

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 1; January 2025; Page No. 323-330

Received: 16-11-2024
Accepted: 21-12-2024

Indexed Journal
Peer Reviewed Journal

Exploring the diversity of rice landraces in Godavari zone of Andhra Pradesh

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DOI: <https://doi.org/10.33545/26180723.2025.v8.i1e.1586>

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Abstract

Rice is a staple food for over two billion people worldwide and a significant source of income for rural populations. Despite the advancements from the Green Revolution, rice yields have stagnated over the past three decades, with traditional rice varieties largely replaced by high-yielding varieties. However, TRVs offer unique advantages, including pest and disease resistance, adaptability and superior nutritional and aromatic qualities. This study identifies and documents landraces of rice in the Godavari zone of Andhra Pradesh, examines constraints faced by farmers in cultivating these varieties, and suggests strategies for conservation. Fifty farmers cultivating rice landraces were surveyed. The gain samples of twenty-eight TRVs were collected and analysed the kernel characteristics of each variety at quality lab of RARS, Maruteru. Based on the kernel characteristics TRVs were categorised into five categories. The results indicating that five varieties fall under long slender category, nine varieties in medium slender, three varieties in short slender and eleven varieties under short bold categories. The results highlighted the diversity and potential of TRVs while underscoring challenges such as lower yields, market constraints. Recommendations include community seed banks, biodiversity parks and consumer awareness campaigns to ensure the preservation and utilization of these genetic resources.

Keywords: Andhra Pradesh, desi varieties, Godavari zone, Kernal characteristics, landraces, rice, TRVs, L/B ratio

Introduction

Rice is the primary food source for over two billion people worldwide, particularly in Asia, where it provides 40-70% of the total food calories consumed. Despite the Green Revolution's significant increase in rice yields, poverty and hunger persist. In recent decades, rice yields have stagnated, and traditional rice varieties have been replaced by high-yielding varieties.

In India, over 200,000 indigenous rice varieties are cultivated, but many are facing extinction. conserving these desi rice varieties is crucial for ecological importance *viz.*, biodiversity, climate resilience and management soil health. The have socio-cultural importance like cultural heritage, food security and provides livelihoods to the rural communities. TRVs also have economic importance due to growing demand for indigenous varieties in urban areas, desi varieties can be exported, capitalizing on global demand and conservation desi varieties can lead to value addition through processing and branding.

Over the past thirty years, the Green Revolution has led to a

significant increase in rice yields; however, this surge in food production has not eradicated poverty and hunger. In fact, rice yields have remained stagnant during this period, despite the availability of improved varieties and technologies. Globally, at least two billion individuals go to bed hungry each night, with a staggering 320 million of those in India alone. The introduction of high-yielding varieties (HYVs) has resulted in the near extinction of many traditional varieties (TRVs) in farmers' fields. Although production costs have risen, aromatic rice varieties such as Gobindobhog, Badsabhog, Radhatilak, Kalonunia, and Tulaipanji, along with fine rice types like Dudheswar and Seetasail, continue to command good market prices. The chemical-intensive practices of the Green Revolution have not only diminished local crop genetic diversity but have also eradicated their wild relatives, which are vital sources of unique genes for disease and pest resistance. Initially, farmers were attracted by the high yields of these so-called "miracle" seeds, overlooking the associated costs of external inputs, the subsequent loss of non-grain biomass, the decline

of desirable traits (such as resistance to diseases, pests, drought, and flooding), and the significant environmental degradation affecting soil and water quality. Over time, the average grain yield of the widely used modern variety (HYV) MTU-7029 in West Bengal has decreased from 5 t ha-1 to approximately 3.75 t ha-1 in many farmers' fields. These HYVs do not provide a significant yield advantage in marginal lands, such as drought-prone areas, saline soils, or deep-water conditions.

A survey conducted by the World Wildlife Fund (WWF) in India in 1994 across six districts of southern West Bengal identified 137 traditional rice varieties still thriving in marginal farming conditions. An examination of the factors contributing to the persistence of these varieties revealed several key points: Small and marginal farmers cultivating traditional rice varieties (TRVs) often lacked the financial means to purchase expensive inputs required for high-yielding varieties (HYVs). Additionally, HYVs were unsuitable for cultivation in dry uplands and wet lowlands, where only a select few locally adapted varieties could thrive. Many indigenous varieties were favored for their unique aroma and flavor, which were notably absent in HYVs. Furthermore, certain native varieties commanded higher market prices compared to HYVs. Numerous varieties exhibited resilience to drought and flooding, as well as adaptability to poorly drained and lowland environments. A significant number of these varieties also demonstrated resistance to diseases and pests. Some possessed exceptional traits, such as tolerance to salinity and alkalinity, and the ability to grow in deep-water inland areas. In light of this, a study was conducted to assess the performance of selected traditional rice varieties in comparison to widely used HYVs, alongside a genetic analysis.

A study was undertaken to evaluate the performance of traditional rice varieties compared to popular high-yielding varieties, along with genetic analysis. The objectives included:

1. Identifying existing landraces of rice in the Godavari zone.

2. Documenting characteristic features of existing landraces.
3. Identifying constraints faced by farmers in cultivating landraces.
4. Developing a strategy for conserving identified landraces.

Methodology

Research Design: Descriptive Research design. This design used to describe a phenomenon, situation, or population in an accurate and systematic way. It uses a variety of research methods, including surveys, observations, and case studies, to collect information about a target population. The goal of descriptive research is to answer questions about what, when, where, and how, rather than why.

Sampling: Purposive Sampling. The Godavari zone consists five districts namely East Godavari, West Godavari, Eluru, Kakinada and Dr. B. R. Ambedkar Konaseema districts. Ten farmers from each district were selected, who are cultivating or previously cultivated rice land races, thus total sample become 50.

Data collection tools: Semi structured interview schedule was used to collect primary data from farmers. And missing data was obtained through secondary sources.

Statistics Used: Frequency, Percentage and Ranking.

Results & Discussion

A total of 28 desi rice varieties were collected from the farmers and analyzed through image processing technique. Rice seeds are counted and categorized according to their length, width, and length-to-breadth ratio. The length-breadth ratio is determined as $L/B = [((\text{Average length of rice grain})/(\text{Average breadth of rice}))]$ where length is the average length of rice grain and width is the average breadth of rice grain. Based on the kernal size and form 28 varieties were categorized in to five categories and presented in the Table 1.

Table 1: Categorization of the landrace identified in Godavari zone

S. No.	Category	Kernal characteristics	Landraces	No. of varieties
a.	Long Slender	Kernal length: > 6.0 mm L:B ratio: > 3 mm	Burma Black, Parimala Sanna, Kempu Sanna, Sannajajulu, Narayana Kamini	5
b.	Long Bold	Kernal length: > 6.0 mm L:B ratio: < 3 mm	Nil	0
c.	Medium Slender	Kernal length: < 6.0 mm L:B ratio: < 2.5 to 3 mm	Kunkumashali, Ambe Mohar, Pancha Rathna, Iluppai poo samba rice, Gandhakasala, Rathnachodi, Mettu Dhnyam, Sidda Sanna, Chinni Ponni	9
d.	Short Slender	Kernal length: < 6.0 mm L:B ratio: > 3 mm	Mysore Malliga, Kuji Pataliya, HMT	3
e.	Short Bold	Kernal length: < 6.0 mm L:B ratio: < 2.5 mm	Mada Murangi, Radhuni Pagol, Kala Batti, Bahuroopi, Ramjeera, Kulakar, Tulasibaso, Gurumattiya, Kuruthekar, Dhaniyaphul, Singarakaima,	11

The varietal characteristics of each variety was collected from farmers, through semi - structured interview schedule.

And the results were triangulated through secondary sources. Five varieties fall under long.

Table 2: Physical characteristic features of plant and kernel of long slender type landraces

Name of the Land Race	Burma Black	Parimala Sanna	Kempu Sanna	Sannajajulu	Narayana Kamini
Duration (Days)	110 - 120	120 - 125	130 - 135	120 - 125	130 - 140
Kernal Colour	Blackish Brown	White	Red	White	White
Kernal Length (mm)	7.40	8.09	6.16	6.97	6.27
Kernal Breadth (mm)	2.01	1.89	1.89	1.46	1.91
L: B Ratio	3.68	4.28	3.25	4.77	3.28
Panicle Length (cm)	24.5	25.5	27.5	26.5	20.5
No. of grains / Panicle	143	213	146	136	65
1000 grain weight (gm)	24.8	17.7	20.1	16.9	20.2
Kernal Type	Long Slender	Long Slender	Long Slender	Long Slender	Long Slender
Special Characters	Originates from Manipur, possesses glutinous texture. This character is essential for some rice dishes which require creamy consistency. This variety is known to lower bad cholesterol levels and offers protection against heart diseases, cancer, and diabetes.	Scented Rice. Ideal for making Pulihora, Payasa, and Prasada. Enhances the body's resistance.	This variety consists calcium, iron, and zinc. It possesses antioxidant properties and enhances resistance.	Foods with low calorie content. Enhance resilience. Indigenous to Karnataka.	This variety is rich in Ca, Fe and zinc. Highly nutritious and abundant in fiber, contributing to the alleviation of joint pain.

Table 3: Physical characteristic features of plant and kernel of medium slender type landraces

Name of the Land Race	Kunkumashali	Ambe Mohar	Pancha Rathna	Iluppai poo samba rice	Gandhakasala	Rathnachodi	Mettu Dhnyam	Sidda Sanna	Chinni Ponni
Duration (Days)	120	110 - 120	135	140 - 145	135 - 140	130 - 135	120 - 125 days	120 - 130	120 - 125
Kernal Colour	Red	Red	Red	Black	White	White	White	White	White
Kernal Length (mm)	5.25	5.83	5.72	5.19	4.52	5.34	6.11	5.13	5.55
Kernal Breadth (mm)	2.04	2.17	2.03	1.83	1.77	1.89	2.08	1.73	1.99
L: B Ratio	2.57	2.68	2.81	2.83	2.55	2.82	2.93	2.96	2.78
Panicle Length (cm)	20.5	26.5	15.5	23.5	24.5	23.5	24.5	23.5	15.0
No. of grains / Panicle	127	194	91	134	195	152	46	174	81
1000 grain weight (gm)	17.3	17.4	18.0	15.0	12.1	15.7	19.2	13.0	17.9
Kernal Type	Medium Slender	Medium Slender	Medium Slender	Medium Slender	Medium Slender	Medium Slender	Medium Slender	Medium Slender	Medium Slender
Nutritional Characters	Kunkumashali/Rakthashali rice, an ancient variety dating back over 3,000 years, is renowned for its exceptional nutritional profile and numerous health benefits. This traditional rice is rich in essential nutrients and vitamins, making it an	Ambemohar, which translates to "Mango Blossom" in Marathi, is a fragrant rice variety native to the Maval region in Pune, Maharashtra. Its distinctive aroma is reminiscent of mango blossoms, making it a unique and	Despite being rich in amino acids, the available data on this source's diversity is limited and lacks comprehensive information.	luppai Poo Samba rice is a nutrient-dense food, rich in vitamins, minerals, and fiber, making it an excellent choice for maintaining overall health and well-being. Additionally, this rice	Gandhakasala rice is a unique and aromatic variety cultivated exclusively by farmers in the Wayanad District of Kerala. Its distinct flavor profile makes it an ideal choice for traditional dishes like Pulihora, Payasa, and Prasada. This rice variety is not only prized for its culinary uses but also believed to possess medicinal properties that enhance the body's natural resistance to illnesses. In keeping with its	This traditional rice variety, originating from Karnataka's Chamarajnagar District, is renowned for its exceptional quality and unique characteristics. Its fine grains and delicate flavor make it a culinary delight, while its superior cooking qualities ensure that it becomes soft, smooth, and easily digestible. This makes it an ideal choice for	The tribal communities of the Eastern Ghats cultivate unique hilltop and slope rice varieties that thrive in challenging terrain. These rainfed varieties possess remarkable resilience, enabling them to withstand drought conditions and maintain their productivity.	Sidda Sanna is a distinctive variety of small, fine-grained rice renowned for its exceptional cooking quality, rivaling that of the popular Sona Masuri. This unique rice was carefully developed by Mr. Boregowda, a visionary farmer from Mandya,	Through meticulous natural selection, a farmer successfully cultivated this unique rice variety. Notably, the plant exhibits a compact growth habit, reaching a height of just 75 cm. This characteristic makes it particularly well-suited for raw rice production.

	<p>excellent addition to a healthy diet. The consumption of this variety is particularly beneficial for individuals suffering from anemia, as it enhances the production of red blood cells and helps stabilize blood counts. Additionally, its immune-boosting properties increase stamina and overall well-being. This rice variety also supports metabolic processes, aiding in weight management. Research suggests that the variety may have a protective effect against chronic diseases, such as cancer and diabetes, due to its unique composition. Furthermore, according to Ayurvedic texts, this rice is believed to promote balance among the three doshas - Vatha, Pitha, and Kafa</p>	<p>sought-after variety. Ambemohar rice is an excellent choice for children and the elderly, providing essential nutrients for their well-being. In local cuisine, it's often used to prepare a nourishing rice and milk soup called "Bhatachi Pej," which is typically served to children, seniors, and patients. Beyond its culinary uses, Ambemohar rice holds cultural significance, playing a vital role in various religious and wedding ceremonies. Its versatility also makes it an ideal choice for everyday meals, ranging from traditional dishes like pulao, vaangi bhat, and sweets to modern creations like Chinese fried rice and dosa-idli.</p>		<p>variety boasts medicinal properties, which have been traditionally used to alleviate health issues such as migraines and sinus problems, ultimately enhancing the body's natural resistance.</p>	<p>cultural significance, Gandhakasala rice is traditionally reserved for special occasions, such as wedding feasts, where its distinctive aroma and flavor are truly appreciated.</p>	<p>children and the elderly. The rice plant itself is slender, producing long, well-developed ear heads and whitish-hued grains that require no polishing. Historically, this variety was valued for its nourishing properties, serving as a staple for soldiers to enhance their strength and stamina. It is also known as Scented Rice, recognized for its ability to boost the body's resistance and promote overall well-being.</p>		<p>Karnataka. Sidda Sanna's versatility makes it an ideal choice for a wide range of dishes, but it truly shines when used to prepare traditional favorites like chitranna (lemon rice) and puliyogare (tamarind rice).</p>	
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Table 4: Physical characteristic features of plant and kernel of short slender type landraces

Name of the Land Race	Mysore Malliga	Kuji Pataliya	HMT
Duration (Days)	110 - 120	120 - 125	125 - 130
Kernal Colour	White	White	White
Kernal Length (mm)	5.33	5.32	5.38
Kernal Breadth (mm)	1.68	1.50	1.49
L: B Ratio	3.17	3.54	3.61
Panicle Length (cm)	16.2	18.5	19.0
No. of grains / Panicle	155	154	223
1000 grain weight (gm)	12.8	11.9	12.3
Kernal Type	Short Slender	Short Slender	Short Slender
Special Characters	Mysore Mallige, affectionately known as Jasmine Paddy or Malli Rice, is a cherished indigenous rice variety from Karnataka. This traditional treasure is often lovingly referred to as "children's rice" due to its remarkable properties that support healthy digestion, immunity, and energy levels in developing children. Furthermore, Mysore Mallige is a rich source of dietary fiber and fatty acids, making it a nutritious and wholesome choice.	This traditional South Indian biryani rice is a standout variety, boasting exceptionally fine, slender, and elongated grains that release a captivating aroma. Its distinctive flavor profile makes it a preferred choice for preparing delectable pulao and biryani dishes. What's more, this rice variety offers several health benefits, making it an excellent choice for daily consumption. With a moderate glycemic index of 50, it is suitable for those seeking to manage their blood sugar levels.	HMT Rice is a distinguished fine short grain variety, carefully developed through natural selection by the visionary farmer Sri. Dadaji Ramaji Khobragade. Its origins can be traced back to the esteemed 'Patel 3' variety, created by Dr. J. P. Patel at JNKV Agriculture University in Jabalpur. HMT Rice has garnered widespread recognition for its exceptional characteristics, particularly its high milling recovery and superior cooking quality. These attributes have catapulted it to become the most sought-after rice variety in Andhra Pradesh, with its cooking quality surpassing that of BPT 5204.

Table 5: Physical characteristic features of plant and kernel of short bold type landraces

Name of the Land Race	Mada Murangi	Radhuni Pagol	Kala Batti	Bahuroopi	Ramjeera	Kulakar	Tulasibaso	Gurumattiya	Kuruthekar	Dhaniyaphul	Singarajakaima
Duration (Days)	130 - 135	140 - 145	150	140 - 150	120 - 130	100 - 110	110	130 - 135	120 - 125	120 - 125	120 - 125
Kernal Colour	Red	White	Black	White	White	Red	White	White	Red rice	White	White
Kernal Length (mm)	5.55	4.56	5.46	5.29	4.33	5.54	3.70	5.58	5.67	3.66	5.12
Kernal Breadth (mm)	2.80	1.94	2.59	2.50	1.90	2.45	1.92	2.63	2.60	2.49	2.41
L: B Ratio	1.96	2.35	2.10	2.11	2.27	2.26	1.92	2.12	2.18	1.46	2.12
Panicle Length (cm)	25.3	27.2	23.5	23.5	21.5	19.5	27.5	19.5	25.0	29.5	25.5
No. of grains / Panicle	147	320	92	162	118	42	218	73	62	361	221
1000 grain weight (gm)	26.3	12.2	25.0	20.3	11.3	11.9	11.7	27.6	23.0	14.4	18.9
Kernal Type	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold	Short Bold
Special Characters	This remarkable rice variety is not only a nutritional powerhouse, rich in essential minerals like	This exquisite, small-grained rice variety is distinguished by its striking straw-colored grains, each adorned with a vibrant purple	Kalabatti, a unique and nutrient-rich local variety of black rice, is native to Odisha. This remarkable crop reaches	Bahurupi Rice is a nutritional powerhouse, offering an impressive array of essential nutrients, including	Ram Jeera Rice is a distinctive and aromatic variety of basmati rice, hailing from the picturesque foothills of the Himalayas. This	The red rice varieties cultivated in Tamil Nadu are remarkably resilient and adaptable, thriving in a diverse range of	Tulasibaso is a fragrant and versatile variety, perfectly suited for crafting traditional dishes like	This remarkable rice variety is a nutrient-dense powerhouse, boasting an impressive array of essential	Karuthakkar rice is a treasured traditional rice variety, highly revered for its integral role in South Indian cuisine and	This unique and aromatic rice variety, once a staple in the Kannur and Kasaragod districts of Kerala, now holds a nostalgic	This rice variety's nostalgic appeal is deeply rooted in the memories of those who once savored it in the Kannur and Kasaragod districts of Kerala. The

<p>calcium, magnesium, and iron, but also boasts impressive antioxidant properties. Its adaptability is equally noteworthy, as it can flourish in challenging environments with severely waterlogged conditions. This unique trait makes it an ideal choice for cultivation in river-adjacent areas, where its hardiness can be fully leveraged.</p>	<p>spot at the tip. Its short and bold white kernel, combined with a robust and alluring aroma, makes it a true culinary treasure. Indigenous to West Bengal, this fragrant rice is perfectly suited for crafting traditional dishes like Pulihora, Payasa, and Prasada. Its unique properties also extend to promoting enhanced resistance in the body, making it a cherished and wholesome choice.</p>	<p>impressive heights of 5 to 6.5 feet and has a growth period of 150 days. Unlike Burma Black, Kalabatti can only be cultivated once a year, specifically during the Kharif season. The anthocyanin present in Kalabatti's grains is a powerhouse of antioxidant properties, which play a significant role in enhancing human resistance. This incredible rice variety offers numerous health benefits, including lowering bad cholesterol, protecting against heart diseases, cancer, and diabetes.</p>	<p>protein, fiber, and calcium. It is also an exceptionally rich source of zinc and B vitamins, making it an exemplary addition to a balanced diet. In fact, consuming a bowl of Bahurupi Rice is akin to taking a multivitamin tablet, providing a broad spectrum of vital nutrients. This versatile and aromatic rice variety lends itself beautifully to a wide range of popular dishes, from idli, dosa, and ven pongal to khichadi, pulao, biryani, kheer, and porridge.</p>	<p>nutrient-rich rice is an excellent source of dietary fiber, which plays a vital role in maintaining optimal digestive health, regulating blood sugar levels, and supporting effective weight management. Furthermore, the fiber content in Ram Jeera Rice helps eliminate bad cholesterol, promoting a healthier cardiovascular profile.</p>	<p>soil conditions, including sandy, clayey, alkaline, and waterlogged environments. This variety typically reach an average height of approximately 100 cm, demonstrating their hardiness and ability to flourish in varied settings, even in drought-prone areas. this variety</p>	<p>Pulihora, Payasa, and Prasada. Its unique properties also extend to promoting enhanced resistance in the body, making it a nutritious and wholesome choice</p>	<p>minerals, including calcium, iron, and zinc. Its exceptional nutritional profile is further enhanced by its high fiber content, which plays a significant role in alleviating joint pain and promoting overall well-being.</p>	<p>biryani. Beyond its culinary significance, this exceptional rice boasts impressive health benefits, notably enhancing the immune system's robustness. Karuthakkar rice is typically cultivated during the late kharif season, which falls between September and October, adding to its distinct charm and allure.</p>	<p>charm for many. The rice seeds, with their striking resemblance to coriander seeds and subtle fragrance, are a distinguishing feature of this variety. Well-suited to sandy soil conditions, this rice is not only a culinary treasure but also a valuable source of health benefits and medicinal properties, making it a truly remarkable and cherished variety.</p>	<p>distinctive coriander-like seeds and their subtle fragrance evoke a sense of warmth and familiarity. Adapted to thrive in sandy soil conditions, this aromatic rice is a treasured find, offering not only a rich culinary experience but also a wealth of health benefits and medicinal properties that have captivated the hearts and palates of many.</p>
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It could be inferred from the Table 2.0 that, a total of five land races falls under long slender kernel type category with more than 6.0 mm kernel length and more than 3.0 mm L/B ratio. The bio diversity of land races includes, the duration is ranging from 110 - 140 days. The kernel characteristics includes the colour of kernel is ranging from blackish brown to white and red. The kernel length is from 6.16 to 8.09 mm, kernel breadth from 1.46 - 2.01 mm and the L/B ratio is ranging from 3.25 - 4.77. The panicle diversity includes panicle length is ranging from 20.5 - 27.5 cm, number of grains per panicle is ranging from 65 to 213 and the test weight of the varieties is ranging from 16.9 - 24.8 gm.

The long kernel varieties like IR - 64, MTU 1010 with more than 6.0 mm length are having good export market. The landraces exhibit diverse characteristics, highlighting their potential for conservation and utilization in rice breeding programme. Hence the breeders must utilize these long slender land races for development of export-oriented rice varieties under non - Basmati category.

It could be inferred from the Table 3.0 that, a total of 11 land races falls under medium slender kernel type category with less than 6.0 mm kernel length and 2.5 to 3.0 mm L/B ratio. The bio diversity of land races includes, the duration is ranging from 110 - 145 days. The kernel characteristics includes the colour of kernel is ranging from red, black and straw coloured. The kernel length is from 4.52 to 6.11 mm, kernel breadth from 1.73 - 2.17 mm and the L/B ratio is ranging from 2.55 - 2.96. The panicle diversity includes panicle length is ranging from 15.0 - 26.5 cm, number of grains per panicle is ranging from 45 to 195 and the test weight of the varieties is ranging from 12.1 - 19.2 gm.

The medium slender desi varieties are suitable for public distribution system with high nutritional properties; hence the breeders must conserve and utilize this type of desi varieties in development of medium slender varieties with high nutritional properties to meet the nutritional requirements of poor people.

These results are somewhat inline with findings of Manickam *et al.* (2024) [3], Muralikrishnan (2021) [4] and

Rubilah *et al* (2023) [5].

It could be inferred from the Table 4.0 that, a total of 3 land races falls under short slender kernel type category with less than 6.0 mm kernel length and more than 3.0 mm L/B ratio. The bio diversity of land races includes, the duration is ranging from 110 - 130 days. The kernel characteristics includes the colour of kernel is white. The kernel length is from 5.32 to 5.38 mm, kernel breadth from 1.49 - 1.68 mm and the L/B ratio is ranging from 3.17 - 3.61. The panicle diversity includes panicle length is ranging from 16.2 - 19.0 cm, number of grains per panicle is ranging from 154 to 223 and the test weight of the varieties is ranging from 11.9 - 12.8 gm.

The short slender desi varieties are suitable for open market system with good palatability. Majority of middle, upper middle and rich class people are preferring these types of short slender varieties, hence the breeders must conserve and utilize this type of desi varieties in development of short slender varieties with good cooking quality.

These findings are in contradiction with the findings of Shanmugam *et al.* 2023 [6].

It could be inferred from the Table 5.0 that, a total of 13 land races falls under short bold kernel type category with less than 6.0 mm kernel length and less than 2.5 mm L/B ratio. The diversity of these land races includes, the duration is ranging from 110 - 150 days. The kernel characteristics includes the colour of kernel is ranging from red, white and black. The kernel length is from 3.66 to 5.67 mm, kernel breadth from 1.90 - 2.80 mm and the L/B ratio is ranging from 1.46 - 2.35. The panicle diversity includes panicle length is ranging from 19.5 - 29.5 cm, number of grains per panicle is ranging from 42 to 361 and the test weight of the varieties is ranging from 11.3 - 27.6 gm.

These landraces exhibit diverse characteristics, highlighting their potential for conservation and utilization in rice breeding programs.

The results are somewhat inline with the results of Bera (2020) [1] and Shanmugam *et al.* (2023) [6].

Table 6: Constraints faced by farmers in cultivation of land races

S. No.	Constraint	Total Score	Mean Score	Rank
1.	Requires more labour for conservation of land races	120	40.00	I
2.	farmers and consumers are not having proper awareness on advantages of land races	110	36.67	II
3.	Lack of policy guidelines and government support for conservation of land races	102	34.00	III
4.	Land races giving very lesser yields	95	31.67	IV
5.	Farmers not getting proper rice mills for marketing facilities	81	27.00	V
6.	Land races are prone to lodging due to more plant height	74	24.67	VI
7.	Duration of the native varieties is more	73	24.33	VII
8.	Land races prone to more pest and diseases	67	22.33	VIII
9.	Land races are not fetching premium price in market	60	20.00	IX

It could be inferred from the Table 6.0 that, labor requirement is more for cultivation and conservation of landraces (Mean score: 40.00) is the major constraint, followed by lack of awareness among farmers and consumers on the advantages of landraces (Mean score: 36.67), insufficient policy and government support for cultivation and conservation (Mean score: 34.00), landraces have lower yields compared to high yielding (Mean score: 31.67) and difficulties in accessing proper rice mills and marketing facilities (Mean score: 27.00) are the most

important constraints expressed by the farmers.

These constraints highlight the need for targeted interventions to support the conservation and promotion of indigenous rice landraces.

These results are somewhat in line with the Blakeney *et al.* (2020) [2].

Conclusion

The study indicating that, the conservation and promotion of rice landraces in the Godavari zone are crucial for food

security, environmental sustainability and cultural preservation. Policymakers, researchers, and consumers must collaborate to support these efforts, ensuring the survival of valuable genetic resources for future generations. Strategies for Conservation and Promotion of Indigenous Rice Landraces are

- **Incentivize farmers:** Provide incentives to farmers conserving landraces to encourage their continued efforts.
- **Establish community seed banks:** Set up village-level community seed banks for collecting and conserving landraces.
- **Create biodiversity parks:** Establish biodiversity parks at research stations to conserve landraces before they become extinct.
- **Conduct research:** Analyze DUS (Distinctness, Uniformity, and Stability) characters and quality parameters of landraces at research stations.
- **Use landraces in breeding programs:** Utilize landraces as parent material for developing high-yielding, resistant, and biofortified varieties.
- **Raise consumer awareness:** Educate consumers about the health benefits of desi varieties.
- **Provide market access:** Offer open market facilities and other amenities to increase the area under desi varieties and encourage farmer participation.

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