



Paddy or Maize? Decoding Punjab's Crop Conundrum

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In the fertile fields of Punjab, agriculture holds a central role in livelihoods and culture. Rice cultivation has been prominent in recent years in Punjab, covering 31.68 lakh hectares during 2022-23. This resulted in a total paddy production of 205.24 lakh tonnes, which translates to 137.51 lakh tonnes of rice and the average yield of paddy was 64.79 quintals per hectare (26.22 quintals per acre). However, there has been a noticeable shift towards maize cultivation from last few years in Punjab. In 2022-23, maize occupied 0.93 lakh hectares, producing 4.10 lakh tonnes with an average yield of 43.93 quintals per hectare (17.78 quintals per acre). (Anonymous 2024)



Field View of Rice and Maize Cultivation

Over the decades, the maize acreage in Punjab has undergone a significant transformation, decreasing by over 83% from 1970-71 to 2022-23, a decline that coincided with a substantial decrease in production over the years. However, the adoption of hybrid maize varieties has proven to be a game-changer, substantially increasing crop yields and injecting optimism amidst broader declines. Districts like Kapurthala, Ludhiana and few other districts which were historically known for robust maize cultivation even before the Green Revolution, have seen a resurgence, despite facing negative growth rates under neoliberal policies. (Sidana *et al* 2023)

Maize's efficiency in resource utilization is a compelling factor driving its resurgence in Punjab. This efficiency is particularly crucial in Punjab, where sustainable water management and agricultural diversification are increasingly vital. Environmentally, maize requires less water than rice, offering a sustainable alternative in a region grappling with water scarcity. Economically, maize provides farmers with opportunities for diversification, potentially enhancing income streams and reducing reliance on mono-cropping.

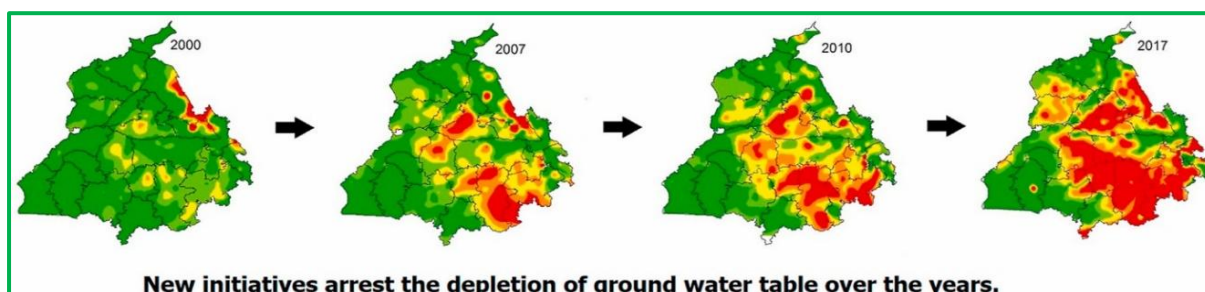
Agriculturally, maize cultivation supports soil health and biodiversity, fostering a more resilient ecosystem. Moreover, maize serves as a versatile crop with diverse uses in food, animal feed, and industrial applications, enhancing its economic viability and market demand. While rice remains integral to Punjab's agricultural heritage, the shift towards maize underscores the state's adaptability to changing agricultural dynamics and market demands.

As Punjab navigates this agricultural transition, challenges such as optimizing crop rotation management and market integration will require strategic solutions. However, with its proven track record in agricultural innovation and infrastructure, Punjab is well-positioned to leverage maize's potential benefits effectively. By embracing maize alongside traditional crops, Punjab not only enhances agricultural productivity but also sets a standard for balanced and forward-thinking agricultural policies nationwide.

Maize is not expected to fully substitute rice in the agricultural framework of Punjab but its growing prominence signifies a significant evolution towards diversified and sustainable farming practices. By strategically integrating maize into its agricultural framework, Punjab secures its agricultural resilience and ensures a prosperous future for its farming communities. This journey towards agricultural diversification not only addresses current challenges but also sets the stage for sustainable growth, contributing to India's agricultural success story.

Environmental Imperatives: Water Scarcity and Sustainability

Punjab, despite occupying only 1.57% of India's geographical area, is predominantly agrarian, with 85% of its land under cultivation at cropping intensity exceeding 198%. The paddy-wheat crop rotation from last many years has significantly increased irrigation water demand. However, unreliable surface water and excessive groundwater extraction due to free electricity have caused a drastic annual decline of 41.6 cm in groundwater levels. (Baweja *et al* 2017). The rice-wheat cropping system, once a pillar of Punjab's agricultural success, now strains groundwater reserves, with a staggering 73% of irrigation demands met from underground sources. (Sidhu *et al* 2021)



Sidhu *et al* 2021

Studies by Punjab Agricultural University and the Indian Council of Agricultural Research paint a stark picture that rice alone consumes 70% of Punjab's water resources dedicated to agriculture. This intensive cultivation not only depletes groundwater levels but also exacerbates the region's water scarcity issues. In response, Punjab has enacted initiatives like 'The Preservation of Sub-soil Water Act, 2009' aiming to curb water use by delaying rice planting, thereby reducing evaporation and easing pressure on groundwater.

In the middle of these challenges emerges maize, a beacon of hope in Punjab's quest for sustainable farming. Unlike rice, maize requires less water to thrive, making it a promising alternative in water-stressed regions like Punjab. Studies from the Central Ground Water Board and Punjab State Farmers' Commission highlight that shifting from rice to maize cultivation could significantly alleviate the strain on groundwater reserves.

Maize is remarkably water-efficient compared to rice. While rice requires 1000 to 1500 mm of rainfall annually, maize thrives on just 400 to 800 mm. This makes maize well-suited for Punjab's semi-arid landscapes, where conserving water is crucial.

The benefits extend beyond practicality as they're pivotal for Punjab's future prosperity. Economically, maize offers farmers new avenues for income and potentially higher returns per unit of water compared to rice. Environmentally, cultivating maize means less strain on groundwater as Rice which requires 800 to 5000 litres of water to produce 1 kg of rough rice, crucial for preserving Punjab's delicate ecosystem amidst climate uncertainties. (Bouman 2009)

By embracing maize, Punjab isn't just diversifying crops but it is securing its agricultural legacy. This shift represents a stride towards smarter farming practices, optimizing resources to ensure food security and environmental sustainability for generations to come.

In Punjab's fields, where each season tells a story of adaptation and resilience, maize stands as a promise, a promise to sustain the land and the lives that depend on it. It's not just a crop change but it is a journey towards safeguarding Punjab's agricultural heritage while paving the way for a greener, more sustainable future.

Economic Opportunities: Rising Demand and Profitability

Crops like wheat and paddy have dominated the landscape for many years due to government policies that guarantee stable incomes through Minimum Support Prices (MSP), assured procurement, and subsidies on essential inputs like fertilizers and free electricity. (Saran *et al* 2013; Pujara *et al* 2016). These policies, aimed at securing farmer's welfare, inadvertently steered them away from exploring alternative crops.

Nationally, the discourse around MSP and public procurement remains contentious, especially concerning the promotion of crop diversification (Kaur *et al* 2018). Despite the government annually announcing MSPs for different crops, many farmers remain unaware of non-traditional options. In Punjab, studies reveal that awareness of MSPs for all other seasonal crops is notably low, reinforcing the dominance of wheat and paddy in the agricultural landscape.

The average yield of rice is 26.22 quintals per acre, with a Minimum Support Price (MSP) of Rs. 2183 per quintal for common grade, totalling Rs. 50,909.80 per acre. In contrast, maize averages 17.78 quintals per acre with an MSP of Rs. 2090 per quintal for common grade, resulting in a total yield value of Rs. 37,192.20 per acre (Anonymous 2024). Despite maize having lower production costs, the cultivation costs of maize are comparatively lower than those of rice, highlighting the need to raise the MSP of maize and ensure proper procurement to match the economic benefits of rice farming.

Punjab's agricultural landscape shifted from maize to rice cultivation. This change is largely influenced by the reliable market and higher profits associated with rice due to current pricing policies. However, this shift raises concerns about crop diversity and water management, as rice requires more irrigation compared to maize. Despite these economic benefits favouring rice, maize farmers face challenges such as limited government procurement, leading to maize being sold below its Minimum Support Price (MSP). This situation forces farmers to sell maize with high moisture levels, highlighting the pressing need for accessible drying facilities tailored to smaller-scale producers. (Kaur *et al* 2018).

Simultaneously, India is expanding its maize portfolio with value-added products such as quality protein maize (QPM) and baby corn, aimed at enhancing nutritional value and capturing global markets. "In addition to normal maize, there is significant potential to cultivate baby corn, popcorn, sweet corn, and QPM in both kharif and rabi seasons, which is being actively promoted for domestic and export markets" (Economic Times 2024, July 16).

Looking forward, enhancing research efforts to develop high-yielding maize varieties and bolstering market infrastructure are pivotal steps to enhance maize cultivation's profitability in Punjab. The state has already observed an upswing in maize production, driven by its diverse industrial applications such as animal feed and biofuels, as highlighted by the Agricultural and Processed Food Products Export Development Authority (APEDA). Maize's shorter growing cycle allows for multiple cropping seasons annually, offering farmers increased productivity and stability in income.

Moreover, India's shift towards ethanol production from foodgrains like maize and rice has risen significantly, from 37.4% to 51% this year, reflecting a governmental push to prioritize grain-based ethanol over traditional sources like sugarcane (Hindustan Times 2023, April 6).

To fully capitalize on maize's economic potential, Punjab must strategically invest in drying technologies and establish maize processing industries. These initiatives not only

promise better prices for farmers but also pave the way for agricultural diversification and sustainability. By addressing these challenges and seizing opportunities, Punjab can boost its position as a key player in India's agricultural sector, ensuring resilient livelihoods for its farming communities.

Agricultural Advantages: Resilience and Soil Health

Studies conducted by PAU and local agricultural extension services underscore maize's adaptability and yield potential under varying soil and climatic conditions prevalent in Punjab. Farmers adopting maize cultivation report positive outcomes, highlighting its role in diversifying crop portfolios and mitigating risks associated with mono-cropping practices.

Challenges and Considerations: Transitioning from Rice to Maize

Transitioning from rice to maize in Punjab's agricultural landscape is not without its challenges. Despite the promising advantages of maize cultivation, several obstacles must be addressed to facilitate a smooth transition and



1. Market Dynamics: One of the primary challenges faced by maize farmers in Punjab is the disparity in market support compared to crops like rice that have been dominant in recent years. Government procurement policies and Minimum Support Prices (MSPs) heavily favour rice, providing assured markets and better financial returns. In contrast, maize often faces inadequate procurement infrastructure and lower prices relative to its MSP, particularly for smaller-scale producers. This disparity discourages farmers from shifting away from rice cultivation, despite maize's potential benefits (Kaur *et al* 2018).

2. Infrastructure: The lack of adequate drying and storage facilities poses a significant challenge for maize farmers, especially during peak harvesting seasons. Maize harvested with high moisture content requires proper drying to prevent spoilage and maintain quality. However, small-scale farmers often lack access to affordable drying technologies and storage

solutions tailored to maize, leading to post-harvest losses and reduced profitability (Kaur *et al* 2018).

3. Water Management: While maize is more water-efficient compared to rice, effective water management remains crucial, especially in Punjab's semi-arid regions facing water scarcity. Farmers need support and guidance on implementing efficient irrigation techniques and optimizing water use to ensure sustainable maize cultivation. This includes promoting technologies like drip irrigation and rainwater harvesting systems to conserve water resources and mitigate the environmental impact of agriculture.

4. Awareness and Education: Despite efforts to promote crop diversification, awareness among farmers about the benefits and practices of maize cultivation remains limited. Many farmers in Punjab are accustomed to the rice-wheat cropping system and may be hesitant to adopt new crops without adequate knowledge or support. Enhancing extension services, farmer training programs, and demonstrations of successful maize cultivation can play a crucial role in encouraging wider adoption and ensuring the sustainable growth of maize in the region.

5. Policy Support: Policy frameworks need to be strengthened to incentivize and support maize cultivation effectively. This includes revisiting MSPs and procurement mechanisms to ensure equitable pricing and market access for maize. Additionally, targeted subsidies and financial incentives for investments in drying technologies, storage infrastructure, and water-saving irrigation systems can facilitate the transition and enhance the profitability of maize cultivation in Punjab.

Conclusion: Towards a Sustainable Agricultural Future

The shift from rice to maize in Punjab marks a significant stride towards achieving agricultural sustainability and resilience. Maize offers multiple advantages, including higher water productivity, improvements in soil health, and diversified income streams for farmers. However, reaping these benefits necessitates addressing various challenges, encompassing market dynamics, infrastructure deficiencies, water management issues, and farmer education.

To fully exploit maize cultivation's potential and bolster agricultural productivity, profitability, and environmental sustainability amidst climate change, Punjab must strategically overcome these challenges. This can be achieved through targeted policy reforms, substantial investments in infrastructure, and comprehensive support mechanisms. Key recommendations include reviewing and adjusting Minimum Support Prices (MSPs) to ensure fair pricing and adequate market support for maize procurement, thereby encouraging farmers to diversify away from rice. Investing in maize-specific infrastructure such as affordable drying, storage, and processing facilities is crucial to minimizing post-harvest losses and enhancing profitability. Promoting the adoption of water-efficient technologies like drip irrigation and rainwater harvesting will optimize water use in maize farming, contributing to sustainable water management.

Moreover, enhancing farmer education through extensive training programs, demonstrations, and extension services will equip farmers with knowledge of maize cultivation's benefits and best practices. Strengthening policy frameworks with targeted subsidies and financial incentives for maize production, processing, and value-added products will further support sustainable agricultural practices.

By implementing these systemic recommendations, Punjab can successfully transition towards maize cultivation, paving the way for a resilient and sustainable agricultural future in the region.

References

1. Anonymous (2024) Package of practices for the crops of Punjab (Kharif)

2. Baweja S, Aggarwal R, Brar M and Lal R (2017) Groundwater depletion in Punjab, India. *Encyclopedia of Soil Science* 1-5.
3. Bouman B (2009) How much water does rice use. *Management* **69(2)**: 115-33.
4. Economic Times (2024, July 16) India shifts focus to value-added maize: https://economictimes.indiatimes.com/india-shifts-focus-to-value-added-maize/articleshow/1852539869.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
5. Hindustan Times (2023, April 6) India's ethanol production gradually shifts from sugar to maize and rice: <https://www.hindustantimes.com/business/indias-ethanol-production-gradually-shifts-from-sugar-to-maize-and-rice-101719462155575.html>
6. Kaur G (2018) Crises of agriculture in Punjab: setbacks to diversification and role of state. *Int J Adv Sci Res Manage* **3(8)**: 197-200.
7. Pujara M and Shahid A (2016) Crop diversification: challenges of switching crops in Punjab. *Indian J Econ Dev* **12(1)**: 579.
8. Saran S, Kataria P and Kaur A (2013) An electricity energy usage and energy subsidy in Punjab agriculture. *Indian J Econ Dev* **9(3)**: 404-13.
9. Sidana B K, Priscilla L, Kaur G and Vatta K (2023) Potential of maize crop for sustainable agriculture in Punjab. *Journal of Agricultural Development and Policy* **33(2)**:174-82.
10. Sidhu B S, Sharda R and Singh S (2021) Spatio-temporal assessment of groundwater depletion in Punjab, India. *Groundwater for Sustainable Development* **12**:100498.