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Agricultural development in Siddipet District: An analysis of food and non - food crops at the Mandal level

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Abstract : The agriculture sector in Telangana State has expanded at an impressive rate since the state's creation. The new Telangana government is implementing a number of programs, including Rythu Bandu, Rythu Bheema, and Mission Kakatiya. One of Telangana's biggest projects is the Kaleshwaram Lift Irrigation Project. The irrigation sector is supported by the Mallanna Sagar and Ranganayak Sagar, which provide a significant amount of water. The main goal of this research is to explain the intra-Siddipet district, or mandal-wise variance in area under food crops and non-food crops, and to look into the reasons behind this significant variation in disparity. The Telangana Government supplied secondary data sources between 2019–20 and 2024–2025, which served as the foundation for the entire study. The study concludes that by constructing a sizable number of irrigation tanks in the study area, the Telangana government began to increase irrigation capacity. Both food and non-food crop production and planted area have significantly grown. The Mandal-wise analysis shows that the irrigated area under food crops in the Siddipet district has changed noticeably during the course of the study. Kondapak, Wargal, Siddipet Rural, Thoguta, and Rayapole are high-growth mandals with a spatial concentration of irrigation advantages, while nearly all other mandals have moderate benefits. Additionally, it is found that the non-food industry has greatly improved.

IndexTerms **- Telangana State; Agriculture; Food crops; Non-food crops, Irrigation**

I. INTRODUCTION

The civilization of India has a solid past; the people who practiced agriculture and produced food crops are the ones we are only following. The primary occupation of the people in our state and nation is agriculture. Nearly 70% of the population is employed in agriculture. In India, crops occupy around 40% of the land, and we are producing high-quality crops with the help of all-natural resources like water, excellent soil, the monsoon, and a tropical climate. It provides them with a source of income. India's geographical characteristics are unique, and its agricultural conditions are favorable. People in developing nations like India who rely on agriculture for their livelihood are still generally far poorer than those who work in other economic sectors, and they make up a sizable portion often the majority of the total population of the impoverished in the nations in which they reside. "The majority of the world's impoverished people depend on agriculture for their livelihood, so understanding the economics of agriculture would help us understand the economics of poverty" (Shultz, 1979).

In India, agriculture plays a major role in the rural economy, particularly in semi-arid areas where production stability is significantly impacted by rainfall unpredictability. Many districts in Telangana have switched from rainfed to irrigate farming methods as a result of the state's notable irrigation expansion during the last ten years. Siddipet district stands out among these as a notable illustration of structural agricultural transformation. The area has experienced substantial change with the construction of irrigation infrastructure, pond restoration, and groundwater use. Historically, the district was defined by a reliance on seasonal rainfall and restricted Rabi farming. Cropping patterns, seasonal intensity, variety, and sustainability results are all impacted by these changes. A thorough comparison of the agricultural transformation in Siddipet district from 2019–20 to 2024–25 is the goal of this study.

II. NEED OF THE STUDY.

In rural States like Telangana, where a significant percentage of the population depends on agriculture for their living, it is especially important for economic growth. Despite a gradual fall in its GDP contribution, agriculture remains the foundation of the rural economy, providing employment, revenue production, and food security. Even after decades of planned development, water resource efficiency is still a big problem, particularly in semi-arid areas. Telangana agriculture has received a lot of attention due to issues like farmer despair and suicides, which are a consequence of systemic flaws including reliance on rainfall and a lack of diversity. Understanding changes in cropping patterns, the spread of irrigation and seasonal stability in this context requires an examination of agricultural development at the district level. The Siddipet district provides a useful framework for examining irrigation-led agricultural change and its implications for sustainable development.

2.1 Review of Literature

Telangana agricultural growth has been primarily fueled by changes in planting patterns, state policy initiatives, and irrigation expansion. Due to semi-arid environments, little canal irrigation, and a significant reliance on groundwater, the Telangana region of undivided Andhra Pradesh historically had variable agricultural performance. Vakulabharanam (2004) showed that regional differences in productivity, cropping intensity, and farm incomes were significantly influenced by irrigation access. Irrigation-led development became a key tactic following Telangana creation in 2014. Surface irrigation was further increased by large-scale lift

irrigation projects, particularly the Kaleshwaram Lift Irrigation Project (KLIP). Irrigation infrastructure is a major factor in short-term output development, especially in paddy agriculture, according to recent geospatial studies (Panjala et al., 2024) that demonstrate quantifiable increases in cropped area and cropping intensity in command regions. At the same time, guaranteed irrigation and procurement support have caused a significant shift in planting patterns toward paddy and maize. Due to inadequate value chains and marketing infrastructure, diversification into high-value horticulture is still unequal despite the tremendous growth in production.

By reducing liquidity restrictions, policy efforts like Rythu Bandhu have aided in the growth of agriculture. After Telangana state became a distinct state in 2014, farmers anticipated significant changes in the agriculture industry. As a result, the Telangana government started a number of initiatives, including free power for farmers, Rythu Bandhu, and Rythu Bheema (Vijay et al, 2023). Critical analyses, however, indicate that complementing expenditures in markets, storage, and extension services are necessary for long-term productivity improvements. Micro-level studies (Reddy, 2016) show continuing intra-regional inequities, with larger landholders benefiting more than small and marginal farmers. Sustainability in the environment is a growing concern. In addition to using a lot of energy, lift irrigation projects pose concerns about the long-term groundwater balance and financial sustainability. In order to evaluate sustainability, comprehensive water-energy-food evaluations are required, even when remote sensing data shows increased vegetation and irrigated land.

2.2 Objectives of the study

The objective of this research is to provide a comprehensive comparative analysis of the Siddipet district's agricultural transformation from study period. In particular, it answers the following research questions:

- To study the rainfall situation of Telangana State
- To explains the intra districts variation of food and non-food crops
- Explores the causes behind this high variation in disparities

III. RESEARCH METHODOLOGY

The article solely relies on secondary data sources. In this regard, the article was analyzed using Telangana Government statistics (Statistical Abstract and Census of India reports) from 2019–20 and 2024–2025. The required maps are also displayed using GIS software. The spatial distribution of rainfall in Telangana is also displayed on rainfall maps created by the Telangana Remote Sensing Application Center. The Siddipet district's historical and current conditions were also greatly aided by the Google Earth engine.

3.1 About study area

After separating from Andhra Pradesh, Telangana became the 29th State in India, on June 2, 2014. The rivers Krishna and Tungabhadra form Telangana southern boundary, while the Penganga, Wardha, Pranahita, and Godavari form its northern boundary. In the west, there isn't anything notable to act as a border. Maharashtra borders the State on both the northwestern and northern sides.

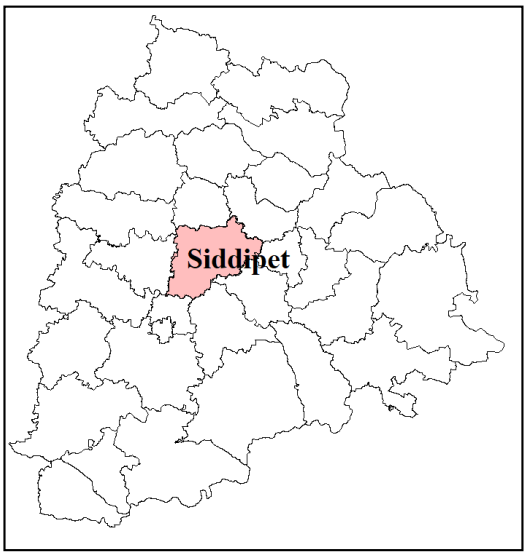


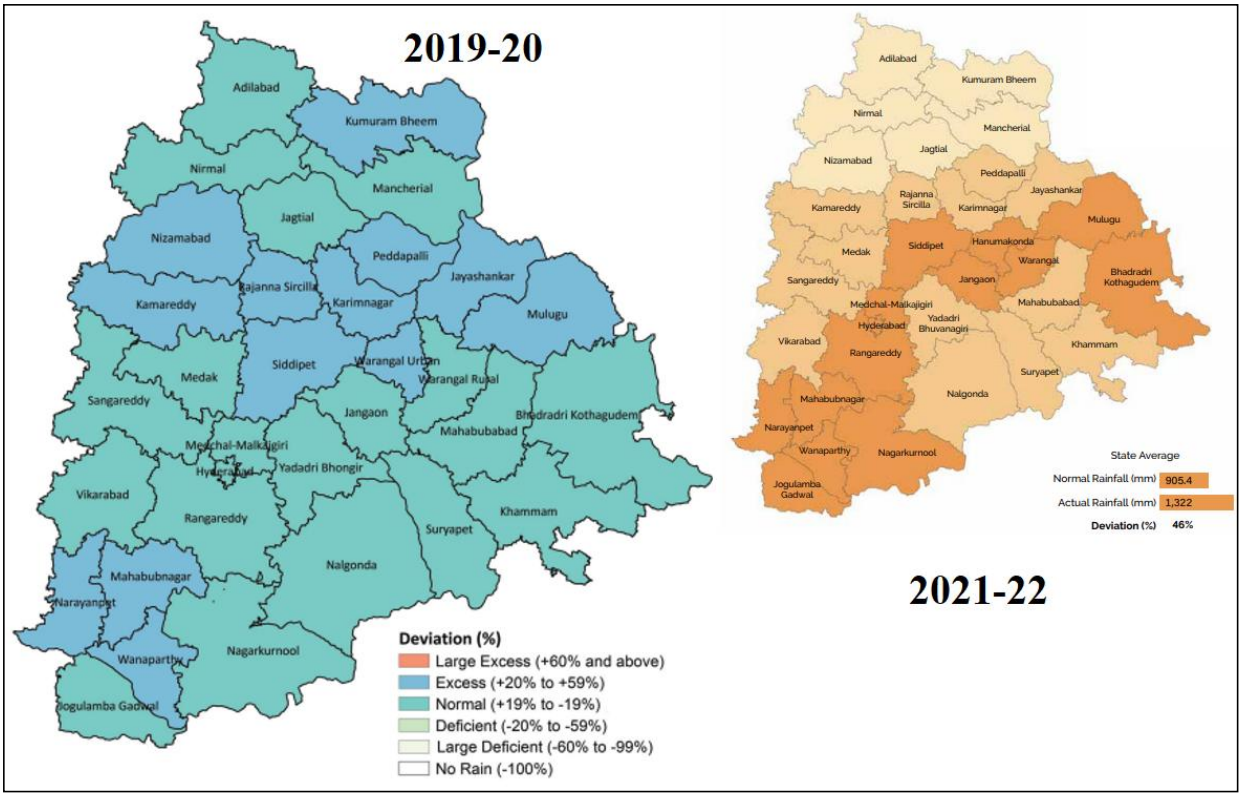
Figure 1: Location of the Siddipet District

The state is bordered to the west by Karnataka, to the northeast by Chhattisgarh, and to the east by Odisha. Telangana State is home to 3,50,03,674 people, 83,03,612 homes, 1,76,11,633 men, and 1,73,92,041 women. Its total land area is 1,12,077 sq.kms. In the state, there are 988 females for every 1000 males. 61% of people live in rural areas, compared to 39% in urban areas. Each sq.kms has 312 people. The literacy rate in the state is 66%. Scheduled Tribes (ST) comprise 9.1% and Scheduled Castes (SC) comprises 15.4%. Most people in rural areas rely on agriculture and related jobs to make a living.The district of Siddipet have 3,632 sq.kms areas. According to the 2011 Census, it has 10.12 lakh populations, and its literacy rate is roughly 62%. In terms of agriculture, rice, maize, castor oil, and pulses are the principal crops. The district is renowned for its ideal oil palm cultivation conditions. The district is home to several important landmarks, including Sri Kondapochamma Temple (Markook), Sri Mallikarjuna Swamy Temple (Komuravelli), and Sri Vidya Saraswati Temple (Wargal). Recreational facilities like Ranganayaka Sagar Reservoir in Siddipet town and Komati Cheruvu (small tank bund) are also located there.

IV. RESULTS AND DISCUSSION

4.1 Rainfall trends

Rainfall is a major factor in Telangana agriculture. The first week of June marked the beginning of the rainy season, which ended in September. The South-West monsoon brings additional rainfall to Telangana. It is more than 800 mm. However, empirical evidence shows that average rainfall is not a common occurrence. The average rainfall in Telangana in 2021–2022 is 905 mm.



Source: Statistical Abstract of Telangana State 2020 and 2022

Figure 2: District wise rainfall in Telangana (2019-20 and 2021-22)

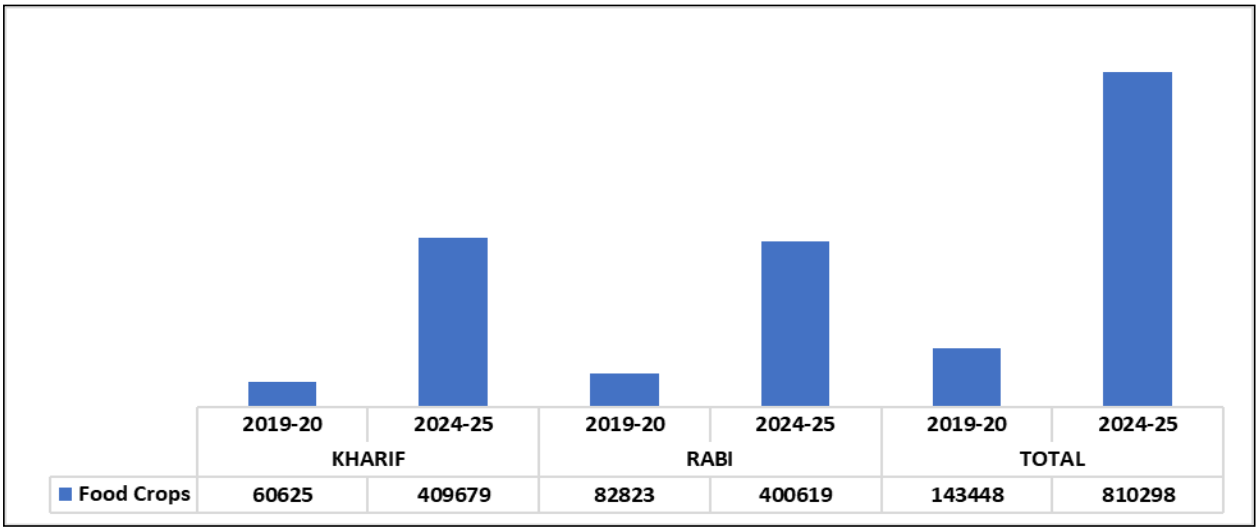
The south-west monsoon provides 80% of the state's rainfall. Based on the State's average rainfall, Komaram Bheem, Mancherial, Bhadradri, and Nirmal receive more than 1100 mm annually, but Mulug district receives the most (1292 mm), followed by Adilabad. Less than 600 mm of rain falls annually in former Mahbubnagar districts such Jogulamba Gadwal (533 mm), Narayanapet, and Wanaparthy. The Siddipet district, the study region, received 1499 mm of rain, 91% more than the typical rainfall of 785 mm. In 2021–2022, the State experienced 1322 mm of annual rainfall, 46% more than the typical amount of 905 mm. Rainfall in the state was 14% more in 2019 than the yearly average of 905 mm. The districts with the most rainfall this year (1647 mm) were Mulugu, Komaram Bheem, Jayashankar, and Nizamabad, which got above 1300 mm of precipitation throughout the state. Additionally, the research area received more than 1050 mm. Out of 33 districts; one fourth (8 districts) had less rainfall than the average rainfall in the state.

Jogulamba received the lowest amount of rainfall, as usual, 561 mm, while Nagar Kurnool received 609 mm. According to the data, the average rainfall in the state is not evenly distributed. Compared to the southern and western parts of the State, Telangana's northern and eastern districts received the most rainfall. The semi-arid climatic zone includes the low rainfall districts, which are structurally vulnerable to drought. Because rainfed and borewell-based agriculture predominates here, there is a greater chance of groundwater depletion. A strategic plan based on the rainfall condition at the district level is required. During the study period, the Siddipet district, the study area, experienced unusually high rainfall. The observed rainfall was 1499 mm, which is a positive departure of 91% from the district's usual annual rainfall of 785 mm. Siddipet is one of the districts with high rainfall in the reference year because of this rainfall, which is greater than the state average of 905 mm. The district received more than 1050 mm of rain in 2019–20 as well, the most in recent memory.

4.2 Agriculture

Historically, the majority of people in our state and nation worked in agriculture. Geographically, our nation is ideal for the agricultural sector. It features a wide range of weather conditions, fertile soils, hilly and plain regions, and other geographical features. Similar favourable geographic circumstances and the Godavari and Krishna rivers can be found in Telangana. Telangana's agricultural sector has evolved over time. Telangana's percentage of fallow land rose from 14% in 1968 to 23% in 2011, according to statistical abstract statistics, indicating that the State's cultivable areas have been growing. As per the Government of Telangana Planning Department (2015), agriculture was one of the many areas of focus in order to realize their vision for the State and half (55%) of the State's workforce was employed in agriculture and associated sectors. Therefore, farming and related activities must

become a viable occupation in order to address poverty challenges. The analysis in this work is limited to the food and non-food crops grown in the Siddipet district over the two seasons (Rabi and Khareef). Telangana has good fertile soils. Major soils are Red and Black. The physiography, climate, and soil of Telangana are diverse. As a result, a wide variety of food crops are grown. The monsoon is the only factor that determines Khareef season. Cotton, maize, jute, rice, jowar, and bazra are among the crops planted during this time. The State's main crop is paddy; the value of other food crops including Jowar, Raagi, and maize crops is dropping. These crops are replaced with cash crops such as sugarcane, chilies, and groundnuts.

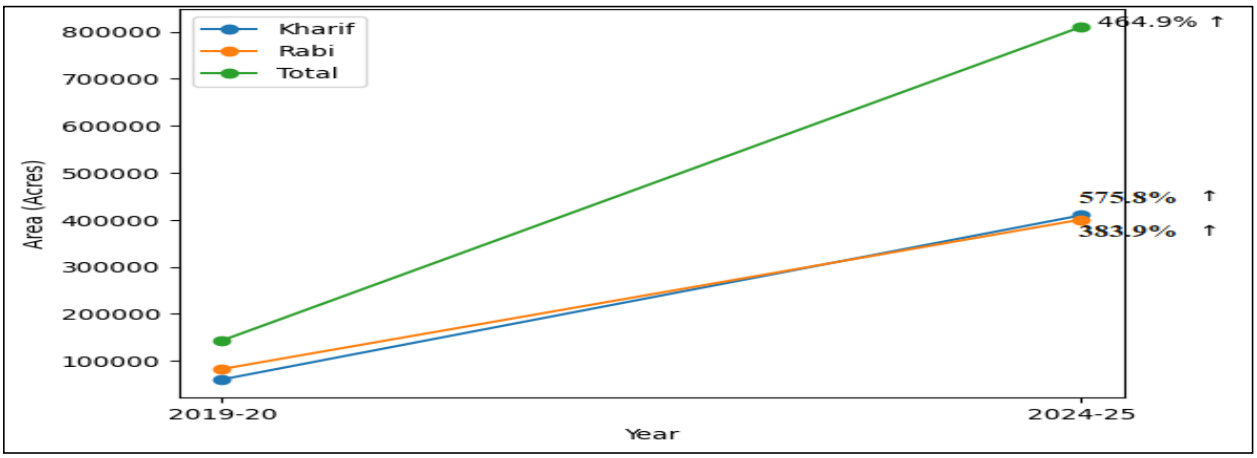


Source: Agriculture Department, Telangana State, 2025

Figure 3: District wise total cropped area in Kharif and Rabi seasons in Siddipet district

4.2.1 Food Crops

In 2019, 42% of the district's total area was Kharif, with the remaining 58% being cultivated during the Rabi season. In contrast, during the 2024–2025 periods, the Kharif and Rabi seasons' cropped areas were nearly equal, meaning that 50% of the entire area was Kharif and Rabi. The irrigated area under food crops grew from 1.43 lakh acres in 2019–20 to 8.10 lakh acres in 2024–25, indicating a remarkable rise of 464.8% over the previous five years, according to district-level data. Seasonally, the Rabi season recorded 383.8% (82823 to 4.00 lakhs) and the Kharif season recorded 575.9% (60625 to 4.09 lakh acres). It is indicating a significant expansion of the district, especially during the Kharif season.



Source: Agriculture Department, Telangana State, 2025

Figure 4: Growth of Food crops area in Siddipet district (In %) (2019-20 to 2024-25)

Table 1: Mandal wise irrigated area under Food crops in Siddipet district (In Acres)

Name of the Mandal	Kharif		Rabi		Total		Growth In %
	2019-20	2024-25	2019-20	2024-25	2019-20	2024-25	
Akbarpet- Bhoompally*		17269		17304		34573	
Akkannapeta	4084	23363	5371	19528	9455	42891	354
Bejjanki	2441	12714	5146	14889	7587	27603	264
Cheriyal	4468	22612	4908	22674	9376	45286	383
Chinnakodur	3933	23512	5017	23479	8950	46991	425
Dhoolmitta*		10429		11526		21955	
Doultabad	1487	16007	3167	17478	4654	33485	619
Dubbak	6391	25805	5669	28280	12060	54085	348
Gajwel	1795	15335	3155	15942	4950	31277	532
Husnabad	3153	13936	3602	13525	6755	27461	307

Jagadevpur	2008	11122	2885	10685	4893	21807	346
Koheda	5693	25654	5749	23900	11442	49554	333
Komaravelly	1980	10855	2610	11273	4590	22128	382
Kondapak	2253	22868	3461	20410	5714	43278	657
Kukunoorpally*		6747		6224		12971	
Maddur	3205	10714	3376	9888	6581	20602	213
Markook	835	9048	1453	8979	2288	18027	688
Mirdoddi	2718	13981	3736	13167	6454	27148	321
Mulug	1985	10268	1581	7639	3566	17907	402
Nanganur	3548	24488	7178	24039	10726	48527	352
Narayanraopet	955	11236	2579	11533	3534	22769	544
Rayapole	949	10590	1143	13313	2092	23903	1043
Siddipet_Rural	1579	14638	2994	14934	4573	29572	547
Siddipet_Urban	1607	14256	2643	13199	4250	27455	546
Thoguta	1648	14938	2956	13215	4604	28153	511
Wargal	1910	17294	2444	13596	4354	30890	609
District Total	60625	409679	82823	400619	143448	810298	465

Source: Agriculture Department, Telangana State, * newly created mandals

4.2.1.2 Intra district (mandal) variations

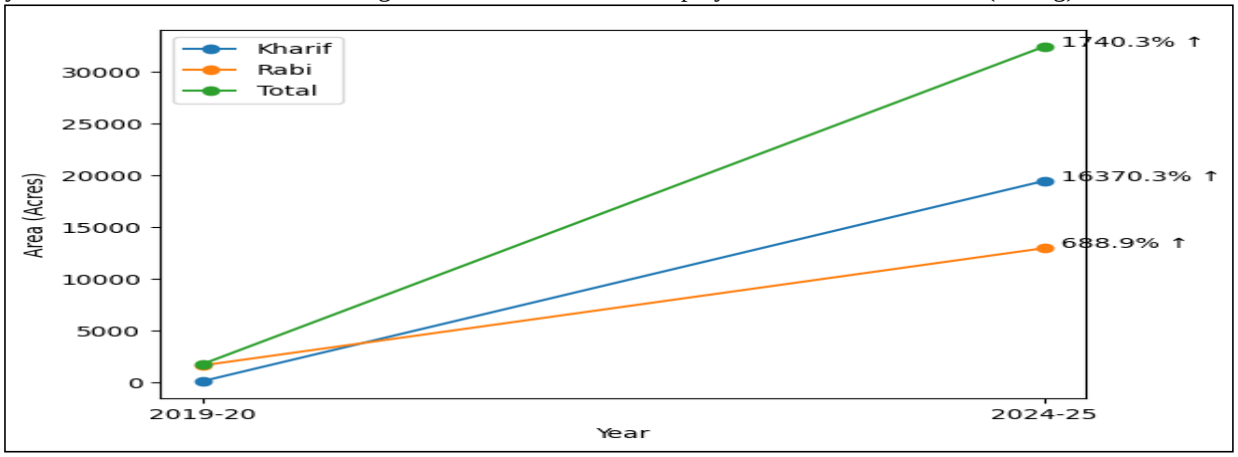
Data is categorized into three groups based on mandal-wise data. Mandals with high growth (above 465%), moderate growth (between 300 and 465%), and lower yet good growth (below 300%). 46 percent is the district average. Accordingly, of the 26 mandals, 38% (10) had strong growth rates, 40% had moderate growth rates, and over 8% had growth rates below 300%. Recently, three more mandals were made; growth in this area is not displayed here. Rayapole, Markook, Kondapak, Doultabad, Wargal, Siddipet Rural, Siddipet_Urban, Narayanraopet, Gajwel, and Thoguta were among the mandals that registered high grwotha rates. Among these, the Rayapole Mandal recorded a growth rate of 1043 percent. In the district's food crops area, Bejjanki and Maddur had the lowest growth rates, while Chinnakodur, Mulug, Cheriyal, Komaravelly Akkannapeta, Nanganur, Dubbak, Jagadevpur, Koheda, Mirdoddi, and Husnabad mandals had intermediate growth rates. Since the creation of the mandals like Akbarpet-Bhoompally, Dhoolmitta, and Kukunoorpally occurred after 2019, growth data is not available.

4.2.2 Non-food crops

One important aspect of this diversification that seems to have gotten little attention is the field of non-food crops. Telangana's climate is perfect for crops other than food. Cash crops, also known as commercial crops, are non-food crops such as sugarcane, tobacco, cotton, jute, and spices. For non-food crops, farmers must pay for fertilizer, seeds, and others. According to Siddipet district data on non-food crop area, the district-level total irrigated area used for non-food crops increased by an incredible 1,740 percent over the period of five years, from 1,760 acres in 2019–20 to 32,389 acres by 2024–2025. Seasonally, the area increased by 16,371 percent, from 118 acres in the Kharif season of 2019–20 to 19,435 acres in 2024–2025. from 1,642 acres in 2019–20 to 12,954 acres in 2024–2025, a 689 percent increase on average when Rabi season arrives. It is evident from the data that the Kharif season is the primary driver of the increase in production of non-food crops.

4.2.2.1 Intra district (mandal) variations

Data is categorized into three groups based on mandal-wise data. Mandals with high growth (above 1740%), moderate growth (between 1000 to 1740%), and lower yet good growth (below 1000%). 1740% growth is the district average. Accordingly, of the 26 mandals, 53% (14) had strong growth rates, 20% had moderate growth rates, and over 12% had growth rates below 1000%. Recently, three more mandals were made; growth in this area is not displayed here and one mandal (Mulug) data is not available.



Source: Agriculture Department, Telangana State

Figure 5: Growth of non-food crops area in Siddipet district (In %) (2019-20 to 2024-25)

Table 2: Mandal wise irrigated area under Non-Food crops in Siddipet district (In Acres)

Name of the Mandal	Kharif		Rabi		Total	
	2019-20	2024-25	2019-20	2024-25	2019-20	2024-25
Akbarpet- Bhoompally		284		200		484
Akkannapeta	2	1344	189	1008	191	2352
Bejjanki	12	577	102	1281	114	1858
Cheriyal	4	982	1	18	5	1000
Chinnakodur	11	1108	40	1968	51	3076
Dhoolmitta		391		14		405
Doultabad	0	249	39	1208	39	1457
Dubbak	1	516	50	53	51	569
Gajwel	3	428	26	869	29	1297
Husnabad	12	752	247	111	259	863
Jagadevpur	12	1141	0	65	12	1206
Koheda	8	1506	136	199	144	1705
Komaravelly	1	677	1	2	2	679
Kondapak	0	1321	5	72	5	1393
Kukunoorpally		817		12		829
Maddur	2	680	17	14	19	694
Markook	6	791	1	23	7	814
Mirdoddi	8	415	60	877	68	1292
Mulug	0	255	0	20	0	275
Nanganur	8	2042	42	361	50	2403
Narayanraopet	5	472	88	146	93	618
Rayapole	0	466	98	1386	98	1852
Siddipet_Rural	5	679	373	560	378	1239
Siddipet_Urban	13	677	27	165	40	842
Thoguta	5	419	57	2139	62	2558
Wargal	0	446	43	183	43	629
District Total	118	19435	1642	12954	1760	32389

Source: Agriculture Department, Telangana State

The non-food area saw the most growth in Komuravelly mandal, followed by Kondapak, Cheriyal, Markook, and Jagdevpur, all of which saw growth rates over 10,000%. The mandals with the lowest growth (below 1000%) rates in the district were Narayanraopet, Husnabad, and Siddipet Rural. The paper finds out that, as a percentage of irrigated land, non-food crops have grown significantly more quickly than food crops. A greater focus on income crops with guaranteed irrigation is evident from the expansion, which has mostly been Kharif-based. From a small (near zero) area in 2019–20 to a large area in 2024–25, several mandals have changed. It is suggested by spatial diversification that irrigation and market orientation will improve stability.

4.2.3 Comparative analysis of Food and Non-Food Crops

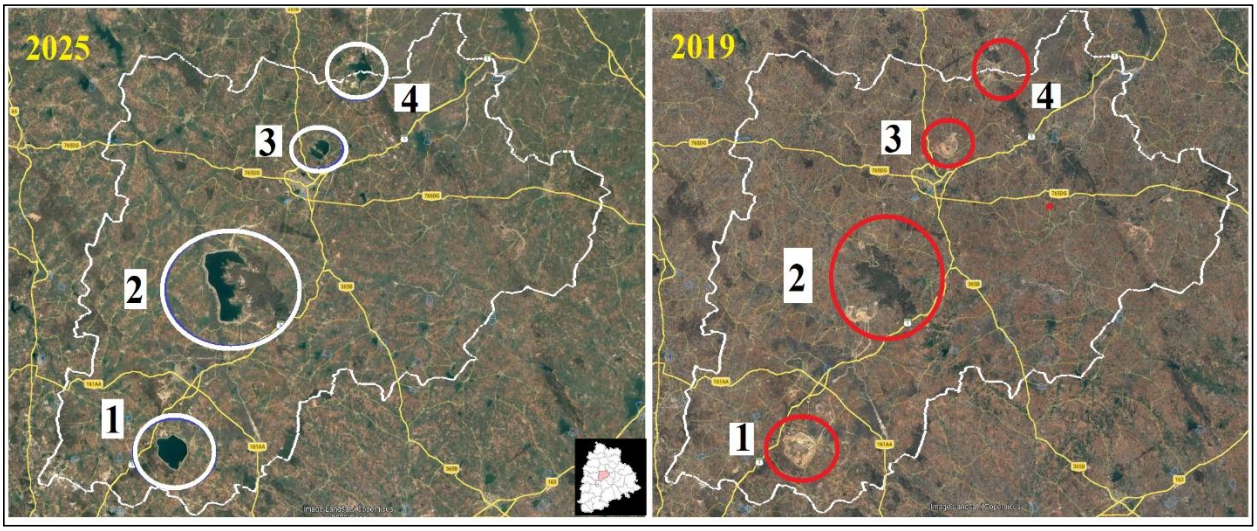
Examining the irrigated land used for food and non-food crops in Siddipet district from 2019–20 to 2024–25 revealed a notable structural shift in agricultural land use patterns. The irrigated area used for food crops at the district level grew from 1.4 lakh acres in 2019–20 to 8.1 lakh acres in 2024–2025, a 464.8% increase. However, the irrigated area used for non-food crops grew from 1,760 acres to 32,389 acres over that time, a notable rise of 1,740.3%. In absolute terms, food crops continue to dominate the cropping pattern, notwithstanding the rapid growth of non-food crops. Food crops will occupy over 96% of all irrigated farmed area in 2024–2025, with non-food crops making up a comparatively minor percentage.

A seasonal comparison reveals that the Kharif season is primarily responsible for the growth in both crop categories. Under Kharif, the area of food crops grew by 575.9%, while the area of non-food crops climbed by an astounding 16,371%. Food crops grew 383.8% and non-food crops grew 688.9% during the comparatively moderate Rabi season. This implies that advances in agricultural intensity and irrigation extension are more likely to occur during the wet season. Crop diversity varies geographically according to zone-wise patterns. The integration of irrigated food production is demonstrated by the notable growth in the area under food crops in mandalas such as Kondapak, Wargal, Siddipet Rural, Thoguta, and Nanganur. In keeping with the new commercial trend, mandals such as Komaravelli, Chinnakodur, Raipol, Nanganur, Thoguta, and Markook exhibit a notable proportional rise in the area planted to non-food crops. A substantially lower percentage in 2019–20 can be linked to the high percentage increase of non-food crops in several zones, suggesting a recent transition rather than a long-term dominance.

4.2.4 Reasons for the high growth

Agriculture in the Telangana region was revolutionized by the building of dams such as Sriram Sagar and Nagarjunasagar after Andhra Pradesh was established. Focus switched from income crops to food crops in the 1970s with the development of hybrid seeds. Farmers have become more vulnerable as a result of their reliance on bore wells as opposed to more conventional irrigation techniques. Crop loans and high-interest borrowing put a heavy financial burden on many farmers, which can result in forced evictions when yields fall short. On the other hand, bigger farmers are able to make investments in their businesses more easily. Numerous irrigation projects were initiated by the new Telangana administration in order to get around the irrigation restrictions. One of these, the Kaleshwaram project, was situated in the Bhupalpalli area, close to the Kaleshwaram temple. It is among the

world's most significant lift irrigation initiatives. It is built on the Godavari with the intention of transferring and using a lot of Godavari water throughout Telangana's thirteen districts. With barrages, reservoirs, pump houses, and lift systems; it is arranged in a number of linkages. Total water routed/produced is 240 TMC, according to project records and audits.



Source: Google Earth, 27th February, 2026;

Figure 6: Spatial variation of the Irrigation facilities in the Siddipet District (2019 &2025); Water Bodies-1) Kondapochamma Reservoir 2) Mallanna Sagar reservoir 3) Ranganayaka Sagar reservoir 4) Ananthagiri reservoir

The large Mallanna Sagar project, which has a water capacity of 50 TMC, was built in the Siddipet district as part of this. In addition to Mallanna Sagar, the Siddipet district also saw the construction of the Kondapochamma Reservoir, Ranganayaka Sagar Reservoir, and Ananthagiri Reservoir. Work on the proposed Gouravelli and Gandipally reservoirs has begun and is nearly finished. The use of satellite or geographical imagery was necessary to determine the causes of this significant expansion. For this aim, two time points—the 2019 and 2025 images—were captured or obtained from Google Earth. The illustration displays the amazing results of the satellite imagery. The Siddipet district's comparison satellite photos demonstrate a noticeable increase in surface water bodies in 2025 that was not apparent in the 2019 image.

The circles in Figure 6 indicate the well-defined definition of irrigation projects (major, medium, and minor tanks) that are now being built. Compared to the 2019 image, which shows partially filled or hydrologically challenged places, the 2025 satellite images show much higher water spread areas. This demonstrates the improvement in hydrology brought about by the closure of the Kondapochamma Reservoir. The Siddipet district's cropping pattern and agricultural growth have been directly impacted by the Mallanna Sagar, Ranganayaka Sagar, and Ananthagiri reservoirs. It also indicates that between 2019 and 2025, the district experienced the following. They are increased reservoir storage levels; rejuvenation and stabilization of minor irrigation tanks; enhanced tank density across the central and peripheral mandals.

IV. Conclusion

Food crops, which are supported by extensive irrigation, make up the majority of the Siddipet district's agricultural system. A reliable irrigation infrastructure and the capacity to double crop are necessary for balanced seasonal food crop cultivation. Although the district is a model for irrigation-based agricultural expansion, long-term sustainability requires government attention to crop diversification and sustainable water management. It seems that real hydrological improvements, rather than merely a statistical expansion, are primarily responsible for the Siddipet district's notable growth in irrigated area and cropping intensity. Surface water growth over the study period seems to provide the basis for accelerating agricultural production and increasing crop variety. Thus, the district's agricultural growth has been structurally supported by the development of the water supply. Notably, almost all mandals under food crops have changed. High-growth mandals like Kondapak, Wargal, Siddipet Rural, Thoguta, and Rayapole have a spatial concentration of irrigation advantages, while almost other mandals show moderate improvements. Over the course of the study, non-food crops' irrigation areas saw substantial changes. When irrigation conditions are improved, mandals like Kondapaka, Komaravelli, Chinnakodur, Nanganur, Thoguta, and Markook clearly turn toward revenue crops.

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