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Economic Assessment of Rice in Taluka Tangwani, District Kashmore at Kandhkot

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Abstract
The paper evaluates the socioeconomic situation, production, and economic feasibility of the major rice varieties grown in Taluka Tangwani, District Kashmore, Sindh. Structured questionnaires, on-farm observations, and secondary data sources were used to survey 120 rice farmers, randomly selected during the 2024 cropping season. Findings indicate that young and moderately experienced farmers in the region mainly farm rice on rented land. In the variety-wise analysis, GUARD-50 had the highest grain yield (81.36 maunds/acre), but Super King, although yielding lower, had the highest profitability due to a higher market price. The cost analysis also revealed that capital and labour requirements vary significantly, with GUARD-50 the most input-intensive and Super King the least expensive. The profitability measures showed that all varieties were cost-effective, and that Super King, Diamond, and GUARD-50 had the best cost-benefit and input-output ratios. The research concludes that rice production in Tangwani is a very lucrative business, but is constrained by rising input prices, the unavailability of certified seed, poor extension services, and market inefficiencies. The recommendation to maintain and further increase rice productivity and profitability in the region is to strengthen seed systems, improve access to low-cost inputs, expand extension outreach, improve market infrastructure, and encourage practices that are more resilient to climate change.

Keywords: Rice production; Economic assessment; Profitability analysis; Cost–benefit ratio; Taluka Tangwani; Sindh agriculture

Introduction
Rice (*Oryza sativa* L.) is a vital cereal crop worldwide, an excellent source of calories as starch. It provides protein of higher nutritional quality than that of other cereal grains. Rice is an important food and cash crop, accounting for 2.5 per cent of value addition in agriculture and 0.6 per cent of GDP. During 2023-24, rice crop area increased by 22.2 per cent to 3,600,000 hectares, up from 3,000,000 hectares last year. Its production stood at 9.9 million tons against the target of 7.3 million. The increase in production compared to last year was due to higher area cultivated and demand. The agriculture sector in the country witnessed robust growth of 6.25 per cent, exceeding the 3.5 per cent target set for the fiscal year 2023-24. According to the economic survey 2023-24, the country achieved the agriculture growth target due to sufficient water availability, mitigation of climate change, accurate use of fertilizers, and the use of certified seeds, which led to a boost in cultivated area and increased fertilizer uptake. The crop sector recorded 6.25 per cent growth, exceeding the 3.5 per cent target, driven by stronger growth in essential crops. (GoP, 2023). Sindh is one of the leading rice-growing provinces. The main rice tract lies in the Punjab province, covering more than one million hectares annually. Punjab province, with soil conditions suitable for rice, accounted for 100% of the country's basmati rice production. The two most important methods for transplanting rice are the direct seeding system and the wet seeding system. A wet seeding system (Puddled condition) is a conventional

technique for sowing rice, and most farmers use it. The direct-seeding method is a dry method for sowing rice. It is a latest technique for sowing rice. The direct seeding method comprises seeding dry seeds onto dry loam, whereas the conventional method, wet seeding, comprises sowing pre-germinated seeds onto puddled loam. Said that per-acre puddle production in Pakistan is much less than the key rice-producing countries of the world because of many yield-limiting factors, like weed infestation, improper combination of fertilisers, smaller plant population per acre, and shortage of labour, which are significant constraints for the transplanting and harvesting of rice crop. Unfortunately, in Pakistan, there is no proper, economically viable cropping system in practice to make the best use of rice land to determine productivity. Usually, farmers use the conventional method for transplanting rice. The conventional method requires much water for rice transplanting, resulting in farmers incurring higher labour costs. On the contrary, the dry rice method has recently been introduced in rice-growing areas. It is a modern cost-saving technique that not only saves water but also increases farmers' yields and efficiency (Ahmad & Zaman, 2022). Rice is a cereal grain; it is the most widely consumed staple food worldwide, especially in Asia. It is the grain with the second-highest worldwide production. Rice is the most important grain for human nutrition and caloric intake, providing more than one-fifth of the calories consumed worldwide. Rice cultivation is well-suited to countries and regions with low labour costs and high rainfall, as it is labour-intensive to cultivate and requires ample water. Rice can be grown practically anywhere, even on a steep hill or mountain. Although its parent species are native to Asia and certain parts of Africa, centuries of trade and exportation have made it commonplace in many cultures worldwide (FAOSTAT, 2006). In Pakistan's economy, rice is the second most important food source after wheat and an important foreign-exchange-earning commodity, fetching about $3.93 billion annually. It is one of the highest water-requiring crops, depending on early- and late-maturing varieties. Sixty-two per cent of the total rice area is under fine varieties, 27 per cent under coarse grain varieties, and 11 per cent under other varieties. Moreover, about 96 per cent of fine varieties are grown in Punjab because the climate there is suitable for maintaining their quality and aroma. The yield of fine varieties is much lower than that of course-grain varieties, but the demand for fine rice is high in national and international markets. Most farmers prefer to grow fine varieties despite low yields, high production costs, and greater water requirements (Khushk et al., 2011). Technical efficiency has led to the development of methods for estimating farmers' relative technical efficiency. The common feature of these estimation techniques is that they extract information from extreme observations in a dataset to determine the best-practice production frontier (Lewin & Lovell, 2021). From this, the individual farmer's relative technical efficiency can be derived. Despite this similarity, the approaches for estimating technical efficiency can be generally categorised into the distinctly opposing parametric and non-parametric methods (Seiford & Thrall, 1990). However, rice is a significant crop in Sindh province, and the province is a major contributor to Pakistan's rice production. Therefore, the present study will explore the profitability of rice production in the district of Kashmore, specifically in the Kandhkot area.

Review of Literature

Recent research has examined rice production from multiple dimensions, including sustainability, profitability, environmental impact, and production economics. Wang et al. (2025) developed an integrated framework combining life cycle impact assessment and economic analysis to evaluate the sustainability of rice production in China. Their findings show progress toward greener production but highlight persistent environmental challenges, particularly methane emissions and high-water footprints. Similarly, Vinci et al. (2023), in a review of 40 LCA studies on rice, noted significant methodological inconsistencies and underrepresentation of major rice-producing regions, emphasizing the need for more standardized and socially integrated sustainability assessments. Hybrid rice has received growing attention for its role in increasing yields and profitability. Wang et al. (2024) documented how hybrid rice seed technologies influenced productivity trends in China and Pakistan, noting that hybrid varieties now occupy around 20% of Pakistan's cultivated area. Ashraf et al. (2024) highlighted advancements in hybrid rice breeding, particularly through QTL mapping, GWAS, and molecular markers, which have improved key floral traits essential for hybrid seed production. Fieldbased comparisons also show strong hybrid performance: Banerjee et al. (2024) reported that hybrid rice outperformed high-yielding varieties (HYVs) in coastal West Bengal in both the boro and aman seasons, yielding higher yields, better economic returns, and improved eco-efficiency than traditional varieties. Studies assessing the economic potential of rice systems further strengthen this evidence. Goswami et al. (2023) found that black rice cultivation in Assam was highly profitable, with a cost–benefit ratio above 2.0, and recommended policy support for inputs, credit, and market access. Sapkota et al. (2021) examined rice production in Nepal and reported differences in productivity and profitability between small and large farms, identifying labour, fertilizer, and irrigation as key determinants of income. In Bangladesh, Anwar et al. (2021) showed that hybrid rice yields 20–25% higher than those of HYVs, but adoption remains limited due to high seed costs and pest pressures, underscoring the role of extension services and input availability.

In Pakistan, rice remains a vital crop for smallholder livelihoods and national export earnings. Ahmed and Khoso (2021) observed that rising input costs, particularly for fertilisers, labour, and irrigation, have narrowed farmers' profit margins. Low yield levels are also a concern: Jatoi et al. (2021) reported that average rice yields in Sindh (2.5 t/ha) remain well below potential yields due to a lack of certified seeds, weak extension support, and soil degradation, including salinity and waterlogging. Market inefficiencies further constrain profitability; Khan and Qureshi (2022) noted that intermediaries dominate the value chain, often offering prices below market levels. Government efforts to improve rice production, outlined in the Sindh Agricultural Policy (2023), aim to enhance access to quality inputs and irrigation infrastructure. However, Shah et al. (2022) noted that implementation gaps persist, particularly for small farmers in remote regions. Climate change adds another layer of risk to Pakistan's rice sector. Khushi et al., (2024) and Ahmed et al. (2022) documented severe losses from the 2022 floods, particularly in Sindh and Kashmore, while Nasir et al. (2020) projected substantial future yield declines under high-temperature scenarios if no adaptation strategies are adopted. These studies collectively emphasise the vulnerability of farmers to extreme weather events and the need for climate-resilient production practices (Khoso et al., 2024); (Asif & Sheikh, 2025). Despite these rich contributions, limited research has specifically examined the localized production economics and constraints of rice farmers in areas such as Taluka Tangwani and District Kashmore. Most studies generalize findings at the provincial level, overlooking site-specific agronomic conditions, cost structures, and market challenges. This gap underscores the need for focused, micro-level economic assessments to better understand the profitability and constraints of rice farming in these regions.

Methodology

Research Design

The study used a descriptive and economic analysis research design. A quantitative survey was conducted to estimate the production costs, revenues, net returns, input–output ratios, and benefit–cost ratios of major rice varieties grown in Taluka Tangwani.

Study Area

The study was conducted in Taluka Tangwani, District Kashmore, at the northern boundary of Sindh, Pakistan. The region is predominantly agrarian, with rice being one of the major crops cultivated due to its favourable climate and irrigation-based farming system.

Population and Sample

All the farmers who produce rice in the Taluka Tangwani formed the study's target population. Sampling was conducted in a multistage design to ensure that the entire region was represented. The taluka was purposively picked in the first stage because it has a high concentration of rice cultivation. At the second stage, 15 randomly selected villages were chosen. Respondents were selected in the third stage, with eight rice farmers per village selected at random to achieve a final sample size of 120. This sampling type ensured that farmers with varying farm sizes and production methods were not under-represented.

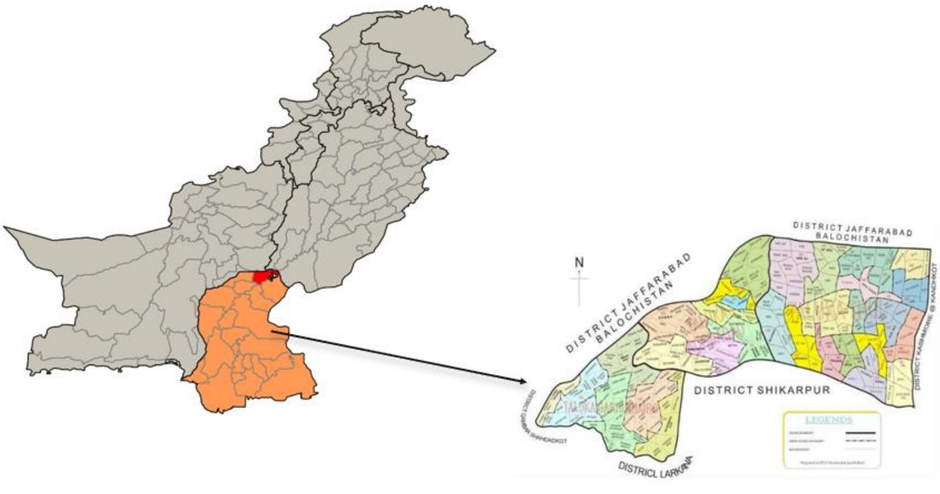

Figure 1: Study Area Map

Data Collection

Data was gathered from primary sources through structured questionnaires, face-to-face interviews, and on-farm observations during the cropping season. The questionnaire collected data on input use, land labour employment, capital costs, agricultural yields, revenue, and marketing practices. Secondary data were obtained from the Sindh Agriculture Extension Department, Pakistan Economic Survey, previous studies, and records of local market prices. The combined use of primary and secondary sources ensured the data was accurate and enhanced the credibility of the findings.

Data Analysis

The data were analysed by using SPSS 25. The socioeconomic traits and production patterns were summarised using descriptive statistics, including means, frequencies, and percentages. The analysis of the economy encompassed estimates of total production costs, variable and fixed costs, gross revenue, net returns, input/output ratios, and benefit/cost ratios (BCRs). The profitability of rice varieties was compared using standard agricultural economics formulae. The findings were presented in tables and briefly discussed to highlight the main differences in economic performance.

Total Cost of Production

The total cost of production was estimated by using the following formula:

TC=TFC+TVC

Net Returns

Net returns were estimated by using the following formula:

NR TI- TC

Input-output and cost-benefit ratio

The input-output ratio was estimated by using the following formula:

$$IO_R = \frac{T1}{TC}$$

Where IOR = Input-Output Ratio

The cost-benefit ratio was estimated by using the following formula:

$$CBR = \frac{NR}{TC}$$

Where *CBR* = Cost-Benefit Ratio

Results

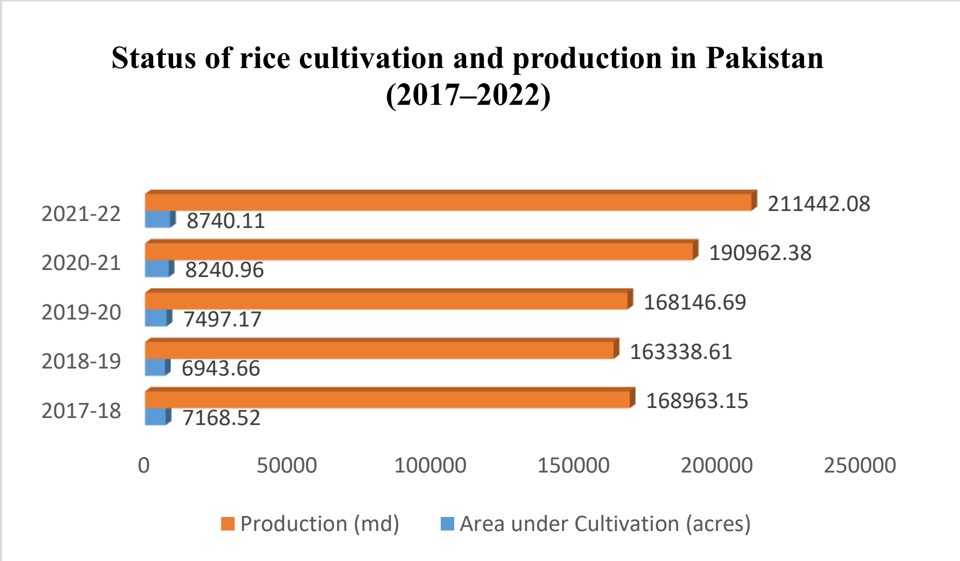

Figure 2: Cultivation and Production Chart

The trend in Figure 2 shows how rice production and cultivation in Pakistan have performed between 2017 and 2022. The statistics represent the annual change in cultivated areas and total output, providing a clear overview of the sector's performance over time. During the year 2017-18, rice was planted on approximately 7,168.52 thousand acres, yielding 168,963.15 thousand maunds. In 2018-19, there was a minor decrease, with cultivated land at 6,943.66 thousand acres and production at 163,338.61 thousand maunds, indicating a temporary shrinkage in the rice industry. This progressed to the year 2019-20, when the area increased to 7,497.17 thousand acres and production increased to 168,146.69 thousand maunds, almost in line with 2017-18. The growth did not stop in 2020-21, with 8,240.96 thousand acres under cultivation and an output of 190,962.38 thousand maunds. The peaks were recorded in 2021- 22, when the area cultivated reached 8,740.11 thousand acres and production reached 211,442.08 thousand maunds. All in all, the data shows that the Pakistani rice sector has been increasing significantly in the period post-2018- 19 due to increased cultivation, higher productivity, and growing farmer interest, supported by improved farming practices and market demand.

Table 1: Socioeconomic Characteristics of Rice Growers in The Study Area

Items		**Units**	**Statistics**
Family size		Numbers	5.55
Age of the farmer		Year	31.01
Education	Illiterate	Percentage	14
	Primary		27
	Matric		15
	Intermediate		23
	B.Sc.		29
	M.Sc.		12
Family system	Nuclear	Percentage	56
	Joint		64
Farming experience		Year	17.74
Rice farming experience		Year	8.62
Average land holdings	Own	Acre	3.66
	Tented		34.13

Table 1 outlines the important sociocultural characteristics of rice farmers in the study area. Overall, the average household size of 5.55 suggested an adequate family labor supply to assist with the farmers' activities. The farmers were pretty young, with a mean age of 31 years. In terms of education, 41% of respondents had either intermediate or graduate education, while 27% had primary education and 14% were illiterate. Most respondents lived in either a nuclear family system or a joint family system, both of which are common in the area. On average, farmers had 17.74 years of experience in general farming and 8.62 years of experience in rice farming, indicating moderate levels of specialization in rice farming. With respect to landholding, the farmers owned an average of 3.66 acres but rented 34.13 acres, resulting in a rented land incidence, an important characteristic of local rice production.

Table 2: Variety-Wise Physical Productivity Per Acre Obtained by The Rice Growers

Variety	**Rice Grain (maunds)**			**Chuff (Binds)**		
	Total	**Sold**	**Own consumption**	**Total**	**Sold**	**Own consumption**
ANURAJ	78.86	66.17	12.70	12.05	5.83	6.22
DIAMOND	77.94	67.94	10	10.06	4.09	5.97
GUARD-50	81.36	66.89	14.47	13.22	6.93	6.29
DHAGA-50	80.78	69.39	11.39	11.50	4.33	7.17
BASMATI SUPER	60.43	49.80	10.63	8.06	1.67	6.39
LP-18	79.6	69.62	9.98	10.00	2.42	7.58

Table 2 presents the variety-wise physical productivity of rice per acre, including the quantities of rice grain and chuff obtained, along with their distribution between sales and own consumption. GUARD-50, by far the highest yielding variety, produced a grain yield of 81.36 md/acre, while DHAGA-50 yielded 80.78 md/acre. Basmati Super was the lowest-yielding variety (60.43 md/acre). However, Basmati Super tends to be priced high in the market and remains a preferred variety for many consumers. Chuff production by GUARD-50 followed a similar pattern, yielding the highest by-product amounts. In general, GUARD-50 and DHAGA-50 are the most productive varieties in the study area.

Table 3: Variety-Wise Capital Cost Per Acre (In Rupees)

Particulars	**Rice varieties**					
	Anuraj	**Diamond**	**Guard-50**	**Dhaga**	**Super King**	**LP-18**
Plowing	2550	2600	2750	2850	2770	2250
Levelling	950	1000	900	850	970	700
Seed	11500	9680	12450	11550	3880	11550
Fertilizer	9000	9300	9550	9450	7550	8560
Pesticide	1500	1300	1400	1290	1100	1150
Insecticide	600	700	1120	1200	1160	1100
Threshing	7500	7200	8450	8350	6550	8250
Total capital cost	33600	31780	36620	35540	23980	33560

Table 3 presents the capital costs per acre for the parcels representing the study area, including the capital costs of land preparation, seed, fertilizer, pesticides, insecticides, and threshing. There is some variation in per-acre costs across rice varieties, reflecting differences in input requirements and cultivation practices. The lowest per-acre land preparation capital cost was for LP-18, and the highest was for DHAGA and Diamond. Seed cost showed the most tremendous difference among rice varieties, with GUARD-50 at the premium end and Super King at the least expensive. Fertilizer input costs were also significant for all of the rice varieties, ranging from Rs. 7,550 to Rs. 9,550. The cost of pesticides and insecticides showed relatively lower variation. The cost of threshing was another important capital cost variable, with GUARD-50 at the premium end of the range and Super King at the lower end. In the end, the total capital costs per acre were most significant for GUARD-50 (Rs. 36,620), followed by DHAGA (Rs. 35,540) and ANURAJ (Rs. 33,600). The variety Super King was the most economically viable, costing Rs. 23,980. The range in capital cost reflects an important factor when accounting for and estimating the profitability of rice varieties.

Table 4: Variety-Wise Per-Acre Labor Cost of The Rice Growers (In Rupees)

Particulars	**Rice varieties**					
	Anuraj	**Diamond**	**Guard-50**	**Dhaga**	**Super King**	**LP-18**
Jungle clearance	350	300	400	500	400	470
Clod crushing	400	400	400	400	400	400
Preparation of nursery	800	900	950	800	600	750
Irrigation labour	500	550	600	500	400	450
Transplantation	2600	2700	2900	2700	2650	2760
Application of fertilizer of / F.Y.M.	600	500	550	450	530	530
Application of insecticide/weedicide	400	450	500	400	550	400
Harvesting	5000	4500	5500	4300	4700	4600
Labour in threshing	2700	2500	2000	2200	2200	2650
Loading	500	600	550	450	450	540
Total labour cost	13850	13400	14350	12700	12880	13550

Table 4 breaks down how much it costs to grow different types of rice per acre, looking at stuff like getting the land ready, starting the nursery, watering, planting, using fertilizer and pesticides, plus harvesting, threshing, and loading. The amount of work needed really depended on the rice type. Getting the land ready initially cost anywhere from Rs. 300 (Diamond) to Rs. 500 (DHAGA), but crushing clods was the same for everyone at Rs. 400. Setting up the nursery cost the most for GUARD-50 (Rs. 950) and the least for Super King (Rs. 600). Watering ranged from Rs. 400 (Super King) to Rs. 600 (GUARD-50). Transplanting accounted for most of the work, costing between Rs. 2,600 and Rs. 2,900 across all types. Putting on fertilizer ranged from Rs. 450 (DHAGA) to Rs. 600 (ANURAJ), and using pesticides did not change much (Rs. 400–550). Harvesting costs the most for GUARD-50 (Rs. 5,500) and the least for DHAGA (Rs. 4,300). Threshing and loading also had different costs, with ANURAJ costing the most to thresh (Rs. 2,700) and Diamond costing the most to load (Rs. 600). If you add it all up, GUARD-50 cost the most in labor overall (Rs. 14,350), and DHAGA cost the least (Rs. 12,700), with Super King and Diamond being somewhere in the middle. Basically, transplanting and harvesting take the most work. GUARD-50 needs the most labor, while DHAGA needs the least, which could mean some are cheaper to grow than others.

Table 5: Revenue Productivity Per Acre

Variety	Rice Grain revenue per acre			Chuff revenue			Total revenue (a+b)
	Total Productivity (maunds)	Rate per maund	Total revenue (a)	Total Productivity	Rate per Bind	Total revenue (b)	
Anuraj	78.86	3000	236580	12.05	250	3012.5	239592.5
Diamond	77.94	3200	249408	10.06	250	2515	251923
Guard-50	81.36	3150	256284	13.22	250	3305	259589
Dhaga	80.78	2900	234262	11.50	250	2875	237137
Super King	60.43	4000	241720	8.06	250	2015	243735
LP-18	79.6	2800	222880	10	250	2500	225380

Table 5 presents the revenue productivity per acre for different rice varieties, including earnings from both rice grain and chuff (a by-product). The results show substantial variation in gross revenue across varieties, influenced by differences in yield levels and market prices. For grain revenue, GUARD-50 generated the highest income at Rs. 256,284 per acre, followed closely by Diamond (Rs. 249,408). This was mainly due to their higher yields and competitive market rates. Super King, despite having the lowest yield (60.43 maunds per acre), achieved relatively high grain revenue of Rs. 241,720, owing to its premium market price of Rs. 4,000 per maund. By contrast, LP-18 recorded the lowest grain revenue (Rs. 222,880) due to its comparatively lower market price of Rs. 2,800 per maund, despite having a respectable yield of 79.6 maunds per acre. Chuff also contributed to farm revenue, though to a much smaller extent than grain. The highest chuff earnings were recorded at GUARD-50 (Rs. 3,305) and ANURAJ (Rs. 3,012.5), reflecting greater by-product output. Other varieties ranged between Rs. 2,015 for Super King and Rs. 2,875 for DHAGA. When combined, GUARD-50 ranked first in terms of total revenue with Rs. 259,589 per acre, followed by Diamond (Rs. 251,923) and Super King (Rs. 243,735). ANURAJ (Rs. 239,592.5) and DHAGA (Rs. 237,137) generated moderate revenue, while LP-18 had the lowest total revenue at Rs. 225,380. In summary, the findings reveal that although yield plays a crucial role in determining revenue, market price is equally important. Varieties like Super King, with lower yield but higher price, can still compete with high-yielding varieties. Meanwhile, GUARD-50 combines both firm productivity and favorable market value, making it the most revenue-generating variety among those assessed.

Table 6: Input-Output and Cost-Benefit Ratio of Rice

Variety	Total cost (a)	Total revenue (b)	Profit (c)=b-a	Input-output ratio (d) =b/a	Benefit Cost ratio (e)=c/a
Anuraj	49750	239592.5	189842.5	1:4.81	1:3.81
Diamond	47460	251923	204463	1:5.30	1:4.30
Guard-50	53340	259589	206249	1:4.86	1:3.86
Dhaga	50580	237137	186557	1:4.68	1:3.68
Super King	38810	243735	204925	1:6.28	1:5.28
LP-18	49440	225380	175940	1:4.55	1:3.55

Table 6 summarises the profitability of the different rice varieties using total cost, total revenue, net profit, and economic efficiency ratios. The results indicate that Super King was the most cost-efficient variety, with a profit of Rs. 204,925 per acre, along with input–output (1:6.28) and cost–benefit ratios (1:5.28). Diamond and GUARD-50 were also efficient. Diamond recorded a profit of Rs. 204,463, while GUARD-50 had the highest absolute profit of Rs. 206,249; however, its efficiency ratios were lower. ANURAJ and DHAGA generated average profits, whereas LP-18 was the least profitable at Rs. 175,940 net profits with the lowest efficiency ratios. In general, however, all varieties were profitable, but Super King was the most economically efficient, followed by Diamond and GUARD-50. In contrast, LP-18 was the least competitive of the six rice varieties evaluated.

Discussions

The socioeconomic characteristics of rice farmers in Taluka Tangwani, District Kashmore, reveal both similarities and differences compared to other regions of Sindh. The average age of farmers was about 31 years, reflecting a younger and more active population that is more receptive to modern technologies and innovative practices. The average family size was 5.5 members, slightly smaller than in other parts of Sindh, indicating reliance on family labour, which helps reduce dependence on hired workers and lowers production costs. Educational levels among farmers ranged from illiteracy to advanced degrees, suggesting that while some farmers are well-positioned to adopt improved practices, others face barriers due to limited literacy. These findings are consistent with earlier studies in Sindh, which also highlighted variations in household structures and educational backgrounds among rice farmers (Noonari et al., 2015). The results highlight variety-wise differences in yield, cost, and profitability among rice varieties in Tangwani. GUARD-50 recorded the highest yield (81.36 maunds/acre), followed by DHAGA-50 and LP-18, while Basmati Super had the lowest (60.43 maunds/acre). These findings align with earlier evidence that Sindh's rice yield remains below potential due to uncertified seeds and outdated practices (Chandio et al., 2018). The strong performance of GUARD-50 and DHAGA-50 confirms that improved or hybrid varieties can substantially increase productivity, supporting earlier findings that hybrids may double yields compared to traditional types (Abbasi, 2024; Gilani, 2020). Despite its lower yield, Basmati Super remains popular due to premium prices and consumer preference, a trend similarly noted in Sindh's rice sector (Saeed et al., 2020). Moreover, the cost analysis showed GUARD-50 as the most cost-intensive variety, requiring Rs. 36,620 in capital and Rs. 14,350 in labour per acre, mainly due to high seed and fertiliser costs, as well as intensive labour for nursery preparation and harvesting. By contrast, Super King was the least costly at Rs. 23,980 (capital) and Rs. 12,880 (labour). Rising input prices and labour shortages have similarly been highlighted as critical production challenges in Sindh (Ali et al., 2022). Profitability analysis revealed GUARD-50 earned the highest gross revenue (Rs. 259,589/acre), yet Super King was the most cost-efficient, with the highest benefit–cost ratio (5.28) and input–output ratio (6.28). This underscores the role of market price in profitability, as varieties like Super King achieved higher returns despite lower yields. Diamond and GUARD-50 also proved profitable, while LP-18 showed the lowest returns (BCR 3.55). These results reaffirm that both yield and market price are decisive factors in varietal profitability (Chandio et al., 2018). Compared with studies from other districts, Tangwani's profitability appears firmer. For instance, in Taluka Pano Akil of District Sukkur, net income was reported at around Rs. 38,290 per acre, with an input–output ratio of 1.58, which is far lower than the figures reported for Tangwani (Noonari et al., 2015). Similarly, in Dokri of District Larkana, gross margins were around Rs. 28,197 per acre with ratios below 2, again much lower than the profitability observed in Tangwani (Wagan et al., 2025). This suggests that Tangwani farmers benefit from a more favourable cost-to-revenue balance, possibly due to higher market prices for certain varieties and lower risks during the study year. Although rice production in Tangwani is clearly profitable, farmers continue to face significant constraints. High input prices, lack of certified seeds, limited access to extension services, and inefficiencies in the marketing system remain major issues (Chandio et al., 2016). Further, the findings underscore the importance of effective policy interventions. Although the Sindh Agricultural Policy (2018–2030) has introduced subsidies and support mechanisms, their implementation remains weak in rural areas like Tangwani (Government of Sindh, 2018). This study has certain limitations, as it covers only 120 farmers from one Taluka and one cropping season. Thus, the findings cannot be generalized to all rice-growing

regions of Sindh. Future research should therefore extend to multiple districts, compare conventional and hybrid varieties more broadly, and examine efficiency through advanced methods such as Data Envelopment Analysis (DEA) (Coelli et al., 2005).
In conclusion, rice farming in Tangwani is highly profitable, with all varieties generating positive returns. Super King proved to be the most cost-efficient due to its high market price, while GUARD-50 and Diamond stood out as the most revenue-generating varieties (FAO, 2022). Compared with other districts of Sindh, such as Larkana and Sukkur, Tangwani demonstrates stronger profitability, which reflects favourable production and marketing conditions (Noonari et al., 2015; Wagan et al., 2017). However, systemic issues such as rising input costs, weak extension services, and market inefficiencies continue to pose challenges (Chandio et al., 2016). Addressing these constraints through policy reforms, infrastructure investment, and farmer education will be essential to sustain and enhance rice production in Tangwani and across Sindh (Government of Sindh, 2018). Kabir & Uphoff, 2007).

Conclusions and Recommendations

In Taluka Tangwani, rice production is highly profitable across all varieties studied. Overall, Super King offers the best cost-effectiveness, as it is sold at a premium price in the marketplace; GUARD-50 and Diamond offer the highest gross revenues due to their higher yields. However, constraints to rice farmers' performance remain, including high input costs, limited access to certified seed, poor extension services, and marketing constraints. It is therefore recommended that policymakers strengthen the certified seed system and support seed/seedling distribution systems; improve accessibility to affordable fertilisers and labour-saving technologies; improve access to extension services for modern production management; promote high value, high-yielding varieties; invest in market infrastructure and price information systems; and encourage climate-resilient responses in order to promote and maintain an economically viable rice farming system in the future.

References

Asif, M., & Sheikh, M. J. (2025). Climate Change and Displacement in Pakistan: Resettlement Policy Challenges and Multisectoral Impacts. Zakariya Journal of Social Science, 4(1), 17-26.

Abbasi, S. (2024). Impact of Hybrid Varieties on the Productivity of Rice Cultivation: The Case of Sindh, Pakistan. *Jordan Journal of Agricultural Sciences*, *20*(3), 210-218.

Ahmad, N., & Zaman, B. (2022). Rice production and export potential in Pakistan: A comprehensive review. *Pakistan Journal of Agricultural Research, 35*(2), 65-74.

Ahmed, K., & Khoso, R. (2021). Economic challenges in rice farming: A case study of Sindh, Pakistan. *Journal of Agricultural Economics and Policy, 12*(3), 45-55.

Ahmed, S., Rehman, H., & Khan, A. (2022). Impact of climate change on rice production in Pakistan. *Climate and Agriculture Research Journal, 14*(2), 102-110.

Ali, S., Ahmad, N., & Mehmood, Y. (2022). Does education and farming experience affect technical efficiency of rice crop? *Pakistan Journal of Agricultural Research, 35*(1), 221–229.

Anwar, M., Zulfiqar, F., Ferdous, Z., Tsusaka, T. W., & Datta, A. (2021). Productivity, profitability, efficiency, and land utilization scenarios of rice cultivation: An assessment of hybrid rice in Bangladesh. *Sustainable Production and Consumption, 26*, 752-758.

Ashraf, H., Ghouri, F., Baloch, F. S., Nadeem, M. A., Fu, X., & Shahid, M. Q. (2024). Hybrid rice production: A worldwide review of floral traits and breeding technology, with special emphasis on China. *Plants, 13*(5), 578

Banerjee, S., Mahato, K., Pramanik, S., & Dimitrov, S. E. (2024). Impact analysis of hybrid and high yielding rice varieties (HYVs) on productivity, profitability and GHGs emission in the coastal saline zone of West Bengal state, India: A multi-criteria approach. *Journal of Eco-friendly Agriculture, 19(2), 364-373*

Chandio, A. A., & Yuansheng, J. I. A. N. G. (2018). Determinants of adoption of improved rice varieties in northern Sindh, Pakistan. *Rice Science*, *25*(2), 103-110.Gilani, I. (2020, October 10). Hybrid rice seeds triple yield in lower Sindh, south Punjab. *The Nation*.

Chandio, A. A., Magsi, H., & Rehman, A. (2016). Determinants of access to agricultural credit for small farmers in Sindh province, Pakistan. *Journal of Applied Environmental and Biological Sciences, 6*(3), 39–45

FAOSTAT (2006). Crop Production 2006, Statistics Division, Food and Agriculture Organization of the United Nations. Government of Sindh, 2006. Agriculture Statistics of Sindh 2005-06. Government of Sindh, Karachi.

GoP, (2023). Agriculture: Economic Survey of Pakistan, 2022-23, Ministry of Food and Agriculture, Govt of Pakistan, Islamabad. https://www.finance.gov.pk/survey_2022.html.

Goswami, K., Thapa, D. B., Sandilya, J., & Deka, N. (2023). An assessment of economic profitability of black rice (*Oryza sativa* L. indica) production in Assam, India. *Journal of Applied Research on Medicinal and Aromatic Plants*, *34*, 100488. https://doi.org/10.1016/j.jarmap.2023.100488

Government of Sindh. (2018). Sindh agricultural policy 2023: Policy framework for sustainable agricultural development. Karachi: Government of Sindh. https://www.informea.org/en/content/legislation/sindh-agriculture-policy-2018-2030

Jatoi, N., Shah, A., & Hussain, R. (2021). Productivity constraints in Sindh's rice sector. *Pakistan Journal of Agriculture, 39*(4), 345-360.

Khan, A., & Qureshi, T. (2022). Market dynamics and rice farming in Sindh. *Agricultural Economics Today, 18*(1), 25-38.

Khoso, A. R., Jintu, G., Bhutto, S., Sheikh, M. J., & Narejo, K. V. A. A. (2024). Climate change and its impacts in rural areas of Pakistan: a Literature. Journal of Environmental Science and Economics, 3 (1), 18, 26.

Khushi, S. R., Khoso, A. R., Bhutto, S., & Narejo, A. A. (2024). The long-term health impacts of repeated flood events: A Review. Journal of Environmental and Energy Economics, 3(1), 11-19.

Khushk, A. M., A. Memon & K. M. Aujla. (2011). Marketing channels and margins of rice in Sindh, Pakistan. *J. Agric. Res., 47*(3): 293-308.

Lewin, A. Y., & Lovell, C. A. K. (2021). Frontier efficiency analysis: Parametric and nonparametric techniques. *Journal of Econometrics, 46*(1-2), 3-38. http://www.amis.pk/agristatistics/statistics.aspx.

Nasir, I. R., Rasul, F., Ahmad, A., Asghar, H. N., & Hoogenboom, G. (2020). Climate change impacts and adaptations for fine, coarse, and hybrid rice using CERES-Rice. *Environmental Science and Pollution Research, 27*, 9454-9464.

Noonari, S., Memon, M. I. N., Jatoi, A. A., Peerzadio, M. B., Chandio, A. A., Wagan, S. A., ... & Shah, T. (2015). Analysis of rice profitability and marketing chain: A case study of district Sukkur Sindh Pakistan. *International Journal of Business and Economic Research*, *4*(3), 133-143.

Saeed, I., Mubarik, A., Umar, F., & Aqsa, Y. (2020). Basmati rice cluster feasibility and transformation study. *2020) Cluster Development Based Agriculture Transformation Plan Vision-2025. Project*, (131), 434.

Sapkota, N., Yadav, P. K., & Sapkota, S. (2021). An economic analysis of rice production in Rautahat district of Nepal. *Food and Agri Economics Review, 1*(1), 01–09.

Seiford, L.M. & R.M. Thrall., (1990). Recent developments in DEA: The mathematical programming approach to frontier analysis. *Journal of Econometrics, 46* (1/2): 112-119.

Shah, S., Ahmed, M., & Zafar, N. (2022). Assessing the economic viability of rice cultivation in Sindh. *South Asian Journal of Agricultural Research, 8*(3), 65-78.

Vinci, G., Ruggieri, R., Ruggeri, M., & Prencipe, S. A. (2023b). Rice Production Chain: Environmental and Social Impact Assessment—A Review. *Agriculture*, *13*(2), 340. https://doi.org/10.3390/agriculture13020340

Wagan, S. A., Jingdong, L., Shuangxi, X., Noonari, S., Memon, I. N., Memon, Q. U. A., & Wagan, G. H. (2017). Economic assessment of rice production in Sindh, Pakistan. *American Journal of Environmental and Resource Economics*, *1*(1), 37. https://doi.org/10.11648/j.ajere.20160101.15

Wang, L., Zhang, T., Zhou, X., Xu, T., Li, C., Li, Z., Wang, S., Li, M., & Hong, J. (2025). Insights into the al–economic sustainability of rice production in China. *Journal of Cleaner Production, 498*, 145205.