

Research Article



Future of Cotton Sector in Pakistan: A 2025 Outlook

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Abstract | Major objective of this study was an overtime analysis of secondary data to calculate compound growth and forecast area, production and average yield in the Punjab Pakistan. Cotton is essential crop with significant role in national economy and livelihoods of the growers. For the purpose, data from 1990-2017 was analyzed. Empirical results indicated that area under cultivation showed negative compound growth rate while production and average yield showed positive compound growth in Pakistan. While, in Punjab, compound growth rate of area under cotton cultivation and production showed negative while average yield showed positive growth. Forecasting of cotton showed that in Pakistan, area, production and average yield will be on rise by 2025. In the Punjab, area of cotton cultivation will increase by 2025 but production and average yield of cotton will show consistent decline. As the Punjab is leading contributor in terms of cotton production, this decline will impact economy and livelihoods significantly. Therefore, study urge the need of cotton policy and holistic actions by government to subsidize inputs availability and conserve water and land.

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Introduction

In Pakistan, agriculture sector is the significant constituent of economy with approximate share of 19% in Gross Domestic Product (GoP, 2017). However, performance of agriculture sector is poor as compared to potential subject to various impediments. Conversely, share of agriculture sector in GDP is downsizing with the passage of time. Cotton is widely preferred cash crop and being source of raw material for textile industry, importance is always on rise. Cotton accounts for 5.2% of value added in agriculture and 1% of Gross Domestic Product GoP (2017).

Cotton is practiced across the Punjab and Sindh provinces of Pakistan, but the Punjab province is leading in terms of cultivated area and production. About

80% production comes from Punjab while 18% from Sindh province (Ali et al., 2013). Productivity in both provinces is below than potential despite of favorable soil characteristics and viable environmental conditions. Canal irrigation system persists across both provinces to fulfill irrigation demand while other sources like tube well are additional sources to combat irrigation needs.

Cotton facilitates textile sector tremendously which is one of the major supporter of national economy. Pakistan stands 4th in cotton production while 3rd largest consumer of the world. During 2016-17, Pakistan significantly missed the target of 10.671 million bales of cotton (GoP, 2017). This restricted production was pertinent to pest infestations, sluggish marketing system and significant reduction in sowing area. Watoo

and Mugera (2014) unveiled that tube well owners and water buyers can increase their cotton production by 19 and 28% respectively but use of improved quality seed, poor consultation with extension field staff and poor availability of irrigation water are major obstacles. Availability of quality seed, fertilizer and irrigation are scarce commodities for farmers affecting production significantly (Chaudhry et al., 2009). Production of cotton in Pakistan is dependent upon price of competing crops, prices of fertilizers and area under cultivation. Unfortunately, marketing in Pakistan is crashed (Carlos et al., 2002). Effective marketing could foster cotton production on farm level and ensure quality. In addition, more education, finance and improved transport facilities may enhance participation of growers in markets (Ali et al., 2017). Education to growers, plant protection practices, fertilizers and inputs availability had contributed towards increased production of cotton (Nadeem et al., 2013).

Number of research studies have forecasted production of different crops in Pakistan. Muhammad (1992) forecasted rice production, forecasted wheat area and production, forecasted wheat production, forecasted wheat supply and demand, forecasted production of mangoes, forecasted behavior of food crops in SAARC nations, forecasted production of wheat, rice and maize area and production, forecasted area and production of major crops in Pakistan. Forecasting of cotton crop in Pakistan is scanty except of Ali et al. (2015) where forecasting was conducted in comparison of sugarcane crop. Hence this forecasting was planned to forecast specifically the area and production of cotton across Punjab province.

This study entailed overtime analysis of the cotton area, production and yield in the Punjab and Pakistan. The study further emphasized on forecasting cotton area and yield to visualize future trends in the Punjab and Pakistan. Production forecasting is an important input to decision making and scheduling production more effectively, so it was assumed that this forecasting will be helpful in planning cotton production policy for coming years.

Materials and Methods

Punjab is the leading cotton produced of the country, therefore study was mainly focused in the Punjab province and Pakistan. Study was based on secondary data of cotton crop and data regarding area, produc-

tion and yield of cotton in Punjab Province and entire Pakistan were taken from various issue of Economic Survey of Pakistan and Agricultural Statistics of Pakistan. Study analyzed data from 1990 to 2017. Compound growth rate was calculated through the formula $Y_t = Y_0(1+r)^t$, while, forecasting of cotton has been estimated basing on the calculated compound growth.

Compound growth rate

To calculate the compound growth rate 2016 was set as base year while following formula was applied. Similar formula has also been applied by the Ali et al. (2017).

$$Y_t = Y_0(1+r)^t$$

Where;

Y_t : Area/ production/ Yield in year t ; Y_0 : base year of Area, Production and yield; r : Compound Growth Rate

$$\text{Compound Growth Rate} = (\text{last year/first year})^{(1/\text{No of Years})} - 1$$

Forecasting

On the basis of compound growth rate the productivity of next 12 years was forecasted by keeping 2013 as base year. Various issues, problems and factors affecting the productivity were kept constant such as climatic variability, unapproved varieties, non-adoption of improved practices, market fluctuations, production risks and adulterated inputs. Used equation is following:

$$Y_{t+1} = Y_t + (Y_t * r) / 100$$

Y_t : Base Year (i.e. 2013); r : Calculated compound growth year.

Results and Discussion

The calculated compound growth rates as depicted in Table 1, infer that area under cotton exhibited negative growth in Pakistan while production and average yield reflected positive growth. The negative behavior of area under cotton is pertinent to shifting of cotton growers toward cultivation of sugarcane. Growers assumed better returns from cultivation of sugarcane because of policy incentives undertaken by government (Khan, 2017). Similarly, role of subsidies offered by the government is prominent in increasing

per acre production of major crops including cotton. Therefore, average yield showed positive growth in the Punjab province as well. However, area under cotton and production showed negative growth. This negative production in Punjab was mainly due to abrupt climatic variations as well.

Table 1: Compound growth rate of Pakistan and the Punjab province.

Pakistan		Punjab	
Area	-0.25%	Area	-0.42%
Production	0.38%	Production	-0.30%
Yield	0.64%	Yield	0.12%

Table 2: Distribution of area, production and yield of cotton in Punjab and Pakistan.

All Pakistan							Punjab Province					
Year	Area (000 ha)		Production		Yield		Area (000 ha)		Production		Yield	
	Area	% Change	000 Bales	% Change	Kg/h	% Change	Area	% Change	000 Bales	% Change	Kg/h	% Change
1990-91	2662		9628		615		2125		8501		680	
1991-92	2836	6.5	12822	33.2	769	25.0	2287	7.6	11417	34.3	849	24.8
1992-93	2836	0.0	9054	-29.4	543	-29.4	2438	6.6	8237	-27.9	574	-32.3
1993-94	2805	-1.1	8041	-11.2	487	-10.2	2249	-7.8	6523	-20.8	493	-14.2
1994-95	2653	-5.4	8697	8.2	557	14.4	2244	-0.2	7410	13.6	561	13.9
1995-96	2997	13.0	10595	21.8	601	7.8	2463	9.8	8720	17.7	602	7.2
1996-97	3149	5.1	9374	-11.5	506	-15.8	2540	3.1	7103	-18.5	475	-21.0
1997-98	2960	-6.0	9184	-2.0	527	4.2	2348	-7.6	6817	-4.0	494	3.8
1998-99	2923	-1.3	9790	6.6	569	7.9	2283	-2.8	6628	-2.8	494	0.0
1999-00	2983	2.1	11240	14.8	641	12.5	2329	2.0	8804	32.8	643	30.2
2000-01	2928	-1.8	10732	-4.5	623	-2.7	2386	2.4	8540	-3.0	608	-5.3
2001-02	3116	6.4	10613	-1.1	579	-7.1	2526	5.9	8046	-5.8	541	-11.0
2002-03	2794	-10.3	10211	-3.8	621	7.3	2208	-12.6	7664	-4.7	590	9.0
2003-04	2991	7.1	10048	-1.6	571	-8.1	2387	8.1	7702	0.5	549	-7.0
2004-05	3229	8.0	14600	45.3	769	34.6	2518	5.5	11149	44.8	753	37.2
2005-06	3103	-3.0	13019	-8.7	714	-10.3	2426	-3.7	10268	-7.9	720	-4.4
2006-07	3075	-0.9	12856	-1.2	711	-0.4	2463	1.5	10350	0.8	715	-0.7
2007-08	3054	-0.6	11655	-9.4	649	-8.7	2425	-1.5	9062	-12.4	636	-11.0
2008-09	2820	-7.7	11819	1.1	713	9.9	2224	-8.3	8751	-3.4	696	9.4
2009-10	3106	10.1	12914	9.3	707	-0.8	2436	9.5	8552	-2.3	597	-14.2
2010-11	2689	-13.4	11460	-11.3	725	2.5	2201	-9.6	7854	-8.2	607	1.7
2011-12	2835	5.4	13595	18.6	816	12.6	2534	15.1	11129	41.70	716	18.0
2012-13	2879	1.6	13026	-4.2	769	-5.8	2334	-7.9	9599	-13.7	690	-3.6
2013-14	2806	-2.5	12769	-2.0	774	0.6	2199	5.7	9145	4.72	695	-0.72
2014-15	2961	5.5	13960	9.3	802	3.6	2323	-5.6	10277	-12.37	739	-6.33
2015-16	2902	-2.0	9917	-29.0	582	-27.4	2243	3.44	6343	43.01	707	4.3
2016-17	2489	-14.2	10671	7.6	730	25.4	1896	-15.47	7838	-23.56	703	0.56
Mean	2910.4		11195		654		2335		8608		634	
SD	171.5		1763.5		97.1		146.5		1447.6		94.1	
Min	2489		8041		487		1896		6343		475	
Max	3229		14600		816		2540		11417		849	

Source: Economic Surveys of Pakistan, 2007-17; Agricultural Statistics of Pakistan. **Note:** growth rates calculated from the coefficient of a time variable in the semi log equation $\ln Y = a + bt$, where Y is the dependent variable, SD: Standard deviation.

Data depicted in Table 3 describes that with the passing year area under cotton cultivation will increase from 2918.3 thousand hectares to 2998.6 thousand hectares while production will also rise to 15245.9 thousand bales in 2025. Average yield also expressed a rise to 863.4 kg/ha in 2025. It is noteworthy to say that this elevation of cotton area, production and yield is imperative to meet the needs and pertinent to mitigating those factors affecting cotton production.

Table 3: *Forecasted production of cotton in Pakistan.*

Year	Area "000 ha"	Production "000 Bales"	Yield Kg/ha
2017	2918.355	13727.51	799.2741
2018	2928.277	13908.71	807.0271
2019	2938.233	14092.31	814.8553
2020	2948.223	14278.33	822.7594
2021	2958.247	14466.82	830.7401
2022	2968.305	14657.76	838.7983
2023	2978.397	14851.25	846.9347
2024	2988.524	15047.28	855.1499
2025	2998.685	15245.91	863.4449

Data depicted in Table 4 indicates that there will be slight increase in area of cotton in the Punjab province by 2025. According to forecasting by 2025 area under cultivation of cotton may rise to 2220 thousand hectares. As compared to increase in area production and average yield will face decline with the passage of time. By 2025 production may decline to 7085 thousand bales followed by average yield of 595.1 Kg/ha. This decline of cotton production in the Punjab province could affect national economy badly as Punjab is major cotton producer and textile requirements are fulfilled from the raw material produced in Punjab. In addition, livelihoods of the cotton growers will lose sustainability.

Cotton is cash crop equally important for the national economy as well as livelihoods of cotton growers. Area, production and average yield of cotton in Pakistan is facing several challenges. In results area of cultivation is shrinking, production is slack and average yield is likely to go down. Overall production of cotton is lower than potential. Among competitive nations production of cotton is upward. OECD/FAO (2013) reported 1.7% annual growth of cotton production by 2022. Pakistan is truly a land of cotton, but level of production is lower as compared to neighboring countries followed by poor quality produce

(GoP), (1). Cotton across Pakistan is surrounded with number of challenges and risks (Ashraf et al., 2013). Prominent example of risks is prevalence of flood in 2010 claiming immense loss to standing cotton and casing substantial loss to economy and livelihoods (Ashraf et al., 2013).

Table 4: *Forecasted production of cotton in the Punjab Province.*

Year	Area "000 ha"	Production "000 Bales"	Yield Kg/ha
2017	2199.526	7387.325	613.5842
2018	2202.166	7348.911	611.2526
2019	2204.808	7310.697	608.9299
2020	2207.454	7272.681	606.6159
2021	2210.103	7234.863	604.3108
2022	2212.755	7197.242	602.0144
2023	2215.411	7159.816	599.7268
2024	2218.069	7122.585	597.4478
2025	2220.732	7085.548	595.1775

Higher cost of production was reported major barrier in cotton production (Bakhsh et al., 2005). Ali et al. (2015) unveiled 97% variation in cotton production pertinent to higher cost. Bakhsh et al. (2005) reported higher returns and high production due to cost of plant protection measures. Average income was greater than average cost among cotton growers, hence cultivating cotton and investing cost was profitable (Saleem and Jami, 2013). Contrary, Ahmad (2000) argued bad performance of cotton pertinent to high fixed costs among small farmers in particularly.

The cotton production process entails numerous inputs starting from land preparation to marketing. Entire process is cost intensive and overtime this production cost has increased. This extensive cost has resulted in negative growth of cotton (Ali et al., 2012). Production of cotton in Pakistan depends upon pricing of cotton, input prices, climatic conditions and most of these are erratic in Pakistan (Carlos et al., 2002). Nadeem et al. (2014) argued inadequate literacy, inadequate adoption of protection measures, fertilizers, land preparation issues affected cotton productivity. Fertilizers, water and certified seeds were reported as scarce elements for farmers by Chaudhary and Khan (2009) depicting them as factor affecting productivity of cotton. In addition, Pakistani cotton growers are experiencing rising cost of production while less out-

put and return [Bakhsh \(2009\)](#). Cost of inputs negatively affects the production of cotton ([Ahmad, 2017](#)).

In addition to cost of production, high temperature and water shortage are prominent factors affecting cotton production ([Malik and Ahsan, 2016](#)). Cotton crop in Pakistan is vulnerable to climate change ([ADB, 2009](#)). [Raees and Collins \(2004\)](#) argued that cultivation of cotton is reliant on irrigation through Indus River and fast melting of icecaps on Himalayas followed by decrease in snowfall are putting pressure on irrigation requirement. If this water shortfall persists, farmers shall shift to other crops which are less water consuming ([Pakistan, 2003](#)). Now Government is urge farmers to shift toward less water consuming crops to amid water scarcity ([Anonymous, 2017](#)). Moreover, efforts are directed to adopt micro irrigation techniques and updated irrigation system to conserve water. [Kamal \(2009\)](#) stated that Pakistan didn't transformed irrigation system, neither generated storage capacities, farmers' ability to market their produce is scanty, agro-based industries are weak and subsidies are benefiting the landlords more. Hence, farmers have no choice of leaving farming of switching their cropping patterns. High temperature, heat stress, less availability of water and less mechanized farming are further obstacles to cotton production in future ([Raza, 2009](#); [Malik and Ahsan, 2016](#)).

Summarizing the discussion principal factors limiting cotton production in Pakistan are cotton leaf curl virus disease (CLCuV), heat stress, limited water availability, the high price of inputs (fertilizer, seed, pesticide, insecticide, etc.), the relatively higher intensity of insect pest attacks, shortage of good quality seed, seed adulteration, cotton marketing issues and the crop insurance system. In previous fiscal year 2015-16, about 28% decline in cotton production has been documented pertinent to climate change, competition with relevant crops, poor marketing prices and infestation of pink bollworm ([Ahmad, 2016](#)). Subject to various constraints country is not able to keep pace in cotton production ([Ali, 2005](#)). Managerial and policy based proficiency on country level and farm level is imperative to boost cotton yield ([Ahmad and Qureshi, 2009](#)).

Conclusions

Study concluded that compound growth of cotton indicated negative growth in area in Pakistan and the

Punjab province. While, production of cotton is expected to face decline in coming years. Forecasting of cotton production exhibited positive growth and rise in area, production and yield of cotton in Pakistan. However, in the Punjab, area and production appeared inverse as area is expected to rise while production and average yield will face decline in future. This decline in Punjab province could be major blow to economy and livelihoods of the cotton growers. Cotton is cash crop and it is imperative to boost production to meet domestic requirements and earn foreign exchange. Study urge government to underpin cotton policy and take initiatives of subsidized inputs and water conservation for sustained utilization of water. Additionally, there is need of strong marketing, capacity building of farmers and strengthened role of extension service providers.

Author's Contribution

Mr. saleem Ashraf Conceived the Idea and write up of paper; Mr. Ashiq Hussain Sangi Conducted Analytical activities on data; Dr. Zakaria Yousaf Hassan Conducted Research, helped in collection and verification of data; Dr. Muhammad Luqman Supervised the work, prepared methodology and critically reviewed the paper.

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