MAIZE: PUNJAB'S SUSTAINABLE PATH TO AGRICULTURAL DIVERSIFICATION

Dr. Arshdeep Singh
Research Associate, ICAR-NIAP, New Delhi

IPunjab's Agricultural Crossroads

Punjab has played an important role in mitigating food insecurity since the Green Revolution. The high productivity of paddy and wheat, and major procurement of the foodgrains in the central pool, also known as the grain bowl of India. The abundant availability of natural resources, such as rivers, canals, underground water, and high-quality soils, makes it an important state in India.

Once known as India's foodgrain bowl, Punjab is now at a critical stage. While delivering food security, decades of rice-wheat monoculture have come at a heavy cost: severe groundwater depletion, soil degradation, and increasing ecological stress. Paddy cultivation, in particular, consumes an unsustainable 2,500-3,000 litres of water per kilogram and contributes significantly to carbon emissions. A sustainable, climate-resilient, and economically viable cropping system is now more critical than ever.

Why Maize?

In Among the alternatives, maize stands out-not just as a water-efficient crop, but also as a lower carbon emitter crop and a high-demand crop due to high protein quantity and different type of maize based on endosperm characteristics. Requiring only 1,000 litres of water per kilogram, maize uses up to 70% less water than paddy and emits 63-75% less carbon.

It also boasts strong demand across diverse sectors-poultry feed, ethanol production, food processing, and snacks- making it a robust market commodity. Maize fits well into Punjab's existing cropping calendar, offering a practical and less disruptive shift from the paddy cropping pattern, with a similar time for cultivation and harvesting of the crop.

Profitability Gap: The Core Challenge

Despite these compelling advantages, the kharif maize crop has a lower adoption rate in Punjab. The biggest hurdle is the economic feasibility of the maize crop. With current yields averaging 37.5 quintals per hectare and market prices around ₹1,707 per quintal, maize gives an average profit of just ₹18,316 per hectare to farmers, which is far below the ₹83,613 earned from paddy.

Bridging this ₹65,000+ profitability gap is essential to drive large-scale farmer adoption. That profitability shows a comparative and absolute advantage of paddy crop over maize.

Short-Term Relief, Long-Term Questions

To incentivize maize cultivation, the Punjab government has introduced subsidies of ₹21,000 per hectare under a pilot project in Bathinda. However, the neighbouring state of Haryana, which also shares similar agronomic conditions in the upper Gangetic plains, provides a subsidy of ₹7,500 per hectare to encourage farmers to replace paddy with maize. Despite this, the initiative has not been successful. While such measures offer temporary relief, they are neither financially nor politically sustainable in the long run. Moreover, these direct subsidies fall under the WTO's "amber box" classification, potentially exposing India to trade disputes.

Yield and Market Reforms: The Long-Term Solution

For maize to truly replace paddy in Punjab's fields, structural reforms are needed, chief among them boosting yields and improving market access.

To match paddy's profitability under current MSP levels, maize yields must rise to 68.8 quintals per hectare. At prevailing market prices, they need to hit 81.4 quintals, a staggering 37.5 quintal jump from current productivity. This is achievable, but only with:

- **Investment in High-Yielding Varieties:** Punjab must urgently focus on R&D to develop high-yielding, drought-resistant, and early-maturing maize hybrids suited to its agro-climatic zones. Current yields in Punjab lag significantly behind states like Tamil Nadu, where maize yields average 75 quintals per hectare, peaking at over 80 quintals.
- **Market Reforms:** Stronger price discovery, fair procurement mechanisms, and the dismantling of entrenched cartel systems are critical. Expanding ethanol production infrastructure can also create stable demand and absorb surplus maize, insulating farmers from price crashes.

Broader Implications: Beyond Maize

Punjab's over-reliance on rice and wheat isn't accidental. These crops have long benefited from government-backed MSP procurement and sustained public investment in breeding and technology. Between 1966 and 2024, wheat yields surged from 8.87 to 35.59 quintals per hectare, and paddy from 8.63 to 28.82 quintals. This growth was fueled by targeted R&D into pest resistance, high yields, and climate resilience.

In stark contrast, maize and other crops, such as pulses and oilseeds, have suffered from chronic neglect in agricultural research. This disparity has led to a self-perpetuating cycle: farmers stick with rice and wheat not just because of price support, but because these crops deliver predictable yields and returns.

Breaking the Cycle

To promote genuine diversification, Punjab must replicate its rice-wheat strategy for maize: provide MSP assurance, but more importantly, invest in research to create high-yielding, resilient maize varieties. Only then can farmers confidently switch without compromising income or risking crop failure.

The Way Forward

For Punjab, maize is more than an alternative crop; it is a pathway to sustainability. Prioritizing innovation over subsidies and enabling market reform over short-term fixes is the only durable solution. By embracing maize, Punjab can safeguard its groundwater, reduce emissions, and ensure economic stability for its farmers.

The choice before Punjab is clear: continue down the unsustainable rice-wheat path or take a bold step toward a greener, more resilient future with maize at the helm.

Particulars	Maize (Current Situation)	Maize Yield Equivalent (Implicit Price)	Maize Yield Equivalent (MSP)
Yield (q/ha)	37.5	81.4	68.8
Yield Gap to Mitigate Paddy Profitability Gap (q/ha)	-	43.9	31.3
Profit (Rs./ha)	18316	83613	83613
Profitability Gap: Maize vs Paddy (Rs./ha)	65297	-	-