A STUDY OF INDIAN GOVERNMENT POLICY ON PRODUCTION AND PROCESSING OF COTTON: IMPLICATIONS FOR U.S. COTTON EXPORTS

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Abstract

Cotton is a very important commodity in Indian Agriculture. Recent technological advances and trade liberalization have made India a major player in international cotton markets. In the year 2009-10, India was the world's second largest producer and third largest exporter of cotton (FAOSTAT). The increasing role of the Indian cotton sector in international markets is a direct challenge to the US cotton exports, especially in markets like China which account for 40 percent of the total mill use of cotton in the world. Within this context, a better understanding of the Indian cotton sector is needed to assess its competitive position in international markets. The overall objective of this paper is to assess the competitiveness of Indian cotton producers and potential implications for India as a competitor in the world cotton market. The focus is on an updated estimate of the costs of production in India and representative farm models for cotton production in three important cotton production states (Gujarat, Maharashtra and Andhra Pradesh) of India. These models are utilized for understanding the impact of government policies like subsidies to fertilizers on farm level profitability and ultimately on the competitiveness of Indian cotton in international markets. Another objective of this paper is to understand the impact of National Fiber Policy of the government of India on the processing sector and thereby on the domestic consumption in India. These policies along with changes in trade policies are expected to have an impact on cotton exports from India. The results demonstrate that the net income of the cotton farmers will decrease considerably without the presence of fertilizer subsidies. The study also concludes that if the objectives of the national fiber policy are fulfilled, India will export more of value added cotton products like textiles and garments rather than raw cotton. The results from both the scenarios in this paper show that in future US cotton farmers may benefit from these outcomes and remain more competitive than their counterparts in India in the international markets.

Introduction

Cotton is a very important commodity in Indian Agriculture and it has played a major role throughout India's history. Recent technological advances and trade liberalization have made India a major player in international cotton markets. In 2009-10, India was the world's second largest cotton producer, consumer and exporter (FAOSTAT). The increasing role of the Indian cotton sector in international markets is a direct challenge to the US cotton exports, especially in markets like China which accounts for 40 percent of the total mill use of cotton in the world. The importance of Chinese market is going to increase in future as China is expected to import cotton which is almost double to that of present level (FAPRI, 2010). Within this context, a better understanding of the Indian cotton production system will allow US cotton producers to assess their competitive position in international markets and allow for long-term strategic marketing planning. The overall objective of this paper is to assess the competitiveness of Indian cotton producers and potential implications for India as a competitor in the world cotton market. The focus will be on developing an updated estimate of the costs of production in India and develop representative farm models for cotton production in India. These models will be utilized for understanding the impact of government policies like subsidies to fertilizers on farm level profitability and ultimately on the competitiveness of Indian cotton in international markets. This paper also studies the impact of National Fiber Policy of the government of India on the processing sector and its ability to expand the capacity of cotton processing and thereby increase the mill use of cotton in India. The results further can be used to understand the potential impact on US cotton sector and its competitiveness in international markets.

In the following section, a brief description of the production, consumption, marketing structure and government policies in the Indian cotton sector is presented. The third section provides a discussion of the data collection and methodology for this study. The final section discusses results and provides conclusions.

Cotton in India

Production

Cotton is an important cash crop for Indian farmers. It is third in total acreage planted among all crops in India behind rice and wheat. In the last decade, cotton acreage increased by almost 2.4 million hectares from 2002 to 2011 (See Table 1). In 2010-11, it was cultivated on about 11.14 million hectares producing 32.5 million bales (1 bale = 170 Kilograms). In the last ten years, cotton acreage has been growing at an average annual rate of around 3 percent. In 2010-11 the cotton acreage increased by 8 percent from previous year which is attributed to increasing demand in international markets. The increase in acreage led to an increase in the production of cotton in India over the last ten years from 15.8 million bales in 2001-02 to 32.5 million bales in 2010-11, an increase of 106 percent (see Table 1). However, the average cotton yield in India is only 0.49 tons per hectare compared to a world average of 0.73 tons per hectare (ICAC, 2010). The low yields persistent in Indian cotton production have been partially attributed to less intensive farm management practices along with a lack of disease resistant and high yielding varieties. Another factor affecting the yields is the rainfall pattern in India.

About 65 percent of the cotton acreage in India is dependent on rain; the annual variation in monsoon rainfall plays an important role in production and yield for any particular year (Aggarwal, et al., 2008). The planting period for cotton in India is from March to September while harvesting takes place from October to February. The monsoons occur between June and September. Any mismatch in timing of planting operations and occurrence of monsoons impact the yield and hence production of cotton.

Cotton yields have increased on an average by almost 7 percent in the last ten years, but are still considerably lower than world average. The major reasons for this improvement is the increasing usage of high yielding varieties including Bt cotton, improved pest management practices and improved irrigation facilities in some parts of India. The acreage of Bt cotton in India was almost 65 percent of the total cotton acreage in 2007-08 (Qaim and Sadashivappa, 2009), a major reason for increased yields.

Table 1. Area, Production and Yield of Cotton in India 2001-12

Year	Area (million ha)	Production (million metric tons)	Yield (tons/ha)
2000-01	8.58	2.38	0.28
2001-02	8.73	2.69	0.31
2002-03	7.67	2.31	0.30
2003-04	7.63	3.04	0.40
2004-05	8.79	4.13	0.47
2005-06	8.68	4.15	0.48
2006-07	9.14	4.76	0.52
2007-08	9.41	5.22	0.55
2008-09	9.41	4.93	0.52
2009-10	10.31	5.19	0.50
2010-11	11.14	5.53	0.50
2011-12*	12.19	6.05	0.50

*Provisional figures Source: Cotton Corporation of India

Cotton is produced in three zones in India. The Northern zone comprising the states of Punjab, Haryana and Rajasthan, the Central zone comprising the states of Maharashtra, Madhya Pradesh and Gujarat and the Southern zone comprising the states of Andhra Pradesh, Karnataka and Tamil Nadu (Chakraborthy, et al 1999). The states of Gujarat, Maharashtra and Andhra Pradesh contribute about three quarters of the total production. Even though the acreage in Maharashtra is 50 percent more than the state of Gujarat in 2010-11, the production is almost 20 percent less than in Gujarat as the yield is almost double that of Maharashtra (See Table 2). Historically, the low yields in the state of Maharashtra are due to irregular rainfall pattern and use of low yielding varieties (Chakraborthy et al, 1999). But, the productivity in the state of Maharashtra is also increasing considerably fast as the adoption rate of Bt cotton is one of the highest compared to many other states even Gujarat in some years. The proportion of Bt cotton as percentage of total area of cotton increased by almost 10 times more than that of Gujarat between 2003-05 (Gandhi and Namboodiri, 2006). It was estimated that if India's cotton yield reached the world average by 2016/17, its cotton production would dramatically increase by almost 27 percent more than that of a lower yield scenario (Pan, et al., 2007).

Figure1. Map of India

Table 2: Top Five States in India in Terms of Area, Production and Yield.

	2009-10			2008-09		
State	Area	Production	Yield	Area	Production	Yield
Gujarat	2.63	10.30	0.67	2.62	9.80	0.64
Maharashtra	3.93	8.20	0.36	3.50	6.58	0.32
Andhra Pradesh	1.78	5.30	0.51	1.48	5.45	0.63
Madhya Pradesh	0.65	1.70	0.45	0.61	1.53	0.42
Punjab	0.53	1.60	0.51	0.51	1.30	0.43

Notes: Area in million hectares, Production in million bales, Yield in tons per hectare
Source: Cotton Corporation of India

Consumption and Exports

The demand for Indian cotton is largely from the domestic textile industry which is one of the largest industries in the country and has witnessed great improvements in terms of installed spindlage and yarn production. The total consumption of cotton in India has increased by almost 46 percent from 2000-01 to 2010-11. Cotton consumption has witnessed a sustained increase since 2003-04 onwards due to growing demand for Indian textiles and thereby leading to considerable expansion and modernization of the textile mills. Currently, India's domestic mill consumption accounts for about 78 percent of production. In the same period the imports of cotton for domestic consumption decreased by almost 80 percent (See Table 3). Cotton production in India is sufficient to meet the demand originating from the domestic textile industry (CCI, 2010). The textile industry in India is dominated by the powerloom units which account for almost 60 percent of all the cloth that gets produced in India. They have shown impressive growth in the last decade increasing their number from 0.37 million units to 0.49 million units (Table 4). The fabric production in India is skewed towards cotton and cotton blended fabrics compared to other non-cotton (man- made) fibers as seen in the table 4. The domestic fiber consumption ratio in India is approximately 40:60 between man-made fibers and cotton, whereas it is almost 60-40 globally (National Fiber Policy, 2010). The government of India has designed the National Fiber Policy in 2010 to place India firmly on the world fiber map by strengthening the existing policy framework and providing institutional and technological support for rapid fiber growth in the country in the coming decade. Under this policy, Technology Up gradation Fund Scheme (TUFS) has been revamped to provide interest reimbursements and capital subsidies for modernization of the textile value chain in India. It is expected that in order to fulfill the objectives of National Fiber Policy, the textile industry needs about $40 billion dollars over the next decade. The Indian government is allocating the required resources along with encouraging the private industry to invest in modernization of textile industry.

Table 3: Cotton Balance Sheet (Qty in million bales`

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
SUPPLY											
Opening stock	4.1	2.9	4.0	2.4	2.1	7.2	5.2	4.8	3.6	7.2	4.1
Crop size	14.0	15.8	13.6	17.9	24.3	24.4	28.0	30.7	29.0	30.5	32.5
Imports	2.2	2.5	1.8	0.7	1.2	0.4	0.6	0.6	1.0	0.6	0.5
Total Availability	20.3	21.2	19.4	21.0	27.6	32.0	33.8	36.1	33.6	38.3	37.1
DEMAND											
Total Consumption	17.3	17.2	16.9	17.7	19.5	21.7	23.2	23.7	22.9	25.9	25.3
Export	0.1	0.1	0.1	1.2	0.9	4.7	5.8	8.9	3.5	8.3	7.0
Total disappearance	17.4	17.2	17.0	18.9	20.4	26.4	29.0	32.5	26.4	34.2	32.3
Carry forward	2.9	4.0	2.4	2.1	7.2	5.6	4.8	3.6	7.2	4.1	4.8

Note: Cotton year from October to September
Source: Cotton Corporation of India

In addition to increased consumption of cotton by the domestic textile industry, India has also become a major exporter of cotton. Domestic consumption of cotton in India could not keep pace with cotton production, thereby leading to a surplus since 2003-04. Indian exports have increased from 0.1 million bales in 2000-01 to 7.0 million bales in 2010-11 (CCI, 2011), with Chinese textile industry being an important importer of Indian cotton (FAOSTAT). The relatively lower cotton prices and convenient transportation contribute to India's competitiveness, whereas the competitiveness of US is attributed to quality and reliability of the supply (USDA, 2010). It is also estimated that if India's cotton yields reach world average by 2016-17, Indian cotton exports would dramatically increase leading to a lower world price as well (Pan, et al., 2007). The usage of cotton in China is 10.3 million tons whereas the production is 6.8 million tons in 2009-10, leaving a huge gap to be filled by major cotton exporters like US and India. In spite of government support to boost cotton production in China, it is limited due in part to dominance of other government polices to increase food and feed grain production. So, the gap between the production and use is expected to continue into the future, forecasted Chinese cotton imports are expected to rise to 29 percent of its domestic use by 2019/20 and over 40% of world trade flows (FAPRI, 2010). Such an increase would make China the dominant destination for cotton trade, leaving the market open for US and Indian cotton exporters to compete with each other.

Table 4: Textile Industry in India

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Textile Mills										
Spinning Mills (non SSI)	1565	1579	1599	1564	1566	1570	1608	1597	1653	1657
Composite Mills (non SSI)	281	281	276	223	223	210	200	176	177	177
Total	1846	1860	1875	1787	1789	1780	1808	1773	1830	1834
Spinning Mills (SSI)	996	1046	1146	1135	1161	1173	1236	1219	1247	1249
Powerloom Units (million)	0.374	0.375	0.38	0.413	0.426	0.434	0.44	0.469	0.494	0.499
Production of Cotton Yarn (million kg)	2267	2212	2177	2121	2272	2521	2824	2948	2898	3079
Production of Cotton Fabric (million sq m)	19718	19769	19300	18040	20655	23873	26238	27196	2689 8	16982
Production of Blended Fabric (million sq m)	6351	6287	5876	6068	6032	6298	6882	6888	6766	4350
Production of NonCotton Fabric (million sq m)	14164	15978	16797	18275	18691	19406	19545	21173	2053 4	13291

Source: South India Cotton Association and Annual Report 2011, Ministry of Textiles, Govt. of India.

Marketing Structure

Along with the private traders who constitute the majority of the buyers in the local cotton markets in India, the government of India also actively participates in the industry and serves as an umbrella for government agencies like Cotton Corporation of India (CCI) and state marketing federations. The CCI is the primary organization engaged in marketing of cotton through regular presence in the markets. Its presence in the markets helps create a competitive environment to the advantage of cotton farmers in realizing prices commensurate with the quality of their produce (Chakraborthy, 1999). The CCI operates more than 300 centers in different cotton growing states, and purchases are made either under Minimum Support Price operations or under commercial operations.

The government of India fixes the Minimum Support Prices (MSP) for various groups of cotton varieties depending upon their staple length every year. When the open market cotton prices go below the MSP level, the CCI intervenes in the market and makes purchases without any quantitative limits. The actions of the CCI prevent farmers from going for distress sales and helps in retaining their interest in continuing cotton cultivation. The actions of CCI have become all the more important policy amendments in the last few years due in part to the cotton farmer suicides in India (The New York Times, 2006). But, in the last ten years, CCI intervened in the market only twice, as the open market prices were higher than the MSP for many varieties. During times when the market price is more than the MSP, the CCI undertakes commercial operations to supply their cotton to mills in domestic markets. These operations help in meeting the annual cost of maintaining the necessary infrastructure to be used for price support activities.

Input Subsidies

Along with the Minimum Support Prices, the government of India also subsidizes fertilizers, power and irrigation. In some areas and for some disadvantaged groups of farmers credit facilities are also offered at subsidized rates. Input subsidies can be beneficial to Indian farmers by improving their profitability and thereby raising their living standards, but the subsidies may also lead to excess use of fertilizers, pesticides and water with potentially negative environmental implications. Among these subsidies, fertilizers comprise the largest group of inputs, and receive the most subsidies. In 2010-11, the fertilizer subsidies disbursed totaled almost $12 billion and it is expected to reach about $21billion in 2011-12 (Ministry of Fertilizers and Chemicals, 2011). The main objectives of fertilizer subsidies are to provide farmers with fertilizers at affordable prices in order to induce them to use fertilizers to increase production as well as providing adequate return on investments for fertilizer manufacturers. To attain these objectives, the government introduced the Retention Price cum Subsidy scheme (RPS), a cost-plus approach. In this scheme, the retail price of fertilizers was fixed and uniform throughout the country and difference between the retention price of the manufacturer (adjusted for freight and dealer's margin) and the maximum retail price at which the fertilizers were sold to the farmer was paid back to the manufacturer as subsidy. Depending upon the international prices of fertilizers and the cost of production of domestic fertilizer manufacturers, the subsidy payments calculated through retention price scheme (RPS) paid to the importers and domestic manufacturers which are different from each other. Even though the fertilizer subsidies are beneficial to the farming community, they are becoming very expensive programs for the government (See Table 5). Beginning in the 1990s, the government of India took steps to contain the fertilizer subsidies, but with limited effect (Sharma and Thaker 2009).

Table 5. Fertilizer Subsidies in India (Rs billions)

Fertilizer Subsidies in India (Rs billions)			
	Urea	P&K	Total
2002-03	77.91	32.25	110.16
2003-04	85.22	33.26	118.48
2004-05	109.86	51.42	161.28
2005-06	127.93	65.96	193.89
2006-07	177.21	102.98	280.19
2007-08	263.85	169.33	433.18
2008-09	339.4	655.55	994.95
2009-10	245.8	394.52	640.32
2010-11*	243.41	285	528.41

Note: * denotes budget estimates.
Source: Ministry of Fertilizers and Chemicals, Govt. of India

Although India is one of the largest producers of fertilizers, the demand surpasses the production capacity leading India to be an importer of fertilizers. Table 6 provides information about the consumption, production and imports of fertilizers according to the nutrient groups.

Table 6. Nutrient-wise Production, Consumption and Imports of Fertilizers (million metric tons)

CONSUMPTION					PRODUCTION				IMPORTS			
	N	P	K	TOTAL	N	P	K	TOTAL	N	P	K	TOTAL
2000-01	10.9	4.2	1.6	16.7	11.0	3.7	0.0	14.7	0.2	0.4	1.5	2.1
2001-02	11.3	4.4	1.7	17.4	10.8	3.9	0.0	14.6	0.3	0.4	1.7	2.4
2002-03	10.5	4.0	1.6	16.1	10.6	3.9	0.0	14.5	0.1	0.2	1.4	1.7
2003-04	11.1	4.1	1.6	16.8	10.6	3.6	0.0	14.3	0.1	0.3	1.5	2.0
2004-05	11.7	4.6	2.1	18.4	11.3	4.1	0.0	15.4	0.4	0.3	2.0	2.8
2005-06	12.7	5.2	2.4	20.3	11.4	4.2	0.0	15.6	1.4	1.1	2.7	5.3
2006-07	13.8	5.5	2.3	21.7	11.6	4.5	0.0	16.1	2.7	1.3	2.1	6.1
2007-08	14.4	5.5	2.6	22.6	10.9	3.8	0.0	14.7	3.7	1.3	2.7	7.6
2008-09	15.1	6.5	3.3	24.9	10.9	3.5	0.0	14.3	3.8	2.9	3.4	10.2
2009-10	15.6	7.3	3.6	26.5	11.9	4.3	0.0	16.3	3.4	2.8	2.9	9.1
2010-11	NA	NA	NA	NA	8.0	3.0	0.0	11.0	3.4	3.5	3.0	10.0

Note: N, P and K denote Nitrogen, Phosphorous and Potassium fertilizers respectively.
Source: Ministry of Fertilizers and Chemicals, Govt. of India

Data Collection and Methodology

Data Collection

Data was collected in three cotton producing states of India namely Gujarat, Maharashtra and Andhra Pradesh (A.P) in 2010 and 2011. These are the top three states in terms of production and acreage in India contributing about 73 percent and 75 percent of the total production and total acreage in India respectively. Rapid Rural Appraisal (RRA) methodology has been adopted to collect information, where in a multidisciplinary team conducted focus group discussions in various villages to get information and develop hypotheses. In each state, information was collected from focus groups in different villages and the information was aggregated. There were a total of ten focus group discussions conducted with three each in Gujarat and Maharashtra in summer of 2010 and four in AP in summer of 2011. Each focus group constituted about 7-12 farmers and a survey instrument was used to provide structure to the discussion. Table 7 provides summary information on the cost of cultivation collected in all the three states. The cost of production of cotton in Gujarat is 21 percent more than that of Maharashtra due to more usage of fertilizers and micronutrients and greater irrigation costs, whereas the cost of production in AP is high due to more fertilizers and pesticides. Along with these, the higher harvesting expenses in Gujarat and AP made the total cost of cultivation higher than in Maharashtra. In focus group discussions, the average yield of seed cotton that was reported in Gujarat was 1500 kg per acre compared to 1100kg per acre in AP and only 1000 kg per acre in Maharashtra. The yield levels can be much lower in many others areas of these two states which were not covered by this study, as the average yields in Gujarat, AP and Maharashtra are 266, 202and 142 Kg per acre respectively in 2010-11(CCI, 2011). The gross profit in Gujarat is considerably higher than in the other two states demonstrating the importance of higher yields prevalent in Gujarat. The gross profit excludes returns to family labor and managerial compensation. The cost of production in the above table does not include transportation expenses from farm to processor. In all the locations, the buyer/broker who buys cotton from the farmers is responsible for the transportation and he also performs quality checking at the time of transaction. Almost all the transactions of the

Table 7. Cost of Cultivation and Gross Profit in Top Three States in India ($ per Acre)

	Maharashtra	**Gujarat**	**A.P.**	**India**
Fertilizers (including FYM)	79.81	104.65	86.00	92.02
Herbicides	-	5.23	14.44	5.5
Micronutrients, Water Sol. Fert. PGR, etc.	5.97	22.43	7.51	14.11
Irrigation	15.7	32.53	15.56	22.95
Pest Control(Insecticides, fungicides, etc.)	63.11	36.68	92.22	59.09
Seed	30.85	30.85	44.82	39.8
Total Material Costs (A)	195.44	232.36	250.55	233.47
Labor Expenses:				
Land preparation	23.91	40.38	39.44	34.5
Fertilizer application	11.04	3.37	14.44	8.52
Seed sowing	11.58	9.71	18.33	12.29
Pesticide Application	10.45	20.19	8.80	14.31
Manual Weeding	41.5	21.67	30.56	30.62
Total Labor Costs (B)	98.49	95.32	111.57	100.26
Total Harvest Costs (C)	85.99	131.24	261.11	144.52
Total Production Cost/Acre (A+B+C)	379.91	458.93	623.23	478.25
Yield (Kg per Acre)	1000	1500	1100	1260
Price Per Kg ($)	0.72	0.74	0.93	0.93
Revenue	720	1110.49	1023	1171.8
Gross Profit	340.09	651.56	399.77	693.55

farmers are with private dealers who in turn may represent cotton ginners. The data gathered from the three states is aggregated by giving appropriate weights according to their share in the total cotton acreage in India to obtain an India wide representative cotton model. The results can be seen in the last column of table 7.

The cost of production and profitability estimates by various studies sponsored by government of India and the respective state governments are much lower than estimated by our study. The differences may be due to the limited coverage area of this study compared to other studies and also the higher knowledge and skill levels of the farmers who participated in our focus group discussions. Most of the participants in our focus group discussions are progressive farmers who have higher knowledge and skills in farming than their peers in that area.

This study also included an analysis of the cotton processing sector in India. Data about the operational parameters of spinning mills was collected through meetings with representatives of spinning mills as well as office bearers of South India Cotton Association (SIMA) and South India Textile Research Association (SITRA). The costs and operational parameters of yarn production in spinning mills in India are given in the table 8 below. The values are approximations from a survey of spinning mills in India conducted by SITRA and, as well as from our discussions. The values are denominated in terms of per spindle basis. The contribution per spindle is defined as the difference between yarn sale value per spindle and all the variable costs per spindle. The contribution is the amount that accrues to fixed costs and profits.

Table 8: Costs and Operational Parameters of Yarn Production in Spinning Mills in India

Salaries and Wages	$/Spindle/Yr	32.00
Power	$/Spindle/Yr	49.33
Raw Material	$/Kg of Yarn	2.78
Raw Material	$/Spindle/Yr	293.56
Number of Operatives per 1000 spindles	--	2.40
Yarn Selling Price	$/Kg of Yarn	5.18
Yarn Sale Value	$/Spindle/Yr	508.89
Yarn Production	Kg Per Spindle	98.28
Contribution	$/Spindle/Yr	134.00

Methodology

Stochastic simulation models are used to generate a large random sample of outcomes for a dependent variable where that dependent variable is a function of some selected set of explanatory variables. A unique feature of these types of models is that there is an explicit recognition that the independent variables have some probability distribution around their mean values.

The forecast of the dependent variable is thus a function of the probability distributions of the explanatory variables as well as their mean value. The simulated distribution of the dependent variables thus captures the variability or risk associated with forecasting the dependent variable that cannot be obtained by using simply the mean value of the explanatory variables. If the explanatory variables are uncorrelated an appropriate univariate probability distribution is chosen (e.g. normal, Poisson, empirical, etc).

It is also possible to capture the joint variability of two or more correlated explanatory variables on the dependent variable. The joint variability can be captured by determining the multivariate probability distribution (e.g. multivariate normal, multivariate empirical, etc.) for the two or more correlated explanatory variables. The multivariate probability distribution is developed much the same as the univariate probability distribution but includes information in the correlation matrix to account for the correlation between the independent variables. The determination of the appropriate probability distributions and the construction of stochastic models is followed from Richardson (2010).

The simulated forecast of dependent variables using either univariate or multivariate probability distributions of the explanatory variables is very useful in informing decision makers of the variability or risk in the dependent variable forecast, the skewness of the forecast, and the probability of a specific outcome for the dependent variable. Most stochastic simulation models have more than one dependent variable. The dependent variables in a stochastic simulation models are often referred to as Key Output Variables (KOV's).

From the sample of farms in the rapid assessment study, the impact of fertilizer subsidies and minimum support prices (MSP) on the profitability of Indian cotton farms can be analyzed. Two Indian cotton representative farm simulation models have been developed for the states of Gujarat and Maharashtra using information collected through focus groups. Representative farm models are stochastic simulation models that are used to analyze the impacts of current and changing market conditions and government policies on a number of KOV's. Examples of KOV's in a representative farm models are yearly net income, cash flow position, financial ratios such as debt to equity or liquidity, and net present values of net income.

These models can be used for several purposes. They simulate the producer's income statement, statement of cash flows, and balance sheet as well as any financial indicator calculated from those three statements. From there we can analyze the impact a new policy may have on a producer's net income or net present value prior to implementation. They can also determine the impact a change in production practices may have on the producer's financial statements prior to actually changing practices. In other words, these models act as a decision making tools. The models are constructed in a way that allows for easy analysis of several variables.

By using a stoplight chart, one of the graphical capabilities of the model, we can compare probabilities for one or more alternatives for the target values of net present values of net income. In order to generate the stoplight chart, two value targets, lower and upper, are chosen from observed returns. The stoplight function calculates the probabilities of: (a) exceeding the upper target (green), (b) being less than the lower target (red), and (c) observing values between the targets (yellow). In this study, the stochastic simulation models are used to analyze the impact of fertilizer subsidies on the net income of the representative cotton farm in India and as well as to analyze the impact of National Fiber Policy on profitability of a spinning mill. The analysis forecasts the net income for a period of two years from 2012-13.

Results and Conclusion

Impact of Fertilizer Subsidies

As fertilizer subsidies constitute a major proportion of the total subsidies given to farmers by Indian government, a counterfactual scenario forecasts the net income of Indian farmers without the fertilizer subsidies for a two year period from 2012-13. In the counterfactual scenario, only the subsidies to Urea, Di-ammonium Phosphate (DAP), Murate of Potash (MOP) and NPK complex fertilizers are considered. The subsidies given to other fertilizers are not considered as their proportion in the total fertilizer subsidies is meager. The subsidies given to Urea, DAP and MOP are obtained by calculating the difference between the international prices (CFR Mumbai prices for DAP, MOP and Urea) and the maximum retail prices of those fertilizers in India. The subsidies to NPK complex fertilizers are calculated depending on the proportion of N, P and K nutrients and applying the same rate of subsidies as that of Urea, DAP and MOP. Although the subsidies given by government of India to indigenous manufactures are different from the subsidies given to imported fertilizers (Ministry of Fertilizers and Chemicals, 2010), this scenario considers them as equal and takes into account only the international prices of the fertilizers. Table 9 compares the international prices and maximum retail prices of fertilizers in India.

Table 9. Comparison of International and Domestic Prices of fertilizers

	International Price ($ per Metric ton)	Maximum Retail Price in India ($ per Metric ton)
DAP	499.13	209.76
MOP	381.25	99.94
Urea	306.88	108.36

Source: Ministry of Fertilizers and Chemicals, Govt. of India

India is one of the largest importers of the fertilizers in the world and entry of India in world markets as an importer influences world prices significantly (Sharma and Thaker, 2009). But, this study assumes that imports by India from the world fertilizer market would not affect world prices and world fertilizer markets are perfectly competitive. In other words, India is considered to be a small country whose markets are not going to influence the world market for purposes of this analysis.

In the counterfactual scenario, the fertilizer expenditure is calculated taking the international prices (prices without fertilizer subsidies) into consideration. The fertilizer expenditure without subsidies is almost double to that of fertilizer expenditure with subsidies. The fertilizer expenditure per acre with subsidies is $92.02, whereas it is $191.29 without subsidies. The fertilizer expenditures without subsidies are incorporated into the representative farm model of cotton to get the results of the counterfactual scenario.

The results of the simulations of baseline model and counterfactual model are analyzed for any differences in the cost of production, net income and net present value of sum of income streams of both years 2012 and 2013. The two year forecast shown in Table 10 estimates that the present value of the net income of the farmers decreases by about 22 percent where as the production cost increases by 17 percent in both the years. Charts 1A and 1B in Figure 2 provide a comparison of the simulated probability distributions of net present value of sum of net income after taxes per acre in years 2012 and 2013 with and without subsidy. The removal of fertilizer subsidies reduces the probability of earning a net income of more than $950 per acre by 14 percent and the probability of earning a net income between $700 and $950 also decreases by 22 percent, whereas the probability of earning less than $700 per acre increases by 36 percent.

Table 10. Comparison of Results with Baseline Forecast.

($ Per Acre)	**Baseline**		**Without Fertilizer Subsidies**	
	2012	**2013**	**2012**	**2013**
Net Income	442.68	479.6	343.43	378.61
Production Cost	567.27	584.11	666.51	685.09
Net Present Value (Sum of Income Stream 2012-2013)	832.62		651.66	

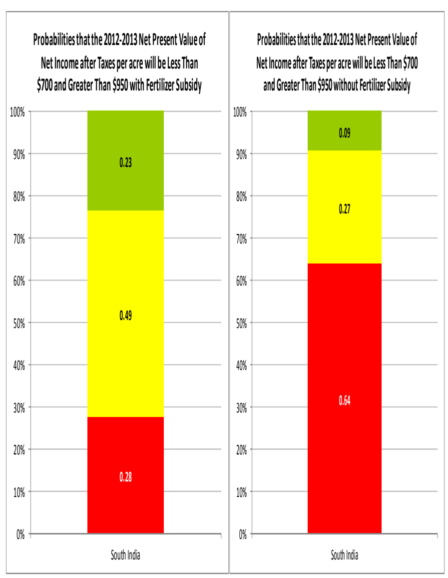

Chart 1A Chart 1B

Figure 2. Stop-light Charts ‘With’ and ‘Without’ Fertilizer Subsidies

Impact of National Fiber Policy:

The government of India has been working on providing institutional, technological and financial support for rapid fiber growth in the country in the coming decade. Under this policy various schemes have been implemented like Technology Upgradation Fund Scheme (TUFS) where in capital subsidies were provided to various segments of textile value chain to promote modernization and increase productivity. Many other programs have been envisaged to provide training and improve skills of laborers working in textile value chain including spinning and garment manufacturing. All the above programs/schemes are expected to increase labor productivity in the spinning mills thereby creating more profitability to the firms. In this background, this study analyzes a baseline scenario where in the contribution per each spindle in a spinning mills is forecasted for 2012 and 2013 taking into consideration the costs and operational parameters given in Table 8. In the scenario where in the national fiber policy is implemented and its objectives are fulfilled, it is expected to foresee an increase in labor productivity in the spinning mills due to the effect of various skill improvement and modernization programs. So, this study assumes that the salaries and wages component in running a spinning mill will decrease to \$25.57 from \$32.30 per spindle per year. The decreased value of salaries and wages component (\$ 25.57 per spindle per year) is adopted as it is the value of the top 20 percent of the spinning mills that took part in the survey conducted by South India Textile Research Association (SITRA). This study applies the salaries and wages component of top 20 percent spinning mills to all the spinning mills as a proxy for modernization of mills and increased labor productivity due to National Fiber Policy of India.

The results of the simulations of baseline model and National Fiber Policy model are analyzed for any differences in the cost of production, contribution and net present value of sum of contributions of both years 2012 and 2013. The two year forecast shown in Table 11 estimates that the present value of the contributions of the spinning mills increases by about 7percent where as the production cost decreases by about 2 percent in both the years.

Table 11. Comparison of results with baseline forecast.

(\$ Per Spindle)	Baseline		Under Fiber Policy	
	2012	**2013**	**2012**	**2013**
Contribution	94.42	115.39	101.15	122.49
Production Cost	364.3	385.22	357.57	378.12
Net Present Value (Sum of Contributions 2012-2013)	189.04		201.53	

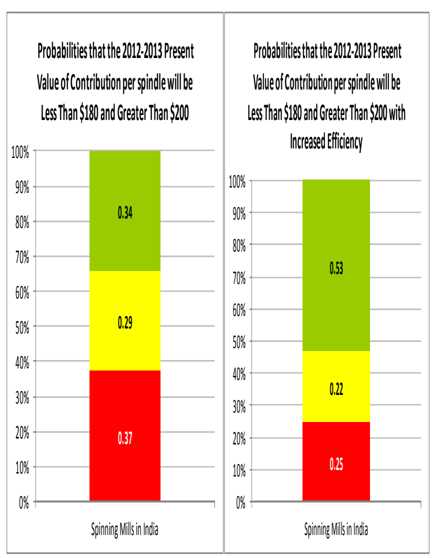

Chart 2A Chart 2B

Figure 3. Stop-light Charts ‘Without’ and ‘With’ National Fiber Policy

Charts 2A and 2B in Figure 3 provide a similar comparison of the simulated probability distributions of net present value of sum of contributions per spindle per year in 2012 and 2013 with and without the National Fiber Policy. The implementation of National Fiber Policy increases the probability of earning a contribution of more than $200 per spindle per year by 19 percent, whereas it reduces the probability of earning a contribution between $200 and $180 by 7 percent and also reduces the probability of earning less than $180 per spindle per year by 12 percent.

Conclusion

In this paper we have analyzed the impact of fertilizer subsidies on the net income of Indian cotton farmers and the impact of National Fiber Policy on the profitability of spinning mills. We have used information collected from focus group discussions of farmers in top three cotton growing states of India. Indian government provides various subsidies to farmers to improve the profitability of their farming enterprises and to increase their living standards. But, due to the growing fiscal deficit in Indian economy, the government is changing the fertilizer policy and started decontrolling the fertilizer prices (Sharma and Thaker, 2009). Though the decontrolling of fertilizer prices is not to the fullest, this study analyzes the impact on profitability of Indian cotton farms if the domestic prices of India were equal to international prices. This study analyses the profitability of cotton farms in India with and without the fertilizer subsidies. The results demonstrate that the net income of the cotton farmers represented from this study group will decrease considerably without the presence of fertilizer subsidies. The results also show that the probability of earning a lower net income increases, whereas the probability of earning a higher net income decreases when fertilizer subsidies are removed as shown in the stop light charts. This may lead to a shift in cultivation patterns of cotton farmers and they may shift to other crops. But, as the fertilizer subsidies are not product specific, the shift in cropping patterns may be very minimal as the impact of fertilizer subsidies is going to be similar on all the crops where fertilizers are used intensively. Therefore crops where fertilizers are not used as intensively as in cotton would be candidates for an increased allocation of land at the expense of cotton. In order to understand more details about the shift in cropping patterns, we need to understand the profitability of other substituting and competing crops of cotton in those areas. On the other hand, as fertilizers become expensive, the farmers may use fewer fertilizers than before leading to lesser yields in cotton. The lesser yields may lead to decrease in profitability of cotton farming. In this scenario, the results suggest that the US cotton farmers may benefit from decreasing export competition as cotton production declines in India.

This paper also analyzed the impact of National Fiber Policy of India on cotton processing sector. The results show that the contribution of spinning mills will increase as labor productivity increases due to the modernization and skill development programs for workers under the National Fiber Policy. The increase in contribution of the spinning mills and thereby their profitability may positively impact the demand originating from the spinning mills for raw cotton thereby leading to an increase in domestic cotton consumption. This may also lead to capacity building and expansion of spinning mills further leading to more domestic consumption. The Indian government estimates that by 2020, the production and consumption of cotton may reach approximately 48 and 41 million bales (National Fiber Policy, 2010). This may leave a surplus of only 7 million bales in 2020 that can be exported which was approximately the level of exports in 2010-11 as well. The estimation by government of India shows that the exports of raw cotton may not increase in the future. Our results also show that the domestic consumption of cotton may increase due to the capacity building and modernization of spinning mills. Ultimately, the exports of value added cotton products like textiles and garments may increase in the future rather than the exports of raw cotton due to the implementation of National Fiber Policy. This scenario likely suggests that the US cotton farmers may benefit from a very limited to zero growth in raw cotton exports from India in the future, thereby creating an opportunity for them to capture new expanding international markets. The results in this paper can be used to draw more concrete implications for international market prices of cotton and its impact on cotton farmers worldwide by using dynamic international trade models.

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