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Impact of national horticulture mission (NHM) scheme on horticulture development in Karnataka

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Abstract
The Karnataka state has implemented the developmental activities under the mission in the 30 districts, covering 16 important horticultural crops and the scheme has been in function successfully from 2005-06 to till. Karnataka, one of the major fruit growing states in the country was selected purposively for the study. With this background the present study was undertaken to analyze impact of National Horticulture Mission (NHM) scheme on horticulture development in Karnataka. The study is based on both primary and secondary data source. The analytical techniques like CAGR, CV, Instability index, Principle Component Analysis technique and averages were employed. Out of total physical achievement (2.10 lakh ha) of horticultural crops under NHM, the highest area of about 60.82 per cent has been covered under fruit crops followed by flowers (12.88 %), plantation crops (12.36 %), spices (11.24 %) and least was medicinal and aromatic plants (2.69 %). Based on the analysis it was observed that the instability in area, production and productivity of horticulture crops was reduced after implementation of NHM in the study area which showed positive impact of NHM but growth was slightly reduced but significantly positive during the same period when compared to pre-NHM period. The per hectare net returns (without subsidy) from grapes, mango and pomegranate were estimated to be Rs. 9,68,705, Rs. 2,76,275 and Rs. 3,66,533, respectively. Similarly, the net returns (with subsidy) from these crops were Rs. 10,26,039, Rs. 3,03,001 and Rs. 3,98,033, respectively. B: C ratio (without subsidy) was 2.58, 2.66 and 2.41 for grape, mango and pomegranate, respectively and B: C ratio (with subsidy) was estimated to be 3.19, 3.18 and 2.73 for respective crops. Horticultural crops had advantage over conventional food crops not only in terms of total profits but also provided better employment opportunities by increasing labour mandays.

Keywords: NHM, Compound annual growth rates, instability index, pre and post NHM

Introduction
The National Horticulture Mission (NHM) scheme in the State of Karnataka is being implemented by the State Horticulture Development Society through District Mission Committees involving farmers, Societies, NGOs, Grower Associations, SHGs, State institutions *etc* during 2005-06. Karnataka is the first state to set up a separate Department of Horticulture in India for the overall development of horticulture. It stands second in area and ninth in production of horticultural crops in India and accounts for 18.6 per cent of horticultural production of the country (Anon., 2014) [2]. The scheme aims at holistic development of horticulture sector and works on "Cluster Basis'. The programme is being implemented in 30 districts including 6 districts covered under the Rehabilitation Package for distressed farmers. The focus crops identified under the programme include Mango, Banana, Grape, Pomegranate, Pineapple, Cashew, Cocoa, Ginger, Pepper, Flowers and Aromatic plants. Major activities being undertaken under NHM are production and distribution of planting material, Plantation Infrastructure and Development-Nurseries, Tissue Culture labs, vegetable seed production, area expansion, rejuvenation of old and senile orchards, creation of community water resources, protected cultivation, Integrated Pest Management/Integrated Nutrient Management, organic farming, mushroom cultivation, development of post-harvest management & marketing infrastructure and human resource development *etc.*,. The horticulture sector generates over Rs. 35307 crore annual incomes and is an important source of livelihood for as many as 12.50 lakhs farm families in the state. Annual growth rate is seen to be higher at around 6 per cent (Anon., 2014b). The scheme is implemented in 372 districts

in the country during 2005-06 to 2013-14, which is about 76 per cent of the total number of districts in the country and an additional area of 18.92 lakh hectares horticulture area was covered. In case of Karnataka all districts (30 districts) had covered under National Horticulture Scheme. Apart from this it also covered about 17 crops, which is highest among all states. Under this back drop, the study attempted to investigate the impact of NHM on different dimensions of horticulture sector. This will provide necessary inputs to policy makers and programme implementing agencies. Farmers are getting financial assistances like subsidies, planting materials and plant protection materials.

Material and Methods

The present study is based on both primary and secondary sources. The primary data were collected through intensive survey of the sample farmers through structured questionnaire by personal interviews. Data on cost and returns of principal crops were also collected through personal interviews. Three horticultural crops namely, grapes, mango and pomegranate in three districts *i.e.,* Vijayapura, Dharwad and Koppal, respectively were selected based on highest area in north-Karnataka. The sample respondents for each fruit crop were 90 and the total sample size was 270. The secondary data regarding new area coverage under National Horticulture Mission scheme (from 2005-06 to 2013-14) and the data on area, production and productivity of the selected crops for the period of 16 years *i.e.,* from 1998-99 to 2013-14 were obtained from the Directorate of Horticulture, Bangalore and District Statistical Offices, other published sources. Parameters considered for analyzing the impact of NHM in Karnataka state are as follows

Compound Annual Growth Rate (CAGR)

For computing compound annual growth rate of area, production and productivity of crops and financial progress of NHM scheme, the exponential function of the following form was used.

$$Y = a\, b^t e^{Ut} \quad \cdots\cdots (1)$$

Where,
Y = Area/Yield/Production
a = Intercept
b = Regression coefficient
'a' and 'b' are the parameters to be estimated
t = time period
U_t= Disturbance term in year't'

The equation (1) was transformed into log linear form and written as;

$$\log Y = \log a + t \log b + U_t \quad \cdots\cdots (2)$$

Equation (2) was estimated by using Ordinary Least Squares (OLS) technique.

Compound growth rate (g) was then computed

$$g = (b - 1)\, 100 \quad \cdots\cdots (3)$$

Where,
g: Compound growth rate in per cent per annum
b: Antilog of log b
The standard error of the growth rate was estimated and tested for its significance with 't' statistic.
Compound annual growth rate in area, production and productivity of selected crops was computed using 16 years time series data. For better interpretation, the time series data was classified broadly into pre-NHM (1998-99 to 2005-06) and Post NHM period (2006-07 to 2013-14). NHM period was covered for 8 years.

Cuddy-Della Valle Index

The coefficient of variation was used as measure to study the variability in progress of different components of NHM scheme as well as area, production and productivity of horticulture crops in Karnataka. The coefficient of variation (CV) was computed by using the following formula

$$CV = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (\bar{X})} \times 100$$

Linear trend were fitted to the original data of area, production and productivity of selected crops, for the periods of pre-NHM (1998-99 to 2005-06) and Post NHM period (2006-07 to 2013-14). The trend coefficients were tested for their significance. Whenever the trend of series found to be significant; the variation around the trend rather than the variation around mean was used as an index of instability. Therefore in order to examine the extent of risk involved in horticultural crop production, the instability in the horticultural crops area and production was estimated using Cuddy-Della Valle Index. The formula suggested by Cuddy and Della was used to compute the degree of variation around the trend. That is Coefficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determinations (r^2) in the cases where r^2 was significant to obtain the Instability Index.

$$\text{Instability index (II)} = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (\bar{X})} \times 100 \times \sqrt{1-r^2}$$

Tabular analysis/ budgeting technique

The data collected were subjected to tabular method of analysis to work out averages, percentages and ratios. The meaningful conclusions were drawn from such simple statistical measures. To study the economics of selected crops, averages and percentages were used. In the present study all calculations pertaining to the economics of selected crops were made on per hectare basis.

Financial feasibility analysis

Financial feasibility analysis was carried out to evaluate the feasibility of investment on selected horticultural crops. Two conventionally used project evaluation techniques were used in the study to evaluate the feasibility of investments.

Net Present Value (NPV): Net present value represents the discounted value of the net cash inflows to the project. In order to consider the investment worthiness, the net present value should be positive and of higher magnitude before alternative opportunities considered. In the present study, a discount factor of 10.5 per cent was used to discount the net cash inflows representing the opportunity cost of capital. It can be represented by,

$$NPV = \sum_{i=1}^{n} Y_i\, (1 + r)^{-i} - I$$

Where,

Y_i = Refers to the net cash inflows in the n^{th} year
r = Refers to the discount rate
I = Initial investment
i = Years of life period 1, 2..... n.

***Benefit Cost Ratio (BCR)*:** Benefit Cost Ratio (BCR) refers to the ratio of discounted net cash flows (project benefits) to investments. The ratio must be more ≥ 1 for an enterprise to be considered worthwhile. The Benefit Cost Ratio (BCR) was worked out by using the following formula discounted net cash flows

$$\text{B:C ratio} = \frac{\text{Discounted net cash flows}}{\text{Initial investment}} = \frac{\sum_{i=1}^{n} Y_i (1 + r)^{-i}}{I}$$

Results and Discussion

Year-wise new area covered under NHM & other schemes during period 2005-06 and 2013-14 in Karnataka is depicted in the Table 1. An additional area of 2.10 lakh hectares have been brought under National horticulture Mission and about 2.44 lakh hectare area under other than NHM schemes since inception in Karnataka. As per the statistical data, the additional area of about 4.44 lakh hectares has been covered under different horticultural crops during last eight years from inception of NHM. Apart from this one could see that during last eight years (2005-06 to 2013-14) positive growth has been observed in case of area coverage under NHM where as negative coverage has been observed under other than NHM schemes. Co-efficient of Variation (CV) in area coverage during the same period was concerned, less variation was observed under NHM scheme which is about 86 per cent when compared to yearly increment (130 per cent) and area under other schemes (181 %) in Karnataka (Bajpai, 2012) [3]. This directly showed the better performance of NHM as compared to other schemes related to horticultural development in the Karnataka. The similar situation was observed in case financial achievements (Bajpai, 2012) [3].

Crop-wise physical and financial achievements under National Horticulture Mission during 2005-06 and 2013-14 in Karnataka showed in Table 2. Physical achievements under NHM in different crops is concerned, about 2, 10,353 hectare has been covered under NHM since inception under different horticultural crops. Out of total physical achievements under horticultural crops about 61 per cent area has been covered under fruit crops followed by an area 27,103 hectares of flowers (about 13 %), 26,003 hectares of plantation crops (about 12 %), 23,650 hectares of spices (about 11 %) and 5,662 hectares of medicinal and aromatic plants (about 3 %). Among different fruit crops highest area was contributed by banana (about 35 %) followed by mango (about 33 %), sapota (about 9 %), pomegranate (about 8 %), grape (about 6 %) and so on. Apart from this, table also showed the co-efficient of variation (CV) in area coverage of different horticultural crops. Among all crops, the highest variation has been observed in medicinal and aromatic plants (101.16 %) followed by plantation crops (98.16 %), spices (88.29 %), flowers (83.88 %) and comparatively less variation was seen in case of fruit crops (71.1 %) (Usha, 2011) [11].

Financial achievements under NHM in different crops were concerned, about Rs. 269.06 crores has been achieved under NHM since inception under different horticultural crops. Out of total financial achievement under horticultural crops about 66 per cent (Rs. 168.8 crores) expenditure made on fruit crops followed by flowers (about 17 %), spices (about 11 %), plantation crops (about 7 %) and least was medicinal and aromatic plants (about 2 %). Among different fruit crops highest expenditure was made on banana (36 %) and mango (31 %). Co-efficient of Variation (CV) in financial achievements during the same period were concerned, the highest variation has been observed in medicinal and aromatic plants (101.5 %) followed by spices (84.79 %), flowers (83.88 %), plantation crops (78.22 %), and comparatively least variation was observed in case of fruits (66.97 %). Similar conditions as in case of area coverage were seen in case of financial achievements. These figures showed that the government was giving more importance to fruit crops, especially mango, banana, grapes, pomegranate and sapota crops through National Horticulture Mission programme (Chattopadhaya and Roy, 2011) [4].

Karnataka state as whole, the area, production and productivity of horticulture crops showed negative growth during pre-NHM period but that was turned positive and significant during post-NHM period (Kadam and Rathod, 2015) [6]. During the same period instability of area, production and yield were reduced in the state (Table 3). Among the different horticulture sub sectors, fruits, vegetable and commercial flowers showed positive and significant growth in area and production with less instability during post-NHM period compared to pre-NHM period. Similarly, productivity was showed positive growth but insignificant during post-NHM period (Kadam *et al.*, 2015) [6]. Impact of NHM on area, production and productivity of spices and plantation crops was evidently noticeable, which were negative with high instability during pre-NHM period in case of spices and which were improved slightly during post-NHM period (Acharya *et al.*, 2013) [1]. In case of plantation and garden crops, growth in area was positive but production and productivity showed negative trend during post-NHM period (Table 3). Negative growth rate of area in spices and plantation crops was mainly due to lesser importance given to these crops during pre-liberalization period, non-availability of high yielding varieties and traditional package of practices. Growth and instability of major fruit crops were concerned (Table 3), all crops were showed positive and significant growth rates in area and production except mango (positive but non-significant) during post-NHM period when compared to pre-NHM period. During the same period all crops showed positive growth in productivity except mango and banana which were showed negative trend. All crops showed reduced instability during post-NHM period than pre-NHM period. The positive growth and low instability in horticultural crops during post-NHM period was mainly due to an additional area was brought under horticultural crops through area expansion component, rejuvenation of old trees with new cultivars, better technologies like integrated nutrient management and integrated pest management activities under the assistance of NHM. The results were on par with the results obtained in the study conducted by Saraswati *et al.* (2012) [8] and Satishgowda (2014) [9].

Profitability of cultivation of selected fruit crops under the respective study area were concerned (Table 4). Per hectares total maintenance costs of grape, mango and pomegranate crops during bearing period (in Vijayapura, Dharwad and Koppal districts, respectively) were estimated to be Rs. 5, 25,002, Rs. 1,65,525 and Rs. 2,60,832, respectively. Out of

total cost, variable costs were estimated to be Rs. 4,12,399, Rs. 1,07,985 and Rs. 2,14,435 (for grape, mango and pomegranate crops, respectively). It was mainly due to the fact that in grapes labour, material and establishment costs were high when compared to mango and pomegranate crops. Per hectares fixed costs was high in case of grapes (Rs. 1,12,603) followed by mango and pomegranate were Rs. 57,541 and Rs. 46,397, respectively. This could be contributed by fact that grape orchard had higher initial investment and high rental value of land. Yield and returns were estimated to be 10.30 tonnes and Rs. 14,93,707; 9.40 tonnes and Rs. 4,41,800 and 7.38 tonnes and Rs. 6,27,365 from grape, mango and pomegranate orchards, respectively. The average price of grapes, mango and pomegranate was considered to be Rs. 145 per kg, Rs. 35 per kg and Rs. 85 per kg, respectively during study period. The net returns (without subsidy) from grapes, mango and pomegranate were estimated to be Rs. 9,68,705, Rs. 2,76,275 and Rs. 3,66,533, respectively. Similarly, the net returns (with subsidy) from these crops were Rs. 10,26,039, Rs. 3,03,001 and Rs. 3,98,033, respectively. B: C ratio (without subsidy) was 2.58, 2.66 and 2.41 for grape, mango and pomegranate, respectively and B: C ratio (with subsidy) was estimated to be 3.19, 3.18 and 2.73 for respective crops. These results were clearly indicated that cultivation of these crops were highly profitable even when without subsidy but since these have higher initial investments, it required even high subsidy at initial period of establishment of these crops. Among these crops grape has higher profit compared to mango and pomegranate due to higher demand for its dry raisins in the market. Beneficiary farmers were getting higher profits by growing horticultural crops. Thus, horticultural crops had an advantage over traditional food crops not only in terms of higher employment and value addition but provided better income to the households in comparison to all other crops. There is a potential in augmenting income levels of farmers by processing at farm level. NHM has helped farmers to raise their income by augmenting production of horticultural crops. A bulk of the beneficiary opined that NHM helped them by providing subsidies and supply of good quality planting materials. The results obtained in the present study were on par with the study conducted by Gangaiah (2012) [5] and Surwase *et al.* (2015).

Employment generation through selected horticulture crops under NHM scheme in the study area were depicted in the Table 5. Total employment generation by grapes, mango and pomegranate cultivation concerned; total mandays required for grape cultivation was comparatively higher than mango and pomegranate. In particular, the use of human labour in grape cultivation is almost two-and-a-half times higher than that in case of mango and pomegranate. Next to grapes, pomegranate cultivation creates 387 mandays per hectares per year, followed by mango cultivation 298 mandays per hectares. In all the three fruit cultivation recurring activities requires more mandays than the non-recurring activities. NHM helped in increasing the employment opportunities through area expansion of horticultural crops, creating processing units in local areas, financial assistances like subsidies. Source of benefit from NHM among farmers was mainly through subsidy assistances, area expansion and infrastructural facility created by NHM. The results obtained in the present study were on par with the study conducted by Umesh *et al.* (2005) [10], Kusuma (2014) [7] and Surwase *et al.* (2015).

Table 1: Year-wise progress of new area coverage under NHM & other schemes in Karnataka (2005-06 to 2013-14) (Area in lakh ha)

Sl. No.	Year	Area as per statistic	Yearly increment	Area cover under NHM	Area cover other than under NHM
1	2004-05	16.31			
2	2005-06	16.50	0.19	0.01	0.18
2	2006-07	17.25	0.75	0.18	0.57
3	2007-08	17.64	0.39	0.58	-0.19
4	2008-09	18.00	0.36	0.37	-0.01
5	2009-10	18.99	0.99	0.36	0.63
6	2010-11	19.02	0.03	0.19	-0.16
7	2011-12	18.85	-0.17	0.20	-0.37
8	2012-13	18.36	-0.49	0.11	-0.60
9	2013-14	20.80	2.44	0.10	2.34
Additional area during last 8 years			4.49	2.10	2.39
C.V. (%)			130.9	86.5	181.7

Source: Karnataka State Horticulture Mission Agency (KSHMA), Lalbagh, GOK, Bengaluru 2014-15

Table 2: Crop wise physical and financial achievements under NHM in Karnataka (2005-06 to 2013-14) (Phy. in ha. & Rs. in lakh)

Crops	Achievements					
	Physical (ha)	%	C.V. (%)	Financial (Rs.)	%	C.V. (%)
Mango	42,388.6	33.13	76.71	52.51	31.11	130.61
Grape	7,778.8	6.08	79.61	12.86	7.62	161.12
Pomegranate	9,614.5	7.52	104.33	11.84	7.02	189.13
Sapota	12,544.5	9.81	99.53	14.72	8.72	32.83
Citrus group	5,063.5	3.96	84.77	6.72	3.98	95.00
Fig	457.6	0.36	111.02	0.58	0.34	5.38
Guava	89.7	0.07	153.16	0.08	0.05	6.75
Banana	44,366.5	34.68	87.33	59.97	35.53	307.55
Pineapple	2,429.7	1.90	64.73	3.57	2.11	46.66
Papaya	3,200.2	2.50	96.44	5.94	3.52	187.51
Total fruits	1,27,933.6	60.82	78.64	168.80	62.74	66.97
Flowers	27,103.2	12.88	83.88	46.72	17.36	83.88

Spices	23,650.0	11.24	88.29	28.47	10.58	84.79
Medicinal & Aromatic	5,662.7	2.69	101.16	6.55	2.43	101.50
Plantation crops	26,003.5	12.36	98.16	18.52	6.88	78.22
Total	2,10,353.1	100	78.96	269.06	100	76.03

Source: Karnataka State Horticulture Mission Agency (KSHMA), Lalbagh, GOK, Bengaluru 2014-15

Table 3: Growth and instability in area, production and yield of horticulture crops in Karnataka state

Particulars	Pre-NHM (1998-99 to 2005-06)				Post-NHM (2006-07 to 2013-14)			
	Average	C.V. (%)	II	CAGR (%)	Average	C.V. (%)	II	CAGR (%)
Fruit Crops								
Area (ha)	2,64,587	8.80	7.40	-1.83	2,99,504	8.25	3.42	3.11**
Production (t)	43,87,456	14.23	10.43	-3.55	52,38,460	8.53	2.92	3.29**
Yield (t/ha)	16.58	52.97	48.64	-5.92	17.49	1.86	1.77	0.24
Vegetables								
Area (ha)	3,72,924	6.57	6.39	0.63	4,23,837	3.08	1.96	0.97*
Production (t)	49,35,005	18.15	18.08	0.59	71,79,725	7.81	5.56	2.21*
Yield (t/ha)	13.23	10.47	9.33	1.79	16.94	2.35	1.87	0.58
Commercial Flowers								
Area (ha)	19,356	7.76	7.49	0.83	26,434	9.04	5.27	3.05*
Production (t)	1,42,438	10.02	4.01	3.69	1,98,896	4.58	2.54	1.56*
Yield (t/ha)	7.36	11.35	9.99	2.23	7.52	4.73	3.93	1.07
Spices								
Area (ha)	2,53,687	13.20	10.30	-3.54	2,38,400	8.06	6.96	-1.70
Production (t)	6,61,188	31.24	21.70	-8.29*	7,74,307	22.35	18.86	4.82
Yield (t/ha)	2.61	24.62	15.68	-7.23*	3.25	9.12	7.74	1.98
Garden / Plantation crops								
Area (ha)	6,96,884	7.39	6.31	1.62	7,97,079	4.88	2.06	1.81**
Production (t)	4,18,975	28.73	28.73	0.23	4,65,245	2.67	2.67	-0.02
Yield (t/ha)	0.60	27.81	27.55	-1.34	0.58	11.89	6.34	-4.02**
Total horticulture crops								
Area (ha)	16,07,438	3.99	3.99	-0.05	17,85,253	3.74	1.61	1.39**
Production (t)	1,05,45,062	14.88	14.23	-1.66	1,38,56,633	7.44	3.53	2.67**
Yield (t/ha)	6.56	27.17	25.23	-3.32	7.76	1.91	1.27	0.58**

Source: Directorate of Economics & Statistics, G O K., Bangalore, 2014-15
Statistical Wing, Directorate of Horticulture, Lalbagh, Bangalore (2014-15)
Note: *, ** indicates significance at 1 and 5 per cent level, respectively

Table 4: Profitability of cultivation of selected crops under study (Rs./ha)

Sl. No.	Particulars	Vijayapura	Dharwad	Koppal
		Grapes	Mango	Pomegranate
1	Variable cost	4,12,399	1,07,985	2,14,435
2	Fixed Cost	1,12,603	57,541	46,397
3	Total cost	5,25,002	1,65,525	2,60,832
4	Yield (t/ha)	10.30	9.40	7.38
5	Total return	14,93,707	4,41,800	6,27,365
6	Net return	9,68,705	2,76,275	3,66,533
7	Subsidy	57,334	26,726	31,500
8	B:C ratio	2.85	2.66	2.41
9	Net return with subsidy	10,26,039	3,03,001	3,98,033
10	B:C ratio with subsidy	3.19	3.18	2.73

Table 5: Total employment generation through cultivation of selected crops under study (Man days/ha)

Man days	Vijayapura	Dharwad	Koppal
	Grapes	Mango	Pomegranate
Recurring man days	672	230	291
Non recurring man days	224	68	96
Total man-day's	**896**	**298**	**387**

Conclusion

Based on the results, one could see that during last eight years positive growth has been observed in case of area coverage under NHM where as negative coverage has been observed under other than NHM schemes and also less variation was observed under NHM scheme. This directly showed the better performance of NHM as compared to other schemes related to horticultural development in the Karnataka. similarly, in crop wise area coverage was concerned the figures showed that the government was giving more importance to fruit crops, especially mango, banana, grapes, pomegranate and sapota crops through National Horticulture Mission programme. Based on the analysis it was observed that the instability in area, production and productivity of horticulture crops was reduced after implementation of NHM in the study area which showed positive impact of NHM but growth was slightly reduced but significantly positive during the same period when compared to pre-NHM period. Hence, the government

needs to boost the growth of horticulture crops by covering more area under NHM programme with attractive subsidies to interested farmers. Investment in the selected fruits was found to be economically viable even without subsidy. Hence, the farmers need to be encouraged to take up the cultivation of these fruit crops in large areas. Even though NHM made lot of efforts to increases the income and employment opportunities to the beneficiaries but still the beneficiaries were facing some major constraints like, insufficient subsidy amount, incidence of pest and disease, delay in getting the subsidy *etc.* Hence, NHM needs to take care of these problems and need to revise its policies accordingly.

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