

Crop Diversification: A Solution to Declining Groundwater in Punjab

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Punjab has historically been regarded as the “food bowl of India” due to its significant contribution to national food security. The Green Revolution of the 1960s marked a turning point in the state’s agriculture, introducing high-yielding varieties, expanded irrigation systems, and modern farming techniques. These advancements significantly increased wheat and rice production.

However, continuous dependence on the wheat–rice cropping system has led to serious environmental concerns, particularly groundwater depletion. In recent years, crop diversification has gained importance as a sustainable approach to conserve water resources while ensuring farm profitability and productivity.

Groundwater Crisis in Punjab

Groundwater forms the backbone of irrigation in Punjab, with farmers heavily relying on tube wells. Excessive extraction, particularly for water-intensive

crops like rice, has caused a rapid decline in groundwater levels.

Punjab withdraws approximately 33.8 billion cubic metres of groundwater annually, whereas recharge is only about 20.6 billion cubic metres, indicating severe overexploitation.

In many parts of central Punjab, groundwater levels have declined from about 10 metres during the early

Green Revolution period to 40–50 metres today. More than three-fourths of the blocks in Punjab are now classified as overexploited.

This decline has increased irrigation costs and poses a serious threat to long-term agricultural sustainability and rural livelihoods.

The Wheat–Rice Cropping System and Water Use

The wheat–rice cropping system dominates Punjab agriculture. Rice, in particular, is highly water-intensive, requiring continuous irrigation.

- Water requirement of rice: 2,500–5,500 litres/kg



- In Punjab: 3,800–4,000 litres/kg
- Maize (alternative crop): 600–700 litres/kg

Rice cultivation involves standing water conditions, leading to excessive groundwater extraction. Currently, paddy covers more than 30 lakh hectares in Punjab.

Despite environmental concerns, farmers prefer rice due to assured procurement at Minimum Support Price (MSP), established markets, and strong policy support.

Status of Crop Diversification in Punjab

Table 1: Cropping Pattern Trends in Punjab (%)

Year	Paddy (%)	Wheat (%)	Other Crops (%)
1980	45	40	15
2002	60	35	5
2024	65–70	30–32	3–5

The declining share of diversified crops highlights increasing monoculture and environmental stress.

Benefits of Crop Diversification

A. Groundwater Conservation

Shifting from paddy to less water-intensive crops reduces irrigation demand and allows groundwater recharge.

B. Improved Soil Health

Crop rotation improves soil fertility, reduces nutrient depletion, and lowers dependence on chemical inputs.

C. Economic Opportunities

Diversification enables cultivation of high-value crops like fruits, vegetables, and oilseeds, increasing farmers' income.

D. Climate Resilience

Diverse cropping systems enhance resilience to climate variability, reducing the risk of crop failure.

Challenges to Adoption

1. Bias in MSP and Procurement

Assured procurement of wheat and rice discourages diversification.

2. Uncertain Market Conditions

Alternative crops lack stable markets and price assurance.

3. Lack of Infrastructure

Inadequate storage, processing, and transport facilities hinder diversification.

4. Risk-Averse Farming Practices

Farmers prefer familiar crops with assured returns.

5. Policy Constraints

Existing policies prioritize rice production, limiting diversification incentives.

Government Initiatives and Their Limitations

Several initiatives have been introduced to promote diversification, including incentives for maize and horticulture promotion. However, their impact has been limited due to weaker incentives compared to paddy, poor implementation, and lack of coordination among agencies.

As a result, the area under paddy cultivation continues to increase.

Policy Recommendations

1. Reform Procurement Policies

Extend MSP and assured procurement to maize, pulses, and oilseeds.

2. Rationalize Subsidies

Restructure subsidies like free electricity to encourage efficient water use.

3. Promote Water-Saving Technologies

Encourage drip irrigation, sprinkler systems, and direct-seeded rice.

4. Develop Infrastructure

Invest in storage, processing, and marketing systems.

5. Enhance Extension Services

Provide training, awareness, and technical support to farmers.

6. Encourage Private Sector Participation

Promote agro-industries and contract farming.

Conclusion

Punjab's groundwater crisis is a result of unsustainable agricultural practices, particularly the dominance of the wheat-rice system. Crop diversification offers a practical and sustainable solution to balance environmental conservation with farm profitability.

However, its success depends on strong policy support, market assurance, infrastructure development, and farmer-centric incentives. Effective implementation can ensure long-term agricultural sustainability while conserving Punjab's critical groundwater resources.

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