

Integrated Farming System as a Real Time Contingency for Sustainability and Livelihood Security - A Success Story

Integrated Farming System (IFS) emphasizes inter-related set of enterprises so that the “waste” from one component becomes a resource input for another component and thus reduce cost of production and improves production and/ or income.

The National Innovation in Climate Resilient Agriculture (NICRA) action research project is in operation at Chikkamaranahalli cluster (Chikkamaranahalli, Chikkamaranahalli Colony, Chikkaputtayanapalya, Mudalapalya and Hosapalya), Nelamangala Taluk, Bengaluru Rural district since 18th January, 2011. The normal rainfall of the area is 751.9 mm with erratic distribution and comes under Eastern Dry Zone (Zone-5) of Karnataka. The area is dominated by resource poor marginal and small farmers. The predominant crops and cropping system in the area are monocropping of finger millet with alkadadi crops in traditional system prior to the intervention.

Monocropping of finger millet, imbalanced fertilizer use, delayed onset of monsoon, intermittent dry spells, lack of awareness about improved varieties and dryland production practices are the major constraints in crop production, as indicated during Participatory Rural Appraisal Report (PRA) and bench mark survey. Based on the farmers needs and bio-physical resources, technical interventions have been taken up under different themes, under NICRA, emphasizing real time contingency measures for the domain.

Agromet-advisory services and crop-weather bulletins are issued twice a week (Tuesday and Friday) in collaboration with All India coordinated Research Project on Agrometeorology (AICRPAM) and India Meteorological Department (IMD) and messages are written in front of milk collection centers notice board of Chikkaputtayanapalya and Hosapalya for the benefit of beneficiary farmers under project and farmers of surrounding villages. Soil samples collected using GPS Geopoints and soil health cards containing soil physico-chemical properties were issued. The fertilizers were recommended to individual farmer based on soil test results.

Custom hiring centre comprising of hand tools, bullock drawn implements and water lifting pumps has been established at Chikkaputtayanapalya.

A farmer by name Sri Gubbanna S/o Shivanna, Chickmaranahalli village, Nelamangala taluk, Bengaluru rural district, having 1.0 hectare of rainfed land was chosen for IFS intervention program. Farming is the prime occupation of the farmer, practices dairy farming as subsidiary enterprise and feeds family of five members. Earlier the farmer had a farm pond of 250 m³ capacity without lining. The farmer was growing finger millet + *akkadi* in a traditional system. The farmer was advised to intensify cropping with finger millet + pigeonpea (8:2), finger millet varieties for different sowing windows, pigeonpea + field bean/cowpea (1:1), groundnut + pigeonpea (8:2) and also mango + finger millet/ horsegram based agri-horti system. Also, agro forestry tree species silver oak was introduced on bunds. The farm pond was lined with bricks and advised to divert runoff water into the pond and cultivated azolla and fishes in farm pond.

Impact of the intervention

NICRA action research project on dryland agriculture with its main focus on climate resilient demonstration motivated the farmer to grow long duration varieties of finger millet *viz.*, MR-1, MR-6 for early sowing, medium duration varieties such as GPU-28, ML-365 and GPU-66 for mid sowing, while short duration variety GPU-48 for late sowing, along with local variety for comparison.

Among the three varieties, long duration variety MR-1 recorded a net income of Rs. 8609; the medium duration variety GPU-28 registered a net income of Rs. 8103. Short duration variety GPU-48 recorded a net income of Rs. 7487 under late sown condition over four years from an area of 0.2 ha respectively. The farmer was convinced with the performance of MR-1, GPU-28 and GPU-48 during early, mid and late sowing conditions and convinced about the income generated and right variety for the right time of sowing. Surrounding farmers were also convinced about success of early, mid and late varieties and adopted these varieties in the upcoming season.

Simultaneous sowing of groundnut + pigeonpea (8:2) cropping system and opening of conservation furrow in between paired rows of pigeonpea at 30 days after sowing with improved high yielding varieties and production practices increased the yield of main and intercrop (59%) with improved technology as compared to traditional production practices. The farmer was very impressed with the performance of both main and intercrop and paved way for horizontal spread of improved technology.

Simultaneous sowing of pigeonpea + cowpea (1:1) or pigeonpea + fieldbean (1:1) cropping system with improved high yielding varieties fetched more income of Rs. 6767 and Rs. 7936

respectively, to the farmer as compared to sole pigeonpea Rs. 5192.

The farmer was maintaining three milch cows and growing fodder maize in 0.1 ha area to meet the fodder requirement. Azolla grown in farm pond was fed to cows along with concentrated feeds and observed on an average increase of 1.5 liters milk per day and he realized an additional net income of Rs. 39,650 from dairy component. Simultaneously fish rearing helped to realize additional net return of Rs. 6000. Further, the kitchen garden maintained around the farm pond (drumstick, chilly, curry leaves and nourishing mango seedling) yielded a profit of Rs. 1700.

Before the introduction of improved interventions, the farmer was growing finger millet + *akkadi* crops and sole crops like pigeonpea and groundnut, which was enough to feed his family only without any extra income to his family. Sometimes due to this erratic rainfall, complete crop could fail and force the farmer to distress. At this situation real-time contingent crop planning worked well with the advice given on various technologies like rainwater harvesting, growing of vegetables using farm pond water, finger millet + pigeonpea (8:2), groundnut + pigeonpea (8:2), pigeonpea + cowpea/fieldbean (1:1) cropping system etc., and subsidiary activities like dairy, fishery, azolla cultivation which made him to generate additional income and employment.

From 2014-15, the farmer under took different cultivation practice as advised by the All India Coordinated Research Project on Dryland Agriculture (AICRPDA), NICRA team and introduced improved technology which made him to realize profit besides conserving the natural resources *viz.* soil, water and other biomass. Table-2 shows the year wise net income realized with different interventions under rain-fed conditions by the farmer even under erratic rainfall condition. The farmer could generate employment for 438-460 man days with IFS approach (Table 2) with improved net income ranging Rs. 1,11,249 to 1,43,735 even during the distress rainfall years.

Further the soil health improvement in-terms of organic carbon (0.24 - 0.31%) and available major nutrients were also observed with integrated farming approach (Table 3).

The main factors contributing for the success of farmer is *Ex-situ* harvesting of runoff water, storing in lined farm pond and efficient utilization of the stored water by adopting IFS approach. After the success of these intervention, many farmers in and around the project expressed their interest and implemented the different component and technologies.

Table-1: Comparative economics of IFS under rainfed condition (pooled data of four years)

Finger millet based cropping system						
Intervention	Area (ha)	Yield* (kg)	CoC (Rs.)	NR (Rs.)	B:C	
Improved practice	FM + PP(8:2)	0.2	636	5491	7622	2.51
Farmers practice	FM + Akkadi	0.2	492	5820	4129	1.71
* Finger millet grain equivalent yield						
Employment generation (man days)	55					
Finger millet Varieties						
Intervention	Area (ha)	Yield* (kg)	CoC (Rs.)	NR (Rs.)	B:C	
Improved practice	MR-1	0.2	434	4802	8609	2.82
	GPU-28	0.2	417	4802	8103	2.71
	GPU-48	0.2	409	4802	7487	2.61
Farmers practice	Local variety	0.2	362	4802	5236	1.88
Employment generation (man days)	50					
Groundnut based inter-cropping system						
Intervention	Area (ha)	Yield* (kg)	CoC (Rs.)	NR (Rs.)	B:C	
Improved practice	GN + PP(8:2)	0.1	434	7135	17341	3.43
Farmers practice	GN + Akkadi	0.1	333	6641	12045	2.81
* Groundnut pod equivalent yield						
Employment generation (man days)	40					
Pulse based inter-cropping system						
Intervention	Area (ha)	Yield* (kg)	CoC (Rs.)	NR (Rs.)	B:C	
Improved practice	PP+FB (1:1)	0.1	119	2874	7936	3.76
Farmers practice	PP+CP (1:1)	0.1	105	2874	6767	3.35
Farmers practice	Sole PP	0.1	84	2365	5192	3.20
* Pigeonpea equivalent yield						
Employment generation (man days)	20					
Mango based Agri-Horti system						
Intervention	Area (ha)	Yield* (kg)	CoC (Rs.)	NR (Rs.)	B:C	
Mango + FM/HG	0.2	406	3776	8424	2.23	
Sole Mango	0.2	349	3120	5620	2.80	
* Mango equivalent yield						
Employment generation	50					
Fodder crops /leaf forage	0.1	18000	2500	8000	4.0	
Employment generation	20					
Leafy vegetables	-	-	1800	1700	1.94	
Employment generation (man days)	20					
Cows	(2 no's)	2600lt	25350	39650	2.56	
Employment generation (man days)	235					
Fisheries	0.04	60 kg	-	6000	6000	

CoC: Cost of cultivation NR: Net returns
 FM: Finger millet, GN: Groundnut, PP: Pigeonpea, HG: Horsegram,
 FB: Fieldbean, CP: Cowpea

Table-2: Year wise net income generated by different interventions under rain-fed conditions

Year	Net income (Rs.)	B:C	Employment generation (man days)
2014	1,43,735	2.29	460
2015	1,38,362	2.71	440
2016	1,11,249	2.31	438
2017	1,19,235	2.76	456

Table-3: Soil properties initial (year 2014) and after implementation of IFS (year 2017)

Sl. No	Parameters	Initial status	Present status
1	pH (1:2:5)	5.90	5.93
2	EC (dS m ⁻¹)	0.12	0.13
3	OC (%)	0.24	0.31
4	Available N (kg ha ⁻¹)	100.80	130.20
5	Available P ₂ O ₅ (kg ha ⁻¹)	22.80	28.20
6	Available K ₂ O (kg ha ⁻¹)	167.9	192.5



Finger millet + pigeonpea (8:2)



Groundnut + pigeonpea (8:2)



Pigeonpea + fieldbean (1:1)



Custom hiring centre

Integrated Farming System as a Real Time Contingency for Sustainability and Livelihood Security - A Success Story



Chief Scientist
AICRP on Dryland Agriculture
 University of Agricultural Sciences
 GKVK, Bengaluru-560 065



2018