Crimson Publishers
Wings to the Research

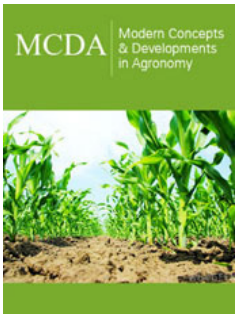
Review Article

Prospectus of Wheat (*Triticum aestivum L.*) Farming in Kashmir Region of Northwestern Himalayas

Razia Gull, M Anwar Bhat*, IA Jehangir, Tahir A Sheikh, Waseem Raja, Ashaq Hussain , S S Mahdi, Sadaf Iqbal and Moneesa Bashir

Faculty of Agriculture Wadura, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, India

ISSN: 2637-7659



***Corresponding author:** Anwar Bhat M, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Wadura -193201, India

Submission: July 28, 2023
Published: September 15, 2023

Volume 13 - Issue 2

How to cite this article: Razia Gull, M Anwar Bhat*, IA Jehangir, Tahir A Sheikh, Waseem Raja, Ashaq Hussain, S S Mahdi, Sadaf Iqbal and Moneesa Bashir. Prospectus of Wheat (*Triticum Aestivum L.*) Farming in Kashmir Region of Northwestern Himalayas. Mod Concep Dev Agrono. 13(2). MCDA. 000810. 2023.
DOI: 10.31031/MCDA.2023.13.000810

Abstract

Cereal production round the globe is vital for meeting the food requirement of increasing human population. Among cereals wheat is of paramount importance, playing a significant role in safeguarding food security in the South Asian region. It accounts for nearly one-third of the total food grain production in India. In the union territory of Jammu and Kashmir, the growing of wheat holds immense promise, as the region exhibits diverse regional patterns and significant potential for its growth. The study explores the climatic suitability and identifies recommended wheat varieties that thrive well in the region. While the agrarian landscape offers promising opportunities, several major constraints hinder optimal wheat production. However, through the implementation of strategic approaches, higher productivity can be achieved. The comprehensive study sheds light on the crucial aspects related to wheat cultivation in the region, while recognizing the obstacles also that need to be addressed. Implementing the suggested strategies could lead to increased productivity, ultimately contributing to food security and economic growth of the farming community in this North-Western Himalayan region.

Keywords: Wheat; Productivity; Food security; Constraints; Strategic approaches

Introduction

Wheat (*Triticum aestivum* L.) holds significant importance as a cereal crop, playing a crucial role in ensuring food security in South Asia [1,2]. It stands as the second most vital staple food crop after rice and accounts for nearly 30% of the production of cereals globally with 220-million-hectare area (mha) and substantial production of 781 million tonnes [3,4]. Its usage is diversified, with approximately 65% being allocated for human consumption,17% for livestock feed and 12 % employed in various industrial applications, including biofuels [5]. In India, wheat cultivation is done on an area of 29.55mha accounting for 13.43% of global wheat growing area with total production of 101.20 million tons representing 12.98% of the global wheat output (MoA & FW-2019). The primary wheat-producing states in India are Uttar Pradesh, Punjab, Madhya Pradesh, Bihar, Haryana, Rajasthan, Maharashtra, Karnataka, Gujarat, Uttarakhand, Himachal Pradesh, West Bengal, and Jammu and Kashmir contributing a substantial 99.5% of the total national wheat production. On the other hand, the remaining states contribute only a meager 0.5% of the total wheat production (Directorate of Wheat Development). Wheat cultivation in J&K had a relatively late start, commencing in the 1970s. Initially, wheat-growing areas in the region were limited to subtropical regions of the Jammu division. The valley, despite having considerable potential for wheat cultivation and favorable climatic conditions, exhibited low cultivation levels [6,7]. The overall average production in the union territory of J&K stands at 0.40MT with a productivity of 1541.13Kgha^{-1} [8]. Thus, comparatively, wheat productivity falls below the national average. However, in the financial year 2020, the northernmost part of Jammu and Kashmir witnessed a significant production of about 488 thousand metric tons [9]. Nonetheless, the temperate climate of Kashmir valley

and higher hills provides a more suitable environment for achieving higher wheat crop yields [10]. The region receives the majority of its annual precipitation between December to May, coinciding with the critical period of crop growth in the valley. Adequate availability of moisture during sowing, from mid-October to mid-November, ensures favorable crop growth. In recent times, many traditional rainfed wheat growing areas in the foothills have been converted into apple orchards. Despite this shift, efforts have been made to revive wheat cultivation in some of the remaining rainfed areas.

Regional Patterns and Potential for Growth

In 1996-1997 wheat cultivation covered approximately 2.12 lakh hectares, with the majority (2.05lakh hectares) in the Jammu division and about 4000 hectares in the Kashmir division. The crop has been widely adopted across most districts of the union territory, with significant concentrations in Jammu (42%), Kathua (42%), Udhampur (37%), and Rajouri (39%) [11]. However, in the remaining districts of the Jammu and Kashmir, the terrain and temperature conditions are not favourable for its cultivation, except for small areas in the valley and river terraces. In the Jammu plains, which is adjacent to the province of Punjab, wheat serves as the staple food. Overall, wheat occupies about one fourth of the total cropped area in the union territory. Prior to the introduction of high yielding varieties, the wheat production was 112 lakh quintals in 1964-65, which increased to over 20 lakh quintals in 1981-82 and further to 34.75 lakh quintals in 1992-93. By 1996-97 the total wheat production in the region had reached about 40 lakh quintals, reflecting the growing interest of farmers in cultivating this crop [11]. The productivity of wheat in Jammu & Kashmir registered a consistent increase from 6.45 to 18.9qha^{-1} over the past five decades from 1964-65 to 2016-17. Additionally, the high mountain regions of Ladakh and Gurez which are ideally not suitable for successful cultivation of any other cereal crop provide sustenance to wheat as an important niche crop. This successful diffusion of wheat cultivation has been achieved in the Kargil and Leh districts of Ladakh division. In Ladakh, wheat is grown in the Sura, Nubra and Rupsa valleys, with sowing taking place in May and harvesting in august and September.

Climatic Suitability

The productivity of any crop in general is a complex trait which is determined as a function of genotype, agronomic management and climate of the region. Wheat crop is versatile in nature capable of thriving over diverse climatic zones of tropical, subtropical, temperate, and cold regions, extending even beyond 67 °N. While it can adapt to different environments, it predominately flourishes in the temperate zone, making winter the primary season for its cultivation. Given its origin in mid-latitude grasslands, wheat requires a cool climate with moderate rainfall during its growth period. The ideal conditions for wheat production involve cool winters, warm springs, and ample sunshine during the ripening and harvesting phases. In the union territory of Jammu and Kashmir, wheat is primarily grown as a rabi crop except for Ladakh division and higher reaches of Gurez, where it is grown as a single crop during the summer season. Wheat exhibits remarkable adaptability to different altitudes, with successful cultivation possible up to 3000 meters above sea level. For optimal germination, an average temperature of around 20 °C is conducive at the time of sowing, while during the ripening the average temperature should range between 25 to 27 °C. Adequate water supply is crucial for its growth, with approximately 30 cm of well-distributed rainfall over the growth period.

Varieties of Wheat Recommended for the Region

A. Shalimar wheat -1: Well suited to rainfed or restricted irrigation, under temperate climate. Matures within 225-235 days. Responsive to fertilizer application. High yielding (35-38qha^{-1}) and resistant to Leaf stripe and leaf rust.

B. Shalimar wheat -2: Adapted well to the temperate climatic conditions of Kashmir region. Matures within 225-230 days (early maturing than Shalimar Wheat-1). Responsive to fertilizer application. High yielding (35-45qha^{-1})

C. Kailash: Recommended for the cold-arid region of Ladakh. Medium maturity. Moderately resistant to yellow rust, loose smut, and ear cockle. Resistant to lodging, non-shattering, fertilizer responsive, tolerant to intense solar radiation, intermittent stresses of high temperature, and moisture. Grain Yield of 40-45qha^{-1}, straw yield 90-115qha^{-1}. Straw is palatable fodder for animals.

D. Singhchen: Recommended for the cold-arid Ladakh region. Medium maturity, tolerant to high-temperature and moisture stress and intensive solar radiation. Resistant to yellow rust and ear cockle. Moderately resistant to lose smut. Grain yield 30-35qha^{-1}, straw yield 80-95qha^{-1}.

E. K-9130: K-9130 is another popular wheat variety known for its cold tolerance and suitability to the temperate climate of Kashmir.

F. Mansarover: Recommended for agro-climatic conditions of Ladakh. Early maturity. Medium in resistance to stripe rust and insect and pest attack. Tolerant to high temperature and moisture stresses. Grain yield 30-40qha^{-1}, straw yield 100-115qha^{-1}.

G. Selma: A rust-resistant variety of wheat that is suitable for cultivation in the temperate climate of Kashmir.

Shalimar Wheat 3 and Shalimar Wheat-4 are other two high yielding varieties developed by SKUAST-Kashmir which seem to be promising and mature one week earlier than Shalimar Wheat 1 and Shalimar Wheat 2.

Major Constraints Affecting the Wheat Growth in the Region

Besides long harsh winters, hilly terrain and small land holdings are the major impediments for mechanization in wheat crop. One of the major constraints for horizontal expansion of wheat in Kashmir valley is the non-availability of short duration varieties, which can be accommodated in rice based cropping system. Moreover,

a number of faulty agronomic practices hamper the growth and yielding ability of the crop. These agronomic practices primarily include using local poor-quality seed, conventional method and time of sowing with suboptimal seed rate, inappropriate usage of inputs and heavy weed infestation [7,12,13]. Furthermore, there are certain biotic and abiotic constraints that affect wheat growth of the region [10].

A. Abiotic Constraints: Among major abiotic constraints moisture stress at the time of sowing and reproductive stage (flowering and grain filling). Unavailability of cultivars to suit the ecology of the region.

B. Moisture stress: During the regular wheat sowing period in the mid-hills, successful germination depends on the residual moisture from the rainy season. Consequently, any moisture stress during this time leads to poor germination and poor plant stand.

C. Early season low-temperature stress: Spring wheat cultivars sown before mid-October, tend to flower in December–January and are vulnerable to damage due to extremely low temperatures. Traditional winter wheat also performs poorly under these conditions, as they require extended vernalization and maturity.

D. Moisture stress at flowering to grain filling: Crop growth experiences adverse effects from December to February but improves rapidly in March and April because of favourable climatic conditions. However, the crop may suffer from moisture stress again from the end of April, which coincides with the grain-filling stage, as no rainfall is anticipated from mid-April to mid-June, the normal time for harvesting the wheat crop.

E. Lack of short-duration varieties: In higher hilly areas (1,700m above mean sea level), where the temperature is generally low and crop period is short. Under such scenario the farmers generally remain content to cultivate wheat crop as fodder. Since there are number of other alternatives in other fodder crops such as oats with greater. Green fodder tonnage [14], the cultivation of wheat is discouraged for the lack of short-duration varieties.

F. Biotic constraints: The major biotic constraints limiting the production potential of wheat crop have been identified as weeds, diseases and their interaction.

Weeds are considered as one of the major biotic constraints inflicting the 20-40 % decrement in the production [15]. Being a rabi season crop the weed flora of wheat crop is diverse and highly variable in density such as *Phalaris minor*, *Convolvulus arvensis* L., *Chenopodium album*, *Poa annua*, *Cynodon dactylon* and *Matricharia Chamomilla* different to that of rice [16] but similar to flora identified in other major winter crops like *Brassica rapa* of Kashmir valley [17]. All the weed control measures like manual, cultural or chemical are resorted before the critical stage is over (30-60 days after sowing). Since chemical weed control in general is favored in any crop and every scenario on account of being less cumbersome and more effective, for rice crops 90,93 and 94% weed control efficiency was reported under direct dry seeding, water seeding and conventional transplanted [16]. Further the mortality of the weed population to the tone of 91 and 84%was reported in wheat and conventionally transplanted rice crop, respectively when the weeds were taken care off by resorting to herbicides such as clodinafop-propargyl in combination with bromoxynil +MCPA and Pretilachlor + Pyrazosulfuron, respectively [18,13].

Wheat production in the region is further hampered by the occurrence of multiple diseases. Being highly susceptible to disease incidence with the yield loss potential varying from 16-25% at global level [19,20]. It has become imperative to develop disease-resistant varieties to keep pace with the global food demand. Cultivated wheat in Jammu and Kashmir is highly vulnerable to a number of diseases Table 1 [21].

Table 1: Major fungal diseases reported in wheat in Jammu and Kashmir.

S. No	Fungal Disease	Casual Organism	Favourable Conditions
1	Yellow Rust	*Puccinia striiformis*	Traditional varieties and landraces.
2	Brown Rust	*Puccinia triticina* Eriks	Changing climatic conditions
3	Loose Smut	*Ustilago nuda tritici*	Farmers own seed

Strategies to attain higher productivity

a. Key strategies to attain horizontal and vertical intensification in wheat crops are needed for attaining self-sustenance in food production. Since there is large variability in the climatic and edaphic conditions in Jammu and Kashmir, selection of the suitable cultivar is pivotal for seeking higher yield.

b. For efficient utilization of the residual moisture, harvesting of Kharif crops should be completed by the end of September for its timely sowing. This will ensure quick germination and better plant stand to withstand the sub-zero temperatures of harsh winter. Better agronomic management practices should be followed to create an environment favourable to the crop both at micro and macro level.

c. Concerted efforts are needed to develop the short duration climate resilient varieties with greater phenological plasticity such as shorter vegetative and longer reproductive phases. Which could lead to better portioning of photosynthates coupled with sufficient time for grain filling.

d. Continuation of the efforts to breed the varieties resistant to brown rust and rigorous screening of advanced resistant wheat lines to combat loose smut of wheat.

Conclusion

Kashmir valley offers a tremendous scope for the cultivation of wheat owing to its congenial climatic suitability. The region offers a range of recommended varieties that have demonstrated resilience to local conditions, ensuring better yields and improved grain

quality. In the face of the climatic advantages, there are certain challenges that need to be addressed like development of cultivars which can fit well in rice based cropping system. Identification of climate resilient cultivars to curb various types of stresses. Awareness among the farmers regarding cultivation of the crop on scientific lines for seeking dual objectives of self-sufficiency in food production and economic prosperity.

References

1. Kumar A, Sharma M, Kumar S, Tyagi P, Wani SH, et al. (2018) Functional and structural insights into candidate genes associated with nitrogen and phosphorus nutrition in wheat (*Triticum aestivum* L.). International Journal of Biological Macromolecules 118(Pt A): 76-91.
2. Wani SH, Sheikh FA, Najeeb S, Iqbal AM, Kordrostami M (2019) Genetic variability study in bread wheat (*Triticum aestivum* L.) under temperate conditions. Current Agriculture Research Journal 6(3): 268-277.
3. Wheat initiative (2019) An international vision for wheat improvement.
4. USDA (2019) United States Department of Agriculture.
5. FAO, Statistics (2018) FAO statistical yearbook world food and agriculture. Food and Agriculture Organization of the United Nations, Rome 2225-7373: 132.
6. Kour M, Singh KN, Thakur NP, Sharma R (2012) Crop performance, nutrient uptake, nitrogen use efficiency and harvest index pf wheat (*Triticum aestivum*) genotypes as influenced by different sowing dates under temperate Kashmir and its validation using CERES model. Indian Journal of Agricultural Research 46(2): 119-126.
7. Wani SH, Ganai MA, Parray GA, Sheikh FA, Najeeb S, et al. (2017) Frontline demonstrations on wheat (*Triticum aestivum* L.) yield under rainfed temperate Kashmir conditions. International Journal of Current Microbiology and Applied Sciences 6(12): 2121-2124.
8. Sharma S, Sehgal S (2015) Trends in area, production and productivity of wheat crop in J&K vis-à-vis India. Journal for Studies in Management and Planning 1(6): 123-136.
9. Statista Research Department (2021) Production volume of wheat across Jammu and Kashmir from financial year 2009-2020.
10. Gupta HS, Lakshmi Kant (2012) Wheat improvement in northern hills of India. Agricultural Research 1(2): 100-116.
11. Ali ZK (2019) Cultivation of Wheat in Jammu and Kashmir.
12. Tiwari BK, Sharma A, Sahare KV, Tripathi PN, Singh RR (2014) Yield gap analysis of wheat through front line demonstration under limited irrigation conditions. Plant Archives 14(1): 495-498.
13. Bhat M Anwar, A Hussain, Ganai M, Teli NA (2013) Efficacy of penoxsulam against weeds in transplanted rice (*Oryza sativa* L.) under temperate conditions of Kashmir. Applied Biological Research 15(2): 145-148.
14. Jehangir IA, Khan HU, Mubarak T, Mahdi SS, Rasool Faisal UR (2013) Productivity of fodder oat (*Avena sativa* L.) under different sowing times, fertility levels and cutting management in temperate environment. Indian J Agron 58(4): 603- 606.
15. Hussain S, Khaliq A, Matloob A, Fahad S, Tanveer A (2015) Interference and economic threshold level of little seed canary grass in wheat under different sowing times. Environ Sci Pollout Res 22(1): 441-449.
16. Jehangir IA, Hussain A, Sofi NR, Wani SH, Ali OM, et al. (2021) Crop establishment methods and weed management practices affect grain yield and weed dynamics in temperate rice. Agronomy 11(11): 2137.
17. Jehangir IA, Hussain A, Ganai MA, Bhat MA, Mahdi SS, et al. (2019) Phyto-sociological attributes of weed flora in brown mustard growing areas of temperate Kashmir valley. Indian Journal of Weed Science 51(4): 381-384.
18. Hussain Z, Marwat KB, Munsif F, Samad A, Ali K (2013) Evaluation of various herbicides and their combinations for weed control in wheat. Pak J Bot 45(1): 55-59.
19. Oerke EC, Dehne HW (2004) Safeguarding production-losses in major crops and the role of crop protection. Crop Prot 23(4): 275-285.
20. Savary S, Willocquet L, Pethybridge SJ, Esker P, Mc Roberts N, et al. (2019) The global burden of pathogens and pests on major food crops. Nat Ecol and Evol 3(3): 430-439.
21. Shabir H, Wani Ganai MA, Parray GA, Sheikh FA, Najeeb S, et al. (2017) Frontline demonstrations on wheat (*Triticum aestivum* L.) yield under rainfed temperate Kashmir conditions. Int J Curr Microbiol App Sci 6(12): 2121-2124.