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Doubling the small farmers income through integrated farming system approach in irrigated ecosystem

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Abstract
An Integrated Farming System study was carried out at Agricultural Research Station, Siruguppa, Karnataka, under AICRP on Integrated Farming System (IFS) for doubling the small farmers income through integrated farming system approach in irrigated ecosystem. The study site was in *Vertisol* with clayey in texture having more than 100 cm depth. To meet out the basic components required for IFS model and small family (Six members) needs, the land was allocated under different components mainly on agriculture components including crop (Cereals and pulses components in 0.74 ha), horticultural in 0.18 ha (Sapota, curryleaf, vegetables and floriculture) and fodder component in area of 0.02 ha. The remaining land of 0.06 ha was allotted for agriculture allied activities such as live stock unit including 2 cows and goatary (14 nos.), Fish pond, Vermicomposting unit (4), compost unit (1) and Azolla unit (1). The boundary plantation with teak and *Glyricidia* was established to protect the unit and to generate the biomass for further utilization. The internal bunds were also planted with pigeon pea, fig and banana to meet out nutritional security of a small family (six member's family). The experiment was carried out from 2011-12 to 2018-19. The results revealed that the higher gross returns (Rs. 436408/ha) and net returns (Rs. 288406/ha), B:C (2.95) and employment generation of 627 man days per year was registered in 2016-17 as compared to initial year 2011-12 and other years. The percent increase in gross and net returns was to the extent of 133 and 200, respectively compared to initial year 2011-12. Among the different components, goat component recorded maximum gross return and net return of Rs.118750 and Rs.66900, respectively with an advantage of 30.31 and 30.63 per cent in gross return and net return, respectively compared to other components. Among the different components boundary plantation has recorded lowest gross return and net returns compared to other components.

Keywords: Integrated farming system, small farmers, gross returns, net returns B:C and man days

Introduction
The agriculture growth rate in the recent past is very slow in spite of the rapid economic growth in the country. According to the Business Standard reports, the growth rate of food grain production slipping to 2.7% during 2018-19 versus 5% in 2017-18 (http://, 2019). The present Indian population is around 1.26 billion and it is projected that will increase to 1.53 billion by 2030. To meet the demand, we have to produce 289 and 349 mt of food grains during the respective periods. The current scenario in the country indicates that area under cultivation may further dwindle and more than 20% of current cultivable area will be converted for non-agricultural purposes by 2030 (Gill et al., 2005).
The increasing energy crisis due to shrinking of non-renewable fossil-fuel based sources, the chemical fertilizer and other inputs cost have also increased steeply and with gradual withdrawal of fertilizer subsidy. It is expected to have further hike in the cost of fertilizers. This will leave the farmers with no option but to fully explore the potential alternate sources of plant nutrients at least for the partial substitution of the fertilizer nutrients for individual crops and in the cropping systems (Manjunatha *et al*., 2014). It is also coupled with declining in operational land holding in India and over 85 million out of 105 million are below the size of 1 ha. Due to ever increasing population and decline in per capita availability of land in the country, practically there is no scope for horizontal expansion of land for agriculture in the present situation. The only option is through vertical expansion of land is most feasible by adopting the IFS approach. Besides, some of the suggestions are also pouring in from experts

and leaders of organization for strengthening the income base of farmers, the government cannot implement them entirely due to compulsions from socio-economic and political considerations. However, the Government of India has made an announcement about Doubling Farmers' Income by 2022. In this context there is need to implement the integrated farming system approaches.

The IFS assumes greater importance for sound management of farm resources to enhance the farm productivity and reduce the environmental degradation, improve the quality of life of resource poor farmers and maintain sustainability (Singh *et al*., 2006) [22]. The IFS is a combination of farm enterprises like crop, livestock, horticulture, sericulture, sheep/goat, aquaculture, agro-forestry, honeybee etc., in which farm families allocate resources for efficient utilization of the existing enterprises for enhancing productivity and profitability of the farm and there is a considerable scope for resource recycling, but also concept of ecological soundness leading to sustainable agriculture. In this context the present investigation on doubling the small farmers income through Integrated farming system approach in irrigated ecosystem was carried out at Agricultural Research Station, Siruguppa, Karnataka.

Material and Methods

The IFS study was carried out at Agricultural Research Station, Siruguppa located 15^0 38^I N latitude and 76^o 54^I E latitude with a mean sea level of 380 msl. It received an average rainfall of 453.6 mm from 2011-12 to 2015-16 and it comes under semi-arid climate. The IFS model of 1 ha initiated under irrigated condition during 2010-11 and was in *Vertisol* with clayey in texture having more than 100 cm depth. The soil was low in available nitrogen (280 kg ha^{-1}), medium in organic carbon content (0.67%) and available P (10.8) and rich in K (364 kg ha^{-1}) status. To meet out the basic components required for IFS model and small family (Six members) needs, the land was allocated under different components mainly on agriculture components including crop (Cereals and pulses) components in 0.74 ha, horticultural in 0.18 ha (Sapota, curryleaf, papaya, vegetables and floriculture) and fodder component in an area of 0.02 ha. The remaining land of 0.06 ha was allotted for allied activities of agriculture (Fig.1) such as live stock unit including 2 cows and goatary (14 nos.), farm pond, kitchen garden, vermicompost unit (4), compost unit (1) and azolla unit (1). The boundary plantation with teak and *Glyricidia* was established to protect the unit and to generate the biomass for further utilization. The internal bunds were also planted with pigeon pea, fig and banana to meet out nutritional security of a small family. While allocating the different components in IFS model, major cropping systems followed and animals suited to this region was considered and animal numbers/size, allocation of land resource for accommodating different enterprises was done as per the family needs (calculated for a family of 6 members) as per standard give by Swaminathan, 1998. The crop components consists of different cropping systems viz., paddy-paddy, which is the dominant cropping system in the TBP command area, Paddy followed by maize/sorghum/pulses were included to develop alternative cropping system to dominant cropping system, maize followed by chickpea and Bt cotton followed by greenmanure crops with a view to maintain soil fertility. In horticulture crops along with plantation crops vegetables like lady finger, eggplant, beans and flowers grown in between the rows of perennials to utilize the land effectively and small portion of land was allotted for kitchen garden to grow leafy vegetables viz., spinach, fenugreek coriander etc. The fodder crop was introduced to provide green fodder for live stock feed and live stock comprise of 2 cows (Devoni) and 14 Shirohi goats. The house for family, dairy and goat shed, vermicompost unit (6), Compost unit (1) and azolla unit (1) were established in the existing model. The data on cow dung, urine, goat manure, farm waste and crop residue were recorded regularly and were properly recycled in the system by composting and vermicomposting and were in corporate in to the soil and excess quantity were sold to the farmers in order to educate the importance of vermicompost in the crop production. Similarly azolla produced was used as animal feed. Plot wise yield and straw data was recorded along with cost of cultivation, gross returns and net returns were computed and also number of man days generated in each system was calculated. The Total system equivalent yield (kg/ha) was calculated considering the farm gate price of each enterprise and rice crop.

Results and Discussion

The different components are evaluated in IFS model, out of which goat component has recorded maximum gross return (Rs.118750) and net returns (Rs. 66900) with an advantage of 30.31 per cent and 30.63 per cent in gross return and net returns, respectively compared to other components, which was closely followed by crop component with gross and net returns of Rs. 110555 and Rs.69410. The per cent advantage in gross and net returns was to the extent of 28.22 and 31.78, respectively (Table 1). The next best was animal component with gross and net returns of Rs. 110003 and Rs. 49658, respectively. The lowest gross and net returns was recorded in boundary plantation. In another experiment conducted at North Telangana zone, farming system with agriculture and dairy generated more than 200% additional employment over agriculture alone. The net returns were higher in agriculture and dairy followed by agriculture and poultry and agriculture and sheep (Reddy, 2005) [20].

The pooled results of eight years from 2011-12 to 2018-19 presented in Table 2, revealed that the higher gross returns (Rs. 436408/ha) and net returns (Rs. 288406/ha), B:C (2.95) and employment generation (627 man days/year) was registered in 2016-17 as compared to initial year 2011-12 and other years. The percent increase in gross and net returns was to the extent of 133 and 200, respectively compared to initial year 2011-12 and it was followed by 2018-19 with gross return (Rs. 427890/ha) and net returns (Rs.244650/ha). There was a two fold increase in the gross return in 2016-17 when compared to 2011-12. However, the gross return over a period of eight years suggests that the increase in the gross return from Rs. 187576/ha (2011-12) to Rs. 436408/ha (2016-17) with a tune of 133 per cent increase over initial years. It also indicates that there is an ample scope for gross income in the 1 ha model (Table 2). Mohanty *et al*. (2010) [16] at Orissa reported that higher profitability and sustainability was observed under IFS model as compared to the conventional farming system and earned 7 times higher Net Monetary Return (NMR) as compared to traditional method of farming. In the present study, the higher net return was observed during 2016-17 (Rs. 288406/ha) as compared to 2011-12 (Rs. 95878/ha). The per cent increase in net returns during 2016-17 was to the extent of 200 when compared to 2011-12 and it was followed by 2018-19 (Rs. 244650/ha). Over the eight years the average net returns of Rs. 193023/ha was registered in IFS model (Table 2). Kulkarni *et al.* (2014) [10] conducted

IFS in farmers' field of Raichur in Karnataka and found that integration of various components improved farm income in a sustainable manner.

In the present study maximum B:C (2.95) was noticed in 2016-17 when compared to initial year 2011-12(2.05) and it was closely followed by 2018-19 (2.40). Lowest B:C (1.93) was recorded during 2014-15 compared to other years. Further higher employment generation was observed in 2016-17 (627 man days/year) with an added advantage of employment generation (232 man days per year) compared to initial year 2011-12 (395 man days/year) and it was closely followed by 2015-16 (556 man days/year). Further, the average employment generation over eight years was 486 man days per year was recorded in IFS model (Table 2). Similar results were also reported by Devendra and Thomas (2002) [6] and Sutradhar (2016) [23]. In an another study conducted by Kumar *et al*. (2015) [11] reported that IFS generate more employment for the family members throughout the year.

Table 1: Gross, net returns and percent contribution under doubling the small farmers income through integrated farming system at the end of seventh year (2018-19)

Components	Area in (m^2)	Per cent area	Gross returns	Per cent contribution	Net returns	Per cent contribution
Crop component	7400	74.0	110555	28.22	69410	31.78
Horticulture	1443 256	16.99	18859	4.69	8921	3.87
Cows	81	0.81	110003	28.08	49658	22.74
Goats	13	0.13	118750	30.31	66900	30.63
Vermicompost	51	0.51	29365	7.49	20703	9.48
Fodder	527	5.27	35608	7.88	26266	12.03
Boundary plantation			4750	1.21	3265	1.50
G. Total	10000		427890		244650	

Table 2: Year wise gross returns, net returns, Benefit Cost ratio and employment generation under doubling the small farmers income through IFS in irrigated ecosystem

Years	Gross Returns (Rs.)	Net Returns (Rs.)	B:C	Employment generation (Man days)
2011-12	187576	95878	2.05	395
2012-13	260252	132895	2.04	412
2013-14	350861	194569	2.24	354
2014-15	332373	160578	1.93	563
2015-16	375484	208779	2.25	556
2016-17	436408	288406	2.95	627
2017-18	360980	218426	2.53	511
2018-19	427890	244650	2.40	472
Average	341478	193023	2.30	486

Conclusion

The results clearly revealed that Integrated Farming system plays a vital role in securing sustainable production of high quality food and fulfilling the other basic needs of household viz., food (cereal, pulse, oilseed, milk, vegetables, meat etc), fodder, fuel etc. This system helps not only in sustaining farm income by reducing the cost of production and also generates lot of employment opportunity. Hence, the IFS model developed by AICRP on IFS of this centre would help in doubling the small farmer's income in the irrigated ecosystem.

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