CHAPTER – I

INTRODUCTION

1.1 Introduction

Horticultural development had not been a priority in India until recent years. In the period of 1948-80, the main focus of the country was on cereals. Much planned efforts had not been made for horticultural development, except for some technical support and development efforts for specific commodities like spices, coconut and potato. During 1980-92 there was consolidation of institutional support and a planned process for the development of horticulture. It was in the post 1993 period that a focused attention was given to horticulture development through a enhancement of plan allocation and knowledge based technology. Despite of last decade being called a *"golden revolution"* in horticultural production, the productivity of horticultural crops has increased only marginally from 7.5 MT/ha in 1991-92 to 11.00 MT/ha in 2010-11 *(Indian Horticulture Database - 2011).*

In 2007-08 the total area under fruits and vegetables was 13.53 million hectare and the aggregate production stood at 185.11 million tones, which increased to 221.43 million tones in 2010-11. As a result of this huge spurt in horticulture produce, India has become the second largest producer of fruits and vegetables in the world, net only to Peoples Republic of China. The annual area and production growth under fruits and vegetables in the period 1991-2005 was 2.60 per cent and 3.60 per cent respectively. This growth is quite significant compared to the decline in area under cereals and cereal production, which is growing at the rate of 1.40 per cent per annum only in the last two decades. The share of fruits and vegetables in total value of agricultural exports has increased over the years from 9.50 per cent in 1980-81 to around 17.00 per cent in 2004-05. But India is still lagging behind in actual exports of these produce. However, the per capita availability of fruit and vegetables increased from 391 gm/day in 2004-05 to 466 gram/day in 2008-09.

Since 2005-06 the Department of Agriculture & Co-operation, Ministry of Agriculture, Government of India is implementing a centrally sponsored scheme of 'National Horticulture Mission' (NHM) in all the states and Union Territories except the North-Eastern States, Himachal Pradesh, Jammu & Kashmir and Uttaranchal (for which a separate Technology Mission for integrated development of horticulture exists) to promote holistic growth of the horticulture sector covering fruits, vegetables, root and tuber crops, mushroom, spices, flowers, aromatic plants, cashew and cocoa; duly ensuring forward and backward linkages with the active participation of all the stakeholders. The main objective of the Mission is to promote the holistic growth of horticulture sector through area based regionally differentiated cluster approach for development of horticultural crops having comparative advantage. Moreover the specific objectives of the Mission are:

i. *To provide holistic growth of the horticulture sector through an area based regionally differentiated strategies, which include research, technology promotion, extension, post-harvest management, processing and marketing, in consonance with comparative advantage of each state/region and its diverse agro-climatic feature;*
ii. *To enhance horticulture production, improve nutritional security and income support to farm households;*
iii. *To establish convergence and synergy among multiple on-going and planned programme for horticulture development;*
iv. *To promote, develop and disseminate technologies, through a seamless blend of traditional wisdom and modern scientific knowledge;*
v. *To create opportunities for employment generation for skilled and unskilled persons, especially unemployed youth.*

The mission envisages an end-to-end approach covering production, post-harvest management, primary processing and marketing for which, assistance is being provided to farmers, entrepreneurs, besides organizations in the public and private sector.

The scheme has been in operation effectively for about five years from now, it would be necessary to analyze the impact of the programme vis-à-vis objectives of the NHM scheme especially for the major focused crop in terms of area expansion, increase in production and productivity. Since the focus is on cluster approach for holistic development of potential crops, it will be necessary to undertake in depth study in respect of selected crops taken up for the development. It is therefore, the

Ministry of Agriculture, Government of India assigned to its Agro-Economic Research Centre/Units to carryout crop based impact evaluation study across the states. Accordingly Agro-Economic Research Centre for Bihar & Jharkhand, T M Bhagalpur University, Bhagalpur (Bihar) has undertaken this study in Bihar.

1.2 Background of the Horticultural Crops in the State

The state of Bihar, endowed with very fertile plain land and sub-tropical climate, holds a vast potential for growing a large variety of horticultural crops. Many tropical and sub-tropical fruits, vegetables, tuber crops, medicinal and aromatic plants, flowers, spices and plantation crops are grown commercially in the state. Presently fruits and vegetables crops cover about 1.11 million hectare (2008-09) accounting for 19.73 per cent of the net sown area and 14.39 per cent of gross cropped area of the state. There has been a substantial increase both in area and production of these crops in the last three decades. Now the state ranks 4th in fruit production and 3rd in vegetable production in the country. The state is also one of the leading producers of spices for which there is good demand in domestic as well as foreign markets.

The area under fruits in the state during 2008-09 was about 292 thousand hectare with a total annual production of 3.7 million tones. The state thus contributes nearly 7.00 per cent of the country's total fruit production, which are around 62.85 million tones (2007-08). Demographically about 8.00 per cent of the country's total population lives in the state. Thus, there exists a deficiency of 1.00 per cent between population level and production. The availability of fruit per head per day is about 70 gram. Mango is the most important crop with the large acreage (49.56%) and production (35.72%). The productivity of mango in the state is 9.23 ton/ha, which is lower than the national average of 11.93 ton/ha. Guava occupies 29 thousand hectare with a productivity rate of 7.88 ton/ha. Banana is the second most important crop with respect to production. The average productivity of banana in the state is 43.93 ton/ha. The state offers most salubrious climate for cultivation of litchi. About 2/3 of the total litchi production in the country comes from Bihar. Among citrus fruits, only lime, lemon and pummeloes are grown throughout the state but large

commercial establishments are not common. Pineapple is cultivated commercially in north-eastern part of the state particularly in Kishanganj, Purnea, Katihar and Saharsa district. Similarly coconut has also shown promise in Kosi belt. Area under papaya is often fluctuating. It is estimated that papaya is grown in an area of about 2000 ha in Samastipur, Begusarai, Muzaffarpur and adjoining districts with a total production of around 64 thousand tons per annum. Some other fruits grown in the state area: jackfruit, custard apple, aonla, bael, ber, pomegranate, peach, sapota, jamun, karonda, mulberry, khirni and amra.

The state of Bihar has also a long tradition of growing a large number of vegetables. Due to diversified agro-ecological situations, a wide range of vegetables are grown throughout the year, ensuring a regular year round supply of summer vegetables like bottle gourd, sponge gourd, cucumber, brinjal, chilli, radish, onion and cowpea. Depending on the situation, vegetables are grown in open fields as a seasonal commercial crop, in family kitchen gardens (or in backyards) for home consumption, in newly established fruit orchards as an inter-crop, or grown with sugarcane or maize as an intercrop. The total area under vegetable production is about 827 thousand hectare with annual production of 13386 tones. The average productivity is 16.19 ton/ha. The primary commercial vegetable crops representing more than 90.00 per cent of the cultivated vegetables area are crucifers (cauliflower, cabbage), salanceous vegetables (eggplant, tomato and chili), okra, cucurbits (gourds, cucumber and melons), root crops (radish, carrot, turnip) and pulses (peas, beans). Secondary vegetable crops, also of significant commercial importance include leafy vegetables (spinach and amaranth), tubers (sweet potato, amorphophallus, colocasia, yam-bean) and crucifers (broccoli and celary).

Root and tuber crops are the third most important food crop after cereals and legumes for providing food and nutritional security to the ever increasing population. Among tuber and root crops, sweet potato, amorphophellus, yambean, colocasia (Arvi) and lesser yam are very popular and being extensively cultivated in Bihar. Apart from sweet potato, tuber consumed by human, the vine is widely used as green fodder for animals.

Spice crops like turmeric, ginger and chilies are grown commercially during kharif season and coriander, fenugreek, fennel, omun and nigella during rabi season. Besides these, dill, bay-leaf and long pepper are also grown in some areas to a limited extent. Total area under spice crops is 10.80 thousand ha with annual production of about 57 thousand tones. Turmeric is grown either as a sole crop or as a mixed crop with maize or pigeon pea. Contribution of Bihar to the national production of different spices is follows: omum (24.50%); nigella (21.75%); turmeric (10.75%); fennel (10.32%); fenugreek (3.68%); coriander (3.58%) and ginger (1.47%).

The state is not producing enough flowers to meet its domestic requirements. Huge quantity of flowers is brought from the neighbouring states like: West Bengal and Uttar Pradesh. At present the area under cultivation of flowers in the state is very limited. Organized commercial cultivation in a large area is seldom found. Flowers are grown mainly in tiny plots near cities for loose flowers to make lari, garland, veni and gazara. Recently farmers have also started commercial production of crops like rose, gladidus and tuberose. The main markets are located at Patna, Muzaffarpur, Bhagalpur, Gaya, Rajgir, Purnea, Munger and others. Due to government support and some other initiative the area under floriculture in the state has now gone up to 593 ha. Flowers are grown mainly for their loose and cut flowers.

As regards the medicinal and aromatic plants is concerned, the exact area is not known but its plantation are becoming popular amongst the farmers and the area under these crops is gradually increasing in the state. Among the plantation coops coconut has expanded to about 15,000 ha in north Bihar. Tea plantation has also come up in Kishanganj and its adjoining areas.

1.3 Objectives of the Study

The study has following objectives:

i. *Assess the impact in terms of increase in area, production and productivity of identified horticultural crops covered under NHM, keeping 2004-05 as the base year in the state in general and for the identified crops/districts in particular.*
ii. *Extent to which the scheme has helped in creating employment opportunities and enhancement of income of the farmers, and;*
iii. *Suggest measures in improving the implementation strategy.*

1.4 Data base and Methodology

This study has been undertaken in Bihar. It is based on intensive sample survey. The main reliance is on primary data. To obtain primary data, first of all, on the advice of the Ministry of Agriculture, Govrernment of India, 2 districts have been selected. These are Muzaffarpur and Vaishali. From each selected district, 2 villages have been selected one on the basis of near the periphery of district headquarters and another from a district place so as to realize the effect of distance factor. Lohsarai (Bochhan block) and Amnor (Oraie block) villages in Muzaffarpur district and Satpura (Bhagwanpur block) and Katarmala (Gouraul block) villages in Vaishali district have been selected. To select the bottom unit of the sample, lists of the beneficiaries under the programme, mainly the area expansion scheme of the sample villages, have been obtained from the concerned DHO offices. Thereafter, the beneficiaries have been classified in different categories of farms and social sections, so that outreach of the scheme could be reflected in the study. The farm wise distribution of the sample households is as below:

Table No. 1.1: Farm wise Distribution of the Sample Farms

Districts	Marginal (< 1 ha)	Small (1-2 ha)	Medium (2-4 ha)	Large (4 + ha)	Total
BIHAR					
Muzaffarpur	10	9	21	10	50
Vaishali	7	13	22	8	50
Total	17	22	43	18	100

Mango and litchi crops have been covered for in depth study in Bihar. Besides the collection of primary data, secondary data have also been collected from the concerned DHO offices and state office of the NHM. Various published and unpublished literatures, documents etc. have been consulted. Discussions with the

officials at the state and district levels have also been arranged to elicit the information.

The reference periods of the study are 2004-05 (pre-project) and 2005-06 to 2008-09 (implementation of the programme).

1.5 An Overview

Before moving on to a detailed analysis of the impact of NHM in Bihar, a brief overview of the study is presented in this section. This report has been presented in six chapters. The first chapter discusses the state of horticulture in the country in general and in the state of Bihar in particular. It has also dealt the specific objectives of the study, data base and methodology adopted to carry out it. The second chapter analyses the area, production and productivity of horticultural crops based on secondary data in the state of Bihar. District wise growth in area and production of horticultural crops in general and selected horticultural crops viz., Mango & Litchi in particular have been presented in this chapter. The third chapter mainly deals with the findings of the study, spelling out the household characteristics, cropping pattern and production structure of 100 sample beneficiary households. The characteristics of operational holdings, sources of irrigation, sources and purpose of credit, assets holdings, structure of tenancy, area under HYV seeds, cropping pattern and production, costs and returns have also been analyzed in this chapter. The fourth chapter discuses about the production structure and resource use under horticultural crops in general and two selected crops in particular. The net returns from horticultural and non-horticultural crops and use of human labour in horticultural and non-horticultural crops have presented in this chapter. This chapter also analyses the marketing channels of horticultural crops and about the status of on-farm processing activities in horticultural crops in case of our two selected crops. The fifth chapter makes an assessment of overall impact of the NHM programme on the expansion of horticultural area and yield of selected horticultural crops (mango & litchi) during a period from 2004-05 to 2009-10. This chapter also analyses the expansion of area under rejuvenation/protection and resource procurement through NHM. The performance of the Mission with respect to NHM

resource for our sample farmers, the subsidy provision, capacity building and perception of the households about to NHM have been examined in this chapter. The suggestions of the farmers regarding the changes required so as to make NHM more effective has also been captured in this chapter. The sixth chapter highlights the summary of the findings of the study as discussed in preceding chapters and contains some policy implications of the study. Some specific policy suggestions have also been made for overall improvement in implementation of NHM with special reference on the selected crops and districts in Bihar.

CHAPTER – II

AREA, PRODUCTION AND PRODUCTIVITY OF HORTICULTURAL CROPS

2.1 Status of Horticultural Crops

Apart from major cereals and pulses, Bihar has a vast potential of growing a variety of horticultural crops like fruits, vegetables, medicinal and aromatic crops, flowers, spices and other plantation crops. The state has identified one horticultural crop for each district, depending upon the climate and suitability of the crop in the district. A cluster of crop fields is likely to be developed in the district. This, in turn, will act as a backdrop of an agro-based industry for the district. Bihar produces a variety of vegetables and fruits. The farmers of Bihar are also taking interest in floriculture in recent years. The commercial production of flowers is taking place in the state in view of its rising demand. The important flowers of the state are rose, gladiolus, jasmine (bela), marigold and tuberose. Moreover, the state has 9359.57 thousand hectares of geographical area and out of it the cultivable area in 2004-05 is 6669 thousand hectares (71.25% of total geographical area), which slightly decreased to 6653.18 thousand hectares (71.08% of total geographical area) in 2008-09. The area under horticultural crops (fruits + vegetables + flowers) in the state was 785.39 thousand hectares, in 2004-05, accounts for 11.78 per cent horticulture area to cultivable area. It increased to 1116.17 thousand hectares in 2008-09 i.e., 16.81 per cent to cultivable area of the respective year in the state. It recorded a significant increase in area under horticultural crops during 2004-05 to 2008-09. The district wise geographical, cultivable and horticultural crops area in the state are presented in table No. 2.1.

Table No. 2.1: District wise Geographical, Cultivable and Horticultural Crop Area in Bihar ('000 hectares)

SN.	Name of the Districts	Geographical Area ('000 ha)	Cultivable area during		% age Cultivable Area to Geographical Area		Area under Horticulture Crops (Fruit + Vegetab + Flowers)		% age Horticulture Area to Cultivable Area	
			TE 2004-05	TE 2008-09	TE 2004-05	TE 2008-09	TE 2004-05	TE 2008-09	TE 2004-05	TE 2008-09
1.	Patna	317.24	229.24	228.85	72.26	72.14	29.92	47.16	13.05	20.61
2.	Nalanda	232.73	186.73	186.28	80.23	80.04	37.16	65.37	19.90	35.09
3.	Bhojpur	237.34	197.34	197.17	83.15	83.07	17.63	27.08	8.93	13.73
4.	Buxar	167.00	148.00	147.80	88.62	88.50	12.31	18.31	8.32	12.39
5.	Rohtas	390.72	259.72	259.80	66.47	66.51	19.02	29.61	7.32	11.39
6.	Kaimur	342.45	177.45	176.65	51.82	51.58	11.62	15.90	6.55	9.00
7.	Gaya	493.77	315.77	316.09	63.95	64.02	17.13	28.52	5.42	9.02
8.	Jehanabad	94.04	73.04	75.29	77.67	80.06	5.61	10.20	7.68	13.54
9.	Arwal	62.63	52.63	50.57	84.03	80.74	3.91	8.10	7.43	16.02
10.	Nawada	248.73	138.73	138.54	55.78	55.70	13.57	19.10	9.78	13.79
11.	Aurangabad	330.01	240.00	240.49	72.73	72.87	14.43	20.35	6.01	9.53
12.	Saran	264.89	213.89	213.53	80.75	80.61	23.56	37.83	11.02	17.72
13.	Siwan	224.41	184.41	184.53	82.18	82.23	19.08	29.45	10.35	15.96
14.	Gopalganj	203.77	165.77	165.83	81.35	81.38	19.63	32.44	11.84	19.56
15.	East Champaran	431.72	348.72	347.99	80.77	80.61	34.94	47.40	10.02	13.62
16.	West Champaran	484.35	295.35	295.74	60.98	61.06	33.86	48.21	11.46	16.30
17.	Muzaffarpur	313.35	248.35	247.87	78.75	78.60	53.15	65.46	21.40	26.36
18.	Sitamarhi	221.89	157.89	157.83	71.16	71.13	21.26	28.52	13.47	18.07
19.	Sheohar	43.48	31.48	30.62	72.40	70.42	10.95	15.54	34.78	50.75
20.	Vaishali	201.45	141.45	140.87	70.22	69.93	42.47	61.46	30.02	43.63
21.	Bhagalpur	254.30	164.30	164.00	64.61	64.49	26.84	36.04	16.34	21.98
22.	Banka	305.62	175.62	174.90	57.46	57.23	15.09	21.11	8.59	12.07
23.	Munger	139.79	68.79	68.71	49.21	49.15	9.41	18.61	13.68	27.08
24.	Sheikhpura	62.08	51.08	51.18	82.28	82.44	4.91	10.74	9.61	20.98
25.	Lakhisarai	128.60	94.60	94.30	73.56	73.33	3.18	7.41	3.36	7.86
26.	Jamui	305.29	144.29	144.47	47.26	47.32	7.72	11.21	5.35	7.76
27	Khagaria	149.34	104.34	105.03	69.87	70.33	14.09	20.48	13.50	19.50
28.	Darbhanga	254.08	193.08	192.53	75.99	75.88	39.08	44.28	20.34	23.00
29.	Madhubani	353.50	266.50	265.62	76.39	75.14	27.00	36.38	10.13	13.70
30.	Samastipur	262.39	196.39	196.19	74.85	74.77	34.09	47.82	17.36	24.37
31.	Begusarai	187.83	128.83	128.95	68.59	68.65	14.98	34.31	11.63	26.60
32.	Purnea	313.88	255.88	256.46	81.52	81.71	22.56	30.75	8.82	11.99
33.	Araria	271.71	214.71	215.14	79.02	79.18	11.18	15.33	5.21	7.13
34.	Kishanganj	189.08	144.08	143.68	76.20	75.99	12.93	19.13	8.97	13.31
35.	Katihar	291.35	211.35	211.05	72.54	72.44	31.48	38.05	14.89	18.03
36.	Saharsa	164.56	125.56	125.64	76.30	76.34	21.14	28.04	16.84	22.32
37.	Madhepura	179.59	145.59	144.74	81.07	80.59	21.38	27.23	14.69	18.81
38.	Supaul	238.60	167.60	167.71	70.24	70.29	9.64	15.22	4.04	9.08
	Total	9359.57	6669.00	6653.18	71.25	71.08	785.39	1118.17	11.78	16.81

2.2 Growth of Horticultural Crops

In fact time series data for various constituents of horticultural sector is not available with any of the major secondary data sources, including state government publications. Moreover, an analysis of the triennium ending averages area and production of horticultural crops in the state (table 2.2) reveals that both fruits and vegetables signify a steady growth in terms of area and production since 1990-91 onwards to 2009-10. Considering triennium ending values, data on area and production of fruits, vegetables, spices, flowers and medicinal and aromatic show moderate increase over the period. On a comparative basis, it comes out that while the production of fruits grew from 27.99 lakh MT in 1990-91 to 39.12 lakh MT in

2009-10 (an increase of about 1.4 times), the production of vegetables grew from 86.43 lakh MT in 1990—91 to 146.30 lakh MT in 2009-10 registering an increase of 1.69 times. During last decade (2000-01 to 2009-10), total area under fruits grew from 2.72 lakh hectare in 2000-01 to 2.96 lakh hectare in 2009-10 (an increase of 1.09 times), while total vegetables area grew from 5.78 lakh hectare in 2000-01 to 8.45 lakh hectare in 2009-10 (an increase of 1.46 times). In case of spices, total area grew from 0.091 lakh hectare to 0.131 lakh hectares during TE 2004-05 to TE 2009-10 (an increase of 44%) whereas the production increased from 0.094 lakh MT in 2004-05 to 0.154 lakh MT in 2009-10 (an increase of 63.83%). During TE 2004-05 to TE 2009-10, the area under commercial flowers increased 4 times whereas the production increased about 6 times.

A detailed analysis of percentage growth in area and yield of different horticultural crops in Bihar reveals that it is impressive in the period of 2000-01 to 2009-10 in case of fruits and vegetables. In particular, while the rate of growth of fruits area stands 8.82 per cent in the period of 2000-01 to 2009-10, that for yield comes out 24.95 per cent over the same period. Again growth rates for fruits area and vegetables indicate 1.72 per cent and 31.80 per cent respectively in the period of 2004-05 to 2009-10. Similarly for vegetables sub-sector for area and yield are 46.19 per cent and 24.71 per cent respectively in the period of 2000-01 to 2009-10, while these figures are 71.05 per cent and 12.11 per cent for the period of 2004-05 to 2009-10. In case of spices the growth in area and yield recorded by 43.96 and 14.56 per cent during the period of 2004-05 to 2009-10. The corresponding growth in flower sub-sector stands at 389.36 per cent for area and 20.77 per cent for yield (table 2.2 (A)).

It comes out that horticulture in Bihar has shown an impressive growth in area and production of almost all sub-sectors.

Table No. 2.2: Area and Production of Horticultural Crops in Bihar

(Area in Lakh hectare, production in Lakh tones/Production of flowers in Lakh Cut)

Year	Fruits		Vegetables		Spices, Garden & Plantation		Commercial Flowers		Medicinal & Aromatic	
	Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn
TE 1990-91	2.67	27.99	8.43	86.43	0.000	0.000	0.000	0.000	0.000	0.000
TE 2000-01	2.72	28.77	5.78	80.23	0.000	0.000	0.000	0.000	0.000	0.000
TE 2004-05	2.91	29.20	4.94	76.28	0.091	0.094	0.00141	0.011	0.000	0.000
TE 2005-06	2.91	31.92	4.98	76.54	0.103	0.109	0.00189	0.023	0.000	0.000
TE 2006-07	2.79	34.26	8.24	136.08	0.111	0.123	0.0297	0.033	0.021	NA
TE 2007-08	0.73	7.31	8.24	140.68	0.122	0.141	0.4706	0.047	0.245	NA
TE 2008-09	2.90	37.23	8.27	133.86	0.127	0.149	0.0059	0.061	0.026	NA
TE 2009-10	2.96	39.12	8.45	146.30	0.131	0.154	0.0069	0.065	NA	NA

Table No. 2.2 (A): Growth in Area and Yield of Horticultural Crops (In %)

Year	Fruits		Vegetables		Spices, Garden & Plantation		Commercial Flowers		Medicinal & Aromatic	
	A	Y	A	Y	A	Y	A	Y	A	Y
1990-91 to 2000-01	1.87	0.95	- 31.44	- 20.55	0.00	0.00	0.00	0.00	0.00	0.00
2000-01 to 2009-10	8.82	24.95	46.19	24.71	0.00	0.00	0.00	0.00	0.00	0.00
2000-01 to 2004-05	6.99	- 5.20	- 14.53	11.24	0.00	0.00	0.00	0.00	0.00	0.00
2004-05 to 2005-06	0.00	9.37	0.81	- 0.45	13.19	2.91	34.04	56.03	0.00	0.00
2004-05 to 2006-07	- 4.12	22.43	66.80	6.93	20.88	7.67	2006.38	-85.77	0.00	0.00
2004-05 to 2007-08	-74.91	-0.20	66.80	10.56	34.07	12.62	33275.89	-98.72	0.00	0.00
2004-05 to 2008-09	-0.34	28.02	67.41	4.86	39.56	13.59	318.44	32.44	0.00	0.00
2004-05 to 2009-10	1.72	31.80	71.05	12.11	43.96	14.56	389.36	20.77	0.00	0.00

2.3 District wise Growth of Horticultural Crops

Barring the negative annual growth in area of fruits, the horticultural sector has recorded significant growth in almost all the sub-sectors of horticulture during 2004-05 to 2008-09 in terms of area and yield. The data presented in table 2.3 shows the district wise area and yield of fruits, vegetables and flowers during 2004-05, the pre-launching year of the NHM in the state. After implementation of the NHM programme, the district wise area and yield has also been captured for the year 2008-09 in table 2.4. Both the tables revealed that fruits are prominently grown in the districts of north-west Bihar namely Muzaffarpur, East & West Champaran, Vaishali, Darbhanga, Madhubani and Samastipur. Similarly the potential areas for cultivation of vegetables in the state are the districts of Nalanda, Patna, Vaishali, East & West Champaran, Muzaffarpur etc. Flowers are mainly grown in Rohtas, Patna Vaishali, Muzaffarpur, Kaimur districts. As regards the annual growth of horticultural crops in the state is concerned, the data presented in table 2.5 showed that the area under fruits has marginally fallen by 0.04 per cent in the state during 2004-05 to 2008-09, however, the annual growth in yield of fruits has recorded by 6.69 per cent during

the period. The annual growth in area under fruits has fallen in seven districts of Darbhanga (-027%), Madhubani (-0.24%), Purnea (-03.49%), Araria (-5.14%), Kishanganj (-0.098%), Saharsa (-4.51%) and Supaul (-03.47%) during the same period. The annual growth in yield has recorded increase in all districts during the same period. As regards the vegetables annual growth in area and yield both recorded by 16.84 per cent and 1.21 per cent respectively during 2004-05 to 2008-09 in the state. Annual growth in vegetables' area has been recorded in Bhojpur (25.26%), Rohtas (28.89%), Jehanabad (25.00%), Arwal (33.33%), Banka (33.95%), Lakhisarai (76.13%), Jamui (49.54%), Khagaria (39.85%) and Supaul (26.27%) of districts. Similarly, annual growth in yield has been found negative in 09 districts of the state (38 districts). These districts are Rohtas, kaimur, Gaya, Nawada, Aurangabad, Banka, Jamuie and Khagaria during 2004-05 to 2008-09. Taken together fruits and vegetables, annual growth in area and yield have been found 10.58 per cent and 3.50 per cent during the same periods. The tremendous growth in area of commercial flowers has also been registered by 52.75 per cent however, the yield rate fallen by 4.10 per cent in the state during the same periods. Out of the 38 districts in Bihar, the annual growths on both the area and yield have been recorded higher in almost all districts during the periods in floriculture sub-sector. Above analysis clearly reveals that on account of implementation of NHM programme in the state, substantial growth in area and yield has been found almost in all sub-sectors of horticultural crops in the state during the period of 2004-05 to 2008-09.

Table No. 2.3: Area and Production of Horticultural Crops at Districts level in Bihar 2004-05

Area in Lakh hectares, production in Lakh tone/Production of flowers in Lakh Cut

SN.	Name of the District	Fruits		Vegetables		Total (Fruits + Vegetab)		Commercial Flowers	
		Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn
1.	Patna	0.075	0.672	0.223	3.413	0.298	4.085	0.00030	448.18
2.	Nalanda	0.060	0.545	0.310	5.044	0.370	5.589	0.00004	46.78
3.	Bhojpur	0.081	0.646	0.094	1.457	0.175	2.103	0.00008	115.78
4.	Buxar	0.057	0.450	0.065	1.010	0.122	1.460	0.00002	18.20
5.	Rohtas	0.100	0.707	0.090	1.407	0.190	2.114	0.00002	16.72
6.	Kaimur	0.055	0.373	0.060	0.961	0.115	1.334	0.00001	11.34
7.	Gaya	0.032	0.260	0.138	2.132	0.170	2.392	0.00013	165.63
8.	Jehanabad	0.011	0.108	0.044	0.720	0.055	0.828	0.00005	76.14
9.	Arwal	0.008	0.079	0.030	0.477	0.038	0.556	0.00005	67.73
10.	Nawada	0.031	0.259	0.104	1.619	0.135	1.878	0.00001	11.16
11.	Aurangabad	0.034	0.281	0.110	1.716	0.144	1.997	0.00003	34.17
12.	Saran	0.092	0.790	0.143	2.221	0.235	3.011	0.00002	14.53
13.	Siwan	0.065	0.614	0.125	1.934	0.190	2.548	0.00001	10.34
14.	Gopalganj	0.066	0.599	0.130	2.016	0.196	2.615	0.00001	8.74
15.	East Champaran	0.163	1.394	0.185	2.907	0.348	4.301	0.00006	62.12
16.	West Champaran	0.136	1.168	0.202	3.151	0.338	4.319	0.00005	59.61
17.	Muzaffarpur	0.252	3.153	0.278	4.354	0.530	7.507	0.00020	210.42
18.	Sitamarhi	0.095	0.844	0.116	1.859	0.211	2.703	0.00002	17.41
19.	Sheohar	0.046	0.387	0.062	0.988	0.108	1.375	---	7.16
20.	Vaishali	0.174	2.074	0.289	4.446	0.463	6.520	0.00014	171.41
21.	Bhagalpur	0.115	1.176	0.152	2.359	0.267	3.535	0.00009	108.29
22.	Banka	0.082	0.577	0.067	1.055	0.149	1.632	0.00001	11.74
23.	Munger	0.023	0.230	0.070	1.052	0.093	1.282	0.00005	55.61
24.	Sheikhpura	0.014	0.115	0.034	0.548	0.048	0.663	---	7.10
25.	Lakhisarai	0.009	0.077	0.022	0.328	0.031	0.405	0.00001	9.74
26.	Jamui	0.021	0.183	0.055	0.847	0.076	1.030	0.00001	9.00
27	Khagaria	0.038	0.441	0.101	1.546	0.139	1.987	0.00001	14.02
28.	Darbhanga	0.183	1.841	0.207	3.149	0.390	4.990	0.00006	78.63
29.	Madhubani	0.103	1.001	0.166	2.530	0.269	3.531	0.00001	10.52
30.	Samastipur	0.159	1.661	0.181	2.806	0.340	4.467	0.00009	99.98
31.	Begusarai	0.074	0.692	0.179	2.828	0.253	3.520	0.00004	47.83
32.	Purnea	0.093	1.323	0.162	2.438	0.255	3.761	0.00005	63.92
33.	Araria	0.034	0.426	0.077	1.208	0.111	1.634	---	7.71
34.	Kishanganj	0.051	0.827	0.078	1.213	0.129	2.040	0.00006	66.55
35.	Katihar	0.073	0.746	0.241	3.645	0.314	4.421	0.00005	69.21
36.	Saharsa	0.083	1.042	0.128	1.883	0.211	2.925	0.00004	49.27
37.	Madhepura	0.068	0.984	0.145	2.168	0.213	3.152	0.00002	23.73
38.	Supaul	0.036	0.439	0.059	0.857	0.095	1.296	0.00002	18.34
	Total	2.912	29.205	4.940	76.284	7.852	105.484	0.00189	2330.82

Table No. 2.4: Area and Production of Horticultural Crops at Districts level in Bihar 2008-09.

(Area in Lakh hectare, production in Lakh tones/Production of flowers in Lakh Cut)

SN.	Name of the District	Fruits		Vegetables		Total (Fruits + Vegetab)		Commercial Flowers	
		Area	Prodn	Area	Prodn	Area	Prodn	Area	Prodn
1.	Patna	0.076	0.925	0.395	6.619	0.471	7.544	0.00054	703.93
2.	Nalanda	0.064	0.726	0.589	10.307	0.653	11.033	0.00015	156.81
3.	Bhojpur	0.081	0.813	0.189	3.310	0.270	4.123	0.00020	245.04
4.	Buxar	0.059	0.581	0.124	2.202	0.183	2.783	0.00008	75.04
5.	Rohtas	0.102	0.992	0.194	2.942	0.296	3.934	0.00057	49.11
6.	Kaimur	0.056	0.538	0.102	1.517	0.158	2.055	0.00048	41.38
7.	Gaya	0.035	0.391	0.249	3.795	0.284	4.186	0.00030	331.93
8.	Jehanabad	0.013	0.176	0.088	1.449	0.101	1.625	0.00014	156.86
9.	Arwal	0.010	0.141	0.070	1.148	0.080	1.289	0.00012	149.07
10.	Nawada	0.032	0.385	0.159	2.431	0.191	2.816	0.00005	48.65
11.	Aurangabad	0.036	0.416	0.167	2.259	0.203	2.675	0.00010	108.52
12.	Saran	0.095	1.007	0.283	4.525	0.378	5.532	0.00010	97.63
13.	Siwan	0.067	0.812	0.227	3.680	0.294	4.492	0.00006	62.56
14.	Gopalganj	0.068	0.803	0.257	4.179	0.325	4.982	0.00007	77.36
15.	East Champaran	0.163	1.647	0.311	5.118	0.474	6.765	0.00017	181.73
16.	West Champaran	0.146	1.646	0.336	5.563	0.482	7.209	0.00019	207.38
17.	Muzaffarpur	0.252	3.935	0.402	6.807	0.654	10.742	0.00048	492.23
18.	Sitamarhi	0.097	1.029	0.188	3.090	0.285	4.119	0.00008	67.32
19.	Sheohar	0.048	0.497	0.108	1.708	0.156	2.205	0.00004	30.20
20.	Vaishali	0.180	2.799	0.434	7.432	0.614	10.231	0.00054	512.02
21.	Bhagalpur	0.117	1.450	0.243	3.969	0.360	5.419	0.00024	239.31
22.	Banka	0.083	0.950	0.158	1.979	0.241	2.929	0.00006	48.66
23.	Munger	0.028	0.396	0.092	2.502	0.120	2.898	0.00018	185.23
24.	Sheikhpura	0.015	0.177	0.063	1.491	0.078	1.668	0.00003	25.04
25.	Lakhisarai	0.011	0.155	0.089	0.972	0.100	1.127	0.00006	53.88
26.	Jamui	0.023	0.270	0.164	1.318	0.187	1.588	0.00005	37.72
27	Khagaria	0.041	0.661	0.262	2.593	0.303	3.254	0.00007	63.04
28.	Darbhanga	0.181	2.172	0.261	4.101	0.442	6.273	0.00014	136.40
29.	Madhubani	0.102	1.260	0.261	4.207	0.363	5.467	0.00009	79.59
30.	Samastipur	0.162	2.244	0.315	5.324	0.477	7.548	0.00037	331.33
31.	Begusarai	0.076	1.026	0.267	4.458	0.343	5.484	0.00018	179.50
32.	Purnea	0.080	1.281	0.227	3.527	0.307	4.808	0.00016	210.57
33.	Araria	0.027	0.421	0.126	1.922	0.153	2.343	0.00006	44.53
34.	Kishanganj	0.049	0.944	0.142	2.088	0.191	3.032	0.00022	191.15
35.	Katihar	0.073	1.006	0.307	4.897	0.380	5.903	0.00023	223.33
36.	Saharsa	0.068	1.045	0.212	3.321	0.280	4.366	0.00015	151.99
37.	Madhepura	0.058	1.030	0.214	3.281	0.272	4.311	0.00007	65.36
38.	Supaul	0.031	0.475	0.121	1.805	0.152	2.280	0.00005	47.03
	Total	2.907	37.228	8.269	133.857	11.176	171.085	0.00593	6113.75

Table No. 2.5: Average Annual Growth Rate in Area and Yield of Horticultural Crops at Districts Level in Bihar from TE 2004-05 to TE 2008-09

(% per Annum)

SN.	Name of the District	Fruits		Vegetables		Total (Fruits + Vegetab)		Commercial Flowers	
		Area	Yield	Area	Yield	Area	Yield	Area	Yield
1.	Patna	0.33	8.96	19.28	2.37	14.51	4.21	20.00	-3.19
2.	Nalanda	1.66	6.22	22.50	1.89	19.12	2.96	68.75	-2.65
3.	Bhojpur	0.00	6.46	25.26	3.24	13.57	6.76	37.50	-3.84
4.	Buxar	0.87	6.21	22.69	3.57	12.50	6.77	85.71	0.77
5.	Rohtas	0.50	9.37	28.89	-0.75	13.94	4.85	55.71	-22.42
6.	Kaimur	0.45	13.38	17.50	-1.79	9.34	3.02	84.09	-23.10
7.	Gaya	2.34	9.39	20.10	-0.34	16.76	1.19	32.79	-3.29
8.	Jehanabad	4.54	9.47	25.00	0.17	20.91	1.73	36.72	-6.61
9.	Arwal	6.25	10.71	33.33	0.79	27.63	2.53	40.26	-2.07
10.	Nawada	0.81	11.02	13.52	-0.45	10.37	1.49	86.95	-3.20
11.	Aurangabad	1.47	9.96	12.95	-3.32	10.24	-1.24	53.96	-11.81
12.	Saran	0.81	5.89	24.47	0.74	17.21	3.55	117.85	8.60
13.	Siwan	0.77	7.06	20.40	1.20	13.68	3.49	108.33	0.21
14.	Gopalganj	0.75	7.55	24.42	1.23	16.45	3.73	160.71	6.61
15.	East Champaran	0.00	4.53	17.02	1.19	9.05	3.86	46.36	0.81
16.	West Champaran	1.84	7.80	16.58	1.52	10.65	4.24	66.51	-2.11
17.	Muzaffarpur	0.00	6.20	11.15	2.03	5.85	3.99	38.58	-0.63
18.	Sitamarhi	0.52	4.87	15.51	0.66	8.76	3.20	75.00	-0.83
19.	Sheohar	1.08	5.77	18.54	0.20	11.11	2.75	100.00	---
20.	Vaishali	0.86	7.64	12.54	2.83	8.15	4.58	72.03	-5.64
21.	Bhagalpur	0.43	5.28	14.96	1.30	8.70	3.42	41.02	-4.28
22.	Banka	0.30	15.63	33.95	-5.13	15.43	2.74	68.33	-7.73
23.	Munger	5.43	10.35	7.85	20.23	7.25	18.81	58.17	-1.87
24.	Sheikhpura	1.78	10.93	21.32	11.71	15.62	13.70	91.66	---
25.	Lakhisarai	5.55	16.20	76.13	-6.69	55.64	3.43	104.54	-1.95
26.	Jamui	2.38	8.70	49.54	-11.95	36.51	-9.33	84.52	-4.04
27	Khagaria	1.97	9.74	39.85	-8.85	29.49	6.21	107.40	-8.94
28.	Darbhanga	(-) 0.27	4.82	6.52	0.82	3.33	2.74	33.12	-6.41
29.	Madhubani	(-) 0.24	6.76	14.30	1.44	8.73	3.67	171.59	-3.98
30.	Samastipur	0.47	8.13	18.50	2.26	10.07	5.10	77.77	-4.85
31.	Begusarai	0.67	11.10	12.29	1.42	8.89	3.74	87.50	-4.15
32.	Purnea	(-) 3.49	3.15	10.03	0.81	5.09	1.54	55.00	0.74
33.	Araria	(-) 5.14	6.11	15.91	0.70	9.46	1.00	00.00	---
34.	Kishanganj	(-) 0.98	4.70	20.51	1.37	12.01	0.09	00.00	-5.42
35.	Katihar	0.00	8.71	6.84	1.37	5.25	10.30	90.00	-7.46
36.	Saharsa	(-) 4.51	5.62	16.40	1.61	8.17	3.12	68.75	-4.43
37.	Madhepura	3.67	5.68	11.89	0.64	6.92	1.77	62.50	-5.32
38.	Supaul	(-) 3.47	6.42	26.27	0.69	15.00	2.49	37.50	0.64
	Total	(-) 0.04	6.93	16.84	1.21	10.58	3.50	52.75	-4.10

2.4 Area and Production of Selected Crops --- Rate of Growth under NHM

As stated earlier mango and litchi crop have been selected for the purpose of the study. Bihar's mango and litchi reach almost all the markets in north and eastern India. Litchi of Muzaffarpur (Tirhut Division) has become a proud brand name throughout the country. In litchi seasons, juice packers from Mumbai are seen doing their agro-processing in Muzaffarpur and Vaishali districts (the sample districts). Likewise, Dhudhai Maldah and Zardalu variety of Mangoes of Bhagalpur (the sample district) district have privileges for its taste and flavour. After carving out Jharkhand state from old Bihar in 2000, the area and yield under both the selected crops have increased in the state data presented in table nos. 2.6 & 2.7 reveal that the

area and yield of mango rose by 0.351 per cent and 0.610 per cent respectively during the period of 2000-01 to 2008-09 whereas those were fallen by 0.352 per cent during 2000-01 to 2004-05. However, it increased annually thereafter by 0.071 per cent during 2004-05 to 2005-06, 0.249 per cent during 2004-05 to 2006-07, 0.499 per cent during 2004-05 to 2007-08, 0.714 per cent during 2004-05 to 2008-09 and 0.842 per cent during 2004-05 to 2009-10. It reveals that after the launching of NHM programme in the state, the annual growth rate in the area under the mango crop has registered growth of 0.842 per cent. The annual growth rate in yield of mango crop has also registered by 5.017 per cent during 2004-05 to 2009-10; after the launching of NHM programme. However it has recorded higher increase during the first two years of the NHM programme. In case of litchi crop, the area registered positive annual growth after launching of NHM programme in the state. It increased annually by 9.82 per cent during 2000-01 to 2008-09, 0.528 per cent during 2004-05 to 2006-07, 1.643 per cent during 2004-05 to 2007-08, 1.848 per cent during 2004-05 to 2008-09 and 1.549 per cent during 2004-05 to 2009-10. The annual growth in yield of litchi crop has registered a negative growth during 2000-01 to 2008-09 (-8.60%) and subsequently (-) 2.342 per cent during 2004-05 to 2005-06, after a year of launching the programme but it again recorded positive annual growth by 1.708 per cent during 2004-05 to 2006-07, 2.977 per cent during 2004-05 to 2007-08, 1.464 per cent during 2004-05 to 2008-09 and 0.995 per cent during 2004-05 to 2009-10.

The analysis clearly reflects that after the interventions made under the NHM programme in the state the area and production of both the selected crops have increased annually but the increase in case of area under mango crop was found less than 1.00 per cent whereas production's growth trend was uneven ranging between less than 1.00 per cent to 40.00 per cent during the 2004-05 to 2009-10. In case of litchi crop, the annual growth rate in area was calculated at 1.549 per cent during 2004-05 to 2009-10 whereas the growth in production was 0.995 per cent during the same period. In nutshell positive annual growth has been recorded on both the crops in both the terms i.e., area and yield, after the launching of NHM programme.

Table No. 2.6: Area and Production of selected Horticultural Crops in Bihar

(Area in Lakh hectares, Production in Lakh tones)

Year	Crop – I (Mango)		Crop - 2 (Litchi)	
	Area	Production	Area	Production
TE 1990-91	1.521	14.305	0.184	1.802
TE 1991-92	1.540	14.503	0.185	1.854
TE 1992-93	1.520	14.200	0.198	1.950
TE 1993-94	1.520	14.200	0.198	1.970
TE 1994-95	1.470	13.870	0.200	2.100
TE 1995-96	1.460	13.652	0.213	2.120
TE 1996-97	1.460	13.559	0.220	2.170
TE 1997-98	1.430	12.700	0.215	2.177
TE 1998-99	1.433	12.300	0.219	2.168
TE 1999-00	1.445	12.450	0.207	2.142
TE 2000-01	1.421	12.800	0.219	2.373
TE 2001-02	1.408	12.550	0.242	2.635
TE 2002-03	1.400	12.500	0.263	2.970
TE 2003-04	1.400	15.401	0.283	3.390
TE 2004-05	1.401	8.656	0.284	2.049
TE 2005-06	1.402	12.228	0.284	2.001
TE 2006-07	1.408	13.070	0.287	2.119
TE 2007-08	1.422	8.703	0.298	2.232
TE 2008-09	1.441	13.299	0.305	2.169
TE 2009-10	1.460	9.959	0.306	2.151

Table No. 2.7: Growth rate in Area and Yield Rate of selected Horticultural Crops in Bihar *(In %)*

Year	Crop – I (Mango)		Crop - 2 (Litchi)	
	Area	Yield	Area	Yield
1990-91 to 2000-01	NA	NA	NA	NA
2000-01 to 2008-09	0.351	0.610	9.82	-8.60
2000-01 to 2004-05**	(-) 0.352	0.973	7.420	(-) 3.413
2004-05 to 2005-06**	0.071	41.301	0.000	(-) 2.342
2004-05 to 2006-07**	0.249	25.490	0.528	1.708
2004-05 to 2007-08**	0.499	0.181	1.643	2.977
2004-05 to 2008-09**	0.714	13.410	1.848	1.464
2004-05 to 2009-10**	0.842	5.017	1.549	0.995

*** Growth rates are based on annual averages.*

2.5 District wise Area and Production Growth of Selected Crops under NHM

District wise area and production of two selected horticultural crops, viz., mango and litchi have been presented for the years 2004-05 and 2008-09 in table Nos. 2.8 & 2.9 respectively. The average annual growth rate in area and yield of these two horticultural crops at district level from 2004-05 to 2008-09 has been presented in table No. 2.10. A glance at the table 2.10 shows that the average annual growth rate in area and yield of both the crops are well dispersed over the districts. The overall annual growth in area and yield of mango crop in the state has been found at 0.715 per cent and 12.34 per cent respectively. Some districts like Jehanabad, Munger, Sheikhpura, Lakhisarai, Jamui, Araria, Kishanganj and Saharsa have recorded higher

annual growth in area of mango crop. However, the rate of annual growth in yield of mango crop in almost all districts are quite higher, which indicate that the yield rate of crop has been increased significantly during the 204-05 to 2008-09. It further reveals that the interventions made under the NHM programme have resulted to higher yield of the crop (mango). In case of litchi crop the average annual growth rate in area in the state is just 1.847 per cent and incase of yield it fallen by 0.35 per cent during the period of 2004-05 to 2008-09. Its district wise analysis reveals that average annual growth in area is higher in the districts of Supaul (25.00%), Jamui (25.00%), Madhepura (12.50%), West Champaran (10.71%), Araria (8.33%), Kishanganj (8.33%), etc. In fact, all districts have recorded positive annual growth in terms of growth in area during the period of 2004-05 to 2008-09. However, 16 districts have indicated negative annual growth in terms of yield during the period.

Above analysis reveals that average annual growth rate in area and yield of both the selected crops in the state have found positive but in terms of yield of mango crop it has recorded significant growth during the periods of 2004-05 to 2008-09. In other words, interventions made under NHM as establishment of new orchards, rejuvenation of orchards, etc. have contributed in increase in area and production of both the crops in the state.

Table No. 2.8: Area and Production of selected Horticultural Crops at districts level in Bihar (2004-05)

(Area in Lakh hectares, Production in Lakh tones)

SN.	Name of the District	Crop – I (Mango)		Crop - 2 (Litchi)	
		Area	Production	Area	Production
1.	Patna	0.037	0.222	---	---
2.	Nalanda	0.026	0.156	---	---
3.	Bhojpur	0.044	0.268	---	---
4.	Buxar	0.032	0.194	---	---
5.	Rohtas	0.055	0.278	---	---
6.	Kaimur	0.032	0.162	---	---
7.	Gaya	0.011	0.056	---	---
8.	Jehanabad	0.002	0.010	---	---
9.	Arwal	0.002	0.010	---	---
10.	Nawada	0.010	0.051	---	---
11.	Aurangabad	0.010	0.053	---	---
12.	Saran	0.049	0.296	0.010	0.080
13.	Siwan	0.023	0.140	0.010	0.074
14.	Gopalganj	0.028	0.169	0.011	0.079
15.	East Champaran	0.090	0.542	0.017	0.142
16.	West Champaran	0.068	0.411	0.014	0.117
17.	Muzaffarpur	0.095	0.668	0.071	0.571
18.	Sitamarhi	0.051	0.358	0.020	0.143
19.	Sheohar	0.025	0.152	0.009	0.066
20.	Vaishali	0.080	0.564	0.034	0.241
21.	Bhagalpur	0.072	0.504	0.004	0.032
22.	Banka	0.061	0.307	0.005	0.003
23.	Munger	0.010	0.063	0.002	0.012
24.	Sheikhpura	0.007	0.045	0.009	0.005
25.	Lakhisarai	0.004	0.023	0.005	0.003
26.	Jamui	0.009	0.056	0.001	0.009
27	Khagaria	0.015	0.093	0.002	0.019
28.	Darbhanga	0.127	0.895	0.007	0.054
29.	Madhubani	0.058	0.412	0.007	0.054
30.	Samastipur	0.102	0.615	0.010	0.073
31.	Begusarai	0.039	0.195	0.005	0.030
32.	Purnea	0.022	0.136	0.011	0.070
33.	Araria	0.005	0.032	0.003	0.022
34.	Kishanganj	0.006	0.033	0.003	0.021
35.	Katihar	0.026	0.156	0.013	0.081
36.	Saharsa	0.024	0.144	0.004	0.026
37.	Madhepura	0.018	0.111	0.002	0.014
38.	Supaul	0.011	0.068	0.001	0.010
	Total	1.401	8.656	0.284	2.049

Table No. 2.9: Area and Production of selected Horticultural Crops at districts level in Bihar (2008-09)

(Area in Lakh hectares, Production in Lakh tones)

SN.	Name of the District	Crop – I (Mango)		Crop - 2 (Litchi)	
		Area	Production	Area	Production
1.	Patna	0.038	0.372	---	---
2.	Nalanda	0.028	0.264	---	---
3.	Bhojpur	0.045	0.404	---	---
4.	Buxar	0.033	0.294	---	---
5.	Rohtas	0.056	0.530	---	---
6.	Kaimur	0.033	0.289	---	---
7.	Gaya	0.013	0.119	---	---
8.	Jehanabad	0.003	0.030	---	---
9.	Arwal	0.002	0.030	---	---
10.	Nawada	0.011	0.099	---	---
11.	Aurangabad	0.012	0.116	---	---
12.	Saran	0.050	0.441	0.011	0.025
13.	Siwan	0.024	0.220	0.011	0.077
14.	Gopalganj	0.029	0.271	0.012	0.081
15.	East Champaran	0.091	0.856	0.018	0.132
16.	West Champaran	0.071	0.676	0.020	0.149
17.	Muzaffarpur	0.096	0. 903	0.072	0.543
18.	Sitamarhi	0.052	0.457	0.021	0.153
19.	Sheohar	0.026	0.229	0.010	0.067
20.	Vaishali	0.082	0.780	0.035	0.269
21.	Bhagalpur	0.073	0.687	0.005	0.037
22.	Banka	0.062	0.569	0.0006	0.004
23.	Munger	0.012	0.115	0.002	0.017
24.	Sheikhpura	0.008	0.073	0.001	0.006
25.	Lakhisarai	0.005	0.052	0.0005	0.003
26.	Jamui	0.010	0.098	0.002	0.012
27	Khagaria	0.016	0.153	0.003	0.023
28.	Darbhanga	0.129	1.140	0.008	0.058
29.	Madhubani	0.060	0.545	0.008	0.057
30.	Samastipur	0.104	0.986	0.012	0.091
31.	Begusarai	0.040	0.374	0.006	0.043
32.	Purnea	0.024	0.222	0.012	0.088
33.	Araria	0.006	0.060	0.004	0.027
34.	Kishanganj	0.007	0.071	0.004	0.028
35.	Katihar	0.027	0.252	0.015	0.108
36.	Saharsa	0.025	0.226	0.005	0.037
37.	Madhepura	0.019	0.178	0.003	0.019
38.	Supaul	0.012	0.111	0.002	0.013
	Total	1.441	13.298	0.305	2.169

Table No. 2.10: Average Annual Growth rate in Area and Yield of selected Horticultural Crops at districts level in Bihar from 2004-05 to 2008-09

(Percent per Annum)

SN.	Name of the District	Crop – I (Mango)		Crop - 2 (Litchi)	
		Area	Yield	Area	Yield
1.	Patna	0.675	15.79	---	---
2.	Nalanda	1.922	14.29	---	---
3.	Bhojpur	0.567	11.86	---	---
4.	Buxar	0.780	11.72	---	---
5.	Rohtas	0.455	21.83	---	---
6.	Kaimur	0.780	18.28	---	---
7.	Gaya	4.545	19.94	---	---
8.	Jehanabad	12.500	25.00	---	---
9.	Arwal	00.00	---	---	---
10.	Nawada	2.5	19.12	---	---
11.	Aurangabad	5.0	20.61	---	---
12.	Saran	0.510	11.51	2.50	-17.91
13.	Siwan	1.087	12.64	2.50	-1.35
14.	Gopalganj	0.892	13.66	2.272	-1.50
15.	East Champaran	0.277	14.08	1.470	-3.05
16.	West Champaran	1.102	14.40	10.715	-2.72
17.	Muzaffarpur	0.262	8.46	0.352	-1.55
18.	Sitamarhi	0.490	6.30	1.250	+0.49
19.	Sheohar	1.00	11.23	2.778	-2.15
20.	Vaishali	0.625	8.72	0.735	2.12
21.	Bhagalpur	0.347	8.61	6.250	-1.88
22.	Banka	0.410	20.63	5.000	2.79
23.	Munger	5.00	13.02	0.00	10.42
24.	Sheikhpura	3.572	10.50	2.778	247.73
25.	Lakhisarai	6.25	18.65	0.00	225.00
26.	Jamui	2.777	14.39	25.00	-8.33
27	Khagaria	1.667	13.55	12.500	-4.82
28.	Darbhanga	0.392	-21.77	3.572	-1.49
29.	Madhubani	0.862	6.97	3.572	-1.91
30.	Samastipur	0.490	14.30	2.500	0.96
31.	Begusarai	0.640	21.75	5.000	4.88
32.	Purnea	2.272	12.42	2.272	3.81
33.	Araria	5.00	16.68	8.332	-1.98
34.	Kishanganj	4.167	21.09	8.332	0.00
35.	Katihar	0.962	13.88	3.845	3.89
36.	Saharsa	9.042	12.67	6.250	3.46
37.	Madhepura	1.390	12.97	12.500	-2.39
38.	Supaul	2.272	12.42	25.000	-8.75
	Total	0.715	12.34	1.847	-0.35

2.6 An Overview

The state has 9359.57 thousand hectares of geographical area and out of it 71.08 per cent is cultivable. It has 11.78 per cent horticultural area to the cultivable area. Analysis reveals that both fruits and vegetables signify a steady growth in terms of increase area and production from 1990-91 to 2009-10. The production of fruits grew by 1.4 times, whereas that of vegetables by 1.69 times during the same period. During 2000-01 to 2009-10, area under fruits grew by 1.09 times while vegetables by 1.46 times and species by 44 per cent. During the same period, the area and production of commercial flowers increased by 4 times and 6 times respectively.

Growth analysis reveals that fruits' area and yield grew by 8.82 per cent and 24.95 per cent during 2000-01 to 2009-10. Growth rates for fruits area and vegetables indicate 1.72 per cent and 31.80 per cent respectively during the period of 2004-05 to 2009-10. Similarly for vegetables sub-sector 46.19 per cent and 24.71 per cent respectively during the period of 2000-01 to 2009-10, while these are 71.05 per cent and 12.11 per cent for the period of 2004-05 to 2009-10. Growth in area and yield of species and flowers sub-sector recorded 43.96 per cent & 14.56 per cent and 389.36 per cent & 20.77 per cent respectively for the period of 2004-05 to 2009-10. The district wise growth analysis of horticultural crops for TE 2004-05 to TE 2008-09 reveals that the area and yield of fruits sub-sector has recorded fall in area by 0.04 per cent and increase in yield rate by 6.93 per cent, 16.84 per cent and 1.21 per cent respectively for vegetables sub-sector, 10.58 per cent and 3.50 per cent respectively for total (fruits +vegetables) and 52.75 per cent and (-) 4.10 per cent respectively for floriculture sub-sector at aggregate levels. The growth of area and yield of mango crop have been recorded at 0.842 per cent and 5.017 per cent respectively during the period of 2004-05 to 2009-10. Similarly in case of litchi crop, it has been recorded at 1.549 per cent and 0.995 per cent respectively during the same period. The average annual growth in terms of area and yield of mango crop has been found 0.715 per cent and 12.34 per cent respectively during 2004-05 to 2008-09 whereas that of 1.847 per cent and (-) 0.35 per cent respectively in case of litchi crop during the same period. The preceding analysis clearly reveals that NHM programme has made tremendous success in increasing area of mango and litchi crops. In case of yield rate the average annual growth of mango was recorded at 12.34 per cent but it fell by 0.35 in litchi crop at the aggregate levels.

CHAPTER – III

HOUSEHOLD CHARACTERISTICS, CROPPING PATTERN AND PRODUCTION STRUCTURE

3.1 Socio-Economic Characteristics of the Selected Farms

The socio-economic characteristics of the sample farm households are given in table 3.1. It is observed from the table that the sample constitutes 17.00 per cent from marginal farms, 22.00 per cent from small farms, 43.00 per cent from medium farms and 18.00 per cent from large farms. The average size of the household is 6.10 persons. Its farm wise classification reveals that marginal farm household has 5.41 persons, small farm households 6.14 persons, medium farm households 5.88 persons and large farm household 7.22 persons. The average numbers of earners are 2.07 at total farms. Data on gender wise classification of households' members reveal that 49.63 per cent are males and 50.33 females. Out of the total members (610 persons), 40.82 per cent are in the age group of less than 16 years, 36.89 per cent in the age group of 16 to 60 years (i.e., working population) and 22.29 per cent in the age group of above 60 years (i.e., non-working population). The data on identity of respondents reveal that 84.00 per cent are heads of the households and 16.00 per cent other members of the households. It is observed from the table that of the total members, only 11.14 per cent are illiterate. About 28.20 per cent have attained the educational level of up to primary, 50.33 per cent up to secondary, 7.38 per cent up to graduation level and 2.95 per cent only up to above graduation level. The social composition of households reveals that 5.00 per cent are from scheduled castes category, 29.00 per cent other backward category and 66.00 per cent from general category. The data presented in the table shows that males are the decision makers in 91.00 per cent of the households. It is further observed that 81.78 per cent of the

working population have adopted farming as the main occupation, 10.22 per cent are engaged in petty businesses, 6.67 per cent are in salaried group and 1.33 per cent in the category of wage-earning group. Since rural migration is continued but is observed just around 6.67 per cent out of the total population of the sample farm households during the year 2009.

Table 3.1: Demographic Profile of the selected Farmers ***(% of households)***

Characteristics		Marginal	Small	Medium	Large	Total
No of HH		17	22	43	18	100
Household size (number in persons)		5.41	6.14	5.88	7.22	6.10
Average numbers of earners		2.35	2.14	1.76	2.44	2.07
Gender (% of members)	Male	55.43	40.00	54.55	46.15	49.67
	Female	44.57	60.00	45.45	53.85	50.33
Age group of the members (%)	<16	46.73	42.96	45.06	26.15	40.82
	16-60	40.22	29.62	36.36	43.08	36.89
	>60	13.05	27.42	18.58	30.77	22.29
Identity of respondent (%)	Head	82.35	90.90	86.05	72.22	84.00
	Others	17.65	9.10	13.95	27.78	16.00
Education status of the members (%)	Illiterate	17.39	9.62	10.67	9.23	11.14
	Up to primary	23.91	27.41	32.02	24.62	28.20
	Up to secondary	56.52	58.52	47.04	43.85	50.33
	Up to graduate	2.18	4.45	7.51	13.85	7.38
	Above graduate	0.00	0.00	2.76	8.45	2.95
Caste (% of households)	SC	17.65	9.09	0.00	0.00	5.00
	ST	0.00	0.00	0.00	0.00	0.00
	OBC	41.18	22.73	27.91	27.78	29.00
	General	41.17	68.18	72.09	72.22	66.00
Decision maker (% of hh)	Male	100.00	90.90	93.02	77.78	91.00
	Female	0.00	9.10	6.98	22.22	9.00
Main occupation (% of working members)	Farming	81.08	70.00	89.13	78.57	81.78
	Self business	10.81	25.00	7.61	3.57	10.22
	Salaried/pensioners	0.00	5.00	3.26	17.86	6.67
	Wage earners	8.11	0.00	0.00	0.00	1.33
Involved in migration during year 2009 (% of members)		18.92	12.50	3.26	0.00	6.67

3.2 Characteristics of Operational Holdings

The figures relating to farm wise characteristics of operational holdings are given in table 3.2. It is observed from the table that per household net operated area at total farms is 4.73 acre, which is about 77.54 per cent of the per household average owned area. However, it is 1.75 acres on marginal farms, 2.96 acre on small farms, 4.83 acres on medium farms and 9.47 acres on large farms. Per household under cultivable waste land is 0.66 acre, non-cultivable land 0.34 acre, leased in 0.01 acre and leased out 0.40 acre. These figures account for 10.82 per cent, 5.57 per cent, 0.16 per cent and 0.56 per cent respectively of the average owned area of total farms. The gross

cropped area is 7.03 acre/household at total farms. It is further revealed that the average cropping intensity is 148.94 per cent/household at total farms. However, it is 145.14 per cent per household on marginal farms, 140.88 per cent/household on small farms, 149.28 per cent/household on medium farms and 151.85 per cent/household on large farms.

Table 3.2: Characteristics of operational holdings ***(acres per household)***

Farm size	Owned land	Cultivable waste	Non cultivable	Leased-in	Leased -out	NOA	GCA	Cropping intensity
	(1)	(1b)	(1c)	(2)	(3)			
Marginal	1.95	0.24	0.03	0.07	0.00	1.75	2.54	145.14
Small	3.72	0.63	0.11	0.01	0.03	2.96	4.17	140.88
Medium	6.33	0.75	0.43	0.00	0.32	4.83	7.21	149.28
Large	12.40	0.86	0.72	0.00	1.35	9.47	14.38	151.85
Total	6.10	0.66	0.34	0.01	0.40	4.73	7.03	148.94

3.3 Sources of Irrigation

As regards the irrigation, the relevant data are presented in table 3.3. A look on the table reveals that the major source of irrigation is tube well, which accounts for 74.70 per cent by diesel runned tube well and 10.20 per cent by electric runned tube well, taking together it accounts for 84.90 per cent of the total operated area. Tanks and other sources contribute only 9.80 per cent of the total operated area and 5.30 per cent are rainfeds. The analysis of data clearly reveals that tubewell occupies the major source of irrigation and due to poor and erratic supply of power diesel runned tube well has larger spread in the area.

Table 3.3: Source of irrigation of net operated area (%)

Farm size	Only canal	Canal + tube well	Only electric tube well	Only diesel tube well	Tanks and others	Rainfed area	Total operated area
Marginal	---	---	14.38	66.22	15.80	3.60	100.0
Small	---	---	13.36	64.73	15.52	6.39	100.0
Medium	---	---	9.69	77.21	9.65	3.45	100.0
Large	---	---	8.90	76.90	6.75	7.45	100.0
Total	---	---	10.20	74.70	9.80	5.30	100.0

3.4 Sources and Purpose of Credit

The details of sources of credit and its purpose by the selected households are given in tables 3.4 & 3.5. It is observed from the table No. 3.4 that per household owes a

credit of Rs. 3829.20 against which Rs. 2115 (55.24% of total credit obtained by per household) is from institutional sources and 42.00 per cent (Rs. 1607.55) from non-institutional sources at total farms level. The field study found that medium farms (Rs. 3581.40) have obtained larger credit from the institutional sources followed by small farms (Rs. 1250); large farms (Rs. 1000) and marginal farm (Rs. 705.88). Out of the total credit availability per household, traders/moneylenders/landlords accounted for Rs. 879 (22.96%), Rs. 567.30 (14.82%) from friends/relatives and Rs. 161.25 (4.22%) from local input dealers at the overall level. Government programmes contribute only 2.79 per cent (Rs. 106.65) at the overall level. It shows that about 42.00 per cent of the total available credit is met non-institutional sources. The availability of credit from institutional sources is Rs. 447.13/acre, which accounts for 55.24 per cent of per acre availability of the total credit at the overall level. Though, it varies largely across the farms. It is higher on medium farms (75.32%) followed by small farms (39.89%), marginal farms (35.04%) and large farms 7.39%). In case of Rs. per household from all the sources, the medium farms followed by large farms, small farms and marginal farms borrow a large amount whereas in Rs. per acre it is reverse to farm sizes.

Further table 3.5 shows that out of per household availability of the credit about 57.93 per cent are used for productive purposes at the overall farms level. Though, it varies among the farms. It is 84.37 per cent on large farms followed by 64.33 per cent by marginal farms, 54.81 per cent by small farms and 48.11 per cent by medium farms. The analysis of data reveals that except on medium farms, more than 50.00 per cent of the total credit available to per household is used for productive purposes.

Table 3.4: Details of source of credit by the selected households

Farm size	Institutional loan by banks	Commission agents	Trade/ ML/ Landlord	Friends/ relatives	Govt. programmes	Others (Local dealers)	All Sources
(Rs. per household)							
Marginal	705.88	0.00	473.53	479.41	147.06	209.12	2015.00
Small	1250.00	0.00	925.00	363.64	0.00	571.36	3110.00
Medium	3581.40	0.00	395.35	662.79	115.46	0.00	4755.00
Large	1000.00	0.00	2361.11	671.11	177.78	0.00	4210.00
Total	2115.00	0.00	879.00	567.30	106.65	161.25	3829.20
(Rs. per acre)							
Marginal	403.36	0.00	270.59	273.95	84.03	119.50	1151.43
Small	422.30	0.00	312.50	122.85	0.00	193.03	1050.68
Medium	741.49	0.00	81.85	137.22	23.90	0.00	984.46
Large	105.60	0.00	249.33	70.86	18.77	0.00	444.56
Total	447.13	0.00	185.82	119.93	22.55	34.09	809.52

Table 3.5: Details of purpose of credit by the selected households

Farm size	Productive uses		Non productive uses		
	Agriculture	Animal husbandry	Daily consumption	Social ceremonies	Others (Illness, etc)
(Rs. per household)					
Marginal	970.50	325.70	455.20	0.00	263.60
Small	1535.09	169.25	30.90	781.50	593.26
Medium	2239.65	47.94	75.25	1155.00	1237.16
Large	2836.82	715.00	50.50	410.00	197.68
Total	1976.38	241.91	125.63	742.38	742.90

3.5 Assets Holdings

It has been observed from the field survey that on an average each household have a total value of Rs. 37027 of productive assets at current price. These productive assets are tractor, trolley, harrow, tiller, plank, threshing machine, reaper, pump sets, animals and other implements. It is noticed that major implements and animals are mostly with medium and large farm households. However, it varies largely across the farm sizes. The value of the ownership of productive assets is according to the farm sizes.

Similarly the data on the value of per acre availability total assets is Rs. 5284. Farm wise analysis shows that it is Rs. 5667/acre on medium farms, Rs. 4678/acre on large farms, Rs. 4578/acre on small farms and Rs. 3331/acre on small farms. The analysis

of data reveals that large farms have larger the numbers and value of productive assets and it follows according to the farm sizes except per acre value of productive assets on medium farms table No. 3.6.

Table 3.6: Ownership of productive assets

Assets		Rs. Per household					Rs per acre				
		Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
Tractor		---	---	22604	39672	18861	--	---	3135	2759	2683
Trolley		---	---	1422	1871	948	---	---	197	130	135
Harrow		---	---	---	1692	304	---	---	---	118	43
Tiller		---	---	---	1887	340	---	---	---	131	48
Plank		---	---	---	1902	342	---	---	---	132	49
Threshing machine		---	7512	2385	2927	3205	---	1801	331	204	456
Combine harvester		---	---	---	---	---	---	---	---	---	---
Other reaper (specify)		---	---	---	4569	822	---	---	---	318	117
Pump set diesel		911	1076	1255	1286	1153	359	258	174	89	164
Pumpset electric	Submersible	---	---	---	---	---	---	---	---	---	---
	Non submersible	603	758	1357	1875	905	237	182	188	130	129
Bullock cart		2117	1902	1809	1942	1906	833	456	251	135	271
Fodder Chaffer	Manual	447	309	735	455	542	176	74	102	32	77
	Power driven	---	---	---	---	---	---	---	---	---	---
Spray Pump		---	---	372	412	234	---	---	52	29	33
Storage Bin		710	344	890	792	722	280	82	123	55	121
Poultry Sheds		---	---	472	389	273	---	---	65	27	39
Dairy Sheds		415	619	778	1135	746	163	148	108	79	106
Animals	Cows	2198	3342	4271	1970	3300	865	801	592	137	469
	Buffaloes	---	1719	692	889	836	---	412	96	62	119
	Calves	449	574	817	610	664	177	138	113	42	94
Any Other		612	942	1011	987	924	241	226	140	69	131
Total		8462	19097	40870	67262	37027	3331	4578	5667	4678	5284

3.6 Structure of Tenancy

The data on characteristics of operational holdings presented in table No. 3.2 showed that on and average per household have 0.01 acre of leased-in land. It is 0.07 acre on marginal farm households and 0.01 acre on small farm households. Medium and large farm households have no leased-in areas. Further data presented in table No. 3.7 shows the nature of tenancy in leased-in land. It reveals that the structure is only

in terms of fixed rent both in cash and kind. The analysis of data shows that 63.83 per cent accounts for fixed rent in kind and 36.17 per cent fixed rent in cash on overall farms. However, it is 100.00 per cent in kind on small farm households whereas that of 43.00 per cent in cash and 57.00 per cent in kind on marginal farm households. Besides, fixed rent either in cash or kind, no other ways could be noticed in the field survey.

Table 3.7: Nature of tenancy in leasing-in land (%)

Farm size	Share cropping	Fixed rent in cash	Fixed rent in kind	Both cash and kind	Against labour	Others
Marginal	---	43.00	57.00	---	---	---
Small	---	0.00	100.00	---	---	---
Medium	---	---	---	---	---	---
Large	---	---	---	---	---	---
Total	---	36.17	63.83	---	---	---

3.7 Area under HYV Seeds

Hybrid rice, wheat and maize are practically feasible and readily adoptable genetic option to increase the production of rice, wheat and maize. It gives 25-50 per cent more yield than local varieties. But in case of our field study we found that out of the total area covered under the paddy crop only 30.18 per cent of area is covered under HYV seeds on total farms. Maize and wheat cover 89.09 per cent and 49.78 per cent respectively under HYV seeds of the total area covered under respective crops. As regards the pulses, due to lack of improved seeds, farmers usually grow their traditional varieties. There is very poor replacement of seeds particularly for gram and lentil pulses. Seeds purchased from private seed dealers do not perform well as they have not been tested earlier. They usually succumb to higher pressure of insect-pest and diseases.

So the study finds that pulses are grown only in 4.27 per cent of the total pulses' area under HYV seeds on total farms. Similarly oilseeds are grown in 3.20 per cent of the total oilseeds' area under HYV seeds. In case of mango and litchi, the data reveal that 15.33 per cent and 7.87 per cent of the total cropped area of the respective crops are under HYV seeds. Vegetables are found to be undertaken in 12.72 per cent of the total vegetables' area under HYV seeds on total farms level. Others which include

various spices are grown in 11.08 per cent of the total spices area under HYV seeds. So there is need to increase the SRR of pulses, oilseeds and horticultural crops area by way of seed movement in the state table 3.8.

Table 3.8: Percentage of area under HYV seeds

Name of the crop	Marginal	Small	Medium	Large	Total
Kharif crops during 2008					
Paddy	26.65	24.15	32.10	31.72	30.18
Maize	84.50	82.11	89.16	92.47	89.09
Rabi crops during 2008					
Wheat	49.88	54.94	45.80	58.10	49.78
Pulses	4.30	5.12	4.39	4.05	4.27
Oilseeds	3.15	4.19	3.89	2.92	3.20
Horticultural crops during 2008-09					
Mango	0.00	7.00	10.15	22.00	15.33
Litchi	0.00	0.00	7.40	11.35	7.87
Vegetables	8.45	7.32	13.52	14.26	12.72
Others (Spices)	6.10	5.57	5.03	13.86	11.08

3.8 Cropping Pattern

The data presented in table 3.9 show the cropping pattern of sample farm households for 2008-09 crop years. It is observed from the table that paddy and maize are the most important crops during the kharif season. It is grown in 31.29 per cent and 10.67 per cent respectively of the Gross Cropped Area (GCA). In rabi season, wheat, pulses and oilseeds are prominently grown. Wheat, pulses and oilseeds are grown in 23.19 per cent, 4.69 per cent and 3.13 per cent respectively of the GCA on total farms level. The above analysis reveals that of the gross cropped area 72.97 per cent occupied by kharif and rabi crops. Out of that paddy and wheat cover 54.48 per cent area. Among the horticultural crops mango, litchi, vegetables and spices are grown, which cover 27.03 per cent of the gross cropped area on total farms. Mango is largely grown, which covers an area of 16.35 per cent of the GCA.

Table 3.9: Cropping pattern of selected farmers (% of GCA for the whole year)

Name of the crop	Marginal	Small	Medium	Large	Total
Kharif crops during 2008					
Paddy	40.15	40.77	34.95	22.04	31.29
Maize	11.02	10.07	11.09	10.37	10.67
Rabi crops during 2008					
Wheat	27.95	27.81	24.41	19.33	23.19
Pulses	0.79	1.92	5.27	5.91	4.69
Oilseeds	0.39	0.48	1.94	6.26	3.13
Horticultural crops during 2008-09					
Mango	10.24	12.00	13.04	21.42	16.35
Litchi	6.70	5.03	5.69	7.51	6.26
Vegetables	1.97	1.44	1.67	1.67	1.56
Others (Spices)	0.79	0.48	1.94	5.49	2.86
Gross cropped area	100.00	100.00	100.00	100.00	100.00

3.9 Production, Cost and Returns

The figures relating to farm wise total value of output produced by the sample households, cost of production, net returns, non-farm income and total income have been presented in table 3.10. The field survey found that the total value of the output, both main and by-products, is Rs. 67087/household and Rs. 9637/acre on total farms. Farm wise analysis reveals it is higher on large farms and lower as according to the farm sizes. Per acre cost of production has also been separately calculated for material and labour components, which shows that the per acre cost of production for material components is Rs. 3977 whereas that of Rs. 1586 for labour component, accounting for 71.49 per cent for materials and 28.51 per cent for labour component. The total income has been calculated at Rs. 67225/household on total farms. It varies as according to farm sizes. Per household net returns is Rs. 61524 whereas that of Rs. 4278/acre. The non-farm income is Rs. 5701/household. However, it is higher on small farms (Rs. 9012/household) followed by large farms (Rs. 5372/household), marginal farms (Rs. 9012/household) and Rs. 4702/household on medium farms.

Table 3.10: Value of output, cost and net returns for the survey year – aggregate of all crops (Rs)

Farm Size	Value of output (main + by product)		Cost of production per acre		Net returns (Farm business income)		Non-farm income per household	Total income per household
	Per household	Per acre	Material cost	Labour cost	Per household	Per acre		
Marginal	22910	9020	3610	1392	10205	4018	4965	15170
Small	40765	9776	3497	1279	20849	5000	9012	29861
Medium	66369	9205	4018	1572	26066	3615	4702	30768
Large	142695	9923	4160	1717	58184	4046	5372	63556
Total	67087	9637	3977	1586	61524	4278	5701	67225

Note: Labour cost includes the imputed value of family labour

3.10 Summary of the Chapter

This chapter is dealt on household characteristics, cropping pattern and production structure of the sample respondents. The sample size is 100 farm households constituting 17.00 per cent by marginal farms, 22.00 per cent by small farms, 43.00 per cent by medium farms, 18.00 per cent by large farms. The net operated area is 4.73 acre/household and the GCA is 7.03 acre/household on overall farms. The overall cropping intensity is 14.94 per cent. Out of the total operated area, the study finds that tube well provides irrigation to about 84.90 per cent constituting 74.70 per cent from diesel run tube well and 10.20 per cent by electricity run tube well. Tanks and other sources contribute only 98.0 per cent irrigation to the net operated area. Rainfed area is about 5.30 per cent of the net operated area. It reveals that the major source of the irrigation is tube well in the study area. As regards the availability of credit, it is observed that a sum of Rs. 3829.20/household on overall farms. Out of it, 55.24 per cent is obtained from institutional sources. Similarly the availability credit is Rs. 809.52/acre on overall farms. Out of it, institutional sources contribute 55.24 per cent. It reveals that nearly more than half of the total available credit is met by institutional sources. It is to be noted here that out of per household total available credit, 57.93 per cent is used for productive purposes on overall farms. It is further observed that each household owes productive assets for a total value of Rs. 37027 at current level of prices whereas that of Rs. 5284/acre. The analysis of nature of tenancy in leasing-in land is in terms of fixed rent comprising cash (36.17%) and kind (63.83%). The area under HYV seeds are 30.18 per cent for paddy and 89.09 per cent for maize in kharif 2008; 49.78 per cent for wheat, 4.27 per cent for pulses and 3.20 per cent for oilseeds in rabi 2008 and 15.33 per cent for mango, 7.87 per cent for litchi

crops, 12.72 per cent for total vegetables and 11.08 per cent for others in horticultural crops during 2008-09. The analysis of area under HYV seeds reveals that it is higher in maize crop followed by wheat and paddy. Pulses and oilseeds are mainly grown by traditional varieties of seeds due to lack of improved/HYV seeds. The analysis of cropping pattern of the selected farmers reveals that kharif crops occupy 41.96 per cent, rabi crops 31.01 per cent and horticultural crops 27.03 per cent of the GCA. Staple food crops like paddy, wheat and maize together occupy 65.15 per cent of the GCA. The overall value of the output is estimated at Rs. 67087/household and Rs. 9637/acre. The overall cost of production is calculated at Rs. 5563/acre constituting 71.49 per cent for materials and 28.51 per cent for labour component. The overall net returns are Rs. 61524/household and Rs. 4278/acre. Rs. 5701/household is the overall non-farm income and the total income is traced out at Rs. 67225/household on overall farms.

CHAPTER – IV

PRODUCTION STRUCTURE AND RESOURCE USE UNDER HORTICULTURAL CROPS

4.1 An Introduction to the Crops Selected for the Study

A. Mango

Mango *(Mangifera indica L.)* is one of the most celebrated of tropical fruits, occupies nearly half of the total area under fruits in the country. It is adaptable to a wide range of soil and climatic conditions and grows well right from Assam to the southernmost limits of the country and from sea level up to about 1500 metres. It withstands both fairly dry conditions and heavy rainfall, provided severe and recurring forests in winter do not endanger the young trees. The trees are long lived, as some specimens still fruit after 300 years. The fruit takes three to six months to ripen.

A native to Southern Asia, especially eastern India, Burma, and the Andaman islands, the mango has been cultivated, praised and even revered in its homeland since ancient times. *The English word 'mango' originated from the Tamil word marigai or mankay.* The mango is the national fruit of India, Pakistan and the Philippines. It is also the national tree of Bangladesh. It accounts for approximately half of all tropical fruits produced worldwide. The FAO and UN estimate world wide production at nearly 38 million tones. The aggregate production on the top 10 countries (including India) is responsible for roughly 80.00 per cent of worldwide production.

In terms of area and production, India occupies first position in the world. In India, it is cultivated in 2297 thousand hectares (36% of total fruits area) and produces 15188 thousand MT (20.3% of total fruit production in 2010-11. Bihar covers an area of 147 thousand hectares (6.40 % of total mangoes area of the country) and produces 1334.9 thousand MT (8.79 % of total mangoes production of the country). In terms of food value mango is a very good source of carbohydrates (17%), calcium (8%) etc.

B. Litchi

Litchi *(Litchi Chinesis)* is a tropical and sub-tropical fruit tree, native to southern China. The fresh fruit has a delicate, whitish pulp with a floral smell and a fragrant, sweet flavour. The litchi is cultivated in China, Thailand, Vietnam, Japan Bangladesh and northern India, in particular Muzaffarpur, Bihar; which accounts for 75.00 per cent of total Indian production. South Africa and United States also have commercial litchi production. The litchi has a history of cultivation going back as far as 2000 BC according to records in China. Litchi chinesis was described and named by Frech naturalist Pierre Sonnerat. Litchi chinesis is an evergreen tree that is frequently less than 19 m (62 ft.), sometimes reaching more than 15 m (49 ft). Fruits mature in 80-122 days depending on climate, location and cultivar. It requires a warm sub-tropical to tropical climate that is cool but also frost-free or with only very slight winters frosts and with high summer heat, rainfall and humidity. Growth is best on well-drained, slightly acidic soils rich in organic matter. It contains on average a total of 72 mg of vitamin C per 100 grams of fruits. On an average nine litchi fruits would meet an adult's daily recommended Vitamin C requirement.

India is the second largest producer of litchi in the world after China. The spread of litchi to other parts of the world was rather slow probably due to its soil, climatic requirements and short life span of its seed. Litchi reached India through Myammar and North-East region during the 18th Century. In India, Litchi is cultivated in 78 thousand hectares (1.22% of total fruits area) and produced 497 thousand MT 0.66 per cent of total fruit production in 2010-11. Among fruit crops, litchi ranks seventh in area and ninth in production but is 6th in terms of value in India.

Bihar covers an area of 31 thousand hectares (39.74% of total litchi area of the country) and produces 227 thousand MT (45.67% of total litchi production of the country). It ranks first in terms of area and production among the states.

4.2 Economics of Production, Cost and Resource use in Horticulture

An analysis of the economics of production of the selected horticultural crops provides us with a deeper insight relating to impact of the National Horticultural Mission. It is here that the findings of the present study relating to the economics of

production (with costs and returns) have been briefly described here for the selected horticultural crops, viz., Mango and Litchi. It can be observed from the table No. 4.1 that the total revenue accrued per acre of land from mango cultivation stands at Rs. 49289/acre per annum on an average. However, the cost of production of mango appears at Rs. 26041.65/acre on an average. Therefore, the net return from mango cultivation turns out to be Rs. 26643.35/acre, excluding the variable cost. The net returns stands at Rs. 23247.35 excluding the total cost.

In contrast to mango cultivation, the cost of production in litchi cultivation (table 4.2) appears different. In fact, the total revenue accrued per acre of land per annum from litchi cultivation stands at Rs. 24925.11 on an average. While the total costs of production stands at Rs. 14925.19 per acre. The net return per acre from litchi cultivation turns out to be Rs. 9999.92 on an average excluding the total cost, which in much lower as compared to Mango cultivation.

Table 4.1: Net returns per acre from horticultural crops – Mango

(Rs per acre)

Farm Size		Marginal	Small	Medium	Large	Total
Average Area Planted (acres)		0.18	0.36	0.63	2.03	0.75
Preparatory tillage/Digging of Pits (32 nos)		160.00 (0.74)	190.00 (0.78)	192.00 (0.70)	192.00 (0.65)	183.68 (0.71)
Manure & fertilizer		59.00 (2.72)	598.00 (2.46)	592.00 (2.17)	605.00 (2.03)	596.64 (2.29)
Transplanting & gap filling		3142.00 (14.46)	3502.00 (14.40)	3418.00 (12.53)	3270.00 (11.00)	3333.12 (12.80)
Irrigation, canal, electricity and diesel		840.00 (3.89)	1172.00 (4.82)	1058.00 (3.87)	1215.00 (4.08)	1071.36 (4.11)
Weeding and Inter cultural operations		240.00 (1.10)	325.00 (1.34)	275.00 (1.01)	288.00 (0.97)	282.24 (1.08)
Topping / pruning		320.00 (1.47)	375.00 (1.54)	350.00 (1.28)	342.00 (1.15)	346.88 (1.33)
Plant protection, pesticides etc.		392.00 (1.80)	415.00 (1.72)	510.00 (1.87)	480.00 (1.62)	449.28 (1.73)
Repair, maintenance and depreciation@10%		846.20 (3.89)	1909.70 (7.85)	4087.00 (14.98)	6726.20 (22.62)	3702.70 (14.22)
Harvesting and collection		550.00 (2.53)	625.00 (2.57)	617.00 (2.27)	712.00 (2.39)	626.25 (2.40)
Grading, storage, transport, packing		1950.00 (8.98)	2125.00 (8.74)	2470.00 (9.07)	2080.00 (7.00)	2156.00 (8.28)
Market/mandi fee etc.		312.00 (1.44)	390.00 (1.60)	427.00 (1.57)	411.00 (1.38)	392.00 (1.50)
Miscellaneous (Watchman)		2250.00 (10.35)	1900.00 (7.81)	2400.00 (8.80)	2200.00 (7.40)	2187.50 (8.40)
Interest on Working Capital#		809.20 (3.72)	964.00 (3.96)	1260.00 (4.62)	1491.00 (5.02)	1163.00 (4.47)
Variable labour cost		6110.00 (28.13)	6210.00 (25.54)	6175.00 (22.64)	5965.00 (20.06)	6155.00 (23.64)
Total Variable Cost		18511.40 (85.22)	20700.70 (85.13)	23831.00 (87.38)	25977.20 (87.37)	22645.65 (86.96)
Fixed cost including planting material, field preparation cost, supporting material and irrigation setup (Amortized over the life time)##	Material cost	2493.00 (11.48)	2705.00 (11.12)	2585.00 (9.48)	2792.60 (9.39)	2547.00 (9.78)
	Labour cost	718.60 (3.30)	912.00 (3.75)	857.00 (3.14)	963.20 (3.24)	849.00 (3.26)
Total Cost		21723.00 (100.0)	24317.70 (100.0)	27273.00 (100.0)	29733.00 (100.0)	26041.65 (100.0)
Total Revenue		47550.00	50255.00	51776.00	52355.00	49289.00
Total Revenue - Total Cost		25827.00	25937.30	24503.00	22622.00	23247.35
Total Revenue - Variable Cost		29038.60	29554.30	27945.00	26377.80	26643.35
Output produced per acre (quintals)		42.00	47.00	45.00	49.50	45.74

In parenthesis percentage figures are shown.

Note: All variable cost items consist of two components:

(i) Bearing period cost - that is already during the reference period (i.e., 2008-09)

(ii) Cost during the plantation year/gestation period - that has been brought into the 2008-09 prices from the year of plantation/gestation, using the wholesale price index of all commodities for Bihar state.

@ Repair, maintenance and depreciation is 10% discounted value of agricultural assets holdings including tractor & implements and tube well motor etc. that is divided in proportionate to each crop sown during the year.

Interest on working capital is interest paid on the loans/borrowing divided in proportionate to each crop sown during the year.

Fixed cost has been amortized with 10% discount rate.

Table 4.2: Net returns per acre from horticultural crops – Litchi

(Rs per acre)

Farm Size		Marginal	Small	Medium	Large	Total
Average Area Planted (acres)		0.012	0.149	0.274	0.711	0.0280
Preparatory tillage/Digging of Pits		160.00 (1.44)	190.00 (1.42)	192.00 (1.25)	192.00 (1.05)	183.68 (1.23)
Manure & fertilizer		587.00 (5.29)	512.00 (3.82)	581.00 (3.78)	592.00 (3.24)	568.82 (3.81)
Transplanting & gap filling		1375.00 (12.39)	1917.00 (14.29)	1192.00 (7.75)	1264.00 (6.91)	1395.57 (9.35)
Irrigation, canal, electricity and diesel		712.00 (6.42)	810.00 (6.04)	888.00 (5.77)	818.00 (4.47)	828.32 (5.55)
Weeding and Inter cultural operations		179.00 (1.61)	212.00 (1.58)	208.00 (1.35)	168.00 (0.92)	196.75 (1.32)
Topping / pruning		270.00 (2.43)	281.00 (2.09)	323.00 (2.10)	292.00 (1.60)	299.17 (2.00)
Plant protection, pesticides etc.		469.00 (4.23)	385.00 (2.87)	312.00 (2.03)	510.00 (2.79)	390.39 (2.62)
Repair, maintenance and depreciation@ 10%		846.20 (7.62)	909.70 (6.78)	1087.00 (7.07)	2726.20 (14.91)	1456.12 (9.76)
Harvesting and collection		854.00 (7.70)	765.00 (5.70)	811.00 (5.27)	739.00 (4.04)	785.23 (5.26)
Grading, storage, transport, packing		970.00 (8.74)	885.00 (6.60)	915.00 (5.95)	1065.00 (5.83)	944.75 (6.33)
Market/mandi fee etc.		416.00 (3.75)	530.00 (3.95)	809.00 (5.26)	665.00 (3.64)	654.39 (4.38)
Miscellaneous (Watchmen)		250.00 (2.25)	800.00 (5.96)	665.00 (4.32)	590.00 (3.23)	610.95 (4.09)
Interest on Working Capital#		609.00 (5.49)	820.00 (6.11)	998.00 (6.49)	1262.00 (6.90)	956.00 (6.41)
Variable labour cost		2819.00 (25.40)	3012.00 (22.45)	3734.00 (24.28)	4220.00 (23.08)	3897.09 (26.11)
Total Variable Cost		10516.20 (94.76)	12029.70 (89.66)	12715.00 (82.67)	15103.20 (82.62)	13167.23 (88.22)
Fixed cost including planting material, field preparation cost, supporting material and irrigation setup (Amortized over the life time)##	Material cost	309.00 (2.78)	946.00 (7.05)	1694.00 (11.01)	2291.00 (12.53)	1272.10 (8.52)
	Labour cost	272.00 (2.46)	441.00 (3.29)	972.00 (6.32)	889.00 (4.86)	485.86 (3.26)
Total Cost		11097.20 (100.0)	13416.70 (100.0)	15381.00 (100.0)	18283.20 (100.0)	14925.19 (100.0)
Total Revenue		22937.00	23765.00	24552.00	29112.00	24925.11
Total Revenue - Total Cost		11839.80	10348.30	9171.00	10828.80	9999.92
Total Revenue - Variable Cost		12420.80	11735.30	11837.00	14009.80	11757.88
Output produced per acre (quintals)		40.00	38.75	36.25	39.80	38.08

In parenthesis percentage figures are shown.

Note: All variable cost items consist of two components:

(i) Bearing period cost - that is already during the reference period (i.e., 2008-09)
(ii) Cost during the plantation year/gestation period - that has been brought into the 2008-09 prices from the year of plantation/gestation, using the wholesale price index of all commodities for Bihar state.

@ Repair, maintenance and depreciation is 10% discounted value of agricultural assets holdings including tractor & implements and tube well motor etc. that is divided in proportionate to each crop sown during the year.

Interest on working capital is interest paid on the loans/borrowing divided in proportionate to each crop sown during the year.

Fixed cost has been amortized with 10% discount rate.

4.3 Net Returns from Horticultural Crops versus Non-Horticultural Crops

A comparison of net returns from horticultural crops and non-horticultural crops (table 4.3) reveals that net return from horticultural crops especially mango remain considerably higher than the traditional non-horticultural crops measured in terms of net monetary returns per acre of land. In fact, net returns from mango stands more than double the net returns from traditional crops like paddy, wheat, maize, lentil and gram. As such, it can be safely said that horticulture appears as a more profitable cultivation practice in general as compared to traditional kharif & rabi crops.

Table 4.3: Net returns (gross value of output - total cost) from horticultural and non-horticultural crops (crop wise Rs per acre)

Name of the crop	Marginal	Small	Medium	Large	Total
Kharif crops during 2008					
Paddy	8910.93	8330.77	11138.87	10752.63	9252.23
Maize	6614.57	7913.36	7491.50	9317.00	7430.77
Rabi crops during 2008					
Wheat	8927.94	8267.21	10121.45	11351.82	9209.72
Lentil	9206.07	12244.13	11174.09	13059.11	10906.48
Gram	5597.98	6165.18	6778.95	7073.68	6176.52
Horticultural crops during 2008-09					
Mango	25827.00	25937.30	24503.00	22622.00	23247.35
Litchi	11839.80	10348.30	9171.00	10828.80	9999.92

4.4 Use of Human Labour in Horticultural Vs. Non-Horticultural Crops

An analysis of the human labour application, in terms of crop wise mandays per acre, reveals that the requirement of human labour in mango and litchi crops are 63.69 and 59.54, is comparatively much higher than the use of human labour in case of kharif and rabi crops. In particular, the use of human labour in horticultural crops like mango and litchi is almost two to three times than that in maize, wheat, lentil and gram crops. It is one-and-a-half times than that in case of paddy. A size-class wise comparison shows that average human labour application increases sharply with the increase in farm size in case of both horticultural and non-horticultural crops. It is to be pointed out here that in this analysis, human lower application refers to both hired labour and family labour, and have been converted at the state's average wage rates.

A more detailed crops specific activities wise analysis of use of human labour (table 4.4.1) reveals that in case of mango cultivation, a major part of human labour has been expended in weeding and inter-cultural operations and harvesting and collection followed by application of manure and fertilizer and providing irrigation. In particular about 68.32 per cent of total human labour is expended on recurring activities undertaken annually and 31.68 per cent on fixed activities undertaken during the plantation year on total farms. Almost same trend was indicated across the farm sizes.

In case of litchi cultivation, about 66.37 per cent of total human labour is expended on recurring activities and 33.62 per cent on fixed activities undertaken during the plantation year on total farms. However, a major part of human labour has been expended on harvesting and collection followed by application of fertilizer and manure, weeding cultural operation etc. which are somewhat different compared to mango cultivation for recurring activities. Farm wise analysis reveals almost the same trend (table 4.4.2).

Table 4.4: Use of human Labour in Crop Production (crop wise man days per acre)

Name of the crop	Marginal	Small	Medium	Large	Total
Kharif crops during 2008					
Paddy	36.11	38.62	39.44	43.05	39.34
Maize	28.15	31.42	32.66	31.76	31.46
Rabi crops during 2008					
Wheat	22.29	24.17	26.92	29.15	25.93
Lentil	18.20	18.11	21.32	24.28	20.61
Gram	19.22	17.10	21.68	22.32	20.37
Horticultural crops during 2008-09					
Mango	52.43	61.37	65.40	73.10	63.69
Litchi	54.10	53.47	61.17	68.22	59.54
Gross cropped area	100.0	100.0	100.0	100.0	100.0

Note: The man days are calculated by dividing the labour cost by the wage rate prevailing in the village

Table 4.4.1: Use of human Labour in Mango Cultivation by activities (man days per acre)

Farm Size	Marginal	Small	Medium	Large	Total
(A) Recurring activities undertaken every year#					
Preparatory tillage	05.17	9.13	10.77	9.11	8.55
Manure & fertilizer	8.11	7.12	6.12	6.89	7.06
Transplanting & gap filling	0.00	0.00	0.00	0.00	0.00
Irrigation, electricity and diesel	7.00	8.14	10.13	11.10	9.09
Weeding and inter cultural operations	11.10	12.19	12.89	13.05	12.31
Topping / pruning	3.42	4.17	4.82	3.22	3.91
Plant protection, pesticides etc.	2.11	3.17	3.72	2.31	2.83
Harvesting and collection	10.21	12.10	14.10	17.40	13.45
Grading, storage, transport, packing	5.31	5.35	2.85	10.02	5.88
Total Recurring Activities	52.43	61.37	65.40	73.10	63.69
	(68.05%)	(70.79%)	(65.35%)	(68.59%)	(68.32%)
(B) Fixed activities undertaken during the plantation year##					
(a) Planting material like seedling, nursery etc	10.11	9.52	12.24	11.74	10.90
(b) Field preparation - digging, pit making, fencing etc	6.19	7.41	9.10	8.52	7.81
(c) Supporting material - bamboo, iron angles, etc	4.13	4.32	7.14	6.19	5.45
(d) Laying down of permanent irrigation	4.19	4.07	6.19	7.02	5.37
Total Fixed Activities	24.62	25.32	34.67	33.47	29.53
	(31.95%)	(29.21%)	(34.65%)	(31.41%)	(31.68%)
Gross total (A + B)	77.05	86.69	100.07	106.57	93.22
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: # Mandays are calculated by dividing the labour cost by the prevailing wage rate during the year in which cost was incurred for example, for the bearing period wage rate is for 2008-09 but for gestation period wage rate is during the gestation year.

Mandays are calculated, dividing labour cost by the prevailing wage rate during the year of plantation.

In brackets percentage figures to gross total have been indicated.

Table 4.4.2: Use of human labour in Litchi Cultivation by activities (man days per acre)

Farm Size	Marginal	Small	Medium	Large	Total
(A) Recurring activities undertaken every year#					
Preparatory tillage	4.81	5.92	6.44	7.92	6.27
Manure & fertilizer	9.32	6.17	5.17	6.83	6.87
Transplanting & gap filling	0.00	0.00	0.00	0.00	0.00
Irrigation, electricity and diesel	6.21	5.88	7.21	8.29	6.90
Weeding and inter cultural operations	4.10	7.92	6.89	8.47	6.84
Topping / pruning	3.12	4.10	8.77	6.12	5.53
Plant protection, pesticides etc.	2.11	3.17	4.16	6.41	3.96
Harvesting and collection	16.12	13.89	14.84	16.76	15.40
Grading, storage, transport, packing	8.31	6.42	7.69	7.42	7.46
Total Recurring Activities	54.10	53.47	61.17	68.22	59.23
	(67.55%)	(66.52%)	(64.67%)	(66.96%)	(66.37%)
(B) Fixed activities undertaken during the plantation year##					
(a) Planting material like seedling, nursery etc	9.37	8.41	11.74	10.32	9.96
(b) Field preparation - digging, pit making, fencing etc	7.18	8.03	7.68	9.09	8.00
(c) Supporting material - bamboo, iron angles, etc	6.30	7.58	9.32	8.14	7.84
(d) Laying down of permanent irrigation	3.13	2.89	4.68	6.11	4.20
Total Fixed Activities	25.98	26.91	33.42	33.66	30.00
	(32.45%)	(33.48%)	(35.33%)	(33.04%)	(33.62%)
Gross total (A + B)	80.08	80.38	94.59	101.88	89.23
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: # Mandays are calculated by dividing the labour cost by the prevailing wage rate during the year in which cost was incurred for example, for the bearing period wage rate is for 2008-09 but for gestation period wage rate is during the gestation year.

Mandays are calculated, dividing labour cost by the prevailing wage rate during the year of plantation.

In brackets percentage figures to gross total have been indicated.

4.5 Marketing Channels of Horticultural Crops

Marketing of output produced is one of the most important aspects in agriculture. It is equally important in case of horticultural crops also. Unlike field crops like paddy, wheat, maize, pulses etc., horticultural crops like mango and litchi are perishable in nature. Both the produce is generally consumed in raw form in stead of preserving in cans. However, processing of litchi crop in Muzaffarpur (Tirhut Division) is being made and preserved in cans at a smaller scale for export purposes mostly in domestic markets. In recent past it has also been exported outside the country but encouraging response is yet to get. The data presented in table No. 4.5

shows about the different marketing channels through which products were sold by the sample households. In case of mango, we find that the mango produced by the sample farms is marketed through different marketing channels, which vary greatly over the size classes. In fact, a major part of output produced by marginal farms is channeled to the intermediaries at the farm gate (37.36%), which acts as a pre-dominant marketing channel for the marginal farms. On the other hand, major part of the output produced by the small, medium and large farms is marketed to the merchant/traders on pre-arranged contract. It reflects pre-arranged contract (67.05%) is the major channel in marketing the produce at the overall level, followed by local market (16.82%), directly to the consumers at village (15.08%) and wholesale market (14.15%). It remains extremely unfortunate to observe that the government agencies or the cooperative agencies do not have any role in marketing of output in the study areas.

In case of the litchi too, it has been observed that there has been a complete absence of formal marketing channels like government agencies, cooperatives etc. Moreover, most of the output produced by all the categories of farms is sold to marchant/traders on pre-arranged contract. On overall, 65.58 per cent of the produced quantity is sold on pre-arranged contract, followed by wholesale markets (22.94%), directly to the villagers (8.61%) and local market (2.87%).

Table 4.5: Marketing channels through which horticultural products were sold by the selected households (percentage of output)

Farm Sizes	Wholesale market	Local market	Village directly	Coop-erative	Govt Agencies	Interme diaries at farm gate	Merchant or pre arranged Contract	Others	Aggre gate
Crop – 1 (Mango)									
Marginal	35.90	17.86	8.88	---	---	37.36	---	---	100.0
Small	24.85	8.31	4.11	---	---	---	62.73	---	100.0
Medium	19.40	---	---	---	---	---	80.60	---	100.0
Large	9.24	---	21.81	---	---	---	69.95	---	100.0
Total	14.15	16.82	15.08	---	---	1.90	67.05	---	100.0
Crop – 2 (Litchi)									
Marginal	---	---	22.12	---	---	---	77.82	---	100.0
Small	---	19.56	11.21	---	---	---	69.23	---	100.0
Medium	44.44	---	5.11	---	---	---	50.45	---	100.0
Large	20.41	---	8.36	---	---	---	71.23	---	100.0
Total	22.94	2.87	8.61	---	---	---	65.58	---	100.0

4.5 On Farm processing activity in Horticultural Crops

In case of both mango and litchi, it has been observed that none of the sample beneficiary farmers are involved in on-farm processing activities. However, it may be noted here that the variety of mangoes and litchi grown in the study area is best suited for consumption in raw, though they can processed also, particularly litchi. However, litchi is being processed in a nearby district namely Muzaffarpur at a very small scale. But in lack of promoting packages, it is not taking place adequately.

4.7 Summary of the Chapter

There is no doubt in the fact that an analysis of the economics of production of the selected horticultural crops provides us with a deeper insight relating to the impact of NHM. The findings on production structure and resource use of the selected horticultural crops reveal that in case of mango, total revenue accrued per acre of land stands quite high (as also the cost of production), thereby generating higher net returns. In sharp contrast to this, total revenue accrued per acre of land from litchi cultivation comes to be lower than mango cultivation (as also the costs of production). Again a comparison of net returns from horticultural and non-horticultural crops reveal that net return per unit of land from selected horticultural crops (viz., mango and litchi) turns out to be much higher than the net return per farm from kharif and to some extent rabi crops. However, net return per unit of land from mango cultivation turns out to be more than double than from litchi.

As regards human labour application per unit of land, it has been observed that the application of human labour (including family labour) remains much higher for mango and litchi crops as compared to traditional kharif and rabi crops.

A more detailed crops specific activities wise analysis of use of human labour reveals that in case of mango cultivation, a major part of human labour has been expended in weeding and inter-cultural operations and harvesting and collection followed by application of manure and fertilizer and providing irrigation. In particular about 68.32 per cent of total human labour is expended on recurring activities undertaken annually and 31.68 per cent on fixed activities undertaken during the plantation year on total farms. Almost same trend was indicated across

the farm sizes. In case of litchi cultivation, about 66.37 per cent of total human labour is expended on recurring activities and 33.62 per cent on fixed activities undertaken during the plantation year on total farms. However, a major part of human labour has been expended on harvesting and collection followed by application of fertilizer and manure, weeding cultural operation etc. which are somewhat different compared to mango cultivation for recurring activities. Farm wise analysis reveals almost the same trend.

In case of marketing of the produce, it is hard to find that in case of both mango and litchi, there has been a complete absence of formal marketing channels like government agencies, cooperatives to the relief of the farmers. As such most of the produce is sold to the merchant/trader on pre-arranged contract followed by the wholesale market, local market, directly to the villagers and intermediaries at farm gate.

Moreover, it is extremely unfortunate to observe that none of the sample beneficiary farmers are involved in on-farm processing activities. In fact, there is complete absence of mango or litchi processing plants in the regions concerned. As such, output is sold in raw form. There is no value addition in either of the sample produces.

CHAPTER – V

IMPACT OF NHM ON THE EXPANSION OF HORTICULTURAL CROPS

5.1 Impact of NHM on Area and Yield of Selected Horticultural Crops

National Horticulture Mission (NHM) in Bihar was launched in 2006-07 to promote holistic approach of the horticulture sector covering fruits, vegetable seed production, spices, aromatic plants, betelvine and flowers. A roadmap was prepared for development of mission in right direction from 2008-09 to 2011-12. As mentioned earlier this study covers two sample crops, namely mango & litchi in two districts of Bihar. Since NHM scheme is being implemented in various states including Bihar, it is imperative to look in depth at the effectiveness and relevance with respect to different components of the scheme, which are taken into account and to make an attempt to evaluate the impact of the mission in the study area using farm level data collected from the sample households for the reference year 2008-09. This chapter particularly assesses the overall impact of NHM on the expansion of horticulture area and yield and attempts to identify all possible constraints and outcomes of the programme.

Table 5.1 presents, a comparative analysis of area and productivity of mango and litchi. The data showed that the average area under the mango cultivation was 0.26 acre/household during 2004-05 has increased to 2.03 acres/household during 2009-10. On the other hand, the average yield has declined to 45.74 quintals/acre during 2009-10 from 59.14 quintals/acre during 2004-05. The increase in area was found from 2006-07, the year of implementation of the programme; and was constant upto 2009-10. But the yield rate was found decreased to 38.02 quintal per acre during 2006-07 and further increased to 45.74 quintal per acre during 2009-10 mainly due to non-bearing of new plants during first three years and thus, the yield rate has been found declined during 2006-07 to 2008-09.

In case of litchi, same trend has been recorded. The average area under the litchi cultivation was 0.069 acre per household during 2004-05 has increased to 0.280 acre per household during 2009-10. On the other hand, the average yield has marginal increased to 38.08 quintals per acre during 2009-10 from 32.17 quintals per acre during 2004-05. During 2006-07 to 2008-09, the yield rate was found declined mainly because of non-bearing period of the new plants.

Table 5.1: Impact of NHM on Area and Yield – of Mango and Litchi

Year	Area cultivated in acres per household					Yield rate obtained quintals per acre				
	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
Crop – 1 (Mango)										
2004-05	0.05	0.12	0.19	0.78	0.26	56.30	57.70	60.12	61.22	59.14
2005-06	0.05	0.12	0.19	0.78	0.26	55.00	52.00	58.30	59.40	56.55
2006-07	0.18	0.36	0.63	2.03	0.75	29.10	38.70	39.40	42.30	38.02
2007-08	0.18	0.36	0.63	2.03	0.75	31.30	40.20	40.60	42.80	39.16
2008-09	0.18	0.36	0.63	2.03	0.75	40.40	43.20	44.30	48.20	43.40
2009-10	0.18	0.36	0.63	2.03	0.75	42.00	47.00	45.00	49.50	45.74
Crop – 2 (Litchi)										
2004-05	0.002	0.038	0.092	0.113	0.069	28.20	30.50	32.90	36.20	32.17
2005-06	0.002	0.038	0.092	0.113	0.069	29.10	30.80	32.60	35.80	32.19
2006-07	0.012	0.149	0.274	0.711	0.280	19.30	30.20	23.40	25.50	32.38
2007-08	0.012	0.149	0.274	0.711	0.280	22.20	24.70	23.50	26.70	24.12
2008-09	0.012	0.149	0.274	0.711	0.280	25.40	26.20	25.40	28.30	26.10
2009-10	0.012	0.149	0.274	0.711	0.280	40.00	38.75	36.25	39.80	38.08

5.2 Rejuvenation/Protection, Resource Procurement Provision

No case of rejuvenation/protection is found in case of mango and litchi crops among the sample households. However, the state annual action plan of NHM for the years 2006-07 and 2007-08 shows that out of 13 components of NHM, rejuvenation/protection component has also been included but the financial achievement level for the years as stated above is just 15.00 per cent. During 2008-09, a sum of Rs. 1.20 lakh was the expenditures on account of it. A sum of Rs. 75 lakh was proposed for the year 2009-10.

5.3 NHM Reaching to the Households with Resource Provision

The mission envisages coverage of large areas under improved varieties of horticultural crops. As per NHM guidelines of Government of India, the assistance for cultivation as below:

Establishment of New Gardens (Ha)

SN	Fruits	Amount	Rate
1.	Fruits--- Perennials	Rs. 30,000/ha	75 % of cost subject to a maximum of Rs. 22,500/ha limited to 4 ha/beneficiary in three installments of 50:20:30 subject to survival rate of 75% in 2nd year and 90 % in 3rd year
2.	Fruits-Non-Perennials	Rs. 30,000/ha	50% of cost subject to a maximum of Rs. 15,000/ha limited to 4 ha/beneficiary in three installments of 50:20:30 subject to survival rate of 75% in 2nd year and 90% in 3rd year.

The data presented in table No. 5.2 shows the sources of NHM resource procurement for the sample households during the period of 2006-07 to 2008-09. It may be noted that about 71.00 per cent of total NHM resource procurement by the sample households was through State Department of Horticulture. The private nurseries provided 21.00 per cent whereas fellow/progressive farmers provided 8.00 per cent of total NHM resource procurement by the beneficiaries' households. Among different household categories, the small households received highest of 77.27 per cent of the total resource management procurement through the State Horticulture Department, followed by marginal households (70.59%), medium households (69.77%) and large households (66.67%). The private nurseries provided 33.33 per cent of the total resource procurement to large households followed by marginal households (29.41%), small households (22.73%) and medium households (11.63%). The role of fellow/progressive farmers does not appear much significant.

Table 5.2: Sources of NHM Resource Procurement for all Crops during 2004-05 to 2009-10 (percentage of households)

Farm Size	Department of Horticulture	Private Nursery	Fellow Farmers	Through contract farming	Others	Total/ All
Marginal	70.59	29.41	0.00	0.00	0.00	100.00
Small	77.27	22.73	0.00	0.00	0.00	100.00
Medium	69.77	11.63	18.60	0.00	0.00	100.00
Large	66.67	33.33	0.00	0.00	0.00	100.00
Total	71.00	21.00	8.00	0.00	0.00	100.00

Farmers were also benefitted through various promotional activities undertaken through NHM. Table 5.3 shows the proportion of sample farmers benefitted through there promotional activities. Needless to mention, besides establishment of new gardens (45%), provisions of many other crucial aspects is supposed to have significant horticultural crops. However, the study finds that 27.00 per cent farmers have benefitted by making available good quality planting materials followed by promotion of INM/IPM (26%), training and capacity building (25%) and help provided for organic farming (24%). But majority of sample farmers were benefitted by few of these activities. However, it is to clear here that some farmers did not fulfill eligibility criteria to avail some of the facilities provided under NHM.

Table 5.3: Promotional Activities of NHM to increase area under horticultural crops (% of households saying *'yes'*)

Descriptions	Marginal	Small	Medium	Large	Total
Making available good quality planting material like nursery	3 (17.65)	8 (36.36)	11 (25.55)	5 (27.78)	27 (27.00)
Rejuvenation with improved cultivars	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Upgrading the existing tissue culture unit	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Mother stock block maintenance under poly cover to protect from adverse weather conditions	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Raising root stock seedlings under net house conditions	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Polyhouse with ventilation, insect proof netting, fogging and sprinkler irrigation	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Pump house to provide sufficient irrigation with/without storage tank, community tank	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Soil sterilization-steam sterilization system with boilers	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Establishment of new garden or seed production	11 (64.71)	10 (44.45)	20 (46.51)	4 (22.22)	45 (45.00)
Protected cultivation like green house, shade net, plastic tunnel etc	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Precision farming implements, e.g., computer, GPS, GIS, sensors and application control	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Promotion of integrated nutrient management or integrated pest management	2 (11.76)	6 (27.27)	11 (25.58)	7 (38.89)	26 (26.00)
Help provided for organic farming (vermi compost unit, certification etc.)	3 (17.65)	5 (22.73)	9 (20.93)	7 (38.89)	24 (24.00)
Post harvest management like pack house, storage unit, mobile processing unit etc	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Training and capacity building	4 (23.53)	7 (31.82)	3 (20.93)	5 (27.78)	25 (25.00)
Total	17 (100.0)	22 (100.0)	43 (100.0)	18 (100.0)	100 (100.0)

5.4 Subsidy Provision under NHM

As the present study is conducted only upon beneficiary households of the scheme, so it is found that all the sample households have received subsidies (table 5.4). Table 5.4 has five parts. They are: (a) crops/items for which subsidy provided in per cent, (b) details of activities for which subsidy was provided in per cent, (c) amount of aggregate investment at Rs. per household, (d) amount of subsidy provided by NHM at Rs. per household, and; (e) subsidy as a per cent of investment. It is clear from the table that all the sample households in their respective categories of farms have received the subsidies in respective sample crops. The overall amount of investment, which includes both variable and fixed costs, is Rs. 24345.40. However, it is Rs. 5316.40 on marginal farms, Rs. 9830.50 on small farms, Rs. 65382.50 on medium farms and Rs. 24345.40 on total farms. The amount of subsidy was given into two parts viz., in terms of sapling and cash for maintenance in 2nd & 3rd year of the plantation subject to the rates of survival of plants. The table reveals that the subsidy as percentage of total investment is 61.02 per cent at total farms. However, it is, higher at 66.78 per cent on marginal farms, followed by 60.65 per cent on small farms, 58.11 per cent on medium farms and 54.13 per cent on large farms. It further reveals that the percentage of cash subsidy across the farms is 2 to 4 times higher in the form of cash subsidy compared to the subsidy given in purchase of sapling of the crops.

Table 5.4: Details of subsidy provided by NHM

S N	Details of the items	Marginal	Small	Medium	Large	Total
Crops/items for which subsidy provided (% of households)						
1	Maize	10 (20.00)	9 (18.00)	22 (44.00)	9 (18.00)	50 (100.00)
2	Litchi	7 (14.00)	13 (26.00)	21 (42.00)	9 (18.00)	50 (100.00)
Details of activities for which subsidy was provided (% of households)						
1	Area Expansion	17 (17.00)	22 (22.00)	43 (43.00)	18 (18.00)	100 (100.00)
Amount of aggregate investment (Rs per household)						
1	Aggregate Investment (Variable + Fixed)	5316.40	9830.50	20120.00	65382.50	24345.40
Amount of subsidy provided by NHM (Rs per household)						
1	Sapling	1070	1650	2372	8040	3515
2	Cash	2480	4313	9319	27352	11340
3	Total	3550	5963	11691	35392	14855
Subsidy as a percentage of investment (%)						
1	Sapling	20.13	16.78	11.79	12.30	14.44

2	Cash	46.65	43.87	46.32	41.83	46.58
3	Total	66.78	60.65	58.11	54.13	61.02

5.5 Capacity Building by NHM

It is presumed that the extension activities of the State and District Horticulture Offices with training, demonstration, publicity and training of the master trainers might have a positive impact on area expansion for enhancing horticultural cultivation among the farmers. Our sample farmers also availed this facility under NHM programme to learn about the adoption of modern techniques in horticulture. Table 5.5 shows the different aspects of training and dissemination facility provided to the sample farmers. It may be noted that the training was provided to the sample farmers through various sources. Out of these sources, the state department of horticulture is the prime one followed by the SAU, others (friends, relatives and progressive farmers), KVKs and input dealers. On an average 1.33 times of the training was provided during the year to the sample households by the state department of horticulture whereas that of 0.04 times by SAU, 0.03 times by others, 0.02 times by KVK and 0.01 by input dealers. Sources like Kisan Call Centres (KCCs), Co-operatives/Local bodies, Special Research Stations and NGOs have not played any role in providing extension backup to the sample farms. It is also clear from the table that the medium and large farms have availed more that one or two sources of training compared to marginal and small farms.

As far as the number of days of training per household per year is concerned, the same table also shows, on an average, the training session arranged for about 0.59 day per household per year through state department of horticulture followed by 0.04 day per household each by SAU & KVK and 0.01 day by input dealers and others.

It may also be noted that about 52.00 per cent of the sample households have got the training within the village or nearby village by state department of horticulture followed by KVK (3% of the sample households) and input dealers and others (2 % of the sample households). Further, majority of the sample farmers did not prefer training within the village or nearby village, so 2.00 per cent or less of the sample

farmers attended the trainings outside the village or nearby village meaning thereby in town or state capital.

Table 5.5: Sources of Training/Dissemination Activity Provided to the Farmers

Details of training	Marginal	Small	Medium	Large	Total
Frequency of the training provided during the year					
State Horticulture Department	1.22	1.37	1.44	1.29	1.33
State Agricultural University / Colleges	0.00	0.00	0.00	0.15	0.04
Krishi Vigyan Kendras	0.00	0.00	0.07	0.02	0.02
Kisan Call Centre	0.00	0.00	0.00	0.00	0.00
Cooperatives / Local Bodies	0.00	0.00	0.00	0.00	0.00
Input Dealers / Private Company Representatives	0.03	0.00	0.02	0.00	0.01
Special Research Stations set up by the Government	0.00	0.00	0.00	0.00	0.00
Non Government Organisations (NGOs)	0.00	0.00	0.00	0.00	0.00
Any other (Relative/Prog. Farmers, etc.)	0.00	0.00	0.00	0.13	0.03
Average number of days per household during the year					
State Horticulture Department	0.67	0.53	0.59	0.56	0.59
State Agricultural University / Colleges	0.00	0.00	0.00	0.16	0.04
Krishi Vigyan Kendras	0.00	0.00	0.09	0.03	0.04
Kisan Call Centre	0.00	0.00	0.00	0.00	0.00
Cooperatives / Local Bodies	0.00	0.00	0.00	0.00	0.00
Input Dealers / Private Company Representatives	0.02	0.00	0.01	0.00	0.01
Special Research Stations set up by the Government	0.00	0.00	0.00	0.00	0.00
Non Government Organisations (NGOs)	0.00	0.00	0.00	0.00	0.00
Any other	0.00	0.00	0.00	0.06	0.01
Training sessions organized within village or nearby village (% of households)					
State Horticulture Department	11.00	16.00	19.00	6.00	52.00
State Agricultural University / Colleges	0.00	0.00	0.00	0.00	0.00
Krishi Vigyan Kendras	0.00	0.00	2.00	1.00	3.00
Kisan Call Centre	0.00	0.00	0.00	0.00	0.00
Cooperatives / Local Bodies	0.00	0.00	0.00	0.00	0.00
Input Dealers / Private Company Representatives	2.00	0.00	0.00	0.00	2.00
Special Research Stations set up by the Government	0.00	0.00	0.00	0.00	0.00
Non Government Organisations (NGOs)	0.00	0.00	0.00	0.00	0.00
Any other	0.00	0.00	0.00	2.00	2.00
Training sessions organized within town/district or state capital (% of households)					
State Horticulture Department	0.00	0.00	3.00	0.00	0.00
State Agricultural University / Colleges	0.00	0.00	0.00	2.00	2.00
Krishi Vigyan Kendras	0.00	0.00	0.00	0.00	0.00
Kisan Call Centre	0.00	0.00	0.00	0.00	0.00
Cooperatives / Local Bodies	0.00	0.00	0.00	0.00	0.00
Input Dealers / Private Company Representatives	0.00	0.00	1.00	0.00	1.00
Special Research Stations set up by the Government	0.00	0.00	0.00	0.00	0.00
Non Government Organisations (NGOs)	0.00	0.00	0.00	0.00	0.00
Any other	0.00	0.00	0.00	0.00	0.00

5.6 Perception of Households about NHM

The perception of the beneficiary farmers about their experiences in cultivating sample horticultural crops with the help of NHM assistance is very helpful in reviewing the impact of NHM. Table 5.6 shows various perceptions of households about the performance in the sample districts of Bihar. Cent per cent of sample farmers said that NHM helped them by providing seedlings/saplings for increasing

the area under horticultural crops. While on an average 48.00 per cent of all farmers expressed that NHM helped them by providing training to the farmers.

Cent per cent farmers were of opinion that financial assistance through NHM is a good point. On an average 54.00 per cent of sample farmers said that the subsidy provision of NHM is also an encouraging point. Nearly 54.00 per cent reported that NHM helped in increasing the employment opportunities for farmers through increasing area under horticultural crops, 35.00 per cent expressed that by providing subsidy to those who have diversified their crops from field to horticulture crops and on an average 46.00 per cent opined that NHM has not increased employment in any way.

Regarding the impact of NHM on income levels of the farmers, about 31.00 per cent told that their income has increased up to 20.00 per cent after adopting horticultural crops, 17.00 per cent said that their income increased by 20 to 40 per cent and only 11.00 per cent were of the view that their income increased by 40 to 60 per cent. However, it is sorry to say that 41.00 per cent of all sample farmers have reported that their income have not increased after adopting the NHM may be due to poor survival rate of the plant and shrinkage of litchi crop from the field due to climate factors.

As regards the awareness about the NHM in the village sample farmers were asked some qualitative questions. Responding to them they said that they have actively benefitted from the subsidies provided by the NHM (42%), actively participated in the trainings (22%), able to raise their area under horticultural crops with the help of NHM (17%) and 35.00 per cent of sample farmers reported that they stand aloof and completely unaware about the activities of NHM.

Moreover, suggestions were also sought from the sample farmers to make the NHM scheme more effective. Of the total sample farmers 53.00 per cent suggested to provide irrigational facilities in the field because horticultural crops require regular irrigation. Since irrigation facilities in linked with power supply, so 33.00 per cent of sample farmers suggested to increase power supply in the rural areas. About 29.00 per cent suggested for making fencing provision of the orchards so as to cattle grazing problem could be checked. Increase in project costs and subsidies was also suggested by 27.00 per cent of sample farmers mainly due to increasing input costs. Since for the last 3-4 years, the climate change is found, which is badly affecting the survival & growth rates of horticultural crops in general and litchi in particular, so

25.00 per cent suggested for new researches/inventions to suit the changing pattern of climate. About 13.00 per cent of sample farmers suggested ensuring supply of original medicines for spraying the plants.

Table 5.6: Perception of households about the NHM (% of households saying 'Yes')

Details of training	Marginal	Small	Medium	Large	Total
A. How NHM has helped you to increase your area under horticultural crops					
By providing seedling/nursery	17.00	22.00	43.00	18.00	100.00
By providing material inputs	0.00	0.00	0.00	0.00	0.00
By capacity building (providing training)	8.00	12.00	22.00	6.00	48.00
By providing processing facilities	0.00	0.00	0.00	0.00	0.00
By providing market for our end product	0.00	0.00	0.00	0.00	0.00
By providing procurement facility	0.00	0.00	0.00	0.00	0.00
B. What are the good points in the policy towards NHM					
Financial assistance	17.00	22.00	43.00	18.00	100.00
Building infrastructure	0.00	0.00	0.00	0.00	0.00
Capacity Building (awareness camps / training etc)	8.00	12.00	22.00	6.00	48.00
Subsidy provision	12.00	11.00	24.00	7.00	54.00
Any other	0.00	0.00	0.00	0.00	0.00
C. Do you think NHM has increased employment opportunities for the farmers and agricultural Labourers, How?					
By increasing area under horticultural crops that are manually operated	7.00	14.00	26.00	7.00	54.00
By establishing horticultural processing units in the local areas	0.00	0.00	0.00	0.00	0.00
By providing subsidy to those who have diversified their crops from field to horticultural crops	4.00	6.00	12.00	13.00	35.00
No NHM has not increased employment in any way	10.00	8.00	17.00	11.00	46.00
D. Do you think your income has grown up after adopting horticultural crops with the help of NHM. If yes how much					
less than 20 %	6.00	9.00	11.00	5.00	31.00
20 to 40 %	5.00	3.00	3.00	6.00	17.00
40 to 60 %	1.00	4.00	2.00	4.00	11.00
60 to 100 %	0.00	0.00	0.00	0.00	0.00
No increase at all	5.00	6.00	27.00	3.00	41.00
E. Are farmers in your village aware about the National Horticulture Mission, How?					
They have actively benefited from the subsidies provided by the NHM	8.00	7.00	20.00	7.00	42.00
They actively participate in the training programmes provided by the NHM	3.00	5.00	11.00	3.00	22.00
They have benefited from the infrastructural building up being done by the NHM	0.00	0.00	0.00	0.00	0.00
They have been able to raise their area under horticultural crops with the help of NHM	4.00	4.00	3.00	6.00	17.00
No they stand aloof and completely unaware about the activities of NHM	6.00	11.00	13.00	5.00	35.00
F. What changes do you suggest to make NHM more effective – mention					
Irrigation Facilities	11.00	13.00	22.00	7.00	53.00
Fencing Provisions be made	8.00	7.00	11.00	3.00	29.00
Increase in Project costs & subsidy	6.00	8.00	7.00	6.00	27.00
Research/Inventions in case of Litchi crops be made in view of climate change	3.00	7.00	11.00	4.00	25.00
Original medicines for spraying the plants be made available	0.00	0.00	7.00	6.00	13.00
Power supply should be increased	3.00	9.00	14.00	7.00	33.00

5.7 Summary of the Chapter

An analysis of the subjective perceptions of the farmers in general and the beneficiaries owing to implementation of this mission is particular brings out some interesting observations. While analyzing the impact of NHM on area and yield of selected horticultural crops viz., mango and litchi during a period of 2004-05 to 2009-10, it was found that the extent of expansion of area was impressive but the overall in yield was not satisfactory in case of both the crops, which may be due to gestation period of the new cropped area. In case of mango crop, the average area increased from 0.26 per household during 2004-05 to 0.75 acre per household during 2009-10, indicating 2.88 times increase during 2009-10. Similarly, the average area of litchi crop has increased from 0.069 acre per household during 2004-05 to 0.280 acre per household during 2009-10, indicating 4.06 times increase during 2004-05 to 2008-09. The yield rate actually declined in case of mango crop from 59.14 quintals per acre in 2004-05 to 45.74 quintals per acre in 2009-10. However, in case of litchi crop, it increased sharply from 32.17 quintals per acre in 2004-05 to 38.08 quintals per acre in 2009-10.

As far as the area under rejuvenation/protection, resources procurement through NHM and the resulted increase in production is concerned, no cases of rejuvenation are found in case of both the sample crops. The state annual action plan of NHM for the years 2006-07 and 2007-08 relating to rejuvenation also shows that the level of financial achievement is just 15.00 per cent. It is further at the low ebb during 2008-09 and 2009-10.

As regards the NHM reaching to the households with resource provision, it is found that about 71.00 per cent of total NHM resource procurement by the sample households was through state department of horticulture followed by 21.00 per cent through private nurseries and 8.00 per cent through fellow/progressive farmers. The majority of sample farmers were benefitted through various promotional activities undertaken through NHM. About 45.00 per cent farmers said that they established new garden. About 27.00 per cent farmers told that they made use of available good quality planting material like nursery through NHM. Nearly 26.00 per cent were found promoted of INM/IMP, 25.00 per cent said that their capacity

builded through training made under NHM and 24.00 per cent said that they were helped for organic farming. Not a single farmer was found benefitted under rejuvenation, upgraded issue culture unit, mother stock block maintenance under poly cover to protect from adverse weather conditions, raising root stock seedling under net house conditions, ploy house with ventilation, insect proof nettings, fogging and sprinkler irrigation, pump house to provide sufficient irrigation, soil sterilization, protected cultivation and of course, post harvest management. However, it is true that these components of the NHM scheme were either not adopted under NHM or did not qualify the eligibility criteria to avail such facilities.

The subsidy was also provided to the sample farmers. Cent per cent sample farmers were found to receive the subsidy made under NHM scheme. The average aggregate amount of subsidy was Rs. 24345.40 per household. However, it varies from Rs. 5316.40 per household to Rs. 65382.50 per household across the farm sizes. The percentage of subsidy as a percentage of total investment was indicated at 61.02 per cent comprising 14.44 per cent on account of supply of sapling and 46.58 per cent under the cash benefit.

Since capacity building is an integral part of NHM scheme so it was found that the training was provided to the sample farmers through various sources. It was just 1.33 times per household per year received from the state department of horticulture followed by SAU (0.04 time), others (0.03 time), KVK (0.02 time) and input dealers (0.01 time). The training sessions arranged for 0.59 day per household per year by the state horticulture department followed by 0.04 day each by SAU and KVK and 0.01 day each by input dealers and others.

The perceptions of the beneficiary farmers about their experiences in cultivating horticultural crops with the help of NHM assistance are very helpful in analyzing the performance of NHM scheme. Cent per cent of sample farmers told that NHM helped them by providing seedling nursery for increasing the area under horticultural crops. On an average 48.00 per cent expressed that NHM helped in capacity building by providing training. Cent per cent opined that financial

assistance made under the programme is a good point, 54.00 per cent expressed about subsidy provision and 48.00 per cent for training. Regarding the increased employment opportunities, 54.00 per cent of sample households said that by increasing area under horticultural crops employment opportunities have increased. About 31.00 per cent of sample households have reported that their income has increased up to 20.00 per cent after adopting horticultural crops with the help of NHM. About 17.00 per cent reported about increase in income by 20 to 40 per cent and 11.00 per cent by 40 to 60 per cent.

Suggestions were also captured from sample households to make NHM more effective in the state. Of them, irrigational facilities (53%) occupy the first followed by adequate power supply (33%), need for fencing of orchard (29%), increase in project costs and subsidy (27%), need of research/inventions in case of litchi crop to suit the changing pattern of climate (25%) and ensure supply of good quality of medicines for spraying the plants (13%).

CHAPTER – VI

CONCLUDING REMARKS AND POLICY SUGGESTIONS

6.1 Introduction

India is the second largest producer of fruits and vegetables in the world after China. Till 1980, the main focus of the country was on cereals' production. During 1980-92, efforts began for consolidation of institutional support and planned process for the development of horticultural sector. In post 1993 period, focused attention was given on horticulture development by increasing plan allocations. Despite that the yield of the horticultural crops increased marginally during1991-92 to 2006-07. It rose from 7.5 MT/ha in 1990-91 to 11.00 MT/ha in 2010-11. In fact the horticulture sector is facing severe constraints like low crop productivity, limited irrigation facilities and underdeveloped infrastructure support. With a view to promote holistic growth of horticulture sector, the Department of Agriculture & Co-operation, Ministry of Agriculture, Government of India has launched a centrally sponsored scheme of "National Horticulture Mission" (NHM) in April 2005 in all the states and union territories except north-eastern states. The main objective of the NHM is to promote area based regionally differentiated cluster approach for development of horticultural crops having comparative advantage. Since then the scheme is in operation, so it would be necessary to analyze its impact. It is therefore, the Ministry of Agriculture, Government of India assigned to its Agro-Economic Research Centres/Units to carryout crop based impact evaluation study across the states. Accordingly, Agro-Economic Research Centre for Bihar & Jharkhand, T M Bhagalpur University has undertaken this study in Bihar.

Bihar, endowed with very fertile land and sub-tropical climate, holds a vast potential for growing a large variety of horticultural crops. Fruits and vegetables crops cover about 1.11 million hectare (2008-09) accounting for 19.73 per cent of the net sown area and 14.39 per cent of gross cropped area of the state. The state ranks 4th in fruit

and 3rd in vegetable production in the country. The state contributes nearly 7.00 per cent of the country's total fruit production (62.85 MT in 2007-08). Mango is the most important crop with the largest acreage (49.56%) and production (35.72%). The yield rate of mango is 9.23 MT/ha, lower than the national average of 11.93 MT/ha. As regards the litchi, about 2/3 of its total production is produced in the state. Guava, banana (2nd most important crop), citrus fruits (lime, lemon and pummeloes), pineapple, coconut, papaya, jackfruit, custard apple, aonla, bael, ber, pomegranate, peach, sapota, jamun, karonda, mulberry, khirni, amra, etc are also grown in the state. Besides the state has also a long tradition of growing large number of vegetables due to diversified agro-ecological situations. The total area under vegetable production is about 827 thousand hectare with annual production of 13386 MT. The average productivity is 16.19 MT/ha. Root and tuber crops are the third most important food crop after cereals and legumes. The total area under spice crops is about 10.80 thousand hectare with annual production of about 57 thousand MT. The state is not producing enough flowers to meet its domestic requirements. The area under cultivation of flowers is very limited. Due to government support and some other initiative, the area under floriculture in the state has now gone up to 593 hectare. As regards the medicinal and aromatic plants, the exact area is not known but its plantation is becoming popular amongst the farmers and the area under these crops is gradually increasing. Among the plantation crops coconut has expanded to about 15000 hectare. Tea plantation has also come up in Kishanganj and its adjoining areas.

The specific objectives of the study are to assess the impact in terms of increase in area, production and productivity of identified horticultural crops covered under the NHM, keeping 2004-05 as base year; extent to which the scheme has helped in creating employment opportunities and enhancement of income of the farmers, and; suggest suitable measures in improving the implementation strategies.

The study has been undertaken in two districts i.e., Muzaffarpur & Vaishali. Two villages from each of the selected districts and 25 beneficiaries from each of the selected villages, taken together 100 beneficiaries' households form the size of the

sample. Mango and litchi crops have been covered for the purpose of the study. The reference periods of the study are 2004-05 (pre-project) and 2005-06 to 2008-09 (implementation of the programme).

6.2 Area, Production and Productivity of Horticultural Crops in the State

The state has 9359.57 thousand hectares of geographical area and out of it 71.08 per cent is cultivable. It has 11.78 per cent horticultural area to the cultivable area. Analysis reveals that both fruits and vegetables signify a steady growth in terms of increase area and production from 1990-91 to 2009-10. The production of fruits grew by 1.4 times, whereas that of vegetables by 1.69 times during the same period. During 2000-01 to 2009-10, area under fruits grew by 1.09 times while vegetables by 1.46 times and species by 44 per cent. During the same period, the area and production of commercial flowers increased by 4 times and 6 times respectively. Growth analysis reveals that fruits' area and yield grew by 8.82 per cent and 24.95 per cent during 2000-01 to 2009-10. Growth rates for fruits area and vegetables indicate 1.72 per cent and 31.80 per cent respectively during the period of 2004-05 to 2009-10. Similarly for vegetables sub-sector 46.19 per cent and 24.71 per cent respectively during the period of 2000-01 to 2009-10, while these are 71.05 per cent and 12.11 per cent for the period of 2004-05 to 2009-10. Growth in area and yield of species and flowers sub-sector recorded 43.96 per cent & 14.56 per cent and 389.36 per cent & 20.77 per cent respectively for the period of 2004-05 to 2009-10. The district wise growth analysis of horticultural crops for TE 2004-05 to TE 2008-09 reveals that the area and yield of fruits sub-sector has recorded fall in area by 0.04 per cent and increase in yield rate by 6.93 per cent, 16.84 per cent and 1.21 per cent respectively for vegetables sub-sector, 10.58 per cent and 3.50 per cent respectively for total (fruits + vegetables) and 52.75 per cent and (-) 4.10 per cent respectively for floriculture sub-sector at aggregate levels. The growth of area and yield of mango crop have been recorded at 0.842 per cent and 5.017 per cent respectively during the period of 2004-05 to 2009-10. Similarly in case of litchi crop, it has been recorded at 1.549 per cent and 0.995 per cent respectively during the same period. The average annual growth in terms of area and yield of mango crop has been found 0.715 per cent and 12.34 per cent respectively during 2004-05 to 2008-09 whereas that of 1.847

per cent and (-) 0.35 per cent respectively in case of litchi crop during the same period. The preceding analysis clearly reveals that NHM programme has made tremendous success in increasing area of mango and litchi crops. In case of yield rate the average annual growth of mango was recorded at 12.34 per cent but it fell by 0.35 in litchi crop at the aggregate levels.

6.3 Household Characteristics, Cropping Pattern and Production Structure

This chapter is dealt on household characteristics, cropping pattern and production structure of the sample respondents. The sample size is 100 farm households constituting 17.00 per cent by marginal farms, 22.00 per cent by small farms, 43.00 per cent by medium farms, 18.00 per cent by large farms. The net operated area is 4.73 acre/household and the GCA is 7.03 acre/household on overall farms. The overall cropping intensity is 14.94 per cent. Out of the total operated area, the study finds that tube well provides irrigation to about 84.90 per cent constituting 74.70 per cent from diesel run tube well and 10.20 per cent by electricity run tube well. Tanks and other sources contribute only 98.0 per cent irrigation to the net operated area. Rainfed area is about 5.30 per cent of the net operated area. It reveals that the major source of the irrigation is tube well in the study area. As regards the availability of credit, it is observed that a sum of Rs. 3829.20/household on overall farms. Out of it, 55.24 per cent is obtained from institutional sources. Similarly the availability credit is Rs. 809.52/acre on overall farms. Out of it, institutional sources contribute 55.24 per cent. It reveals that nearly more than half of the total available credit is met by institutional sources. It is to be noted here that out of per household total available credit, 57.93 per cent is used for productive purposes on overall farms. It is further observed that each household owes productive assets for a total value of Rs. 37027 at current level of prices whereas that of Rs. 5284/acre. The analysis of nature of tenancy in leasing-in land is in terms of fixed rent comprising cash (36.17%) and kind (63.83%). The area under HYV seeds are 30.18 per cent for paddy and 89.09 per cent for maize in kharif 2008; 49.78 per cent for wheat, 4.27 per cent for pulses and 3.20 per cent for oilseeds in rabi 2008 and 15.33 per cent for mango, 7.87 per cent for litchi crops, 12.72 per cent for total vegetables and 11.08 per cent for others in horticultural crops during 2008-09. The analysis of area under HYV seeds reveals that it is higher

in maize crop followed by wheat and paddy. Pulses and oilseeds are mainly grown by traditional varieties of seeds due to lack of improved/HYV seeds. The analysis of cropping pattern of the selected farmers reveals that kharif crops occupy 41.96 per cent, rabi crops 31.01 per cent and horticultural crops 27.03 per cent of the GCA. Staple food crops like paddy, wheat and maize together occupy 65.15 per cent of the GCA. The overall value of the output is estimated at Rs. 67087/household and Rs. 9637/acre. The overall cost of production is calculated at Rs. 5563/acre constituting 71.49 per cent for materials and 28.51 per cent for labour component. The overall net returns are Rs. 61524/household and Rs. 4278/acre. Rs. 5701/household is the overall non-farm income and the total income is traced out at Rs. 67225/household on overall farms.

6.4 Production Structure and Resource use under Horticultural Crops

There is no doubt in the fact that an analysis of the economics of production of the selected horticultural crops provides us with a deeper insight relating to the impact of NHM. The findings on production structure and resource use of the selected horticultural crops reveal that in case of mango, total revenue accrued per acre of land stands quite high (as also the cost of production), thereby generating higher net returns. In sharp contrast to this, total revenue accrued per acre of land from litchi cultivation comes to be lower than mango cultivation (as also the costs of production). Again a comparison of net returns from horticultural and non-horticultural crops reveal that net return per unit of land from selected horticultural crops (viz., mango and litchi) turns out to be much higher than the net return per farm from kharif and to some extent rabi crops. However, net return per unit of land from mango cultivation turns out to be more than double than from litchi.

As regards human labour application per unit of land, it has been observed that the application of human labour (including family labour) remains much higher for mango and litchi crops as compared to traditional kharif and rabi crops.

A more detailed crops specific activities wise analysis of use of human labour reveals that in case of mango cultivation, a major part of human labour has been

expended in weeding and inter-cultural operations and harvesting and collection followed by application of manure and fertilizer and providing irrigation. In particular about 68.32 per cent of total human labour is expended on recurring activities undertaken annually and 31.68 per cent on fixed activities undertaken during the plantation year on total farms. Almost same trend was indicated across the farm sizes. In case of litchi cultivation, about 66.37 per cent of total human labour is expended on recurring activities and 33.62 per cent on fixed activities undertaken during the plantation year on total farms. However, a major part of human labour has been expended on harvesting and collection followed by application of fertilizer and manure, weeding cultural operation etc. which are somewhat different compared to mango cultivation for recurring activities. Farm wise analysis reveals almost the same trend.

In case of marketing of the produce, it is hard to find that in case of both mango and litchi, there has been a complete absence of formal marketing channels like government agencies, cooperatives to the relief of the farmers. As such most of the produce is sold to the merchant/trader on pre-arranged contract followed by the wholesale market, local market, directly to the villagers and intermediaries at farm gate.

Moreover, it is extremely unfortunate to observe that none of the sample beneficiary farmers are involved in on-farm processing activities. In fact, there is complete absence of mango or litchi processing plants in the regions concerned. As such, output is sold in raw form. There is no value addition in either of the sample produces.

6.5 Impact of NHM on the Expansion of Horticultural Crops

An analysis of the subjective perceptions of the farmers in general and the beneficiaries owing to implementation of this mission is particular brings out some interesting observations. While analyzing the impact of NHM on area and yield of selected horticultural crops viz., mango and litchi during a period of 2004-05 to 2009-10, it was found that the extent of expansion of area was impressive but the overall

in yield was not satisfactory in case of both the crops, which may be due to gestation period of the new cropped area. In case of mango crop, the average area increased from 0.26 per household during 2004-05 to 0.75 acre per household during 2009-10, indicating 2.88 times increase during 2009-10. Similarly, the average area of litchi crop has increased from 0.069 acre per household during 2004-05 to 0.280 acre per household during 2009-10, indicating 4.06 times increase during 2004-05 to 2008-09. The yield rate actually declined in case of mango crop from 59.14 quintals per acre in 2004-05 to 45.74 quintals per acre in 2009-10. However, in case of litchi crop, it increased sharply from 32.17 quintals per acre in 2004-05 to 38.08 quintals per acre in 2009-10.

As far as the area under rejuvenation/protection, resources procurement through NHM and the resulted increase in production is concerned, no cases of rejuvenation are found in case of both the sample crops. The state annual action plan of NHM for the years 2006-07 and 2007-08 relating to rejuvenation also shows that the level of financial achievement is just 15.00 per cent. It is further at the low ebb during 2008-09 and 2009-10.

As regards the NHM reaching to the households with resource provision, it is found that about 71.00 per cent of total NHM resource procurement by the sample households was through state department of horticulture followed by 21.00 per cent through private nurseries and 8.00 per cent through fellow/progressive farmers. The majority of sample farmers were benefitted through various promotional activities undertaken through NHM. About 45.00 per cent farmers said that they established new garden. About 27.00 per cent farmers told that they made use of available good quality planting material like nursery through NHM. Nearly 26.00 per cent were found promoted of INM/IMP, 25.00 per cent said that their capacity builded through training made under NHM and 24.00 per cent said that they were helped for organic farming. Not a single farmer was found benefitted under rejuvenation, upgraded issue culture unit, mother stock block maintenance under poly cover to protect from adverse weather conditions, raising root stock seedling under net house conditions, ploy house with ventilation, insect proof nettings,

fogging and sprinkler irrigation, pump house to provide sufficient irrigation, soil sterilization, protected cultivation and of course, post harvest management. However, it is true that these components of the NHM scheme were either not adopted under NHM or did not qualify the eligibility criteria to avail such facilities.

The subsidy was also provided to the sample farmers. Cent per cent sample farmers were found to receive the subsidy made under NHM scheme. The average aggregate amount of subsidy was Rs. 24345.40 per household. However, it varies from Rs. 5316.40 per household to Rs. 65382.50 per household across the farm sizes. The percentage of subsidy as a percentage of total investment was indicated at 61.02 per cent comprising 14.44 per cent on account of supply of sapling and 46.58 per cent under the cash benefit.

Since capacity building is an integral part of NHM scheme so it was found that the training was provided to the sample farmers through various sources. It was just 1.33 times per household per year received from the state department of horticulture followed by SAU (0.04 time), others (0.03 time), KVK (0.02 time) and input dealers (0.01 time). The training sessions arranged for 0.59 day per household per year by the state horticulture department followed by 0.04 day each by SAU and KVK and 0.01 day each by input dealers and others.

The perceptions of the beneficiary farmers about their experiences in cultivating horticultural crops with the help of NHM assistance are very helpful in analyzing the performance of NHM scheme. Cent per cent of sample farmers told that NHM helped them by providing seedling nursery for increasing the area under horticultural crops. On an average 48.00 per cent expressed that NHM helped in capacity building by providing training. Cent per cent opined that financial assistance made under the programme is a good point, 54.00 per cent expressed about subsidy provision and 48.00 per cent for training. Regarding the increased employment opportunities, 54.00 per cent of sample households said that by increasing area under horticultural crops employment opportunities have increased. About 31.00 per cent of sample households have reported that their income has

increased up to 20.00 per cent after adopting horticultural crops with the help of NHM. About 17.00 per cent reported about increase in income by 20 to 40 per cent and 11.00 per cent by 40 to 60 per cent.

6.6 Policy Suggestions

Bihar has excellent development potential of horticultural sector despite several constraints. The efforts over the last some years made for systematic and planned development of horticultural sector have started gaining responses from the producers. However, there are several challenges, which are required to be addressed seriously. Moreover, based on the findings and observations of the present study, the following are the suggested policy measures to mitigate the problems relating to performance of the NHM. The specific policy suggestions may be presented hereunder:

i. For expansion of area under horticultural crops, irrigation is most important input, so irrigational is required, which can be ensured by re-starting non-functional tube wells and facilities of micro-irrigation may be provided. So, 53.00 per cent of the sample farmers suggested for making them available of irrigational facilities *(Attention: Directorate of Agriculture, Government of Bihar).*

ii. Since irrigational facility is related to the un-interrupted power supply, so 33.00 per cent of the sample farmers suggested for increase in power supply in the region. Though, the state government is contemplating the efforts for separate power grid or transmission line for the rural areas, which may be expedited *(Attention: Bihar State Power (Holding) Company Ltd, Government of Bihar).*

iii. Cattle grazing is largely found in the study region/area, so, 29.00 per cent of the sample farmers suggested for fencing of the new gardens, which may be met by RKVY or other related schemes *(Directorate of Horticulture, Government of Bihar).*

iv. Due to soaring of input prices, 27.00 per cent of the sample farmers suggested to increase the costs of project and the amount of subsidy *(Ministry of Agriculture, Government of India).*

v. Adverse impact of climate change was also found in the study area particularly on litchi crop, so 27.00 per cent of the sample farmers suggested the need of new researches and inventions, particularly suited to the litchi crop *(ICAR & SAU).*

vi. Attack of insects and pests was found in the study area on the sample crops, so 13.00 per cent of the sample farmers suggested ensuring original medicines for spraying the plants *(Directorate of Agriculture, Government of Bihar).*

vii. It was observed that there is insufficient monitoring and supervision personnel of the new gardens by the extension staff of the NHM scheme, which may be due to lack of sufficient staff and providing facilities for the same. To meet such limitations, outsourcing of the field staff may be done *(Directorate of Horticulture, Government of Bihar).*

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Appendix – I

Coordinator's Comments on the Draft Report
Impact Study of the National Horticulture Mission Scheme in Bihar

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Bhagalpur - 812007

1. Chapter 1, page no 6: two villages have been selected one near the periphery of district headquarter and the other from the distant (and not the district) place was selected, make the correction. Overview at the end of the chapter should present the structure of the report chapter wise.
2. Table 2.2 (page 11), Area and production is given only for TE 2004-05 to TE 2009-10 where as check the original chapter plan, we have asked this for long term data from TE 1980-81 onwards all the years. Please provide all historical data as that is needed for the consolidation report.
3. Table 2.3 providing growth rates from 1980-81 to 1990-91; 1990-91 to 2000-01 and 2000-01 to 2009-10; 2000-01 to 2004-05 and 2004-05 to 2008-09 is missing. Please carry out these growth rates and discuss in the report.
4. The horticultural crops include fruits; vegetables; spices gradens and plantation crops; floriculture; and medicinal and aromatic crops. However in Bihar report it seems author has included only fruits, vegetables and floriculture. Kindly provide data including all horticultural crops in table 2.3 (district level data on horticultural crops). If the district level figures are small, then please provide data in 000 hectares rather than lakh hectares.
5. Table 2.5 (page 15): Provide the growth rate (district level) for area and yield and not area and production (See chapter plan). Growth in area and yield sum together makes growth in production (which is redundant given the growth in area and yield).
6. Table 2.6 (page 17); Provide data for TE 1980-81 up to TE 2009-10 (at present data given is only from 1990-91 to 2009-10 and not Trinnium Ending data), missing information from 1980-81 to 1989-90 should be provided. Table 2.7: provide growth rate for the period 1980-81 to 1990-91; 1990-91 to 2000-01 and 2000-01 to 2009-10 as per our Plan Schedule.
7. Table 2.10 page (21); The growth rates should be provided for area and yield and not area and production.
8. Table 3.4 (page 26); also provide a column at the end for sum total loan (institutional + non institutional) for each category of marginal, small, medium and large farmers.
9. The detailed table on use of human labour in horticultural crops (mango and litchi separately including the recurring and fixed activities is not provided (Sample given below).

Sd/-
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04/12/2012

Annexure – I

Action Taken Report

1. In Chapter – I, the subtitle: An Overview has been changed as per the given suggestion.
2. Available data incorporated.
3. Available data could be incorporated and analyzed accordingly.
4. District wise data for sub-groups other than fruits, vegetables and commercial flowers are not available.
5. Incorporated and re-analyzed.
6. Available data incorporated and analyzed accordingly.
7. Incorporated and analyzed accordingly.
8. Incorporated and analyzed accordingly
9. Incorporated and analyzed accordingly.

08/02/2013

Ranjan Kumar Sinha
Project Leader

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