Cotton Resurgence Through Early Sowing

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Introduction

Pakistan ranks among the ten countries most vulnerable to climate change globally, facing increased temperature variability and irregular monsoon patterns that directly impact agricultural productivity. The cotton sector faces particular challenges due to the crop's limited margin of ecological adaptation. Climate change has reduced growth duration, boll opening, and sowing-to-harvest periods by approximately 5.66 days per decade in Pakistan from 1961 to 2015[1].

The cotton crop is particularly sensitive to temperature fluctuations, which directly affect its growth and yield. High temperatures during the reproductive phase can cause significant reductions in yield for early-sown cotton, while late-planted cotton often faces flowering and maturity challenges due to high rainfall, low temperatures, and shorter growth periods. These climate-induced shifts necessitate a strategic response in terms of sowing dates to maintain and improve cotton productivity.

The sector also suffers from significant policy imbalances that have undermined its competitiveness against other crops. Cotton is the least protected crop under Pakistan's existing policies, with a Nominal Protection Coefficient[2] of just 1.01, compared to 1.41 for sugarcane and 1.05 for rice. The Effective Protection Coefficient[3] data shows that cotton producers are implicitly taxed (EPC of 0.94), while sugarcane (EPC of 1.55) and rice producers (EPC of 0.98) receive relatively more protection[4]. This policy imbalance has contributed to cotton's declining competitiveness, adversely affecting producers' incentives, farm investments, and rural growth, particularly in Punjab.

Additional challenges include high prices of fertilizers, seeds, and energy, which are important factors hindering cotton production. Similarly, poor quality of seed and pesticides cause significant obstacles. Late planting often results from wheat-cotton cropping systems, where cotton sowing is delayed waiting for wheat harvest. This conflict between crops is a significant practical limitation that needs addressing through improved crop management practices such as relay cropping, intercropping, conservative tillage or the development of shorter-duration wheat varieties such as Hashim-8, Arooj 2022, or Subhani 2021 etc. Limited farmer awareness about optimal agronomic practices represents another challenge, as only 20.8% of cotton farmers are registered with the agriculture department, and just 14.4% have received training regarding agricultural practices[5].

1 (Imran et al., 2024)
2 NPC is the ratio of the domestic price (DP) to the foreign price (PP), both expressed in the national currency. An NPC value greater than 1 indicates that the policies for the crop in question provide protection to farmers through an implicit subsidy, whereas a value less than 1 suggests the opposite.
3 EPC measures the ratio of private value added (PVA) to social or economic value added. An EPC value greater than 1
4 (Baig et al., 2022)
5 Ibid

The Early Sowing Solution

Early sowing of cotton (mid-March to mid-April in most regions) offers multiple benefits that can address many of these challenges and revitalize Pakistan's cotton sector. Research conducted across different regions of Pakistan consistently demonstrates that early sowing provides numerous advantages, although the optimal timing window varies by location due to local climate differences.

From an agronomic perspective, early sowing results in stronger root establishment and proper vegetative growth before the onset of extreme summer heat. Plants experience increases in flowering by approximately 10%, improved boll opening by about 23%, and enhanced fruiting branch development[6]. The extended growing season allows plants to utilize available resources efficiently and produce more fruit over a longer period. Plant growth parameters such as plant height, number of nodes per plant, and internodal distance are significantly affected by sowing dates. Maximum plant height (153.6 cm) and nodes per plant (47.19) occur when cotton is sown on April 1[7]. Similarly, the highest number of fruiting points (406 and 390 per m^2) appear in crops sown on April 15, while the lowest numbers occur in late-sown crops (June 15)[8].

Early planting also provides optimal conditions for Leaf Area Index (LAI) development and Crop Growth Rate (CGR), leading to greater photosynthetic efficiency and dry matter accumulation. Early-sown cotton enjoys better agro-resource utilization, which protects the primary fruiting branch nodes from hot, humid weather that can cause fruit losses. Additionally, early sowing can help reduce the incidence of certain pests and diseases. Cotton leaf curl virus infestation appears significantly lower in early-sown cotton, with MNH-1020 showing least susceptibility to cotton leaf curl virus when planted on March 1 (25.0%) and March 16 (3.0%) in consecutive years[9]. Late-sown cotton faces early virus attacks during the month of July, limiting plant growth and development.

6 (Imran et al., 2024)
7 (Ali et al., 2021)
8 Ibid
9 9 (Iqbal et al., 2021)

The economic advantages of early cotton sowing for farmers are substantial. Net income and benefit-cost ratio decrease linearly with delays in sowing time. The maximum net income of PKR 155,725 (in 2016) and PKR 142,365 (in 2017) was achieved when cotton was sown on April 15 using the CIM-620 cultivar[10]. Similarly, the maximum benefit-cost ratio (2.90 and 2.74) was achieved with the same combination[11]. While the minimum net income of PKR 8285 (2016) and PKR 2125 (2017) was achieved when cotton was sown on 15th May using CIM-608 cultivar. Also, minimum cost benefit ratio (1.10 and 0.97) with same combination. Cotton generates PKR 40,175 per hectare in terms of labor income, injecting approximately PKR 100 billion into the rural economy. This is significantly more labor income per hectare than rice (PKR 37,209/PKR 113 billion) or sugarcane (PKR 57,100/PKR 416 billion)[12].

Early-sown cotton (March-April) demonstrates yield increases of 14-35% compared to late-sown cotton[13]. Early-planted crops show 18% higher seed cotton yield compared to June plantings[14]. This improved yield directly translates to higher returns per unit area for farmers. Fiber quality is also enhanced in early-sown cotton, resulting in premium market prices. Early planting allows for complete fiber development, producing better fiber characteristics including improved length, strength, and micronaire values. Early-sown cotton (April 15) produces the highest fiber strength of 94.8 and 94.3 (tppsi), while late-sown cotton (June 15) produces significantly weaker fibers[15].

The impact of early cotton sowing extends beyond individual farmers to benefit the export sector and national economy. Cotton has the longest value chain among all crops in Pakistan, with major contributions to foreign exchange earnings. Early sowing contributes to increased cotton productivity, supporting foreign exchange earnings through both direct exports and value-added textile products. The domestic textile industry, which plays a pivotal role in Pakistan's economy, benefits from improved quality raw material for value-added products. Early sowing helps ensure more consistent supply of cotton, reducing dependence on imports to meet quality requirements. This strengthens the entire value chain from cotton production to textile manufacturing and export.

From a comparative advantage perspective, Pakistan has favorable conditions for cotton production with a Domestic Resource Cost[16] (DRC) of 0.47, showing that the country utilizes approximately PKR 0.47 of domestic resources to produce cotton output worth PKR 1 in international markets. This indicates economic efficiency in cotton production when optimal practices like early sowing are employed. The efficiency varies by region, with Balochistan showing the strongest comparative advantage (DRC of 0.26), followed by Sindh (0.30) and Punjab (0.75)[17]. Additionally, early sowing contributes to employment generation in rural areas where 1.5 million rural families depend on cotton. By optimizing sowing dates, Pakistan can better utilize its agricultural resources, contributing to improved agricultural value addition to GDP and strengthening its position in the global cotton and textile market.

10 (Hussain et al., 2020)
11 Ibid
12 (Baig et al., 2022)
13 (Imran et al., 2024)
14 Ibid
15 (Hussain et al., 2020)
16 DRC measures the opportunity cost of domestic resources and the social value added per unit of a crop. A country has a comparative advantage in a given product if the DRC value is less than one; otherwise, it does not.
17 (Baig et al., 2022)

Regional Adaptation Strategy

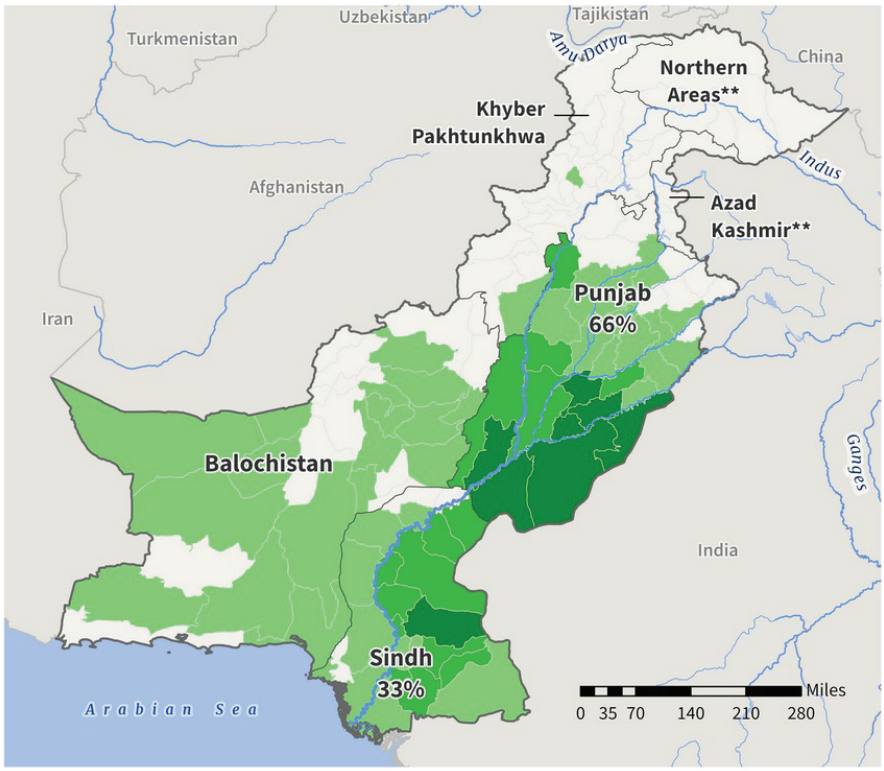
The selection of appropriate cultivars for specific regions is crucial for maximizing the benefits of early sowing. Region-specific cultivar performance can significantly impact yields, fiber quality, and disease resistance. The table below summarizes the optimal sowing dates and recommended cultivars across different regions in Pakistan:

Region	Recommended Cultivars	Optimal Sowing Window	Key Performance Characteristics
Southern Punjab[18]	MNH-1020	March 1 - April 16	Highest seed cotton yield (3021 kg ha^{-1}); Highest ginning out turn(41.1%);mBest fiber strength (35.88 g/tex); Improved CLCV resistance
	MNH-1016	March 16 - April 15	Good yield performance (2150 kg ha^{-1}); Good fiber quality
	CIM-620	April 15 - May 1	Highest seed cotton yield (2456 kg ha^{-1}); Best benefit-cost ratio (2.90); Superior fiber brightness
	Cyto-120	April 1 - May 1	Moderate yield (2124 kg ha^{-1}); Good crop growth rate
Faisalabad	SLH-284	Up to May 20	Highest yielding variety; Good fiber quality
	NIAB-886, NIAB-9811, NIAB-112	April 1 - May 10	Superior seed cotton yields; Good fiber properties
Sargodha	FDH-170	April 15 - May 10	Highest leaf area index (4.45); Best net assimilation rate (3.87 g m^{-2} day^{-1})
	Bt. FH-142	April 15 - May 10	Highest total dry matter (1104.33 g m^{-2}); Best crop growth rate (6.67 g m^{-2} day^{-1})
	Bt. MNH-886	April 15 - May 10	Good boll maturation (48.05 days); Overall balanced performance
Balochistan[19]	CIM-506	March - April	Yield: 96.43 kg/ha, Boll Weight: 3.1g, Ginning Outturn: 38.5%, Staple Length: 28.7 mm
	CRIS-129	March - April	Yield: 3850 kg/ha, Boll Weight: 3.7g, Ginning Outturn: 35.0%, Staple Length: 27.5 mm

For optimal results, sowing dates should be adjusted according to specific regional conditions. In arid and semi-arid Southern Punjab, March 15 to April 15 is optimal; in Central Punjab (Faisalabad region), April 1 to May 20 produces best results; in the Sargodha region, April 15 to May 10 is recommended; and in the Multan area, March 15 to April 16 is best for maximum productivity. These recommendations should be adjusted based on local microclimate conditions and seasonal weather forecasts. Figure 1 highlights the cotton-producing regions of Pakistan, with Punjab (66%) and Sindh (33%) being the dominant contributors to national cotton production. Balochistan also has some cotton-growing areas, but they play a comparatively minor role in overall production.

18 (Hussain et al., 2020), (Iqbal et al., 2021)
19 (Kakar et al., 2018)

Figure 1: Cotton producing areas of Pakistan



Source: USDA[20]

Policy Recommendations

Based on the comprehensive evidence presented, a series of policy interventions are recommended to promote early cotton sowing and revitalize Pakistan's cotton sector:

Financial Incentives for Early Sowing:

The Punjab government has already implemented a proactive approach to incentivize early cotton sowing, announcing in February 2025 a financial assistance package of PKR 25,000 for farmers who cultivate cotton between February 15 and March 31. This initiative aims to achieve an early cotton sowing target of 1 million acres, utilizing both government-owned and leased lands. This model should be expanded to other provinces. If implemented nationwide, early sowing on one million acres could inject PKR 25 billion into rural economies. Given that early sowing improves yield by approximately 30%, this could result in an additional 1.41 million bales (239.7 million kg) of cotton production, reducing import dependency by approximately $350 million (at $1.46 per kg as of 12 March 2025).

Price Support Mechanisms:

A Minimum Support Price (MSP) of PKR 10,000 per 40 kg should be announced to provide farmers with price stability. This represents a 17.6% increase from the current MSP of PKR 8,500. Price fluctuations often discourage farmers from planting cotton, making them shift to alternative crops. An MSP would help stabilize the market and ensure

20 https://ipad.fas.usda.gov/countrysummary/images/PK/cropprod/Pakistan_Cotton.png

A Minimum Support Price (MSP) of PKR 10,000 per 40 kg should be announced to provide farmers with price stability. This represents a 17.6% increase from the current MSP of PKR 8,500. Price fluctuations often discourage farmers from planting cotton, making them shift to alternative crops. An MSP would help stabilize the market and ensure profitability, with earnings reaching PKR 200,000 per acre. Evidence from comparable cotton markets shows that MSP increases directly correlate with production growth. For instance, India demonstrates that when MSP for cotton increased by 8.69%, production grew by 5.14% (Period 2005-06 to 2016-17)[21].

Applying this relationship to Pakistan's context, our 17.6% MSP increase combined with early sowing techniques could boost production by approximately 40.4% (30% from early sowing combined with 10% from increase in MSP). Higher domestic production could reduce Pakistan's dependence on cotton imports, potentially saving $650 million annually[22]. The mechanism should be designed to insulate domestic producers from excessive fluctuations in market prices while maintaining alignment with global markets.

Area Expansion Strategy:

Expanding cotton cultivation from the current 2.4 million hectares to 3 million hectares (a 25% increase) can ensure sustainable production growth. This area expansion could increase total production from the current 10.2 million bales to approximately 12.75 million bales, generating an estimated $633 million in additional value at current market prices ($1.46/kg as of 12 March 2025[23])[24]. This expansion would create approximately 1 million jobs across the cotton value chain, supporting rural employment and industrial growth. Strategic focus should be placed on promising regions with optimal conditions for cotton cultivation, including Potohar, Balochistan, and Sindh areas, which offer unique microclimatic advantages.

Market Linkage Development:

Market linkages should be strengthened to ensure farmers receive fair prices for their produce. Direct sales to textile mills should be promoted, reducing dependence on middlemen in the cotton value chain. By eliminating intermediary handling and reducing transaction costs, farmers could capture a greater share of the final value of their cotton crop. Improving market transparency and developing direct farmer-to-mill connections would increase farmer profitability while providing textile manufacturers with more reliable access to quality raw materials. Moreover, stronger market linkages would support Pakistan's cotton export value chain, which currently generates $3.05 billion in direct cotton exports and sustains $16.7 billion in textile exports (FY24). Ensuring competition in markets and improving marketing infrastructure would help farmers secure better prices while stabilizing supply for the textile industry.

21 (Geetha & Mahesh, 2019)
22 Author's own estimates
23 https://markets.businessinsider.com/commodities/cotton-price
24 Author's own estimates

Input Quality and Subsidy Program:

Seed quality and input subsidies should be prioritized to enhance productivity. Providing certified high-yield cotton seeds could help increase yields from 20 to 25 maunds per acre, leading to an additional production of 2.55 million bales. These improvements could reduce Pakistan's reliance on imported cotton and increase export earnings by an estimated $633 million at current market prices ($1.46 per kg as of 12 March 2025) . Establishing warehouses at the Markaz level in each tehsil to supply certified seed and pesticides to farmers would help address quality concerns. Since only 30% of cotton farmers currently have access to loans, expanding financial services for cotton producers would enable greater investment in appropriate inputs and technologies.

Research and Technology Investment:

The government should focus on investing in research and technology for climate-resilient cotton varieties. This includes the development of pest-resistant and drought-tolerant seeds tailored for various agro-ecological zones. Early sowing has been shown to reduce CLCV incidence by 20-30%, making crops more resistant to diseases. Expanding research on short-duration wheat varieties can also help address conflicts between wheat and cotton cropping seasons. Efficient irrigation techniques, such as drip irrigation and laser leveling, should be promoted to improve water efficiency and ensure sustainability. Development of region-specific sowing guidelines would help farmers optimize planting dates based on local conditions. This should be coupled with strengthened weather forecasting systems to guide sowing decisions, particularly in the face of increasing climate variability.

Tax Structure Reforms:

Removing the 18% sales tax on locally produced cotton is necessary to strengthen domestic production. The existing taxation framework inadvertently favors imports over domestic procurement, contributing to Pakistan's significant cotton import bill of $1.61 billion in FY24. Strategic tax adjustments would improve the competitiveness of domestic cotton, encouraging local ginning and spinning industries to source locally while stabilizing supply chains for textile manufacturers. These reforms would complement other policy measures by creating a more level playing field between cotton and competing crops, supporting the overall goal of increasing self-sufficiency in this critical agricultural sector.

Balancing Agricultural Policies:

Pakistan has a comparative advantage in producing cotton with a Domestic Resource Cost (DRC) of 0.47, indicating efficient use of domestic resources for cotton production. However, current policies favor other crops, particularly sugarcane. Therefore, a rebalancing of agricultural policies is needed to provide more equitable support for

25 Author's own estimates

cotton production. This includes rationalizing taxation on domestic cotton, ensuring competition in markets, improving marketing infrastructure, enhancing the processing of seed cotton and ginning to fetch higher prices in world markets, and developing mechanisms to insulate domestic producers from excessive fluctuations in market prices while maintaining alignment with global markets.

Conclusion

Early cotton sowing represents a critical adaptation strategy that addresses both climate change challenges and economic inefficiencies in Pakistan's agricultural sector. The evidence demonstrates that shifting sowing dates to March through mid-April (varying by region) yields substantial benefits, including 14-35% higher yields, improved fiber quality, reduced pest pressure, and enhanced economic returns for farmers.

The proposed policy framework addresses the cotton crisis through integrated interventions: financial incentives, price support mechanisms, area expansion, market linkage development, input quality improvements, research investments, tax reforms, and balanced agricultural policies. These measures target the institutional constraints that have hindered cotton's competitiveness relative to other crops.

With Pakistan's favorable comparative advantage in cotton production (DRC of 0.47), implementing region-specific early sowing strategies offers a path to reclaim the country's position as a global cotton producer while strengthening rural economies and reducing import dependency. By adopting these evidence-based policies, Pakistan can transform climate adaptation challenges into opportunities for agricultural growth and economic resilience.

A detailed overview of stakeholders, their roles in cotton resurgence and the economic impact is provided in the table 1 in Annex A.

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Annex-A

Table 1: Details of stakeholders, recommendations and economic impact

Who	What needs to be done	Economic Impact
Provincial Agriculture Depts & Ministry of Food Security	Implement PKR 25,000/acre incentive for early sowing	14-35% yield increase; PKR 25B rural injection
Trading Corp of Pakistan & Economic Coordination Committee	Set MSP at PKR 10,000 per 40kg; establish procurement centers	40.4% production boost; save $650M in imports
Planning Commission & WAPDA	Expand cotton area by 25%; prioritize water allocation	12.75M bales production; create 1M jobs
Cotton Standards Institute & Textile Associations	Establish grading system; connect farmers with mills	Support $3.05B exports; improve fiber quality
Federal Seed Dept & ZTBL	Control seed quality; provide targeted credit	Increase yields by 5 maunds/acre; expand financial access
Agricultural Research Institutes	Develop climate-resilient varieties and short-duration wheat	Reduce disease by 20-30%; improve flowering by 10%
Federal Board of Revenue	Remove 18% sales tax on local cotton	Reduce $1.61B import bill; level the playing field

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