

## **Rice Monoculture and Sustainability Challenges in Nellore District, Andhra Pradesh: Profitability, Policy Dependence, and Farmer Realities**

Siddhardh Reddy Kotamreddy

The International School Bangalore

DOI: 10.46609/IJSSER.2025.v10i10.057 URL: <https://doi.org/10.46609/IJSSER.2025.v10i10.057>

Received: 1 October 2025 / Accepted: 19 October 2025 / Published: 30 October 2025

### **ABSTRACT**

*Rice cultivation dominates the agrarian economy of Nellore district, Andhra Pradesh, supported by favorable climatic conditions and extensive policy incentives such as subsidized water, electricity, fertilizers, and assured procurement. This study investigates the implications of rice monoculture on profitability, sustainability, and farmer livelihoods through a mixed-method approach combining primary survey data from 53 farmers with secondary state- and district-level statistics. Findings reveal that small and marginal farmers, who constitute the majority, continue to cultivate rice across both Kharif and Rabi seasons due to government support and lower perceived risks compared to alternative crops. However, this overdependence on rice has led to serious sustainability concerns, including groundwater depletion, soil degradation from excessive fertilizer and pesticide use, and minimal crop diversification as reflected in a Herfindahl index of 0.94. Market vulnerabilities, storage constraints, and the dominance of intermediaries further limit farmer profitability despite MSP guarantees. The paper argues that while rice remains economically viable in the short term, Nellore's agricultural trajectory is ecologically unsustainable. Policy reforms aimed at promoting diversification, strengthening storage and market infrastructure, and incentivizing drought-resistant alternatives are critical for balancing food security, farmer incomes, and long-term environmental resilience.*

**Key words:** Rice monoculture, Nellore district, Crop diversification, Agricultural sustainability, Herfindahl index

### **1. Introduction**

The agrarian economy of Andhra Pradesh is rooted in rice cultivation, and one district in which this is prominently seen is in the Nellore district. The region has been a centre of rice production for a long time, largely due to its climate and agro-ecological landscape. With an annual rainfall averaging around 1,080 mm, which is driven by both the southwest (June to September) and

northeast monsoons (October to December), and temperatures ranging from 23–36 °C, Nellore supports paddy growth in multiple seasons. This unique climate in Nellore allows for at least two rice crops annually, creating a natural inclination among local farmers toward paddy cultivation. According to research by Ashok Gulati et al., staple crops such as rice have occupied a dominant position in Andhra agriculture, due to favourable ecologies and policy support (state). In addition, Mahendra Dev has emphasized the role of smallholder farmers in sustaining rice output, noting that around 80% of paddy in Andhra Pradesh is grown by small and marginal landholders.

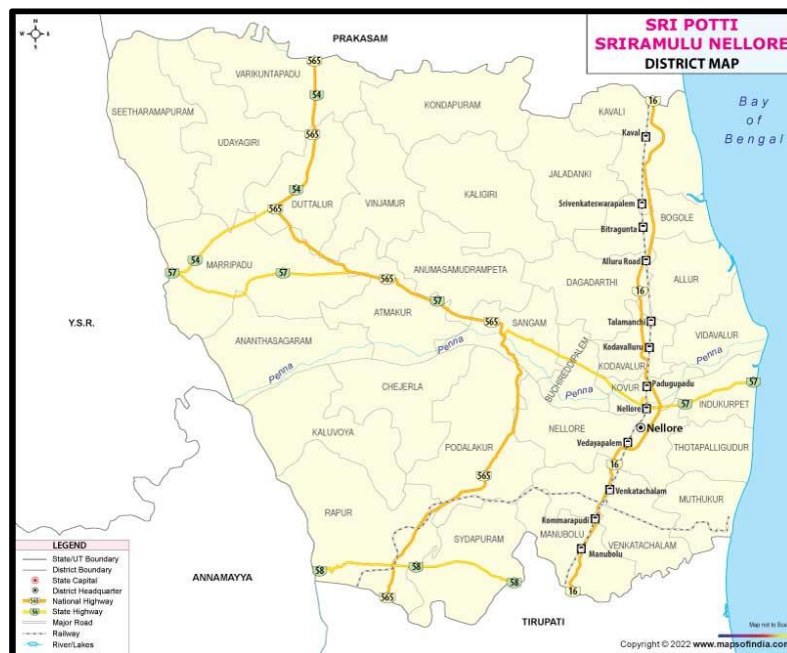
In Nellore, average rice yields (state average yield) surpass the state average, reaching approximately 4,473 kg/ha, one of the highest across Andhra Pradesh's districts. However, despite its climatic suitability, rice cultivation in Nellore is not without challenges. Weather variability, including rainfall deficits up to 35%, has delayed sowing, threatened crop health and reduced crop yields. The extreme focus on rice, which is at the expense of crop diversification, raises important sustainability concerns. Paddy-intensive systems in Nellore consume high levels of water, chemical inputs, and labour, problems underscored in input-utilisation studies. Sustainability frameworks, as proposed by Ranjan Roy et al., stress that only 44% of rice systems can be considered economically viable, environmentally sound, and socially equitable. This is a warning signal for districts like Nellore, where rice monocropping remains deeply entrenched. The core questions emerge clearly: Do small and large farmers in Nellore profit differently from rice? Why does rice dominate the cropping pattern? What are the ecological and economic implications of sustained rice monoculture? Has rice maintained its profitability premium over alternative crops?

This paper investigates these issues through detailed primary field surveys, yield and cost-based profitability analysis across farm sizes, ecological evaluations, and government policies. It aims to provide evidence on rice production's current and future trajectory in Nellore, guiding sustainable agricultural planning in the region and beyond.

This is part of the Deccan Plateau which is a hot and arid region. It is partly a plateau and a hilly area. Nellore falls in the NARP zone which consists of Nellore, Chittoor and Dr.YSR Kadappa districts. This area experiences the southwest monsoon (June to September), the onset of it being from the first of June and the normal rainfall is 337mm with 16 rainy days during this time period. It also experiences the northeast monsoons from October to December with 665mm and 21 rainy days. The onset of this is from the first week of October to 4th week of December, while the earliest is from the first week of June till the second week of October. January to February experiences 30mm of rain with 0 rainy days. March to May experiences 64mm of rain. The type of soil is of the following type: Red soil, Coastal sandy soil, Black Cotton soil, Alluvial soil and latried soil. The largest proportion is of red soil (536.1('000ha)), Coastal sandy soil

(444.6('000ha)) and Black Cotton Soil (196.1('000ha)). The net sown area is 330.5('000ha) and the area sown more than once is 76.1('000ha). The main sources of irrigation are canals, major projects, reservoirs, medium irrigation projects and streams. The total percentage of irrigated area is 35.9%. [2]

**Figure 1: Indicating the position of Nellore in Andhra Pradesh<sup>[1]</sup>**



## 2. Research Gap and Methodology

The methodology used is a mixed type consisting of both quantitative and qualitative methods. The quantitative methods would consist of the use of both primary and secondary data. The primary data would be collected from various farm owners whose land varies from (add size of farms of the respondents) acres. This data would then be analyzed to understand the extent of profit earned by farmers, why farmers grow rice, impact of sustainability on the environment, and the continuous decision to grow only rice. Secondary quantitative data from government sources would be analyzed to bring out a comparison of rice grown in Nellore compared to the state and the country levels. Qualitative data is used to understand the reasons why rice is continuously supported by both the state government and the central government, and also the main reasons for the continuous support that the government at all levels provide to this staple crop compared to any other crops.

### **3. Comparison of the Growth of Rice in Nellore Compared to the Rest of Andhra Pradesh and Other Important Rice Growing States**

A rice variety in NLR34449 also called Nellore Masuri that was developed by the NG Ranga Agricultural Research Station has become very popular not only in Andhra Pradesh, but also in Tamil Nadu, Karnataka and Maharashtra. It is preferred due to the high yield of the seeds that indicate the following production; 3-5 puttis (1 putti = 850kg of paddy) an acre as against 3 puttis for other varieties. The size of the grain is thin and is amongst the best variety in the market. The state government’s procurement MSP stipulates that the moisture content in the paddy procured should not be above 17%. This crop has a higher moisture content and to bring it under the MSP stipulations the farmers have indicated that they spend nearly 600-700Rs for drying paddy so that it meets these standards.

**Table 1: Impact of MSP Prices on the Production of Rice in Nellore**

| Year | MSP* | Production of Rice |            |
|------|------|--------------------|------------|
|      |      | Kharif             | Rabi       |
| 2018 | 1750 | 5539 kg/ha         | 7431 kg/ha |
| 2019 | 1815 | -                  |            |
| 2020 | 1868 | -                  |            |
| 2021 | 1940 | -                  |            |
| 2022 | 2040 | 5680 kg/ha*        | 6865 kg/ha |
| 2023 | 2183 | 6661 kg/ha**       | 7380 kg/ha |
| 2024 | 2300 | -                  |            |
| 2025 | 2425 | -                  |            |

Source: \*[3], \*\*[4]

Note: The data on rice production in Nellore for several years could not be obtained due to gaps in official reporting and the unavailability of reliable published records.

There are 2 sets of people involved in the harvest and the procurement; one is the farmers and the second is the rice millers. In the case of rice millers, they are skeptical to purchase paddy from the market because the food corporation of India has not fixed the target related to boil rice (Nellore Masuri) that is grown and procured from the Nellore district. The rice millers are happy to purchase paddy if they get the assurance that their rice would be procured by FCI. The millers have objected that they have not been reimbursed for the cost of gunny bags to store rice. The actual cost of these bags are 45Rs, but the government only pays them 3Rs 39 paise and even this has not been paid for some year, leading to losses incurred by the millers. [5]

There has been concern amongst the farmers of Nellore in the procurement of rice according to the seed that has been sown. The farmers on August 20th 2021 agreed to buy the paddy variety MTU 1010 which is produced only in Nellore. The reason that this was not bought earlier was due to its inferior quality and the public's reluctance to consume rice grown from this seed. The farmers decided to cultivate this variety due to a very high yield from this seed. The production in this year was expected to be 1 lakh metric tonnes. This 1 lakh metric tonnes was produced from 40,000 acres of land. The fine variety of NLR34449 (type of seed) was cultivated on 65,000 acres for the same time period but the production remained the same at 1 lakh metric tonnes. The difference between the 2 is that NLR34449 has a good market demand where farmers and rice millers were able to sell their stocks without government intervention, while MTU 1010 required government support to be sold. The civil services department has been creating awareness amongst the farmers not to cultivate those varieties of seeds that could not be easily offloaded in the market. The then Chief Minister Jagan Reddy had indicated that the type of rice that would be distributed through the public distribution system(PDS) would be of the same variety that was available in the market. This suggestion was an indication that all farmers should shift to fine grain rice to get remunerative prices and avoid problems at the time of procurement. But farmers in Nellore continued to cultivate MTU 1010 given the fact that this variety gave them good yields. To avoid stress to the farmers the government then decided in that year to procure all rice that was grown from MTU 1010 and send the crop to identified mills so that they could be converted into fortified rice and then supply them for mid day meal programs and Anganwadi centres. [6]

#### **4. Pattern of input utilization**

Besides the seeds, fertilizers were purchased from cooperative societies, dealers, sub-dealers and the department of agriculture. The majority of the farmers were outrightly buying fertilizers by paying cash. One third of the farmers were buying it on credit. Fungicide was also purchased primarily from the cooperatives. The majority decisions with regard to input utilization were dependent on speaking to fellow farmers who were successful rather than consulting scientists and department of agricultural officials. Cooperative society was one of the most important input

agencies which provided seeds, fertilizers and other inputs. Most of the farmers purchased them without going in for credit. There were very small numbers that purchased these inputs on borrowings.[7] This indicated that the farmers had sufficient funds to purchase the subsidized inputs.

### **5. Problems faced by farmers in Nellore District**

The major constraints faced by farmers in this district are:

- Low crop diversification - Nellore district shows the lowest crop diversification levels in Andhra Pradesh, this is measured with the help of the Herfindahl index (It measures crop diversification by addition of the squares of the proportion of the area occupied by each crop.  $HHI = \sum(S_i)^2$ , where  $S_i$  is the total cropped area of the  $i^{th}$  crop. The value 0 indicates full diversification and any value closer to 1 implies specialization). The HHI in Nellore is 0.94 which indicates near specialization in the Kharif season. The district remains heavily dependent on paddy cultivation, which occupies 80% of the cropped area during Rabi season, while rice-rice, rice-groundnut rotation dominates the cropping pattern. [8]
- Indiscriminate use of fertilizer and pesticide - Excessive application of chemical fertilizers and pesticides has severely degraded soil health in Nellore district, reducing organic matter content and disrupting beneficial soil microorganisms essential for nutrient cycling. The overuse of these subsidized inputs has created a dependency cycle where soil nutrients are depleted, requiring even more chemical applications to maintain yields. One of the reasons is the subsidized fertilizer that has been provided by both the centre and the state government leading to excessive consumption of scarce resources. [9]
- Lack of godown space and other infrastructure - Nellore district has only 62 godowns with a total storage capacity of 68,100 MT, which is inadequate for the district's agricultural production needs. Capital formation in agriculture remains insufficient as marginal farmers constitute 61.95% of holdings and operate 74.41% of the area. This indicates the limited investment capacity among small-scale farmers. The lack of adequate capital investment restricts farmers' ability to acquire modern machinery, irrigation infrastructure, and other productive assets necessary for improving agricultural productivity. [10]
- Problem of the availability of inputs - Farmers face challenges in accessing quality agricultural inputs, including insufficient availability of organic inputs and limited access to improved seed varieties. The distribution system for agricultural inputs remains

inefficient, with farmers reporting difficulties in obtaining timely supplies of fertilizers, pesticides, and quality seeds during critical farming periods.

- Depletion of groundwater - Groundwater levels in Nellore district have declined significantly, with many bore wells yielding salty water due to over-extraction and sea water intrusion in coastal areas. The district has approximately 47,109 bore wells, with the overall stage of groundwater development at 28.72%, indicating increasing pressure on groundwater resources. [11]
- Scientific storage supply chain and market linkage - The lack of scientific storage facilities results in significant post-harvest losses, with organic farmers particularly affected by storage pest damage due to the absence of synthetic pesticides. Poor supply chain infrastructure limits farmers' access to markets, forcing them to sell through middlemen at reduced prices and reducing their profit margins. [12]

### *5.1 Types of Seeds Cultivated (Insights from the Primary Survey)*

- a. **KNM 733** - It is also known as Kunaram Rice 1, a seed variety developed by professor Jayashankar Telangana State agriculture university. It is inferior to RNR 50148 due to its poor grain quality and higher water requirements.
- b. **KNM 1638** - This is also known as Kunaram Vari 2. It is a high yielding, medium slender early duration rice variety which is sown majorly in the Telangana state. It is resistant to 'gall midge' and 'leaf blast' and is fairly well adaptable to the conditions.
- c. **MTU 1010** - This is known for its high yield, short duration and slender grains. But it requires extensive irrigation and is susceptible to soils which do not have adequate phosphorus content.
- d. **BPT 5204** - This is also known as Samba Mahsuri. It is a medium duration rice variety. It is resistant to diseases like bacterial blight and can be sown both in the Kharif and Rabi seasons, but requires adequate water.
- e. **NLR34449** - This is also known as Nellore Masuri and is most popular in southern India. Its fine grain commands a premium but it is susceptible to bacterial blight and this is being addressed through genetic improvement.
- f. **KNM 7715** - This is a new high yielding, short grained variety. It produces high yields and has a good grain quality.
- g. **RNR 15048** - This is also known as Telangana Sona. It is characterised by a growth cycle of 125 days as a fine grain and is blast resistant. It is suitable for both Kharif and Rabi seasons. It is a popular seed to sow as it has a high yielding potential and high head rice recovery.

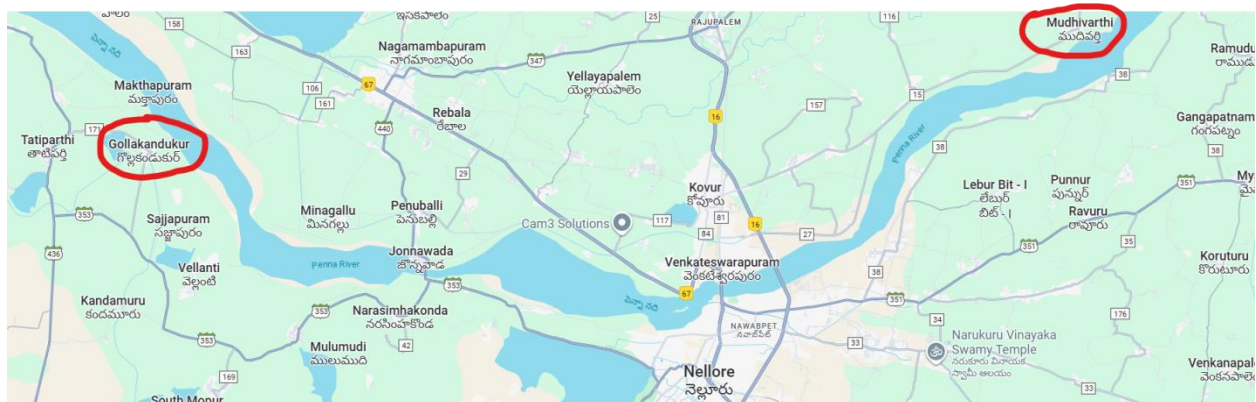
### 6. Reasons for Continued Concentration of Rice Production and Lack of Diversification

Historical Significance and inadequate health given by the state government in the form of loans for diversification an important example is the promotion of dairy farming. The government should provide affordable loans to sheep farmers to encourage them. The NABARD in assisting the state has decided to provide funds for rural infrastructure development such that the irrigation projects, water harvesting and other related complimentary facilities like storage etc are developed. This would reduce the dependence on ground water and at the same time help diversification into other crops and occupations once the infrastructure storage facilities etc are well developed.[13] Diversification is primarily dependent on physical availability of various variables and secondarily on technical and economic consideration. The important attributes which are important in the decision making of the cropping farmer one of them is the competition amongst various activities for space; the lesser the competition the greater is the emphasis on growing 1 or 2 crops. In Nellore the extent of crop diversification is insignificant. There was some diversification that existed prior to 2012-2015, but since then there has been a substantial decline and all the districts have leaned towards paddy production. This is primarily due to the adequate availability of irrigation and the tradition of that area to grow paddy.

### 7. Analysis of Primary Survey

This survey was conducted in the following districts in Nellore: Mudhivarthi and Gollakandukur, where there were approximately 50+ farmers who were interviewed. The districts have been marked in the map below.

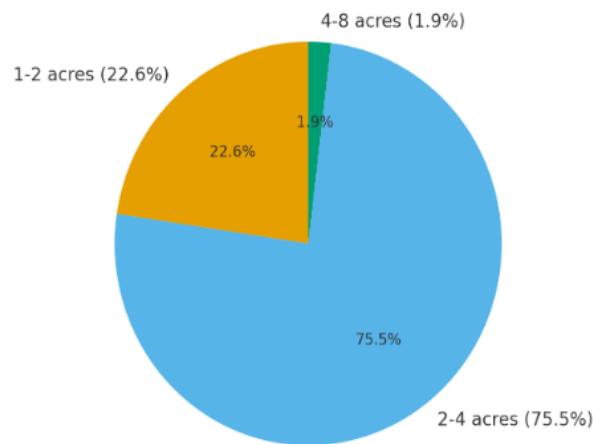
Figure 2: Districts marked where survey was conducted



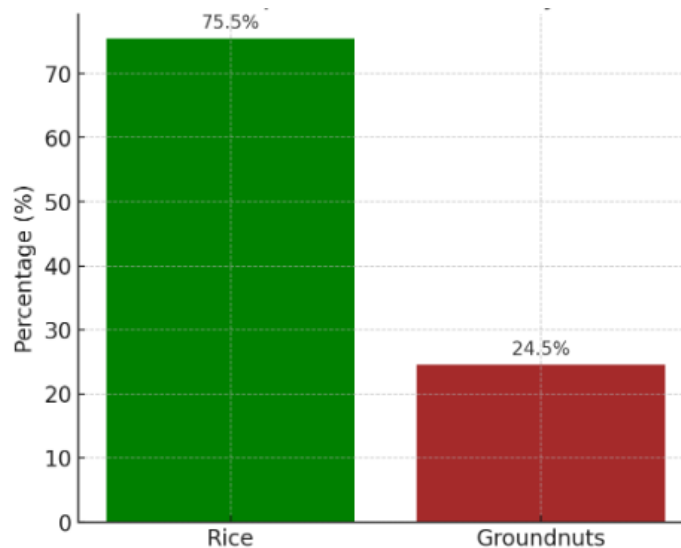
Source: Google image

The land distribution according to the survey indicated that 75.5% of the farmers held 2-4 acres, followed by 22.6% holding 1-2 acres. This means that the majority of these farmers are going to grow rice in both the Kharif and Rabi seasons. This can also be seen in the answers to the second question where a large majority grew rice.

**Figure 3: Land Holding Survey Distribution (N=53)**



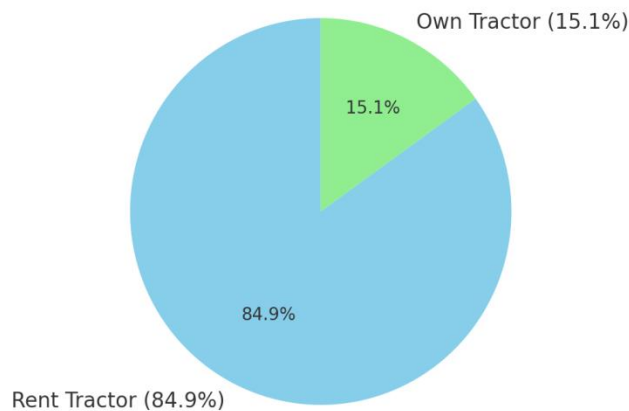
**Figure 4: Crop Preference (N=53)**



Amongst the respondents surveyed 40 of them grew only rice and 13 grew only peanuts. This is indicated in the bar chart below. It was expected that as close to 90% of the farmers were growing rice in both the seasons the main crop from these districts was going to be rice. There is a scientific reason behind the majority of farmers growing rice; firstly as most of them have 2-4

acres, paddy is the best option for them. The time period for both the crops is almost the same: rice - 4 months and 20 days; ground nuts - 3 months and 20 days. The major variety of paddy that the respondents indicated in the districts covered was KNM 1638. It is a high yielding variety that is fairly resistant to pests. The farmers in these districts indicated that they got free water and electricity, but the fertilizers were provided to them at a subsidized rate. This is one of the factors that encourages rice growing in both the seasons in this district as water is free. To grow rice a lot of water is required.

**Figure 5: Tractor Use Among Farmers (N=53)**



Amongst the respondents it was seen that all of them used the tractor and labour services to till their land. Nearly 85% of them rented the tractor and used their own labour services in tilling and preparing the soil. The 15% who owned the vehicle were likely to hire labour to prepare the fields for the crop. This conforms to the earlier answers where a majority of the farmers owned 2-4 acres and did not have the finances nor the need to buy the tractor for such small pieces of land. The respondents indicated that the government provided raw materials but did not help in the marketing of their crop. The MSP price was announced but most of these farmers who had small tracts of land were at the mercy of intermediaries and agencies as they neither had storage facilities nor the waiting capacity to get the quoted MSP price. The fact that they were assured a price close to the MSP led them to choose paddy over other crops as it seemed a completely safe alternative.

The respondents who own very small acreage were the ones who were more adventurous and attempted to try new crops such that they could earn a higher profit per acre. The reasons are that in spite of an MSP for ground nuts it is not a popular option because of the climatic conditions in the district. The climate is more suited for rice production and growing ground nuts would be an adventurous attempt which may not lead to profits for the farmers. This is the reason why there is an extremely small proportion of farmers producing ground nuts.

It was noticed while conducting the survey that as the majority of the farmers owned very little land, the female members worked in big farmers' houses to supplement the income earned from their own farm. The parents did send their children, male and female to school, but most of them dropped out after the 10th grade. The male child followed his fathers steps and worked on the farm while the female child followed her mother in either working in other peoples' houses or doing the housework at home. There does not seem to be a dearth of food grains for these farmers. The problem that arises is that there is a lack of money in their hands for other basic necessities. It depends on the largesse of the big farmers on whether they would help in educating children whose parents own small holdings. On their own it becomes difficult for parents to get out of the circle of lack of opportunities.

### **8. Limitations of the Survey**

The survey was conducted only among 53 respondents. It is possible that if the numbers increase, the answers may change slightly. Data was difficult to collect and evaluate. A translator was required to convey the exact idea behind the question in the questionnaire. The respondents, largely uneducated, had to be explained in clear terms that this was not a government initiated attempt and were encouraged to give an honest reply. Many times the respondents were unwilling to speak their mind in spite of attempting to meet them a couple of times. The male members were the ones who answered the questions, giving very little leeway to the rest of the family.

### **9. Conclusion**

Rice cultivation in Nellore district reveals that while rice production remains economically viable and climatically suited to the region as it is the main produce both in the Rabi and the Kharif season. One of the many reasons is the government support mechanism of MSP, free water and electricity, and subsidized seeds. The excess use of these factors have impacted significantly the sustainability of the region. There are reports that the water table is declining at a fast rate due to excess withdrawal of water. Rice being a crop that is water dependent, farmers tend to use water more than required due to the subsidized charges. It presents significant sustainability challenges that threaten long-term agricultural resilience. Small and marginal farmers, who constitute the majority with 75.5% holding 2-4 acres (according to the primary survey), have gravitated toward rice as their primary livelihood despite facing market vulnerabilities and dependency on intermediaries who offer prices below MSP levels. In spite of this the farmers feel that they get a better price for their crops than the other alternative which is ground nuts. Most of the farmers surveyed did not own their own tractor and were hiring when required. This is primarily due to the economies of small scale indicated by the tiny holdings that

they held. The women of the respondents supplemented the family income by working in other peoples' houses as the income from the holdings were not enough to support the family.

The rice-centric approach has created alarming sustainability concerns, particularly the depletion of groundwater resources with 47,109 bore wells (2022-23) and increasing saline water intrusion, along with severe soil degradation from the overuse of chemical fertilizers and pesticides. The district exhibits the lowest crop diversification in Andhra Pradesh with a Herfindahl index of 0.94, indicating near-complete specialization in rice production at the expense of agricultural diversity. While government policies have successfully ensured food security and farmer income stability, they have inadvertently reinforced rice monoculture through subsidies and procurement guarantees. The research concludes that Nellore's agricultural future requires urgent policy intervention to balance economic viability with environmental sustainability, including development of drought-resistant alternative crops, improved storage infrastructure, reformed subsidy structures to incentivize diversification, and enhanced farmer education. Without such changes, the district risks continuing on an unsustainable trajectory that may compromise future agricultural productivity and environmental integrity, which will create challenges for small farming households.

## References

- [1] "Sri Potti Sriramulu Nellore District Map," Maps of India. <https://www.mapsofindia.com/maps/andhrapradesh/districts/nellore.htm>
- [2] G. K. Reddy, S. M. M. Naidu, K. P. Raju, and P. Rajasekhar, "Agriculture Contingency Plan for District: SPSR NELLORE," Central Research Institute for Dryland Agriculture, 2018. [Online]. Available: <https://www.icar-crida.res.in/CP/AndhraPradesh/Nellore.pdf>
- [3] ACHRAYA N G RANGA AGRICULTURAL UNIVERSITY and Centre for Agriculture & Rural Development Policy Research (CARP), "Crop Outlook Reports of Andhra Pradesh." [Online]. Available: [https://angrau.ac.in/downloads/AMIC/OutlookReports/2023\\_24/paddy%20outlook-June-july-2023-24.pdf?utm\\_source](https://angrau.ac.in/downloads/AMIC/OutlookReports/2023_24/paddy%20outlook-June-july-2023-24.pdf?utm_source)
- [4] "AGRICULTURE | Sri Potti Sriramulu Nellore District, Government of Andhra Pradesh | India." <https://spsnellore.ap.gov.in/agriculture/>
- [5] P. Rajasekhar, P. Rajasekhar, and D. Chronicle, "Deccan Chronicle," Deccan Chronicle, Apr. 02, 2025. [https://www.deccanchronicle.com/southern-states/andhra-pradesh/farmers-wary-of-governments-faq-norm-in-paddy-procurement-1870562?utm\\_source](https://www.deccanchronicle.com/southern-states/andhra-pradesh/farmers-wary-of-governments-faq-norm-in-paddy-procurement-1870562?utm_source)

- [6] S. Mn, "Andhra Pradesh govt to the rescue of Nellore rice farmers," The Times of India, Aug. 20, 2021. [Online]. Available: [https://timesofindia.indiatimes.com/city/vijayawada/govt-to-the-rescue-of-nellore-rice-farmers/articleshow/85467720.cms?utm\\_source](https://timesofindia.indiatimes.com/city/vijayawada/govt-to-the-rescue-of-nellore-rice-farmers/articleshow/85467720.cms?utm_source)
- [7] C. Deepa, P. V. Sathya Gopal, T. Lakshmi, and S. Hemalatha, "Input utilization pattern of rice farmers in Nellore district of Andhra Pradesh, India," Chemical Engineering, vol. 02–03, pp. 22–31, 2021, [Online]. Available: <https://chemjournal.researchfloor.org/wp-content/uploads/2021/10/input-utilization-pattern-of-rice-farmers-in-nellore-district-of-andhra-pradesh-india-.pdf>
- [8] T. N, "Dynamics of crop diversification in Andhra Pradesh: A District-Level Analysis 1Tanuja N, 2K Nirmal Ravi Kumar, 3 IVY Rama Rao and 4K Suseela 1-4 Department of Agricultural Economics, Agricultural College, Bapatla, ANGRAU, Andhra Pradesh, India," International Journal of Agriculture Extension and Social Development, 2024, [Online]. Available: <https://www.extensionjournal.com/article/view/1445/S-7-12-16>
- [9] T. O. India, "Excessive use of pesticides leads to soil degradation, say experts," The Times of India, Dec. 05, 2022. [Online]. Available: <https://timesofindia.indiatimes.com/city/patna/excessive-use-of-pesticides-leads-to-soil-degradation-say-experts/articleshow/95990295.cms>
- [10] "AGRICULTURE | Sri Potti Sriramulu Nellore District, Government of Andhra Pradesh | India." <https://spsnellore.ap.gov.in/agriculture/>
- [11] S. L. N. Damodra and S. R. K. Gumma, "AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES NELLORE DISTRICT, ANDHRA PRADESH," 2023. [Online]. Available: <https://www.cgwb.gov.in/cgwbpm/public/uploads/documents/1684133956531732920file.pdf>
- [12] "Sustainable Farming – Nellore Region (Second year) | Save Indian Farmers." <https://www.saveindianfarmers.org/project/nellore-region-second-year/>
- [13] N. B. Ankanna and A. K. Kumari, "Changing patterns of Crop diversification in Nellore District, Andhra Pradesh," ResearchGate, 2018, [Online]. Available: [https://www.researchgate.net/publication/364429878\\_Changing\\_patterns\\_of\\_Crop\\_diversification\\_in\\_Nellore\\_District\\_Andhra\\_Pradesh](https://www.researchgate.net/publication/364429878_Changing_patterns_of_Crop_diversification_in_Nellore_District_Andhra_Pradesh)