

SHRIMP IN THE SALT AFFECT- ED SOIL

**How Salty Groundwater Is Turning Punjab and
Haryana into India's Newest Seafood Hub**

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How Salty Groundwater Is Turning Punjab and Haryana into India's Newest Seafood

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Abstract

Landlocked. Salt-poisoned. Written off as wasteland for generations. That's how you'd describe huge stretches of Punjab and Haryana — hundreds of kilometres from any ocean. And yet today, some of these same fields are producing shrimp. Real, plump, export-quality shrimp, farmed not in the sea but in the salty groundwater that once ruined the soil.

It's one of Indian agriculture's more surprising turnarounds: the very water that killed off crops is now the reason farmers are earning more than they ever did growing wheat.

The Problem: Land Poisoned by Its Own Water

Salt has been quietly wrecking farmland for decades. In dry, low-lying regions, salts naturally build up in the soil when rainfall isn't enough to wash them away. But farmers have made it worse — years of irrigating with salty groundwater, often with nowhere for the excess to drain, has pushed water tables higher and left fields waterlogged and barren.

The scale is hard to ignore: over 380 million hectares across 20 countries are affected worldwide. In India,

that's roughly 8.62 million hectares — and 40% of it sits right here in Punjab, Haryana, Uttar Pradesh, and Rajasthan.

For years, that land was simply a loss. Then scientists in India, the US, China, Israel, and Australia asked a different question: what if, instead of fighting the salt, we farmed it?

The Unlikely Star: Pacific White Shrimp

Meet *Litopenaeus vannamei* — the Pacific white shrimp. It's originally from the coastline between Peru and Mexico, but since arriving in India as a pilot project in 2009, it's become the go-to species for inland saline farms across Punjab and Haryana.

Why this shrimp, of all creatures? Because it's built for exactly this kind of tough, unpredictable water:

- Grows fast and handles crowding well — up to 60 shrimp per square metre.
- Doesn't need an expensive, high-protein diet to thrive.
- Shrugs off swings in temperature (15–30°C) and salinity (0.5–45 ppt) that would stress most species.
- Breeds in captivity, so farmers can improve their stock generation after generation.

- Packs on more meat than the older favourite, the tiger shrimp.
- Resists disease far better than most farmed species.

A full-grown female can reach 230 mm and lay up to 250,000 eggs at a time — each barely visible at 0.2 mm across.

FAST FACTS: PACIFIC WHITE SHRIMP

Species: *Litopenaeus vannamei*

First introduced in India: 2009 (pilot scale)

Stocking density: up to 60 shrimp / m²

Salinity tolerance: 0.5 – 45 ppt

Growth cycle: 100–120 days to harvest

Harvest weight: 22.8 – 28 grams

Eggs per female: up to 2,50,000

How a Shrimp Farm Actually Works

Running one of these farms is less like fishing and more like precision manufacturing — every step is measured, timed, and repeated.

1. **Prep the pond:** After each harvest, the pond is drained, scraped clean, and left to dry until the bottom cracks. That drying is crucial — it releases trapped gases and refreshes the soil. Lime and calcium go in next, both essential for helping

shrimp shed and regrow their shells.

- 2. **Fill and season the water:** Borewell water is filtered, chlorinated, then left alone for several days so the chlorine fades. A slurry of molasses, rice polish, and yeast kick-starts the pond's natural food web.
- 3. **Pick disease-free seed:** Only certified, pathogen-screened baby shrimp from approved hatcheries make it into the pond — no exceptions.
- 4. **Stock carefully:** Newly arrived shrimp are slowly acclimatised to the pond, fed baby brine shrimp so they don't turn on each other, then released at a precise density.
- 5. **Feed by the numbers:** Pellet size grows with the shrimp — from 1mm to 2.5mm — and farmers track exactly how much is eaten to avoid waste or shortage.
- 6. **Harvest in months, not seasons:** By day 100–120, shrimp are ready — averaging 23–28 grams — and get packed on ice within hours for market.



The finished product: a fresh harvest, lined up and ready for grading, icing, and market — all within hours of leaving the pond.

Here's the twist that makes inland shrimp farming genuinely tricky. Groundwater isn't seawater. It's usually loaded with calcium and magnesium but starved of potassium — a mineral shrimp desperately need. Get that balance wrong, and growth stalls or shrimp start dying.

The fix is straightforward in theory: add potassium chloride before stocking, aiming for about half the potassium level of natural seawater. Farmers use one simple formula to know exactly how much to add:

Potassium needed = (10.7 × target salinity) – potassium already in the water

The Hidden Ingredient: Potassium

They also keep a close eye on the calcium-to-magnesium ratio, aiming for roughly 1:3. Here's what healthy pond water looks like at a working farm in Rohtak, Haryana:

Parameter	Ideal Range
Salinity	13–15 ppt
Dissolved Oxygen	5.4–8.2 ppm
pH	7.8–9
Alkalinity	200–230 ppm
Hardness	3200–3700 ppm
Calcium	235–270 ppm
Magnesium	610–695 ppm
Potassium	80–100 ppm

The Habits That Separate a Good Harvest from a Wipeout

Success here comes down to routine, not luck. Farmers check their shrimp every week for early warning signs — damaged antennae, cloudy shells, white muscle. They drag a chain across the pond floor twice a week to release trapped gases, and each pond gets its own separate net at harvest to stop disease from spreading between them. None of it is glamorous. All of it matters.

From Wasteland to Wealth

The payoff is real. Shrimp farming on salt-damaged land earns more than traditional

crops ever did — and does it in just 100 to 120 days, a fraction of a normal growing season. Even better, pumping out the groundwater for aquaculture helps drain waterlogged fields and slows the very salinity that caused the problem in the first place.

The next frontier is scale. Researchers are now pushing "cluster farming" — grouping large saline areas so farmers can run two harvests a year, share costs, create local jobs, and grow shrimp exports. If it keeps working, the salt-ruined wastelands of Punjab, Haryana, and Maharashtra could become some of India's most valuable farmland — just not for anything that grows in soil.