Attaining Livelihood Security Through Horticulture Development in Karnataka, India

Abstract

The present study aimed to assess the overall impact of horticulture development on farmers' livelihood security in Karnataka. Livelihood security was analysed in terms of expenditure on food, education, and health across different farming systems. Primary data were collected from 180 growers from two taluks of the Vijayapur district, India. Looking into the farming system, the analysis revealed a higher income from horticulture crops should culminate in the secured livelihood of farm households. In the case of the study area, no discernible pattern was noticed in expenditure on food items across different farm families in three types of farming systems. The expenditure on food intake was Rs. 9154, Rs. 9931, and Rs. 9728, respectively, in high-investment farming systems, medium-investment farming systems, and low-investment farming systems, respectively. In respect of other components of livelihood security, namely education and health, it was observed that low-investment farming systems and high-investment farming systems spent more on education. In respect of expenditure on health, farms in low-investment farming systems had spent more on this as compared to the other two categories. Thus, it is clear that higher income from horticulture enterprises enabled farmers to spend more on livelihood components.

Key words: Horticulture development, livelihood security, expenditure on food, education and health.

Introduction

In the past few decades, there have been substantial changes in the patterns of production, consumption, and trade in Indian agriculture. The relative importance of grains and other starchy staple crops is declining, while that of horticulture commodities is increasing. The horticulture sector creates opportunities for marginal and small farmers to raise their income and livelihood security by participating in the growing markets for horticulture goods. The Green Revolution was driven by technological innovation, namely the development of high-yielding varieties of rice and wheat. In contrast, the current restructuring of the agricultural sector is driven not by supply factors but by shifts in consumer demand, both domestic and international. The horticultural crops provide a better alternative for diversification of Indian agriculture in view of higher return. It plays an important role in a country's nutritional security as well, including poverty alleviation and employment generation [9,10].

From a human nutrition point of view, horticulture is most important to our daily lives. Many of the horticulture crops and their products find place in our meals and diet. The human

body requires vitamins, minerals, proteins, energy, etc. for its health. All these are supplied by horticultural crops. Fruits and vegetables are the chief sources of vitamins, minerals, carbohydrates, fats, proteins, etc. Fruits and vegetables are recognised as protective foods as they are necessary for the maintenance of human health. It has been recommended diversification of agriculture, especially dry land agriculture, in terms of horticulture to enhance livelihood security. Prita (2001). The importance of maintaining food security the world over has been abundantly recognised since long. Food security essentially means that all people at all times have access to safe and nutritious food to maintain health and an active life. This definition implies three dimensions to food security, namely, availability, access, and stability at various levels of aggregation, i.e., global, national, household, and individual level. The horticulture sector can enable farms to have food security through increased income from the horticulture sector besides providing nutrients and food items (Viswanathan and Shivakoti, 2008; Sherbinin et al., 2008; and Jhamtani et al., 2003).

To meet the objectives of poverty reduction, nutrition and food security, competitiveness, and sustainability, several researchers have suggested a farming system approach. Farming system may be defined as the approach that involves the allocation of available resources of a farm to the production enterprises in a manner that helps the attainment of the goals of maximisation of farm income and employment, Abruzzese et al. (2005) and Apata (2006).

The ultimate goal of sustainable agriculture is to develop farming systems that are productive and profitable, conserve the natural resource base, protect the environment, and enhance health and food safety. Horticulture provides excellent opportunities for raising the income of the farmers, even in the dry tracts. A significant shift towards horticulture is evident in the state with an increase in area and production. Horticulture provides higher unit productivity and offers great scope for value addition, and this sector is making inroads throughout the length and breadth of the state. Karnataka, having the highest acreage under dry farming in the country next only to Rajasthan, has a great potential to grow high-value but less water-demanding horticultural crops.

Further, it has contributed significantly to poverty alleviation, enhancing nutritional security, and supplying raw materials for a number of agro-based industries, which generate huge employment opportunities. The pertinent research questions are whether horticultural development in the state is even across the state. Which horticulture crops performed well? What is the importance to the

economic status of farmers whether horticulture crops improve economic and livelihood security status? Keeping these issues under consideration, the overall objective of the study is to analyse the impact of horticulture development on the livelihood security of farm families. The present study was taken up in the two districts of Bijapur and Kolar, which are well developed with respect to horticulture in the state.

2. Research Data and Methodology

The present study was taken up in Bijapur and Indi Taluks of Bijapur district. These farmers were post-classified into three groups based on the investment pattern on farms. Farms with an investment of Rs. 3 lakhs or more were classified as high investment farming systems, including grapes, field crops, and dairy; those with Rs. 1 lakh to Rs. 2 lakhs are categorised as medium investment farms, including sericulture, field crops, and dairy. Farms whose investment was Rs. one lakh is less being classified as low investment farming systems. Lime, vegetables, field crops, and dairy were major enterprises. Focusing on these crops, primary data were collected from the randomly selected farm households. From each taluk, three villages were selected randomly, and from each selected village, 30 farmers were selected randomly. Thus, the total sample for the study was 180 farm households. To study the economics of selected crops, averages and percentages were used. Different concepts of costs and returns were used in the study. In the present study, all calculations pertaining to the economics of principal crops were made on a per-hectare basis.

3 Results and Discussion

The cost and return structure of principal crops and subsidiary enterprises practiced by farm households under major farming systems was worked out (the details are given in the appendix), and summary results are presented under the following headings.

3.1 Relative economics of principal crops

The relative economics of annual crops (jowar, maize, red gram, tomato, and onion) and perennial crops of grapes, lime, and mulberry crops on a hectare basis is presented in Table 1. The net returns were highest from grapes (Rs 335505), followed by jowar (Rs 8896), red gram (Rs. 9081), and maize (Rs. 20296) among small farmers in high-investment farming systems. Among medium farmers, grapes (Rs. 225477), jowar (Rs. 3647), redgram (Rs. 4957), and maize

(Rs. 11335) respectively gave higher returns. For large farmers, grapes (Rs. 332872), jowar (Rs. 3374), redgram (Rs. 13749), and maize (Rs. 18487) were profitable crops in the order mentioned. The net returns related to the medium investment farming system revealed that among small farmers, sericulture jowar, redgram sunflower, and maize contributed net incomes of Rs. 66425, Rs. 8468, Rs. 15498, Rs. 21753, and 8597 per ha, respectively. In the case of medium farmers, sericulture (Rs. 53200), jowar (Rs. 6450), sunflower (Rs. 15498), red gram (Rs. 24192), and maize (11335) were the profitable enterprises. Among large farmers, sericulture, jowar, sunflower, red gram, and maize gave a profit of Rs. 51282, Rs. 7790, Rs. 13914, Rs. 10841, and Rs. 12917, respectively. In the low-investment farming system, small farmers were getting returns to the extent of Rs 155770, Rs. 4229, Rs. 14122, Rs. 9840, Rs 92857, and Rs. 24580 per ha from lime, jowar, sunflower, redgram tomato, and onion, respectively. For medium farmers, net income from lime, jowar, sunflower, redgram tomato, and onion was Rs 165465, Rs 19590, Rs 9522, Rs 10152, Rs 82857, and Rs 20695 per ha, respectively. In the case of large farmers, lime (Rs. 131458), jowar (Rs. 8505), sunflower (Rs. 17670), redgram (Rs. 28259), tomato (Rs. 91525), and onion (57790) turned out to be profitable crops.

Grape, lime, mulberry, jowar, red gram, maize, tomato,tomato and onion are the predominant crops in all the farming systems in the study area where irrigation facilities are available. In order to assess profitability across farming systems, the costs and returns structure for the principal crops was worked out. Although net income from jowar was low in all farming systems, it is cultivated every year as it is the staple food crop of this region. The net returns per rupee of cost were highest in the case of low-investment, medium-sized farm households, as the total cost of cultivation was lower than the other groups. The reason behind the low cost of cultivation was the application of a lower quantity of FYM and lesser use of machine power by low-investment farming households. Interestingly, the net return per ha from grapes was maximum in all categories of high farming systems. The maximum net income was Rs. 335505 among small farms in high-investment farming systems. The net return from lime in a low-investment farming system was more than grapes and sericulture because the cost of cultivation of lime was the lowest and it required lower maintenance. It was observed that most of the farmers were shifting from sericulture and grapes to lime cultivation due to its greater profitability and lower incidence of pests and diseases. In the case of grapes, higher costs and a higher net return were

observed among small farmers. Perhaps due to the operation of scale economies among medium and large farmers, the cost might have seen a lower.

Table-1: Relative economics of principle crops (Rs. per hectare)

SI	Particulars	HI Farming system small				HI Farming system medium				HI Farming system large			
		Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR
1	Jowar	16962	8066	8896	1.10	10420	6773	3647	1.10	66120	32371	33748	1.04
2	Redgramm	16538	7457	9081	1.21	19615	10658	4957	0.84	55557	25808	29748	1.15
3	Maize	34954	14658	20296	1.38	21371	10037	11335	1.12	38892	20404	18487	0.91
4	Grape	454609	119104	335505	2.82	335778	110301	225477	2.04	540210	207338	332872	1.61
		MI Farming system small				MI Farming system medium				MI Farming system large			
1	Jowar	18172	9704	8468	0.87	16362	9912	6450	0.65	23710	15920	7790	0.48
2	Sunflower	23737	8239	15498	1.28	23737	8239	15498	0.53	22621	10764	13914	1.10
3	Redgramm	41115	16924	21753	1.43	41115	16924	24192	1.42	32438	21596	10841	0.50
4	Maize	15008	6383	8597	1.35	21371	10037	11335	1.13	24238	11321	12917	1.14
5	Sericulture	132535	66110	66425	1.01	80224	27024	53200	1.97	79744	28462	51282	1.80
		LI Farming system small				LI Farming system medium				LI Farming system large			
1	Jowar	14388	10159	4229	0.41	34274	14684	19590	1.33	19161	10655	8505	0.80
2	Sunflower	24933	10811	14122	1.30	21997	12475	9522	0.76	20615	9185	17670	1.24
3	Redgramm	28000	18160	9840	0.54	26324	16172	10152	0.62	40080	19108	28259	1.10
4	Lime	374069	93609	210460	4.88	340665	61645	279020	4.53	299048	67907	231142	3.40
5	Tomato	128725	35868	92857	2.59	135725	45868	82857	2.19	132612	41087	91525	2.23
6	Onion	36530	11950	24580	2.05	32530	11950	20695	1.72	93095	35305	57790	1.64

HI : High investment MI: Medium investment and LI: low investment farming systems

3.2 Relative economics of subsidiary enterprises

The summary of net returns from major subsidiary enterprises under each farming system is presented in Table 2. Dairy was one of the major subsidiary enterprises practiced by all households in the study region. The net return per local buffalo was maximum in high-investment farms for small farmers at Rs. 45028. The magnitude of return from this activity among farmers in medium investment was Rs. 34958. In the case of a low-investment farming system, medium farmers were getting the highest income of Rs. 46416 from dairy. Dairy is one of the important components in all farming systems. Major part of the total costs in dairy enterprises were covered by feed and concentrates in all farming systems. Small farmers realised the highest net income per cow per year under a high-investment farming system. The lowest net returns were in high-investment farming per cow per annum. The findings of the present study are in contrast to those of Kandasamy (1998), who reported that the dairy-based farming system gave the highest annual income (Rs. 6090/ha) with a per-day income of Rs. 16.16 and provided additional employment of 217-man days per year as against Rs. 1902 and Rs. 5.21 net annual income and per-day income, respectively, with the farmer's method of sole cropping. Kumar *et al.* (2002) studied interactions and changes in farming systems in semi-arid parts of India. There were wide variations in the source and magnitude of household income among the identified farming systems. However, the farming system comprising crops and livestock contributed a major share, accounting for more than 80 percent of the total family income in all the farming systems.

Table -2: Relative economics of Dairy Enterprises (Rs/animal)

Particulars	HI Farming system small				HI Farming system medium				HI Farming system large			
Dairy (per local cow per year	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR
	84740	39712	45028	1.13	82246	40268	41978	1.04	75788	46902	28886	0.61
	MI Farming system small				MI Farming system Medium				MI Farming system large			
Dairy (per local cow per year	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR
	56340	24690	31650	1.28	79600	44642	34958	0.78	86405	53350	33055	0.61
	LI Farming system small				LI Farming system medium				LI Farming system large			
Dairy (per local cow per year	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR	Gross returns	Total cost	Net returns	BCR
	99145	52729	46416	0.88	78133.7	38254.6	39879.1	1.04	50778	31424	19354	50778

Note : HI, High investment farming system MI: Medium investment farming system, LI: Low investment farming system

3.3 Annual farm household income

A farming system aims at the efficient use of resources to maximise income for the farm family. It also tries to minimise the production risk by spreading the risk to various enterprises instead of one activity. The details of annual income of households derived from the major farming systems are furnished in Table 3. In the high investment farming system, small farmer households realised a maximum annual income of Rs 281772, of which 78 percent was from farm enterprises, followed by dairy (Rs. 45028), which contributed 12 percent to the total income. The contribution of nonfarm income was 10 percent. In the case of medium farmers, farm income contributed 86 percent, dairy 9 percent, and nonfarm activities five percent. Among the large farmers, farm income contributed 97 percent, dairy 2 percent, and nonfarm activities about one percent to the total income of Rs 2333474 per household. In the medium-investment farming system, pooled farm income contribution was 72 percent, while dairy contribution was 17 percent and non-farm income was 11 percent. In the case of a low-investment farming system, the contribution of farm income was 65 percent among small farmers, 78 percent among medium farmers, and 96 percent in the case of large farmers. The dairy sector contributed 28 percent to the total income in the case of small farmers, 13 percent among medium farmers, and 2 percent in the case of large farmers. The nonfarm income contribution to total income was 6, 7, and 2 percent, respectively, for the three types of farmers. Farmers in the low-investment farming system realised a maximum net annual income of Rs. 464555 per farm. However, large farmers in all categories realised the highest income. It is quite obvious that large farmers, because of their strong economic position, were in a position to adopt high-value enterprises and practices, which resulted in higher income. Grapes was another commercial crop grown profitably in the study area, but it requires a huge amount of establishment of cost even though it gives a higher return, but the risk is also very high due to climatic factors.

Table-3: Annual farm household income from various sources (in Rupees/annum/ farm)

Particulars	High investment farming system				Medium investment farming system				Low investment farming system			
	Small	Medium	Large	Pooled	Small	Medium	Large	Pooled	Small	Medium	Large	Pooled
Farm income	281772 (78)	399050 (86)	2280021 (97)	992293 (93)	107459 (48)	209175 (67)	510811 (82)	275815 (72)	345521 (74)	637938 (85)	1357388 (94)	780282 (88)
Dairy income	45028 (12)	41978 (9)	28886 (2)	38631 (4)	63300 (28)	69916 (23)	66110 (11)	66442 (17)	99248 (22)	79758 (10)	19354 (4)	79453 (9)
Nonfarm income	35000 (10)	23678 (5)	24567 (1)	27748 (3)	54237 (24)	29867 (10)	45378 (7)	43160 (11)	19786 (4)	34251 (5)	17890 (2)	23976 (3)
Total income	361800 (100)	464706 (100)	2333474 (100)	1058672 (100)	2,24996 (100)	308958 (100)	622299 (100)	385417 (100)	4,64,555 (100)	7,51,947 (100)	13,94,632 (100)	8,83,711 (100)

Note: Figure in parentheses indicates percentage to the total

3.4 Distribution of annual income among farm households

Equity in the distribution of income among farm households is an important dimension of welfare. To examine the equity in the distribution of income among farm households in the study region, the Gini coefficients were computed, and numerical values are presented in Table 4. The zero corresponds to perfect equality in the distribution of income (that is, everyone has the same income), and the numerical value of one corresponds to perfect inequality in the income distribution. As revealed by Gini coefficients and the Lorenz curve, the inequality in the income distribution was relatively lower among small and medium farm households of high investment farming systems, while it was relatively higher among large farmer households of the group. The inequality in general was higher among households with low investment farming systems, as the Gini ratios were relatively higher between 0.434 and 0.853. The income distribution among households in the medium-investment farming system was relatively better than the other two groups. An important policy dimension is equity in the distribution of income and benefits across different types of households. It is expected that gains from horticulture development must be even (equity) across all farmers. To examine this hypothesis, the Gini coefficients were computed. The results of Gini coefficient analysis showed that there was a fair degree of equity among small farmers in all farming systems. The inequality was greater among farmers of low-investment farming systems, which was due to their dependence on lime and grape, which provide employment almost year-round.

Table-4: Gini coefficient for distribution of annual income among farm households

SI No	Category of farmers	High investment farming System Gini coeffient	Medium investment farming System Gini coeffient	low investment farming System Gini coeffient
1	Small	0.488	0.460	0.434
2	Medium	0.416	0.644	0.676
3	Large	0.779	0.437	0.853

3.5 Consumption pattern of food items in physical quantities

Livelihood security of farm households was analysed in terms of food intake and health education expenditure. In order to assess the influence of different types of farming systems on the consumption expenditure, the consumption behaviour of farmers across all types under the three farming systems was nalyzed. Quantities of different food items consumed by the sample households were computed on a per-family basis, and results are furnished in Table 5. The dietary pattern of households belonging to high-investment farming systems was mainly cereal-

based. Jowar, bajra, wheat, and rice were the main food grains consumed by the sample households. Average consumption of cereals was 66 kg per month per family. The magnitude of consumption of pulses was 7 kg per month per family. Pulses are generally considered low-cost protein sources for vegetarians. In the case of the medium investment farming category, the consumption of cereals was 68 kg per month per family, and that of pulses was much lower at 8 kg. Among farmers in low-investment farming systems, cereal consumption was about 51 kg per family per month, and that of pulse was only 6 kg per family per month.

Consumption of vegetables was highest among farm families belonging to high-investment farming systems at 9 kg per family per month. In the case of medium and low investment farming systems, the consumption of vegetables was 36 and 37 kg per family per month, respectively. In respect of edible oil consumption, it was almost the same across the three farming systems, at an average of about 8 kg per family per month. With respect to fruit consumption, it was highest in the case of farmers belonging to high investment systems, with an average consumption of about 33 kg per month per family. Per capita consumption of milk worked out to about 57 litres per family per month among farmers belonging to high-investment farming systems. In the case of medium- and low-investment farming systems, the corresponding figures were 49 and 47 litres per family per month. The consumption of non-vegetarian food like meat, fish, and eggs was extremely low, as the mean per capita consumption of meat was 4, 6, and 6 kg per family per month among farm families belonging to high investment, medium investment, and low investment farming systems, respectively. Fish consumption was highest at 0.66 kg per family per month among farmers in the medium investment farming system, as opposed to 5, 3, and 7 kg among farmers in the high investment and low investment farming systems, respectively.

3.6 Expenditure pattern on food and non-food items

The per capita expenditure pattern on food items under different farming systems is presented in Table 6. The total per capita expenditure on food items was highest (Rs 4966 per month) among households under a medium-investment farming system. This was followed by households with a high investment farming system spending Rs. 4577 per month. The households of low investment farming spent around Rs. 4864 per month on food, which was the least per capita expenditure among the different groups of sample households. The total expenditure per family was highest among households under a low investment farming system

(Rs. 7499 per month) and was least in the case of a high investment farming system with an expenditure of Rs. 6955 per month. The total expenditure per family was highest in households under a medium investment farming system (Rs. 4966 per month) and was least in the case of a high investment farming system with an expenditure of Rs 4577 per month. The expenditure on food captured the major share of the total expenditure under three farming systems (73 to 85 percent of total expenditure). The non-food expenditure was incurred on clothing, fuel, medical expenses, education, and festivals. The expenditure on education ranged between 15 and 20 percent in households practicing different farming systems.

3.7 Livelihood security in terms of food intake and expenditure on education and health

The net income from horticulture enterprises in general was highest among households and in particular among farms of high investment farming systems and low investment farming systems, which were specialised in horticulture crop production. It is expected that higher income from horticulture crops should culminate in the secured livelihood of farm households. Livelihood security was analysed in terms of expenditure on food, education, and health across different households in all the farming systems, and results pertaining to these are presented in Table 1. In the case of the study area, no discernible pattern was noticed in expenditure on food items across different farm families in three types of farming systems. The expenditure on food intake was Rs. 9154, Rs. 9931, and Rs. 9728, respectively, in high investment farming systems, medium investment farming systems, and low investment farming systems, respectively. In respect of other components of livelihood security, namely, education and health, it was observed that low investment farming systems and high investment farming systems spent more on education. In respect of expenditure on health, farms in low-investment farming systems had spent more on this as compared to the other two categories. Thus, it is clear that higher income from horticulture enterprises enabled farmers to spend more on livelihood components.

Table-5 Consumption of food items (per family) under different farming systems (Quantity/Month)

SN	Particulars	High investment farming				Medium investment farming				low investment farming			
		Small	Medium	Large	Pooled	Small	Medium	Large	Pooled	Small	Medium	Large	Pooled
	Average family size	6	7	10	8	8	9	11	9	5	8	9	7
1	Cereals (Kg)	59	67	72	66	62	73	70	68	58	50	45	51
2	Pluses (Kg)	5	8	9	7	8	7	9	8	3	6	10	6
3	Vegetable (Kg)	6	7	15	9.33	31	38	40	36	32	39	40	37
4	Fruits (Kg)	24	27	48	33	10	12	18	13	9	12	15	12
5	Edible oils (Kg)	9	7	9	8.33	9	11	8	9	5	6	9	7
6	Milk (lit)	42	54	75	57	45	56	46	49	36	48	57	47
7	Meat (Kg)	6	5	2	4.33	5	4	8	5.67	2	7	9	6
8	Egg (No)	30	28	63	40.33	20	19	38	25.67	42	61	52	52
9	Fish (Kg)	2	6	9	5.66	5	2	4	3.67	4	6	10	7
10	Sugar (Kg)	2	5	1	2.67	5	6	6	5.67	6	6	9	7
11	Jaggery(Kg)	4	7	12	7.67	3	5	4	4	4	3	7	5
12	Total (Kg)	189	221	315	241.32	207	240	280	242	201	244	263	236

Table-6: Per family Expenditure pattern of different farming systems (Rs. /Month)

SN	Expenditure Groups	High investment farming				Medium investment farming				low investment farming			
		Small	Medium	Large	Pooled	Small	Medium	Large	Pooled	Small	Medium	Large	Pooled
1	Food security	2737	4928	6066	4577	3854	4739	6303	4966	3377	4256	6960	4864
2	Fuel	145	220	986	450	231	453	500	395	435	512	763	570
3	Clothing	456	568	783	602	386	593	891	623	432	903	623	541
4	Medical security	342	453	239	345	347	452	687	495	573	784	894	750
5	Festivals	543	673	874	697	236	348	412	332	378	897	674	501
6	Education Security	167	254	432	284	109	213	289	204	126	318	376	273
7	Total	4390	7096	9380	6955	5163	6798	9082	7015	5321	7670	10290	7499

Conclusion

The horticulture crops also provide better alternatives for diversification of Indian agriculture in view of higher returns. It plays an important role in a country's nutritional security as well, including poverty alleviation and employment generation. The changed economic order in the context of globalisation and liberalisation of world trade in agriculture has opened up new vistas of growth. The spice sector is one of the key areas in which India has an inherent strength to dominate the global markets. Thus, the horticulture sector is emerging as an important subsector of agriculture with a great deal of potential. With rising population, declining land-man ratio, and increasing mechanisation in farm operations, agriculture alone is not able to provide adequate income and employment to households in India. Integration of farm enterprises provides better livelihood in terms of increased food production, higher net income, improved productivity, and reduced income disparity between agricultural labourers and urban factory orkers. The introduction of appropriate farming systems has been proposed as one of the approaches to achieve higher growth in agriculture and livelihood. With this background, the present study was undertaken in Bijapur district of Karnataka, with an overall objective of examining the influence of the horticulture sector on the livelihood status of farm households under major farming systems.

Policy implications

- Although the National Horticulture Mission Programmes are underway in the state, in a good number of districts the area under horticulture crops is still lower, as indicated by the statistics on area and production. Therefore, on a priority basis, programs have to be devised to bring in large areas under horticulture crops in each district, taking into consideration the potential of each district. This could enhance the livelihoods of farmers, especially those of small and marginal farmers.
- The study revealed that lime emerged as the most profitable enterprise, especially in the study area, and farmers are shifting to cultivation of this crop in place of grapes and other horticultural enterprises. Periodical estimation of profitability of horticulture crops along with their market potential could be an appropriate extension strategy for enhancing the livelihoods of farmers. Lower annual income

of households under the sericulture farming system revealed the need for strong market linkages with highly profitable enterprises, so it suggested promoting low-investment crops like lime and dairy enterprises, which provide the maximum profit and employment among all classes of the rural population.

- One of the means of enhancing the incomes of farmers and maintaining the ecology of the region is the conversion of dry lands under annual crops to perennial dry land crops. Perhaps farmers can take advantage of benefits in this respect from watershed development programs, wherein in recent years, under watershed programs, thrust has been given to dry land horticulture. Extension programs may be initiated to educate farmers in this respect. Farmers are to be advised to participate in the watershed development programs not only to meet food, fodder, fuel, and financial needs but also to help maintain the ecological balances and to prevent environmental degradation through the adoption of soil and moisture conservation measures and also afforestation.

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