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RESEARCH PAPER

Performance of national horticulture mission (NHM) scheme and its impact on horticulture development in Karnataka

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Abstract: National Horticulture Mission is a centrally sponsored scheme, the Karnataka state has implemented the developmental activities under the mission in the 30 districts, covering 16 important horticultural crops since from 2005-06 to till. With this background the present study was undertaken to analyze performance of National Horticulture Mission (NHM) scheme and its impact on horticulture development in Karnataka. The study is completely based on secondary data source. The analytical techniques like CAGR, CV, Instability index, Principle Component Analysis technique and averages were employed. The overall financial growth of the state was observed to be positive of 6.06 per cent per annum. Co-efficient of Variation (CV) in financial progress during the same period was observed to be higher in all the districts under NHM scheme. In short, it was showed that Karnataka was one of the important states in performing NHM components of NHM which are having highest contribution to Indian total. The similar situation was observed in case financial achievements. Since, area coverage, creation of water resources, protected cultivation, horticulture mechanization, post-harvest management and rejuvenation, vermi-composting units/bio-digester unit were the most important components which influencing the performance of NHM in the study area. It was important to note that there was lot of scope to improve the performance of component like area coverage and rejuvenation under NHM programme, so these need to be taken intense care. 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.

Key words: Biodigestor, Growth rate, Instability index, Horticulture

Introduction

National Horticulture Mission is a centrally sponsored scheme, launched by the Department of Agriculture & Cooperation of the Ministry of Agriculture, Govt. of India during the year 2005-06.The scheme aims at holistic development of horticulture sector and works on "Cluster Basis'. 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). The NHM programme 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. 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 and marketing infrastructure and human resource development *etc.,* The horticulture sector generates over ₹ 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., 2014). 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 performance and 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

Karnataka, one of the major fruit growing states in the country was selected purposively for the study. In Karnataka,

the net additional area of 7,779 hectares, 42,389 hectares and 9,615 hectares brought under NHM for grapes, mango and pomegranate respectively since inception (Anon., 2014). The present study is based entirely on secondary sources. The secondary data regarding different components (physical and financial) of National Horticulture Mission scheme for the period from 2005-06 to 2013-14 were collected from National Horticulture Board database, Department of Horticulture, GoK and other published sources. Parameters considered for analyzing the performance 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.

$Y = a\, b^t e^{Ut}$

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 was transformed into log linear form and written as;

$\log Y = \log a + t \log b + U_t$

Above equation was estimated by using Ordinary Least Squares (OLS) technique.

Compound growth rate (g) was then computed

$g = (b - 1)\, 100$

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.

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

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

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.

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

Principle Component Analysis (PCA)

Principal component analysis was employed, with a view to aggregate the performance indicators into a few groups of factors. The physical and financial indicators were chosen for the study and the analysis was made in Karnataka state for the period from 2005-06 to 2013-14. To achieve this objective, linear transformation of the variables of the following type was done.

$Z_i = a_{i1}X_1 + a_{i2}X_2 + \text{- - - - - - - - - - - - } + a_{ip}X_p$

Where,

Z_i = Standardize variables

$X_1 - X_2$ - - - - - - - X_p are the P variables considered for the study and i = 1, 2..... p are the components.

The coefficients a_{i1} a_{i2}..... a_{ip} are chosen so that the new variables Z_1 has as large a variance as possible, the second Z_2 was chosen to be uncorrelated with the first and to have as large a variance as possible, *etc.* The technique of principal component analysis was adopted in order to identify the most important physical and financial indicators which had greater influence on the performance of NHM scheme in Karnataka.

Results and discussion

Year-wise figures of amount released and expenditure made under National Horticulture Mission in Karnataka during the period 2005-06 to 2013-14 was depicted in the Table 1. The total amount released and expenditure made during the same period was ₹ 796.68 crores and ₹ 810.15 crores, respectively. To begin with per cent financial expenditure to amount released was about 7.24 per cent in the year 2005-06 but the figures improved to about 140.14 per cent in the year 2013-14. It can also be seen from the table that, the higher annual growth rate per annum was observed in case of expenditure (27.1%) than amount released (4.6%) during the same period (2005-06 and 2013-14) (Anon.,2012). Apart from this during the same period the higher variations in amount released and expenditure made were observed in both the cases i.e., the variation in amount released and expenditure made were observed to be 193.11 per cent and 155.67 per cent, respectively during pre and post NHM period.

Table 1. Year wise financial progress under NHM in Karnataka (2005-13) (₹ in crores)

Years	Amount released	Expenditure	Per cent expenditure
2005-06	44.55	3.23	7.24
2006-07	84.48	65.08	77.04
2007-08	85.71	130.33	152.05
2008-09	125.37	94.35	75.26
2009-10	80.02	113.69	142.08
2010-11	93.25	106.58	114.29
2011-12	99.96	108.8	108.84
2012-13	113.43	90.12	79.45
2013-14	69.91	97.97	140.14
Total	796.68	810.15	101.69
CGR (%)	4.6	27.1	
C.V. (%)	193.11	155.67	

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

District wise financial achievement under NHM in Karnataka state during the period 2005-06 and 2013-14 is in Table 2. Total of Rs. 810.15 crores expenditure was made on different districts of the state with growth of 6.06 per cent per annum and variation was observed to be 55.65 per cent. Out of total expenditure (₹ 810.15 crores), the highest total expenditure under NHM was made in Vijayapura district (7.59 %) followed by Belgaum (7.11 %), Shivmoga (6.8 %), Chitradurga (6.52 %) districts and so on. Among the major districts listed in the table, Koppal and Dharwad districts stands 12th and 14th in total expenditure. This was mainly because of high valued crops grown in these districts (such as grapes, mango, sapota, pomegranate etc) and these required higher initial investment and higher subsidy amount as compared to other crops. Growth per annum was concerned, the highest growth was found in case of Dharwad district (14.88% per annum) which was followed by Bagalkot (10.5% per annum), Chitradurga (10.05% per annum) districts and so on. During the same period, Vijayapura district showed only 2.46 per cent per annum growth in financial progress due to reduction in the area coverage of grapes, pomegranate and banana crops under NHM scheme. Belgaum and Koppal districts showed negative growth of -5.01 per cent and -8.41 per cent respectively due to reduction in the coverage of banana and pomegranate area respectively under NHM scheme. The overall financial growth of the state was observed to be positive of 6.06 per cent per annum. The highest variation has been observed in Koppal district (77.93 %) followed by Belgaum district (73.56 %), Mysore district (67.65 %) and so on. Similar results were found in the study conducted by Anand and Panduranga (2016).

Table 2. District wise financial progress under NHM in Karnataka (2005-13) (₹ in crores)

Districts	Total amount (₹)	%	CAGR (%)	C.V. (%)
Vijayapura	61.46	7.59	2.46	66.89
Belgaum	57.61	7.11	-5.01	73.56
Shimoga	55.1	6.80	1.60	67.17
Chitradurga	52.84	6.52	10.05	65.87
Chickmagalore	48.4	5.97	4.78	52.04
Tumkur	46.15	5.70	0.42	64.86
Kolar	45.16	5.57	2.67	59.35
Bangalore (r)	43.11	5.32	2.85	65.86
U.K	35.21	4.35	3.34	52.68
Hassan	34.38	4.24	6.06	66.33
Bagalkote	31.2	3.85	10.57	67.63
Koppal	28.73	3.55	-8.41	77.93
Mysore	28.03	3.46	3.13	67.65
Dharwad	27.88	3.44	14.88	63.75
Others	215.58	26.61	12.98	55.47
Total	810.15	100	6.06	55.65

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

Crop-wise physical and financial achievements under National Horticulture Mission during 2005-06 and 2013-14 in Karnataka showed in Table 3. Physical achievements under NHM in different crops is concerned, about 2, 10,353 hectare has been covered under NHM since inception under different

Table 3. Crop wise physical and financial achievements under NHM in Karnataka (2005-06 to 2013-14) (Phy. in ha. & ₹ 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

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 %).

Financial achievements under NHM in different crops were concerned, about ₹ 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 (₹ 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).

Principal component and factor loadings of physical and financial indicators influencing the performance of NHM in Karnataka (2005-06 to 2013-14) are depicted in the table 4. To identify the physical indicators having a bearing on the performance of the NHM in Karnataka, twelve variables were subjected to principal component analysis. The first three principal components were selected for detailed analysis, since they together accounted for 88.03 per cent variation. The coefficients of the first two principal components along with the associated Eigen values and the percentage variation are depicted in the Table 4. In the first component five most important variables were closely associated with the performance. They were water resources, area coverage vermi-composting units/ bio-digester unit, promotion INM / IPM and nurseries, which recorded higher scores. Four important variables closely associated with second component, namely protected cultivation, horticulture mechanization, post-harvest management and rejuvenation. Second component explained 30.89 per cent of the variation. Only two variables closely associated with third components namely IPM Infrastructure and Organic farming and explained 14.95 per cent of the variation the study conducted by Usha (2011), Diwas and Pramod Kumar (2011) also reveled that area coverage, protected cultivation and integrated pest management were the major influencing components under NHM.

The technique of principal component analysis was also extended to identify financial indicators closely associated with the performance of the NHM scheme in Karnataka considering 12 variables. The first four components were selected for detailed analysis and they together accounted for 91.74 per cent variation. It was noticed from the table that all 12 variables had their influence on the performance of the NHM scheme. In the first component, five variables were closely associated with the performance of the NHM scheme and they were post-harvest management, protected cultivation, rejuvenation,

Table 4. Principal component and factor loadings of physical and financial indicators influencing the performance of NHM in Karnataka

Sl. No.	Variables/Indicators	Physical indicators			Variables/Indicators	Financial indicators			
		I	II	III		I	II	III	IV
1	Water resources**	0.965	0.012	-0.030	Post-harvest management**	0.973	-0.116	-0.062	-0.176
2	Area coverage*	0.934	-0.282	-0.022	Protected cultivation*	0.885	-0.066	-0.360	-0.098
3	Vermicomposting units/ Bio-digester unit**	0.924	0.047	0.128	Rejuvenation*/ replacement of senile plantation*	0.855	0.111	0.362	0.018
4	Promotion INM / IPM *	0.801	-0.034	0.442	Horticulture mechanization**	0.825	-0.202	-0.393	-0.080
5	Nurseries**	0.738	-0.266	-0.407	IPM Infrastructure**	-0.751	-0.369	-0.046	0.531
6	Protected cultivation*	0.146	0.979	0.087	Vermicomposting units/ Bio-digester unit**	-0.068	0.969	-0.100	0.098
7	Horticulture mechanization**	-0.313	0.929	0.132	Promotion INM / IPM *	0.005	0.924	0.171	0.215
8	Markets**	-0.099	0.883	-0.073	Water resources**	-0.174	0.809	0.308	-0.371
9	Post-harvest management**	-0.266	0.803	0.497	Area coverage*	0.203	0.783	0.440	0.242
10	Rejuvenation*/ replacement of senile plantation*	-0.141	0.268	0.834	Organic farming*	-0.145	0.264	0.925	-0.006
11	IPM Infrastructure**	-0.261	-0.571	-0.737	Markets**	-0.146	0.461	-0.074	0.843
12	Organic farming*	0.216	-0.432	0.713	Nurseries**	-0.428	-0.064	0.436	0.597
Eigen values		5.064	3.706	1.794		4.008	3.553	1.801	1.648
Variation explained (%)		42.204	30.886	14.948		33.400	29.608	15.006	13.730
Cumulative variation explained (%)		42.204	73.090	88.038		33.400	63.008	78.014	91.744

Note: *- Area in ha and **- Quantity in number

horticulture mechanization and IPM Infrastructure. The scores were ranged from 0.97 to 0.75 and the component together accounted for 33.4 per cent variation. In the second component, four variables were closely associated with the performance and they were vermi-composting units/ bio-digester unit, promotion INM / IPM, water resources and area coverage components. The scores were ranged from 0.96 to 0.78 and the component together accounted for 29.60 per cent variation. The Organic farming was the only one variable which was found in the third component. This component explained 15 per cent of the variation. Two variables closely associated with fourth component namely markets and nurseries and explained 13.73 per cent of the variation. The similar important components were identified in the study conducted by Alagawadi and Pushpa (2011).

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). During the same period instability of area, production and yield were reduced in the state (Table 5). 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). 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). In case of plantation and garden crops, growth in area was positive but production and productivity showed negative trend during post-NHM period (Table 5). 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 5), 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) and Satishgowda (2014) *i.e.,* horticultural sector in Karnataka exhibited an impressive growth rate in area and production and these crops are getting popular among farmers with the government support under the NHM.

Table 5. 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

Conclusion

The overall financial growth of the state was observed to be positive of 6.06 per cent per annum. Co-efficient of Variation (CV) in financial progress during the same period was observed to be higher in all the districts. Since, area coverage, creation of water resources, protected cultivation, horticulture mechanization, post-harvest management etc were the most important components which influencing the performance of NHM. So government needs to give more importance in performing of these components. Components like area coverage, rejuvenation and protected cultivation in the state not made appreciable achievement due to lesser subsidies were providing under these components. 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. Hence, the government needs to boost the growth of horticulture crops by covering more area under NHM programme with attractive subsidies to interested farmers.

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