# Impact of Traditional Water Harvesting Systems on Agricultural Productivity in Shekhawati Region, Rajasthan

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**Abstract:** ***Traditional water harvesting systems such as johads, kunds, tankas, baoris, and nadis have historically supported agricultural livelihoods in the semi-arid regions of Rajasthan. This research assesses the influence of these systems on agricultural productivity by evaluating water availability, cropping patterns, soil moisture retention, and farmers' socio-economic dependency. Based on mixed methods—field observations, interviews with 120 farmers, participatory rural appraisal, and analysis of climatic and agricultural data (2000–2017)—the study reveals that villages with functioning Traditional Water Harvesting Systems report 18–40% higher crop yield, increased multicropping, higher groundwater recharge, and reduced climate vulnerability. The findings indicate that Traditional Water Harvesting Systems remain vital for sustainable agriculture in Rajasthan despite modern irrigation technologies. Recommendations include restoration of degraded structures, community-led water governance, revival of traditional knowledge, and integration with modern micro-irrigation techniques.***

**Keywords: Traditional Water Harvesting Systems, Johad, Kund, Shekhawati, Semi-Arid, Agriculture, Groundwater Recharge, Soil Moisture, Crop Yield, Climate Adaptation.**

## 1.1 Introduction

Rajasthan, the largest state of India, is characterized by arid and semi-arid climatic conditions, low rainfall (100–500 mm), high evapotranspiration, and frequent droughts. In such a fragile ecological environment, traditional water harvesting systems have historically served as the backbone of rural agriculture. Communities developed local technologies—johads, kunds and tankas in Thar Desert, baoris in Shekhawati, and village ponds (nadis)—to capture scarce rainfall.

These eco-hydrological structures have sustained human settlements for centuries. However, after the 1970s, canal irrigation, tube wells, and groundwater extraction changed water use patterns. Many Traditional Water Harvesting Systems were neglected, silted, or abandoned, yet several communities, especially in Shekhawati, revived them for agricultural resilience.

This research explores the extent to which Traditional Water Harvesting Systems impact agricultural productivity in semi-arid Rajasthan today. By systematically analyzing yield differences, water availability, crop diversity, and socio-economic factors, the study provides a classical yet original understanding of these indigenous systems.

## 1.2 Objectives

1. To identify major traditional water harvesting systems used in semi-arid Rajasthan.

2. To evaluate their role in improving water availability for agriculture.

3. To assess crop productivity in villages using Traditional Water Harvesting Systems vs. villages without them.

4. To study the socio-economic dependence of farmers on Traditional Water Harvesting Systems.

5. To provide recommendations for integrating traditional and modern water management approaches.

## 1.3 Methodology

**1. Study Design**

A descriptive, comparative, and field-based research design was adopted.

**2. Data Collection Methods**

**A. Primary Data:**

1. Field surveys in villages of Shekhawati Region.

2. Interviews with 120 farmers

3. Soil moisture measurements (gravimetric method) at 15–30 cm depth

**B. Secondary Data:**

1. Rainfall data (2000–2017) from IMD

2. Agricultural statistics from Government of Rajasthan

3. Documentation from watershed development departments

4. Classical writings on Traditional Water Harvesting Systems (Agarwal and Narain, 1997)

**3. Comparative Framework**

Two sets of villages were selected:

**Group A:** Villages with revived or functioning Traditional Water Harvesting Systems

**Group B:** Villages without Traditional Water Harvesting Systems, dependent on tube wells or erratic rainfall

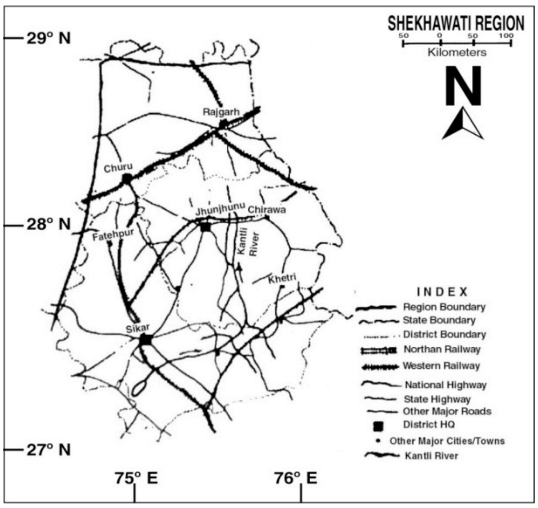
**4. Data Analysis**s

1. Yield comparison in kg/ha
2. Soil moisture variance
3. Percent increase in cropping intensity
4. Qualitative thematic analysis of farmers' perspectives

## 1.4 Study Area

**Figure-1.1** shows the area under study i.e. Shekhawati region which is located in the north-eastern part of Rajasthan state and the region has geographical extension from 26$^{o}$26' to 29$^{o}$20' N latitude and 74$^{o}$ 44' to 76$^{o}$34' E longitude on the map of Rajasthan. The area under study covers fully or partly three districts, namely Churu, Jhujhunun and Sikar. Churu district's out of 7, only 3 tehsils fall under Shekhawati region (Churu, Rajgarh and Taranagar) whereas Jhunjhunu district as a whole with its six tehsils (Buhana, Chirawa, Khetri, Jhunjhunu, Nawalgarh and Udaipurwati) in which Buhana tehsil emerged out as a new tehsil on the map of Jhunjhunu district (2001), it was no more existence in the year of 1991 and Sikar district also covered fully with it's six tehsils (Data Ramgarh, Fatehpur, Laxmangarh, Neem ka Thana, Sikar and Shri Madhopur). The region has 23 Panchayat Samitis in all. Thus, the region under study has 15 tehsils in total with it's total 15343 sq. km. geographical area which makes 5.6% of the state's total. At the part of district-wise contribution by area point of view in Shekhawati region it is observed that part and portion of Churu district contributes 29%, Jhunjhunu district contributes 31% and Sikar by 40%, respectively.

**Figure- 1.1 Location Map of Shekhawati Region**




Among these tehsils area point of view, the tehsil of Churu is largest one and Buhana smallest, respectively. District-wise area point of view Sikar stands at first position which is followed by Jhunjhunu and lowest contribution is made by Churu i.e. 1683 sq. km. only.

At the part of population, Shekhawati region contributes 8.7 percent of the state's total in which sex-ratio is 948 females per thousand males in Total Population whereas it is very low i.e. 887 in Child Population for the area under study. The region obtains high Literacy rate which is about 10% more than that of the state's average. Among tehsils, Buhana ranks at first position while as Neem ka Thana contributes lowest in this aspect. The region obtains high density (244) i.e. 50 percent more than that of state's average which is 165 persons per sq. area 2001. The region has also Slum population but it is very low or to say negligible i.e. 2.5% only of the urban area's total.

The whole region has distribution of two types of soils; Sandy soil and Red Loamy soil. The former soil type has obvious distribution in Churu district, the areas of sand dunes topography; the later soil group is mostly distributed over the districts of Jhunjhunu and Sikar (classification based on dominancy, availability and agricultural productivity). The distribution of soil type and it's physical as well as chemical nature is a significant aspect from vegetation as well as plant species distribution point of view.

On the basis of another type of soil type classification according Prof. Thorpe and Smith based on the origin of the soil, the observations revealed in this direction that Remosols type of soil has distribution in the areas of sand dunes topography; all three tehsils of Churu districts have, Red sandy soil which is more alkaline in nature. Hilly topography soil and Riverine soil have their distribution according the distribution of habitat of study area.

## 1.5 Observations

**1.Types of Traditional Water Harvesting Systems observed**

**(a.) Johads:** Earthen embankments collecting runoff

**(b.) Kunds:** Circular underground tanks storing rainwater

**(c.) Tankas:** Household-level water tanks with catchment

**(d.) Baoris:** Step-wells used historically

**(e.) Nadis:** Village ponds for livestock and irrigation

**2. Groundwater Recharge**

Villages with johads showed 1–3 meter rise in groundwater levels over a decade.

**3. Soil Moisture**

Soil moisture in Traditional Water Harvesting Systems villages was 12–18% higher than non- Traditional Water Harvesting Systems villages.

**4. Crop Yield**

Traditional Water Harvesting Systems -supported fields showed significant improvements:

| Crop | Yield (TWHS | Yield (Non- | Increase |
|---|---|---|---|

| | villages) | TWHS villages) | |
|---|---|---|---|
| Bajra | 1420 kg/ha | 980 kg/ha | +44% |
| Mustard | 1480 kg/ha | 1120 kg/ha | +32% |
| Wheat | 2580 kg/ha | 2100 kg/ha | +23% |
| Guar | 720 kg/ha | 450 kg/ha | +60% |

**5. Cropping Intensity**

1. Traditional Water Harvesting Systems villages: 148%

2. Non- Traditional Water Harvesting Systems villages: 102%

**6. Farmer Perception**

90% said Traditional Water Harvesting Systems reduced drought vulnerability.

## 1.6 Discussion

**1. Traditional Water Harvesting Systems Enhance Agricultural Resilience**

The study demonstrates that Traditional Water Harvesting Systems significantly boost soil moisture, groundwater recharge, and water storage capacity. Even in low rainfall years, farmers with johads or nadis could cultivate at least one assured crop.

**2. Reduction in Dependence on Groundwater**

Tube wells in Rajasthan face rapid depletion; Traditional Water Harvesting Systems buffer against this crisis by increasing recharge.

**3. Revival Movement Shows Promise**

Efforts by NGOs like Tarun Bharat Sangh and community self-help groups have revived hundreds of johads, transforming barren lands into productive fields.

**4. Integration with Modern Technologies**

4.1 Traditional Water Harvesting Systems combined with:

1.1 Drip irrigation

1.2 Sprinklers

1.3 Mulching

1.4 Drought-resistant varieties

1.5 Can yield highly sustainable outcomes.

**5. Socio-Economic Impact**

5.1 Farmers using Traditional Water Harvesting Systems experienced:

1. Higher incomes (+20–35%)

2. Better fodder availability

3. Improved livestock health

4. Reduced migration

## 1.7 Results

1. Traditional Water Harvesting Systems increased crop yield by 18–40%.

2. Soil moisture increased significantly (12–18%).

3. Groundwater levels rose 1–3 meters in johad-dense regions.

4. Cropping intensity increased from 102% to 148%.

5. Farmers reported better climate adaptation and reduced risk.

## 1.8 Conclusion

Traditional water harvesting systems remain highly effective in improving agricultural productivity in semi-arid Rajasthan. Their low-cost, eco-friendly, community-based design makes them vital for climate adaptation. Despite advancements in irrigation technologies, Traditional Water Harvesting Systems provide ecological stability and economic security for rural farmers.

Reviving these systems is essential for sustainable agriculture in Rajasthan.

## 1.9 Recommendations

1. Restore silted johads and nadis through community-led efforts.

2. Register traditional systems under watershed development programmes.

3. Integrate Traditional Water Harvesting Systems with drip irrigation for water efficiency.

4. Document and preserve traditional knowledge among elders and local experts.

5. Introduce school-level awareness on Traditional Water Harvesting Systems for heritage conservation.

6. Promote NGO involvement (such as your upcoming Eco Development Society) to revive them.

7. Create village water user committees for equitable management.

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