International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

An Analytical Study on Red Wheat Cultivation in the Bundelkhand Region

Dr. Babita Singh

Department of Banking, Economics and Finance, Bundelkhand University, Jhansi

Abstract

The agricultural economy and food security of the Bundelkhand region are greatly influenced by red wheat, a crucial crop. This research aims to examine its farming methods, output, and financial feasibility while considering Bundelkhand's particular soil and climate. Using a mixed-method study methodology, we analyse important elements that affect red wheat productivity, including market dynamics, irrigation, and soil health. Statistical methods such as ANOVA, regression analysis, and hypothesis testing were used to assess the importance of different factors influencing yield. According to the results, the use of high-yield varieties (HYVs), effective water management techniques, and improved market connections significantly impact red wheat production. Though historically significant, red wheat production has been diminishing due to market conditions, HYV competition, and insufficient assistance for conventional crops. One recommendation is to promote focused interventions to increase output and guarantee the sustainability of red wheat farming. Policymakers, scholars, and farmers who want to maximize red wheat production in Bundelkhand might use this document as a resource.

Keywords: Red wheat production, HYVs, Sustainable agriculture, Farmer profitability, Nutritional benefits of red wheat, Agricultural policy reforms

INTRODUCTION

The region of Bundelkhand in Central India is a semi-arid region, most of whose economy is based on agriculture that comes from conventional farming. The following regions make it to the region: parts of Madhya Pradesh and Uttar Pradesh. This region is characterized by extreme weather conditions with poor rainfall and recurrent drought. These aspects make farming a high-risk occupation that requires unique and tough choices when choosing what to grow. Well known for its reddish colour and nutritional profile, red wheat has been one of Bundelkhand's mainstay crops for a long time. An important source of income and existence for the farming community it is known for high iron content and the ability to survive in droughts. However, a few problems have been associated with growing red wheat over the years, including a decline in yields, a reduction in profitability, and a shift towards HYVs. This study provides the socioeconomic and environmental factors affecting red wheat yield and an analysis of HYVs regarding the factors pertinent to its decline. It also outlines practical steps to raise red wheat production by at least five-fold and make it profitable enough to support the farmers in the area.

Objectives

- Conduct a comprehensive assessment of red wheat cultivation trends and practices in Bundelkhand.
- Examine the interplay of climatic, economic, and technological factors affecting red wheat production

and provides a comparative analysis with HYVs.

- Propose evidence-based interventions to address the challenges faced by red wheat farmers.

Hypothesis

1. **(H1)** There is a significant difference in yield between farmers using HYVs and traditional varieties (Red wheat).
   (H0): No significant difference in yield between farmers using HYVs and traditional varieties (Red wheat).
2. **(H1)** Input cost significantly affects yield.
   (H0): input cost does not significantly affect yield.
3. **(H1)** Farmers significantly prefer HYVs over red wheat
   (H0): Farmers do not prefer HYVs over red wheat

Literature Review

Many researchers have looked into the future and challenges of cultivating red wheat in regions of low rainfall such as Bundelkhand. Sharma et al.'s (2020) investigation focused on one of the nutraceutical and functional properties of RW, which have greater iron and zinc concentrations than white wheat, which is used to correct the micronutrient deficits in the diet of rural diets. In their article Climate Variability: Impacts on Wheat Yield: Comparative Analysis of Red and White Wheat from India Published in 2019 Kumar and Singh demonstrated that though being more heat resilient compared to white wheat, red wheat also apparently requires top water usage strategies for optimum production. Verma et al., 2018 notes that for enhancing productivity in the region like Bundelkhand which is a semi-arid region, it is important to introduce seed varieties, and modern packages technology in agriculture. Pandey et al. (2021): I presented what the writers have said about red wheat and its economic perspective and showed that although there are no marketing channels or farmer cooperatives marketed red wheat so that they can prove the economic feasibility of marketing red wheat to consumers is still unknown. While red wheat is a cereal with enormous prospect, these researches indicate that enhancing its productivity for a better yield in the long run requires a comprehensive interventionary frameworks that addresses changes in agronomic techniques, financial outcomes, and infrastructural problems.

Methodology

Utilizing a blended technique approach, optional information from government and examination associations was joined with essential information from field perceptions and reviews of 100 farmers. Yield per hectare, input costs (water, manure, and seeds), market valuing, and environment information (temperature, precipitation) are significant factors in this review. Correlation and regression analyses to identify relationships between variables. Hypothesis testing using t-tests and Chi-Square to evaluate significant differences.

Findings and Discussion

Current Status of Red Wheat Cultivation:

Red Wheat Production (1950–2023)

Year Range	Red Wheat Yield (tons/ha)	HYVs Yield (tons/ha)	Area Under Red Wheat (million ha)	Area Under HYVs (million ha)	Average Rainfall (mm)	Market Price of Red Wheat (INR/ton)	Market Price of HYVs (INR/ton)
1950-1960	1.2	-	4.0	-	850	500	-
1970-1980	1.8	2.0	3.5	0.5	800	1,200	1,000
1990-2000	2.0	2.8	2.8	2.0	750	5,000	4,500
2010-2020	2.4	3.2	2.0	3.5	700	15,000	12,000
2023	2.3	3.4	1.8	4.0	700	20,000	18,000

Source - ICAR-Indian Institute of Wheat and Barley Research's annual reports (2022)

According to this table, the average red wheat yield has been on the rise steadily, from 1.2 tons/hectare in the 1950s to 2.3 tons/hectare in 2023. Due to the large performance advantages achieved with HYVs over red wheat, farmers have adopted this technology The yield potential of HYVs reached 3.4 t ha. The differences in resource allocation in conventional hybrid breeding programs and this novel approach are observed in the following aspects: The transition to HYVs was seen in the indicators that shed reduced area of red winter wheat outturn from 4 million hectares in the 50s to 1.8 million hectares in 2023. The use of HYVs expanded from the almost negligible levels in the 1950s to 4 million hectares in 2023.

Over the years ranging from 1950-2023, average annual rainfall has reduced from 850 mm to 700 mm this has pandemic the red wheat since it has been under conventional irrigation methods. While its market price has also increased considerably from INR 500 per tonne in the 1950s to INR 20,000 per tonne. In 2023, it symbolized its special nutritional value. Unclear which ref? While lower in cost at INR 18,000/ton in 2023 than traditional varieties, HYVs are widely used due to their greater availability and better processing characteristics. This was the government support, financial incentives, and substantial research during the 1970s, known as the Green Revolution.

Reasons for Decline in Red Wheat Production

- Lower Yields Compared to HYVs: Farmers prioritize HYVs for their higher yields, which result in greater profitability per hectare despite their higher input costs.
- Market Dynamics: HYVs benefit from better market linkages and higher demand due to their suitability for large-scale processing industries. Red wheat, although nutritionally superior, lacks such organized market systems.
- Subsidies and Government Support: Most agricultural policies and subsidy programs favour HYVs, leaving red wheat farmers with limited resources to improve production.

- Soil Richness Corruption: Ceaseless monocropping and dependence on substance manures have drained soil fruitfulness, influencing red wheat efficiency all the more seriously because of its customary development techniques.
- Climatic Difficulties: Expanding recurrence of dry spells and inconsistent precipitation have lopsidedly influenced red wheat, which depends intensely on conventional water system rehearses.
- Changing Purchaser Inclinations: The absence of mindfulness with respect to red wheat's wholesome advantages has prompted an inclination for HYVs, which are more appropriate for motorized handling and metropolitan business sectors.
- Mechanical Limits: Red wheat ranchers frequently depend on customary cultivating rehearses because of the inaccessibility of present-day gear and expansion administrations customized to this harvest.

Suggestions to Revitalize Red Wheat Production

- Develop hybrid red wheat varieties to match HYVs in productivity while retaining their drought resistance and nutritional content.
- Establish direct marketing platforms for red wheat to connect farmers with health-conscious consumers.
- Introduce premium pricing through certification schemes emphasizing its nutritional value.
- Implement subsidies and crop insurance programs tailored specifically for red wheat farmers.
- Promote red wheat through public procurement programs for welfare schemes.
- Encourage integrated nutrient management to restore soil health. Expand access to modern irrigation infrastructure, such as micro-irrigation systems.
- Launch campaigns to educate consumers on the health benefits of red wheat.
- Collaborate with food industries to include red wheat in health-focused products.

Hypothesis Testing

Statistical Summary of Hypothesis Testing

Hypothesis	Null Hypothesis (H0)	Alternative Hypothesis (H1)	Test Used	p-Value	Result
High-yield varieties	No significant difference in yield with HYVs	Significant difference in yield with HYVs	t-test	0.02	Reject H0 (Significant)
Input costs correlation	input cost does not significantly affect yield	input cost significantly affects yield	Regression	0.05	Reject H0 (Significant)
Preference for HYVs	Farmers do not prefer HYVs over red wheat	Farmers significantly prefer HYVs over red wheat	Chi-Square	0.02	Reject H0 (Significant)

Hypothesis testing results indicate that red wheat yields average 2.3 tons/ha, significantly lower than HYVs at 3.2 tons/ha. The t-test indicates a p-value of 0.02, confirming the significant yield advantage of HYVs. Regression analysis shows a strong positive correlation between input cost and red wheat yield.

Preference for HYVs Chi-square tests indicate that 75% of surveyed farmers prefer HYVs due to higher profitability, better market demand, and government support (p-value = 0.02).

Recommendations

- Invest in the development of improved red wheat varieties that combine high yield with traditional drought resistance and nutritional benefits.
- Establish regional research center in Bundelkhand to focus on adaptive breeding techniques for red wheat.
- Create niche markets for red wheat, highlighting its nutritional superiority and suitability for health-conscious consumers.
- Develop certification systems for red wheat products to attract premium pricing in both domestic and international markets.
- Introduce specific subsidy programs for red wheat farmers to reduce input costs and encourage adoption of improved practices.
- Provide crop insurance schemes tailored to the climatic challenges faced by red wheat farmers.
- Promote organic and integrated nutrient management practices to restore soil fertility.
- Expand irrigation infrastructure and promote water-saving techniques like drip irrigation to improve water availability for red wheat.
- Conduct regular training sessions for farmers on modern techniques tailored to red wheat cultivation.
- Deploy agricultural extension teams to provide on-field guidance and support.
- Raise awareness among consumers and policymakers about the nutritional and ecological benefits of red wheat.
- Collaborate with health organizations to promote red wheat as part of nutritional programs.

Conclusion

Challenges to red wheat production in Bundelkhand include High yield varieties, declining soil quality, changing customer preference, and absence of sound policy. However, the crop has many useful nutritional qualities for humans and animals, is highly resistant to drought, and does not pose a threat to the local ecosystem, which proves that investing in produce is a sound approach for farming. To reverse the trend, it is necessary to undertake a highly integrated approach focused on market expansion, on technical change, and on the implementation of segmented policy measures. Sustainable and profitable farming production and practices depend more on creating farmers' awareness and providing the necessary farming resources. These tactics may assist red wheat in regaining the focus it needs as a food security crop for Bundelkhand people while supporting their careers.

References

1. Ministry of Agriculture & Farmers Welfare (2023). Agricultural Statistics at a Glance.
2. Indian Meteorological Department (2023). Climate Trends in Bundelkhand.
3. ICAR-Indian Institute of Wheat and Barley Research (2022). Annual Report.
4. Local Farmer Surveys (2023). Conducted across Bundelkhand region.
5. Sharma et al. (2020). Nutritional Benefits of Red Wheat. Journal of Agricultural Science.
6. Verma et al. (2018). High-Yield Varieties and Market Dynamics. Agronomy Research.

7. Rao et al. (2023). Government Policies and Traditional Crops. Policy Studies Journal.
8. Chaturvedi & Gupta (2021). Soil Fertility Challenges in Semi-Arid Regions. Indian Agronomy Journal.
9. Pandey et al. (2019). Impact of Irrigation Techniques on Crop Yields. Water Resources Research.
10. Mishra & Singh (2020). Red Wheat Cultivation Trends in Bundelkhand. Regional Agriculture Reports.
11. Indian Council of Agricultural Research (2023). Advances in Wheat Research. ICAR Publications.
12. Bundelkhand Agro-Research Institute (2022). Climate and Crop Resilience in Bundelkhand. Institutional Report.