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Wheat Crop: Evolution and Present Research Status in India

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ABSTRACT

Wheat (*Triticum* spp.) is one of the most important cereal crops globally and holds significant economic and nutritional value. It has been a cornerstone of human civilization, tracing its origins to the Fertile Crescent and evolving through centuries of cultivation and breeding. This paper examines the evolutionary journey and domestication of wheat, highlighting its transformation from wild grasses to modern cultivated varieties. Special attention is given to the historical and cultural significance of wheat in India, where it is the second most important cereal crop after rice. The Green Revolution marked a pivotal era in Indian wheat production, leading to significant yield improvements. Currently, wheat research in India focuses on addressing challenges such as climate change, disease resistance, and nutritional enhancement. By exploring these facets, the paper aims to provide a comprehensive understanding of wheat's evolution, domestication, and its current status in India, underscoring the crop's vital role in the nation's food security and agricultural landscape.

INTRODUCTION

Wheat (*Triticum* spp.) has played a crucial role in the development of human civilization. Its domestication, approximately 10,000 years ago in the Fertile Crescent, marked a significant turning point in agricultural history. Wheat's adaptability to diverse climates and soils has enabled its spread across the globe, making it a cornerstone of human diets. In India, wheat is the second most important cereal crop after rice, with a rich history that intertwines with the nation's agricultural and cultural evolution. The domestication and subsequent cultivation of wheat in India have been shaped by various factors, including climate, technological advancements, and government policies. This article examines the evolution and domestication of wheat, with a particular focus on India, and explores the current state of wheat research in the country.

EVOLUTION AND DOMESTICATION OF WHEAT IN INDIA

The domestication of wheat marked a significant milestone in human history, enabling the transition from a nomadic lifestyle to settled agriculture. Early farmers selectively bred wild wheat species, favoring traits such as larger grains, non-shattering spikes, and adaptation to diverse environmental conditions. This process gave rise to domesticated wheat varieties that were better suited for cultivation and consumption. Wheat belongs to the genus *Triticum*, which encompasses several species, including *Triticum aestivum* (common wheat), *Triticum durum* (durum or pasta wheat), *Triticum dicoccum* (emmer wheat), and *Triticum monococcum* (einkorn wheat). The domestication of wheat involved two primary species: einkorn wheat (*Triticum monococcum*) and emmer wheat (*Triticum dicoccum*). Einkorn was among the first species to be domesticated, while emmer became more widespread due to its higher yields and adaptability. The hybridization of emmer wheat with wild grasses led to the development of bread wheat (*Triticum aestivum*), which is the most widely grown wheat species today. In India, wheat cultivation dates back to the Indus Valley Civilization (around 3000 BCE). Archaeological evidence suggests that ancient Indian farmers cultivated both einkorn and emmer wheat. The introduction of new wheat varieties from Central Asia during the medieval period further enriched the genetic diversity of Indian wheat. The Green Revolution in the 1960s, characterized by the introduction of high-yielding varieties and improved agricultural practices, significantly boosted wheat production in India.

WHEAT GROWING ZONES OF INDIA

India is one of the largest producers of wheat globally, with diverse agro-climatic zones suitable for its cultivation. The major wheat-growing states include Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar. These regions experience varying climatic conditions ranging from temperate to subtropical, allowing for the cultivation of different wheat varieties throughout the year. The diverse climatic conditions, soil types, and geographical features create distinct wheat-growing zones, each with unique characteristics and requirements. Various wheat growing zones and their respective areas are presented in Table 1.

RESEARCH CENTERS WORKING ON WHEAT IN INDIA

Several research institutions and agricultural universities in India are actively involved in wheat research and development. Some prominent centers include the Indian Agricultural Research

Institute (IARI) in Delhi, ICAR- Indian Institute of Wheat and Barley Research (IIWBR) in Karnal, Punjab Agricultural University (PAU) in Ludhiana, ICAR institutes and State Agriculture Universities located across the country. These centers focus on breeding high-yielding, disease-resistant wheat varieties, improving agronomic practices, and enhancing wheat productivity to meet the growing demand.

ALL INDIA COORDINATED WHEAT IMPROVEMENT PROJECT (AICWIP)

The AICWIP was established in 1965 by the Indian Council of Agricultural Research (ICAR) to address the challenges in wheat production and to promote coordinated research efforts across the country. It is a flagship program in India that focuses on improving wheat production through coordinated research and development efforts. Fig 1 shows the significant role of AICWIP in development of wheat production in India. It plays a crucial role in enhancing wheat productivity, disease resistance, and overall crop quality across the diverse agro-climatic zones of India. Numerous high-yielding wheat cultivars have been released which were accepted by the farmers. For example, C 306, HD 2009, WL 711, Lok 1, UP 262, HD 2189, WH 147, HI 617, HD 2285, HD 2329, PBW 343, Raj 3765, PBW 502, HD 2733, MACS 6222, NIAW 1994, NIAW 301, HD 2967, HD 3086, DBW 17, AKAW 4627, PBW 550, GW 273, GW 322, NIAW 3170 and GW 496 in bread wheat and Raj 1555, PBW 34, HI 8498, NIDW 1149, and PDW 233 in durum wheat were evolved. Bio fortified varieties like WB 02, HPBW 01, HI 8759, HI 1605, MACS 4028 etc. also developed under this project.

Table 1. Wheat growing zones and respective research centers working under AICWIP, IIWBR, Karnal

Zone	States	Research Centres
Northern Hills Zone (NHZ)	Western Himalayan regions of Jammu &Kashmir (except Jammu and Kathua districts); Himachal Pradesh (except Una and Paonta Valley); Uttaranchal (except Tarai area); Sikkim and hills of West Bengal and North East States	CSK-HPKVV, Palampur CSK-HPKVV, Bajaura CAU, Imphal SKUAST-K, Srinagar
North Western Plains Zone (NWPZ)	Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions) and Western UP (except Jhansi division), parts of Jammu &Kashmir (Jammu and Kathua districts) and parts of HP (Una district And Paonta valley) and Uttaranchal (Tarai region)	PAU, Ludhiana CCSHAU, Hisar GBPUAT, Pantnagar RAU, Durgapura SKUAST-J, Jammu
North-Eastern Plains Zone (NEPZ)	Eastern Uttar Pradesh, Bihar, Jharkhand, Orissa, West Bengal, Assam and plains of North East States.	CSAUAT, Kanpur NDUAT, Faizabad BHU, Varanasi BAU, Sabour BAU, Ranchi BCKVV, Kalyani

		UBKV, Coochbehar AAU, Shillongani
Peninsular Zone (PZ)	Maharashtra, Karnataka, Andhra Pradesh, Goa, plains of Tamil Nadu Hilly areas of	UAS, Dharwad MPKVV, Niphad MPKVV, Mahabaleshwar ARI, Pune
Central Zone (CZ)	Madhya Pradesh, Chhattisgarh, Gujarat, Kota and Udaipur divisions of Rajasthan and Jhansi division of Uttar Pradesh	IGKVV, Bilaspur SDAU, Vijapur JAU, Junagarh MPUAT, Udaipur JNKVV, Jabalpur JNKVV, Sagar JNKVV, Powerkhera RVSKVV, Gwalior

(Source: https://www.aicrpwheatbarleyicar.in)

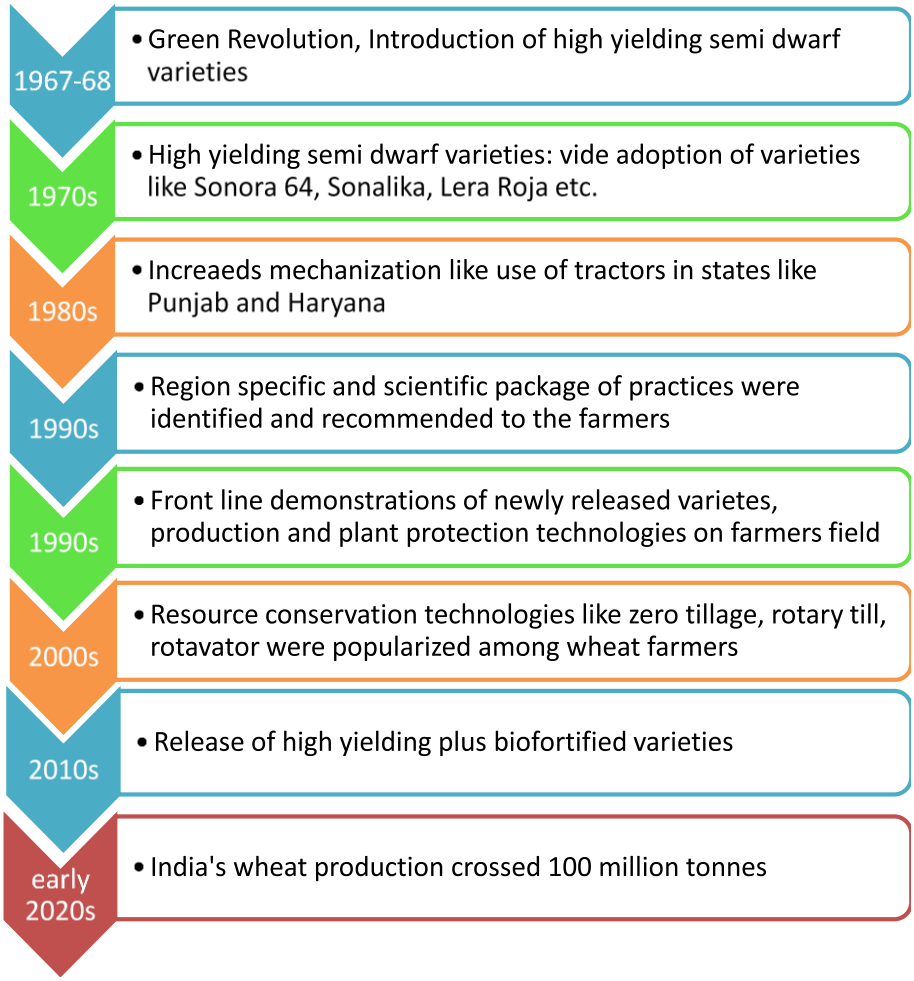

Figure 1. Significant development in the country post inception of AICWIP

CONCLUSION

Wheat cultivation plays significant role in India's agricultural landscape, contributing to food security, rural livelihoods, and economic growth. Through continuous research and innovation, the country aims to enhance wheat productivity, sustainability, and resilience to biotic and abiotic stresses. The collaborative efforts of research institutions, farmers, and policymakers are essential for ensuring the continued success of wheat production which resulted in India's wheat production crossed the 100 million tonnnes and meeting the evolving demands of a growing population.

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