

Impact of National Horticulture Mission on Banana Cultivation of South Gujarat

Dhruti Patel and Alpesh Leua*

Department of Social Science, ASPEE College of Horticulture, Gujarat, India

*Corresponding author: alpeshleua@nau.in

Received: 17-03-2023

Revised: 27-05-2023

Accepted: 05-06-2023

ABSTRACT

National Horticulture mission was started with aim to improve the production, productivity and area under the horticulture crops in 2004-05. The Gujarat state implemented NHM with full strength and developed State Horticulture Mission in parallel to NHM. To capture the impact of NHM (National Horticulture Mission), the study period was re-categorized into: Pre- NHM Period; Post- NHM Period and Overall Period. Major banana producing districts of South Gujarat were selected for analysis. The major analytical tools employed were compound growth rate, Cuddy-Della Vella index and decomposition model. Growth rate analysis showed that on an average, the growth rate of all districts with respect to area, production and productivity of banana was high in period II compared to period I. Instability analysis revealed that, all districts in instability were low in period II compared to period I, except Navsari in terms of area and production. Further, growth-instability analysis showed that most desirable situation in Narmada district was observed in terms of production. Area contribution was more in Bharuch and Surat district and yield contribution was more in Narmada and Navsari district in period I. Whereas, area contribution was more in Narmada and Navsari district and yield contribution was more in Bharuch and Surat district in period II. Area contribution was more in all districts except Bharuch which showed yield contribution was more in production of banana in overall period.

Keywords: NHM, Interaction effect, area effect, Trade off, Decomposition

India is known as the world's fruit and vegetable basket. In terms of production of fruit and vegetable, India ranks second in the world after China. In India, total horticulture production in 2021-22 (first advance estimate) is estimated to be 333.3 million tonne, which has decreased about 1.35 million tonne (decline of 0.4%) over 2020-21. Even though the production of fruits is estimated to be slightly increased as compared to previous year. The production of fruits is estimated to be 102.9 million tonne compared to 102.5 million tonne in 2020-21. The decline is estimated for the first time in seven years after reporting a consistent increase in overall horticulture production since 2014-15. The production of potato has declined due to flooding of

crops in certain states. Decreased output of potato has pulled down overall production of vegetables (Anon., 2022a). Overall horticultural production has decreased but there is an increase in area from 27.48 million hectares in 2020-21 to 27.56 million hectares in 2021-22. The consistent increase in area of horticultural crops reflect the farmer's priorities as they have slowly and gradually been shifting toward producing fruits and vegetables, keeping in pace with the growing demands of these products (Anon., 2022b).

How to cite this article: Patel, D. and Leua, A. (2023). Impact of National Horticulture Mission on Banana Cultivation of South Gujarat. *Agro Economist - An International Journal*, 10(02): 187-194.

Source of Support: None; **Conflict of Interest:** None



Banana is one of the most important fruit crop all over the world. With respect to the nutritional and medicinal aspects of banana, its year round availability, low price, varietal range and taste makes it a favorite fruit among all classes of people irrespective of rich or poor. India was leading producer of banana accounted for 26.29 per cent of total production followed by China, Indonesia, Brazil and Ecuador during the period of 2020-21 (FAO, 2021). The production of banana in case of state-wise, Andhra Pradesh showed the highest production of 5838.88 thousand tonnes, followed by Maharashtra and Gujarat in 2021-22 (Anon., 2022c). For both the area and production of banana, Bharuch has the leading district followed by Narmada, Surat and Navsari in South Gujarat during TE 2020-2021 (Anon., 2021a). Banana is exported to countries like Iran, United Arab Emirates, Oman, Iraq, Afghanistan, Saudi Arab etc. (Anon., 2021b).

National Horticulture Mission is a centrally sponsored scheme launched by Government of India during the year 2005-06 (Tenth Plan). This scheme aims to provide holistic growth for the horticulture sector in India and enhance horticulture production and improve nutritional security and income support to farmers.

An understanding of the various sources of growth and their magnitude would help formulate policies to improve the pace of agricultural growth (Joshi *et al.* 2004). Therefore, calculating the growth rates and analyzing the decomposition of agricultural growth is very important from the view point of policy makers. For agricultural development programs and for investment priorities, these sources of growth are very important (Ranede, 1980).

Instability is an inherent characteristic of agriculture all over the place. Being dependent on weather conditions, crops are subject to substantial variations from year to year in terms of area, yield, and production (Vaidyanathan, 1999).

The specific objectives are:

- ♦ To compute trade off between growth rate and instability index of banana
- ♦ To analyse contribution of area and productivity in output growth in banana for pre and post NHM period.

DATA AND METHODOLOGY

The research is completely based on the secondary data on area, production and productivity of banana crop during 1994-95 to 2019-20. Secondary data has been collected from Director of Horticulture, Agriculture, Farmers' Welfare and Co-operation Department, Government of Gujarat, <https://doh.gujarat.gov.in/>. National Horticulture Mission (NHM) was implemented in India from 2005-06 onwards. The study period was also classified as pre-NHM (1994-95 to 2004-05), post-NHM (2005-06 to 2019-20) and the overall period (1994-95 to 2019-20). The study area was the top four banana producing districts of South Gujarat. Bharuch, Narmada, Surat and Navsari were chosen because these districts contributed more than 80 percent of the triennium average of gross cropped area of banana crop in the region. Narmada and Navsari districts established in 1997, so for these districts pre-NHM period taken as 1999-00 to 2004-05.

Growth rate analysis

The Compound Growth Rate (CGR) of banana was computed by using following regression equation (Vinayaka *et al.* 2014).

$$Y_t = ab^t u_t$$

Where, Y_t = Dependent variable (Area, Production and Productivity of banana crop in the year ' t '); t = Time variable in years taking the value of 1, 2, 3,..., n ; a = Intercept; b = Regression coefficient ($1 + r$); r = Compound growth rate; u_t = Error term

The compound growth rate (%) was calculated using the formulation,

$$\text{Compound growth rate } (r) = [(Antilog \text{ of } \log b) - 1] * 100$$

Student ' t ' test was used to determine the significance of b of compound growth rate.

In the present study, Cuddy-Della Valle index was used to examine the instability in area, production and productivity of banana crop for selected district of South Gujarat by using the following formula:

$$Ix = CV \sqrt{(1 - \bar{R}^2)}$$

Where, Ix = Instability index; CV = coefficient

of variation and $\bar{R}^2$ = adjusted coefficient of determination.

The coefficient of variation was computed by using the following formula:

$$CV(\%) = \frac{\text{Standard deviation}}{\text{Mean}} \times 100$$

Matrix of association between growth and instability

As shown below, an analysis was done for the overall period and subsequent discussions were organized into categories from most desirable to not desirable (Rao and Raju, 2005).

High Growth/Low Instability (HG-LI) (Most desirable situation): The variables whose growth rate is higher than the average but the instability is lower;

High Growth/ High Instability (HG-HI) (Desirable situation): The variables whose growth rate and instability are greater than the average;

Low Growth/Low Instability (LG-LI) (Least desirable): The variables with growth rates and instability below average; and

Low Growth/ High Instability (LG-HI) (Not desirable): The variables with growth rate below average and instability above average.

Decomposition Analysis

Method for decomposition analysis suggested by Palanisami *et al.* (2002) and Laitonjam *et al.* (2018) was used in the present study. The method used to rectify the flaw in the model which is called as the Modified Decomposition Analysis is given below:

$$P_t - P_o = A_o(Y_t - Y_o) + Y_o(A_t - A_o) + (A_t - A_o)(Y_t - Y_o)$$

$$\Delta P_t = A_o \Delta Y_t + Y_o \Delta A_t + \Delta A_t * \Delta Y_t$$

(Yield Effect) (Area Effect) (Interaction Effect)

Where, P , A and Y represents production, area and yield; '0' and 't' represents time periods such that 't' > '0' by an accounting period, which is usually a single year.

$$\Delta P(\%) = \frac{A_o \Delta Y_t}{\Delta P_t} \times 100 + \frac{Y_o \Delta A_t}{\Delta P_t} \times 100 + \frac{\Delta A_t * \Delta Y_t}{\Delta P_t} \times 100$$

Change in production (%) = Yield Effect + Area Effect + Interaction Effect

RESULTS AND DISCUSSION

Spatio-temporal growth pattern of banana:

The results of the compound growth rate of area, production and yield of banana crop in South Gujarat are furnished in Table 1.

The results from Table 1 showed that the per annum compound growth rate of area was found positive and significantly highest in Surat (23.95%) district during period I. While the growth rate of production was found positive and significant in Navsari (20.06%) which recorded highest growth rate followed by Surat and Narmada. The productivity growth rate showed positive and significant growth in Narmada (12.29%) and Navsari (11.73%) districts.

In period II (2005-06 to 2019-20), the area growth rate showed positive and significant growth in Navsari (20.79%), Valsad (10.61%) and Narmada (5.67%) at 1 per cent significant level. The compound growth rate of production was found to be positive and significantly highest in Navsari (20.71%) followed by Valsad and Narmada districts. The productivity growth rate was observed positive and significant at 1 per cent level in Surat (1.79%), Bharuch (1.70%) and Narmada (1.30%) districts.

During the overall period III, the district wise growth rate of area showed positive and significant value in all the selected districts and Navsari (15.31%) district had highest growth rate followed by Bharuch, Valsad, Narmada and Surat. The production growth was also found to be positive significantly highest in Navsari (19.79%) followed by Narmada, Bharuch and Surat districts significant at 1 per cent level, The growth rate of productivity was also found positive and significant in all the selected districts except Valsad district.

These finding were in consonance with Bondar *et al.* (2015) who analysed the growth rate of banana in India and the result revealed that growth rates of area, production and productivity are significant at one per cent level as same as Bharuch and Narmada

Table 1: District wise compound growth rate analysis of banana in South Gujarat

Districts	Study period					
	Period I		Period II		Period III	
	(1994-95 to 2004-05)		(2005-06 to 2019-20)		(1994-95 to 2019-20)	
	CGR (%)	SE(b)	CGR (%)	SE(b)	CGR (%)	SE(b)
Bharuch						
Area	3.82	0.035	-0.72	0.006	6.34**	0.010
Production	-0.63	0.044	0.98	0.007	8.51**	0.012
Yield	-4.29*	0.015	1.70**	0.002	2.04**	0.005
Surat						
Area	23.95**	0.037	-2.03*	0.007	5.21*	0.013
Production	19.57**	0.020	-0.28	0.007	7.18**	0.010
Yield	-3.53	0.020	1.79**	0.002	1.88*	0.005
Valsad						
Area	-13.07**	0.044	10.61**	0.016	5.56*	0.015
Production	-17.72**	0.057	10.61**	0.016	7.00*	0.019
Yield	-5.35**	0.021	0.28	0.004	1.36	0.006
	Period I		Period II		Period III	
	(1999-00 to 2004-05)		(2005-06 to 2019-20)		(1999-00 to 2019-20)	
	CGR (%)	SE(b)	CGR (%)	SE(b)	CGR (%)	SE(b)
Narmada						
Area	1.19	0.020	5.67**	0.006	5.54**	0.004
Production	13.62*	0.036	7.04**	0.006	10.56**	0.007
Yield	12.29**	0.028	1.30**	0.001	4.76**	0.006
Navsari						
Area	7.46	0.035	20.79**	0.023	15.31**	0.014
Production	20.06**	0.044	20.71**	0.021	19.79**	0.011
Yield	11.73**	0.038	-0.06	0.003	3.89*	0.008

Note: * and ** indicates significance at 5 per cent and 1 per cent levels, respectively;

1. CGR-Compound Growth Rate and SE(b) - Standard Error of the coefficient estimates;

2. Period I, Period II, Period III are Pre-NHM, Post- NHM and Overall periods of study.

districts in overall period. Madhunaik and Yogish (2018) analysed the banana cultivation in India and concluded that the overall growth rate was higher in production followed by area and yield were same as all districts of this study.

Instability analysis of banana in South Gujarat region

The results of analysis in instability of banana through Cuddy- Della Valle index method have been represented in Table 2. From the analysed results, it was observed that in period I, the instability in area was found to be highest in Bharuch district with the

CDV value of (47.90%) followed by Valsad (47.51%), Surat (31.24%), Navsari (13.14%). Whereas Narmada recorded (8.38%) instability in case of area which was least value among all districts. The instability of production was found to be highest in Valsad (57.28%) followed by Bharuch, Surat, Navsari and Narmada. In terms of yield, highest instability was observed in Valsad district (22.08%) and the lowest instability was found in Narmada district (11.44%).

For period II, the instability with respect to area was found to be highest in Navsari with CDV value of 28.86 per cent followed by Valsad, Surat, Bharuch and Narmada. In case of production, a similar trend was found in instability. In view of yield, highest

Table 2: District wise instability analysis (1994 to 2020)

Districts	Study Period					
	Period I		Period II		Period III	
	(1994-95 to 2004-05)		(2005-06 to 2019-20)		(1994-95 to 2019-20)	
	CV (%)	CDV (%)	CV (%)	CDV (%)	CV (%)	CDV (%)
Bharuch						
Area	48.22	47.90	9.69	9.48	46.98	28.96
Production	45.51	47.92	11.49	11.09	56.60	34.15
Yield	20.73	15.67	7.77	2.79	20.84	15.86
Surat						
Area	64.18	31.24	14.86	12.22	39.52	31.56
Production	57.91	19.50	11.05	11.40	44.32	25.86
Yield	22.41	20.32	8.55	3.68	20.04	15.95
Valsad						
Area	65.79	47.51	36.97	18.64	54.73	44.69
Production	82.03	57.28	37.99	20.80	61.70	50.97
Yield	27.57	22.08	6.77	6.92	20.67	19.03
	Period I		Period II		Period III	
	(1999-00 to 2004-05)		(2005-06 to 2019-20)		(1999-00 to 2019-20)	
	CV (%)	CDV (%)	CV (%)	CDV (%)	CV (%)	CDV (%)
Narmada						
Area	7.82	8.38	24.54	9.08	33.79	9.55
Production	27.53	15.06	29.30	9.47	52.05	15.26
Yield	23.72	11.44	5.86	1.23	27.14	14.31
Navsari						
Area	16.76	13.14	69.01	28.86	88.19	36.13
Production	39.87	19.19	68.31	26.86	93.72	25.02
Yield	28.63	18.18	5.13	5.32	25.67	17.27

instability was recorded in Valsad district (6.92%) and the lowest instability was found in Narmada district (1.23%) similar to period I but instability per cent was decreased.

Coming to the overall study Period III, the instability in area was found to be highest in Valsad district with the CDV value of (44.69%) followed by Navsari, Surat, Bharuch and Narmada. In terms of production, instability was highest in Valsad (50.97%) followed by Bharuch, Surat, Navsari and Narmada. At the same time for yield, the instability was recorded highest in Valsad (19.03%) followed by Navsari, Surat, Bharuch and Narmada. The results revealed based on over all study period that after the implementation of NHM, the instability rate decreased compared to pre-NHM period.

Nagpure *et al.* (2019) analysed performance of banana in India and revealed lowest instability in area

followed by productivity and production during period I as same as in Narmada and Navsari districts.

Trade-off between growth and instability

Matrix association or trade-off between growth and instability (Table 3) was obtained using four-fold typology as indicated in the methodology.

High Growth-Low Instability (Most desirable situation): This is most desirable situation in which at least one study district was positioned, which was Narmada district in terms of production with 10.56 per cent high growth rate and low instability.

High Growth-High Instability (Desirable situation): In terms of area, Navsari district fall under this category. In terms of production particulars Bharuch, Surat, Navsari and Valsad districts fall under this category.

Table 3: Growth-instability trade-off in area, production and productivity of banana in South Gujarat during 1994-95 to 2019-20

Particulars	High growth	Low growth
Area		
High instability	Navsari (15.31 , 36.13)	Bharuch (6.34 , 28.96) Surat (5.21 , 31.56) Valsad (5.56 , 44.69)
Low instability		Narmada (5.54 , 9.55)
Production		
High instability	Bharuch (8.51 , 34.15) Surat (7.18 , 25.85) Navsari (19.79 , 25.02) Valsad (7.00 , 50.97)	
Low instability	Narmada (10.56 , 15.26)	
Productivity		
High instability		
Low instability		Bharuch (2.04 , 15.86) Narmada (4.76 , 14.31) Surat (1.88 , 15.95) Navsari (3.89 , 17.27) Valsad (1.36 , 19.03)

Note: Value in bold and italics indicate growth (%) and instability (%), respectively.

Low Growth-Low Instability (Least desirable):

In terms of area, Narmada district fall under this category, while in terms of yield all districts comes under this category.

Low Growth-High Instability (Not desirable):

In terms of area particulars Bharuch, Surat and Valsad districts fall under this category. As a result, special and specific interventions are needed in the future in these regions to maintain banana production at desired levels.

Decomposition analysis of output growth in banana

The decomposition analysis of the banana production in the study area has been presented in the Table 4.

In Bharuch district, area contributed 135.05 per cent in period I, whereas yield contributed negative effect and interaction contributed 2.32 per cent positive in growth of production. In post NHM period introduction of new technology in production improve contribution of yield up to 128 per cent, whereas splitting of some area, contribution of area

was negative. In overall period, the yield, area and interaction contributed positively in production growth of banana.

In Narmada district, banana production is mainly contributed by yield (70.22%) followed by area (26.12%) and interaction (3.67%) during period I. In post NHM period, area contributed increased up to 77.76 per cent, whereas yield contribution was slightly decreased up to 21.48 per cent may be because climate change has played major role in impacting the contribution of yield. The area and yield contribution in total production of banana was more than their interaction during overall period.

In Surat district, area contribution in production of banana was 117.46 per cent during period I, whereas yield contributed 33.69 per cent and interaction contributed negatively. In period II, after implementation of NHM, yield increased up to 355.42 per cent, whereas area contributed negative and interaction contributed 31.19 per cent in growth of production. The area (70.79%) was the most contributed factor in production of banana followed by yield (67.04 %) during overall period.

Table 4: Decomposition of growth in banana (1994 to 2020)

Sl. No.	District/ Period	Per cent contribution (%)			
		Area	Yield	Interaction	Total effect
1. Bharuch					
	Period I (1994-95 to 2004-05)	135.05	-37.37	2.32	100
	Period II (2005-06 to 2019-20)	-29.30	128.44	0.86	100
	Period III (1994-95 to 2019-20)	42.64	54.57	2.78	100
2. Narmada					
	Period I (1999-00 to 2004-05)	26.12	70.22	3.67	100
	Period II (2005-06 to 2019-20)	77.76	21.48	0.76	100
	Period III (1999-00 to 2019-20)	59.64	38.99	1.37	100
3. Surat					
	Period I (1994-95 to 2004-05)	117.46	33.69	-51.16	100
	Period II (2005-06 to 2019-20)	-286.61	355.42	31.19	100
	Period III (1994-95 to 2019-20)	70.79	67.04	-37.83	100
4. Navsari					
	Period I (1999-00 to 2004-05)	31.48	66.07	2.46	100
	Period II (2005-06 to 2019-20)	98.79	3.38	-2.17	100
	Period III (1999-00 to 2019-20)	92.60	9.12	-1.72	100

In Navsari district, the yield contribution was the most responsible factor for the increased production of banana during period I, whereas area and interaction contributed 31.48 per cent and 2.46 per cent respectively. In post NHM period, acreage expansion was up to 98.79 per cent whereas yield contributed 3.38 per cent. During overall period, area (92.60 %) was the most responsible factor for increase in production of banana followed by yield (9.12%).

For period I, the highest positive area effect was recorded in Bharuch (135.05%). Yield effect was highest in Narmada followed by Navsari and Surat. The interaction effect was highest in Narmada followed by Navsari and Bharuch.

During period II, Navsari (98.79%) and Narmada (77.76%) districts observed positive area effects. The yield effect was observed positive for all districts, highest in Surat followed by Bharuch, Narmada and Navsari. The interaction effect was positive for all districts except Navsari (2.17%) district due to environmental factors.

In period III, area effect was highest in Navsari (92.60%) followed by Surat, Narmada and Bharuch. The highest yield effect observed in Surat (67.04%) district followed by Bharuch (54.57%) and Narmada (38.09%). In the same period, Bharuch (2.78%) and

Narmada (1.37%) districts observed positive area effects. Overall, the contribution of area and yield effect during period II was higher than it was before implementation of NHM in period I.

Hazarika *et al.* (2020) found that productivity effect and area effect on increased total production of banana in Assam was stronger than their interaction effect as same as Bharuch district. Chaudhari and Singh (2017) found that the area (50.80%) was the most contributing factor in production of mango followed by yield (30.84%) in South Gujarat region level as same as Narmada, Surat and Navsari districts in overall period. At the South Gujarat region level, increase in yield (56.98%) was the most responsible factor in increase in production of sapota followed by area (33.26%) as same as Bharuch district in overall period.

CONCLUSION

From the analysis found that, the growth rate of area, production and yield was found to have significant effect in all the three periods. Based on all districts, on an average, it can be revealed that the growth rate of area, production and productivity of banana was high in period II compared to period I, which indicate that positive impact of NHM. The result of

instability in banana revealed that, In all districts of instability was low in period II compared to period I, except Navsari in terms of area and production. Growth-instability analysis found that most desirable situation (high growth-low instability) in Narmada district was observed in terms of production. Since the banana production in this district depicts a high growth with low instability. During the study period, farmers can be encouraged for area extension of this banana crop as well as for adoption of modern scientific production technologies in the coming seasons. The area effect was increased in period II compared to period I in Narmada and Navsari districts.

SUGGESTION

On the basis of the findings of this study, the following suggestions are summarized below:

The growth rate analysis indicated that the growth rate in productivity of banana was very low compare to area and production during overall study period, emphasis should be given on increasing productivity to meet the growing domestic demand on one hand and to build up a sustainable supply for the international markets to earn revenue on the other.

As the growth-instability trade-off, only Narmada district was observed in 'most desirable situation' with respect to production. So, wider adaption of technology is suggested for farmers of other districts. This can be achieved by making critical inputs readily available, accessible and affordable.

REFERENCES

- Anonymous, 2021a. Director of Horticulture, Agriculture, Farmers' Welfare and Co-operation Department, Government of Gujarat. 2020-21, <https://doh.gujarat.gov.in>
- Anonymous, 2021b. Directorate General of Commercial Intelligence and Statistics (DGCIS), Ministry of Commerce and Industry.
- Anonymous, 2022a. The Times of India. Retrieved from <https://timesofindia.indiatimes.com/india/horticulture-output-to-be-marginally-declined-in-current-year/articleshow/90502698.cms>
- Anonymous, 2022b. Department of Agriculture, Cooperation and Farmers Welfare.
- Anonymous, 2022c. Department of Agriculture and Farmers Welfare.
- Bondar, U.S., Daundkar, K.S. and Khedkar, S.R. 2015. Economics of production of banana in Kolhapur district of Maharashtra. *Int. Res. J. of Agric. Econ. and Statistics*, **6**(2): 336-341.
- Chaudhari, D.J. and Singh, N. 2017. Growth and decomposition analysis of mango and sapota in South Gujarat. *Int. Res. J. Agric. Econ. and Statistics*, **8**(2): 336-341.
- FAO, 2021. Food and Agricultural Organization.
- Hazarika, M., Sarma, R. and Phukon, K.K. 2020. An analysis on area production and productivity of Banana in Assam. *Agril. Sci. Digest*, **41**(2): 334-337.
- Joshi, P.K., Gulati, A., Birthal P.S. and Tewari, L. 2004. Agriculture diversification in South Asia: patterns, determinants and policy implications. *Econ. and Pol. Weekly*, **39**(24): 2457-67.
- Laitonjam, N., Singh, R., Yumnam, A., Kankabati, K. and Meena, N.K. 2018. Rice production in India: Decomposition and trend analysis. *Plant Archives*, **18**(1): 435-438.
- Madhunaik, G.G. and Yogish, S.N. 2018. An economic analysis of banana cultivation in India. *J. Emerging Technol. and Innov. Res.*, **5**(11): 32-39.
- Nagpure, S.C., Mhaske, A.R. and Kokate, S.D. 2019. Trade performance of banana in India. *Int. J. of Res. and Rev.*, **6**(5): 113-123.
- Palanisami, K., Paramasivam, P. and Ranganathan, C.R. 2002. Risk and uncertainty in agriculture. Agricultural production economics: Analytical methods and applications, New Delhi, India: Associated publishing company, pp. 70-89.
- Ranede, C.G. 1980. Impact of cropping pattern on agricultural production. *Indian J. Agril. Econ.*, **35**(2): 191-27.
- Rao, I.V.Y. and Raju, V.T. 2005. Scenario of agriculture in Andhra Pradesh. Daya Publishing House, New Delhi, India.
- Vaidyanathan, N. 1999. Instability in agriculture, extent, causes and consequences: A review article. *Indian Econ. Rev.*, **27**(2): 21.
- Vinayaka, K., Lokapur, S., Gurikar, R. and Hosali, R. 2014. Growth and instability analysis of fruit crops in India-an economic analysis. *J. Environ. Sci., Computer Sci. and Engineer. and Technol.*, **3**(4): 1808-1813.