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Trends in area, production, and productivity of major fruit and vegetable crops under the national horticulture mission in the central dry zone of Karnataka

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Abstract

The National Horticulture Mission (NHM) has played a significant role in promoting horticultural development in India through interventions such as area expansion, micro-irrigation, quality planting materials, integrated nutrient management, protected cultivation and post-harvest infrastructure. The present study analysed the trends in area, production and productivity of four major horticultural crops namely banana, pomegranate, chilli and onion in the Central Dry Zone (Zone-4) of Karnataka covering Chitradurga, Tumakuru and Chikkamagaluru districts during 2013-14 to 2021-22. Secondary data collected from Karnataka State Department of Horticulture were analysed using descriptive statistics and Compound Annual Growth Rate (CAGR). The results revealed contrasting growth patterns across crops and districts. Tumakuru recorded remarkable improvements in banana productivity (4.64%) and pomegranate growing area (8.98%), while Chitradurga exhibited significant expansion in onion cultivation with a CAGR of 7.97 per cent in area. Chikkamagaluru experienced declining trends in banana, pomegranate and chilli cultivation. Overall, NHM interventions substantially contributed towards area expansion, productivity enhancement and commercialization of horticulture, although district-specific challenges continue to influence crop performance.

Keywords: National horticulture mission, CAGR, banana, pomegranate, onion, chilli, productivity

1. Introduction

Horticulture has emerged as one of the fastest-growing sectors of Indian agriculture, contributing significantly towards agricultural GDP, nutritional security, employment generation and export earnings. Recognizing its importance, the Government of India launched the National Horticulture Mission (NHM) during 2005-06 to promote holistic development of horticultural crops through area expansion, technology dissemination, quality planting materials, micro-irrigation, integrated pest management and post-harvest infrastructure. Karnataka is one of the leading horticultural states in India. The Central Dry Zone comprising Chitradurga, Tumakuru and Chikkamagaluru possesses considerable potential for fruit and vegetable cultivation despite climatic variability. NHM interventions have considerably influenced farmers' adoption of improved technologies and commercial horticulture. The present study evaluates the trends in area, production

and productivity of banana, pomegranate, chilli and onion under NHM interventions from 2013-14 to 2021-22.

2. Methodology

The present study was conducted to analyse the trends in area, production, and productivity of selected horticultural crops under the National Horticulture Mission (NHM) in the Central Dry Zone of Karnataka. The study was based entirely on secondary data collected for a period of nine years, from 2013–14 to 2021–22. The required data on area (ha), production (metric tonnes), and productivity ($t\ ha^{-1}$) of selected horticultural crops were obtained from the Karnataka State Department of Horticulture (KSDH), Government of Karnataka.

The study was confined to three districts of the Central Dry Zone (Zone IV) of Karnataka, namely Chitradurga, Tumakuru, and Chikkamagaluru, where NHM interventions have been implemented extensively for the promotion of

horticultural development. Four economically important horticultural crops banana, pomegranate, chilli, and onion were selected for the analysis based on their area under cultivation, economic importance, and relevance to NHM programmes.

The collected data were compiled and analysed using descriptive statistical techniques. Tabular analysis was employed to present the district-wise trends in area, production, and productivity over the study period. Trend analysis was carried out to examine the temporal changes in these variables and to assess the overall growth pattern of each crop across the selected districts.

2.1 Statistical tools

To quantify the annual growth in area, production, and productivity, the Compound Annual Growth Rate (CAGR) was estimated. The CAGR provides a measure of the average annual rate of growth over the study period by assuming a constant rate of increase or decrease.

It was calculated using the following formula:

$$\text{CAGR} = \left[\frac{Y_o}{Y_n} \right]^{(1/n)} - 1$$

Where,

Y_o = Initial value

Y_n = Final value

n = Number of years

3. Result and discussion

The trends in area, production and productivity of banana, pomegranate, chilli and onion cultivated under the National Horticulture Mission (NHM) in the Central Dry Zone of Karnataka during 2013–14 to 2021–22 are presented in

Tables 1–5. The analysis revealed considerable inter-district variation in crop performance, reflecting differences in agro-climatic conditions, technology adoption and the effectiveness of NHM interventions.

3.1.1 Banana

The data presented in Table 1 illustrate the temporal trends in the area, production, and productivity of banana crops in Chitradurga (CTA), Tumakuru (TUM), and Chikkamagaluru (CKM) districts from 2013–14 to 2021–22. An analysis of the trends provides insights into the performance of the banana sector in the Central Dry Zone of Karnataka over the nine-year period. (KSDH, 2022)

The area under cultivation showed considerable fluctuation over the years. In Chitradurga district, the area ranged from 4,616 ha in 2019–20 to a peak of 10,246 ha in 2016–17, indicating instability in crop coverage across seasons. Whereas the Tumakuru district exhibited a relatively moderate area trend, with the lowest area of 3,382 ha in 2019–20 and the highest area of 7,238 ha in 2020–21. While the Chikkamagaluru district consistently recorded a declining trend in area, decreasing from 7,133 ha in 2013–14 to 2,776 ha in 2021–22, suggesting gradual withdrawal or crop substitution over the study period.

With respect to production, the Chitradurga district recorded the highest production of 112,264 metric tons in 2016–17, coinciding with the maximum area under cultivation, while the lowest production (102,259 metric tons) was observed in 2019–20. In TUM, production showed a sharp increase in 2020–21 (220,289 metric tons), the highest during the entire study period, reflecting the combined effect of expanded area and higher productivity. The Chikkamagaluru showed a continuous decline in production from 171,256 metric tons in 2013–14 to 65,677 metric tons in 2021–22, largely corresponding with the reduction in cultivated area.

Table 1: Area, production and productivity of banana in the Chitradurga, Tumakuru and Chikkamagaluru districts

Sl. No.	Year	Area (in ha)			Production (M. Tons)			Productivity (Ton/ha)		
		CTA	TUM	CKM	CTA	TUM	CKM	CTA	TUM	CKM
1	2013-14	5790	5291	7133	155322	114266	171256	26.83	21.60	24.01
2	2014-15	5899	5174	5233	126552	127346	130473	21.45	24.51	24.93
3	2015-16	5836	4335	4951	125070	91287	106901	21.43	21.06	21.59
4	2016-17	10246	4572	4626	212264	118559	98566	20.72	25.93	21.31
5	2017-18	6510	4535	3707	146359	130146	69974	22.48	28.70	18.87
6	2018-19	5109	4225	2906	113729	125734	62021	22.26	29.76	21.34
7	2019-20	4616	3382	2407	102259	101581	50540	22.15	30.04	21.00
8	2020-21	4988	7238	4592	145426	220289	108875	29.15	30.44	23.71
9	2021-22	6912	4061	2776	160227	119351	65677	23.18	29.43	23.66

Note: CTA- Chitradurga, TUM- Tumakuru CKM- Chikkamagaluru

The productivity levels revealed comparatively better performance in the Tumakuru district across most years. Productivity in the Tumakuru district increased steadily from 21.60 t/ha in 2013–14 to a peak of 30.44 t/ha in 2020–21, indicating effective adoption of improved production technologies and management practices. The Chitradurga district productivity fluctuated between 20.72 t/ha (2016–17) and 29.15 t/ha (2020–21), reflecting variability in resource use efficiency and climatic influences. CKM recorded relatively lower productivity levels, ranging from 18.87 t/ha in 2017–18 to 24.01 t/ha in 2013–14, with marginal improvements in later years.

3.1.2 Pomegranate

Pomegranate cultivation exhibited contrasting trends across the three districts (figure 1, 2, & 3). The Chitradurga district remained the major pomegranate-growing district during the initial years consistently reported the highest area under cultivation 10,871 ha in 2015-16. This was followed by a consistent decline, reaching a low of 4,361 ha in 2020-21, before marginally increased in 2021-22 (4,629 ha). The district showed the highest production about 1.46 Lakh MT with the productivity of 13.42 Ton/ha during 2015-16, which corresponded to the maximum area and high

productivity of 13.42 Ton/ha. However, a subsequent decline in both parameters was observed, mainly due to

bacterial blight incidence, water scarcity and market fluctuations.

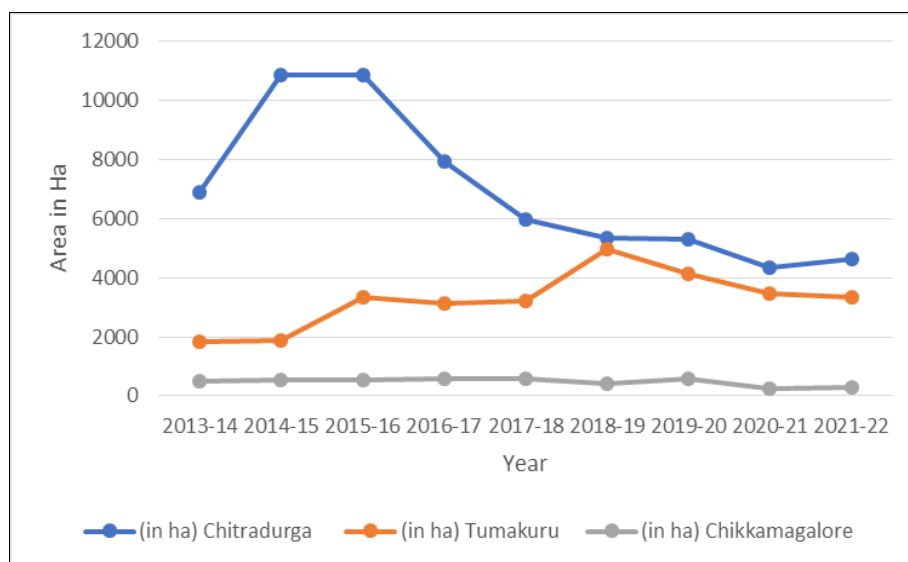


Fig 1: Trends in area of pomegranate crop in Chitradurga, Chikkamagalore and Tumakuru during 2013 to 2021

The Tumakuru witnessed a relatively stable and increasing trend in area until 2018-19, with a substantial peak at 4,951 ha of area, indicating a growing interest in pomegranate cultivation. District demonstrated significant growth in production, notably from 2015-16 onward, achieving its 42,228 MT with the productivity of 10.18 Ton/ha during 2019-20. This can be ascribed to both increased area and a notable improvement in productivity, which may be due to

the adoption of micro-irrigation and high-density planting techniques. The improved irrigation infrastructure, area expansion programme and enhanced extension services under NHM lead to increase in the areas under cultivation. However, slight fluctuations thereafter indicate potential climatic constraints and economic considerations affecting crop sustainability.

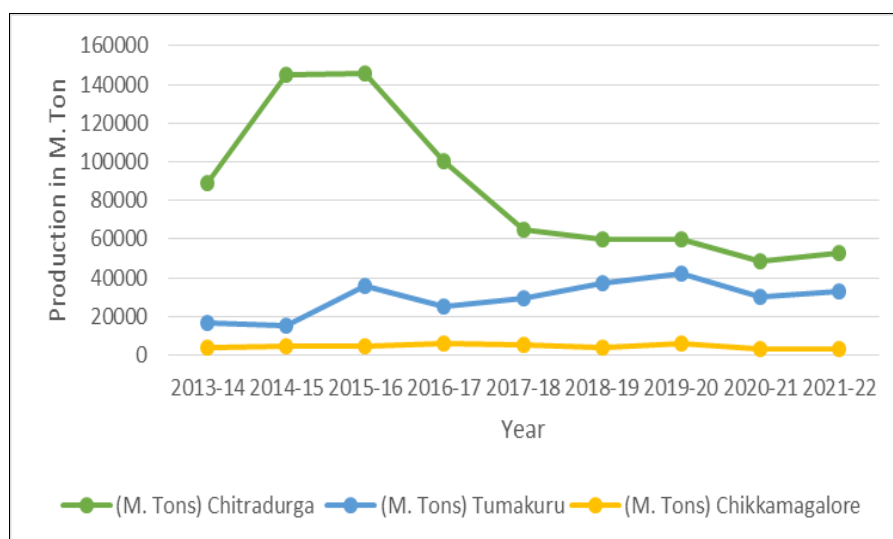


Fig 2: Trends in production of pomegranate crop in Chitradurga, Chikkamagalore and Tumakuru during 2013 to 2021

However the Chikkamagaluru district maintained the lowest area under cultivation among the three districts. However, the area increased steadily until 2019-20 (570 ha), with a sharp decline in 2020-21 (245 ha). Despite its lower area, emerged as a district with notable productivity growth in

recent years, culminating at 11.98 Ton/ha in 2021-22. The reasons are likely due to terrain-specific challenges and relatively less favourable agro-climatic conditions for pomegranate, followed by marginal recovery in 2021-22.

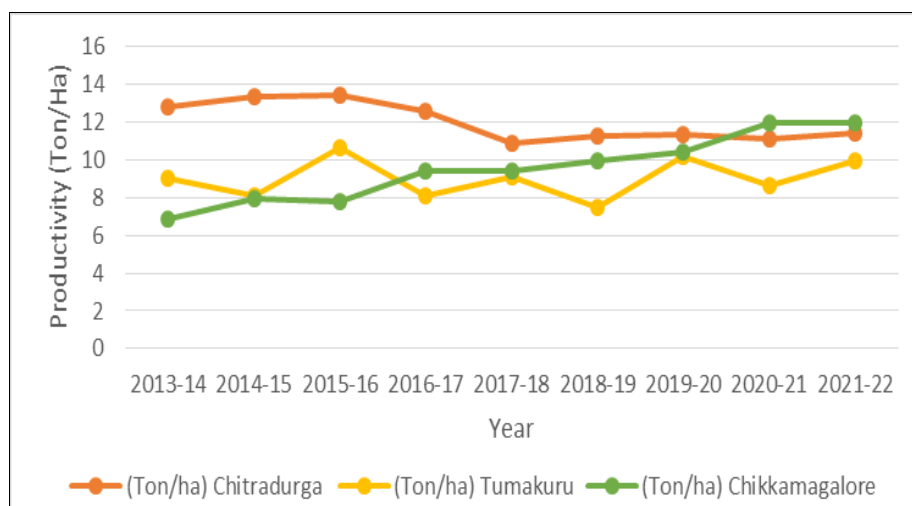


Fig 3: Trends in productivity of pomegranate crop in Chitradurga, Chikkamagalore and Tumakuru during 2013 to 2021

3.1.3 Chilly

Table 2 revealed the change in area, production and productivity of chilly in Chitradurga, Tumakuru and Chikkamagalore districts. In Chitradurga district, the area under chilly cultivation showed a gradual increase from 1,511 ha in 2013-14 to a peak of 3,445 ha in 2018-19, indicating increased adoption of chilly cultivation during this period. However, a sudden drop was observed in 2019-20 (643 ha), possibly due to climatic constraints or market failures. The area then recovered significantly to 3,124 ha in 2021-22, indicating resilience and renewed interest among farmers.

Production followed a similar trend, rising from 15,288 MT in 2013-14 to a maximum of 36,936 MT in 2021-22. Despite the sharp drop in area during 2019-20, the production remained fairly strong (7,423 MT), supported by improved productivity in that year. The productivity of chilly in Chitradurga ranged between 9.86 t/ha (2020-21) and 12.52 t/ha (2016-17). The average productivity remained moderately stable across the years, suggesting

consistent management practices, though there is scope for improvement through better input management, pest control, and irrigation practices.

Tumakuru district demonstrated significant growth and consistent performance in chilly cultivation. The area under cultivation increased from 912 ha in 2013-14 to 2,091 ha in 2021-22, showing a gradual and sustained expansion. This reflects a growing preference for chilly as a commercial crop in the district. Production figures improved substantially, from 13,315 MT in 2013-14 to 37,056 MT in 2021-22, representing nearly a three-fold increase. This increase was driven by both expansions in area and high productivity levels. Tumakuru consistently recorded the highest productivity among the three districts, with values ranging from 12.6 t/ha (2018-19) to a peak of 29.35 t/ha (2019-20). This indicates the successful adoption of improved agronomic practices, better irrigation systems, use of quality seeds, and timely plant protection measures. Tumakuru sets a model for other districts in terms of chilly crop efficiency and profitability.

Table 2: Area, production and productivity of chilly in the Chitradurga, Tumakuru and Chikkamagaluru districts

Sl. No.	Year	Area (in lakh ha)			Production (M. Tons)			Productivity (Ton/ha)		
		CTA	TUM	CKM	CTA	TUM	CKM	CTA	TUM	CKM
1	2013-14	1511	912	802	15288	13315	8152	10.12	14.6	10.16
2	2014-15	1886	912	816	19036	13204	8298	10.09	14.48	10.17
3	2015-16	2119	1316	855	23686	19535	9396	11.18	14.84	10.99
4	2016-17	2401	1393	420	30066	19510	5343	12.52	14.01	12.72
5	2017-18	2967	1388	643	31034	21188	9000	10.46	15.27	13.99
6	2018-19	3445	1250	488	34147	15755	6116	9.91	12.6	12.52
7	2019-20	643	838	212	7423	24606	2011	11.55	29.35	9.49
8	2020-21	3408	1431	230	33597	26247	2519	9.86	18.34	10.96
9	2021-22	3124	2091	359	36936	37056	3240	11.82	17.72	9.03

Note: CTA- Chitradurga, TUM- Tumakuru, CKM- Chikkamagaluru

Chikkamagaluru district exhibited a declining trend in all three indicators—area, production, and productivity. The area under chilly cultivation reduced from 802 ha in 2013-14 to just 359 ha in 2021-22, indicating a steady withdrawal from chilly cultivation over the years. This trend may be attributed to crop diversification, climatic issues, or declining market returns. Production also declined accordingly—from 8,152 MT in 2013-14 to 3,240 MT in 2021-22. However, occasional spikes in productivity

mitigated the drop to some extent in certain years. For example, in 2017-18, the productivity rose to 13.99 t/ha, the highest in the district during the period. Overall, productivity in Chikkamagaluru ranged from 9.03 t/ha (2021-22) to 13.99 t/ha (2017-18). The inconsistent performance indicates the need for technical guidance, input accessibility, and market support to stabilize and improve chilly cultivation in the region.

3.1.4 Onion

The figure 3, 4 & 5 shows the area, production, and productivity of onion across three major districts of Karnataka-Chitradurga, Tumakuru and Chikmagalur over a nine-year period from 2013-14 to 2021-22.

The Chitradurga district emerged as the leading district in terms of area, showing a remarkable expansion from 17,055 ha and 3.31 lakh MT of production in 2013-14 to 40,224 ha and 7.83 lakh MT of production in 2021-22. The sharpest

increases occurred during 2014-15 (28,914 ha), 2016-17 (32,887 ha), and 2020-21 (38,110 ha). This expansion may be attributed to favourable climatic adaptability, market opportunities. The strong correlation between area and production suggests that scaling of area, along with supportive NHM interventions such as support for micro-irrigation systems, and establishment of Onion Storage Structures (OSS) played a key role in minimizing post-harvest losses and stabilizing market supply.

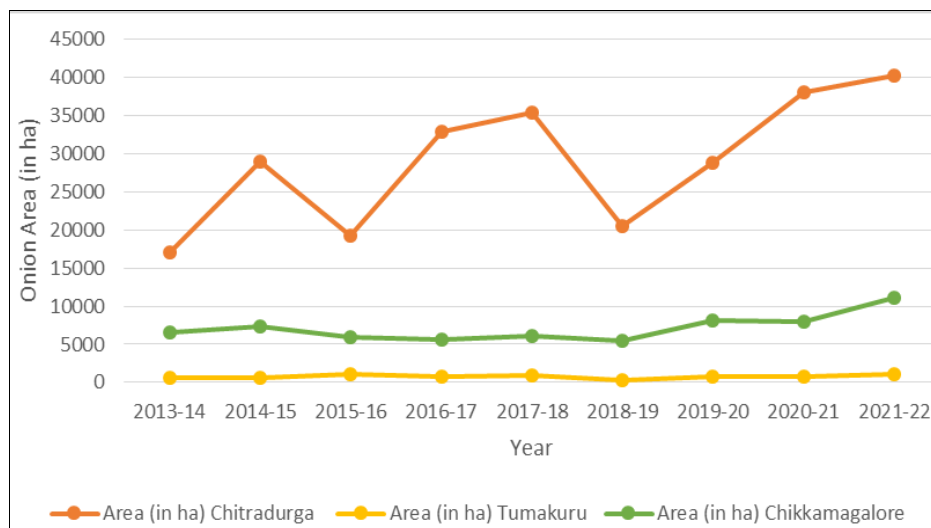


Fig 4: Trends in change area of onion crop production in Chitradurga, Chikmagalur and Tumakuru during 2013 to 2021

The Tumakuru district, in contrast, maintained a relatively lower and fluctuating area under cultivation, ranging between 281 ha and 5902 MT during 2018-19 and 1,111 ha 19,520 MT during 2015-16. This modest area may reflect

limited adoption of onion as a commercial crop, likely due to competition with other horticultural or food crops, lesser investment in onion-specific infrastructure, or challenges in market linkage.

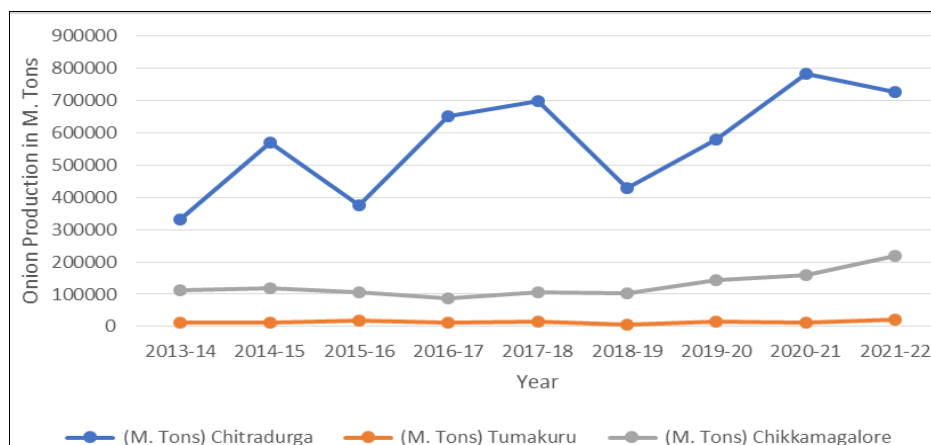


Fig 5: Trends in production of onion crop in Chitradurga, Chikmagalur and Tumakuru during 2013 to 2021

However, the steady increase from 686 ha in 2020-21 to 1,093 ha in 2021-22 could point towards renewed interest, possibly triggered by higher market prices and NHM-induced support for input access and training. This upward trend suggests a renewed interest among farmers in onion cultivation, which may be attributed to favourable market conditions, including higher price realization and improved market access. Furthermore, this growth likely reflects the influence of targeted interventions under the National Horticulture Mission (NHM), which facilitated access to

quality inputs farmer capacity-building programs and post-harvest infrastructure solution. These interventions of NHM might have contributed to the enhanced viability and attractiveness of onion as a profitable crop in the district. The Chikmagalur district experienced a consistent increase in the area under onion cultivation, from 6,521 ha in 2013-14 to 11,171 ha in 2021-22 and substantial rise in production, particularly between 1.01 lakh MT in 2018-19 and 2.22 lakh MT in 2021-22 with stabilized productivity of 19.75 Ton/ha.

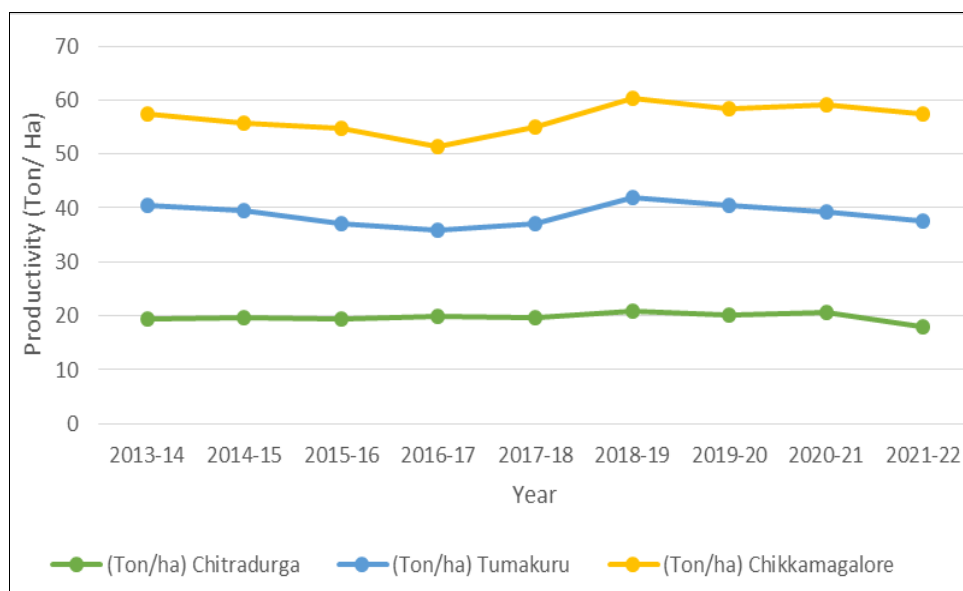


Fig 6: Trends in productivity of onion crop in Chitradurga, Chikkamagalore and Tumakuru during 2013 to 2021

3.1.5 Compound Annual Growth Rate (CAGR)

The Compound Annual Growth Rate (CAGR) analysis (Table 3) revealed distinct growth patterns among the selected crops and districts. Banana recorded a decline in cultivated area across all districts; however, Tumakuru achieved significant productivity growth (4.64%), indicating

efficient resource utilization and improved crop management. Pomegranate exhibited significant negative growth in area and production in Chitradurga and Chikkamagaluru, whereas Tumakuru recorded significant positive growth, highlighting the successful adoption of NHM-supported technologies.

Table 3: Trends in area, production and productivity of banana, pomegranate, onion and chilly in central dry zone area during 2013-2021 (9 years)

Particular	Chitradurga			Chikkamagaluru			Tumakuru		
	Area %	Production %	Productivity %	Area %	Production %	Productivity %	Area %	Production %	Productivity %
Banana	-1.59	-0.81	0.79	-9.63**	-10.02**	-0.44	-1.04	3.56	4.64**
Pomegranate	-9.78**	-11.98**	-2.44**	-8.23**	-1.74	7.05	8.98**	9.82**	0.76
Chilly	4.53	5.20	0.64	-14.86**	-15.66**	-0.92	6.29	11.26*	4.68
Onion	7.97**	7.88**	-0.08	5.14	7.60**	2.12**	1.91	2.11	0.20

Chilli cultivation showed the highest production growth in Tumakuru (11.26%), while Chikkamagaluru experienced a significant contraction in area and production. Onion registered the most favourable growth, particularly in Chitradurga, where significant increases in area (7.97%) and production (7.88%) were observed. These findings demonstrate that NHM interventions have contributed substantially to horticultural development in the Central Dry Zone, although the magnitude of impact varied across districts depending on agro-climatic suitability, technology adoption and market opportunities.

4. Conclusion

Overall, the study indicates that NHM interventions have positively influenced the expansion of horticultural crops through improved production technologies, micro-irrigation, quality planting materials and post-harvest infrastructure. Nevertheless, district-specific constraints such as water scarcity, pest and disease incidence, climatic variability and market fluctuations continue to influence crop performance. Therefore, future NHM strategies should focus on location-specific technological interventions, climate-resilient production practices, strengthening extension services and improving market infrastructure to ensure sustainable

horticultural development in the region.

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