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Decomposition of sources of growth in horticulture crops in Karnataka: An economic analysis

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Abstract

This study was initiated with an objective of analyzing the growth in area, production and productivity of horticultural crops in India and Karnataka in Pre NHM and Post NHM Period. The study analyzed the trends in sources of growth in both the periods. The study was based on the secondary data collected from Department of Horticulture, Bangalore and from other published sources. The CAGR of area under horticultural crops in India had registered a significant growth with 3.24 and 4.31 per cent between pre and post NHM period. The production growth had increased from 2.21 to 3.46 per cent between pre and post NHM period. Similarly, the productivity growth had increased from -1.17 to 2.15 per cent between pre and post NHM period. The CAGR of area under horticultural crops in Karnataka had increased from 2.65 to 4.20 per cent between pre and post NHM period. The production growth had increased from 4.21 to 6.23 per cent between pre and post NHM period. Similarly, the productivity growth had increased from 1.52 to 3.24 per cent between pre and post NHM period. Across divisions in Karnataka, Bengaluru and Mysore divisions registered a significant growth in area and productivity between pre and post NHM period. Bengaluru division alone had registered a significant growth in production of horticultural crops. Among the sources of growth, the contribution of area effect to crop income growth had increased from 31.38 to 51.46 per cent between pre and post NHM period, the yield effect had declined from 423.55 to -280.38 per cent, the price effect had increased from -299.94 to 14.67 per cent, the diversification effect had increased from -106.14 to 183.47 per cent and the interaction effect had increased from -411.86 to 130.78 per cent.

Keywords: CAGR, sources of growth, food security, production, productivity fruits, vegetables

Introduction

India has achieved self sufficiency in food grain production with a maximum production of 281 million tons during 2018-19. The country had addressed the food security concerns while it is time to address the nutritional security concerns as well. In order to address the problem of nutritional security, the Government of India had introduced National Horticultural Mission during 2008 with the objective of tapping the potential for horticultural crops by enhancing area, production and productivity through technological innovations. The technological interventions include introductions of HYVs in fruits and vegetables, application of micro nutrients have enhanced the overall production of horticultural crops. In addition, there is a growing demand for consumption of fruits and vegetables which are considered as high value agricultural commodities due to raising income among both urban and rural households. The consumption expenditure on fruits and vegetables is on the rising trend while that of cereals is declining over the years. The Government of India has invested Rs.1370 (2017-18) crores on NHM for the overall development of horticultural sector in the country. What extent these investments have delivered in terms of growth need to be addressed. The increase in growth among horticultural crops is mainly attributed to various sources including area growth, yield growth, price effect, diversification effect and interaction effect. What is the extent of influence of these sources of growth on entire horticultural sector need to be addressed to take appropriate policy decisions. With this background, the study on impact of NHM on sources of growth in Horticultural crops was initiated.

Post harvest management is another important component need to be addressed by creating suitable infrastructural facilities in terms of better handling, transportation, storage and well established markets etc., besides taking up market promotional activities such as dissemination of market information to the farmers, processors, traders and consumers. Special thrust has to be provided to promote the export of horticultural produce through establishment of AEZs, for which there is enough potential in the global market. National Horticulture Board, Directorate of Marketing and Inspection, National Cooperative Development Corporation, NERAMAC, TRIFED and Agriculture and Processed Food Products Export Development Authority (APEDA) will be involved for the purpose.

In view of these developments, it is essential to know the trends in area, production and productivity of horticultural crops especially after the introduction of National Horticultural Mission (NHM). In addition, it is essential to understand the sources of growth to take appropriate policy

decisions for enhancing the overall growth of horticulture sector in the country.

Methodology

The trends in area, production and yield of major horticultural crops was analysed using Compound Annual Growth Rate (CAGR). In view of the limitation of the data, the present study is confined for a period of 25 year from 1991-92 to 2015-16for analytical purpose. However, for better understanding, the growth in area, production and productivity for the above said period was further bifurcated into two sub periods *viz*., Period-I (1991-92 to 2004-05), Period-II (2005-06 to 2015-16). The Decomposition analysis was employed to capture the factors determining the sources of growth of horticultural crops before and after implementation of NHM scheme.

The growth in area, production and productivity of horticultural crops for the triennium ending from 1991-92 to 2015-16 was computed using the formula given below.

$y_t = ab^t e^u$ ---------- (1)

Where,

y_t= area/ production /productivity of horticultural crops in year t

t = time period

a = intercept (value of y when t = 0)

b = (1+r), 'r' being the growth rate

e = error term

Equation (1) was converted into the logarithmic form in order to facilitate the use of linear regression. Taking logarithms on both sides. We obtain,

$\text{Ln } y_t = \text{Ln } a + t \text{ Ln } b + u$ ----------(2)

a and b are obtained by using Ordinary Least Squares (OLS) procedure to equation (2) and the growth rate 'r' is computed as below:

r = (Anti log of b –1) X 100 ---------- (3)

Decomposition of sources of growth

The decomposition of growth sources of among different horticultural crops was done by using growth accounting referred by Minot *et al.*, (2006) [6]. According to this approach, the change in gross revenue from a single horticultural crop was decomposed into change in area, change in area share, change in yield, change in real price and change in interaction among the four factors.

1. Area effect= change in area (yield X real price X area share)……(1)

Area effect = $L_4 (D_3 X I_3 X K_3)$

- Area share (K) = Area/GCA
- Real price (I) = (value of output/yield), WPI of cropi
- Value of production = real price X production

2. Yield effect = M_4 (GCA X I_3 X K_3)

Yield effect = change in yield (GCA X real price X area share) ……(2)

3. Price effect = $N_4(D_3 X F_3 X E_3)$

Price effect = change in price (yield X area share X GCA) …… (3)

4. Diversification effect = $O_4 (E_3 X D_3 X I_3)$

Diversification effect = change in area share (GCA X Yield X Real price) ……(4)

5. Interaction effect = change in Value of Product (VOP) X $(Q_4+R_4+S_4+T_4)$

Interaction effect = change in Value of Product(VOP) X (area effect (1) + yield effect(2) + price effect (3) + diversification effect(4)) …… (5)

Where, L4= change in area,
M4= change in yield,
N4= change in price,
O4=change in area share,
D3= yield of horticultural crops,
I3= real price,
K3=area share

Results and Discussion

Trends in area, production and productivity of major horticultural crops in India and Karnataka

The growth performance in terms of area, production and productivity of fruits, vegetables, flowers, spices, medicinal and aromatic crops, plantation crops in India, Karnataka and across four divisions in the state in three periods *viz.*, period I (1991-92 to 2004-05), period II (2005-06 to 2015-16) and in Overall period (1991-92 to 2015-16) is presented in Table 1.

At all India level, the introduction of NHM has made a significant impact in terms of all the three sources of growth. In pre NHM period, area growth alone was significant with 2.65 per cent while the production and productivity growth were non-significant. In post NHM period, area, production and productivity growth was positive with 4.20, 6.23 and 3.24 per cent, respectively. In overall period, area and production growth was significant with 3.45 and 5.22 per cent while the productivity growth was positive but non-significant.

Almost similar trend was observed with regard to sources of growth in horticultural crops in Karnataka. In pre NHM period, the area growth alone was significant with 3.24 per cent, while the growth in production and productivity of horticultural crops was non-significant with 2.21 and -1.17 per cent, respectively. Similarly, in post NHM period, area and production growth were significant with 4.31 and 3.46 per cent, respectively while the productivity growth was positive but non significant with 2.15 per cent. In Overall period, only production growth was positive with 2.84 per cent while area and productivity growth was positive but not significant.

In pre NHM period, area growth alone was positive and significant both in India and Karnataka state while in post NHM period, all the sources of growth were positive at all India level while area and production growth was increased at the state level. These findings highlight that implementation of NHM has delivered in terms of growth at

the national level compared to Karnataka state. Still efforts are required to enhance the productivity at the state levels through proper implementation of the different components of the NHM programme.

In pre NHM period, the area growth in Belagavi division alone was significant with 2.54 per cent, while production and productivity growth was non-significant. Similarly in post NHM period, the area, production and productivity growth in horticultural crops was positive but non-significant. In Bengaluru division, all the sources of growth including area, production and productivity were non-significant in pre NHM period, while in post NHM period, the growth in area, production and productivity were significant with 3.31, 2.85 and 2.52 per cent, respectively. In Kalaburagi division, all the sources of growth in pre NHM and post NHM period were non-significant. In Mysore division, the growth in area, production and productivity were non- significant in pre NHM period while the area and productivity growth was positive and significant with 2.90 and 2.48 per cent, respectively in post NHM period. In Overall in Karnataka state, the growth in area, production and productivity was non-significant in pre NHM period while the area growth alone was significant with 2.54 per cent in post NHM period.

The above findings revealed that only area expansion in horticultural crops has taken place after the introduction of NHM while production and productivity enhancement has not taken place much to the expected level. This may be attributed to poor implementation of different components of NHM programme. In addition, there are concerns with respect to the methodology followed in measuring the productivity of horticultural crops due to their long term nature which has led to the poor growth in productivity followed by production.

Sources of growth in horticultural crops in Karnataka

The contribution of area effect to crop income growth has significantly increased from 31.38 to 51.46 per cent between pre and post NHM period. The increase in area effect is mainly attributed to increase in area under fruits, vegetables, nuts and spices. The yield effect to crop income growth has declined from 423.55 to -280.38 per cent between pre and post NHM period. The yield of all the horticultural crops including fruits, vegetables, flowers, nuts, spices, medicinal and aromatic crops and plantation crops has declined. The contribution of price effect to crop income growth has increased from -299.94 to 14.67 percent between pre and post NHM period. The increase in price effect is mainly attributed to increase in prices of fruits, nuts, medicinal and aromatic crops and plantation crops. The contribution of diversification effect to crop income growth has increased from -106.14 to 183.47 per cent between pre and post NHM period. The increase in diversification effect is mainly attributed to increase in diversification of area among vegetables, nuts, spices, medicinal and aromatic crops. Finally, the contribution of interaction effect to crop income growth has increased from -411.86 to 130.78 per cent between pre and post NHM period. The increase in interaction effect is mainly attributed to increase in interaction effect among fruits, flowers, medicinal and aromatic crops and plantation crops.

With the introduction of NHM programme, the area expansion was observed in crops such as fruits, vegetables, nuts and spices due to supply of planting materials, plant protection chemicals and small equipments, irrigation equipments at a subsidized rate. The introduction of NHM has not made much progress with regard to yield effect in Karnataka due to poor implementation of production technology proposed under NHM scheme. Therefore, still there is enough scope to enough yield potential among the horticultural crops. The increase in price of fruits, nuts, medicinal and aromatic crops, plantation crops has resulted in higher price effect in post NHM period. The diversification of area under medicinal and aromatic crops and plantation crops has taken place due to rising market prices of these commodities. The combination all the three including area, price and diversification effect has resulted in positive interaction effect after the implementation of NHM programme.

Table 1: Growth in area, production and productivity of horticultural crops in India (per cent)

Sl. No.	Particulars	Pre-NHM (TE 1991-92 to 2004-05)	Post NHM (TE 2005-06 to 2015-16)	Overall (%) (TE 1991-2015)
1	Area	2.65*	4.20*	3.45*
2	Production	4.21	6.23*	5.22*
3	Productivity	1.52	3.24*	2.38

Note:* Significant at 5 per cent level

Table 2: CAGR of area, production and productivity of Horticultural crops in Karnataka (per cent)

Sl. No.	Particulars	Pre-NHM (TE 1991-92 to 2004-05)	Post NHM (TE 2005-06 to 2015-16)	Overall (%) (TE 1991-2015)
1	Area	3.24*	4.31*	3.75
2	Production	2.21	3.46*	2.835*
3	Productivity	-1.17	2.15	1.66

Note:* Significant at 5 per cent level

Table 3: Growth of area, production and productivity of horticultural crops across divisions of Karnataka (per cent)

Divisions	Pre-NHM (TE 1991-92 to 2004-05)			Post NHM (TE 2005-06 to 2015-16)			Overall (%) (TE 1991-2015)		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
1.Belagavi	2.54**	1.11	0.38	2.52	1.33	1.13	5.07*	2.44**	1.52
2.Bengaluru	2.00	0.81	1.85	3.31*	2.85*	2.52**	5.31*	3.66*	4.37*
3.Kalaburagi	-0.49	0.15	0.57	1.42	1.45	1.10	0.92	1.60	1.67
4.Mysuru	1.57	1.06	1.39	2.90*	2.40	2.48**	4.46*	3.46*	3.88*
Karnataka (Total)	1.40	0.78	1.05	2.54*	2.01	1.81	3.94*	2.79*	2.86*

Note: * Significant at 5 per cent level
** Significant at 10 per cent level

Table 4: Sources of growth in horticultural crops for the period from 1991-92 to 2015-16 in Karnataka (per cent)

Sl.no.	Crops	Karnataka									
		Pre NHM period (1991 to 2004-05)					Post NHM period (2005-06 to 2015-16)				
		Area effect	Yield effect	Price effect	Diversification effect	Interaction effect	Area effect	Yield effect	Price effect	Diversification effect	Interaction effect
1	Fruits	-8.87	137.37	-186.14	128.65	28.99	22.15	-140.23	17.31	-13.23	214.00
2	Vegetables	2.00	10.82	24.18	28.40	34.60	11.01	-53.55	13.21	117.12	12.11
3	Flowers	-14.5	212.17	22.98	527.43	-648.08	-12.91	20.03	-2.02	-49.12	144.02
4	Nuts	0.18	0.74	-154.74	-104.90	358.72	5.52	-13.42	-3.72	-1.23	112.85
5	Spices	-12.98	-70.69	-29.59	180.00	33.26	16.08	-123.32	-42.42	219.21	30.45
6	Aromatic & Medicinal Crops	23.01	112.10	12.05	1.32	-87.22	-3.32	32.43	21.03	22.34	27.52
7	Plantation Crops	42.54	21.04	11.32	45.24	-132.13	12.93	-2.32	11.98	-12.42	89.83
Total		31.38	423.55	-299.94	-106.14	-411.86	51.46	-280.38	14.67	183.47	130.78

Conclusion

At all India level, all the sources of growth in terms of area, production and productivity had increased between pre and post NHM period depicting the better performance of NHM scheme. In Karnataka state, both area and production growth are positive and significant after implementation of NHM while productivity growth is positive but non-significant. Therefore, still there is scope to enhance the productivity of horticultural crops through proper implementation of various components proposed under NHM scheme. Among all the four divisions in Karnataka, in Bangalore division, all the sources of growth were positive and significant depicting better growth performance of horticultural crops in comparison with Mysore, Kalaburagi and Belagavi divisions. The decomposition of sources of growth highlighted that area, diversification and interaction effects contributed more towards income generation from horticultural crops. The yield and price effects contributed less towards income generated from horticultural crops. Therefore, there is a need to review the technological components provided under NHM scheme and explore the possibility of introducing Market Intervention Scheme (MIS) to horticultural crops in order to reduce the market price fluctuations.

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