

Technology Driven Enhancement of Farmers Income in Karnataka : Lessons Learnt from Successful Farmers

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ABSTRACT

Addressing the national agenda of doubling farmer's income, the Indian Council of Agricultural Research used its nation-wide network of Krishi Vigyan Kendras for enhancing farmer's income through technology centric approaches. Successful farmers who could enhance their income with the help and support of technological interventions have clearly demonstrated the possibility for enhancing farmers income. The average income of farm households increased through a multi-pronged approach. Horticulture crops provided the dominant source of total income as well as additional income. Percentage of increase was higher with farm and non-farm enterprises, followed by fisheries activities as the income from these sectors was relatively low during benchmark period. Change in income could be attributed to shift from field crops to horticulture crops and from crops-based farming to crops + livestock; crops + livestock + enterprises and crops + enterprises. Technical advisories based on diagnostic services and supply of critical inputs of new technologies were largely responsible for the shift towards high-income activities. Significant increase in income was evident among farmers from all land classes due to technological interventions. While the rate of increase in income was higher with smaller holdings, the additional income generated was greater with larger holdings.

Keywords: Farmer's income, Extension education, Landholding, Diversification, Technology uptake

IN India, early agricultural development strategies focused primarily on raising agricultural output for attaining food security (Chand, 2017). The announcement by the Prime Minister of India for doubling farmer's income propelled the momentum towards enhancing farmer's income. Since then, farmer's income has been at the centre stage in the debates on agriculture. In 2016, the Inter-Ministerial Committee set up by the Ministry of Agriculture and Farmers Welfare, Government of India examined issues related to farmers income and suggested a seven-point strategy: (i) Enhancing production of crops and livestock through intensification; (ii) Raising productivity through better management and irrigation; (iii) Reducing cost of production through adoption of technologies and conventional

practices; (iv) Higher realization of net income through modern/ electronic marketing; (v) Processing/ value addition to farm produce; (vi) Diversification into high-value crops; and (vii) Adoption of supplementary agricultural/ non-agricultural enterprises backed by skill development programs (Dalwai, 2018). The government initiated several steps in this direction with a focus on enhancing farmers income through intensification, diversification, shift from subsistence to commercialization and business orientation towards agro-based small-scale enterprises (ICAR, 2016).

The Indian Council of Agricultural Research (ICAR), being the premier organization in the field of agricultural research, education and extension,

initiated efforts to develop strategy documents for each state focusing on technologies, technology delivery mechanisms and market linkages. The ICAR utilized its nation-wide network of Krishi Vigyan Kendras (KVKs), which have a multidisciplinary team of specialists, to operationalize the strategies through scientific farming for enhancing farmers income in each district. Agriculture, horticulture, livestock production, sericulture, supplementary enterprises, processing and value addition and farm-based income generating activities comprised the focus of the KVKs to increase farmers income. Farmers are the ultimate deciders in the process of technology adoption as they have mastered the art of making the best use of technologies within the realm of their natural and socio-economic resources. Thus, an effort was made to analyze successful farmers across diverse agro-climatic and socio-economic situations in Karnataka. It was also felt necessary to assess the contribution of agriculture, horticulture, animal husbandry, fisheries and other enterprises to household income across different land holding categories so that the results

throw useful insights into opportunities embedded in increasing farmers income.

METHODOLOGY

A simple format was designed by the ICAR and shared with all the KVKs for creating a database of farmers benefited with KVK interventions in each district. From among the list of contact farmers, about 110 farmers were randomly identified by each KVK for the present study. In all, a total of 3648 successful farmers of 33 KVKs functioning in all the rural districts of Karnataka constituted the sample. Annual net income during 2016-17 served as the benchmark data and was compared with the income levels during 2020-21, estimated at current prices. The income is assessed for the entire farm, not per unit area and by considering income from farm and non-farm enterprises managed by the farm family. Hence, income levels are reported as Rs/ household. Price effect due to higher minimum support price or enhancement in general prices is also included in the estimation. Technological interventions of KVKs that must have contributed to higher income of farm households under each sector are presented below:

Sector	Technological intervention
Field Crops	Introduction of improved varieties of paddy <i>viz.</i> , Gangavathi Sona, RNR-15048, MAS-26, KHP 13, KKP-5, direct seeding of rice (DSR), mechanical sowing and integrated crop management practices. Introduction of new varieties of finger-millet (ML-365, KMR-340, 630 and MR-6), sorghum (SPV-2217) and foxtail-millet (DHFT-109-3). Integrated pest management (IPM) of fall armyworm in maize. Introduction of new pigeonpea varieties <i>viz.</i> , BRG-3, 4, 5, GRG-811, TS3R, BSMR-736 and its intercropping in maize. Introduction of sugarcane variety VCF-517, adoption of nutrient management practices and biological control of root grub. Promotion of a new groundnut varieties GPBD-4, G2-52, DH-256, ICGV-03043, K-6, KDG-128 and cultivation of groundnut in paddy fallows. Introduction of new varieties of chickpea (JAKI-9218 and BGD 111-1), greengram (DGGV-2, BGS-9), blackgram (LBG791), horsegram (PHG-9, CRIDA-18), safflower (PBNS-12), sunflower (KBSH 53, RFSH 1887) and soybean (DSB-21). Promotion of micronutrient and pest management in cotton. Promotion of intercropping in sugarcane, cotton, maize, pigeonpea and groundnut. Adoption of dryland production technologies such as compartment bunding, seed hardening/treatment with CaCl ₂ and farm pond supported protective irrigation, improved pulses production technologies such as pulse-magic and nipping.
Horticultural Crops	Introduction of new varieties/hybrids of chilli (Arka Kyathi and Arka Haritha), weed management and bio-intensive pest/disease management. Introduction of new hybrids of tomato (Arka Rakshak and Arka Abhed) and integrated pest/disease management practices. Promotion of new varieties of frenchbean (Arka Arjun, Sharat and Suvidha). Nutrient management in coconut to reduce nut dropping. Banana disease management and foliar nutrition. Nutrient and disease management in arecanut and arecanut husk decomposition. Mango pest disease management and mango-special

	as micronutrient supplement. Introduction of new onion varieties (Bhima Super and Bhima Shakti) and management of pests and diseases. Ginger rhizome rot management. Introduction of a new turmeric variety Pratibha and its processing at farm level for value addition. Promotion of new varieties of ridgegourd (Arka Prasan), okra (Arka Nikitha) and tuberose (Arka Prajwal)
Animal Husbandry	Promotion of balanced nutrition, area specific mineral mixture and clean milk production practices in dairy animals. Promotion of fodder varieties DHN-6, CoFS-29, 30, 31 Co-3, 4 and 5 and fodder seed production units. Introduction of breeds of backyard poultry (Swarnadhara), low-cost incubation, hatchery units and feed supplementation with azolla. Cost-efficient nutrition management with locally prepared feed formulations. Semi-intensive and intensive sheep and goat farming and micronutrient supplementation and deworming practices.
Farm and non-farm enterprises	Seed production of cereals, pulses, oilseeds and fodder crops. Horticultural nursery for seedlings of fruits, plantation, and vegetable crops. Mulberry cultivation and silkworm rearing for cocoon production. Bee keeping for honey production and its value addition. Millet processing and value addition. Value addition to Plate, direct and digital marketing strategies. Custom hiring of farm machinery and coconut climbing.

Percentage, frequency and weighted averages were used to decipher the data and present the results.

RESULTS AND DISCUSSION

The impact in terms of household income under different components and the change in income for different land-class categories are presented and discussed in this section. The results in Table 1 compare the household income before and after the interventions by the KVKs. The average income of farm households was increased by 147 per cent between 2016-17 and 2020-21 in which horticulture crops (fruits, vegetables, flower crops, plantation crops, spices, medicinal and aromatic crops) provided the dominant source of household income (Rs.144549/ household during 2016-17

and Rs.364361/ household during 2020-21). Field crops comprising of food crops (cereals, pulses, oilseeds and millets) and cash crops (cotton, sugarcane, tobacco, jute and fodder crops) provided the next major amount of income (Rs.78925/ household during 2016-17 and Rs.153727/ household during 2020-21). The household income from livestock was moderate (Rs.71591/ household during 2020-21), but more than income from fisheries and other enterprises (bee keeping, mushroom production, seed / plant material production, food processing and value addition *etc.*).

In terms of percentage increase in income, the highest percentage increase was recorded among farm and non-farm enterprises (330.38%) during this period. The next highest increase in income

TABLE 1
Level and change in household income

Crops and Enterprises	Net income (Rs/household at current prices)		% Increase in income	% Share in total income		Additional net income (Rs/ household)	% Share in additional income
	2016-17	2020-21		2016-17	2020-21		
Field crops	78925	153727	94.78	30.65	24.17	74802	19.76
Horticulture	144549	364361	152.07	56.13	57.28	219812	58.06
Livestock	23104	71591	209.75	8.98	11.26	48487	12.82
Fisheries	1921	7687	300.16	0.75	1.21	5766	1.52
Other enterprises	8985	38670	330.38	3.49	6.08	29685	7.84
Overall	257512	636099	147.02	100.00	100.00	378587	100.00

was observed in fisheries (300.16%). This is basically due to lower income levels during benchmark year (Rs.8233/- and Rs.1921/- per household respectively). Livestock income also increased substantially (209.75%) from Rs.23104/- household to Rs.71591/- household.

In terms of share in total income, horticulture was the major sector with 56.13 per cent of the total income during 2016-17, which further increased to 57.28 per cent during 2020-21. The share of field crops in total income declined from 30.65 per cent to 24.17 per cent, possibly due to crop diversification (from field crops to horticulture crops) and additional investment on livestock-based activities and other enterprises. The livestock sector consolidated its share in the household income to 11.26 per cent in 2020-21 from 8.98 per cent in 2016-17.

Share in additional income over the benchmark year was also highest from horticulture sector (Rs.219812 per household equivalent to 58.06 per cent), followed by field crops (19.76%) and livestock sector (12.82%). These statistics provide valuable insights to the approach of successful farmers for achieving higher income. These are in line with the statistics related to contribution of horticulture and livestock sector in national and state

GDP. As per the secondary sources (DES, 2022), horticulture component constituted 29.51 per cent of the total income from entire agriculture sector and contributed 3.24 per cent to Karnataka GSDP with Rs.52718 crore during 2019-20. Livestock sector employs 8.8 per cent of India's population and contributed 16 per cent of the total income of small farm households (DAHD & F, 2019). Enhancing farmer's income is possible (Chand, 2016) and the study results confirmed that the technology adoption is an important driver of enhancing farmer's income.

Change in income could be attributed to shift from crops-based farming to (i) Crops + livestock which increased from 39.4 per cent to 46.7 per cent (ii) Crops + livestock + enterprises increased from 2.7 per cent to 8.2 per cent and (iii) Crops + enterprises increased from 2.3 per cent to 5.8 per cent as compared to benchmark year. Technical advisories and support in the form of diagnostic services, critical inputs and timely visits provided by KVKs were largely responsible for the shift towards high-income activities (Fig.1).

Practicing innovative cropping systems and activities are essential for increasing farmers income (Bankey *et al.*, 2019). Chand (2016) suggested that farmers income could be increased through diversification of production activities. Increase in

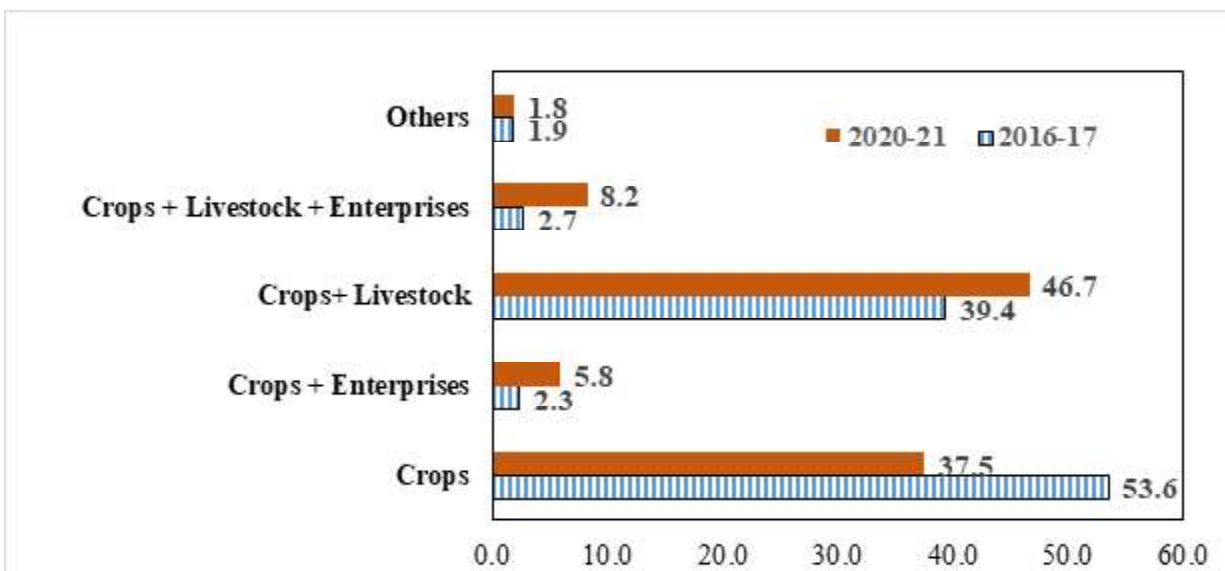


Fig.1 : Change in choice of crops and enterprises by farmers (%) due to KVK interventions

TABLE 2
Income level and change in household income by land class

Land class	No. of households	% Share in total household	Income level (Rs/household at current prices)		Additional income (Rs/ousehold)	% Change in household income
			2016-17	2020-21		
Landless	20	0.55	78702	276401	197699	251.20
Marginal (<1.0ha)	790	21.65	109268	286108	176840	161.84
Small (1-2ha)	1479	40.54	175155	441184	266029	151.88
Medium (2-4ha)	865	23.72	296934	721890	424956	143.11
Large (>4ha)	494	13.54	679367	1643701	964334	141.95
Total	3648	100.00	257512	636099	378587	147.02

total factor productivity is essential for growth in output (Saxena *et al.*, 2017) and profitability in farming. Farmer's income was substantially enhanced when farm income was supplemented with other farm and non-farm activities (Sendhil *et al.*, 2017a).

The results in Table 2 depicted that farmers from all land classes were benefitted from the technological interventions. The income of the landless families increased by 251.20 per cent over benchmark year, which was highest among all categories. This was due to very low-income levels during the benchmark period (Rs.78702/ household per year) and higher additional income generated during the period (Rs.197699/household). Landless families were encouraged and supported to take up livestock and other enterprises with technological backing by the KVKs. Marginal landholder's income was increased by 161.84 per cent, but the additional income generated to each house hold was less (Rs.176840) compared to landless. This is a paradoxical situation where even the successful farmers cultivating marginal landholdings earned less than landless category farmers. Small holders were better than these two categories in terms of additional income generated (Rs.266029/household) although the percentage increase (151.88%) was comparatively less. Collective farming by smallholders with focus on integrated farming and mixed farming (Sendhil *et al.*, 2017b) could have resulted in higher income among small

farmers. The medium landholders earned almost double that of the above three categories (Rs.424956/ household) and large farm households could realize highest additional income (Rs.964334/household). Larger landholdings provided every possible opportunity for diversification, mechanization, economy of scale and risk taking for new activities, which are evident through higher income levels in the present analysis.

Technological breakthroughs that facilitate farmers to engage in the production of crops and commodities as per the demands of local markets is important for driving farmers income (Shivakumar and Chahal, 2018). Since there is huge gap between potential and actual yield being obtained (Swaminathan, 2016), increasing the income levels of farmers across the landholding categories is possible.

The results justify that scientific knowledge, when integrated with farmers experience, can contribute significantly to the income enhancement process in farming. The resilience of the farming sector during COVID proved its relevance to Indian economy beyond any doubt, as it was the only ray of hope for the livelihood amidst the pandemic that hit the economy hard.

The analysis of the success stories offers very important lessons. Diversification into high-value crops and commodities with location-specific technologies emerged as important paths for sustainable and climate-resilient agriculture. In such

cases, farmers information needs became complex and hence, there is a need to design a dynamic and single-window extension delivery system for the timely provision of appropriate advisory services. New technologies and enterprises require skills and therefore continuous upgradation of skills of both extension personnel and farmers needed. Hand holding of farmers in technology application and initial adoption also needs availability of quality inputs within the reach of farming community. This is particularly important during climatic aberrations that demand quick adaptation to contingency strategies. To supplement income from farm, there is a need to strengthen locally preferred agro-enterprises such as bee-keeping, seed production, nursery raising, custom-hiring services, mushroom production and food processing and value addition. Landless households could realize higher income by involving in animal husbandry and related enterprises. Beyond production, innovative marketing attempts played catalytic role in supplementing farmer's income. Successful direct marketing approaches through farmer's organizations and cooperatives need to be scaled up. Digital and online marketing strategies were useful even in remote areas but require further strengthening of internet connectivity and infrastructure.

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