Research Paper

Growth in Vegetable Production and its Decomposition in Karnataka

Afrin Zainab Bi* and Umesh, K.B.

Department of Agricultural Economics, University of Agricultural Sciences, Bengaluru, Karnataka, India

*Corresponding author: afrinzainab22@gmail.com (**ORCID ID:** 0000-0002-3979-3277)

ABSTRACT

Vegetables are important constituents of Indian agriculture and nutritional security. Along with health benefits, vegetables help in flourishing countries economy, as it provides a great opportunity for income and employment generation for the farming sector. The study has an objective to understand the extent of growth each vegetable experiencing and to derive the major factor for the growth in Karnataka, utilizing time-series data. The total area showed an increasing trend over the period with about 40 % increase in a span of two decades. However, figures for increased production were more appealing than its area, as it has shown 60 % increase. Total production of vegetables in Karnataka has increased from 42 lakh tonnes in 1998-99 to 68 lakh tonnes in 2018-19, with an annual growth rate of 3.9 %. The highest growth in production was observed in onion (7.5% annually) followed by tomato and cole crops. The area effect was the most responsible factor for increasing production of tomato, onion, guards, cole crops and other vegetables group. Thus, in effect for overall vegetables, it is 66 % of the total increased production effect. However, for potato and leafy vegetables, only yield effect was found to be positively contributing to the production.

Highlights

⊙ Escalation in vegetable production is majorly contributed by increased in its area rather than increase in yield.

Keywords: Vegetables, Compound growth rate, area effect, production effect and decomposition analysis

Vegetables are important constituents of Indian agriculture and nutritional security due to their short duration, high yield and value, nutritional richness, economic viability and ability to generate on-farm and off-farm employment. Post green revolution, substantial growth in the country's vegetable production was observed. Growth of area under vegetables in India was reported to be negative during 1991-92 to 1995-96, but it has increased to 4.13 % for period between 2001-02 to 2005-06 (Harish *et al.* 2015). However, in the last few years vegetables have principal share contributing more than 50 % of the total horticulture area. (Horticultural Statistics at a Glance 2018). Birthal *et al.* (2007) presented evidence of gradual diversification of Indian agriculture towards high-value crops. Share of land allotted for vegetables had positive relation with household size, however negatively related to land allotted for fruits and size of household. Rao and Joshi (2009) reported that expanding urbanisation together with higher economic growth and changes in the tastes and preferences are causing shift in the food basket in favour of high-value food commodities like fruits, vegetables, milk, meat, egg and fish. These changes in the food basket leading to transformation of the agricultural production portfolio away from food

grains towards high value food commodities. The trend is expected to be continued as the factor influencing would remain more are less similar in the future as well Vanitha *et al.* (2013) reported phenomenal increase in vegetable area in the country which was about 300%, production by 900% and productivity by 300% for the period of six decades. Vegetables are forms a major constituent in country agriculture production and nutritional security because of their characters such as short duration, high yield high nutritional, economic viability. It also provides ample opportunity for generation of on-farm and off-farm employment. However, Un-even growth between the regions and the states was observed for area as well as production (Vanitha *et al.* 2013). The present study was designed with a specific objective to report the extent of growth each vegetable or vegetable group experiencing and to derive the major factor for the growth. A time-series data required for the purpose was collected from the Department of Horticulture, Bengaluru, Karnataka, for the period 1998-99 to 2017-18 pertaining to area, production and productivity of all the vegetables for Karnataka state.

MATERIALS AND METHODS

Estimation of Growth in Area, Production and Yield

In the present study, compound growth rates of area, production and yield for vegetables/ vegetable groups were estimated to study the growth in area, production and yield of these crops. However, compound growth rates were used for the study. Compound growth rates were estimated with the following exponential model.

$$Y = ab_t$$
$$\log y = \log a + t \log b$$
$$CGR(\%) = (Anti \log b - 1) * 100$$

where, CGR = Compound growth rate, t = Time period in year, y = Area or production or productivity, a & b = Regression parameters. The 't' test is be applied to test the significance of 'b'.

Decomposition analysis

To measure the relative contribution of area and yield to the total output change for the major crops, the decomposition analysis model as given below is used. Sharma and Subramanyam (1984) redeveloped the model and several researchers (Kalamkar, 2002) used this model to study growth performance of crops. The method states that, if A_0, P_0 and Y_0, respectively represent area, production and productivity in base year and A_n, P_n and Y_n are values of the respective variable in n^{th} year item.

$$P_0 = A_0 * Y_0 \text{ and}$$

$$P_n = A_n * Y_n \qquad \qquad \dots(1)$$

Where, A_0 and A_n represent the area and Y_0 and Y_n represents the yield in the base year and n^{th} year, respectively,

$$P_n - P_0 = \Delta P$$

$$A_n - A_0 = \Delta A \qquad \qquad \dots(2)$$

From equation (1) and (2) we can write,

$$P_0 + \Delta P = (A_0 + \Delta P)(Y_0 + \Delta Y)$$

Hence,

$$P = \frac{A_0 \Delta Y * 100}{\Delta P} + \frac{Y_0 \Delta A * 100}{\Delta P} + \frac{\Delta Y \Delta A * 100}{\Delta P}$$

Production = Yield effect + area effect + interaction effect

Thus, the total change in production can be decomposed into three components viz., yield effect, area effect and the interaction effect due to change in yield and area.

RESULTS AND DISCUSSION

Growth in area, production and yield over time

Area, production and yield of vegetables in Karnataka from 1998-99 to 2017-18 have been presented in Fig. 1. The total area showed an increasing trend over the period with about 40 per cent increase in a span of two decades. Diversification of agriculture towards high-value crops, especially fruits and vegetables are the contributing factor to this increase (Birthal *et al.*

Table 1: Area under production of vegetables in Karnataka

Crops	1998-99		2008-09		2017-18		Annual growth rate (%)
	Area (ha)	Per cent	Area (ha)	Per cent	Area (ha)	Per cent	
Potato	40675	14.81	77042	23.77	35527	9.38	-2.5*
Tomato	38138	13.89	46038	14.20	64254	16.96	3.4*
Onion	91008	33.15	134534	41.51	195276	51.53	3.6**
Gourd	17057	6.21	19566	6.04	28358	7.48	2.8
Cole crops	14333	5.22	15685	4.84	19471	5.14	3.6*
Leafy Vegetables	18105	6.59	15770	4.87	17776	4.69	-0.1
Other Vegetables	55241	20.12	15481	4.78	18289	4.83	-8.0**
Total	**274557**	**100.00**	**324116**	**100.00**	**378951**	**100.00**	**1.8***

*Note: ***, ** and * indicates significance at 1%, 5% and 10% levels, respectively.*

Table 2: Production of vegetables in Karnataka

Crops	1998-99		2008-09		2017-18		Annual growth rate (%)
	Production (tonnes)	Per cent	Production (tonnes)	Per cent	Production (tonnes)	Per cent	
Potato	513415	12.00	435039	8.57	509353	7.41	-0.5
Tomato	901795	21.07	1504753	29.63	2081594	30.28	5.3**
Onion	1335888	31.21	2158283	42.49	2986593	43.45	7.5**
Gourd	227110	5.31	297836	5.86	432323	6.29	3.8*
Cole crops	266679	6.23	297324	5.85	386285	5.62	3.9*
Leafy Vegetables	178061	4.16	156717	3.09	197582	2.87	1
Other Vegetables	856967	20.02	228966	4.51	280151	4.08	-9***
Total	**4279915**	**100.00**	**5078918**	**100.00**	**6873881**	**100.00**	**3.9****

*Note: ***, ** and * indicates significance at 1%, 5% and 10% levels, respectively.*
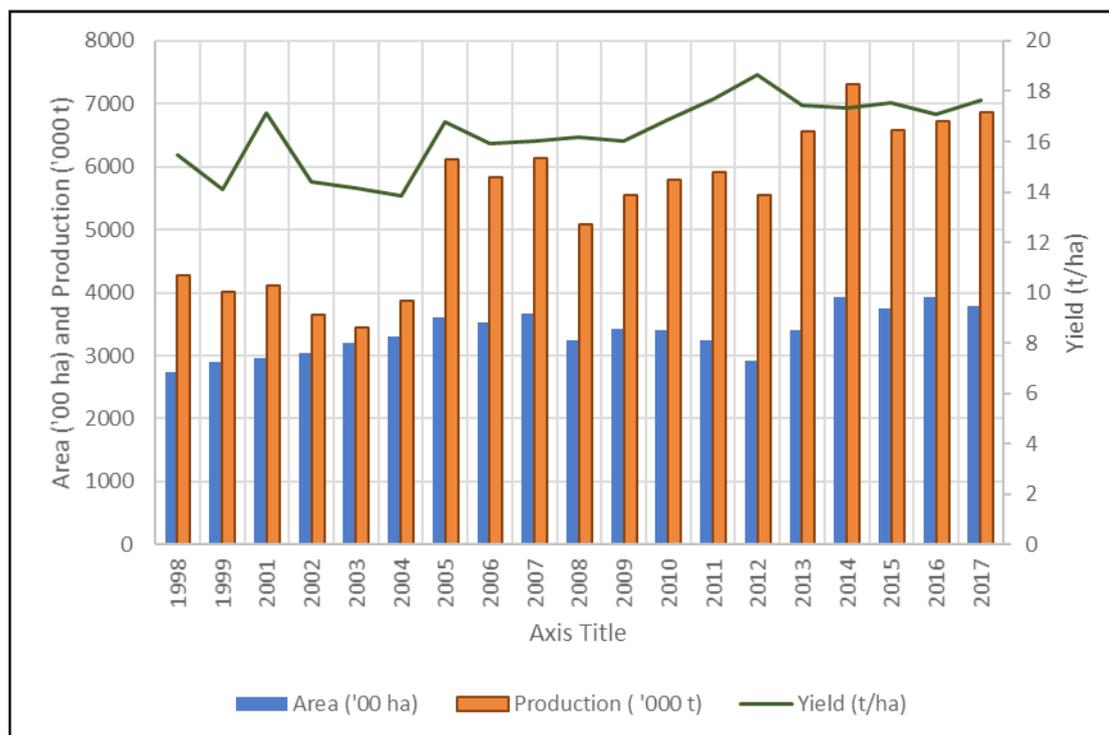
Fig. 1: Area, production and yield of vegetables in Karnataka

Table 3: Productivity of vegetables in Karnataka (MT/ha)

Year	1998-99	2008-09	2017-18	Annual growth rate (%)
Potato	12.62	5.65	14.34	2*
Tomato	23.65	32.69	32.40	1.9*
Onion	14.68	16.04	15.29	3.9**
Gourd	13.31	15.22	15.25	1*
Cole crops	18.61	18.96	19.84	0.3
Leafy Vegetables	9.83	9.94	11.12	1.2
Other Vegetables	15.51	14.79	15.32	-1
Total	**15.46**	**16.18**	**17.65**	**2.2***

*Note: ***, ** and * indicates significance at 1%, 5% and 10% levels, respectively.*

Table 4: Decomposition analysis of production effect of vegetables in Karnataka between 1998 and 2017

Crops	Total effect (tonnes)	Yield effect (per cent)	Area effect (per cent)	Interaction effect (per cent)
Potato	28210	362	-230	-31
Tomato	1179799	28	52	20
Onion	1650705	3	93	4
Gourds	205213	16	73	11
Cole crops	119606	15	80	5
Leafy Vegetables	19521	119	-17	-2
Other vegetables	-576816	2	99	-1
Total	**2443730**	**25**	**66**	**9**

2007 and Vanitha *et al.* 2013). However, figures for increased production were more appealing than its area, as it has shown 60 per cent increase. Yield per unit area under vegetables has increased by 14 per cent in 20 years. Improvement in yield of varieties and/ or hybrids, better farm management practices and increased area under irrigation could be the reasons for enhancement in yield levels.

Area under vegetables for periods between 1998-99 to 2017-18 is depicted in table 1. The vegetable area has reported a spike from 2.7 lakh ha to 3.7 lakh ha, with an annual growth rate of 1.8 per cent. However, the growth is not positive for all the vegetables, *viz.*, potato, leafy vegetables, and other vegetables have recorded a negative growth rate. Among vegetables, onion had the highest area under production followed by tomato and potato. But, Percent share of onion to the total vegetable area in the state has raised from 33 per cent to 51 per cent, the same has fallen for potato (from 14% to 9%). As hypothesized, area under total vegetable production has increased over the period. Thus, the research hypothesis was accepted on the basis of evidences provided above.

Total production of vegetables in Karnataka has increased from 42 lakh tonnes in 1998-99 to 68 lakh tonnes in 2018-19, with an annual growth rate of 3.9 per cent (Table 2).

The highest growth in production was observed in onion (7.5% per annum) followed by tomato, cole crops and gourds. Similar to the area trend, production share of potato and other vegetables group has fallen significantly, which could majorly attribute to the low profitability of such crops.

Yield per hectare of vegetables grown for three periods is presented in table 3. Overall, productivity of vegetables has increased at 2.2 per cent annually, yet, other vegetables group has witnessed fall in its productivity with annual rate of -1 per cent. Among all vegetables tomato has highest productivity (32 MT/ha) and leafy vegetables has least productivity (11 MT/ha). This implies that efforts to increase productivity is highest in tomato and least in leafy vegetables.

Output decomposition in vegetables

Relative contribution of components to aggregate
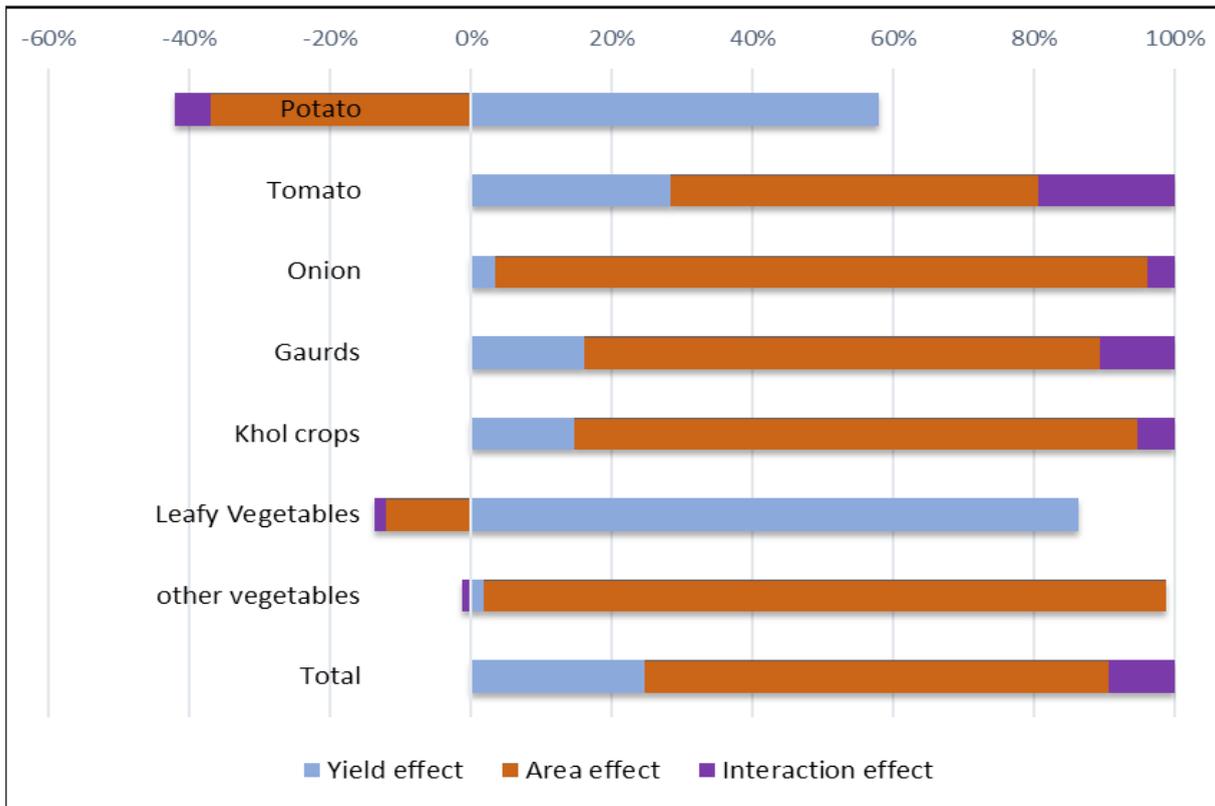
Fig. 2: Decomposition analysis of vegetable production in Karnataka

growth of vegetable in Karnataka output was decomposed into yield effect, area effect and the interaction effect and it is presented in table 4. It demonstrates the per cent contribution of area, yield and their interaction for increasing production of vegetables over the period of 20 years. It is evident from the results that the area effect was most responsible factor for increasing production of tomato, onion, guards, cole crops and other vegetables group. Thus, in effect for overall vegetables, it is 66 per cent. On the contrary area effect is negative for potato and leafy vegetables to the extent of -230 per cent and -17 per cent. These results are contrary to the findings of Anonymous (2008), which stated agriculture growth at national level was attributed to the yield effects.

Yield effect was found responsible for an increase in production of potato and leafy vegetables (362 % and 119 %, respectively). In neither of the vegetable's interaction effect of area and yield has a major share in total production effect, representing a lack of synergies between them. After normalizing the components of total production effect to 100 per cent, individual effects are presented in Fig. 2.

CONCLUSION

In conclusion, Majority of vegetables have witnessed positive growth both in area and production. The exceptions include potato and other vegetables group, potato had negative significant growth in area and other vegetables group had negative growth in both area and production. Decomposing the total production effect of vegetables revealed that positive area effect is more prominent than positive yield effect. Hence, increasing production in future should be aimed through improving productivity, as another option of area expansion has restrictions by the increased human dwelling and other economic development activities. Further it could also be achieved through vertical farming, which is popular for land productivity.

REFERENCES

Anonymous. 2018. Horticulture statistics at a glance 2018, Ministry of Agriculture and Farmers' Welfare, Government of India.

Birthal, P.S., Joshi, P.K., Roy, D. and Thorat, M. 2007. Diversification in Indian agriculture towards high-value crops: The Role of Smallholders. IFPRI Discussion Paper 00727.

Harish, K.K., Amit, K. and Mathur, V.C. 2015. Temporal and Spatial Performance of Horticultural Crops in India. *Eco. Affa.*, **60**(3): 367-373.

Kalamkar, S.S. 2003. Agricultural Development and source of output growth in Maharashtra state. *Artha Vijnana,* **XLV**(3&4): 297-324.

Roy, P.P. and Joshi, P.K. 2009. Does Urbanisation influence agricultural activities? A case study of Andhra Pradesh. *Ind. J. Agril. Eco.*, **64**(3): 401-408.

Vanitha, S.M., Chaurasia, S.N.S., Singh, P.M. and Naik, P.S. 2013. Vegetable Statistics. Technical Bulletin No. 51, IIVR, Varanasi.

Sharma, P.V. and Subramanyam, S. 1984. A note on the decomposition of the growth rate of aggregate crop output. *Agril. Situation in India*, **39**(9): 691-694.

84