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Study on Cotton Production and Constraints in District Mirpurkhas Sindh Province of Pakistan

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ABSTRACT

The study examines the production constraints of cotton growers in District Mirpurkhas of Sindh, Pakistan. Cotton, being a significant cash crop, contributes largely to the source of income for the farmers as well as the region's economic activity. The study employed a comprehensive survey of 120 cotton farmers through a well-designed questionnaire. It is evident the cotton is a profitable crop since a yield of 24 maunds per acre at a price of Rs 6,238 per maund yields a revenue productivity of Rs 149,712 per acre. While the total cost of production is Rs 80,170 per acre, the net income stands at Rs 69,542 per acre. Despite the profitability of cotton farming, there are various production constraints that lower down the potential productivity and profit. The production constraints include high rainfall, high costs of agricultural inputs, water scarcity, pests attack, and lack of adequate farm inputs such as improved seeds and modern machinery, among others. The study recommends that the menace of these production constraints should be addressed through appropriate and effective strategies. The most significant strategy lies in provision of appropriate and timely agricultural advisory services on climate-smart cotton varieties suitable for the region to address the impacts of climate change on cotton production. Furthermore, enhancing the level of education and skills of the farmers through agricultural training to help them adopt modern technologies and utilize them efficiently and effectively. Provision of agricultural inputs at subsidized prices and easy accessibility should be emphasized. Additionally, improving water management practices due to scarcity is a key strategy to address the water shortage problem and enhance agricultural production. Enhancing agricultural extension services through improved and timely information delivery to the farmers and promoting mechanization of agricultural activities should also be emphasized to ensure improved yield. Moreover, providing institution and financial support in the form of subsidy support and accessible credit facilities to the farmers will also help address the production constraints. The production constraints of cotton growers in District Mirpurkhas can be resolved to help promote cotton production. As a result, not only will this promote the socio-economic development and prosperity of this region, but it will also enhance attainment of socio-economic development and prosperity of farmers thus promoting socio-economic and agricultural development of Pakistan.

Introduction

The agriculture sector in Pakistan witnessed robust growth in 2023-24, with an overall increase of 6.25 percent. Notably, the crops saw a remarkable growth of 11.03 percent, a significant improvement compared to the previous year. Within this sub-sector, important crops experienced a substantial surge, growing by 16.82 percent, showing a solid recovery and significant production increase (GoP, 2024). Pakistan is the third largest consumer, fourth largest producer of cotton and is one of the key cotton growing countries in the world. Cotton fiber is the most important cash crop in Pakistan, after wheat, and agriculture and cotton form the backbone of the economy.(Naveed et al., 2023). Cotton is a major crop in Pakistan, also known as "white gold," which plays a crucial role in the nation's agriculture and export earnings. Cotton is one of the major crops in Pakistan, and its production has a significant impact on the agriculture sector as it contributes around 4.5% of the national GDP and about 23.6% of the value addition in the agriculture sector (Dahri et al., 2023).

Cotton is a member of the genus Gossypium, known as the prime fiber crop, and has been cultivated in tropical, subtropical and semiarid areas around the world (Tarazi et al., 2020). Fiber, as the major product of cotton, has been extensively used in the textile industry and requires millions of cotton bales yearly (Shahzad et al., 2019). Globally, cotton plays an important role in agriculture (upland cotton), accounts for 95% of the cotton grown over an area of about 33–35 million hectares and generates about $600 billion a year in the global economy. It is the staple food for almost 250 million people, especially in developing countries and is critical for Pakistan as a major cash crop (Ashraf et al., 2024). Cotton is an important source of income and plays a significant role in the economy of the countries involved in cotton production like Pakistan, where it is the second largest crop after rice (Muhammad et al., 2023).

Cotton is an important cash crop of Pakistan, supporting the economy by contributing to industrial development and helping to earn revenue (Magsi, 2012; Ali et al., 2019, Mustafa et al., 2025). The cotton harvest increased from 4.9 million bales in 2022 to 10.2 million bales in 2023, a remarkable increase of 108.2% after being severely impacted by damage from floods and heavy rainfall in the previous year (GoP, 2024). However, despite the economic significance, cotton production in Pakistan has been facing persistent challenges, which have resulted in reduced yields over time (Ashraf et al., 2024). In the 2023 season, despite an increase in the sown area of 10.7%, the devastating floods in Sindh and Balochistan resulted in a 41% drop in yields to 4.91 million bales (GoP, 2023). Climate change has also been a big threat to global agriculture in recent years, especially for developing countries like Pakistan, which relies heavily on the agricultural sector (Gilal et al., 2025). Pakistan is among the ten countries most vulnerable to climate change (Eckstein et al., 2021). Increased temperatures and other climatic factors have adversely affected cotton production. The objective of this study is to examine and analyze the factors that limit the production of cotton by the growers in District Mirpurkhas, Sindh province of Pakistan, and make recommendations for increasing cotton production and the socio-economic status of the people in the area.

Materials and Methods

The study was conducted in District Mirpurkhas with the aim of exploring cotton production and problems faced by cotton farmers in District Mirpurkhas, Sindh. In this chapter, we discuss the proposed methodology of the research. Different tools and techniques used are mentioned in this section.

Study area

The Mirpurkhas district, located at 68 ° 59 '3 to 69 ° 16' 53 east longitude and 24 ° 48 '33 to 25 ° 48 "7 north latitude, is an administrative division in the lower reaches of the Sindh province, southeast of Pakistan. The district covers an area of 3,319 km2 and is home to one and a half million inhabitants. (Population & Housing Census, 2017). The district is divided into seven tehsils: Mirpurkhas, Sindhri, Digri, Hussain Bux Mari, Kot Ghulam Muhammad, Jhudo, and Shujaabad, having rural-urban population ratio of 71.7: 28.3 (Population & Housing Census, 2017). The main source of livelihood in this district is agriculture and allied activities (PESA, 2014).

Population and sample size

The proposed study was conducted in district Mirpurkhas using primary data collected from field survey. A sample of 120 cotton growers were selected by using simple random sampling. Simple random sampling is an extensively used sampling procedure in scientific research. Simple random sampling is selected for populations which are highly homogenous, where the members of the research are randomly selected to participate in the research (Bhardwaj, 2019).

Questionnaire

The research instrument was initially developed by designing the questionnaire, which was then approved for use. The interviews were conducted by applying a well-developed and pretested questionnaire, and a list of constraints faced by cotton growers was developed. The main questions were related to the research title and objectives. The interviews were held face-to-face with farmers involved in cotton cultivation, as decided by the interviewer. The survey document was prepared in English, while the interviews were held in Sindhi.

Data Analysis

Once the data was collected, it was tabulated and analyzed using Microsoft Excel and SPSS (Statistical Package for the Social Sciences). The tabulated data was then summarized, analyzed, and interpreted to meet the objectives of this study. Descriptive statistics, such as averages, frequencies, and percentages, were the primary statistical tools applied to present the results comprehensively.

Descriptive statistics

To analyse the results of the present study, descriptive statistics were used to find out different characteristics of sample respondents.

a) Estimation of Average

Averages were calculated by applying the following formula:

Average = $\sum Xi / n$

Where,

$\sum Xi$ = sum of independent variables

n = number of observations in data

b) Total cost of production

Total cost of production was estimated by using the following formula:

$$TC=TFC+TVC$$

Net Returns

Net returns were estimated by using the following formula:

NR= TI- TC

c) Input-output and cost benefit ratio

The input-output ratio was estimated by using the following formula:

$$IO_R = \frac{T1}{TC}$$

Where

IOR = Input-Output Ratio

The cost-benefit ratio was estimated by using the following formula:

$$CBR = \frac{NR}{TC}$$

Where

CBR = Cost Benefit Ratio

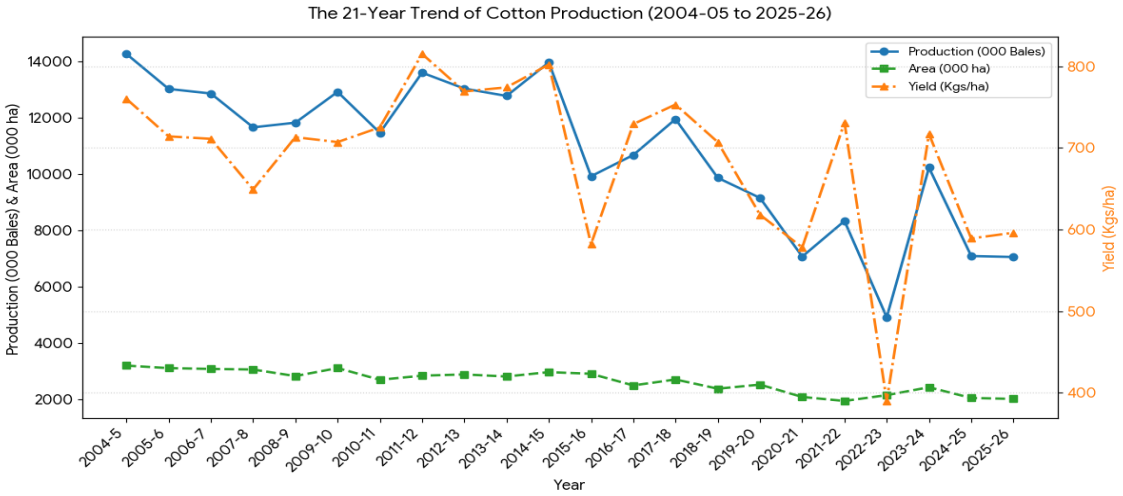
Results and Discussions

This chapter presents the results of the study based on data, descriptive statistics, and visualization. The results of this study reveal that, despite the profitability of cotton farming, this agricultural activity faces several barriers to optimal production. For example, even though a farmer can earn an average of 24 maunds of cotton per acre, the revenue product from this yield is only Rs. 149,712 per acre. This is because the total production cost accounted for Rs. 80,170 per acre. Moreover, multiple factors, including inconsistent weather, increasing production costs, waterlogging, pests, and limited access to quality inputs, hinder profitable cotton farming.

Table.1 below represents the trends of cotton farming in Pakistan for the past 20 years. In particular, the table indicates the area under cultivation, production, and yield during this period. According to the data, the highest cotton production was reported in 2004-05, reaching 14,263 thousand bales. Meanwhile, the lowest output was observed in 2022-23, only 4,910 thousand bales. Furthermore, the yield per hectare peaked in 2011-12 at 815 kg/ha and then dropped to 390 kg/ha in 2022-23. Overall, these trends suggest the impact of climate change, pests, and bad agricultural practices on cotton farming in Pakistan. Figure 4.1 below visualizes this data in a graphical form. In this graph, the blue line indicates the area under cultivation, the green line represents production, and the red line displays the yield per hectare.

Table 1. Area, Production, and Yield of Cotton in Pakistan (2005–2026)

Year	Area 000 ha	Production 000 Bales	Yield Kgs/ha
2004-5	3,193	14,263	760
2005-6	3,103	13,019	714
2006-7	3,075	12,856	711
2007-8	3,054	11,655	649
2008-9	2,820	11,819	713
2009-10	3,106	12,914	707
2010-11	2,689	11,460	725
2011-12	2,835	13,595	815
2012-13	2,879	13,031	769
2013-14	2806	12,769	774
2014-15	2,961	13,960	802
2015-16	2,902	9,917	582
2016-17	2,489	10,671	729
2017-18	2,700	11,946	753
2018-19	2,373	9,861	707
2019-20	2,517	9,148	618
2020-21	2,079	7,064	578
2021-22	1,937	8,329	731
2022-23	2,144	4,910	390
2023-24	2,424	10,223	717
2024-25	2,043	**7,084**	**589**
2025-26	2010	7,050	596



The results show that the majority of respondents in the survey area are about 34 years old and have an average family size, which consists of five members. Moreover, the results indicate that 35% of the respondents are illiterate, 44.17% of them finished primary education, 15.83% received secondary education, 3.83% attended college, and only 1.67% are graduates. According to the respondents, the average income of the population in the study area per year is Rs 124.92.

Table 2. Socio-economic characteristics of cotton growers

Description		Unit	Statistics
Age		Years	34
Family Size		No	5
Illiterate		%	35.00
Literate	Primary	%	44.17
	High school	%	15.83
	College	%	3.83
	Graduate	%	1.67
Annual Income		Rs	124,920

Table 3. presents the respondents' landholding pattern, farming practices, and varieties of cotton grown by the farmers in the selected study area. Generally, the study shows that a farmer owns 38.5 acres of land, 21.5 acres of leased land, and 16.37 acres on average owned and leased together with a quarter of the land used for growing cotton (9.82 acres). A respondent has an average of 13.5 years of experience in farming. As far as cotton varieties are concerned, 39.25% of farmers grow CKC6, 32.41% grow KZ111, 22.15% grow KZ222, and 6.19% prefer CKC3.

Table 3. Tenancy status and landholding of cotton respondents

Particular		Units	Statistics
Landowners		acres	38.5
Land leased/tenants		acres	21.5
Land holding		acres	16.37
Land under cotton crop		acres	9.82
Farming experience		Years	13.5
Cotton Variety grown	CKC6	%	39.25
	KZ111	%	32.41
	KZ222	%	22.15
	CKC3	%	6.19

The tables below include the cost of producing cotton crops per acre, including land taxes, input costs, labor, and marketing. Turning the land costs Rs. 15,210, while the average input costs to produce the crop work out to Rs. 37,600 per acre, which

includes seed, fertilizer, and pesticide costs. The labor costs to cultivate the crop work out to Rs. 22,350 per acre, including sowing, thinning, hoeing, and harvesting. Finally, the marketing costs, which include the costs of loading, transport, and commissions, work out to Rs. 4,800 per acre, giving a detailed overview of the costs of cultivation per acre.

Table 4. Average Per Acre Cost of Cotton Production in district Mirpurkhas

Particulars		Amount (RS)
Land tax		210
Land preparation cost		
Disc Harrow		3000
Laser leveler		3000
Cultivator		3000
Ridges		3000
Band maker		3000
Total cost		15210
Average per acre input costs of cotton crop		
Total seed cost	Rs	6000
Cost of DAP	Rs	13000
Cost of Urea	Rs	12000
Total fertilizer cost	Rs	25,000
Total pesticide cost	Rs	6600
Overall capital inputs cost	Rs	37,600
Labors inputs cost per acre of cotton crop		
Sowing cost labors	2800	
Thinning cost	3200	
Picking or harvest cost	13350	
Hand hoeing cost	3000	
Over all labors inputs cost	22350	
Average per acre marketing costs of Cotton crop		
Loading cost	800	
Un loading	800	
Transport cost	2500	
Commission agent	700	
Total Marketing cost	4800	

The main elements of costs involved in producing a crop of cotton per acre are shown in the table below. First, the fixed cost is Rs. 210, the cost of land preparation is Rs. 15,210. The capital input cost which includes seeds, fertilizers, pesticides comes to Rs. 37,600 and the labor input cost of Rs. 22,350 that covers all kinds of field operations. Finally, the marketing cost which includes loading, commissioning, transportation comes to Rs. 4800. Thus, the total production cost comes to Rs. 80,170 per acre.

Table 5. Average total production cost per acre of cotton crop

Cost components	Average
Fixed cost	210
Land preparation cost	15210
Capital input cost	37,600
Labor inputs cost	22350
Marketing cost	4800
Total cost of production per acre	80170

The table below shows the economic analysis of cotton cultivation in the district of Mirpurkhas. The average production of cotton in this district is 24 maunds per acre and its rate in terms of money is Rs.6238 per maund which makes the revenue productivity Rs. 149712 per acre. The total cost of production is Rs. 80,170 which results in a net income of Rs. 149712 per acre. The ratio between input and output is 1:0.54 and the BCR (Benefit Cost Ratio) is 1:1.87, representing the extent of benefits and cost in this cultivation process.

Table 6. Economic Analysis of Cotton Production

Description	Formula	Statistics
Cotton production mounds per acre	A	24
Rate per maund (40 kg)	B	6238
Revenue Productivity	C=A×B	149712
Total cost	D	80170
Net Income of Cotton Growers in district Mirpurkhas	F=C−D	69542
Input Ratio	D/C	1:0.54
Benefit-Cost Ratio (BCR)	G=C/D	1:1.87

The table below contains the constraints facing cotton growers in the study area ranked according to their frequency. The major constraint faced by cotton growers was the unpredicted rise in temperature and rainfall that was reported by 85 respondents; hence, it ranked first. The second major constraint was rising fertilizer prices during the cotton season which was acknowledged by 72 respondents. Similarly, canal water shortage during sowing time was the third important constraint affecting cotton production in the study area as 64 respondents perceived it. On the other hand, the fourth most influential factor was the high price of seeds during the growing period, which was acknowledged by 52 respondents. With regard to the fifth rank, pest infestation in cotton growing was the primary concern facing cotton growers in the study area as witnessed by 48 respondents. Finally, labor unavailability during the peak cotton season was the sixth important constraint with 32 respondents. Consequently, limited access to machinery was the seventh most influential factor with 21 respondents.

Table 7. Constraints faced by cotton growers

Constrains	Frequency	Rank
Unpredicted rise in temperature and rainfall	85	1st
Rising Fertilizer Costs During Cotton Season	72	2nd
Canal Water Shortages During Cotton sowing time	64	3rd
High price of Seeds During growing time	52	4th
Pest Infestations in Cotton Cultivation	48	5th
Labor Unavailability During Peak Cotton Season	32	6th
Limited Access to Machinery for Cotton Farming Activities	21	7th

The results of the study provided evidence for supporting earlier studies that demonstrated the profitability of cotton production in the area despite the various challenges. The average yield of 24 maunds per acre and a revenue productivity of Rs. 149,712 per acre suggests that cotton farming can be profitable to the farmers in Mirpurkhas. The farmers in the study area have been challenged by a high total production cost, which was recorded at Rs. 80,170 per acre. The constraints that were identified in the study included high risk of crop production due to unpredictable weather patterns, high cost of agricultural inputs, water shortage, occurrence of pests, and the lack of quality agricultural inputs and machinery. The identified constraints are common in Pakistan and other developing countries (Nazir et al., 2024).

The prevalence of unpredictable weather patterns and water shortage is a concern that requires immediate action if sustained agricultural production is achieved in the future (Khalid et al., 2022). The high percentage of farmers who responded that the situation of rising input costs is a challenge in cotton farming indicates the need for policymakers to take decisive action in ensuring farmers have access to quality agricultural inputs at reasonable prices. Farmers also complained of pest infestation and the lack of modern agricultural machinery which implies a gap in agricultural extension services and credit facilities. The authors of this study concluded with Baig et al. (2022) that there is a need for promoting climate resilient varieties of cotton, increasing awareness among farmers and addressing these challenges to enhance sustainable production and profit margins.

Conclusion and Recommendations

The study concluded that cotton farming in district Mirpurkhas Sindh is a profitable agriculture activity, but it is facing a lot of challenges that threatened its continuity. The current study recommends some policies to be adopted for the uplift of cotton production in the area. The following recommendations are proposed based on the findings of this research.

Cotton farming is considered a profitable business, but farmers are unable to maximize their benefits due to various environmental, economic, and managerial constraints, including the unavailability of proper education and training regarding modern technologies and financial assistance from reliable sources. This study recommends a comprehensive awareness program about new technologies for cotton farming in the district.

1. **Promotion of Climate-Resilient Varieties**

   Introduce and promote cotton varieties resistant to hot and dry weather to counteract unpredictable weather, which is identified as the 1st major constraint (reported by 85 respondents), building upon widely grown regional varieties such as CKC6 (39.25%) and KZ111 (32.41%).

2. **Improved Access to Education and Training**

   Strengthen extension services to provide farmers with timeous information, modern techniques and best practices on pest and water management as 35.00% of growers are illiterate and the majority of growers only have a primary level of education (44.17%).

3. **Ensuring Affordable and Quality Inputs**

   Adopt policies to ensure the availability of high-quality seeds, fertilizers and pesticides at affordable prices (for example, through subsidies or regulated markets) to offset heavy capital input costs (Rs 37,600/acre, including Rs 25,000 for fertilizers and Rs 6,000 for seeds) and to address rising fertilizer costs, which are the 2nd major constraint (72 respondents).

4. **Enhanced Water Management Practices:**

   Promote efficient irrigation methods like drip irrigation and invest in infrastructure for improved water resource management to counter water scarcity as canal water shortage during sowing time is the 3rd most important constraint (64 respondents).

5. **Institutional and Financial Support**

   It is of utmost importance to ensure that farmers have greater access to credit and other support mechanisms including subsidies and insurance schemes to help them invest in modern machinery and meet challenges such as price fluctuations. These support systems would help in balancing out their expenditures of Rs. 80,170 on average per acre with an average household income of Rs. 124,920.

6. **Encouraging Mechanized Farming**

   Provide incentives and training for the adoption of mechanized farming techniques to improve efficiency and reduce labor costs, particularly when overall labor expenses reach Rs. 22,350 per acre (picking: Rs. 13,350 per acre) due to labor unavailability being the 6th major constraint (32 respondents). Addressing these constraints through a concerted effort from policymakers, agricultural institutions, and farmers themselves is crucial for sustainable cotton production and the economic prosperity of the region.

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