Potential of Horticulture led Development Pathways and its implications on Income, Employment, Gender Equity and Profitability of Small Holders – Evidences from ICRISAT VDSA Semi-arid Villages of Karnataka, SAT India[12]

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Abstract:

The overarching focus of this paper is to evaluate the horticultural led development pathways in terms of relative profitability for the small holder farmers in the semi-arid villages of Karnataka based on the ICRISAT Village Level Studies data. In addition, the paper also analyses the trends relating to shifts in crop pattern, sources of income, relative profitability, employment and suggest needed technological, institutional and policy interventions. The results indicated that there has been structural transition in the village economies with shift in the cropping pattern towards high value non-food crops that include horticultural enterprises and more income being derived from non-agriculture than agriculture. The horticultural crops generated substantial amount of employment compare to agricultural crops and the women labour absorption per ha of horticultural cropped area is very impressive in Karnataka VDSA villages. The relative profitability of different enterprises indicated that in some years farmers failed to generate adequate returns from agricultural enterprises. But, horticultural enterprises proved to be more remunerative compare to agriculture. A steady flow of income from farming is crucial for farmers to continue in the agriculture. In this regard, horticulture enterprises are comparatively better but its sustainability is also in threat due to scarcity of groundwater.

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Introduction:

Indian agriculture is numerically dominated by small and marginal farmers who constitute around 83 percent of the total holdings. Due to population pressure on land, the per capita land availability has been reducing and land resource has become increasingly scarce. For instance, the average size of the operational holdings has shrunk from 2 ha to 1.23 ha during 1976-77 to 2005-06 reflecting the viability of the small farmer holdings is at stake due to uneconomical size of holdings. Consequently, majority of the small holders have become part time farmers and are drifting away from farming to non-farming activities in order to earn more income for their livelihood (Binswanger 2013). Thus, the key challenge is how to improve the income of small farms with a focus on enhancing productivity and profitability which is sustainable on long-run so that farmers can stay on their farming business. Horticulture is an important source of income, employment and also an entry point for improving food and nutritional security of the farming community. It is the key driver of economic development in many states contributing 30 % per cent to GDP of agriculture in the country.

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Comparative Advantage:

Karnataka has distinct comparative advantage to grow a variety of horticultural crops due to salubrious climate, long growing-season, diversity in soils and other natural endowments, markets, infrastructure and favourable government policies. Horticultural led growth was witnessed very rapidly since 2-3 decades in the state. The State Government has initiated several measures to enhance the growth in horticulture sector. As a result, the area under horticulture increased from 1.7 to 2.0 million ha during 2007 to 2011. The National Horticultural Mission a Centrally sponsored scheme has been greatly responsible for its fastest growth in the state (Kumar 2012). Out of the total cultivated area of 12.3 million ha in the state, horticulture occupied around 2.0 million ha accounting 16 % of the total cultivated area.

Karnataka is one of the states having largest proportion (79%) of the drought prone area in the country. Over 56 % of the population of Karnataka state depends on agriculture for its livelihood. A majority of these are small and marginal farmers with land less than 2 ha (Purushothaman, 2012). The number of land holdings in Karnataka has increased in the last five years, but the average size of holding has decreased from 1.95 ha to 1.74 ha (GoK, 2006). Thus, small size holdings limit the scale economies to generate surplus income from annual seasonal food crops. However, there is a good scope to generate higher incomes by growing a combination of commercial horticultural enterprises like fruits, vegetables and flower crops in Karnataka, the horticulture based farming system has gained prominence providing quick returns and gainful employment throughout the year compare to other field crops.

Focus of the Paper:

The overarching focus of this paper is to evaluate the horticultural led development pathway in terms of relative profitability for the small holder farmers. In addition, the paper also analyses the trends relating to shifts in crop pattern, sources of income, relative profitability, employment and suggest needed technological, institutional and policy interventions.

Approach/ Methodology:

The ICRISAT Village Level Studies (VLS), currently termed as the Village Dynamics in South Asia, (VDSA) collects the panel data from the selected village households by employing resident Field Investigators who stay in the selected villages and collects the household data by personal interview. In each village, the household data was stratified by land size holdings including landless and accordingly four groups have been categorised viz., large, medium, small and landless (40 households, 10 each). However, the labour category has been deleted from the analysis as they do not have substantial crop based activities. The data relating to crop production, costs and returns and employment details for the 3 years period was considered for this study. The costs and returns for different crops were computed by deducting all costs (cost C2) including value of family labour and rental value of land from the output value.

Study villages profile

In Karnataka, Bijapur and Tumkur districts have been chosen for the VDSA project since 2009. The villages selected include Markabinahalli (BasavanaBagewadi, Taluk) and Kapanimbargi (Indi, Taluk) in Bijapur, Tharati (Korategere, Taluk) and Belladamadugu (Madhugiri, Taluk) in Tumkur district. The salient features of VDSA villages are provided in the table (table 1)**.** The Markabinahalli village is situated 25 km away from taluk

headquarters Basavana Bagewadi, 45 km away from the district headquarters Bijapur. The annual normal rainfall of the village is 655 mm, distributed erratically. Major share of the rainfall (of 487 mm) is received during the Southwest monsoon from June to October spread over in 20-30 days. Recurrent drought (Out of 5 years, 3 years happens to be drought years) is compounded by the highest number of dry spells. The average size of holding is 3.3 ha with a family size of 6 members having a literacy of 64 %.

The Kapanimbargi village is situated one km away from the Solapur-Mangalore National Highway (NH-13), about 18 km from Indi taluk headquarters, 45 km from Bijapur district headquarters and 430 km from Hyderabad. The annual normal rainfall of the village is 618 mm, distributed erratically. This village has highest share of landless people. The average size of holding is around 3.6 ha with a family size of 6 members. The village Tharati, is located 18 km from the district viz., Tumkur and 6 km from the taluk headquarters viz., Korategere and 80 km from the capital city Bangalore. It is well connected to the national highway facilitating connectivity to the key business centers. The annual rainfall of the village ranges between 453-717 mm, of which more than 55% is received in the *kharif* season. On an average, the village annually receives over 600 mm rainfall in about 45 rainy days. The striking feature of the village is that small and marginal farmers constitute the lion's share of the total households and landless labour household's accounts for 27 % of the total households. The average land holding is around 1 ha with a family size of 6 members. Belladamadugu village is almost boarder to the Ananthpur district of Andhra Pradesh. From Bangalore, the village is around 123 km and from the district, it is around 53 km and from the taluk 9 km. It comes under central dry agro-climatic zone with an annual rainfall of 600 mm distributed in just 44 days. The average size of holdings is around 1.45 ha with a family size of 4 members.

Out of the four villages selected in Karnataka, the Tharati village in Tumkur district and Kapanimbargi in Bijapur district have large share of area under horticultural crops. Hence, this paper mainly focuses on these two villages relating to horticultural based farming systems. The first section of the paper discusses the horticultural status in India and the state and at village level, followed by trends in cropping pattern and area share in the selected villages of VDSA. The second section turns to the income sources from different sources like agriculture, horticulture, livestock and non-farm enterprises. The third section is on comparative analysis of employment, labour use pattern and gender issues in horticulture and agriculture enterprises followed by relative profitability of different enterprises.

Table 1: Salient features of VDSA Villages in Karnataka

Particulars/villages	Bijapur		Tumkur	
	Markabinahalli	Kapanimbargi	Tharati	Belladamadugu
# of HH's	392	320	401	276
Total geographical area (Ha)	1001	826	519	496
Cultivated area (Ha)	911	876	172	355
% of Irrigated area	0	20	42	27
% of landless households	28	33	28	10
Family size	6.47	6.23	4.24	4.43
Literacy	64	60	24	49
Size of holding (Ha)	3.29	3.6	1.03	1.45
Seasonal migration (% of HH)	-	12	-	-

I. Horticultural status in Karnataka state and in the selected villages

Out of the total area under horticultural crops, Karnataka occupies fourth position with a production share of 7 % among the leading horticultural producing states of India. But in terms of productivity, it is lower (8.6 tonnes/ha) than all India average productivity of 10.5 tonnes/ha. Among the horticultural crops, the state ranked 2nd position in case of flower crops with an area share of 15 % and a production share of 20 %. In terms of productivity, it

is in 2nd position with 7.5 tonnes/ha, as against the all India average productivity of 5.6 tonnes. Similarly, in case of fruit crops, the state occupied 5th position with an area share of 5.3 % and production share of 8 % with a productivity of 16.5 tonnes/ha, which is much higher level compare to all India level of 11.2 tonnes/ha (Parmod Kumar, 2012).

Area shifts in food and non-food crops

The trends of cropping pattern in the 4 villages indicates that the share of food crops has been decreasing and the share of non-food crops/commercial crops has been increasing between 2000 to 2010 (table-2, Fig-1, 2, 3, 4). The non-food crops are notably horticultural enterprises in the two villages viz., Kapanimbargi and Tharati. This shows that farmers are concerned more towards economic security by preferring high value crops rather than food security. The probable reasons for the fall in area under food crops could be 1) considering input and out prices, production of food crops are no more remunerative compare to commercial crops 2) Food grains like wheat and rice are being distributed through fair price shops at subsidised prices hence food security is not an issue for most of the smallholder households. 3) In irrigated area, the productivity of the food crops has increased over time. Hence, farmers are producing the same amount of grain in less land and allocating the saved land to other crops.

In Bijapur, the Markabinahalli village is completely dependent on monsoon for agriculture without any assured source of irrigation either from surface or groundwater sources. In this village, the share of horticulture crops is miniscule, as there is no assured source of irrigation. Even in this village, the area under food crops decreased from 324 ha to 158 ha during 2000 to 2010, reflecting a significant fall of 51 % exhibiting a negative growth rate of 7 % per annum. Similarly, In Kapanimbargi, where there is access to groundwater, the area

under food crops dipped from 417 ha to 334 ha indicating a modest fall of 30 % recording a negative growth (table-2).

In Belladamadugu village, non-food crops exhibited an impressive growth rate of 5.5 % in the last decade. The major non-food crop is groundnut and it has a relative comparative advantage over other crops because of unique natural resource endowments like shallow red sandy and gravel loose soils. The area under groundnut has been increasing after 2005 and area under other food crops has been declining. Under groundwater irrigation, flower crops like chrysanthemum is grown for the market. In addition, perennial crops like coconut, arecanut, guava, sapota and mango are established on small scale. In spite of groundwater irrigation in this village, the horticulture has not picked up mainly because of poor infrastructure, market bottlenecks, poor road connectivity and lack of efficient supply chain.

Table 2: Area coverage under Food and Non-food crops in VDSA villages of Karnataka (ha)

Villages/ F-NF	2000	2005	CGR (2000-05)	2010	CGR (2005-10)	(% change during 2000-10)	CGR (2000-10)
Belladamadugu							
Food	99	103 (4)	0.81%	82 (-21)	-4.49%	-17	-1.88%
Non-Food	136	149 (10)	1.90%	232 (56)	9.26%	71	5.51%
Tharati							
Food	140	124 (-12)	-2.48%	99 (-20)	-4.35%	-29	-3.42%
Non-Food	87	100 (14)	2.64%	136 (36)	6.37%	55	4.49%
Kapanimbargi							
Food	417	249 (-40)	-9.80%	334 (34)	6.05%	-20	-2.19%
Non-Food	405	582 (44)	7.55%	518 (-11)	-2.33%	28	2.49%
Markabinahalli							
Food	324	202 (-38)	-8.97%	158 (-22)	-4.85%	-51	-6.93%
Non-Food	562	680 (21)	3.89%	720 (6)	1.15%	28	2.51%

Trends in area share of horticultural crops:

Between 2000 to 2010, the trends in cropping pattern indicates that the % area share of horticultural crops in Kapanimbargi village has been doubled from 6 to 13 % recording an

impressive growth rate of 6 % per annum. On the contrary, area share under agriculture has been decelerating at the rate of 0.66 % per annum.

Similarly, in Tharati village, there has been drastic shift in the area from food crops to horticultural crops notably flowers, arecanut and betel vine, coconuts and banana witnessing an impressive growth rate of 5 % per annum. The area share under horticultural crops increased from 18 to 31 %, while area share under agricultural crops decreased from 82 to 69 % (table 3). Thus there has been transition of agriculture from low value food crops to high value commercial crops such as floriculture. This shift is mainly due to access to groundwater and water markets in some villages. The existing cropping pattern of sample respondents across all the villages more or less indicates similar to the household cropping pattern of entire village (Table 4).

Table 3: Cropping pattern of VDSA villages in Karnataka from 2000 to 2010

Particulars	Year			CAGR 2000 to 2010
	2000	2005	2010	
Kapanimbargi village				
Area under Horticulture (%)	6	12	13	6.81
Area under Agriculture (%)	94	88	87	-0.66
Total area under cultivation (ha)	**748 (100)**	**702 (100)**	**1030 (100)**	2.92
Tharati village				
Area under Horticulture (%)	18	22	31	5.08
Area under Agriculture (%)	82	78	69	-1.59
Total area under cultivation (ha)	**223 (100)**	**218 (100)**	**228 (100)**	0.19
Belladamadagu village				
Area under Horticulture (%)	2	3	5	8.10
Area under Agriculture (%)	98	97	95	-0.24
Total area under cultivation (ha)	**232 (100)**	**249 (100)**	**310 (100)**	2.66
Markabinahalli village				
Area under Horticulture (%)	1	0	6	21.55
Area under Agriculture (%)	99	100	94	-0.49
Total area under cultivation (ha)	**875 (100)**	**872 (100)**	**868 (100)**	-0.08

Table 4: Cropping pattern of sample farmers in VDSA villages of Karnataka, 2011

Particulars	Area in ha	Percentage
Kapanimbargi (n=40)		
Horticulture	13	12
Agriculture	95	88
Total area under cultivation	108	100
Markabinahalli (n=40)		
Horticulture	4	3
Agriculture	111	97
Total area under cultivation	115	100
Tharati (n=40)		
Horticulture	9	41
Agriculture	13	59
Total area under cultivation	22	100
Belladamadagu (n=40)		
Horticulture	2	5
Agriculture	47	95
Total area under cultivation	50	100

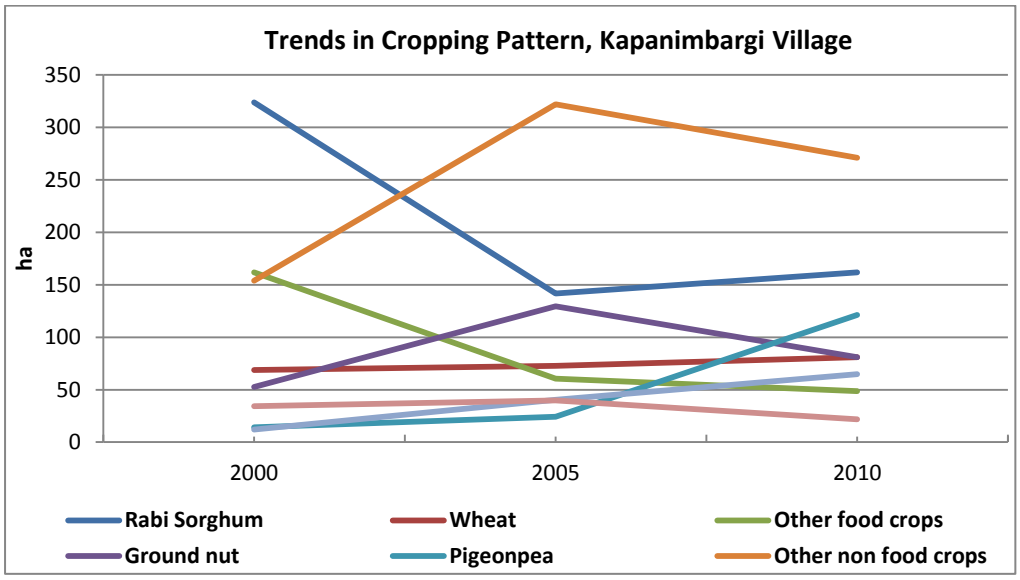

Figure 1: Trends in cropping pattern, Kapanimbargi

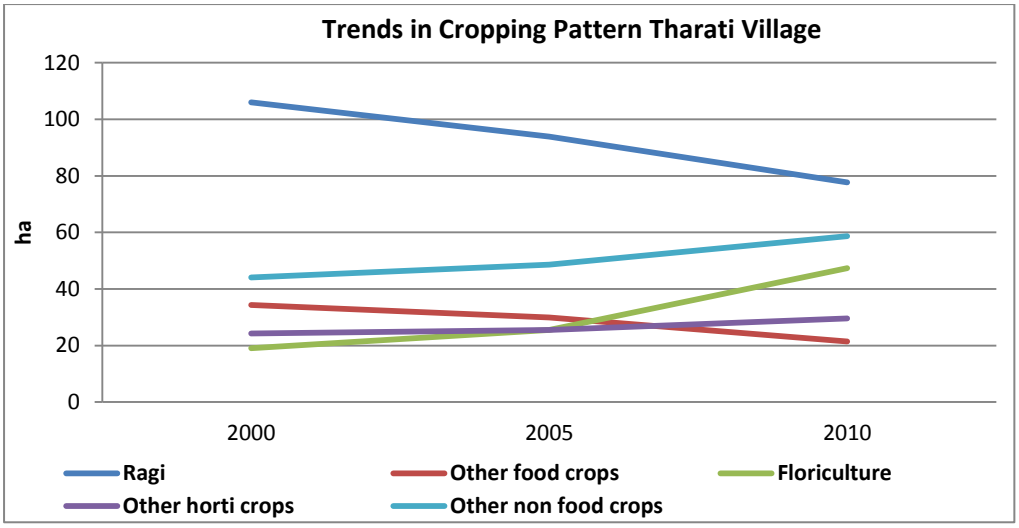

Figure 2: Trends in cropping pattern, Tharati

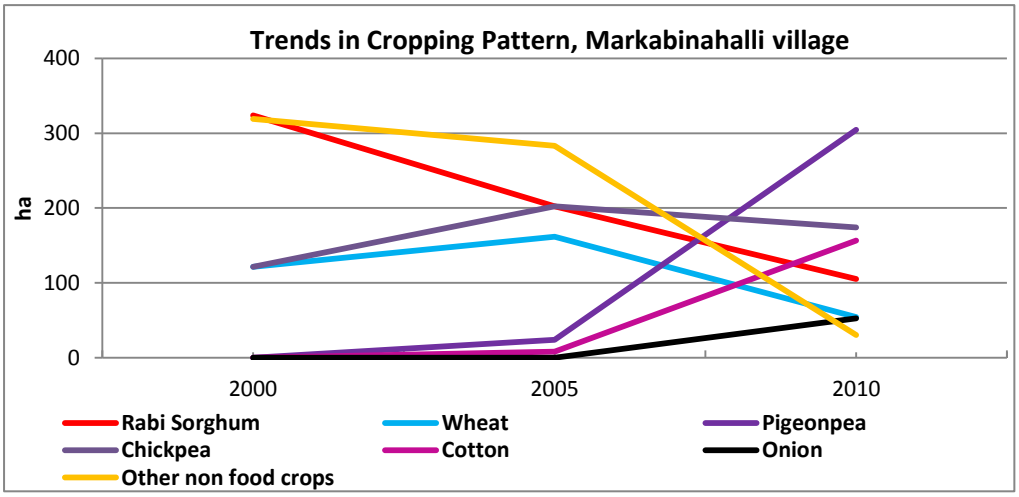

Figure 3: Trends in cropping pattern, Markabinahalli

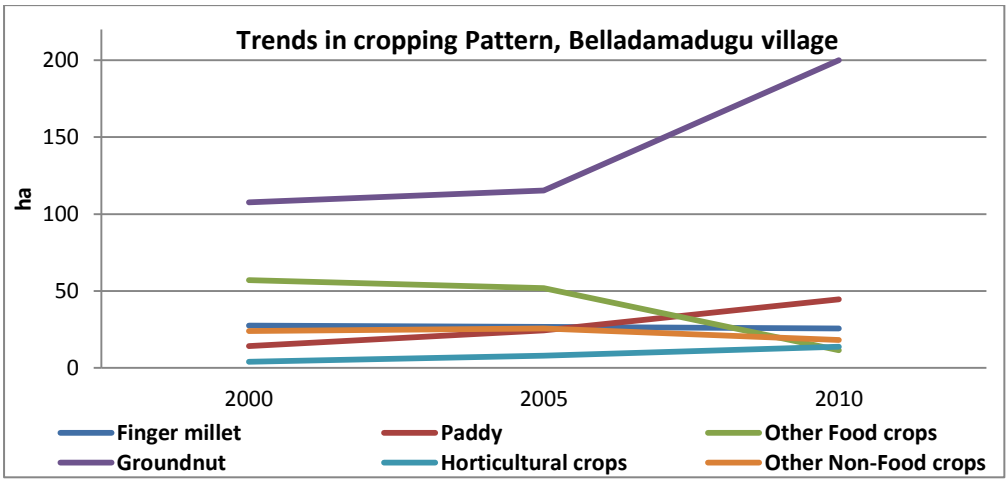

Figure 4: Trends in cropping pattern, Belladamadugu

II. Employment generation:

As evident from the table 5, the employment generated by horticultural crops over the years is twice that of agricultural crops per hectare in Tharati village, while it is 3 to 5 times that of agricultural crops in Kapanimbargi village. This shows that horticultural crops are not only capital intensive but also labour intensive. Further, this sizeable difference in employment generation between horticultural and agricultural crops is mainly attributed to crop failures in both the villages due to incessant drought. While most of the horticultural crops are being grown under assured groundwater irrigation, thus ensuring continued employment. In Tharati village, due to cultivation of flowers, substantial employment is generated within the village and hence there is no migration from the village for work. The emergence of water markets is quite conspicuous in the village providing access to groundwater for those who cannot afford to invest on wells. Thus, groundwater has been the driving force to trigger the growth of horticultural enterprises in the village.

Further, horticulture crops have provided adequate employment to the family members preventing the out-migration. In addition, it has also provided substantial employment opportunities for female labour.

Table 5: Total employment generated between horticultural to Agricultural crops

Year	Kapanimbargi			Tharati		
	Horticultural crops (man-days/ha)	Agricultural crops (man-days/ha)	Ratio	Horticultural crops (man-days/ha)	Agricultural crops (man-days/ha)	Ratio
2009	165	54	3.06	440	206	2.14
2010	372	73	5.1	460	173	2.66
2011	289	71	4.07	280	101	2.77

Women involvement in Horticulture

Out of the total man-days employed in horticultural enterprises like grapes, the women participation in various activities right from production to processing has been substantial over the years. As evident from the table 6, the women share in the total employment

varied from 1/3rd to 2/3rd during 2009-2011. Most of the grape orchard households process grapes into high value resins hence this post-harvest processing provides more employment particularly for women. The ratio of male to female labour employed is 1: 3 indicating high intensity of women employed. Similarly in case of floriculture, women employment has been very impressive accounting more than 60 % of the total mandays engaged over the years. Most female labour are involved not only in flower production but also in stringing the flowers. This has created not only value addition to the flower production but also generated additional employment for women on the farm. Thus, the feminisation of horticulture in both the villages is evident. This is mainly because of "pull" factors such as higher wages and better economic opportunities in the peri-urban and urban areas, the male members of the labour households move out from rural to peri-urban and other fertile areas, while women are engaged in agriculture.

Table 6: Total labour days and share of female labour for Agriculture and Horticulture in VDSA villages of Karnataka (per ha)

Crops		2009		2010		2011	
		Total man days	% of Female to total labour	Total man days	% of Female to total labour	Total man days	% of Female to total labour
Belladamadugu							
Agriculture	Finger millet	82	76	116	79	119	83
	Ground nut	64	58	114	76	168	69
	Paddy	200	48	119	67	121	73
Horticulture	Arecanut			163	42		
	Chrysanthemum			161	62	168	65
Tharati							
Agriculture	Finger millet	116	74	115	69	101	73
Horticulture	Arecanut	431	39	720	28	593	27
	Chrysanthemum	208	64	339	67	225	69
	Jasmine	462	64	659	57	568	58
	Coconut	65	9	161	21	115	6
Markabinahalli							
Agriculture	Pigeon pea	55	46	43	65	57	54
	Cotton	79	75	104	74	86	63
	Chickpea	37	43	50	59	31	63
	Sorghum	20	35	33	53	28	44
Kapanimbargi							
Agriculture	Maize	52	81	54	64	49	70
	Cotton	62	56	106	79	52	62
	Pearl millet	14	46	24	62	34	68
	Pigeon pea	20	45	28	54	17	60
	Groundnut	25	53	34	66	28	64
	Sorghum	12	34	12	23	14	54
Horticulture	Grapes	185	43	324	48	603	74
	Ber	153	55	217	60	131	45
	Onion	124	82	79	47	64	73
	Jasmine	398	57	1611	56	620	59

III. Income sources from different farm and non-farm enterprises

In Kapanimbargi village, large and medium households dominated in the cultivation of horticultural crops. The striking observation from the tables 7a and 7b is that irrespective of all the groups, the share of non-farm income has increased sharply over the years. While the

share of agriculture income has become insignificant. Within agriculture, large and medium farmers derived a significant proportion of income from horticultural enterprises, while small farmers did not derive any income from horticulture. This is mainly because of three factor viz., 1) The horticultural crops in this village mainly comprise grapes, lemons and pomegranates, which are highly capital intensive. 2) Small farmers cannot afford to invest on groundwater irrigation wells, as irrigation is critical factor influencing their cultivation and 3) non-viability of small holdings coupled with vulnerability to the droughts. It is striking to note that though horticultural enterprises occupy around 12 % of total acreage, their income share accounted more than 40-47 %, which is very impressive. This shows that the output vale of horticultural crops per unit of cultivated area is very high.

Similarly, in Tharati village, irrespective of the all groups, a large proportion of income has been derived from non-farm income, followed by income from horticulture and livestock. The agricultural income share has become inconspicuous due to labour scarcity and frequent droughts. As the size of holdings is extremely small, the well owners are involved in selling groundwater for their neighbours. This facilitated to take up floriculture such as chrysanthemum on small scale by large number of small holders in the village whose average holdings are <1 ha. In fact, this village has turned into a model village for flower cultivation in the district. This revolution in floriculture is due to a) emergence of informal water markets in the village providing access to groundwater for those who cannot afford to invest on wells, b) proximity to the markets and 3) road connectivity to the national highways. Thus, groundwater markets promoting horticultural enterprises especially floriculture, also promoted equity.

Table 7a: Source wise share of income derived across different farm groups in Kapanimbargi village of Karnataka:

Particulars	Large			Medium			Small		
	2009	**2010**	**2011**	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
Agriculture (%)	4	2	2	4	3	2	9	7	3
Horticulture (%)	47	40	50	44	31	16	0	0	0
Livestock (%)	7	6	11	24	24	9	7	8	3
Non-Farm income (%)	42	52	37	29	41	73	86	90	94
Total income (Rs)	537515	1040332	601073	64838	143269	190265	52353	67660	148383

Note: Non-Farm income - Salaried job, Business, Remittances, Rental, Migration, Interest etc.

Table 7b: Source wise share of income derived across different farm groups in Tharati village of Karnataka:

Particulars	Large			Medium			Small		
	2009	**2010**	**2011**	**2009**	**2010**	**2011**	**2009**	**2010**	**2011**
Agriculture (%)	3	3	3	3	5	4	3	3	1
Horticulture (%)	27	16	9	8	14	11	8	10	44
Livestock (%)	10	17	11	14	13	11	16	21	9
Non-Farm income (%)	61	64	77	75	68	74	73	65	45
Total income (Rs)	100391	131557	185343	57947	82444	107854	52365	92877	241846

Note: Non-Farm income - Salaried job, Business, Remittances, Rental, Migration, Interest etc.

IV Trend in relative profitability

As evident from the tables 8, 9 the relative profitability trends indicate that horticultural enterprises generated more income per hectare compare to agricultural crops except ber and onion, which are grown under rainfed conditions in Kapanimbargi village. The cost to return ratios shows that for every rupee invested on horticulture generated almost twice the return to that of agriculture proving that horticultural crops are lucrative compare to other crops. Similarly in case of Tharati village, barring arecanut and coconut other enterprises particularly flower crops are proved to be more profitable. The relative profitability of horticultural crops compared to cereals has been shown to be a determining factor for crop diversification into horticultural production in India (Joshi et al). Compare to horticultural crops, farmers incurred loss in growing agricultural crops in some years due to prolonged droughts. Meagre earnings from crop production especially in dry land situation has deterred farmers interest in agriculture leading to shift from farming to non-farming sources of income. Hence farmers have been deriving more income from non-farm sources such as brick making, bullock renting, sand mining, leaf plate making, petty business, construction, transport and son.

Table 8: Costs and net returns from agricultural and horticultural enterprises in Kapanimbargi Village, Bijapur district

Crop	2009				2010				2011			
	Gross Returns	Total Cost	Net Returns	Return to cost ratio	Gross Returns	Total Cost	Net Returns	Return to cost ratio	Gross Returns	Total Cost	Net Returns	Return to cost ratio
Agriculture												
Chickpea	19763	23106	-3343	0.86	12863	13181	-318	0.98	28330	20417	7914	1.39
Green gram	12355	7634	4721	1.62	5357	7190	-1833	0.75	12388	6985	5404	1.77
Maize	16657	16402	254	1.02	39078	26924	12154	1.45	43286	42286	1001	1.02
Pearl Millet	3542	8000	-4457	0.44	23104	21818	1286	1.06	24698	20111	4586	1.23
Pigeon pea	28636	25151	3485	1.14	20293	19106	1187	1.06	26819	15804	11015	1.70
Sorghum	11865	15640	-3775	0.76	21521	13141	8380	1.64	38272	18839	19433	2.03
Sunflower	2142	11422	-9280	0.19	27447	12813	14634	2.14	37375	19945	17429	1.87
Wheat	42094	29703	12391	1.42	31340	17434	13906	1.80	37686	21051	16635	1.79
Groundnut	36004	27072	8931	1.33	15357	12428	2930	1.24	12157	10490	1667	1.16
Cotton	19326	23046	-3720	0.84	30397	25743	4654	1.18	37560	19569	17991	1.92
Sugarcane	255738	68570	187168	3.73	213444	50527	162917	4.22	164618	121453	43166	1.36
Horticulture												
Ber	24017	17589	6428	1.37	127416	77232	50184	1.65	98565	64537	34028	1.53
Grapes	586875	152507	434367	3.85	555039	157299	397740	3.53	666847	297541	369305	2.24
Lemon	144050	32125	111925	4.48	267656	62653	205003	4.27	241866	66996	174870	3.61
Onion	13533	16360	-2826	0.83	41823	26269	15554	1.59	51892	53282	-1390	0.97
Chillies									80584	15295	65289	5.27
Jasmine	163490	45087	118403	3.63	625917	206897	419020	3.03	466146	117431	348716	3.97

Table 9: Costs and net returns from agricultural and horticultural enterprises in Tharati Village, Tumkur district

Crop	2009				2010				2011			
	Gross Returns	Total Cost	Net Returns	Return to cost ratio	Gross Returns	Total Cost	Net Returns	Return to cost ratio	Gross Returns	Total Cost	Net Returns	Return to cost ratio
Agriculture												
Finger Millet	76170	57709	18461	1.32	78233	44542	33691	1.76	52112	29054	23058	1.79
Groundnut	38548	40770	-2222	0.95	14826	16802	-1976	0.88				
Horse gram	30744	19633	11111	1.57					12479	7783	4696	1.60
Maize					39042	24472	14570	1.60	71796	33150	38647	2.17
Pigeon pea	21251	18382	2868	1.16	8673	16657	-7984	0.52	52489	42754	9735	1.23
Paddy	47903	41529	6374	1.15	81298	35392	45906	2.30	55450	28778	26671	1.93
Horticulture												
Acarus calamus	121575	60462	61114	2.01	138774	65332	73441	2.12				
Arecanut	160001	152324	7677	1.05	209379	125849	83529	1.66	133341	118566	14776	1.12
Coconut	44479	21641	22838	2.06	25664	42151	-16487	0.61	35880	52627	-16747	0.68
Banana					45146	20259	24887	2.23				
Brinjal	296525	90731	205793	3.27								
Tomato					158147	67998	90149	2.33				
Carrot	118610	36146	82464	3.28					106749	38962	67787	2.74
China Aster	202010	82518	119491	2.45	198185	61079	137106	3.24				
Chrysanthemum	152569	103856	48713	1.47	175549	79992	95557	2.19	204161	105596	98565	1.93
Jasmine	287187	139337	147850	2.06	219267	85915	133352	2.55	246961	135964	110997	1.82

Grape orchards in Kapanimbargi:

Grapes occupied substantial area under groundwater irrigation in Kapanimbargi village. In order to establish an ha of grape orchard require an investment of Rs 4,68,759/ at current prices**.** Upon amortizing this investment considering gestation period of 20 years with a discount rate of 8%, the annual share of establishment cost works out to be Rs 47,743. The recurring cost incurred on material inputs and labour was to the tune of Rs 242,378. Thus the total cost of production per ha worked out to be Rs 290,121 with a gross output value of Rs 678,744. After deducting total cost of production, the farmers realized a net margin of Rs 3,88,623 per ha. The undiscounted B: C ratio indicated that for every rupee invested on grapes, it has generated a net return of Rs 2.34 (table 10). Through processing, the value addition could be doubled, hence grapes cultivation in this area turned out to be one of the most lucrative enterprises. One of the case studies on processing of grapes revealed that for every kg of grapes processed result an out turn of 350 grams of raisins, while every kg of fresh grapes sold fetched Rs 25 (VDSA data base). Upon processing, the net value addition would be around Rs 50 for every kg. Though Grapes provide high income and employment potential, small and marginal farmers cannot afford to invest because of huge investment for establishment of grape orchards. Hence the implication is that only large farmers are being benefitted even from government schemes meant for supporting grapes. In order to improve equity, small farmers need to be supported both financially and technically to harness potential of returns from grapevine cultivation.

Table 10: Costs and Returns of Grape in Kapanimbargi Village, Bijapur district

Particulars	Value (Rs)	% proportion of total cost
Total Material Cost	117,793	41
Other Production Cost	48,622	17
Total hired labor cost	65,241	22
Total family labor cost	10,723	4
Total production cost (including value of family labor)	242,378	84
Amortized cost of orchard establishment	47,743	16
Total cost	290,121	100
Grape output (kg/ha)	7,713	
Cost of grapes (Rs/kg)	88	
Total Gross Return (Rs)	678,744	
Net return (Rs)	388,623	
Return to cost ratio	2.34	
Unit cost of cultivation (Rs/kg)	38	

Cost of establishment of grape orchard – Rs 468,759/ ha (life span of 20 yrs)

Floriculture in Tharati:

Technology driven intensive agriculture development is the striking feature of farming in the village with high input use intensity per unit area because of extremely small holdings. Since the village is surrounded by hillocks, there is no scope for area expansion. As a result, the land size has become tiny plots over the years. But, farmers are highly entrepreneurial in harnessing the potential of flower cultivation. It is one of the model villages for specialised flower cultivation (Chrysanthemum) under small scale. Women farmers are involved not only in flower production but also in stringing the flowers. This has created not only value addition to the flowers and sale but also generated additional employment for women on the farm. By stringing flowers and selling at retail market, farmer's income has been doubled. Access to groundwater irrigation and water markets promoted more secured employment opportunity preventing migration. Farmers harvest flowers every week. Farmer finds it comfortable to cultivate this crop on staggered plots of 0.1 ha at the most per time to a maximum of 4 plots or 0.4 ha with 4 staggered plantings. Most farmers cannot

afford to have more than one plot due to water and labour scarcity. Further, the selected villages have access to market and transportation and accordingly farmers sell their flowers and other produce in Bangalore and Tumkur markets by pooling their produce and conglomerating to reap better market price. The production economics of chrysanthemum has been converted on hectare basis in order to get a better picture and feel of its remunerativeness. On an average, the farmers cultivating flowers (Chrysanthemum) incurred cost of production to the tune of Rs 1,33,661 per ha yielding a net income of Rs 97,006 per ha (table 11). Every rupee expended on flower production, farmers realised an impressive net rerun of Rs 1.73. The floriculture is best suited for small and marginal holders, as flower production require intensive care and more labour. This is an eye opener that even small holdings possessing less than 0.4 ha with access to water, inputs and market cultivating high value enterprises like flowers can turn small holdings into more economically viable generating substantial income.

Table 11: Costs and Returns of Chrysanthemum in Tharati village, Tumkur district

Particulars	Value (Rs)	% proportion of total cost
Total Material Cost	32,647	24
Other Production Cost	41,469	31
Total hired labor cost	15,459	12
Total family labor cost	21,886	16
Total irrigation cost	22200	17
Total cost (paidout costs)	111,775	84
Total production cost (including value of family labor)	133,661	100
Yield (Kg/Ha)	3,343	
Unit price of output (Rs/kg)	69	
Total Gross Returns	230667	
Net returns	97006	
Return to cost ratio	1.73	
Unit cost of cultivation (Rs/kg)	40	

Issues and Concerns in Horticulture Sector

There have been wide fluctuations in the returns realised by the farmers among all crops over the years, particularly in case of agricultural crops indicating instability in the flow of income. This is mainly because of frequent droughts and groundwater scarcity. The groundwater in the area has been over exploited leading to threats to groundwater based agriculture affecting the sustainability of the groundwater based agricultural and horticultural livelihoods. The major constraints in the production and marketing of fresh fruits and vegetables are quality seed material inadequate soil testing facilities, lack of irrigation and extension staff. Similar constraints have been indicated by Kumar and Pal, 2004 in their study relating to impact of vegetable research in India.

Technological and Institutional Interventions:

Since, there is a great potential to enhance income through horticultural enterprises, there is a need for innovative technological and institutional interventions. Technological interventions to promote horticultural growth in the semi-arid villages of the state inter alia include micro irrigation, good agricultural practices, post-harvest processing, scientific storage, grading, packaging, branding and transport. Further, to improve horticulture performance in the villages horticultural development strategy for differentiated target groups like efficient supply chain with market intelligence and market led extension are crucial. Developing farmers groups for managing inputs and output market, capacity building of the poor for managing their livelihood assets is extremely important. Effective delivery of services including credit and providing information on various aspects right from production, processing, marketing and other Government subsidized schemes meant for small holders is vital.

Public and private investment on Watershed development plus other measure are extremely important**.** The role of watershed development is very vital towards soil and moisture conservation, sustainable use of rainwater harvesting towards reducing drought risk and groundwater recharge. There is also a need to establish a platform for participatory exchange of latest knowledge and advisory services in the villages, especially in the area of plant protection and environmental safety. This would benefit majority of the farmers relating to safety use of chemicals.

Conclusions

There has been structural transition in the village economies with shift in the cropping pattern towards high value non-food crops that include horticultural enterprises and more income being derived from non-agriculture than agriculture and within farming horticulture led development with access to groundwater. The horticultural crops generated substantial amount of employment compare to agricultural crops and the women labour absorption per ha of horticultural cropped area is very impressive in Karnataka VDSA villages. The relative profitability of different enterprises indicated that in some years farmers failed to generate adequate returns from agricultural enterprises. But, horticultural enterprises proved to be more remunerative compare to agriculture. A steady flow of income from farming is crucial for farmers to continue in the agriculture. In this regard, horticulture enterprises are comparatively better but its sustainability is also in threat due to scarcity of groundwater.

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