

Review Article

EXPLORING THE HORTICULTURAL SECTOR IN ARUNACHAL PRADESH: STATUS AND PROSPECTS

Abstract

Arunachal Pradesh is located in the North-Eastern part of India and is rich in diversity, flora and fauna. The state has great potential for growing crops, fruits, vegetables, spices, flowers and medicines. Horticulture, especially fruit crops like citrus, apple and kiwi fruit, contributes to livestock income, economic growth and security. However, the state's natural resources are not being fully utilized due to changes in wealth and food security concerns. Agriculture is seen as a way to reduce the impact of civilizational change while improving the economic health and balance of nature of the country. Arunachal Pradesh's production of aromatic and medicinal plants remained relatively stable at 0.16 to 5.15 metric tonnes. However, cut and cluster flower production decreased while honey increased slightly. The area under cultivation increased slightly between 2020 and 2024, but the area under aromatic and medicinal plants remained stable.

Keywords: *Arunachal Pradesh, North-East, Apple, Kiwis, Aromatics, Area, Production*

1. INTRODUCTION

Northeast India is home to the state of Arunachal Pradesh, often called the "Land of the Rising Sun", and the Orchid State of India. It is the largest state in the east, covering an area of 83,743 square kilometres. These states share borders with Assam and Nagaland and Bhutan shares borders with China and Myanmar. Located between the Patkoi range and the foothills of the Himalayas, Arunachal Pradesh has a unique landscape, flora and fauna. Aqueducts and canals, which are tributaries of the Brahmaputra River, also pass through here [14-16]. The state has great potential for the development of crops, fruits, vegetables, spices, flowers and pharmaceuticals. Horticulture is widely marketed for its valuable food and is an important means of survival contributing to livestock income and economic growth. Sustainability and environmental protection are additional benefits of horticultural diversification. The increasing demand for horticultural produce worldwide provides many opportunities for business growth. Despite Arunachal

Pradesh's natural resources, its development potential is yet to be tapped. The transformation of civilization poses a threat to the environment and with population growth outpacing food production, concerns about food security are intensifying [17-20].

Agriculture is believed to be a way to reduce the impact of civilizational change while improving the health and natural balance of the country. Arunachal Pradesh is the second largest fruit producer in the east after Assam. The state government has encouraged horticulture as an alternative to animal husbandry. Although it requires more investment, horticulture – especially fruit crops such as citrus, apple and kiwi – is considered more profitable than other forms of agricultural training. The businesses benefit the farmers and their livelihoods by creating employment, increasing exports and ensuring food security.

Although plant-based products have been successful for many years, there are still problems such as poor access and poor communication. The objective of this study is to assess the spread of rice cultivation in Arunachal Pradesh, its contribution to the thrift policy of the state and the reasons behind its development[1,2].

2. CONCEPT OF HORTICULTURE CROP IN ARUNACHAL PRADESH.

The production of fruits, vegetables, spices, flowers, plantation crops, and aromatic & medicinal plants in Arunachal Pradesh is referred to as horticulture. A wide range of horticultural crops can be grown in the state because to its distinctive terrain, which is marked by a variety of climatic zones and an abundance of natural resources. In Arunachal Pradesh, horticulture is vital to the state's agricultural economy since it creates jobs, improves food security, and helps local farmers make money [13].

3. AGRO-CLIMATE ZONES

The diverse temperature and elevation of Arunachal Pradesh enable the production of a broad variety of crops, ranging from temperate crops in higher elevations to Sub-tropical fruits in lower elevations [13].

4. FRUIT CULTIVATION

Arunachal Pradesh's horticulture heavily relies on fruit production. Citrus fruits like oranges and lemons, as well as exotic fruits like kiwis, which have become more and more popular in recent years, are produced in great quantities throughout the state. The practice of growing apples & kiwi commercially at higher elevations is also becoming more popular [13].

5. PRODUCTION OF VEGETABLES

The vegetable market is smaller, it still includes leafy greens, cauliflower, peas, and cabbage. Although there is room for expansion and commercialization, vegetables are primarily farmed for local use in kitchen gardens and on small farms [13].

6. AROMATIC PLANTS AND SPICES

Arunachal Pradesh is well-known for growing spices, especially ginger, which is a significant cash crop there. An additional common spice is turmeric [13].

7. OBJECTIVES OF THE STUDY

- To study the trends in area under cultivation of major horticultural crops in Arunachal Pradesh from 2014-2015 to 2023-2024.
- To study the trends in production and productivity of major horticultural crops in Arunachal Pradesh from 2014-2015 to 2023-2024.

8. TOOLS OF ANALYSIS

- To find the Compound annual growth rate and Average.

9. PERIOD OF THE STUDY

- The study period was from 2014-15 to 2023-24 (agricultural year).

10. Table 1- MAJOR FRUIT CROPS IN ARUNACHAL PRADESH

MAJOR FRUIT CROPS IN ARUNACHAL PRADESH, 2024			
			Area in '000 Ha
			Production in '000 MT
Sl. No.	Fruits	Area	Production
1	Citrus	12.79	58.93
2	Apple	3.57	6.79
3	Kiwi	2.43	7.05
4	Pineapple	3.23	20.52
5	Litchi	0.10	0.08
6	Papaya	0.15	0.60
7	Mango	0.00	0.01
8	Banana	3.63	14.49

Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

11. Table 2- MAJOR VEGETABLE CROPS IN ARUNACHAL PRADESH

MAJOR VEGETABLES CROPS IN ARUNACHAL PRADESH			
			Area in '000 Ha
			Production in '000 MT
Sl. No.	Vegetables	Area	Production
1	Tomato	0.15	0.88
2	Potato	0.45	6.07
3	Chile	0.24	0.37
4	Cabbage	0.35	5.03

5	Pea	0.06	0.12
6	Brinjal	0.24	0.81
7	Carrot	0.04	0.45
8	Cucumber	0.04	0.12
9	Bottle Gourd	0.00	0.03
10	Pumpkin	0.10	0.71

Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

12. Table 3- MAJOR SPICES IN ARUNACHAL PRADESH

MAJOR SPICES IN ARUNACHAL PRADESH			
Area in '000 Ha			
Production in '000 MT			
Sl. No.	Spices	Area	Production
1	Ginger	3.78	18.43
2	Cardamom	6.74	1.72
3	Turmeric	0.54	1.47
4	Black Papper	0.05	0.01
5	Red Chillies (Dried)	0.01	0.02

Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

13. AREA UNDER HORTICULTURE CROPS IN ARUNACHAL PRADESH

The table shows changes in fruits, vegetables, plantation crops, aromatics & medicinal plants, flowers, and spices, as well as data on the area under horticultural crops in Arunachal Pradesh from 2014–2015 to 2023–2024[3-12].

Table 4- Area under Horticulture crops in Arunachal Pradesh

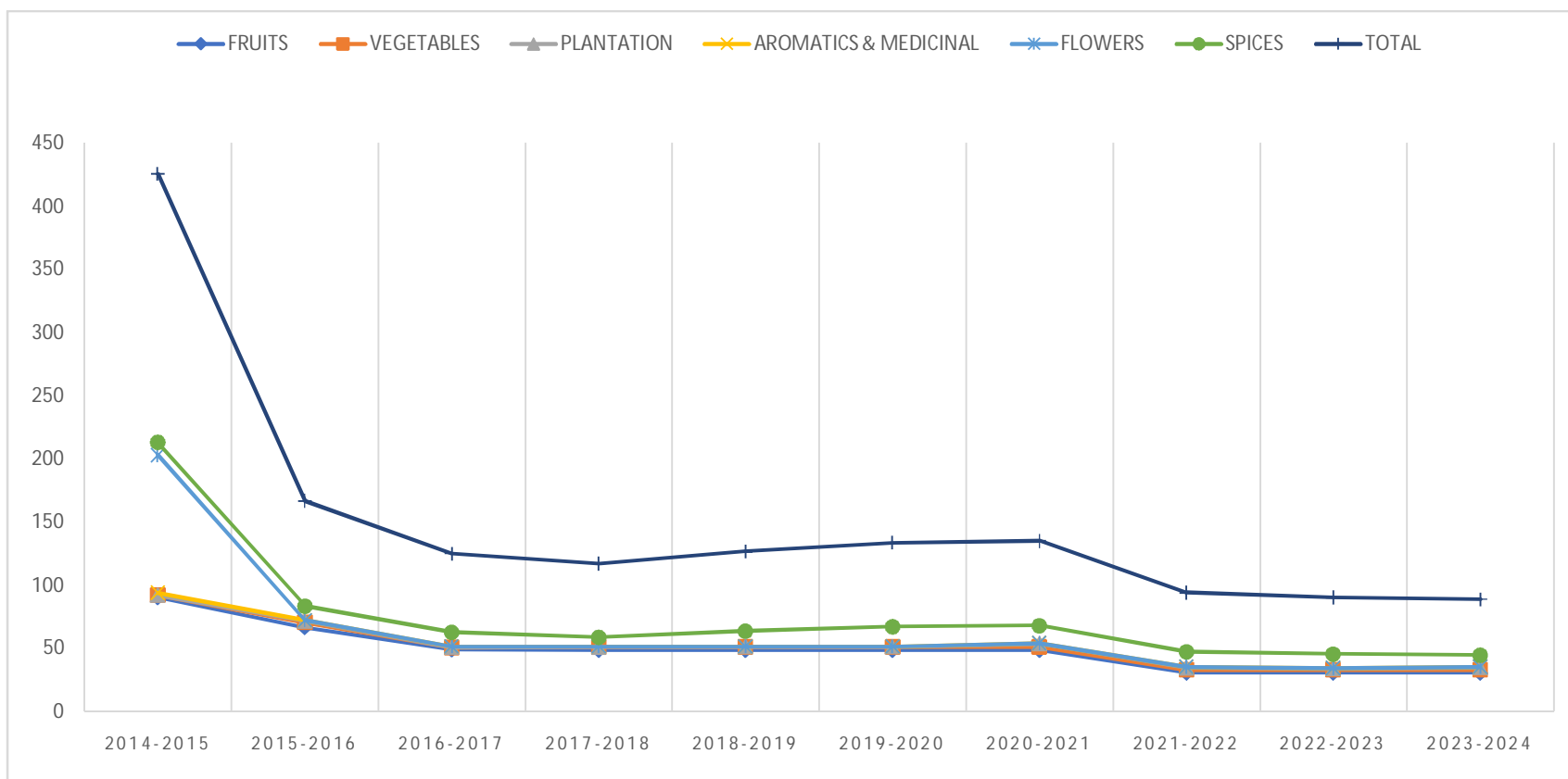
<u>Area under Horticulture crops in Arunachal Pradesh</u> Area in '000 Ha
Production in '000 MT

Sl. No.	YEARS	FRUITS	VEGETABLES	PLANTATION	AROMATICS & MEDICINAL	FLOWERS	SPICES	TOTAL
1	2014-2015	90	1.7	0.02	1.86	109.18	10	212.76
2	2015-2016	66.21	4	1.09	0.46	0.02	11.44	83.22
3	2016-2017	48.71	1.75	0.07	0.46	0.02	11.44	62.45
4	2017-2018	48.13	2.58	0.06	0.25	0	7.48	58.5
5	2018-2019	48.14	2.62	0.07	0.24	0	12.1	63.17
6	2019-2020	48.14	2.62	0.07	0.24	0	15.62	66.68
7	2020-2021	48.14	2.62	2.67	0.24	0	13.86	67.54
8	2021-2022	30.09	2.62	1.6	0.24	0	12.33	46.88
9	2022-2023	30.09	2.62	0.89	0.24	0	11.21	45.05
10	2023-2024	30.09	2.62	1.8	0.24	0	9.53	44.28
AVERAGE		48.77	2.58	0.83	0.45	10.92	11.5	75.05
CAGR		-0.1	0.04	0.57	-0.18	-0.66	0	-0.15

Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

The acreage and output values are expressed in thousand hectares ('000 Ha) and thousand metric tons ('000 MT), respectively. Despite a discernible decrease from 90 thousand hectares in 2014–2015 to 30.09 thousand hectares in 2021–2022, fruits continue to occupy the largest area[3-12].

The number of vegetables has fluctuated little, beginning at 1.7 thousand hectares in 2014–2015 and progressively increasing to 2.62 thousand hectares by 2018–2019, where it will remain until 2023–2024. The slight but steady growth in plantation crops—especially in 2020–2021 with 2.67 thousand hectares—indicates a growing interest in this market[3-12].



Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

Fig 1- Area under horticulture crops from 2014-2024

Due to less focus on these crops, aromatics and medicinal crops saw a sharp decline from 1.86 thousand hectares in 2014–2015 to just 0.24 thousand hectares after that. Following 2014–2015, the flower segment saw a dramatic drop from a noteworthy 109.18 thousand MT to zero in the following years, signifying a total departure from large-scale flower farming. Though they have decreased during the past two years, spices have remained consistent, ranging between 10 and 15.62 thousand MT[3-12].

14. PRODUCTION OF HORTICULTURE CROPS IN ARUNACHAL PRADESH

With an emphasis on the contributions of fruits, vegetables, plantation crops, aromatics & medicinal plants, flowers, as well as spices, the table shows the production of horticultural crops in Arunachal Pradesh from 2014–2015 to 2023–2024. The area is represented in thousand hectares ('000 Ha), while the data is evaluated in thousand metric tons ('000 MT)[3-12].

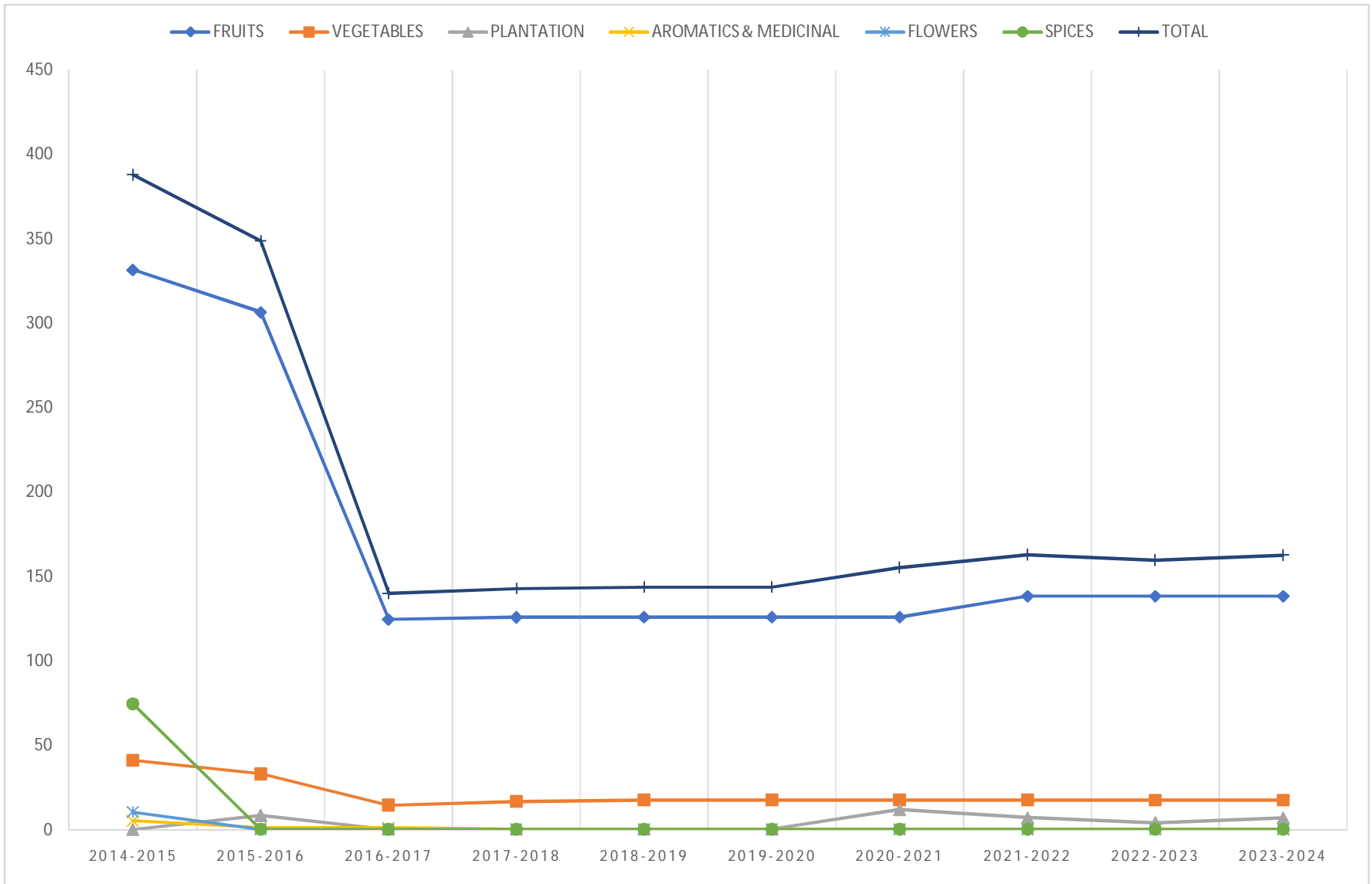
Table 5- Production of Horticulture crops in Arunachal Pradesh

Production of Horticulture crops in Arunachal Pradesh Area in '000 Ha								
Production in '000 MT								
Sl. No.	YEARS	FRUITS	VEGETABLES	PLANTATION	AROMATICS & MEDICINAL	FLOWERS	SPICES	TOTAL
1	2014-2015	331.4	41	0.01	5.15	10.17	74.44	387.73
2	2015-2016	306.27	33.01	8.33	0.99	0.01	0.08	348.62
3	2016-2017	124.38	14.42	0.1	0.99	0.01	0.08	139.91
4	2017-2018	125.7	16.6	0.14	0.16	0	0	142.61
5	2018-2019	125.84	17.39	0.21	0.16	0	0	143.6
6	2019-2020	125.84	17.39	0.21	0.16	0	0	143.6
7	2020-2021	125.84	17.41	11.76	0.16	0	0	155.18
8	2021-2022	138.16	17.41	7.05	0.16	0	0	162.78
9	2022-2023	138.16	17.34	3.89	0.16	0	0	159.55
10	2023-2024	138.16	17.34	6.88	0.16	0	0	162.54
AVERAGE		167.98	20.93	3.86	0.83	1.02	7.46	194.61
CAGR		-0.08	-0.08	0.92	-0.29	-0.56	-0.64	-0.08

Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

With 331.4 thousand MT, fruits constituted the mainstay of production during the 2014–2015 period, making a substantial contribution to the total of 387.73 thousand MT. Fruit production, however, drastically decreased from 306.27 thousand MT in 2015–2016 to 124.38 thousand MT in 2016–2017. It then stabilized at about 125 thousand MT before rising to 138.16 thousand MT starting in 2021–2022[3-12].

UNDER PEER REVIEW



Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

Fig 2- production of horticulture crops from 2014-2024

Changes in crop focus, cultivation methods, or even market conditions may be the cause of the reduction. The trend for vegetables was likewise erratic, beginning at 41 thousand MT in 2014–2015 and falling to about 14.42 thousand MT in 2016–2017[3-12].

After that, there was a recovery, and starting in 2018–2019, vegetable production stabilized at about 17,000 MT. The growing tendency in veggies can be a sign that horticulture is placing more emphasis on variety. Plantation crop production started out small, at 0.01 thousand MT in 2014–2015, but it grew significantly, peaking at 11.76 thousand MT in 2020–2021. Despite a subsequent minor decline in production, overall increase remained significant, indicating a recent strategic focus on plantation crop. Aromatics and medicinal crops saw a steep reduction in focus or viability, as seen by their sharp decline from 5.15 thousand MT in 2014-2015 to just 0.16 thousand MT in subsequent years. The production of flowers also fell precipitously, from 10.17 thousand MT in 2014–2015 to almost nothing in the following years[3-12].

With a production of 74.44 thousand MT in 2014–2015, the spices segment played a major role at first, but in many years after that, it drastically declined to zero. A small recovery was indicated by its 2023–2024 rebound of 7.46 thousand MT. With a Compound Annual Growth Rate (CAGR) of -0.08 and an average total production of 194.61 thousand MT across all crops, horticulture production has been trending downward over time[3-12]. This negative growth was caused in part by the dramatic reduction in aromatics and flowers, as well as the severe decline in fruits and spices. Vegetables and plantation crops, on the other hand, offered some stability and had been growing or staying relatively constant in recent years. Due to market needs, climate conditions, or agricultural policy, this data suggests a change in the state's agricultural strategy, maybe emphasizing some crops while lowering emphasis on others[3-12].

15.PRODUCTIVITY OF HORTICULTURE CROPS IN ARUNACHAL PRADESH.

The productivity of Arunachal Pradesh's horticultural crops from 2014–2015 to 2023–2024 is shown in the table, which offers information on the following important categories: fruits, vegetables, plantation crops, aromatics & medicinal plants, flowers, and spices. The unit of measurement used to express the productivity data is Thousand metric tons per thousand hectares ('000 MT per '000 Ha). Vegetable productivity peaked in 2014–2015 at 24.12 '000 MT per '000 Ha, which helped to achieve the highest overall productivity of 1.82 '000 MT per '000 Ha. Vegetable productivity fell sharply over time, peaking at 8.25 000 MT per 1,000 Ha in 2015–2016 and then levelling off at 6.6 000 MT per 1,000 Ha in subsequent years. This drop points to either a fall in the emphasis on intensive vegetable growing or a decline in yield efficiency[3-12].

Fruits also fluctuated, peaking at 4.63 '000 MT per '000 Ha in 2015-2016 after beginning at 3.68 '000 MT per '000 Ha in 2014-2015. In the following years, they stabilized at 2.61 '000 MT per '000 Ha. Over the past three years, there has been a rebound, which is indicative of an attempt to increase fruit cultivation efficiency[3-12].

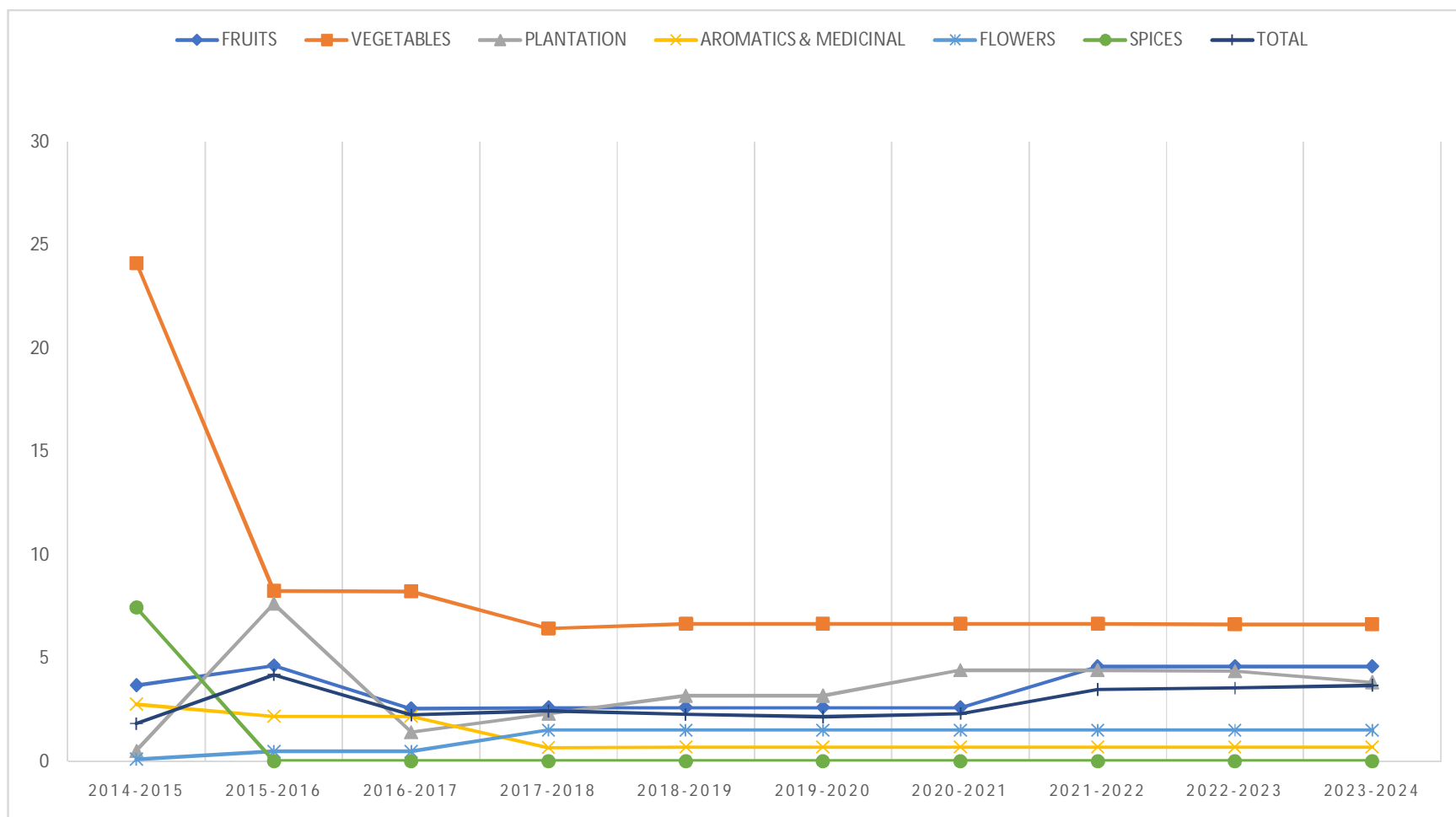
Productivity of plantation crops increased significantly, especially in 2015-2016, when it increased from 0.5 '000 MT per '000 Ha to 7.63 '000 MT per '000 Ha. In the following years, this tendency persisted, with variations ranging from 3.18 to 4.41 '000 MT per '000 Ha[3-12].

Table 6- Productivity of Horticulture crops in Arunachal Pradesh

Productivity of Horticulture crops in Arunachal Pradesh Area in '000 Ha								
Production in '000 MT								
Sl. No.	YEARS	FRUITS	VEGETABLES	PLANTATION	AROMATICS & MEDICINAL	FLOWERS	SPICES	TOTAL
1	2014-2015	3.68	24.12	0.5	2.77	0.09	7.44	1.82
2	2015-2016	4.63	8.25	7.63	2.18	0.47	0.01	4.19
3	2016-2017	2.55	8.23	1.41	2.18	0.47	0.01	2.24
4	2017-2018	2.61	6.43	2.3	0.65	1.5	0	2.44
5	2018-2019	2.61	6.64	3.18	0.67	1.5	0	2.27
6	2019-2020	2.61	6.64	3.18	0.67	1.5	0	2.15
7	2020-2021	2.61	6.64	4.41	0.67	1.5	0	2.3
8	2021-2022	4.59	6.64	4.41	0.67	1.5	0	3.47
9	2022-2023	4.59	6.62	4.36	0.67	1.5	0	3.54
10	2023-2024	4.59	6.62	3.83	0.67	1.5	0	3.67
AVERAGE		3.51	8.68	3.52	1.18	1.15	0.75	2.81
CAGR		0.02	-0.12	0.23	-0.13	0.32	-0.63	0.07

Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

Beginning at 2.77 '000 MT per '000 Ha in 2014-2015 and falling to 0.67 '000 MT per '000 Ha in subsequent years, aromatics and medicinal crops had a significant reduction, suggesting a lack of attention or declining yields. After a brief reduction, flower productivity stayed mostly constant, but spices saw a steep drop from 7.44 '000 MT per '000 Ha to zero for the majority of the time. At a Compound Annual Growth Rate (CAGR) of 0.07, the average total productivity was 2.81 '000 MT per '000 Ha. These patterns, which reflect changes in cultivation techniques or market and environmental conditions, underscore the difficulties Arunachal Pradesh faces in sustaining consistent and effective output across a variety of horticulture crops[3-12].



Source: Data for 2014-2015 to 2023-2024 are taken from Ministry of Agriculture & Farmers Welfare Government of India (2024).

Fig 3- productivity of horticulture crops from 2014-2024

CONCLUSION

Arunachal Pradesh has huge potential for horticulture development due to its unique geographical location and natural resources. Often referred to as the 'Orchid State of India' due to its unique climate and biodiversity, the state is set to become a leader in food production. Despite agricultural challenges and lack of infrastructure and trade, the state's horticulture sector is stable and profitable in terms of agriculture, especially for fruits like citrus, apple and kiwi. As global demand for its products increases, the horticulture industry has the potential to strengthen the economy, ensure food security and promote sustainable development. Arunachal Pradesh can realise its untapped potential by promoting horticulture as a way to reduce environmental degradation and address housing problems. The horticulture sector in Arunachal Pradesh has changed significantly between 2014 and 2024. The area under cultivation has decreased, and the yield of fruits and flowers has decreased. The state's total crop production has decreased, but some good crop like rice have been produced. This decline indicates the need for planning to arrest the decline and increasing the capacity of important crops like spices and vegetables.

REFERENCES

1. Melo, Y., & Das, A. K. Horticulture Crops in Arunachal Pradesh: Growth, Contribution to State Economy and Decomposition Analysis.
2. Mishra, T. S., Mishra, N. K., Singh, H. M., Mishra, K., & Singh, J. Performance of horticultural crops in Arunachal Pradesh with special reference to West Kameng District. *Journal Homepage URL*, 5(2), 173-176.
3. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2014-15).
4. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2015-2016).
5. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2016-2017).
6. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2017-2018).
7. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2018-2019).

8. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2019-2020).
9. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2020-2021).
10. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2021-2022).
11. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2022-2023).
12. Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation & Farmer Welfare, horticulture estimate, 2024 (data estimate for the year 2023-24).
13. Wangchu L., Angami T., Jini D., Bam J., Singh R., Tasung A., Alone R A., Bhagawati K and Suryawanshi A. 2024. Natural Farming: Scope and Prospective in Arunachal Pradesh. ICAR (Research Complex) for NEH Region, Umiam-793103, Meghalaya, 134 p.
14. Lama M. Crop diversification and farm income in the hills of North East India: A Case study of Arunachal Pradesh. International Journal of Food, Agriculture and Veterinary Sciences. 2016;6(2):15-21.
15. Tiwari A, Singh SK, Bora A, Gogoi BJ, Dwivedi SK. Issues, Challenges and Opportunities of Agriculture in West Kameng District of Arunachal Pradesh. Indian Journal of Extension Education. 2022;58(1):111-6.
16. Avasthe R, Babu S, Singh R, Pradhan Y. Prospects and strategies for organic farming in Arunachal Pradesh. Perspective Plan for Resurgent Agriculture and Allied Sector in Arunachal Pradesh. National Bank for Agriculture and Rural Development Publisher. 2013;69.
17. Wangchu L, Angami T, Jini D, Bam J, Singh R, Tasung A, Alone RA, Bhagawati K, Suryawanshi A. Natural Farming: Scope and Prospective in Arunachal Pradesh. ICAR (Research Complex) for NEH Region, Umiam-793103, Meghalaya. 2024.
18. Singh RS. Nature of land use and agricultural change in peripheral regions: a case study of Arunachal Pradesh, India. Spatial Diversity and Dynamics in Resources and Urban Development: Volume 1: Regional Resources. 2015:529-57.
19. Asati BS, Yadav DS. Diversity of horticultural crops in north eastern region. ENVIS Bulletin: Himalayan Ecology. 2004;12(1):1-0.
20. Handique BK, Goswami C, Jena P, Dutta F, Samiam R, Nongrum I, Jha D, Raju PL, Deka CR, Sarma R, Sarmah K. Applications of advanced geospatial technology for expansion of area under horticultural crops in North Eastern region of India. Journal of the Indian Society of Remote Sensing. 2022 Feb;50(2):331-45.