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Agricultural Science in Ancient Indian Farming Practices

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Abstract:
A significant amount of agricultural knowledge went into the farming activity of ancient Indians, as ecological observation, seasonal organization, seed management, water management, soil preparation, crop variety and care of plants was integrated into the farming activity of ancient Indians. The Indian subcontinent developed agriculture early and within diverse climatical conditions, river basins and other cultural contexts. The archaeological record of Mehrgarh and South Asia demonstrates that early farmers grew barley and wheat and eventually diversified into cotton, pulses, rice, and other crops, meaning that there was a long domestication and agricultural adaptation process (Britannica Editors, 2026). The archaeobotanical studies of the Indus civilization also show that ancient agriculture was quite diverse and strategically adaptable as farmers employed monocropping, mixed, and serial seasonal systems based on varying social and climatic patterns (Bates and Choi, 2023). Later, agricultural practices were documented in Sanskrit literature including Krishi-Parashara, Arthashastra and Vrikshayurveda that addressed rainfall, irrigation, ploughing, seed management, land classification and plant health (Sadhale, 2006; Sharma and Nathani, 2025). This article holds that ancient Indian agriculture represented a practical science of agriculture based on repetency, environments, and long-term sustainability. The research consults the historical and textual materials, compares the main scientific characteristics of the ancient agricultural activity, and considers the applicability of these methods to the modern sustainable farm. It concludes that despite the lack of the modern terminology of science a systematic and empirical reasoning was evident in ancient Indian agriculture, which is relevant to the current discourse of low-input, climate-resilient, and ecologically based agriculture (Bates and Choi, 2023; Singh et al., 2020).

Keywords: Indian agriculture in the ancient world, agricultural science, Krishi-Parashara, Vrikshayurveda, sustainable agriculture.

INTRODUCTION

Indian civilization has always been built on agriculture and history of agriculture in the sub-continent has been a relationship of people with plants, animals, soils, rainfall, and water systems. Ancient Indian agriculture was not just determined by the hereditary tradition; it was a tradition of practical knowledge

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that was a reaction to weather, land and water and the seasonal ways of the land. According to Encyclopaedia Britannica, South Asia was at least involved in two significant periods of early agricultural development. The foundation of agriculture was early set up in portions of the present-day Pakistan between approximately 9500 and 7500 BP, especially at Mehrgarh with barley as the dominating one with wheat growing along. The further advances made later the use of cotton, pulses, rice, and millet, which indicated how the system of farming expanded and evolved over the years (Britannica Editors, 2026).

This ancient history of agriculture shows that Indian agriculture was not an unchanging system. Farmers were not just planting a single crop under a single ecological condition; they were playing around with various plants, various seasons and various ecological niches. This adaptation was further enhanced in the Indus or Harappan world where agriculture was applied over extensive areas having different rainfall patterns and topographies. Bates and Choi (2023) demonstrate that Indus farming was not homogenous. Rather, ancient farmers employed varied blends of wheat, barley, millets, pulses and rice among other crops depending on the local weather conditions, labor structure and subsistence measures. This is a significant finding since it implies that ancient Indian agriculture was influenced by decision making, flexibility and risk management.

With the further development of agriculture, the knowledge about farming became more systematized in writing. The old Sanskrit agrarian and horticultural texts did not simply preserve ritual or symbolic attitudes to agriculture; they also documented practical observations concerning rainfall, irrigation, fields, seeds, plants and water harvesting. According to Sadhale (2006), there are ancient Sanskrit texts that were found to have important information concerning the harvesting and conserving of water and that they wrote on how the ancient Indian farmers perceived and controlled water supply towards farming. In a similar way, Sharma and Nathani (2025) believe Vrikshayurveda indicates a very advanced plant knowledge tradition that is still relevant to sustainable agriculture.

This paper contends that the ancient Indian farming practices can be interpreted as a kind of agricultural science. This does not imply that the ancient farmers had experimental stations, laboratory chemistry and contemporary genetics. Instead, it is to say that they have acquired cumulative and orderly knowledge through observation, classification, repetition and adaptation to the environmental conditions. The ancient Indian agricultural science is observable in the way it dealt with climate uncertainty, treated seeds, prepared soil, variety of crops, plant health, and water management. To prove this, the paper reviews the historical background of ancient agriculture in India, analyzes significant textual and archaeological evidence, and reviews the scientific aspects of ancient farming. It also considers the present-day usefulness of this knowledge to sustainable agriculture and climate resiliency.

LITERATURE REVIEW

The contemporary research on the agriculture of the ancient Indian society derives out of several disciplines such as archaeology, agrarian history, hydrology, environmental studies, and Sanskrit textual

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studies. Among other things, one field of study attempts to reconstruct the origin of agriculture in the Indian subcontinent. According to the survey of South Asian agricultural origins by Britannica, it is evident that barley and wheat were already cultivated at Mehrgarh and later stages involved cotton, pulses, rice and millet (Britannica Editors, 2026). The significance of this evidence is that it shows not only the antiquity but also the heterogeneity of the agricultural development in the subcontinent.
The other significant research is the studies on Harappan or Indus agriculture. Bates and Choi (2023) maintain that the Indus agricultural system cannot be assessed as one model since the civilization in the areas had a varying rainfall system, rivers and ecological situation. They highlight that in their work, various areas adopted various methods of farming such as monocropping, duo-cropping, polyculture, and seasonal sequencing. They also relate such diversity to concepts of resilience and sustainability, which implies that ancient farmers made strategic decisions to mitigate risk and ensure food production regardless of the evolving conditions (Bates and Choi, 2023). This literature is particularly useful in that it places the ancient system of farming as an intelligent form of adaptation as opposed to tradition.

Another important perspective is related to textual scholarship. Discussing water harvesting and conservation in ancient agricultural literature, Sadhale (2006) says that the ancient Indian farmers understood their perception of rain, water storage and irrigation planning as written in the Sanskrit agricultural literature. The fact that she puts the agricultural knowledge into the context of more extensive systems of climate awareness and resource management makes her work especially important. It also points out Krishi-Parashara as among the earliest Sanskrit agricultural texts and its issue with rainfall as the main form of irrigation and its effort to explain and predict rain patterns (Sadhale, 2006).

Another area where hydrological scholarship helps to understand scientific content of ancient Indian agriculture is the fact that scientific content of ancient Indian agriculture. Singh et al. (2020) claim that hydrologic knowledge in India was formed during several millennia and ancient literature has observations on rainfall, water cycles, reservoirs, irrigation, and groundwater. Their analysis links the agricultural life with the larger hydraulic systems and demonstrates that the ancient Indian societies, particularly when the larger polities like the Mauryan Empire existed, created dams, reservoirs, channels, and organized water management (Singh et al., 2020). This is particularly applicable since the agriculture in the Indian sub continuum has never been independent of water management and variability of the monsoons.

New research on Vrikshayurveda provides a valuable plant-science and sustainability perspective. According to Sharma and Nathani (2025), Vrikshayurveda is a major tradition of plant knowledge in ancient India that is still important to the modern application of sustainable and organic farming. According to their work, the ancient Indian agriculture was not concentrated on the field crops and yield, rather the focus was on the vitality of plants, their relations with soil and the ecological balance. This extends our knowledge on the agricultural science past mere means of production.

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Collectively, the literature suggests that the ancient Indian agriculture was based on an elaborate knowledge tradition. Long-term adaptation and crop diversity are shown by archaeological studies, systematic interest in rainfall, irrigation, seed care, plant health, and environmental suitability are shown in the writing. These results explain the need to consider ancient Indian agricultural practices as a type of agricultural science that has an empirical basis and experience over time in the environment (Bates and Choi, 2023; Sadhale, 2006; Sharma and Nathani, 2025; Singh et al., 2020).

Objectives of the Study

The following four objectives are associated with this paper. It studies first the historical basis of Indian ancient agriculture. Second, it determines agricultural practices, which are maintained in major texts and bodies of knowledge. Third, it examines the science of the ancient Indian agriculture particularly concerning water, seeds, soils, crops, and planting. Fourth, it assesses the topicality of these practices to current sustainable farming and climate-resilient agriculture.

Ancient Indian Agriculture and its historical Backgrounds.

The domestication and adaptation of animals and plants started as long-term processes to lead to the beginning of the agricultural history of ancient India. In Mehrgarh, barley and wheat were grown in some of the earliest farming societies of the sub-continent as indicated in the archaeological record. With time, the agricultural foundation was diversified to cover cotton, pulses, rice, among others, which points to experimentation as well as ecological diversification (Britannica Editors, 2026). These innovations prove the fact that the agriculture in India did not appear as the simple and single-time innovation, but it developed during the interaction with local environment and modification of human needs.

One important stage of this history is formed by the Indus civilization. It was extremely extensive and covered modern Pakistan and the north part of India and encompassed areas of varying rainfall systems and environmental conditions. Bates and Choi (2023) demonstrate that the Indus world was not based on the standardized model but instead on several farming strategies. There were cereal dependent regions such as wheat and barley and the mixed or sequential cropping such as rice, millets, pulses and other species. The authors suggest that diversity played a significant role in sustainability and resilience in such farming systems. This, of course, indicates that the ancient Indian farmers were aware, practically, that the ecological uncertainty demanded flexibility.

One of the most evident indicators of agricultural science on the go is such flexibility. Farmers in the olden days did not just practice in accordance with tradition; they were modifying the selection of crops, the arrangement of crops, and the time of the year according to land and the weather. The existence of various methods of interculture and different methods of crop production is indicative of experimentation, local ecological understanding, and the ability to adapt to a changing environment. To that extent, agricultural science in ancient India started not only in books but also in the industry.

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This field knowledge was formalized with time passing by. Sanskrit agricultural and associated literature demonstrate that the ancient Indian philosophers took the agricultural activity as an object of formal treatment. According to Sadhale (2006), these texts are still considered as being valuable in terms of their preservation of information on the rainfall, rivers and irrigation, as well as water conservation. This practice to text shift is important in the sense that it portrays that agriculture was regarded as a structured knowledge as opposed to a simply routine activity.

Large Agricultural Textbooks and their Knowledge Systems.

Krishi-Parashara

Krishipara is one of the ancient Indian works on agriculture. It has been determined by Sadhale (2006) as the oldest extant Sanskrit text on agriculture, and as being dated by many contemporary agricultural scholars to date as the 4th century BCE, due to its content. Special significance to the topic of rainfall is also attributed in the text, as rainwater is considered the most reliable source of irrigation. It also emphasizes that agriculture depends on knowledge of rainfall and tries to make inferences of the rainfall pattern, famine and spread of rain on land areas by using the observed indicators (Sadhale, 2006).

This focus is very critical in the perspective of agricultural science. Sowing, harvesting, and food security of a monsoon-dependent agrarian society revolved around knowing about the rainfall. Although the explanatory framework featured astral or cosmological elements even there, the practical intention was definite: farmers had to expect to have water at certain times of the year. This is an indication of a shift on passive dependency on weather towards active interpretation and planning.

Arthashastra

Arthashastra is mostly a work of statecraft, yet Kautilya has provided valuable information on agriculture, irrigation and management of resources. According to Sadhale, Kautilya gave detailed directions on water management (2006), irrigation was one of the main elements of state revenues and administration. Singh et al. (2020) also refer to the Arthashastra as a key source on Indian hydrology and water management in the ancient period.

The topicality of the Arthashastra is in the administrative perspective of the agriculture. Agriculture was not considered as just a housework but also as a governmental, income and community project. The interest of the text on water measurement, irrigation infrastructure, and management apparatus demonstrates that the Indian agricultural science of the ancient period was linked to institutional planning and infrastructure on the one hand and to the level-of-the-field practice on the other hand (Sadhale, 2006; Singh et al., 2020).

Vrikshayurveda

Vrikshayurveda is the botanical aspect of ancient Indian agronomic philosophy. It is defined as an ancient plant medicine and farming system that is still relevant to sustainable farming and organic growth (Sharma

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and Nathani 2025). This writing shows that even the care of plants was done systematically. It does not only display a worrying attitude towards crop production but also to soil, plant feeding, vitality and balance in the environment.

Vrikshayurveda is significant in that it is a wider view of agriculture. Farming was not degraded to the extraction of grain on the land; it entailed knowledge of life processes of plants, their development conditions, and the way of keeping the plants healthy. This practice is like the one that is being attempted by contemporary sustainable agriculture: the notion that good farming is about ecological relationships and not just about external inputs.

Scientific Aspects of the Indian Ancient Agricultural activities.

Climate Consciousness and Rainfall Information.

Agriculture in ancient India was particularly concerned with weather and waterfall, which was one of its strongest scientific characteristics. According to Krishi-Parashara, the rainfall is considered the most reliable means of irrigating a farm and the understanding of rainfall is termed as one of the main requirements of an agricultural activity (Sadhale, 2006). This shows that there is a strong appreciation of the fact that the success of farming is based on the knowledge of the seasonal patterns as opposed to responding to them in retrospect.

According to Sadhale (2006), the text was aimed at giving the information on the occurrence of rainfall well in advance, including its probable distribution and its indications of scarcity. The ways of interpreting rainfall varied some of the methods applied in the interpretation of rainfall were not the methods applied in modern meteorology; however, the underlying agricultural logic was good: climate uncertainty also had to be addressed in terms of forecasting and planning. It is a significant landmark of agricultural science, as it indicates intentional attempt to make environmental observation to be translated into actual decision-making.

Water Management and irrigation.

Early Indian agriculture was also very sophisticated in terms of managing water. Singh et al. (2020) explain how the hydrologic knowledge of the ancient India developed long, covering reservoirs, dams, channels, and water use systems. They add that even the Harappan civilization already had highly advanced hydraulic systems and wastewater systems, and later periods invented other methods of storage and irrigation (Singh et al., 2020).

Sadhale (2006) goes on to state that Sanskrit agricultural texts documented how to preserve water to be used in agriculture and that there was a need to maintain continuity of water supply. This utility issue was of particular concern in monsoon climate conditions, when rain was not regular, and sometimes unpredictable. In the attempt at water conservation, storage, and regulation, it is obvious that the ancient Indian agriculture was not only about planting but also hydrological structuring and planning of resources.

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Tillage and Preparation of Soils.

Even though not all existing summaries provide all the details of the operations, ancient Indian agricultural literature has recorded land preparation as a significant technical issue. According to Sadhale (2006), Krishi-Parashara (along with similar agricultural texts) is part of a tradition, according to which farming knowledge had become systematized enough to qualify as a shastra or even an organized science. This knowledge encompassed ploughing and land preparation, relationship of cultivation and water and soil.

The use of bullocks, and other similar types of animal-drawn cultivation, suggests that ancient farmers had already invented engineering in the field that was practical in their conditions. The land was forced to be opened, managed and ready in relation to crop needs and rainfall conditions. Such systems, even in the absence of modern machinery, demonstrate the concern of efficiency of operations, field conditions, as well as labor and energy management.

Crop Seasonal Strategy and Crop Diversity.

Another of the most explicit pieces of evidence of how ancient Indian agricultural science worked is the Indus evidence. According to Bates and Choi (2023), Indus agriculture was characterized by diversity and not strict monoculture. Various ecological zones and seasons had farmers applying different combinations of crops. Cereal specialization may have been significant in certain regions, yet diversity, seasonal sequencing and mixed systems gave an adaptive and resilient nature elsewhere.

This is of direct scientific importance. The agronomy today is appreciating more the idea that crop diversity can help mitigate the risk in ecology and economy. The ancient Indian farmers seem to have gotten to know the same principle by experience. Their diversification of production among species and seasons gave them resistance to rainfall failure or focal crop loss or environmental pressure. This kind of strategy is sign of a keen attention of risk, and a pragmatic reaction to uncertainty.

Plant Health and Sustainable Cultivation.

One more significant scientific aspect is the health of plants. The authors argue that the concept of Vrikshayurveda is applicable to sustainable agriculture since it also focuses on the vitality of plants and ecological balance (Sharma and Nathani 2025). This indicates that the ancient Indian farmers never treated agriculture as a system that was narrow in its attempt to maximize yields only. They were also aware of the need to ensure healthiness of the plants and the environment in which they grow.

This orientation is particularly relevant nowadays, when the contemporary agriculture tends to face the challenge of soil degradation, a loss of biodiversity, and excessive reliance on the use of external inputs. The agricultural science can also be the ecological science, as ancient Indian tradition of farming, as recorded in the works such as Vrikshayurveda, teaches us. Farming success does not solely lie on the output of the production but on the state of the living system within which the cultivation is taking place.

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Table 1-Major Sources for Agricultural Science in Ancient India

Source	Type of evidence	Agricultural significance
Mehrgarh and early South Asian archaeology	Archaeological	Early cultivation of barley and wheat; later expansion to cotton, pulses, rice, and millet
Indus archaeobotany	Archaeobotanical	Regional crop diversity, mixed farming, sequential cropping, resilience strategies
Krishi-Parashara	Agricultural text	Rainfall knowledge, irrigation dependence on rain, farming guidance
Arthashastra	Statecraft text	Water management, irrigation administration, agricultural governance
Vrikshayurveda	Plant science/agricultural text	Plant health, ecological cultivation, sustainable agriculture

Table 2- Scientific Features of Ancient Indian Farming Practices

Farming domain	Ancient scientific feature	Agricultural significance
Rainfall knowledge	Observation and inference of seasonal rainfall	Climate-risk planning
Water management	Reservoirs, irrigation, conservation	Resource security for farming
Soil and field preparation	Ploughing and land management	Improved cultivation conditions
Crop diversity	Mixed and sequential cropping	Ecological and food-system resilience
Plant care	Attention to plant vitality and growth conditions	Sustainable cultivation

Contemporary Relevance

The agricultural science of ancient India is still applicable today, particularly in terms of environmentally sustainable and climate resistant. Contemporary agriculture has critical challenges, such as lack of water, unpredictable rainfall, soil erosion, and overreliance on chemical and energy-heavy inputs. The ancient Indian farming practices, in this case, present good principles and not solutions. These values encompass the respect of local ecology, climate-sensitive planning, crop diversification, water conservation as well as concern of flora health.

Bates and Choi (2023) demonstrate that diversity and flexibility were the key assets of the ancient Indus farming. That lesson becomes very topical nowadays, when monoculture tends to make people more susceptible to climatic and market shocks. On the same note, Singh et al. (2020) also show that the ancient

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Indian societies have already developed advanced water knowledge and water management systems that can inform modern thought about the concept of decentralized water conservation and climate mitigation. Sharma and Nathani (2025) also indicate that sustainable and organic agriculture can still use Vrikshayurveda because it views agriculture as a component of an overall ecological balance.

Meanwhile, the ancient agriculture should not be romanticized. The life of the ancient farmers was not easy either as they had to deal with famine, unpredictable weather, lack of mechanization and all the work. Ancient Indian farming science does not need to be literally revived to usefulness, but to regain the lessons of ages: farming must adapt to climate, save water, honor biodiversity, and engage ecological processes and not act against them.

Proposed Figures to be Submitted.

Figure 1. History of agricultural development in ancient India: Mehrgarh - Indus agriculture - Krishi-Parashara - Arthashastra - Vrikshayurveda.

Figure 2. The theory of ancient Indian agricultural science conceptual model: rainfall - water management - soil preparation - crop choice - plant health - sustainability.

Figure 3. Comparison of monocropping and diversified farming methods in the Indus world.

Conclusion

The ancient Indian tradition of farming practices indicates a major tradition of agricultural science based on observation, adaptation, and experience over a long period of time. Since the first agricultural communities at Mehrgarh, or the various agricultural systems of the Indus civilization, or the written records of Sanskrit agricultural texts, the evidence indicates a continued interest in rainfall, water, crops, soils, and plant life (Bates & Choi, 2023; Britannica Editors, 2026). The ancient Indian farmers and scientists knew that effective farming did not only entail effort but entailed the knowledge of seasons, security of water, crop plan and ecological adaptation.

The scientific significance of ancient Indian agronomy is not its resemblance to present day laboratory science but rather the logical practical thinking of the time. It was dealing with uncertainty by diversity, resource limitations by conservation and plant development by attentive environmental care. These attributes render the ancient Indian methods of agriculture very applicable to the current trends of sustainable, low-input and climate-resilient agriculture (Sharma and Nathani, 2025; Singh et al., 2020). The ancient Indian agricultural knowledge is an important intellectual and practical resource when it is read critically and contextually.

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