets and adult pigs for meat purpose during the year 2016, 2017 and 2018 were Rs. 1.3 lakh, Rs. 5.1 lakh and Rs. 6.7 lakh, respectively.

Output/Impact:

The impact in terms of income of the different interventions in the IFS is described as per the table and chart below:

Table 1.1: Component wise income generation

Sl. No.	Component	Annual income (Rs.)	Remarks
1	Pulses and oilseeds	4,03,600.00	Rajmah and soybean cultivation
2	Horticulture	6,07,500.00	Assorted vegetables and banana
3	Piggery	6,70,000.00	Income generation recorded during 2018-19

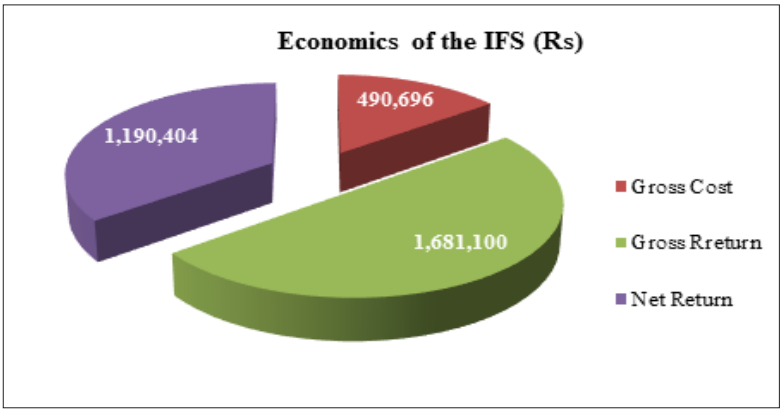


Fig 1.1: Economics of the IFS

Changes in Parameters

Points to be noted before and after the practice of IFS by the farmer are listed below:

Before Intervention

- High incidence of pests and diseases attack
- No proper irrigation
- Low yield
- Only local variety of crops grown

After Intervention

- Low incidence of pests and diseases attack
- Timely irrigation of crops at regular interval
- Improved yield
- Introduction of improved variety of Crops and Pig Breeds

Change in Income (Rs/year)

Before IFS: Rs.5,12,750.00/year

After IFS: Rs. 11,90,404.00/year

2 Multi component IFS

Zutoi villageDimapur, Nagaland

Introduction

Agriculture is a prominent sector of the economy in the state. The farmers are small and marginal and about 80% of the population depends on agriculture for their livelihood. Mono cropping, inadequate irrigation facilities, increased natural calamities, shifting cultivation, soil acidity, steep slopes, improper nutrient management, low yielding/local varieties of crops and livestock are some of the major constrains in agriculture in the state. Integrated Farming System (IFS) was introduced in order to achieve economic and sustain agricultural production so as to meet the diverse requirement of the household by preserving the resource base and maintaining high environmental quality.

Farmer's Name: Shri TokughaZhimo

Village: Zutoi Village

Area: 4.5 ha

Components in detail:

I. Poultry-cum-fish culture

A low cost poultry unit with a capacity of 1000 birds are reared on fishery pond dykes in a 2 ha pond area. In a year four batches of 1000 broiler chicks are raised. He rears the birds for 2½ to three months and disposes it off in the market @ Rs.150/Kg. By that time the birds attain body weight of 2.5 Kg/ bird. He was able to sell one batch of broiler chickens i.e., 2493 kg of meat earning approx. Rs. 3,73,950 as gross income considering 2-3 % mortality per batch. The cost of production per batch comes to around Rs. 2,96,000/-. The net profit realized was around Rs.77,950/- batch.

The fish pond was renovated prior to stocking of fish fingerlings. Five species combination of fish *viz.,* Rohu, Catla, Mrigal, Grass Carp and Common Carp with fingerling size of 10-15 g @ 10000 nos. per hectare were incorporated. Fish was harvested after

6 months of rearing at an average body weight of 350g/fish. At the end of the cultured period, he was able to sell about 6650 Kg of fish @ Rs. 120/Kg. The total cost of production on fishery component was approx. Rs. 2,12,000. By selling fishes, he has obtained a gross income of Rs.7,98,000. The net profit from fish farming was around Rs. 5,86,000.

Table 2.1: Economic analysis from Poultry-cum-fish culture

Cost of production (Rs)	Gross Income (Rs)	Net Income (Rs)	B:C Ratio
5,08,000.00	11,71,950.00	6,63,950.00	2.3:1

II. Paddy-cum fish culture

Two plots of paddy field were converted for paddy cum fish farming. In one plot perimeter trench system model (0.40 ha) was adopted, while central pond system model (0.27) was adopted in the other plot. Fish species of Rohu, Catla, Mrigal and Common Carp were stocked @ 8000 nos. per hectare after 20 days of transplanting rice. The fishes were provided supplementary diet @3% body weight daily. He could harvest 3.0 ton of paddy from 0.67 ha with an estimated yield of 4.5 ton/ha and he could earn Rs. 45,000 from paddy harvest. He harvested nearly 8 quintals of fishes and earned a gross income of Rs. 1,41,000/- in a year.

Table 2.2: Economic analysis from Paddy-cum-fish culture

Cost of production (Rs)	Gross Income (Rs)	Net Income (Rs)	B:C Ratio
51590.00	1,41,000.00	89,410.00	2.7:1

III. Horticulture based farming system

The borders of the fishery ponds were used for planting horticultural crops such as Arecanut, Banana and Coconut to gain maximum income from his fields.

Banana Block: Banana cultivation was one of the main components in horticultural crops apart from vegetables. 1250 number of bananas (*Amritsagar*) was planted surrounding the fishery ponds in between

areca nut plantation. He could harvest 15-20 q of banana /ha /year from the banana plot. During the last five years he could earn an amount of Rs.2, 25,000.00 to Rs. 3,00,000.00 from the sale of banana bunches at the rate of Rs. 30/Kg.

Areca nut: About 1600 numbers of areca nuts were planted in the borders of his field and also in the dyke of fisheries at 3 meter interval; nearly 800 plants are in bearing stage and the rest are yet to flower. Presently he is earning Rs. 1,30,000.00 from selling the areca nuts in the local market as well as from his field itself @ Rs. 15-30/Kg.

Coconut: 150 plants of semi-tall type cultivars collected from Assam were planted in the embankment of fish ponds. Till date he could not earn from the coconut plantation as it is in flowering stage.

Black Pepper: 2000 saplings of black pepper variety Panniyur-1 were introduced in areca nut plantation during the year 2017 as one component for multi-storey cropping.

IV. Portable Vermibed

The portable vermi beds were introduced to recycle the farm waste and to prepare the vermicompost. The vermi beds were in turn utilized to meet the nutrient requirement of banana, arecanut and coconut.

Changes in Parameters

Before Intervention: Mr. Tokugha Zhimo of Zutoi village under Aghunaga block of Dimapur District, Nagaland is an enthusiastic uneducated rural farmer engaged in agricultural activities with traditional pig rearing and fish culture use as a subsidiary component. He started farming by cultivating paddy, a small fish pond and 2 numbers of local pigs to meet his demand. Lack of awareness, technical know-how about scientific cultivation practices in agriculture, livestock and fishery were major stumbling obstacles for his success.

After Intervention: The awareness campaign conducted through different training programs by KVK Dimapur, ICAR Research Complex for NEH Nagaland Centre, Medziphema

and ATMA Dimapur has sensitized him about the prospects of Integrated Farming System. He was also trained in one of the skill training program (Broiler Poultry Farm Worker) under ASCI in the year 2017. With the scientific knowledge that he had learned from KVK Dimapur, he had transformed his field covering an area of 4.5 hectares into an Integrated Farming System model.

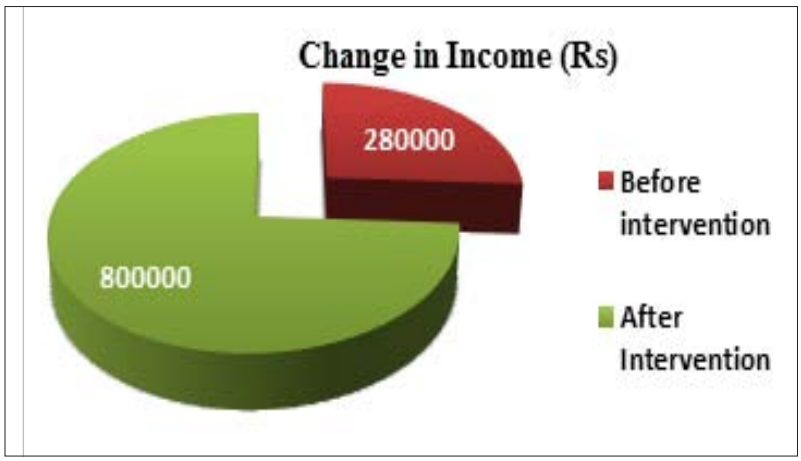


Fig 2.1: Change in income (Rs/yr.)

3 Integrated farming system

Thipuzu Village Phek, Nagaland

Introduction

Mr. Sevohu Chuzho of Thipuzu village has immense interest in diversified commercial farming. He has an area of 4 ha cultivable land. Mr. Sevohu is engaged in Integrated Horticulture-Livestock farming system. He gained his proficiency through training cum demonstration conducted by KVK, Phek. He was also a beneficiary of an exposure visit to YS Parmer University of Horticulture and Forestry, Solan organized by the KVK. Furthermore, the KVK also assisted him by providing trellis, polythene sheet for construction of low cost polyhouse, a water harvesting structure, livestock and seeds under NABARD and TSP programme.

Component Details

i. Kiwi farming: With the assistance from KVK, Phek he was motivated to take up kiwi farming as an enterprise. He planted 200 saplings of recognized varieties viz. Hayward, Allison, Monty, Bruno occupying an area of 0.5 hectare during 2012. At present 150 plants are in fruiting stage with an average yield of 20 Kg/plant. His average annual expenditure is around Rs. 45,000.00 for the development of the farm including intercultural operations and earns a gross income of approx. Rs. 1,65,000.00 from selling of Kiwi.

ii. Low cost poly house: With the assistance from KVK under NICRA programme, Mr. Sevohu constructed a low cost poly house of 60 m^2 area for nursery raising adjacent to a LDPE water harvesting structure. He is presently raising kiwi cuttings, persimmon grafts and seedlings of different vegetable crops. His annual expenditure in nursery production is around Rs. 4,200.00 and earns a net income of Rs. 12,500.00 per year from selling saplings.

iii. Persimmon production: As a new initiative and upcoming market demand, Mr. Sevohu has also planted 50 numbers of grafted persimmon plants (var. Fuyu and Hachiya) occupying an area of 0.1 hectare during 2013. Mr. Shevohu gets a harvest 10-12 Kg/ plant from 10 fruiting plants. Barring the annual expenditure of approx. Rs. 3,500.00 on various intercultural operations, he sells the fruits @ Rs. 250/Kg and earns a net profit of Rs.21,200.00 per year.

iv. Pig farming: Mr. Savehu has established a scientific pig breeding sty. He houses 8 sows and 1 breeding boar of cross-bred Hampshire provided by KVK, Phek. The pig manure is hygienically disposed into dung pit, dried and used in horticultural crop. His net income from sale of piglets is Rs 1,50,000.00 per annum.

v. Poultry farming: Mr. Chuzho is also rearing 100 dual purpose Srinidhi birds in free range system. He has constructed a climate resilient poultry house to mitigate low temperature stress. The built-up litter is used in horticultural crop as FYM. He sells eggs @ Rs. 10/egg in the locality and occasionally sales birds in time of distress and delight. His net income from the poultry component was Rs 8,500.00 in the previous year (2019).

Output/Impact

The economics of the IFS calculated for one year is as the table below:

Table 3.1: Economics from the IFS

Gross cost (Rs.)	Gross return (Rs.)	Net return (Rs.)	BC Ratio
3,37,700	6,46,000	3,08,300	1.9:1

4 Integrated farming system

Chandonpokpi village, Chandel, Manipur

Introduction

The Integrated Farming System approach has multiple objectives of sustainability, food security, farmer security and poverty reduction. It involves use of outputs of one enterprise component as inputs for other related enterprises wherever feasible, for example, cattle dung mixed with crop residues and farm waste can be converted in to nutrient-rich vermicompost. The salient features of IFS include – innovation in farming for maximising production through optimal use of local resources, effective recycling of farm waste for productive purposes and developing a judicious mix of income-generating activities such as dairy, poultry, fishery, vermicomposting and others.

Mr. Samuel of Chandonpokpi village under KVK, Chandel practiced subsistence farming for their livelihood, in order to maximize farm productivity; the technological interventions through Integrated Farming System were adopted in participatory mode by KVK Chandel, ICAR Research Complex for NEH Region, Manipur Centre.

Name: Kh. Samuel Chothe

Village : Chandonpokpi, Chandel District

Area: 3.00 ha

Components in detail

i. **Livestock-Poultry farming:** Cattle unit with two cows and a low cost poultry unit with the capacity of 700 birds are reared. In a year, he earns a profit of Rs.72,000.00 approximately from selling 5 liters of milk every day @ of Rs. 40/L and from eggs and poultry birds he earns a profit of Rs. 1,70,000.00.

ii. **Duck cum fish farming:** A total of 50 ducks are reared near the two Jalkund tanks. He could earn a profit of Rs. 62,500.00 approx. from selling of fishes and ducks apart from using the jalkund water as a live saving irrigation for winter crops.

iii. **Cereal-Legume based cropping system:** Total area of 2 hectare is being utilized for cultivation of rice, maize, black gram, millets followed by lentil, pea, mustard and other vegetables. He could harvest around 5.20 t/ha of rice and earned a profit of Rs.1,30,000.00 from paddy, Rs.31,250.00 from maize, Rs.21,200.00 from black gram and millets, Rs.1,80,200.00 from rabi crops respectively.

iv. **Horticulture based farming system:** Around 0.75 ha area are utilized for growing horticultural crops like, banana, citrus, turmeric, tree bean, beans and king chilies etc. He earns a profit of Rs.2,50,000.00 from selling these horticultural products.

v. **A low cost vermicompost bed** was introduced to recycle the farm waste and to prepare the vermin compost. This was in turn utilized to meet the nutrient requirement of farm.

Output/Impact

The chart below represents the economics of cultivation calculated from the IFS for one year.

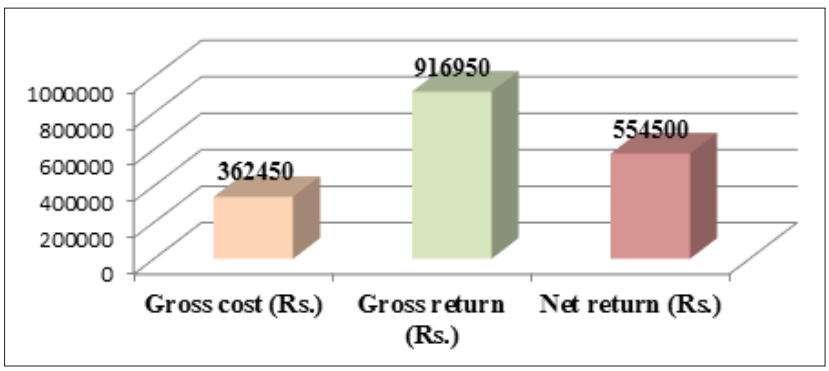


Fig 4.1: Economics of the cultivation

Changes in Parameters

Before Intervention, low cropping intensity practice prevails in the farmers' fields due to lack of knowledge about cropping systems and there was poor soil fertility management due to mono cropping and no crop rotation.

After Intervention of integrated farming practices, there was a change in cropping pattern which leads to enhanced soil fertility as leguminous crops were started to get incorporated frequently in the fields. Change in income pattern was evident from better crop productivity and intensity. Employment generation was possible throughout the year in the village because there was always something to be done at the farm and this led to the enhancement in livelihood security of the famers in the village.

5 Integrated Farming System

Darlak Village Mamit District, Mizoram

Introduction

Integrated farming System was demonstrated at the farm of a prominent progressive farmer of Darlak village by the KVK. The details of the farmer are as under:

Name: Lucy Lalduhsaki

Farmer's Name: VL Remruatpuia

Area: 3 ha

Components in detail

i. **Piggery-cum-fish culture:** A low cost pig sty was constructed on the dyke of the ponds which had a capacity of 2 pigs and the ponds of 0.22 ha.

Fish could be harvested after 8 months or after attaining an average body weight of 600 g. About 25 q of fish could be harvested from the pond and is usually sold at a price of Rs. 150.00/Kg, thereby earning an income of Rs. 3,75,000.00.

ii. **Dairy-cum fish culture:** A cow shed is constructed near a pond of 0.28 ha where the cow dung as well as the urine of the cow could easily flow into the pond.

From this system, fish is usually harvested after 6 months or up to 8 month of rearing or after the fishes have attained an average body weight if 600 g. The farmers was able to harvest about 28 q of fish and sells them at an the rate of Rs. 150.00 per Kg and earns a gross income of Rs. 4,20,000.00.

iii. **Horticulture based farming system-** The borders of the fisheries were used for planting horticultural crops such as Dragon fruit, Banana and Papaya to gain maximum income from her fields.

a. **Banana:** Banana cultivation was carried out on the banks of the ponds to provide subsidiary income. Banana variety (Local Cavendish) which was most preferred by locals was cultivated. One banana sold at Rs. 2/-. Presently she is earning Rs. 80,000/- from selling the Banana in local markets.

b. Papaya: Papaya cultivation was carried out at the banks as well as intercropping with various horticultural crops to provide subsidiary income. Red Lady and Hawaiian Solo were cultivated. One Papaya sold at Rs. 60/- per Kg. Presently she is earning Rs. 5,20,000/- from selling the Papaya at the local markets.

c. Dragon Fruit: Dragon fruit cultivation is being carried out either separately or intercropped with other horticultural crops such as Papaya. Fruits were sold at Rs 250/- per kg. Presently, she is earning an income of Rs. 20,00,000/- from Dragon Fruit.

Output and Impact

The result of the intervention in terms of income generated by the farmer is as under:

Table 5.1: Economics of the intervention

Gross cost (Rs.)	Gross return (Rs.)	Net return (Rs.)	BC ratio
20,30,000	33,95,000	13,65,000	1.67

Changes in Parameters

- Before Intervention: Low produce, poor growth, no usage of animal waste
- After Intervention: Higher productivity, higher growth rate, high profit from all enterprises and optimum usage of animal waste in the farm.

Change in income (Rs/yr.)

- Before IFS: Rs. 9,00,000/-
- After IFS: Rs. 33,95,000/-

6 Integrated Farming System

Mawsiatkhnam KVK East Khasi Hills, Meghalaya

Introduction

Shri Wallam Kupar Lyngrah, a dedicated progressive and innovative farmer, hails from the village Mawsiatkhnam of Mawlai C&RD Block, East Khasi Hills District of Meghalaya. He is a graduate and a teacher by profession. He started devoting his time focusing on better farming practices. He owns a total of 4.94 acres of land of which 2.50 acres has been converted into an Integrated Farm.

Image: Different farm enterprises

As an agriculture entrepreneur, Mr. Lyngrah felt that conventional method of agricultural cultivation minimized the yield and income. It is also associated with low productivity, increased cost on agriculture inputs and poor or no utilization of existing resources available in the farm. The conventional method also produced ecological problems on crop diversity, animals and poultry as well as soil and water pollution.

His journey towards becoming a sustainable farmer began when he was searching for a solution towards sustainable agricultural methods and it was then when he came into close contact with officials from Krishi Vigyan Kendra, East Khasi Hills District in the year 2013 and from that point onwards he was given technical guidance and all sorts of necessary knowledge for sustainable agriculture through integrated farming. He was also inspired by an exposure visit to Indian Council of Agricultural Research for NEH Region, Umroi Road, Umiam, Ri-Bhoi District Meghalaya, where he was introduced to the concept and the income opportunities of integrated Farming System. He gathered technical knowhow by attending a number of trainings programmes, seminars, workshops conducted by the KVK as well as other line departments and he took this opportunity and established an integrated farm in a total of 2.50 acres of land area since 2015 with poultry and piggery units as the main components in the farm. Equipped with a strong foundation about integrated farming, Shri Lyngrah further developed his farm and further upgraded his technical knowhow and could also incorporate additional components to his unit.

Details of Components

The integrated farm at present now has the following components distributed in a total of 2.5 acres of land:

i. Horticulture Unit

ii. Animal Husbandry and Livestock Unit

iii. Vermicompost Unit

i. **Horticulture Unit:** The horticultural unit includes vegetable crops like cabbage, cauliflower, chilli, ginger, chow-chow, etc., fruit crops like papaya, pineapple, Assam lemon, orange etc. Krishi Vigyan Kendra, East Khasi Hills District has been giving special emphasis on effective utilization of land by growing assorted vegetables all through the year which will increase the farm income and sustain the soil health. After undergoing numerous training programmes he understood that vegetable crops are occupying an important place in diversification of agriculture and is also playing an important role in food and nutritional security. In his village Mawsiatkhnam, year round production of vegetables is possible inside the polyhouse as of growing second crop in the open field is very difficult due to higher rainfall during May to October. As he could not afford to construct the polyhouse by himself he approached Krishi Vigyan Kendra, East Khasi Hills District which in turn through the Ministry of Agro Textiles in collaboration with SASMIRA has helped him

in constructing one polyhouse at a subsidized rate. Now, he could produce vegetables throughout the year and is getting year round income from this activity.

ii. Animal Husbandry and Livestock Unit

- **Poultry Unit**

He ventured into farming by starting poultry rearing with fifty nos. birds in his farm in the year 2000, however he was not getting the returns as expected. After that he enhanced his poultry farming activities by doubling the number of birds and started to rear layer birds (*BV 360*) whereby he faced problems regarding scientific poultry rearing. To overcome the problems faced by him, he started adopting new technologies in his farm so as to improve the farm productivity however he still suffered losses. On keen and close observation he observed that the birds are fond of laying eggs on corners and where there are darker shades. Realizing this, the progressive farmer constructed the laying cabins which attracted the birds for laying their eggs. A specific dimensions was maintained in the cabins which prevents breakage of eggs (0% breakage of eggs) during laying and provisions for collecting the eggs where provided in the form of hinged top covers so as to facilitate easy collection of eggs from the cabin without entering the poultry shed. By adopting this method, the farmer could increase the production of eggs from his farm and at the same time could minimize the death of birds. On an average, the modified innovative technology adopted by the farmer reduced the spoilage of eggs by 90 % and thereby increase the productivity by 80-90%. The method adopted by the farmer involves low additional investment cost along with high productivity and low mortality rate of the birds, which makes it economically more viable.


Inside the poultry layer shed


Checking on the laying cabin

- **Piggery unit**

Pigs are the most common and preferred livestock species in East Khasi Hills


Piggery unit

District of Meghalaya. Almost 80% of farming household in the region rear pigs (mostly 1-2 pigs/household) mainly for fattening purpose. The production process is traditional mainly based on indigenous breeds. Moreover, pig producers have traditional knowledge and skills for management of pigs for fattening purpose but, few have the skills to breed pigs. Hence, seeing this opportunity he started the piggery breeding unit. He is rearing 9 sows and 1 boar where one sow gives at least 1 farrowing per year. The demand of pork meat in the market is high, offering good scope to improve the system.

- **Goatary Unit**

The unit consists of 15 numbers of goats which were reared in a fenced area in which they graze. Zero expenditure was incurred for feed except for fencing, low cost shed and miscellaneous expenditure of Rs. 5,000.00 only. The goats are then sold at the local market.

- **Fishery Unit**

In the year 2018 he constructed 3 numbers of fish ponds with a production capacity of 600 Kg/0.3 ha and the average cost of the fishes in the local market is Rs 200 /Kg. The cost incurred for fingerlings, feed and miscellaneous items are minimum of Rs. 15000/0.1 ha per annum. By products from all units of the farm serve as fertilizer and feed to the fish ponds.

iii. Vermicompost Unit

He has 2 vermi-beds that are of 6x4x2 ft. each with a capacity of producing on an average 3000 Kg. of vermicompost per year which is entirely used in all his cropping enterprises in the farm. Raw materials from the farm are the substrates used for composting all year round.

Outcome

Table 6.1: Total cost Incurred and Net income received from each of the components of the Integrated Farm

Components	Area/Nos.	Gross Income	Net Income	B:C
1. **Horticulture unit**				
Protected Cultivation (since 2018)	1 (500 m^2)	1,10,000.00	45583.00	**0.71 (1st Year)**
Open cultivation	Ginger	2,40,000	182508.00	**3.20**

2. **Animal Husbandry & Livestock**				
i. Poultry	Layers	8,76,000.00	7,09,140.00	**4.25**
	Local Breed	18,000.00	8,556.00	**2**
ii. Goatary Unit	15 nos.	60000.00	38000.00	**1.73**
iii. Piggery Unit	1(9sows+1boar)	6,00,000.00	4,31,419.00	**2.4**
iv. Fisheries (estimate)	3 (1000 m^2 each)	15000.00	35000.00	**2.3**

Impact

The new technology developed by the farmer is being practiced by him for the past 3 years and is proven to be economically rewarding. Farmers in his village and of the district who own poultry sheds have been motivated by his success and those having poultry sheds have adopted the award winning innovative idea "***Low cost Poultry Layer shed***". It has been 8 years now that he has adopted new farm technologies and is integrating all the existing resources available in his farm completely for the economic and ecological improvements in which he is running his farm successfully. As a progressive farmer he is always open to skill development and is eager to know every aspect of farming through various sources *viz.* trainings, meeting experts from various line departments etc. Shri Wallam K. Lyngrah's farm is now a model farm and he is now an influencer and motivator to others farmers regarding improved cultivation/farming practices by incorporating all the knowledge he had gathered along with his own innovation**.** With the help of Krishi Vigyan Kendra, East Khasi Hills District, he has been promoted as one of the innovative farmer in East Khasi Hills district of Meghalaya. He is one of the key trainers on IFS with special reference to poultry and piggery rearing in the district. He is a role model to other farmers who are aspiring to set poultry layer farm in the district as well as in other parts of the state. His success has influenced his neighbouring farmers to adopt IFS. He has become role model for establishing a successful Integrated farming System in his block.

7 Integrated Farming System

N. Vanlaiphai Serchhip District, Mizoram

Introduction

Serchhip District occupies the central part of Mizoram, extending more to the eastern side. It lies between 23°35'58'82" and 23°00'20'84" N latitude and 92°41'06'00" and 92° 40'39'63" E longitudes. It is bounded by Aizawl district on the north, Champhai district on the east and by Lunglei district on the south and west. It also shares a few length of boundary line with Myanmar on the south-eastern part of the district. The total geographical area of the district is 1421.60 sq km which account for 6.74% of the total geographic area of the state. The district is situated at an altitude ranging from 500m – 1889m above mean sea level with an average annual rainfall of 1680 mm and temperature ranging from 4°C-34°C.

The intervention was undertaken at the farm of Mr. F. Vanlalchhara, who is a progressive farmer, hailing from N. Vanlaiphai village, E. Lungdar Block. The total land holding by the famer is 1.5 hectare.

Component in details

I. Piggery cum fish culture

Two pig sties with the size of 6 feet X 8 feet were constructed along with the water storage tank (3ft^2). The drainage of the pig dung is connected to the fish pond. Rani pig breed procured from NRC, Guwahati were kept for breeding purposes and gave birth to 8 piglets worth Rs 6000/- per piglets.

II. Fish farming

Common carp and grass carp fingerlings were released in the fish pond which yields about 800 gm/fish after 9 months, the net profit gained from the fish pond was Rs. 1,80,000.00.

III. Horticulture based farming system

A cultivable area of 0.2 ha were utilized with the cultivation of vegetables like tomato, cabbage, and leafy mustard which yield around 8 q. of tomato, 10 q. of cabbage and 50 kg of leafy mustard with the gross income of Rs. 80, 000/- per year

IV. Poultry unit

A small poultry unit was also established in the nearby fish pond in which 20 numbers of Vanaraja, a dual purpose birds were reared. This unit was recently established and it will enable the farmer to gain additional income from eggs and meat, thereby adding towards the overall income generation of the IFS.

Output /impact

The impact of the intervention shows promising result, which is evident in the following table as well as the comparison in the changes in parameters before and after adoption of integrated farming in the farmer's field:

Table 7.1: Economics of the intervention

Component	Gross cost	Gross returns	Net returns	BC ratio
Piggery cum fish	1,05,000.00	3,08,000.00	2,03,000.00	**2.9**
Horticulture based	22,500.00	80,000.00	57,500.00	**3.5**

Changes in parameters

Before intervention: Mr. Vanlalchhara is a dedicated progressive farmer from N. Vanlaiphai village, E. Lungdar block, Serchhipdistrict. He has a total land area of 1.5 ha which 1.0 ha is utilized as fish pond and the remaining land is being unutilized for horticulture. Fish pond is the main source of income but the yield is quite low due to low input and poor utilization of existing farm resources.

After intervention: He attended much training, seminars, workshops conducted by the KVK Serchhip. With the guidance of KVK Serchhip, he practices Integrated Farming by rearing pigs and poultry. Two pig sties were constructed and the pig dung was utilized as fish feed which increases the yield of the fish. He maintained backyard poultry farming through the rearing of dual purpose Vanaraja breed. He utilized the remaining 0.4 ha of his farm by cultivating horticultural crops, compressing of different types of vegetables.

8 Paddy cum Fish Culture

Tuisenphai Champhai District, Mizoram

Introduction

Tuisenphai of Khawzawl area in Champhai district is predominantly a rice growing area due to its topography and water availability. The farmers in this pocket take up lowland rice cultivation annually. However, as the land has been in use for a very long time the rice productivity has been going down gradually. Attempts were made to augment their income through double cropping (*i.e.,* growing winter vegetables). However, due to very low temperatures in winter resulting frost, double cropping was not successful.

Keeping in view the high demand of fish in Khawzawl and its adjoining areas as well as the declining economy of the rice growing farmers, the idea of paddy cum fish culture was adopted by a progressive farmer, Shri. Pu. Sanghluna of Tuisenphai village, Champhai district of Mizoram.

Details of the component

I. Paddy cum Fish Culture Rice fields are puddled and transplanting is finished by mid-July. The rice is usually harvested by 2nd week of November. A trench of 2' wide and 2' deep was dug along the bunds inside the main field. Out of 1.1 ha of the paddy field about 0.449 ha comprising of different blocks of rice fields is utilized for paddy cum fish culture. Shri. Sanghluna has a good water source to keep the fishes for further breeding after harvesting of paddy from which extra income was incurred by selling fingerlings to other farmers. He started selling fingerlings in the month of May because of high demand @ Rs 3-5/ fingerling and he could earn Rs 80,000-120000/year from fingerlings. After harvesting paddy, the field was usually converted into a temporary fish pond. He could harvest paddy around 17 quintals every year and he could earn Rs 55,000. The borders of the paddy field were used for planting horticultural crops such as mulberry, groundnut and winter vegetables etc.

II. Mulberry

1300 saplings of mulberry were introduced by Sericulture Department in his farm. He could earn Rs 8000-10000 annually.

III. Vermicomposting bed

He first came to know about vermicomposting while attending training at Krishi Vigyan Kendra, Champhai District. The trainings organized by the KVK had aroused an interest in him to take up the venture for utilizing Azolla in his paddy field. KVK Champhai District had supplied the vermicompost bed. He could harvest Azolla as well as water hyacinth almost every week from his field and utilized the same in his vermin compost bed. Once the compost is ready, he uses this for vegetable and other horticulture crops.

Output/Impact

Component wise income generation, economics and graphical representation in terms of impact of the system on income generated after the intervention are shown below:

Table 8.1: Component-wise income generation

Sl. No.	Components	Average annual Income (Rs.)	Remarks
1	Paddy cum fish culture	1,75,000.00	Income generated from fish fingerlings mostly
2	Mulberry and other horticulture crops	10,000.00	Maximum profit from mulberry
3	Vermicomposting	-	Used as input in his own farm mostly

Table 8.2: Economics of the IFS

Gross cost (Rs)	Gross Return (Rs)	Net Return (Rs)	BC Ratio
1,30,000	2,90,000	1,60,000	2.2:1

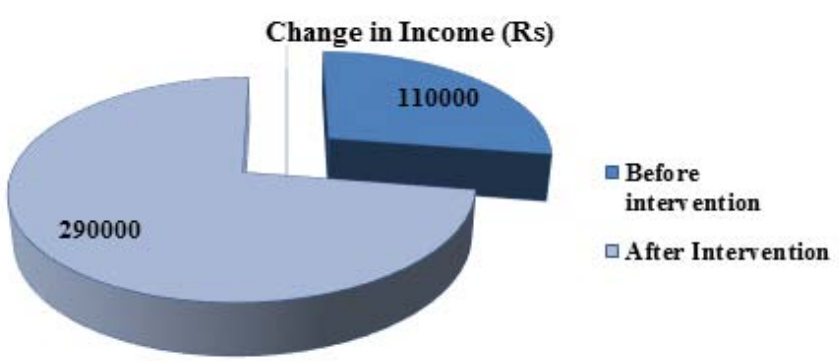


Fig 8.1: Change in income before and after intervention

9 Integrated Farming System

Laxmibill village, Sepahijala Tripura

Introduction

Integrated farming system is a holistic approach or integrated set or scientific combinations of many complementary and supplementary enterprises leading to maximize the crop productivity and enhance net farm income by optimal and sustained use of natural resources and effective use of available by-products. The scientific combinations or integration is made in such a way that product of one enterprise should be the input of other enterprise with high degree of complimentary effects on each other. Adoption of integrated farming system leads to replacement of off farm inputs, sustainable production of high quality food and stability in farm income through multiple enterprises that aim at maximum utilization of available natural resources to meet the family needs and fulfill nutrition requirement too. It aims at generating a threshold level of farm income required for the farm family to maintain sustained interest in farming.

Farmer's name: Manik Das

Village: Laxmibill

Area: 0.74 ha

Components in detail

I. **Crop component:** The IFS model comprising different crops such as cereals (rice and maize), pulses (lentil, pea), oilseeds (soybean, rapeseed), vegetable crops (cabbage, cauliflower, tomato, carrot, okra, brinjal, potato, knoll khol, chili, coriander, amaranthus, bean etc.), fruits (Assam lemon, papaya, banana) etc. were grown in an area of 0.56 ha area. The total cost of cultivation of various crop component of the model was Rs. 39,541.00. The net profit realized from crop component of 0.56 ha area was Rs. 77,046.00.

II. **Dairy component:** A dairy unit with a capacity of 1 milch cow with calf was reared in a 40 m^2 (0.0040 ha) area. The net return from dairy component was calculated

only in terms of milk production since the cow dung produced was recycled back into the model which was used as manure for crop production. The net profit released from dairy unit comes to around Rs. 17,065.00 and cost of cultivation is Rs. 21,365.00 (26.2%).

III. **Fishery component:** A farm pond of 0.16 ha area with average depth of 1.5 meter was part of the IFS model for enhancing farm income. Vegetables such as ash gourd, bottle gourd, cucumber, ridge gourd etc., were grown on a bamboo structure created above water bodies in one side of the farm pond dyke for vertical intensification. Pumpkins were raised in another side of the pond and allowed to crawl on the ground. The washings from the dairy unit were diverted twice in a week (2-3 days interval) to fish pond for promoting growth of zooplankton and phytoplankton for fish growth. The solid waste from cow shed was used for Farm Yard Manure making and vermicomposting. In composite fish culture in stacking pond fish seed of 10-12 cm length fingerlings is stocked (1200-1600 fingerlings per 0.16 ha water bodies) in layer-wise (upper 30%, middle 40% and bottom 30%). The net profit realized from water bodies come to around Rs. 1,60,000.00 (after 1 year harvested 800 kg fish and selling rate @ Rs. 200.00/kg fish) and cost of cultivation is Rs. 16,900.00 (20.7%).

IV. **Nutrient cycling:** To satisfy the crop nutrient requirement and sustainable crop production nutrient cycling within the farm is a matter of great concern. For maintaining composting unit of 80 square meter area and other important operations like residue recycling and liming etc. The expenditure incurred was Rs. 3,700.00 which account to 4.6% of the total cost. Since, the soil of the IFS area is acidic in nature, application of liming (450 Kg/ha in furrow in alternate years) is required.

Table 9.1: Economics of the IFS model

Farming System components	Total area (ha)	Rice Equivalent Yield (t)	Cost (Rs)	Net returns (Rs)
Crops (Cereals, oilseeds, vegetables, pulses, fruits, flowers and fodder crops)	0.5668	7.37	39541	77046
Dairy (1 milch cow + 1 calf)	0.0040	2.56	21365	17065
Fishery component	0.16	3.65	16900	160000
Total	0.74	13.58	81,506	2,50,411
Net income/day				686.00

Considering the benefits from the IFS model with a net return of Rs. 2,50,411.00 per year from 0.74 ha area, a net income of Rs. 20,867.00 per month or Rs. 686.00 per day was achieved which is a modest amount for living by a four member family (2 adults and 2 children). Assuming of food requirement and other expenditure per day for a four member

family (2 adults and 2 children) for rice (1,300 g, Rs. 39.00), lentil (150 g, Rs. 18.00), oil (300 g, Rs.30.00), vegetables (1000 g, Rs. 50.00), fruits (400 g, Rs. 40.00), fish (110 g, Rs.22.00), meat (100g, Rs.20.00), others (milk, eggs etc. Rs. 20.00), a total of Rs. 239.00 is required per day towards food. However, there is further need to enhance the income to meet the other requirement of the family *i.e.,* medicine, schooling, clothing and other essential needs etc.The model seem to be the solution to the problems of increasing food production, enhancing farm income, improving nutrition of the small and marginal farmers of Tripura with limited resources.

10 Integrated farming system

Ukhomgshang village Thoubal District, Manipur

Introduction

An integrated approach to agriculture leads to sustainability and an ever increasing pattern in farm yield and managing resources. Sustainable agriculture through an integrated approach addresses all three critical aspect of sustainability; *i.e.,* economic, environmental and social issues. The IFS approach has multiple objectives of sustainability, food security and poverty reduction. It involves use of outputs of one enterprises component as inputs for other related enterprises wherever feasible, for example, cattle dung mixed with crop residues and farm waste can be converted into nutrient rich vermicompost, which can be used as input in a farm.

In terms of agriculture, crop water requirement in the state of Manipur is entirely depended on rainfed agriculture and rice occupies more than 80% of the agricultural area in the kharif season. The land holdings are small and the farmers practice subsistence farming for their livelihood. The northeastern people are meat lovers and a huge demand exists for poultry, pork and other meat products. Invariably, there exists deficit in crops, livestock and fishery products. Hence, in order to maximize farm productivity, the technological interventions through integrated farming system were adopted.

The intervention was practiced in the farm of a progressive farmer named Phijam Thoiba Singh of Ukhomgshang village. The total area under the intervention is 0.4 ha.

Components in details

Paddy cum fish culture (PFC) is fish farming with paddy. This system is profitable and sustainable, as paddy and fish can be harvested as a unit from the cultivable area. The wet terrace rice fields where surface and ground water is sufficiently available, can be utilized for development of PFC. The plot is renovated by excavating canals, pools, and trenches to retain water for sheltering the fishes during the summer months. The water stored may also be used for irrigating the plot.

- Total area of paddy cum fish culture = 0.4 ha.
- Fish breeds like common carp and rohu were stocked @stocking density of 6000/ ha.

Table 10.1: Stocking of the fingerlings

Species	Stocking density	Average weight during stocking
Common carp	1000	10 -15 gm
Rohu	1500	10gm

Output/ Impact

He could harvest 1.58 ton of paddy from 0.4 ha and he was able to earn Rs.9000.00 as profit from paddy. A total of 95 kg of fishes was harvested with a gain profit of Rs. 14550.00 from fish alone within 3 months of fish culture. The tables and chart below depicts clearly the promising result obtained from the farming system.

Table 10.2: Harvesting of fish after 3 months culture

Species	Average weight	Total weight harvested (Kg)	Amount (Rs.)
Common carp	150 gm	55 Kg	13,750
Rohu	100 gm	40 Kg	10,000
Total		**95 Kg**	**23,750**

Table 10.3: Economics of the paddy cum fish culture

Items	Gross cost (Rs.)	Gross return (Rs.)	Net return (Rs.)	BC ratio
Paddy	31000	40000	9000	1.29
Fish	9200	23750	14550	2.58
Total	**40,200**	**63,750**	**23,550**	**1.5:1**

Changes in parameters

Before intervention

- Only rice could be harvested from the paddy field.
- Income generation is relatively less as compared to integration of paddy with fish.

After intervention

- Enhanced rice yield through indirect organic fertilization through fish excreta.
- Additional income and diversified harvest *i.e.,* fish and rice
- Fish controls the unwanted filamentous algae which may otherwise compete for the nutrients.
- Rice field serves as fish nurseries.
- Economical utilization of land.

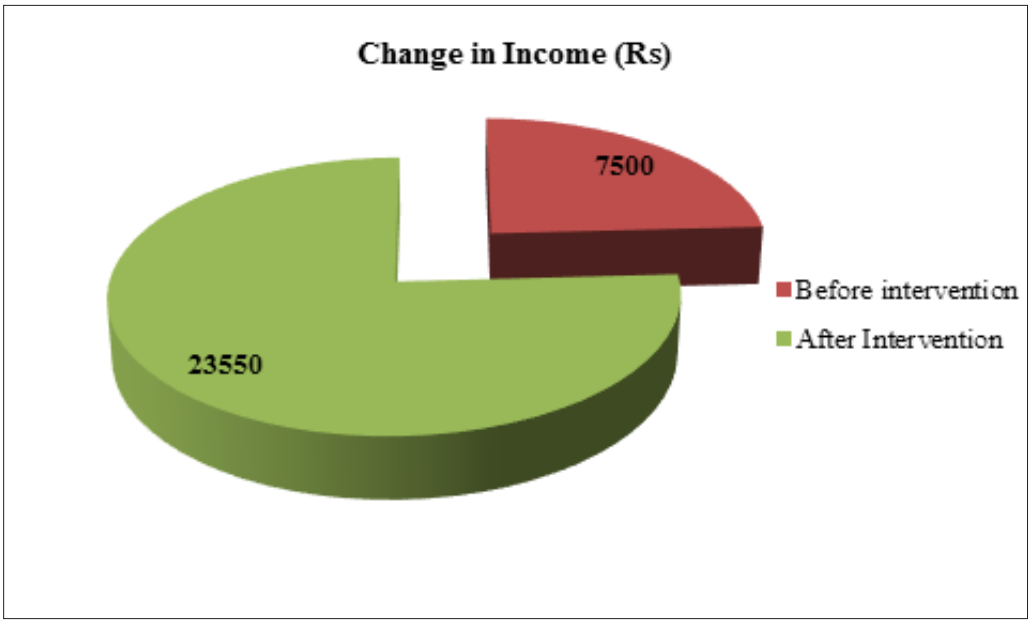


Fig 10.1: Change in income before and after intervention

11 Integrated Farming System

Hnahthial, Lunglei District of Mizoram

Introduction

Integrated Farming System was demonstrated at the farm of a progressive farmer hailing from Hnahthial village, Lunglei District of the state of Mizoram. The farmer's name is Mr. Lalhmingsanga Sailo and his farm covers an area of about 0.25 ha. Integrated Farming System with Piggery cum Fisheries as a main component was conducted at the farmer's farm and he was probably the first farmer in the village or even the district to conduct such intervention. With the intervention from the KVK, the farmer has been reaping the benefits from his farm for two years now. Since most of the people in the village obtain their protein from meat and fish, the intervention was highly adaptable as the yield of fish from the system has been proven to be much higher than conventional farming.

Details of the IFS

A low cost pig sty was constructed on the embankment of his farm pond with locally available materials. 3 numbers of Large White Yorkshire breed piglets were distributed to the farmer. Pig dung, urine and washing of the pig sty were directly released into the pond. For composite fish culture comprising of both Indian Major Carp and Exotic Carp were under taken. Fish fingerlings were stock at 2000 nos. in the pond. No other supplementation feed was provided to the fish and the cost of cultivation was slashed considerably. The total area of 0.25 ha is cultivated as Pig cum Fish farming with vegetable crops.

Outcome

With the intervention from the KVK, the farmer could realize maximum output in terms of revenue from his farm. The economic detail from the different enterprises undertaken in the farmer's field is listed in the table below:

Table 11.1: Economics of the different enterprises

Intervention	Gross cost (Rs.)	Gross return (Rs.)	Net return (Rs.)	BC Ratio
Piggery	16800	43500	26700	2.58
Fisheries	14500	32000	17500	2.2
Vegetable cultivation	15700	54300	38600	3.45

The chart below represents the comparison between the 1st and 2nd year in terms of economic achievement of the intervention which was conducted at the farmer's farm. The income generated during second year was high because of the reduction of cost of cultivation:

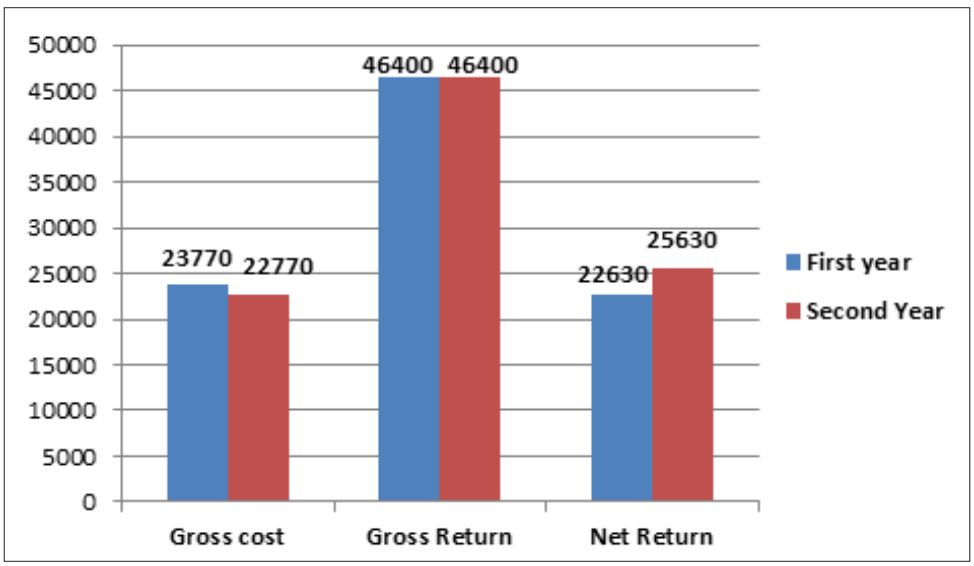


Fig 11.1: Comparison between the 1st and 2nd year of the IFS

The benefit cost ratio was also calculated to be 1.95 and 2.23 during the 1st year and 2nd year respectively.

Impact

KVK, Lunglei made intervention of IFS (Pig cum Fish farming) through technology demonstration under NICRA Project. About 3 numbers of progressive farmers in the

Hnahthial village were selected for carrying out the intervention. Mr. Lalhmingsanga Sailo, a progressive farmer from Hnahthial village was highly successful from the intervention undertaken at his farm and the outcome from the IFS was highly appreciated. The demand for fish and meat in the village is very high and he has no problem in selling his produce in the local market. His success has now motivated other farmers for practicing IFS on pig cum fish farming as the main component in the village.

12 Popularization of Fish cum Duck farming

North Tripura district

Introduction

The farmers of North Tripura district are mainly associated with traditional fish culture methods like culture of Indian Major Carps, exotic carps and few other minor carps in traditional way under normal fish culture activities. The earnings from this type of traditional fish culture practices are less compared to culture of high value commercial fish species. However, there is very little knowledge about integrated farming system among the farmers of this region. Keeping this in mind, development of IFS module (Fish cum Duck farming) appeared to be an innovative as well as high earning source of fish culture practice in this district.

Raising ducks over fishponds fits very well with the fish poly-culture system, as the ducks are highly compatible with cultivated fishes. Ducks fertilize the pond by their droppings, resulting in complete savings on pond fertilizer and supplementary fish feed which accounts for 60 per cent of the total cost in conventional fish culture and they need very little feed. Ducks loosen the pond bottom with their dabbling and help in release of nutrients from the soil which increases pond productivity. Ducks aerate the water while swimming and been termed as biological aerators. Duck houses are constructed on pond dikes; hence, no additional land is required for duckery activities.

Intervention

An innovative approach was undertaken by Krishi Vigyan Kendra, North Tripura for development of Fish cum Duck farming with Indian major carps and khaki Campbell variety of Duck among the special interested groups of farmers in different places of North Tripura district. Under this activity at first beneficiaries were selected based on their interest and two numbers of training programmes were conducted by KVK among the interested farmers.

Technology details: Duck cum fish culture

A total of 30 nos. ducklings of 25 days old were given to four farmers at Chandrapur GP under Dharmanagar Sub-Division under KVK-OFT (F.Y. - 2015-16). Also, 2000 nos. fish seed / trial were distributed. Area per trial was 0.16 ha, and the culture period was 10 months.

Outcome and Impact

The difference in outcome between the farm with integration and the one with conventional method of fish farming are as follows:

Table 12.1: Ponds with Khaki Campbell ducks

S. No.	Particulars	Yield
1	Duck meat	35kg/unit
2	Fish	1980 kg/ha
3	Egg laying	1200 no. egg/ trial
4	B:C Ratio (GR/GC)	4.15

Table 12.2: Control ponds with normal fish culture methods

S. No.	Particulars	Yield
1	Duck meat	32kg/unit
2	Fish	1300 kg/ha
3	Egg laying	532 no. egg/ unit
4	B:C Ratio (GR/GC)	2.12

Impact of the Technology

The inputs like duckling, pellet fish feed and fish fingerling were distributed free of cost to the farmer under the trial. The male ducks were sold out by the farmers when their weight reached 2 kg and above and their eggs were marketed at nearby market at a reasonable price. Two of the progressive farmers namely Sri Bijit Paul and Dipan Paul among this farmers group had kept 50 eggs separately and hatched them out to have a fresh stock of ducklings.

The demand of the duck meat as well as duck eggs is high in the region, duck eggs were sold @ Rs. 4.00 / piece and duck meat were sold @ 200.00 / Kg. Fishes were sold on an average @ Rs.150.00- 200.00/Kg. They received average net income of around Rs. 64,100/ 0.16 ha which was much higher compared to normal fish culture practice which was around Rs. 17,000/ 0.16 ha. After their great experience with the Duck cum fish farming practice, those farmers also started sharing all of their experiences and related information about the benefit of integrated Duck cum fish farming with their neighbors and other farmers.

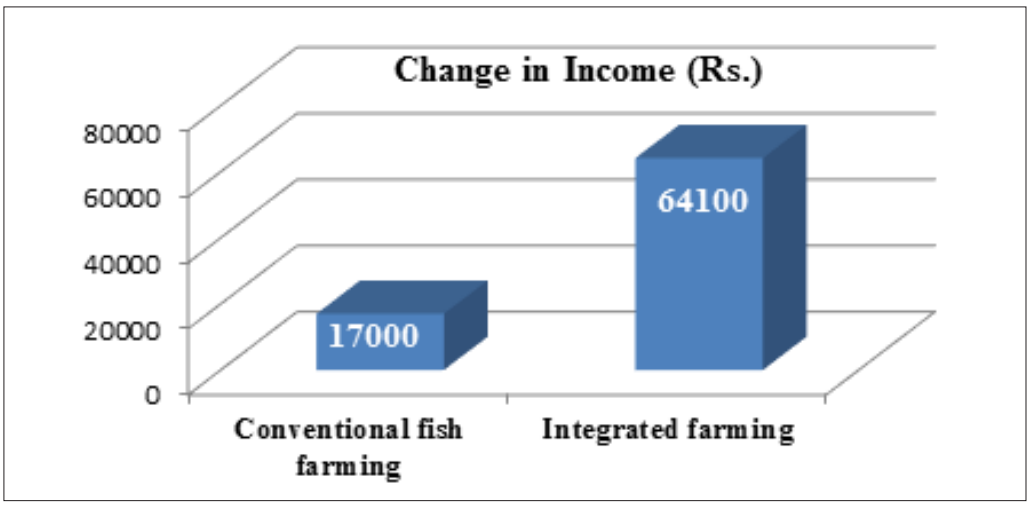


Fig 12.1: Change in income before and after intervention

Impact and Horizontal expansion

Looking into the success of the above mentioned model, similar model of Duck cum fish culture was started in South Padmabil GP, West Panisagar GP and Uptakhali GP under Panisagar Sub division under North Tripura District among the different interested farmer's groups. This in turn improved their livelihood and socio economic status like other parts of India. Of late more and more farmers are coming frequently in the KVK North Tripura office for taking training and gathering knowledge about the benefits of Duck cum fish farming and about other integrated fish farming as well. This shows the wide and horizontal expansion of this culture technology among the rural fisher folk of this District.

13 Integrated Farming System

Dobogre, South Garo Hills, Meghalaya

Introduction

Integrated farming system, fish cum poultry cum horticultural crop at Dobogre village, South Garo Hills includes poultry house built over the pond, fish rearing in the pond, vermi compost unit and turmeric plantation on the embankment of pond. Poultry dropping fertilizes the pond water and helps to enhance the natural fish food organisms resulting in no supplementary feeding. It is mainly introduced to utilize the given unit area efficiently and to increase farmers income. Such IFS enhance the farmer's income by producing poultry meat, eggs, vermicompost and turmeric along with fish at low cost.

Farmer's Name: Jolitha Ch. Marak

Village: Dobogre

Area: 0.1 ha

Components in detail

Fish cum poultry cum horticultural crop:

Fish fingerlings weighing around 10g/fingerling are stocked in the pond @800 fingerlings/0.1 ha. A total of 420 kg fish is harvested after 11 months of rearing without any supplementary feeding (Average body weight of fish is 600g) and sold at 180/kg.

A low cost poultry house made of bamboo and thatch having the capacity of 25-30 nos. of poultry birds (30 ft^2) is built over the pond to fertilize 0.1 ha area of pond water. 25 numbers of 4 weeks old Vanaraja are reared by feeding kitchen waste, rice and rice bran

for 12 months and produced 540 numbers of egg and 57 kg meat. Eggs and meat were sold at Rs.10 and Rs. 250/kg respectively.

The horticultural crop, turmeric (Megha Turmeric-1) is planted on the pond embankment having total area of 148.53 sq.m and yielded 150 Kg.

Vermicompost unit on the pond embankment produces 1800 Kg in a year and the harvested vermicompost were sold at Rs.20/ Kg. It is also used in the turmeric plantation as organic manure.

Output/Impact:

Table 13.1: Economics of the intervention

Gross cost	Gross return (Rs.)	Net return (Rs.)	BC ratio
25,000	1,36,750	1,11,750	5.5

Changes in Parameters

- **Before Intervention**: Before intervention, main source of income was from fisheries only, this was very low. Supplemental feed was also provided and this makes the input cost to be very high. The mode of farming before the intervention of integrated farming by the KVK was highly unsustainable in all fronts and farmers used to suffer tremendously especially in terms of income.

- **After Intervention:** After the intervention of the KVK, a somewhat complete Integrated Farming System was established in the farmer's farm. Waste generated from each component could be used as input for the other and this made the cost of input to reduce to a great extent. For instance, since the poultry unit was constructed just over the fish pond, droppings from the poultry provide supplemental feed to the fishes thereby eliminating the need for external supplemental fish feed. This also made

the fishes to grow much quicker than the ones with conventional system of rearing and the output and yield is thus much higher. The farmer could also obtain income from the selling of eggs as well as from poultry meat. The farmer is also engaged in the process of vermicomposting where he uses it as source of nutrient for growing his crops. Overall, the income generated from the whole system is very high and the cost of input is also reduced.

The farmer was very much pleased with the intervention from the KVK on his farm and it is definitely a source of inspiration to other farmers in the village alike. The outcome in terms of income is very much evident as prior to the intervention, the main source of income was from fisheries alone which was only about Rs. 30,000.00 per annum and now the income generated from the farm is over Rs. 1,11,750.00 per annum.

14 Integrated Paddy cum Fish farming

Ri Bhoi District, Meghalaya

Introduction

Cultivation of paddy as sole crop in low land valley ecosystem is highly prevalent in Ri Bhoi region of Meghalaya and the type of cultivation yields low productivity and income to the farmers. In order to boost the income of famers and also for meeting the target of doubling the income of farmers by the year 2022, paddy cum fish integrated farming system was introduced to the farmers in low lying areas. This system compliments each other with utilization of different ecological niches and function together which lasts for 6-8 months depending upon the availability of water. Fish lives in between the dense paddy which helps as a hideout against birds, in return fish provides fertilizer with their droppings, eat insect pests and help to circulate oxygen around the paddy field resulting in paddy yield enhancement. Realizing the importance of paddy-fish farming, the technology was standardised by the Division of Fisheries, ICAR Research Complex, Umiam so as to enhance the farm income of the farmers. KVK Ri Bhoi undertook OFT at three different villages *viz.,* Kyrdem and Umsawriang covering one hectare area in five different farmers' fields during the year 2018-19 to enhance the system productivity and income of the farming community in the district.

Methodology

Modifications in the paddy fields were done by digging canals or trenches in various forms having a depth of 0.5-0.6 m deep and 1 m wide which serves as a refuge for fishes. The dyke was elevated with gentle slope which can retain or withstand if the water level rises and installed with inlet and outlet protected with fine screening. Depending on the location, fencing with netting material was used to prevent fishes from escaping during heavy rains. Transplantation of paddy was done when the field was ready. After two weeks of transplantation, fingerlings of Amur common carp (main species), catla, rohu, mrigal, silvercarp, grass carp, gonius were stocked @ 6000-7500 nos./ha of paddy area. The fish fed were mainly with rice bran and mustard oil cake in the ratio of 1:1 whenever required. Paddy and fishes are usually harvested at the same time or depending on the availability of the water.

Outcome and impact

The result revealed that the paddy cum fish integrated farming system produced 63.33 q/ha as compared to monocropping of paddy yield with 15q/ ha and fish yield was 4q/ha for 100 days culture period. The net return profit was Rs 127550.00 per ha with the integration of paddy and fish with B:C of 3.1 as compared to mono-cropping of paddy. The farmers were happy with the integration of fish cum paddy as compared with mono-cropping of farming in terms of yield, income and system productivity.

Table 14.1: Paddy cum Fish Farming in Ri Bhoi District of Meghalaya

Details of Technology	Yield/ ha	Cost (Rs/ unit)	Net Return (Rs/ha)	BC Ratio
Paddy cum Fish Yield	■ 63.33 q paddy ■ 4 q fish (100 days culture period)	62450	127550	3.1
Mono cropping Paddy	15	20750	24250	2.16

Another such intervention was undertaken in two other villages in the district. The detail of the intervention is as under:

This intervention was demonstrated at Sohriewblei and Pahambirthem villages of Ri Bhoi District and three farmers were involved. The low lying paddy fields which are prone to floods and crop failure were selected for this intervention. With this practice, the income of farmers has also enhanced per unit area. There is also reduction in the production cost of fish which reflects in minimizing the input cost of production in paddy and fish.

Methodology

The demonstration was conducted in three different farmers' farms *viz.,* Shri Shlei Tamu, Shri Medistar Lyngdoh and Shri James Maring. The farmers hailed from villages Sohriewblei and Pahambirthem respectively under Ri-Bhoi District of Meghalaya. The total area under the demonstration is about 0.05 ha. A total of 600 numbers of fish fingerlings, mostly Indian Major Carp were released to the paddy fields for the purpose of enhancing the production of paddy and attaining additional income from fisheries. Vegetable crops such as maize, cucurbits, pulses and ginger were also grown in small quantity in the vicinity of the farm for self consumption and for gaining additional income also.

Outcome and Impact

It was reported that the yield of fish was 4 q/ha for 100 days culture and yield of paddy was 66.33 q/ha (135 days). It was also reported that the yield of fish without paddy was about 55 kg from 0.01 ha area and fish yield from the paddy integrated system was 150 kg from 0.01 ha area. The average annual income received by the farmers before and after the intervention was Rs. 42,800.00 and Rs. 95,750.00 per farmer respectively.

Table 14.2: Paddy cum fish culture

Sl. No.	Intervention	With IFS	Without IFS
1	Fish yield from 0.01 ha area	150 Kg	55 Kg
2	Paddy yield (135 days)	66.33 q/ha	
3	Annual average income (Rs.)	95,750.00	42,800.00

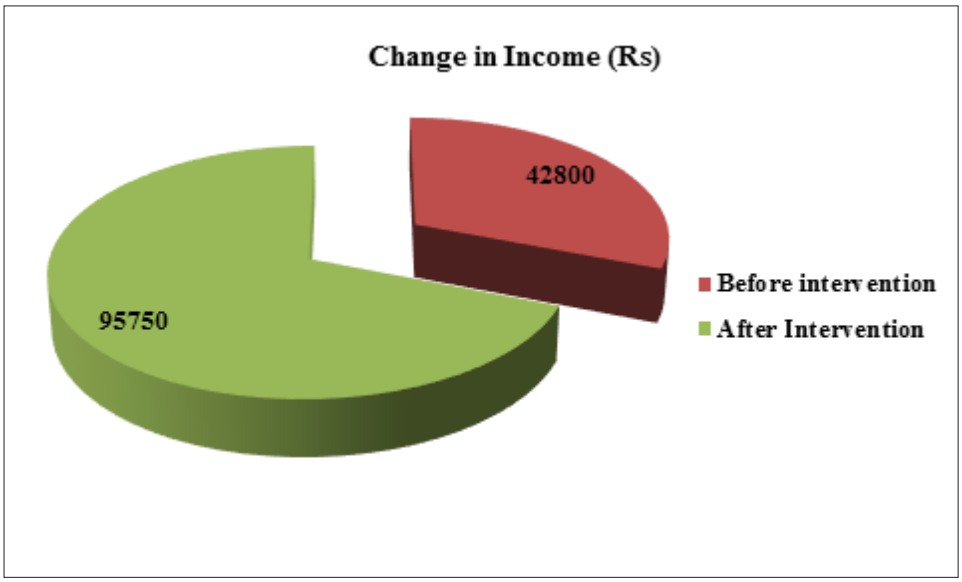


Fig 14.1: Change in income before and after intervention

The intervention was well accepted by the famers and horizontal spread of the intervention seems imminent as neighbouring farmers were highly impressed by the intervention. Optimistically, this practise will definitely have an impact on the farming practises of the farmers in the village as a whole and it might also pave way towards improving the income of farmers of the villages to some extent.

15 Integrated Fish cum Poultry Farming System

Sohriewblei village, Ri-Bhoi, Meghalaya

Introduction

The system was demonstrated at different farmers' farms at Sohriewblei village of Ri Bhoi District and the name of the farmers are Shri Lumlang Masharing, Shri Jus Makri and Shri Sainbor Masharing. The total area covered which was demonstrated to the farmers was 0.05 ha in all. Previously, the farmers were not totally aware on the benefits of such practices and after the intervention the results achieved were highly appreciated by them. Besides poultry and fisheries, vegetable crops and other crops were also grown in the adjoining vacant spaces and this has enabled the farmers to attain additional income.

Methodology

In this system, improved dual purpose poultry 'Vanaraja' breed was used which were supplied to the farmers. Each farmer received 30 numbers of birds. In addition, about 1500 numbers of Indian Major Carp fingerlings per 0.1 ha pond area was supplied to the respective farmers so as to drive the advantages from complimentary economic factors with the rearing of poultry. Poultry sheds were constructed near the fish ponds itself. Crops grown in the vicinity of the farm includes maize, bottle gourd, pumpkin, chilly, black gram, ginger etc. and this has enabled the farmers to obtain additional income.

Outcome and Impact

Based on the recommendations made by the KVK personnel, the outcome from the system is highly promising and neighbouring famers are also encouraged to take up such type of farming for sustainability and profitability. The growth of fish from the

system is much higher than that without poultry and thereby impacting on the yield and overall income. The revenue generated from the system, however, is much higher from eggs than any other enterprise, followed by fisheries then from poultry meat and finally from the crops grown in the available spaces in the farm. Egg production was reported to be on an average of 10 numbers per bird per month and income generated was to the tune of Rs. 26,500.00 per unit. Fish yield was reported to be 165.5 kg per 0.1 ha of pond area. The benefit cost ratio was reported to be 3.3 from the system, which is highly promising for horizontal expansion to the neighbouring famers in the village and neighbouring villages also.

The chart below shows average income distributed between different enterprises from the system.

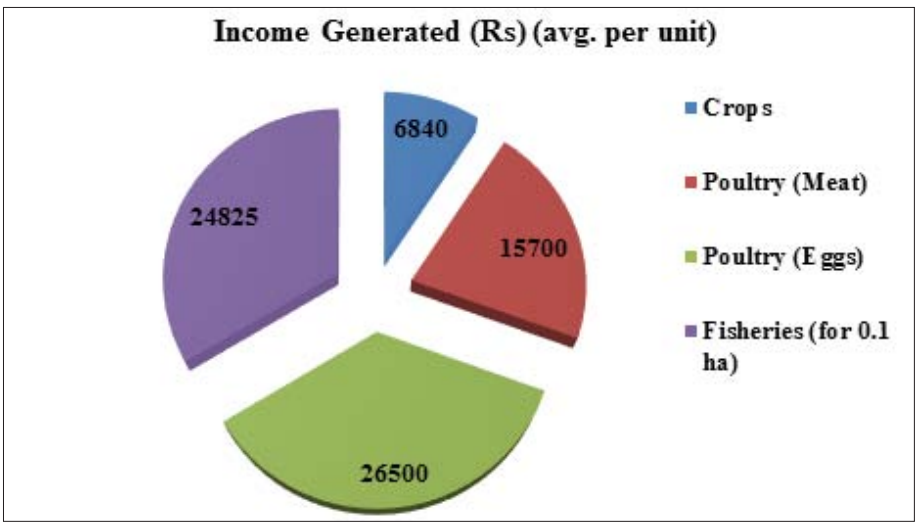


Fig 15.1: Distribution of income from the IFS

16 Vegitable based Integrated farming system

Pekucherra village, North Tripura

Introduction

Prasenjit Das, a progressive farmer of Pekucherra village of North Tripura is a successful farmer IFS in his farm land. He has been associated with farming for over 30 years now, but he normally practises traditional methods of crop cultivation. In consultation with KVK North Tripura in 2014, he started IFS along with high value exotic vegetable (Capsicum) cultivation. He is now the best Farmer with Scientific IFS models in the District and also received recognition from "Tripura Agricultural Graduate Association (TAGA)" for his contribution towards progressive farming. He is also the lead fellow for production linkage business in the district and creating market channel for the last 15 years.

Intervention

An approach was undertaken by Krishi Vigyan Kendra North Tripura during 2014 with the financial help of ICAR ATARI Zone VII and ATMA. KVK, North Tripura is involved for integration of different components, scientific fish culture, composite fish culture, dairy and Goatery, Soil test based fertilizer application, scientific cultivation of exotic vegetables like capsicum, red cabbage, Broccoli, Bok Choi (a type of Chinese cabbage) etc. Integrated pest management and integrated nutrient management were also demonstrated in the farmer's farm and popularized in the neighbouring farmers of Pekucherra village. Adoption of integrated farming system (IFS) with minimum chemical fertilizers/inputs and practicing exotic vegetables was the target for farmer for doubling farm income against conventional system.

Technology adoption

Based on his experience on IFS model, he started two fishery units for composite fish farming, Goatery with 15-20 nos. of Black Bengal goats and dairy farming with 5 nos. of jersey cow and 3 nos. of bull. Exotic crop cultivation through capsicum cultivation using variety Indra was also incorporated in the system.

Output and Impact

The output/ outcome of integrated farming practice are described in the table below:

Table 16.1: Economics of the different enterprises

Crop Enterprise	Technology	Yield	Gross Cost (Rs/acre)	Gross Return (Rs/ acre)	Net Return (Rs/acre)	B:C Ratio
Capsicum cultivation in the IFS	Cultivation high value vegetable crop (Capsicum) with minimum chemical fertilizers/ inputs	12 t/ acre	1,48,600	600,000.00	**451400.00**	4.04:1
Capsicum cultivation before	Cultivation high value vegetable crop (Capsicum) with conventional system	10 t/ acre	1,18,600	450,000.00	**331400.00**	3.79:1
Economics from the IFS						
IFS with capsicum (Horti-Dairy-Fishery-Goatery)-2017	Horti Crop - capsicum	12.00 t/ acre	148600	600000.00	451400.00	4.16:1
	Dairy -	2000 L	30000	100000.00	70,000.00	
	Fishery	500 Kg	12000	100000.00	88,000.00	
	Goatery	10 nos.	8000	20000.00	12,000.00	
	Cereals/ pulses/ oilseeds/ fodder	Combined	30000.00	130000.00	1,00,000.00	
Total IFS			**228600**	**9,50,000.00**	**721400.00**	

Before going for integration of agriculture and allied components, farmers of Pekucherra village and nearby areas used to practice traditional vegetable cultivation. The paddy fields were left as fallows during winter because of high input costs. Similar conditions were observed in the adjoining villages and after witnessing the impact of IFS, they approached the KVK for similar kind of intervention at their respective farms. As a result, more than 105 farmers are now engaged in IFS.


Model-II
1. Fishery
2. Duckery
3. Piggery
4. Poultry
5. Horticulture
6. Bee Hive