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Cotton Value Chain: Skill Gap Analysis in Farming Sub-sector

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KNOWLEDGE FOR LIFE

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Executive Summary

Cotton crop has a strategic importance in Pakistan, as it is the fourth largest producer and the third largest consumer of the cotton in the world. Cotton crop does not only act as mainstay for the economy but also provides livelihood to millions of people directly or indirectly. Cotton crop supplies raw material to textile and other industries. Alone, textile industry in the country accounts for 8.5 percent of GDP, 46 percent of manufacturing, 61 percent of the total export earnings, and 39 percent of employment in Pakistan

Cotton is grown on around 3.103 million hectares in Pakistan and total numbers of farmer who grow cotton are around 1.3 million. The average size of the cotton-farm comes to around 2.38 hectares. Majority of the cotton growers have small landholdings. Moreover, millions of workers from landless and poor families provide workforce for the cotton farming sub-sector, for a variety of activities including farm activities, input supplies, cotton picking, transportation, loading, packing etc. So, the livelihood of millions of farmers depends upon performance of cotton crop in a given year. Cotton crop is also very important from the perspective of gender empowerment and development. In most of cases, cotton is picked by women and it proves a good source of income for them during the season.

Any improvement in the cotton farming sub-sector is expected not only to give a boost to the GDP growth, manufacturing sector and export earnings, but also to create more employment opportunities, hence helping in alleviating poverty in the country. However, one of the key challenges in the improvement of cotton farming sub-sector is the low productivity at the farm level which is associated with a set of low level knowledge, skills and attitudes (KSAs).

It implies that MDG1 can be achieved through a continuous process of building skills of the farmers and people associated with Cotton Production System. What are the key skill gap areas in the cotton farming sub-sector? Existing literature does not adequately and holistically answer this question. Keeping in view the importance of this question in the context of poverty alleviation and improvement of livelihood, a study was designed and launched in the country. The overall goal of the study was to investigate the potential for enhancement in the knowledge and skills of the key stakeholders of the cotton farming sub-sector so as to develop a skill building strategy aiming at improvement in the livelihood of masses associated with it.

It is evident that improvement in knowledge, skills and attitude (KSAs) is a pre-requisite for continuous improvement in the cotton farming system, poverty alleviation, and human development. Low level of KSAs result in low productivity, and low quality, so farming system gets into low-value trap. Eventually, farmers get low returns, who then neither have capability and nor the incentive to invest in technological up-gradation of the cotton farming system. There were several areas in cotton farming system, where there were evident skills gaps. The study showed that farmers had limited capacity in attaining good crop stand establishment. One of the reasons for this weakness may be the limited knowledge and skills on good agricultural practices. There was shortage of good quality, high-yielding, insect and pests resistant varieties of seeds. The survey found that only one fifth of the respondents did follow seed treatment practice during the sowing of current crop. Majority of the farmers buy the cotton seed from the seed companies or fellow farmers. Quality seed production at farm level was concern of high priority. The farmers had limited or no skills of quality seed production at their own farm.

Pests and diseases have proven to be the major constraint in production of cotton in Pakistan. Cotton leaf curl virus (CLCV) and cotton mealy bug emerged devastating pests during the last couple of years. Number of sprays on cotton crop was showing an increasing trend. This study has found that number of pesticides sprays range from 3 to 13 in a crop during 2007. The results showed that farmers heavily rely only on the chemical method of pest control. Cotton farmers heavily depend on the use of chemical fertilizer with a perception to enhance their crop yield in Pakistan. This immoderate use of chemical fertilizers had increased the cost of cultivation by leaps and bounds, which thus reduced the profit margins and had caused deterioration of soil health, resulting in reduction of yield. The soil health depends on the physical as well as the biological environment. Failure to manage soil health effectively can degrade soil biological functions; causing far reaching consequences. Poor quality soils are less able to retain chemicals such as pesticides, nutrients and

fertilizers. About 97 percent of farmers had no knowledge and skills of managing the soil health issues. This study has also found that farmers have poor knowledge about the need of soil analysis.
During recent years, Pakistan has faced severe problem relating to deficiency of irrigation water and this situation calls for even more efficient use of ground and canal water. Farmers in the country use to scheduled irrigation regardless the irrigation requirement of the crop. Furthermore, the cotton planting in flat field worsen the situation, by consuming 30-35% more water as compared to bed/furrow planting method. The study found that farmers have limited knowledge and skills on integrated water management strategies in cotton.
Pakistani cotton products are labelled as low quality and low priced products. Generally raw cotton in Pakistan contains more than 8% trash. Trash in US cotton varies from 0.31% to 0.78% (average less than 0.40%). Previous study has pointed out existence of high impurity content and high counts trash and moisture in Pakistan, which result in poor ranking as per international standards. Eventually, Pakistan fetches much lower returns than what can be achieved. A study showed that Pakistani cotton suffers loss of around 10-15 percent in value, equivalent to around $350 million per annum, which is attributed to; poor quality, poor cotton picking practices, adulteration of cotton with water and other material, mixed grades and seed varieties and improper packing, storage and transportation means.
This study found that improper picking method was mainly due to two factors i.e. lack of incentives for quality, and lack of training of the cotton pickers. Payment was generally made to the pickers on the basis of weight, which offers least incentive to them to pick carefully and present cotton free of contaminations. Adulteration with water and other material was due to improper ways of storing the cotton. There was a temptation to stock cotton piles in wet places so that its weight increases. Mixing of varieties was due to the fact that a farmer in Pakistan generally is in a temptation of cultivating two or more than two varieties in different fields so as to minimize the risk. Eventually, at the time of picking, mixing of cotton of different varieties was very common practice among the farmers. This practice badly impacts the quality of their produce. Furthermore, farmers lack skills of marketing their products. Resultantly, they resort to adulteration, mixing of varieties, etc. to gain more returns. The results showed that there were poor linkages among the agricultural universities, research institutions, extension service providers and the farmers, in Pakistan to facilitate the farming community on up-to-date cotton management knowledge and information. Due to weak linkages, productivity is not experiencing significant improvement.
Owing to weak Research and development (R&D) system, Pakistan has not been able to bring any big breakthrough in the yield of cotton during last two decades. Moreover, performance audit of the research institutes has never been carried out. On the other hand, the competitors of Pakistan are investing huge resources on developing innovative technologies so as to produce cost effective, efficient and innovative cotton and textile products. Furthermore, Pakistan has a well-established network of agriculture extension services but it lacks effectiveness and impact. Around 60 percent of the respondents did not avail any service from the Extension Department. Billions of rupees are spent on running the extension departments in the provinces. Alone, in Punjab Province total budget of the Agriculture, Food, Irrigation, Forestry & Fishing for the year 2008-09 has been estimated at Rs. 30.44 Billion. However, there is hardly any evidence on the impact of the extension services provided by these departments.
Adulterations in pesticides, fertilizers and seeds were becoming important constraints in increasing the yield. This study has also identified issues related with adulteration of fertilizers and pesticides. Moreover, timely availability of fertilizers remained a challenge, which results in delayed application of fertilizer. Eventually, yield of cotton crop suffers. Rising Cost of Inputs: Increasing prices of agricultural inputs like seeds, fertilizers, pesticides, diesel, electricity etc. are continuously resulting in the escalation of the cost of production. Support price for cotton is generally announced when crop has already been grown and is near the point of maturity, eventually, support prices hardly proves beneficial in term of the efforts of farmers in increasing either yield or bringing more area under the crop.
Based on the findings of survey results it is proposed that the Government should evolve both long term and short term strategies for the capacity building of farmers. Focus of long term strategies should be on improvement of knowledge and skills in the integrated crop management. As a short term strategy, a result-oriented campaign should be launched for the capacity building of farmers in good agricultural practices in cotton management. Pakistan needs to adopt good agricultural practices for cotton production like the Australian BMP Model for improvement in the value addition. Australia has invested over US$ 6 billion in R&D relating to BMP. It is proposed to identify good

agriculture practices for cotton farming sub-sector, and document them. These best practices should be compiled regionally and nationally and then widely disseminated among the farmers and extension agents through a capacity building program. Furthermore, a back-up support system should be established to up date the good agriculture practices, on quality seed, insect pests and diseases management, soil health issues management, harvest and post-harvest management, marketing information etc. and be easy accessible to the extension workers and farming community. Good seed initiatives should be launched for producing the quality seed at farm level.

1.0- Introduction

Cotton value chain (CVC) has a strategic importance in Pakistan, as it accounts for 8.5 percent of GDP, 46 percent of manufacturing, 61 percent of the total export earnings, and 38 percent of employment in the country (Government of Pakistan, 2008, p. 39).

1.1- Prelude

Cotton (*Gossypium hirsutum* L.) is an important source of fibre, which is used as an important input in the textile industries throughout the world (Chapagain, et al, 2005, p. 10). It has also significant position in the world trade. In 2004, global trade of textile and clothing totalled US$ 453 billion, giving it a share of 4 per cent in the global merchandize trade (Adhikari & Weeratunge, 2006, p. 111).

History of cotton in the world is 7000 years old (Cotton, 2007). In sub-continent, farmers have been growing cotton for around 3000 years (Government of Pakistan, 2005, p. 7). However, according of Cotton Australia (2007a), cotton was cultivated in the Indus River Valley (Pakistan) around 3000 BC. Before the British Colonial Era (18th and 19th Century) Sub-continent was in the business of cotton processing. After establishing rule in the Sub-continent, The East India company started de-industrialization program through which India could supply raw material (cotton etc.) to British industry (Cotton, 2007). So history of Pakistan in cotton and textile is very rich.

Cotton crop has a strategic importance in Pakistan, as it is the fourth largest producer and the third largest consumer of the cotton in the world (Government of Pakistan, 2007a, p. 36-37). Cotton crop does not only act as mainstay for the economy but also provides livelihood to millions of people directly or indirectly. Cotton crop supplies raw material to textile and other industries. Alone, textile industry in the country accounts for 8.5 percent of GDP, 46 percent of manufacturing, 61 percent of the total export earnings, and 39 percent of employment in Pakistan (Government of Pakistan, 2008, p. 39).

Cotton is grown on around 3.103 million hectares in Pakistan and total number of farmers who grow cotton are around 1.3 million (E-Cotton Exchange, 2003). The average size of the cotton-farm comes to around 2.38 hectares. A majority of the cotton growers have small landholdings (Khan & Iqbal, 2005). Moreover, millions of workers from landless and poor families provide workforce for the cotton farming sub-sector, for a variety of activities including farm activities, input supplies, cotton picking, transportation, loading, packing etc. So, the livelihood of millions of farmers depends upon performance of cotton crop in a given year. Cotton crop is also very important from the perspective of gender empowerment and development. In most of cases, cotton is picked by women and it proves a good source of income for them during the season.

Any improvement in the cotton farming sub-sector is expected not only to give a boost to the GDP growth, manufacturing sector and export earnings, but also to create more employment opportunities, hence helping in alleviating poverty in the country. However, one of the key challenges in the improvement of cotton farming sub-sector is the low productivity at the farm level which is associated with a set of low level knowledge, skills and attitudes (KSAs).

It implies that MDG1 can be achieved through a continuous process of building skills of the farmers and people associated with Cotton Production System. What are the key skill gap areas in the cotton farming sub-sector? Existing literature does not adequately and holistically answer this question. Keeping in view the importance of this question in the context of poverty alleviation and improvement of livelihood, a study was designed and launched in the country. The overall goal of the study was to investigate the potential for enhancement in the knowledge and skills of the key stakeholders of the CPS so as to develop a skill building strategy aiming at improvement in the livelihood of masses associated with it. The study would contribute to CABI's Commodity theme and is also related with MDG 1 (Eradicate extreme poverty and hunger).

1.2- Objectives of the Study

Specific objectives of the study include to:

- Study the existing situation of cotton farming sub-sector in Pakistan.
- Study the existing knowledge systems
- Assess knowledge and skills of farming sub-sector (knowledge/skill census)
- Identify major skill gaps of farming sub-sector
- Study role of knowledge and skill gaps in poverty / livelihood at level of farming sub-sector

2.0- Methodology

The study is more exploratory in nature. Both qualitative and quantitative approaches were employed to accomplish above stated objectives of the study. Data was collected from both primary and secondary sources. Secondary sources included government publications, world literature on the subject. Primary sources included 87 sampled farmers. Views were also sought from seed, fertilizer and pesticide dealers, and extension workers. Semi-structured questionnaires were designed to interview each of these stakeholders. Questionnaires were pre-tested before their administration.

A team of 2 members was selected from the professionals of CABI South Asia, who were entrusted the task of data collection from Multan, Bahawalpur, Khanewal, Vehari, DG, Khan, Hyderabad, and Mitiari districts. Selected professionals already had the experience of surveys. However, before initiating the process of data collection from primary sources, a one-day orientation training was arranged for them at the premises of CABI South Asia to facilitate them in understanding the purpose of survey, nature of the questions, meanings of technical terms etc. Data was collected by them during the last three weeks of October 2008 and first three weeks of November, 2008.

3.0- Organization of the report

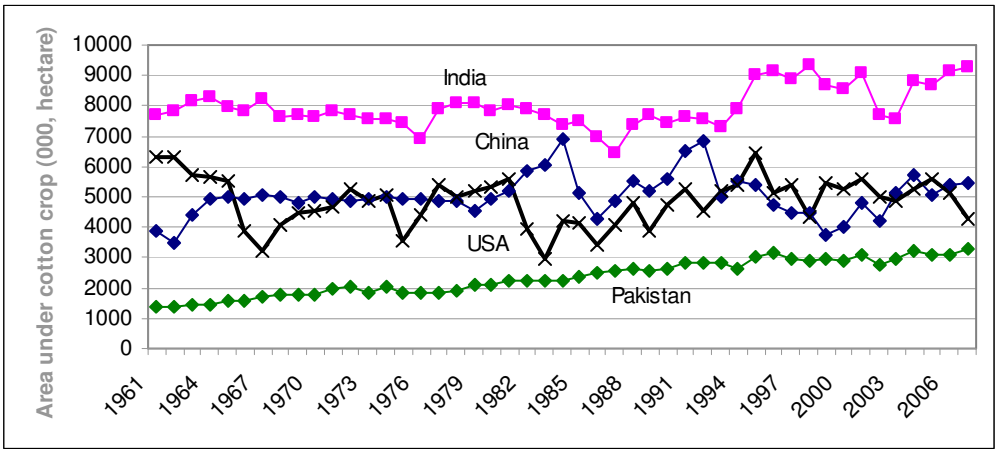
This report is divided into 21 sections. Section 1 introduces the cotton production system in Pakistan and the problem statement, and outlines the objectives of the study. Section 2 gives methodological considerations and limitations of the study. Section 3 maps the scheme of the report. Section 4 presents an overview the cotton production in the world and figures our position of Pakistan in terms of total areas under the crop, total production, and yield. Section 5 provides a profile of the cotton crop and cotton value chain in Pakistan. Section 6 and 7 give a brief profile of the respondents and their farms, pattern of yield etc. Sections from 8 to 12 present the analysis on the survey data relating to inputs and practices. Section 13 discusses the role and impact of extension workers. Sections 14 and 15 delineate issues related production and picking of cotton and its marketing. Section 16 describes institutional linkages. Section 17 identifies skill gaps and analyzes their linkages with poverty and Section 18 discusses other issues responsible for low yield and low quality of cotton, and suggests measures to deal with them. And last section contains relevant references.

4.0- Overview of cotton crop in the world

4.1- Area under cotton crop

Since 1961, total area under cotton has not significantly increased. It increased from 31.86 million hectares in 1961 to 33.8 million hectares in 2007, depicting a change of just by 6 percent. However, analysis of 4 leading cotton countries shows that highest growth on this account has been observed in Pakistan, where area under cotton rose by around 134 percent during afore-said period, followed by China with growth of 40 percent and India with growth of 20 percent. However, in USA area under cotton crop has contracted by about 33 percent. India still remains largest country in the world with respect to area under cotton crop. See Figure 1: Trend in area under cotton crop in selected countries

Figure 1: Trend in area under cotton crop in selected countries



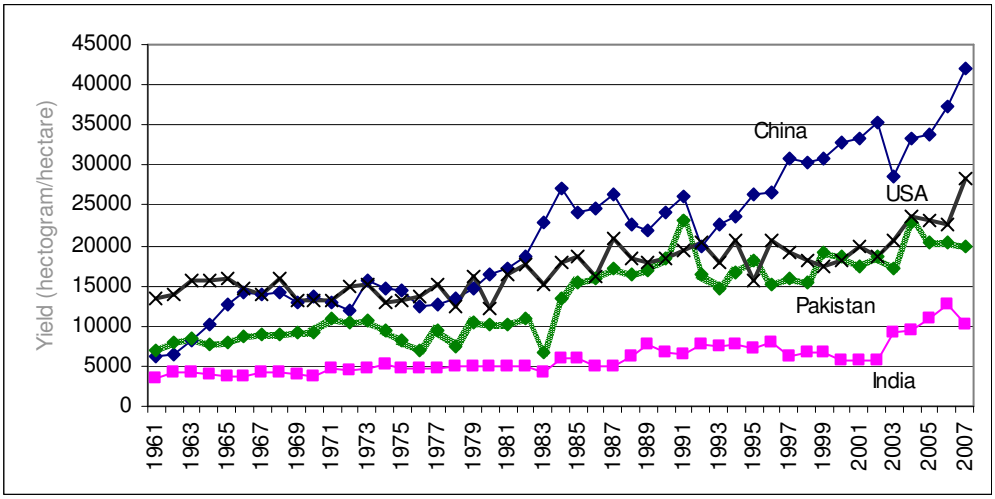
Source: FAOSTAT, 2008

Land resources are scarce in Pakistan. In 2005-06, cotton was grown on around 3.103 million hectares of land, which placed Pakistan as 4th largest owner of the land under cotton crop in the world. In other words, around 8.86 percent of the world area under cotton lies in Pakistan. There exists substantial potential in Pakistan for further expansion in the area under cotton crop, as has been witnessed in the past. It grew by over 19 percent between 1989-90 and 2005-06. During 2003-04, 18,000 hectares of additional land was brought under cotton crop alone in Larkana, Jacobabad and Shikarpur districts of Province Sindh, in response to availability of subsidized seed from the provincial government (Omar, 2007). Area under cotton crop can increased if water is made available in sufficient quantity. Pakistan has an established irrigation system. A slight improvement in the irrigation system can help in making available additional water for irrigation purpose. Cotton crop area is expanding in Balochistan province with the establishment of Mirani Dam.

4.2- Yield of cotton crop

Analysis shows that cotton yield in Pakistan has considerably improved since 1961 in comparison with India and USA. However, China has outpaced the rest of world. China started from low profile point and has advanced progressively. In 1961, average cotton yield in China was around 11 percent less than that in Pakistan. However, in 2007, yield in China was 111 percent higher than that in Pakistan. During 1961-2007, highest growth in cotton yield was observed in China (578 percent), followed by India (199 percent), and Pakistan (186 percent). USA lagged behind these countries, where yield rose by 110 percent. Current per hectare yield (2007) is 42,098 hectogram in China, 28,261 hectogram in USA, 19,938 hectogram in Pakistan, and 10,193 hectogram in India. See Figure 2: Trend in yield of cotton crop in selected countries.

Figure 2: Trend in yield of cotton crop in selected countries

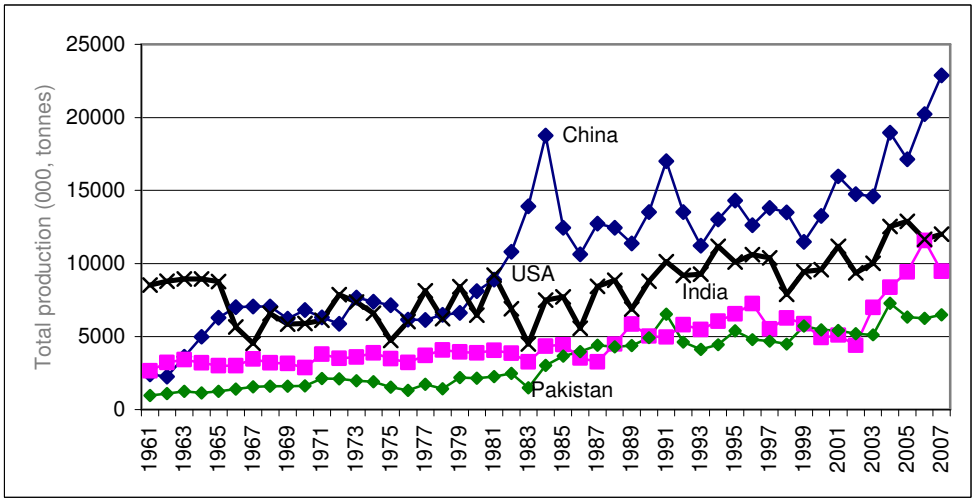


Source: FAOSTAT, 2008

4.3- Production of cotton crop

Total production of cotton in the world has increased by 165 percent from 27 million tones in 1961 to around 73 million tones in 2007. Total production of cotton in China has risen to around 23 million tones in 2007 at annual growth rate of 5.02 percent. After China, Pakistan has registered highest annual growth rate i.e. 4.22 percent, followed by India (2.81 percent). During the same period, USA registered lowest growth rate i.e. 0.74 percent. See Figure 3: Trend in production of cotton crop in selected countries. Increase in production of cotton in the world is mainly attributed to the growth in yield.

Figure 3: Trend in production of cotton crop in selected countries



Source: FAOSTAT, 2008

5.0- Profile of cotton crop in Pakistan

5.1- Cotton growing Regions in Pakistan

Pakistan has three distinct cotton growing regions i.e. Southern Irrigated Plains, Sandy Desert (b), and Northern Irrigated Plains (a). Region-1 is located in Sind Province while rest of two in the Punjab Province. See Table 1: Agro-Ecological Zones of Pakistan. Regions 2 & 3 accounts for almost three fourth of the total production of cotton in Pakistan (Rehman, Farooq & Ahmad, 2008)

Table 1: Agro-Ecological Zones of Pakistan

Name of the Zone	Geographical Coverage	Soil Types	Major Crops
Southern Irrigated Plains	Hyderabad, Sanghar, Dadu, Khairpur, Larkana, Sukkur, R.Y. Khan, Shikarpur, Jacobabad	Calcareous, Loamy, Silty, Clayey and Sandy	Cotton, Wheat, Rice, Sugarcane, Mustard, Sorghum, Berseem
Sandy Desert (b)	Muzaffargarh, Layyah, Sargodha, Khushab	Calcarious, Sandy, Loamy	Gram, Wheat, Cotton, Guar, Sugarcane, Millet
Northern Irrigated Plains (a)	Bahawalnagar, Multan, Khanewal,, Lodhran, Vehari, Sahiwal, Pakpattan, Okara, Lahore, Kasur, T.T. Singh, Faisalabad, Jhang, Sheikhupura, Gujranwala, Hafizabad	Sandy, Clayey, Calcareous, Silt-loam	Wheat, Cotton, Millet, Sugarcane, Maize, Berseem, Citrus, Mango, Melons, Oilseeds

Source: SSD-PSD-PARC (1980) and PARC (1995) cited in Rehman, Farooq and Ahmad (2007)

5.2- Cotton Value Chain

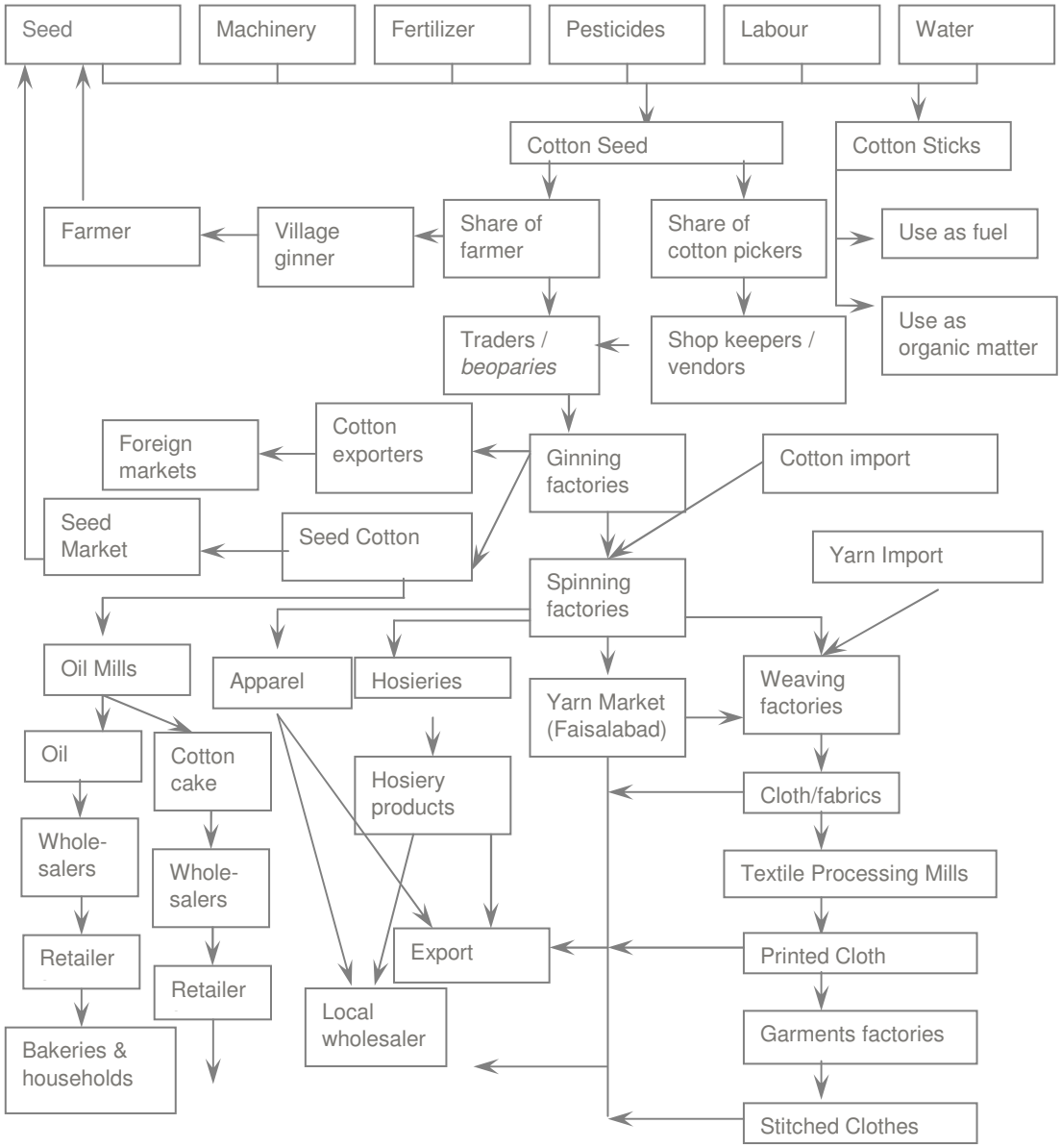
Cotton has very long and complex value chain. Raw cotton is converted into seed and cotton lint in the proportion of 58 percent and 42 percent respectively. Seed contains 3 percent fibre, 40 percent meal, 42 percent hulls, and 15 percent oil (UNCTAD, 2005a).

a farmer in his cotton field

Cotton lint is processed for the production of cotton yarn, which is in turn used for the manufacturing of fabrics / cloth, hosiery, apparel, canvas, tarpaulin. Cloth is processed to have processed or dyed/printed cloth. Printed cloth is used for the manufacturing of ready-made garments and bed ware. Other textile products include terrycloth (for making highly absorbent bath towels and robes), denim (for making blue jeans), chambray (for making blue work shirts), corduroy, seersucker, cotton twill, socks, underwear, T-shirts, bed sheets, crochet and knitting items etc. Non-textile products of cotton include fishnets, coffee filters, tents, gunpowder, cotton paper (origin in China) and bookbinding. By-products of cotton cottonseed oil, cottonseed meal (as feed for livestock) and cotton sticks (for fuel and organic matter). Cottonseed oil is highly valuable by product of cotton. It has several distinct characteristics, being cholesterol-free, high in poly-unsaturated fats and having high levels of antioxidants (Vitamin E) which prolong its shelf life (Cotton Australia, 2007). See Figure 4: Cotton value chain in Pakistan.

Cotton sticks are by-product of cotton crop. Gross value of cotton sticks in Pakistan in 2005-06 was estimated at Rs. 19.562 billion, equivalent to around 20 percent of total value of cotton (Rs. 100.080 billion) produced in the country. Pakistan witnessed highest value of cotton sticks in 2004-05 i.e. Rs. 22.47 billion. (Government of Pakistan, 2006, p. 271)

Figure 4: Cotton value chain in Pakistan



Source: Rehman, Farooq and Ahmad (2008)

6.0- Respondents Profile

6.1- Respondents' Education

Education of farmers plays an important role in the efficient and effective management of farm business. Out of 87 cotton growers who were interviewed, only about 19.5 percent were not literate. Only about 30 percent were having` education higher than 10 years of schooling (Table 2: Respondents' education). Relationship between education of cotton growers and cotton yield is discussed in Section 0.

Table 2: Respondents' education

Education	Frequency	Percent	Valid Percent	Cumulative Percent
No education	17	19.5	19.5	19.5
Primary	12	13.8	13.8	33.3
Middle	10	11.5	11.5	44.8
Secondary	21	24.1	24.1	69.0
Intermediate	11	12.6	12.6	81.6
Graduate	13	14.9	14.9	96.6
Master	3	3.4	3.4	100.0
Total	87	100.0	100.0	

6.2- Respondents' Age

A majority of the respondents (almost 80 percent) were in age between 26 and 45 years (Table 3: Respondents Age).

Table 3: Respondents Age

Age	Frequency	Percent	Valid Percent	Cumulative Percent
Up to 25 years	5	5.7	5.7	5.7
26 – 35	35	40.2	40.2	46.0
36 – 45	34	39.1	39.1	85.1
46 – 55	11	12.6	12.6	97.7
Above 55	2	2.3	2.3	100.0
Total	87	100.0	100.0	

6.3- District of the Respondents

Cotton is mainly grown in the Punjab and the Sind provinces of Pakistan. Majority of the respondents of this survey hailed from Southern part of the Punjab Province. Almost 70 per cent of the respondents represented only two districts i.e. Multan and Vehari, main cotton growing districts in Punjab. (Table 4: Districts of the Respondents).

Table 4: District of the Respondents

Districts	Frequency	Percent	Valid Percent	Cumulative Percent
BWP	2	2.3	2.3	2.3
DG Khan	2	2.3	2.3	4.6
HYD	12	13.8	13.8	18.4
Khanewal	7	8.0	8.0	26.4
Matiari	3	3.4	3.4	29.9
Multan	25	28.7	28.7	58.6
Vehari	36	41.4	41.4	100.0
Total	87	100.0	100.0	

7.0- Acreage and Yield of Cotton Crop

7.1- Land Ownership

Farm size significantly affects the farm management and inputs use. Overall 87 cotton growers were interviewed out of which 63.2 per cent owner of up to 5 hectares were falling under the category of small farmers (Table 5: Land ownership categories). Farmers occupying land 6-10 hectares, 11-20 hectares and above 20 hectares were 19.5, 12.6 and 4 per cent, respectively. Nevertheless, 3.4 per cent of the farmers were land less and were cultivating land of others.

Table 5: Land ownership categories

Hectares	Frequency	Percent	Valid Percent	Cumulative Percent
0	3	3.4	3.4	3.4
< 2 hectares	29	33.3	33.3	36.8
3-5 hectares	23	26.4	26.4	63.2
6-10 hectares	17	19.5	19.5	82.8
11-20 hectares	11	12.6	12.6	95.4
> 20 hectares	4	4.6	4.6	100.0
Total	87	100.0	100.0	

7.2- Cultivated Area

About 65.5 per cent farmers were cultivating up to 5 hectares land i.e. 32.2 per cent farmers < 2 hectares and 33.3 per cent 3-5 hectares (Table 6: Size of farms: cultivated area). Area of 6-10 hectares, 11-20 hectares and > 20 hectares was being cultivated by 18.4, 11.5 and 4.6 per cent farmers, respectively.

Table 6: Size of farms: cultivated area

Farm size	Frequency	Percent	Valid Percent	Cumulative Percent
< 2 hectares	28	32.2	32.2	32.2
3-5 hectares	29	33.3	33.3	65.5
6-10 hectares	16	18.4	18.4	83.9
11-20 hectares	10	11.5	11.5	95.4
> 20 hectares	4	4.6	4.6	100.0
Total	87	100.0	100.0	

7.3- Current Trend in the Area under Cotton

About 47 per cent farmers stated that they had decreased the area under cotton. Reasons for advocating decrease in cotton area were:

i) Escalating costs of plant protection measures
ii) Replacement of cotton crop with maize and rice crops on significant area

However, 32.2 per cent farmers were of the view that they increased area under cotton as compared to last year due to availability of Bt cotton seed as it provided time flexibility regarding sowing of cotton. Bt cotton was sown about one and a half month earlier and rest of area was sown with non Bt cotton. See Table 7: Increased area this year vs last year.

Table 7: Increased area this year vs last year

Area	Frequency	Percent	Valid Percent	Cumulative Percent
Increased	28	32.2	32.2	32.2
Decreased	41	47.1	47.1	79.3
Same	18	20.7	20.7	100.0
Total	87	100.0	100.0	

7.4- Plan to Increase the Cotton Area

Forty six per cent farmers were of the view to increase area under cotton during next year because of obtaining good yield from Bt cotton which was sown in March (Table 8: Planning to Increase the cotton area). Whereas, 54 per cent showed no interest to increase cotton acreage due to high cost of pesticides, significant increase in number of sprays against sucking insect pests and uncertainty in prices of seed cotton.

Table 8: Planning to Increase the cotton area

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	40	46.0	46.0	46.0
No	47	54.0	54.0	100.0
Total	87	100.0	100.0	

7.5- Current Yield of Sampled Farms

The picture depicted by the survey under reference regarding seed cotton yield is not so encouraging. Only 21.1 per cent of respondents stated that they obtained average yield beyond 1976 kg per hectare and was followed by 12.6 per cent respondents who got 1600 kg per hectare (Table 9: Current yield). Contrarily about 23 per cent of the respondents obtained average yield of <500 kg per hectare and were preceded 28.8 per cent growers with average yield of 590-990 kg per hectare. Reason for difference in cotton seed yield might be attributed to difference in cotton varieties, sowing time, fertility management, irrigation management, insect pest management and other crop management practices.

Table 9: Current yield of cotton at sampled farms

Average Yield (kg/hectare)	Frequency	Percent	Valid Percent	Cumulative Percent
< 500	20	23.0	23.0	23.0
590-990	12	28.8	28.8	51.8
1087-1482	5	14.5	14.5	66.3
1600-1976	7	12.6	12.6	78.9
> 1976	43	21.1	21.1	100.0
Total	87	100.0	100.0	

The slowdown in cotton yield was observed during 1980s and 1990s throughout the world, and this phenomenon is partly attributed to the reduced effectiveness of chemical pest control methods and increasing resistance of pests to pesticides (Elbehri & MacDonald, 2003). First major breakthrough in cotton yield came in 1996, when the commercialization of transgenic insect-resistant cotton (Bt cotton) was started in the United States, which also proved to be alternative to insecticides (Elbehri & MacDonald, 2003).
The Bt cotton spread very fast and within three years, it covered almost 20 percent of the total areas of cotton, in countries like USA, Australia, Mexico, China, Argentina, and South Africa (Elbehri & MacDonald, 2003).

7.6- Relationship between Yield of Cotton and Level of Farmers' Education

Various studies have indicated a positive correlation with yield of cotton and the level of farmers' education. For example, Bakhsh, Hassan and Maqbool (2005) in a study conducted in District Sargodha found that one percent increase in schooling year of farmer could enhance cotton yield by 0.15 percent. The present study found a correlation coefficient of 0.424 significant at 0.01 level. This study used a crude linear regression model to estimate B coefficient. Results show that one level higher in education (no education, primary, middle, secondary, intermediate, graduate, and post graduate) results into increase in yield by 494 kg per hectare (Table 10: Relationship between Yield of Cotton and Level of Farmers' Education).

Table 10: Relationship between Yield of Cotton and Level of Farmers' Education

Unstandardized Coefficients	Standardized Coefficients			t	Sig.
	B	Srd. Error	Beta		
(Constant)	1482	4.046		3.600	.001
Respondents education	494	1.287	.424	4.291	.000

a Dependent Variable: Yield (kg/hectare)

However, it has also been observed that some farmers with no education were having yield much higher than average one. Moreover, improvement in the level of education can be achieved only in the long term. Besides, improvement in education in villages is likely to result into problem of brain-drain, leaving a negative impact on the farming business. In view of this situation, the plausible strategy would two-pronged i.e. long term and short term. As far as long term strategy is concerned, the focus should be on improvement of education, and as a short term strategy, a campaign should be launched for knowledge and skills enhancement of farmers in cotton production and management strategies. But such initiatives should not be based on traditional methodologies and must be results oriented. The impact evaluation exercises should be undertaken periodically to examine, whether interventions have produced desired impact or not.

8.0- Seed

Seed plays key role in determining crop stand and yield per unit area. Various aspects of the availability, and quality of seed, types of varieties sown, and sources of information on the selection of seeds are described below:

8.1- Quality of the Seed

Majority of the growers has no or limited access to the quality seed which contributes towards low yield per unit area. Only 12.6 per cent of the respondent farmers were quite satisfied with the quality of seed whereas 47.1 per cent of the respondents showed satisfaction with the quality of seed (Table 11: Satisfaction with quality of seed). About 32.2 per cent of the respondents stated that the

quality of the available seed was just okay whereas 8 per cent were not satisfied with the quality of the seed. Farmers were of the view that numerous seed companies are involved in the seed business. The monitoring/control of government authorities is quite loose; hence, farmers were cheated by the seed companies quite often regarding variety and quality of the seed, as they have limited knowledge about the quality of cotton seed.

Table 11: Satisfaction with quality of seed

Seed quality	Frequency	Percent	Valid Percent	Cumulative Percent
Highly Satisfied	11	12.6	12.6	12.6
Satisfied	41	47.1	47.1	59.8
Just Okay	28	32.2	32.2	92.0
Not Satisfied	7	8.0	8.0	100.0
Total	87	100.0	100.0	

8.2- Varieties Sown

Various varieties of cotton are being cultivated by the growers. According to survey about 15 varieties were cultivated by the respondents and out of which 7 varieties were genetically modified containing *Bacillus thuringensis* (Bt) gene (Table 12: Varieties sown). Despite Agriculture Department has not approved/recognized any Bt cotton variety, as per survey about half of the area was found under Bt cotton. Cotton variety Bt 121 was grown on maximum area i.e. 31.6 per cent and was followed by CIM 496 with 26.4 per cent area. Remaining area was sown with rest of 13 varieties with area ranging from 0.7 to 6.5 per cent area under each variety.

Farmer showing Bt. cotton

Sowing of unapproved Bt varieties without complete testing by the Agricultural Research System may be a matter of concern in future with regard to cotton productivity.

Table 12: Varieties sown

S. No.	Variety	Frequency	Per cent
Bt Varieties			
1.	Bt 121	23	31.6
2.	Neelam 121	5	6.5
3.	Bt 808	4	3.2
4.	Z-33	3	3.5
5.	Bt 96	2	1.4
6.	Bt 448	1	1.1
7.	Bt 1100	1	1.0
Sub-Total		39	48.3
Non Bt Varieties			
8.	CIM 496	15	27.4
9.	CIM 557	8	4.5
10.	CIM 534	7	2.5
11.	MNH 6070	2	4.5
12.	MNH 786	1	4.5
13.	BH 160	1	4.0
14.	FH 100	1	2.8
15.	VH 506	1	1.5
			51.7

8.3- Changes in Variety during Current Season

As per survey about one half (48.3 per cent) of the respondents stated that they changed the varieties during current season whereas rest half did not opt to change the variety (Table 13: Change in variety during current season). Majority of the growers replaced conventional varieties with Bt varieties due to resistance of the later against bollworms and high yielding.

Table 13: Change in variety during current season

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	42	48.3	48.3	48.3
No	45	51.7	51.7	100.0
Total	87	100.0	100.0	

Nevertheless, the survey revealed that the farmers were still looking for new/other varieties. About 65.5 per cent of the respondents asserted that they were looking for such type of varieties which might perform better and consistently (Table 14: Farmers looking for other varieties).

Table 14: Farmers looking for other varieties

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	57	65.5	65.5	65.5
No	30	34.5	34.5	100.0
Total	87	100.0	100.0	

8.4- Sources of Information

Cotton growers are generally considered well informed as compared to other agricultural commodity growers in Pakistan. Even in the era of information communication technologies (ICT), Agriculture Extension Department was ranked at the top (with score of 3.33 out of 5.0) in providing information about cotton seed to the respondents (Table 15: Sources of information on seed).

As per survey, other farmers and seed companies followed the Extension Department with score of 3.05 and 3.02, respectively. Contrarily sources of mass communication could not provide adequate information to the respondents and TV, Newspapers and Radio attained score of 2.13, 2.11 and 2.05, respectively against maximum score of 5.

Table 15: Sources of information on seed

Source of information	N	Mean	Std. Deviation
Extension workers	87	3.3333	1.29099
Pesticide companies	87	3.0000	1.38933
Seed companies	87	3.0230	1.36379
Other farmers	87	3.0575	1.24224
Newspapers	87	2.1149	1.13532
Radio	87	2.0460	1.01050
TV	87	2.1264	1.11860
Valid N	87		

8.5- Treatment of Seed before sowing

Cotton seed is treated with an appropriate insecticide to protect the crop from infestation of sucking insect pests at early sage. About 20 per cent respondents stated that seed was treated before sowing whereas 80 per cent did not practice seed treatment (Table 16: Seed treatment).

The respondents treating the cotton seed with insecticide explained that due to seed treatment their crop remains protected from sucking insect pests for up to 45 days after germination and at least two to three sprays of insecticides are avoided. Agriculture Department need to look into the matter to ensure that seed treatment may be practiced by all the cotton growers.

Table 16: Seed treatment

Seed treatment	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	40	20.0	20.0	20.0
No	47	80.0	80.0	100.0
Total	87	100.0	100.0	

8.6- Use of Own Seed

About 33 per cent respondents asserted that they used their own seed for sowing of current cotton crop whereas 67 per cent respondent obtained cotton seed from other sources (Table 17: Use of own seed). Other sources of seed were mainly, Punjab Seed Corporation, Private seed companies and other growers.

Table 17: Use of own seed

Own seed	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	29	33.3	33.3	33.3
No	58	66.7	66.7	100.0
Total	87	100.0	100.0	

8.7- Role of private sector in the seed market has substantially increased.

Market forces play a vital role in improving efficiency in a system. Private sector is increasingly demonstrating its role in the input market. Fertilizer and pesticide markets are already in the hands of private sector. Seed market is also witnessing increasing role of private sector. In 2006-07, over 90 percent of the total certified seed was supplied by the private sector (CCRI, 2007, p. 4).

8.8- Issues with Seed

8.8.1- Wastage of Seed

According to survey, on the average about 20.63 per cent of the cotton seed is wasted during germination (Table 18: Seed wasted during germination). Seed wastages were 22.95 and 20.79 per cent at the farms having cotton area <2 hectares and 3-5 hectares, respectively. Seed wastage further decreased with the increase in cultivated area and was 14.19 and 18.20 per cent for the cultivated area 6-10 and 11-20 hectares, respectively. However, when cultivated area went beyond 20 hectares, the wastage of seed was as high as 38.75 per cent, which might be attributed to absentee landlordism and less care by the Farm Managers. Nevertheless, overall wastage of seed was found to be on the higher side and Agriculture Department may intervene into the matter.

Table 18: Seed wasted during germination

Cultivated Area Categories	Mean	N	Std. Deviation
< 2 hectares	22.95	22	11.818
3-5 hectares	20.79	24	12.965
6-10 hectares	14.19	16	8.002
11-20 hectares	18.20	10	12.435
> 20 hectares	38.75	4	25.941
Total	20.63	76	13.330

8.8.2- Improvement in Knowledge and Seed Management

To know about the interest of the respondents in seed quality and management they were about their need for improvement in their knowledge and skills. About 98 per cent respondents were of the view that knowledge about seed quality and management was their requirement to obtain better crop productivity. However, 2.0 per cent strongly disagreed with the above view point (Table 19: Improvement in knowledge).

Table 19: Improvement in knowledge

Need for knowledge	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	34	39.1	39.1	39.1
Agree	51	58.6	58.6	97.7
Strongly Disagree	2	2.3	2.3	100.0
Total	87	100.0	100.0	

8.8.3- Bt Seed:

Bt Seed (a pest resistant variety) offers substantial increase in yield. The Bt cotton varieties have demonstrated success in boosting yield, and reducing use of chemicals thus increasing farm profitability (Iqbal & Ahmad, 2007). The popularity of Bt seed has increased fast in the world. Area under Bt cotton rose from 800,000 hectares in 1996 to 5.7 million hectares in 2003 (Khadi, 2008). Countries like Argentina, Australia, Brazil, China (Mainland), Colombia, India, Indonesia, Mexico, South Africa and the USA have commercialized biotech cotton (Chaudhry, 2006). In India, area under Bt cotton has increased from just 0.038 million hectares in 2002-03 to 6.2 million hectares in 2007-08 (Khadi, 2008). But Pakistan has not yet made any officially allowed farmers to grow it. Pakistan direly needs Bt seed as, number of pesticide applications is rapidly increasing. Bt seed is produced with the help of genetic engineering. Genetically modified (GM) cotton was first produced in 1987, which paved for the development of Bt seed. Eventually, in 1989, Monsanto developed Bt seed. Bt cotton was first planted in USA and Australia in 1996. It has gained tremendous popularity in the world. In India, 300,000 small farmers used Bt seed for the production of cotton, in 2004. In just one year (from 2003 to 2004), area under Bt cotton increased from 0.1 million hectares to 0.5 million hectares. In China, area under Bt cotton increased to 3.7 million hectares land (66 percent of the total cotton area) in 2004. (UNCTAD, 2005f). In 2003, first transgenic cotton varieties having independently acting Bt genes were introduced in Australia and the USA (Australia Cotton, 2007a). Pakistan has yet to make advancement in this area.

9.0- Water Management Practices

Water management is inevitable because of gap between availability and requirement of irrigation water is increasing day by day. As per collected data, mixed response of the respondents was noted. About 49.4 per cent of the respondents stated that the available water was inadequate for their cotton crop whereas 2.3 per cent rated water availability is highly inadequate Table 20: Water adequacy). Twenty three per cent growers were just satisfied with the availability of water whereas 19.5 per cent said that water was adequate. Water availability was highly adequate for 5.7 per cent of the respondents.

Table 20: Water adequacy

Water	Frequency	Percent	Valid Percent	Cumulative Percent
Highly inadequate	2	2.3	2.3	2.3
Inadequate	43	49.4	49.4	51.7
Satisfied	20	23.0	23.0	74.7
Adequate	17	19.5	19.5	94.3
Highly Adequate	5	5.7	5.7	100.0
Total	87	100.0	100.0	

As regards irrigation scheduling for the cotton crop, most of the respondents stated that leaves' appearance of the crop indicated the need of water. However, much is needed to educate the farmers in irrigation management strategies through the implementation of integrated water management programs.

9.1- Sources of Information on Water Management

According to the survey other farmers were the most important source of information on water management which attained the mean score of 3.17 on the scale of 5. Agriculture Extension was ranked second with the mean score of 3.03 (Table 21: Sources of information). Sources of information communication technologies i.e. Newspapers, Radio and TV were not consulted much by the respondents and attained mean score of 2.19, 2.18 and 2.36 on the scale of 5.

Table 21: Sources of information on water management

Source of information	N	Minimum	Maximum	Mean	Std. Deviation
Extension workers	84	1.00	5.00	3.0357	1.34833
Pesticide companies	79	1.00	5.00	2.3038	1.40835
Seed companies	75	1.00	5.00	2.0533	1.30377
Other farmers	79	1.00	5.00	3.1772	1.37523
Newspapers	69	1.00	5.00	2.1884	1.23996
Radio	71	1.00	5.00	2.1831	1.26841
TV	74	1.00	5.00	2.3649	1.39052
Valid N (list wise)	59				

The survey revealed that the best water management practices being followed by the respondents were cleaning of water courses, precision land levelling and bed & furrow sowing method.

9.2- Improvement in Knowledge and Water Management

About 98 per cent of the respondents voted for the need of improvement in their knowledge and skills about water management. Only one per cent respondents showed indifferent behaviour and one percent disagreed with the view point of the majority (Table 22: Improvement in water management).

Table 22: Improvement in water management

Need of knowledge	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	32	36.8	36.8	36.8
Agree	53	60.9	60.9	97.7
Indifferent	1	1.1	1.1	98.9
Disagree	1	1.1	1.1	100.0
Total	87	100.0	100.0	

Above statistics reveal that cotton growers are well aware of the importance and need of water management practices. Hence, the matter of concern for government authorities is proper transfer of knowledge and skills to the cotton growers about water management.

9.3- Wastage of Irrigation Water

None of the respondents said that water was not wasted. However, opinion regarding quantity of water wasted differed among the respondents. One-forth of the respondents stated that water losses were about 1-10 per cent whereas 59 per cent respondents claimed water losses as 11-20 per cent (Table 18). About 16 per cent were of the view that 21-40 per cent of the irrigation water was wasted. Above data indicate that there is significant scope to minimize the water losses which will also help in augmenting the water shortages in future.

Table 23: Water wasted

Percent loss	Frequency	Percent	Valid Percent	Cumulative Percent
No loss	0	0	0.0	0.0
1-10%	22	25.3	25.3	25.3
11-20%	51	58.6	58.6	83.9
21-40%	14	16.1	16.1	100.0
Above 40%	0	0.0	0.0	100.0
Total	87	100.0	100.0	

10.0- Pest and Pesticide Management Practices

10.1- Common Diseases

Following are the most common diseases of cotton in the world:

a. Boll Rot (fungi *Diplodia gossyina*, *Fusarium spp.*)

b. Nematodes (root-knot *Meloidogyne incognita*, sting *Belonalaimus longicaudatus*)

c. Fusarium Wilt (*fungus Fusarium oxysporium f. sp. vasinfectum*)

d. Seedling Diseases (fungi *Rhizoctonia solani, Pythium spp.*)

As far as this survey is concerned, the most common disease which hit the cotton crop was cotton leaf curl virus (CLCV). CLCV emerged in Multan and was reported in 1985. It became most threatening factor in the production of cotton during early 1990s (Briddon and Markham, 2000). The disease badly affects the yield and quality of the produce. CLCV is still one of the major threats to cotton crop in Pakistan. The only way to avoid or minimize the infestation of CLCV is the development of virus-resistant varieties and management of its vector i.e. cotton whitefly. Agricultural Research will have to play an anchor role for evolution of CLCV resistant/tolerant varieties.

CLCV attack on cotton during 2008

10.2- Common Insect Pests

Cotton crop is attacked by a variety of insect pests. The insect pests commonly prevailed were whitefly, mealy bug and army worm. See Table 24: Description of cotton pests that attack Pakistani cotton.

Table 24: Description of cotton pests that attack Pakistani cotton

Scientific name	Common name	Mode of attack	Attack stage/month
Sucking Pests			
Bemisia tabaci	White Fly	sucks plant sap and secretes black fluid	early stage of growth to harvest
Aphis gossypii	Aphid	same as White Fly	when the bolls open
Amrasca devastans	Cotton Jassid	sucks plant sap	early stage of growth to harvest
Thrips tabaci	Thrips	same as above	same as above

Boll Worms			
Earias vitella	Spotted Boll Worm	feeds on tender shoots and bolls	July–October
Pectinophora gossypiella	Pink Boll Worm	same as above	July–October
Spodoptera litura	Army Boll Worm	same as above	July–October
Diseases			
Cotton Leaf Curl Virus	Cotton Leaf Curl Virus	Viral	at any stage of growth

Source: Davidson, Ahmad, Ali (2001, p.2)

10.3- Magnitude of Losses due to Pest and Diseases

According to survey no farmer stated that his crop was pest free. About 15.5 per cent of the respondents stated that yield losses due to pests and diseases were above 40 per cent whereas 31.3 per cent reported 21-40 per cent yield losses. Similarly, 34.7 and 18.5 per cent respondents estimated reduction in cotton yield to the tune of 11-20 and 1-10 per cent, respectively due to pest and disease infestation (Table 19).

Mealy bug attack on cotton during 2008

Table 25: Magnitude of Loss due to pests and diseases

Percent loss	Frequency	Percent	Valid Percent	Cumulative Percent
No loss	0	0	0	0
1-10%	16	18.5	18.5	18.5
11-20%	30	34.7	34.7	53.2
21-40%	27	31.3	31.3	84.5
Above 40%	13	15.5	15.5	100.0
Total	87	100.0	100.0	

Majority of the respondents revealed that attack of sucking pests especially whitefly and cotton mealy bug was quite severe on Bt cotton as compared to previous years and most of the time 7 to 9 sprays had to be applied for its control. However, attack of American bollworm was quite rare due to Bt cotton.

10.4- Sources of Information about Pests and Diseases

Farmers obtain information about pest and diseases from number of sources. However, Pesticide Companies were ranked at the top by the respondents with regard to keep them updated about pests and disease attack and control measures. Mean score for the Pesticide Companies was 3.99 on the scale of 5 and was followed by Extension workers with mean score of 3.54 (Table 20). As per information provided by the respondents, mass media had played role in providing information about pest and diseases, but it was ranked below. Mean score of Newspapers, radio and TV was calculated as 2.33, 2.33 and 2.48 on the scale of 5.

Table 26: Ranking of different Sources of Information about pests and diseases

Source of information	N	Minimum	Maximum	Mean	Std. Deviation
Extension workers	87	1.00	5.00	3.5402	1.36232
Pesticide companies	87	1.00	5.00	3.9885	1.11537
Seed companies	87	1.00	5.00	2.3678	1.39029
Other farmers	87	1.00	5.00	3.0345	1.31581
Newspapers	87	1.00	5.00	2.3333	1.25445
Radio	87	1.00	5.00	2.3333	1.19754
TV	87	1.00	5.00	2.4828	1.28373
Valid N (list wise)	87				

As regard the impact of knowledge/skills about pest management (obtained from different sources) on crop yield, 93 per cent respondents agreed that knowledge of pest management helps in obtaining good crop yields. Response of 2 per cent respondents was indifferent whereas 5 per cent strongly disagreed with the majority (Table 21).

Table 27: Impact of improvement in knowledge of pesticides management on crop yield

Category	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	32	36.8	36.8	36.8
Agree	49	56.3	56.3	93.1
Indifferent	2	2.3	2.3	95.4
Strongly Disagree	4	4.6	4.6	100.0
Total	87	100.0	100.0	

10.5- Pest Management Methods

Integrated Pest Management (IPM) means practicing of all methods for controlling pests with minimum possible emphasis on chemical method. Other control methods were biological, physical and cultural.

10.5.1- Biological Control

Biological method of pest control is growing popularity in the world. In Syria, biological method of pest control was applied on 3,823 hectares by using egg parasiteoids: *Trichogramma chilonis*, and larval parasiteoids *Bracon brevicornis* (Nayef, 2008).

Biological control of cotton pests was used by about 7 per cent respondents only whereas 10 per cent respondents rarely listened about this method. Majority (83 per cent) of the respondents never listened/practiced the biological control.

The Punjab Agriculture Extension Department has setup six Biological Control Labs in different districts of the province. However, the survey indicates that extension services regarding biological control of insect pests were not being provided properly to the farming community.

Table 28: Pest management method (biological)

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Very Common	1	1.1	1.1	1.1
Common	2	2.3	2.3	3.4
Less Common	3	3.4	3.4	6.9
Rare	9	10.3	10.3	17.2
Never	72	82.8	82.8	100.0
Total	87	100.0	100.0	

About half of the respondents were familiar with beneficial insects whereas rest half did not aware about them (Table 29: Beneficial insects). There is great potential to enhance the knowledge and skills among the farming community about beneficial insects so that reliance on chemical control may be minimized.

Table 29: Beneficial insects

Information level	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	44	50.6	50.6	50.6
No	43	49.4	49.4	100.0
Total	87	100.0	100.0	

10.5.2- Physical Control

Physical insect pest control is most appropriate to control pink bollworm (PBW) in cotton. This includes destruction of flower rossets infested with PBW larvae and timely removal and destruction/burning of cotton sticks to kill the hibernating pupae of PBW.

According to survey, about 17 per cent respondents were of the view that physical control of pests was common for them whereas 15 per cent respondents rarely followed physical control of pests. About 68 per cent of the respondents never practiced physical control method for pest managementTable 30: Pest management method (physical)].

Table 30: Pest management method (physical)

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Very Common	1	1.1	1.1	1.1
Common	9	10.3	10.3	11.5
Less Common	5	5.7	5.7	17.2
Rare	13	14.9	14.9	32.2
Never	59	67.8	67.8	100.0
Total	87	100.0	100.0	

10.5.3- Chemical Control

Chemical control is considered the quickest method for insect pest management in Pakistan. About 99 per cent of the respondents used to practice chemical control method whereas only one per cent of the respondent rarely followed the chemical control. See Table 31: Pest management method (chemical).

Table 31: Pest management method (chemical)

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Very Common	76	87.4	87.4	87.4
Common	9	10.3	10.3	97.7
Less Common	1	1.1	1.1	98.9
Rare	1	1.1	1.1	100.0
Total	87	100.0	100.0	

10.5.3.1- Average Number of Sprays per Hectare

The data reveal that the minimum number of pesticide sprays was three per crop and was as high as 13 per crop during the year 2007. About 24 per cent of the respondents did eight sprays per hectare and was followed by 7 and 6 sprays per hectare by 17 and 13 per cent of the respondents, respectively (Table 32: Sprays per hectare during 20077). As per respondents, most of the time pesticide was applied against sucking insect pests. Bakhsh, Hassan and Maqbool (2005) in a study

found that one percent increase in expenditure relating to plant protection measures could result in increase in the yield of cotton by 0.244 percent. It implies that there is always temptation among the farmers to apply more pesticides with the expectation that yield will rise.

Table 32: Sprays per hectare during 2007

No. of sprays	Frequency	Percent	Valid Percent	Cumulative Percent
3	3	3.4	3.4	3.4
4	5	5.7	5.7	9.2
5	8	9.2	9.2	18.4
6	11	12.6	12.6	31.0
7	15	17.2	17.2	48.3
8	21	24.1	24.1	72.4
9	7	8.0	8.0	80.5
10	8	9.2	9.2	89.7
11	4	4.6	4.6	94.3
12	4	4.6	4.6	98.9
13	1	1.1	1.1	100.0
Total	87	100.0	100.0	

10.5.4- Issues in Pesticides

10.5.4.1- Deteriorating quality of pesticides

Quality pesticides are inevitable for effective and efficient control of insect pests and diseases. About 39 per cent of the respondents were satisfied with the quality of available pesticides whereas according to 40 per cent the quality was just okay (Table 33: Quality of pesticides). About 17 per cent of the respondents were not satisfied with the quality of pesticides and 3 per cent were highly unsatisfied.

Table 33: Quality of pesticides

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Highly satisfied	0	0.0	0.0	0.0
Satisfied	34	39.1	39.1	39.1
Just Okay	35	40.2	40.2	79.3
Not Satisfied	15	17.2	17.2	96.6
Highly Unsatisfied	3	3.4	3.4	100.0
Total	87	100.0	100.0	

10.5.4.2- Increasing number of sprays

Majority (about 77 per cent) of the respondents stated that number of pesticides to be used has been increasing whereas 17 per cent reported otherwise (Table 34: Number of pesticides increasing or decreasing). Only 6 per cent respondents stated that the number of pesticides remained the same. Farmers were of the view that use of pesticides against bollworms had been minimized due to introduction of Bt varieties, however, use of pesticides against sucking pests had increased significantly because Bt varieties were more susceptible to sucking pests as compared to conventional varieties.

Table 34: Number of pesticides increasing or decreasing

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Increasing	67	77.0	77.0	77.0
Decreasing	15	17.2	17.2	94.3
Same	5	5.7	5.7	100.0
Total	87	100.0	100.0	

10.5.4.3- Wastage of Pesticides during Application

As regards wastage of pesticides during application, about 60 per cent of the respondents were of the view that 11-20 percent of the pesticides were wasted (Table 35: How much pesticides are generally wasted during application?). Twenty five per cent of the respondents stated that pesticide wastage was less than 10 per cent and 15 per cent of the respondents informed about 21-40 per cent wastage of pesticides during application.

Table 35: How much pesticides are generally wasted during application?

Percent wastage	Frequency	Percent	Valid Percent	Cumulative Percent
<10%	22	25.3	25.3	25.3
11-20%	52	59.8	59.8	85.1
21-40%	13	14.9	14.9	100.0
Total	87	100.0	100.0	

10.5.5- Cultural Control

Cultural control involves timely ploughing up of cotton vacated fields to kill the diapausing population of ABW. About 61 per cent of the respondents adapted cultural control measures for pest management (Table 36: Pest management method (cultural)). However, 21 per cent of the respondents rarely did cultural control whereas 18 per cent never practiced cultural control methods.

Table 36: Pest management method (cultural)

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Very Common	5	5.7	5.7	5.7
Common	27	31.0	31.0	36.8
Less Common	21	24.1	24.1	60.9
Rare	18	20.7	20.7	81.6
Never	16	18.4	18.4	100.0
Total	87	100.0	100.0	

11.0- Fertility Management Practices

11.1- Awareness about the Techniques of Fertility Management

Techniques of fertility management include right fertilizer, right doze, right time and method of application of fertilizers. About 56 per cent of the respondents stated that they were quite familiar with the techniques of fertilizer management whereas 46 per cent replied otherwise (Table 37: Awareness about the techniques of fertility management).

Table 37: Awareness about the techniques of fertility management

Level of information	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	49	56.3	56.3	56.3
No	38	43.7	43.7	100.0
Total	87	100.0	100.0	

11.2- Sources of Information Related with Fertilizer

According to Survey, Agriculture Extension Department remained the main and leading sources of information for the farmers regarding fertilizers and their use. Extension workers attained the score of 3.46 on the scale of 5 (Table 38: Ranking of sources of information related with fertilizer). The second most utilized source of information was other farmers with a score of 2.98. Seed companies remained at the bottom with the score of 2.13. Role of mass communication was not acknowledged so much by the respondents and the score computed for newspapers, radio and TV was 2.21, 2.24 and 2.23 on the scale of 5, respectively.

Table 38: Ranking of sources of information related with fertilizer

Source of information	N	Minimum	Maximum	Mean	Std. Deviation
Extension workers	87	1.00	5.00	3.4598	1.31011
Pesticide companies	87	1.00	5.00	2.8046	1.48511
Seed companies	87	1.00	5.00	2.1264	1.26495
Other farmers	87	1.00	5.00	2.9770	1.22927
Newspapers	87	1.00	4.00	2.2069	1.05806
Radio	87	1.00	5.00	2.2414	1.15099
TV	87	1.00	5.00	2.2299	1.12788
Valid N (listwise)	87				

Government may take notice of low ranking of mass communication media and frequency and timing of agricultural programs need to be reviewed.

Regarding impact of knowledge in fertilizer management on crop yield, about 38 per cent of the respondents strongly agreed with it whereas 55 per cent agreed. However, 3 per cent did not agree with the majority (Table 39: Impact of knowledge in fertilizer on yield).

Table 39: Impact of knowledge in fertilizer on yield

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	33	37.9	37.9	37.9
Agree	48	55.2	55.2	93.1
Indifferet	2	2.3	2.3	95.4
Disagree	1	1.1	1.1	96.6
Strongly Disagree	3	3.4	3.4	100.0
Total	87	100.0	100.0	

11.3- Issues Reported with Fertilizer

11.3.1- Wastage of fertilizer during application

About 55 pr cent of the respondents stated that 11-20 per cent of the fertilizer is wasted during application whereas 30 per cent were of the view that fertilizer application losses were less than 10 per cent. About 11 per cent of the respondents estimated fertilizer losses in the range of 21-40 per cent during application (Table 40: Wastage of fertilizer during application).

Table 40: Wastage of fertilizer during application

Percent wastage	Frequency	Percent	Valid Percent	Cumulative Percent
<10%	26	29.9	29.9	29.9
11-20%	48	55.2	55.2	85.1
21-40%	10	11.5	11.5	96.6
41-60%	3	3.4	3.4	100.0
Total	87	100.0	100.0	

11.3.2- Quality of Fertilizer

Majority of the respondents showed reservation regarding quality of fertilizers available in the market. About 62 per cent of the respondents stated that quality of DAP was deteriorating whereas 31 per cent voted for improving quality of DAP (Table 41: Quality of DAP). About 7 per cent respondents stated that quality of fertilizers was being maintained at same level.

Table 41: Quality of DAP

Quality level	Frequency	Percent	Valid Percent	Cumulative Percent
Improving	27	31.0	31.0	31.0
Deteriorating	54	62.1	62.1	93.1
Same	6	6.9	6.9	100.0
Total	87	100.0	100.0	

Similarly 54 per cent of the respondents voted for deteriorating quality of urea while 32 per cent said that quality was improving. However, 14 per cent of respondents stated that quality of urea had been remained unchanged (Table 42: Quality of UREA).

Table 42: Quality of UREA

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Improving	28	32.2	32.2	32.2
Deteriorating	47	54.0	54.0	86.2
Same	12	13.8	13.8	100.0
Total	87	100.0	100.0	

11.4- Demand of the organic cotton:

There exists large potential for the demand of organic cotton in the International market. Organic cotton has some limitations. Constraint is not the demand but relates to economic factors especially the unit cost (ICAC, 2003). In several countries, production of organic cotton has significantly increased during recent years. For example, in Syria, area under organic cotton crop increased by about 200 percent in 2007 (28,851hactares) over previous year (9637 hectares) (Nayef, 2008). Production of organic cotton involves higher per unit cost of produce, which proves to be a disincentive for the producers. Every year, the Federal Government makes announcement of the support price for cotton. Same price is tagged with almost all kinds of cotton. There is no special price for the organic cotton. There exists great demand for organic cotton in the world, and world market is sensitive to the organic cotton. But there are missing market linkages in Pakistan. Therefore, it is proposed that while making announcement of the support prices for cotton, separate prices should be announced for the organic cotton.

12.0- Agronomic Practices

12.1- Satisfaction with Current Agronomic Practices

Agronomic practices in cotton crop include mainly but not limiting to seed rate, seed bed preparation, sowing time, fertilizer application time and method, irrigation scheduling, intercultural operations like rouging for maintaining optimum plant population density, weeding, picking time, etc. Only 5.7 per cent of the respondents were quite satisfied with their current agronomic practices whereas majority i.e. 57.5 per cent was satisfied with their crop management practices (Table 43: Satisfaction with current agronomic practices). About 31.0 per cent of the respondents stated that the existing agronomic practices were just ok and might be improved further. About 4.6 per cent were not satisfied with their crop management practices.

Table 43: Satisfaction with current agronomic practices

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Highly Satisfied	5	5.7	5.7	5.7
Satisfied	50	57.5	57.5	63.2
Just Okay	27	31.0	31.0	94.3
Not Satisfied	4	4.6	4.6	98.9
Highly Unsatisfied	1	1.1	1.1	100.0
Total	87	100.0	100.0	

12.2- Current Knowledge about Agronomic Practices

The respondent growers were interviewed to assess their knowledge level about the current agronomic practices. According to survey only 5.7 per cent respondent growers had very good command on knowledge about current recommended agronomic practices whereas 50.6 per cent fall in the category of good (Table 44: Current knowledge about current agronomic practices). Knowledge level of 36.8 per cent respondents was rated as just okay whereas 6.9 per cent respondents had very poor command on the recommended agronomic practices.

Table 44: Current knowledge about current agronomic practices

Level of knowledge	Frequency	Percent	Valid Percent	Cumulative Percent
Very good	5	5.7	5.7	5.7
Good	44	50.6	50.6	56.3
Just Okay	32	36.8	36.8	93.1
Poor	6	6.9	6.9	100.0
Total	87	100.0	100.0	

Above survey reveals that there is significant room to update the information of cotton growers regarding recommended agronomic practices. Hence, government may intervene to modify the existing extension methodology to enhance the knowledge and skills of the farmers. Moreover, the public private partnership can be strengthened to provide effective extension services to the cotton grower.

12.3- Sources of Information on Agronomic Practices

As regards effectiveness of the source of information providing knowledge about Agronomic practices to the cotton grower, the Extension worker excelled all other sources of information. According to survey mean score attain by Agriculture Extension Department was 3.71 against the maximum score of 5.0 and it was followed by other farmers in the neighbour who achieved the score of 3.29 (Table 45: Sources of information on agronomic practices).

The private sector i.e. Pesticide Companies and Seed Companies maintained the mean score of 2.72 and 2.30, respectively. However, it was debatable that role of mass media was not much acknowledge by the respondents. The mean score attained by newspaper, radio and TV were 2.46, 2.46 and 2.39, respectively.

Table 45: Sources of information on agronomic practices

Source of information	N	Minimum	Maximum	Mean	Std. Deviation
Extension workers	87	1.00	5.00	3.7126	1.19015
Pesticide companies	87	1.00	5.00	2.7241	1.49953
Seed companies	87	1.00	5.00	2.2989	1.39863
Other farmers	87	1.00	5.00	3.2874	1.11968
Newspapers	87	1.00	5.00	2.4598	1.27411
Radio	87	1.00	5.00	2.4598	1.23707
TV	87	1.00	5.00	2.3908	1.15493
Valid N (listwise)	87				

Above statistics reveal that ICTs should be utilized as source of knowledge and information because it will be more effective in terms of information as well as cost.

13.0- Extension Services

There is an established network of extension services in the country. The only need area is the improvement in quality of services. According to survey about 41.4 per cent of the respondent growers acknowledged the usefulness of Agriculture Extension and stated that either the department was providing required information to them or they used to get information from the Extension Worker (Table 46: Are you getting information from Extension Services?). However, majority (58.6 per cent) stated otherwise that they were not getting information from the existing extension services. Agriculture Department Punjab should look into the matter and address the weak linkages in their extension system which may be of administrative or technical nature.

Table 46: Are you getting information from Extension Services?

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	36	41.4	41.4	41.4
No	51	58.6	58.6	100.0
Total	87	100.0	100.0	

14.0- Current Training and Development Practices

Training is considered as a key tool for human resource development in any field. Farming community was asked about their participation in farmer training program mainly conducted by Agriculture Extension. Only 29.9 per cent of the respondents stated that they attended the training in the past (Table 47: Did you attend any training?). Contrarily majority of the respondents (70.1 per cent) asserted that they never attended any training.

Table 47: Did you attend any training?

Participation in training	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	26	29.9	29.9	29.9
No	61	70.1	70.1	100.0
Total	87	100.0	100.0	

Above situation reveals a big question mark on the years' long performance of Agriculture Extension. Cotton grower is considered as the most active farmer with maximum awareness about crop production technology because of strong links with Agriculture Extension. If majority of the cotton grower has not participated in the training program what will be the situation of other growers. There is a need to make farmers training program more attractive, informative and effective.

According to the survey all the growers emphasized that they should be trained in every area that is quality seed production, seed health, fertility management and pesticide application, water management, farm management marketing techniques and overall cotton production technology. Mean score for training required in each area ranged between 4.33 to 4.55 except inventory management with mean score of 3.91 against the maximum score of 5.00 (Table 48: Training needs in different areas).

Table 48: Training needs in different areas

Training need	N	Minimum	Maximum	Mean	Std. Deviation
Seed production	87	2.00	5.00	4.5517	.72751
Fertility Management	87	2.00	5.00	4.3908	.91951
Pesticide Application	87	2.00	5.00	4.4828	.84719
Water Management	87	2.00	5.00	4.4138	.89640
Farm Management	87	2.00	5.00	4.4023	.86884
Cotton Production Technology	87	2.00	5.00	4.4598	.84640
Marketing Management	87	2.00	5.00	4.3333	1.00772
Inventory Management	87	2.00	5.00	3.9080	1.29966
Valid N (listwise)	87				

Above data reveal that every farmer is willing to know about the advanced crop production technology, high rated crop management practices, marketing techniques to earn maximum profit from per unit area. Actually, Agriculture Department has been emphasizing on scale neutral technologies which are either impracticable for small farmers or does not give maximum output under all agro-climatic conditions. We shall have to go for different technologies for small, medium and large growers keeping in view the agro-ecological conditions. Above interventions may make the training programs more effective and informative for all type of growers.

Harvesting and Picking of Cotton

Pakistan's raw cotton and its made ups are not realizing their due share and prices in the international market owing to factor of contamination. Studies showed that we are fetching 4 to 6 cents per pound less than the international market rates causing loss of over $ 2 billion per annum to the country. The extent of contamination in our cotton is in the range of approximately 20 grams per bale which comprises jute (12 percent), polypropylene (2.8 percent) etc. (See Table 49: Contamination of cotton).

Table 49: Contamination of cotton

Contaminant	Extent (gm/bale)
Jute	12.00
Polypropylene	2.80
Polyethylene	1.78
Coloured cloth	0.80
others	2.62
Total	20.00

14.1- Satisfaction with Cotton Yield

Only 8.0 per cent of the respondents showed their high satisfaction about obtaining good cotton yield whereas 29.9 per cent stated that they were satisfied with the prevailing yield of seed cotton (Table 50: Are you satisfied with yield of cotton?). About 24.1 per cent of the respondents

commented the existing yield as just okay whereas 36.8 per cent were not satisfied with the prevailing cotton yield only 1.1 per cent was highly unsatisfied with their achievement.

Table 50: Are you satisfied with yield of cotton?

Farmer's perception	Frequency	Percent	Valid Percent	Cumulative Percent
Highly Satisfied	7	8.0	8.0	8.0
Satisfied	26	29.9	29.9	37.9
Just Okay	21	24.1	24.1	62.1
Not Satisfied	32	36.8	36.8	98.9
Highly Unsatisfied	1	1.1	1.1	100.0
Total	87	100.0	100.0	

14.2- Satisfaction with Quality of Cotton Produce

As regarding quality of cotton, only 9.2 per cent of the respondents were highly satisfied with the quality of cotton produced by them Table 51: Are you satisfied with quality of cotton you produce? Similarly about 34.5 per cent of the respondents showed satisfaction about the quality of their produce.

However, 43.7 per cent of the respondents termed the quality of produce as just okay whereas 12.6 per cent were not satisfied with the quality of seed cotton.

Table 51: Are you satisfied with quality of cotton you produce?

Quality of cotton	Frequency	Percent	Valid Percent	Cumulative Percent
Highly Satisfied	8	9.2	9.2	9.2
Satisfied	30	34.5	34.5	43.7
Just Okay	38	43.7	43.7	87.4
Not Satisfied	11	12.6	12.6	100.0
Total	87	100.0	100.0	

Punjab Agriculture Department has set minimum criteria for the approval of new varieties of cotton, which include Ginning Out Turn (GOT) not less than 38%, staple length not less than 27mm, micronaire not more than 4.8, strength 95,000 psi, uniformity ratio not less than 48 and boll size not less than 4gm (Government of Pakistan, 2005, p. 13).

14.3- Labour for Cotton Picking

Trained and skilled labour not only picks the cotton efficiently but also helps in maintaining the quality and cleanliness of the produce. Mostly the cotton is picked by village women in Pakistan. According to the conducted survey about 26.9 per cent of the respondents stated that they used trained labour for cotton picking whereas 73.1 per cent respondents were of the view that the labour for cotton picking was untrained. See Table52: Did you use trained labour for picking cotton?

Female cotton pickers cleaning cotton on roadside

Table 52: Did you use the trained labour for picking cotton?

Trained labour	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	24	26.9	26.9	26.9
No	63	73.1	73.1	100.0
Total	87	100.0	100.0	

14.4- Proper Dress for Cotton Pickers

Almost all the respondents (99 per cent) stated that cotton pickers did not wear proper dress i.e. proper covering of head by cotton pickers, cotton dress etc., to avoid contamination of cotton with hair other than cotton fibre or closed fibre (Table 53: Do the pickers wear proper dress for picking cotton?).

Table 53: Do the pickers wear proper dress for picking cotton?

Proper dress	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	1	1.1	1.1	1.1
No	86	98.9	98.9	100.0
Total	87	100.0	100.0	

14.5- Cotton Picking Time

Picking of cotton is an important phase of cotton production as it significantly affects cotton quality and cleanliness. Cotton contamination usually starts from picking stage.

It is recommended that picking should be started when dew water has been evaporated after about two hours of sunrise. According to survey about 9.2 per cent of the respondents start picking of cotton even before sunrise whereas only 1.1 per cent go on with the sunrise (Table 54: Generally when do you start picking cotton?). About 27.6 per cent of the respondents wait for one hour after sunrise to start cotton picking and 29.9 per cent start picking after two hours of sunrise. Percentage of respondents who start picking after 3 hours of sunrise was also substantial (29.9 per cent).

Table 54: Generally when do you start picking cotton?

Picking time	Frequency	Percent	Valid Percent	Cumulative percent
Before Sun rise	8	9.2	9.2	9.2
With sunrise	1	1.1	1.1	10.3
One Hour after sunrise	24	27.6	27.6	37.9
Two hour after sunrise	26	29.9	29.9	67.8
Three hours after sunrise	26	29.9	29.9	97.7
Other	2	2.3	2.3	100.0
Total	87	100.0	100.0	

14.6- Cotton Stocking Place after Picking

Cotton moisture and cleanliness is affected by the place where it is stocked just after picking. About 27.3 per cent of the respondents started that their cotton was stocked at wet place inside or along the water course whereas 70.4 per cent respondent stocked the picked cotton at dry place (Table 55: During picking where is cotton stocked?). Only 2.3 per cent of the respondents followed the recommended the practice and piled the picked cotton on a plastic sheet. Above statistics clearly reveal that cotton cleanliness and quality is not properly considered by the grower at farm level.

Extensive education of the cotton farmers along with certain legislative measures may help to improve the prevailing situation.

Table 55: During picking where is cotton stocked?

Stocking place	Frequency	Percent	Valid Percent	Cumulative Percent
In the wet place	2	27.3	27.3	27.3
In the dry place	83	70.4	70.4	97.7
On plastic sheet	2	2.3	2.3	100.0
Total	87	100.0	100.0	

14.7- Storage of Seed Cotton

Each and every cotton variety has specific characteristics regarding ginning out turn (GOT), staple length etc. mostly farmer grow more than one variety as per recommendations of Agriculture Department. Hence, storage of cotton produce may play an important role in keeping the cotton varieties separately for ginning purpose. According to survey, about 73.2 per cent of the respondents used to keep the produce of all varieties in one pool whereas only 24.5 per cent used to maintain separate pool for each variety (Table 56: How do you stock cotton produce?). About 2.3 per cent of the respondents stated that they followed both the above practices.

Table 56: How do you stock cotton produce?

Variety pool	Frequency	Percent	Valid Percent	Cumulative Percent
All Varieties in one pool	48	73.2	73.2	73.2
Separate pool for each variety	37	24.5	24.5	97.7
Both	2	2.3	2.3	100.0
Total	87	100.0	100.0	

Above situation is not a healthy sign for our textile and garment, industry. Admixture of varieties is prohibited under the Cotton Control Ordinance; however, there is big question mark about enforcement of the law. Concerned Government Authorities may look into the matter and corrective measures may be taken accordingly. Moreover, payment of premium to the growers to maintain separate pool for each variety may help to motivate them. Expertise at ginning factory level is also required for identification of variety.

14.8- Wages for Cotton Picking

In Pakistan, wages to cotton pickers are mainly paid in terms of cash or in kind. About 85.3 per cent of respondents stated that they gave wages in terms of cash whereas 15 per cent paid the wages in terms of kind i.e. seed cotton (Table 57: How do you reward cotton pickers?). It was further observed that about 50 per cent of the respondents paid wages on weekly basis whereas rest of respondents paid on sale of cotton produce.

Table 57: How do you reward cotton pickers?

Picking wages	Frequency	Percent	Valid Percent	Cumulative Percent
in cash	78	85.3	85.3	85.3
In Kind	9	14.7	14.7	100.0
Total	87	100.0	100.0	

14.9- Final Storage Conditions

Storage of seed cotton after picking is an important phase to determine the quality of lint. Only 26.4 per cent of the respondents finally stored their cotton produce inside the room whereas 73.6 per cent had to stock their seed cotton in open space (Table 58: Where cotton is finally stocked?).

Table 58: Where cotton is finally stocked?

Final stock	Frequency	Percent	Valid Percent	Cumulative Percent
Inside room	23	26.4	26.4	26.4
Outside room	64	73.6	73.6	100.0
Total	87	100.0	100.0	

As regards condition of the final storage place mostly (97.7 per cent respondents) the seed cotton was stocked at dry place whereas only 2.3 per cent had to stock cotton in dry place (Table 59: Where cotton is finally stocked?).

Above statistics reveal that generally the storage facilities at farm level were inadequate and were not properly looked into by the grower. Government may improve the situation by giving incentive/premium to the cotton growers.

Table 59: Where cotton is finally stocked?

Stocking place	Frequency	Percent	Valid Percent	Cumulative Percent
In the wet place	2	2.3	2.3	2.3
In the dry place	85	97.7	97.7	100.0
Total	87	100.0	100.0	

15.0- Marketing

According to the conducted survey, about 64 per cent of the respondents used to sell their produce to the middle man known as village beopary whereas 3.4 per cent respondents soled seed cotton to the agent of a ginning factory (Table 60: To whom do you sell cotton?). About 27.6 per cent utilized the opportunity of Agricultural Markets to sell their produce whereas only 4.6 per cent respondents sold their produce directly to ginning factory.

Selling & buying cotton by farmer and middle man

Table 60: To whom do you sell cotton?

Cotton marketing	Frequency	Percent	Valid Percent	Cumulative Percent
Village beopary	56	64.4	64.4	64.4
Agent of a ginning factory	3	3.4	3.4	67.8
Ginning factory	4	4.6	4.6	72.4
Others	24	27.6	27.6	100.0
Total	87	100.0	100.0	

Above statistics reveal that due to very loose marketing system, the farmer can't get the premium price for quality and clean cotton. Their must be direct marketing relationship between the cotton grower and the ginner/authorized agent of the ginner so that the producer may get full benefit of his produce. In this regard, government may intervene and ask cotton ginners to purchase directly from the grower by appointing significant number of authorized agents in the area.

15.1- Last Year Cotton Prices

Accordingly to survey lot of variation was observed regarding the price fetched by cotton growers during last year. About 6.9 per cent of the respondents got the maximum price i.e., above Rs.1500 per 40 kg of seed cotton whereas 25.3 per cent of the respondents sold their produce between the range of Rs.1301 to Rs.1500 per 40 kg (Table 61: At what price did you sell cotton last year?) About 43.7 per cent of the respondents got Rs.1101 to Rs.1300 per 40 kg of their produce whereas 21.8 per cent fetched Rs. 901 to Rs.1100. only 2.3 per cent respondents sold their produce up to Rs.900 per 40 kg (Table 61: At what price did you sell cotton last year?).

Variation in cotton produce was mainly affected by the market channel available to the grower. An efficient market system is the solution to minimize the above variation. Actually the market committees are not working according to their mandate and those should be overhauled to improve the prevailing situation.

Table 61: At what price did you sell cotton last year?

Price (Rs/40kg)	Frequency	Percent	Valid Percent	Cumulative Percent
Upto Rs. 900	2	2.3	2.3	2.3
Rs. 901 – 1100	19	21.8	21.8	24.1
Rs. 1101 – 1300	38	43.7	43.7	67.8
Rs. 1301 – 1500	22	25.3	25.3	93.1
Above Rs. 1500	6	6.9	6.9	100.0
Total	87	100.0	100.0	

16.0- Institutional linkages

16.1- Satisfaction with Services of Government Departments

In Pakistan dissemination of information and provision of services relating to Agriculture is mainly considered the responsibility of public sector organizations. According to survey, Agriculture Extension Department was ranked at the top by the respondents and it attained the score of 3.18 against the maximum score of 5. It was followed by Plant Protection Department and Irrigation Department who got same score of 3.05. Services of Agricultural Research were recognized at the bottom at it obtained the score of 2.84 (Table 62: Satisfaction with services of government departments).

Table 62: Satisfaction with services of government departments

Govt. departments	N	Minimum	Maximum	Mean	Std. Deviation
Extension Department	87	1.00	5.00	3.1839	1.12610
Plant Protection Department	87	1.00	5.00	3.0471	1.28087
Irrigation Department	87	1.00	5.00	3.0471	1.25267
Agricultural Research	87	1.00	5.00	2.8415	1.30969

Nevertheless, above statistics reveal that cotton growers are not highly satisfied with the services of all the four public sector organizations. Government authorities may look into their current service provision approaches and modify those as per farmer's need or need of the time.

16.2- Membership of Farmers Association

Farming community in Pakistan may be rated as the most unorganized group of people. Resultantly, they are derived of their rights most of the time.

According to survey, 97.7 per cent of the respondents were not member of any forum representing farming community. Only 2.3 per cent respondents had membership of a farmers association (Table 6347: Are you member of any farmers' association). Farmers will have to think upon the above issue seriously. If the farming community succeeds to establish an association with real representation of farmers, nobody will be able to snatch their rights whether Government or Industrialist.

Table 6347: Are you member of any farmers' association

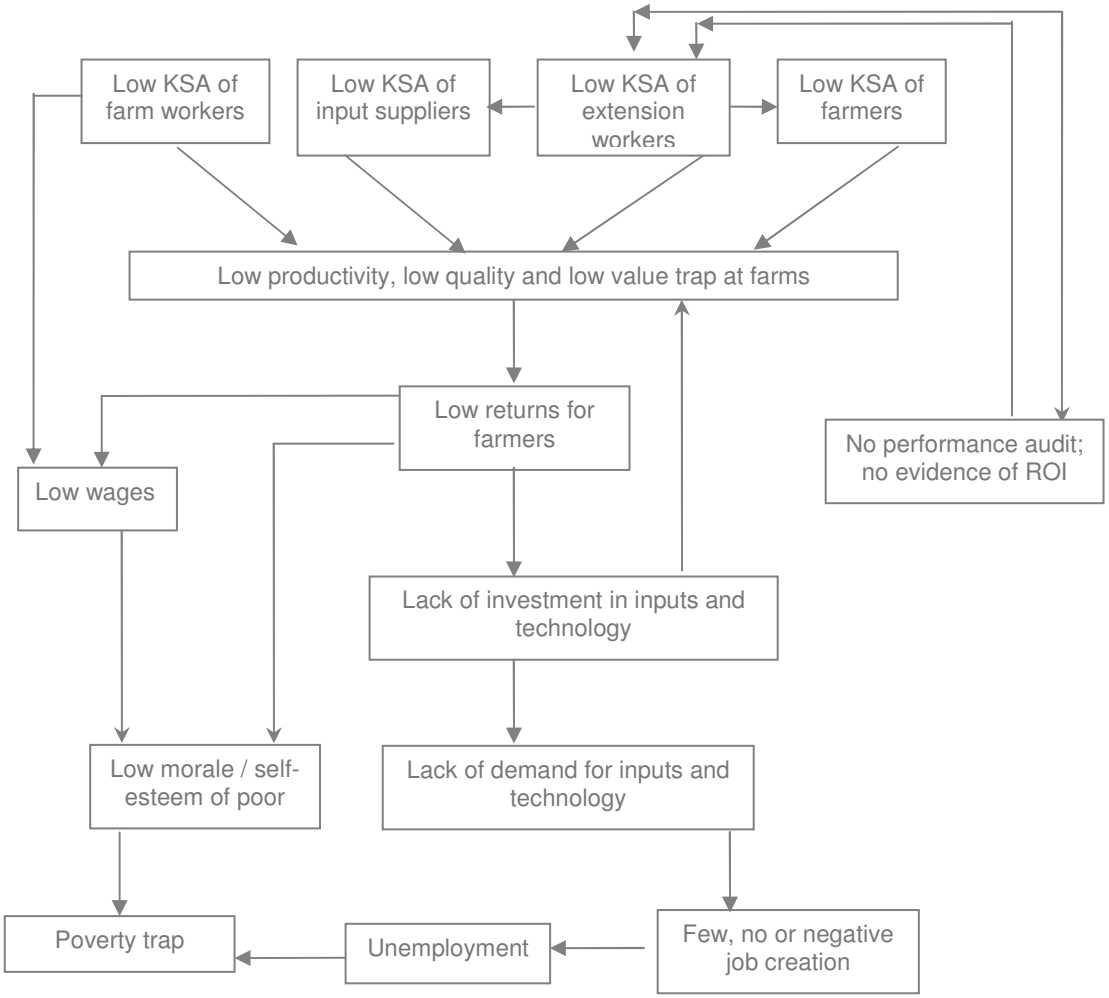
Membership	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	2	2.3	2.3	2.3
No	85	97.7	97.7	100.0
Total	87	100.0	100.0	

17.0- Skill Gaps and Linkages with Poverty

17.1- Skills gaps and linkages with poverty/livelihood

Improvement in knowledge, skills and attitude (KSAs) is a pre-requisite for continuous improvement in the cotton farming system, poverty alleviation, and human development. Low level of KSAs result in low productivity, and low quality, so farming system gets into low-value trap. Eventually, farmers get low returns, who then neither have capability and nor the incentive to invest in technological up-gradation of the cotton farming system. Details of linkages are given in Fig. 5: Skill gaps and linkages with poverty and livelihood. Major skill gaps in the CPS, as identified by this study, are discussed in details along with suggestions in next Section i.e.17.2: Skill Gaps.

Figure 5: Skill gaps and linkages with poverty and livelihood



17.2- Skill Gaps

There are several areas in cotton farming system, where there are evident skills gaps. Following sub-sections briefly discuss skill gaps related with these areas:

17.2.1- Poor Agronomic Practices:

The study shows that farmers had limited capacity in good crop stand establishment. They lack awareness and agro-professionalism (Hassan, 2007). One of the reasons for this weakness may be the limited knowledge and skills on good agricultural practices. As discussed in Section 7.6, the Government should evolve both long term and short term strategies for the capacity building of farmers. Focus of long term strategies should be on improvement of knowledge and skills in the integrated crop management. As a short term strategy, a result-oriented campaign should be launched for the capacity building of farmers in good agricultural practices in cotton management. The impact evaluation exercises should be undertaken periodically to examine, whether interventions have produced desired impact or not.

17.2.2- Lack of Skills in Quality Seed Production:

There is shortage of good quality, high-yielding, insect and pests resistant varieties of seeds. As discussed in Section 8.1, only 12.6 per cent of the respondent farmers were quite satisfied with the quality of seed whereas 47.1 per cent of the respondents showed satisfaction with the quality of seed (Table 11: Satisfaction with quality of seed). Moreover, this study has also found that around 20 percent of the seed is wasted during the process of germination (see Table 18: Seed wasted during germination). Wastage is mainly attributed to two factors i.e. poor quality of seed, poor practice of sowing practices. As discussed in Section 8.5, treatment of seed is required before sowing to protect the crop from infestation of sucking insect pests at early sage. The survey found that only one fifth of the respondents did follow such practice during the sowing of current crop. Majority of the farmers buy the cotton seed from the seed companies or fellow farmers. Quality seed production at farm level is concern of high priority. The farmers had limited or no skills of quality seed production at their own farm. Good seed initiatives could contribute in managing the quality seed issue at farm.

17.2.3- Poor Pest and Diseases Management Practices:

Pests and diseases have proven to be the major constraint in production of cotton in Pakistan. Cotton leaf curl virus (CLCV) out broke in early 1990s and badly impacted the yield of cotton. Increasing intensity of insects and pests attack is one of the major constraints in the production of cotton in the country (Hassan, 2007). Cotton mealy bug has emerged a devastating pest during the last couple of years. Furthermore, unfavourable weather conditions increase incidence of pest attack in the early growth of the crop as well as at the time of flowering and boll formation, reduce the number of bolls and weight and raise weed intensity. (Hassan, 2007)

Number of sprays on cotton crop is showing an increasing trend. It increased from maximum of two in 1988 to 11 in 2001 (Khan et al, 2002). Similarly, according to CCRI (2007, p. 4) average number of sprays on 2006 crop was higher than that on previous year crop. Maximum number of sprays applied on the latest crop was 12 sprays in case of Multan district, 11 in districts of Bahawalnagar and D.G. Khan, and 10 in Lodhran, Khanewal, Vehari, Sahiwal, Pakpattan, Bahawalpur, Muzuffargarh and Toba Tek Singh.

This study has also found almost similar results i.e. number of pesticides sprays range from 3 to 13 in a crop. See Table 32: Sprays per hectare during 2007. These trends show that resistance of existing cotton varieties have eroded away. This phenomenon has also lead to escalation in cost of cotton production (Iqbal & Ahmad, 2007), and dwindled the competitiveness of Pakistani cotton in the international market.

Results of this survey show that farmers heavily rely only on the chemical method of pest control. See Section10.5. Therefore, farmers need proper training in understanding the agro ecosystem of the cotton and the role of beneficial in managing the insect pests. Moreover, they should also be given training in proper selection of cotton variety to avoid the attack of insect pests and diseases.

17.2.4- Poor Soil Health Management:

Cotton farmers heavily depend on the use of chemical fertilizer with a perception to enhance their crop yield in Pakistan. This immoderate use of chemical fertilizers had increased the cost of cultivation by leaps and bounds, which thus reduced the profit margins and had caused deterioration of soil health, resulting in reduction of yield. The soil health depends on the physical as well as the biological environment. Failure to manage soil health effectively can degrade soil biological functions; causing far reaching consequences. Poor quality soils are less able to retain chemicals such as pesticides, nutrients and fertilizers. About 97 percent of farmers had no knowledge and skills of managing the soil health issues. This study has also found that farmers have poor knowledge about the need of soil analysis.

17.2.5- Lack of Skills in Integrated Water Management:

During recent years, Pakistan has faced severe problem relating to deficiency of irrigation water (Hassan, 2007). This study has also found inadequacy of water. See Sections 9. Average annual rainfall in the cotton belt in Pakistan ranges from just 12 mm (in Sind Province) to 21 mm (in Punjab Province), as compared to 500 mm in Mainland China, 851 mm in North East of Argentina, 550 mm in Brazil, 220 in India and 1400 mm in Paraguay (Gruere, 2006). So this situation calls for even more

efficient use of ground and canal water. It is also a source of concern that average yields in Pakistan lags well behind average irrigated yields and even rain-fed yields in some countries Gruere, 2006).

Australia has made significant achievement on this front. Australian farmers work closely with universities, cooperative research centres, government departments and consultants to maximize water use efficiency (Cotton Australia, 2006). Pakistan uses around 4914 m3 water to produce one tonne of cotton where Australia uses 2278 m3 water to produce same quantity of cotton (Chapagain, et al, 2005, p. 15). So lessons can be learnt from the practices of Australia.

Farmers in the country use to scheduled irrigation (Wara Bandi- a weekly turn system) for cotton crop regardless the water requirement of the crop. Furthermore, the cotton planting in flat field worsen the situation, by consuming 30-35% more water as compared to bed/furrow planting method. There is need to build the capacity of farmers in implementing the integrated water management strategies in cotton production.

17.2.6- Poor Harvest and Post-harvest Management practices:

Pakistani cotton products are labelled as low quality and low priced products (NPO, 2003). Generally raw cotton in Pakistan contains more than 8% trash (Rehman, 1996). Trash in US cotton varies from 0.31% to 0.78% (average less than 0.40%). Siddiqui (ud, p. 113) has pointed out existence of high impurity content and high counts trash and moisture in Pakistan, which result in poor ranking as per international standards.

Eventually, Pakistan fetches much lower returns than what can be achieved (Iqbal & Ahmad, 2007). Hassan (2007) estimates that Pakistani cotton suffers loss of around 10-15 percent in value, equivalent to around $350 million per annum, which is attributed to:

1. Poor quality
2. Improper picking methods,
3. Adulteration of cotton with water and other material,
4. Mixed grades and seed varieties and
5. Improper packing, storage and transportation means.

Improper picking method is mainly due to two factors i.e. lack of incentives for quality, and lack of training of the cotton pickers. Payment is generally made to the pickers on the basis of weight, which offers least incentive to them to pick carefully and present cotton free of contaminations. In countries like Australia, farmers are paid according to the quality of cotton (Cotton Australia, 2006). Farmers in Pakistan would have to encourage adopting such practices so as to improve quality of cotton produced in the country. Besides, proper training of cotton pickers should also be arranged.

Adulteration with water and other material is due to improper ways of storing the cotton. There is a temptation to stock cotton piles in wet places so that its weight increases.

Mixing of varieties is due to the fact that a farmer in Pakistan generally is in a temptation of cultivating two or more than two varieties in different fields so as to minimize the risk. Eventually, at the time of picking, mixing of cotton of different varieties is very common practice among the farmers. This practice badly impacts the quality of their produce.

Above discussion leads to the conclusion that there are several areas, where skill gaps exist. Therefore, farmers should be given training in proper harvest and post harvest management.

17.2.7- Unorganized Farming Community:

There is uneven situation of the influence of various players on the Government policies. For example, yarn manufactures have developed into a powerful lobby which has the potential to influence the government policies (Banuri, 1998, p. 3). On the other hand, cotton producers, especially, small farmers are weak in strength on this account. It is generally believed that spinners exploit ginners, who in turn exploit farmers. Cotton producers may be facilitated to form associations at district, provincial and federal levels. Once the associations are formed, their capacity building would be needed in how to participate in policy dialog. These associations would also be used as instrument for capacity building of farmers in a bid to improve cotton production and marketing practices.

Small farmers in particular are poorly organized. This survey has revealed that only 2.3 per cent respondents had membership of a farmers association (Table 6347: Are you member of any

farmers' association). See Section 16.2. They have weak social networking among themselves. Eventually, on one hand, they are unable to influence the Government Policies and the markets and on other hand sharing of information among them is poor. It is therefore, proposed that small farmers should also be organized into groups on similar patterns. These groups should not only provide a platform to the small farmers to raise their voices and provide a mechanism of information sharing among the small farmers aiming at improvement in their knowledge and skills in cotton production practices.

17.2.9- Poor Marketing Skills:

Farmers lack skills of marketing their products. Resultantly, they resort to adulteration, mixing of varieties, etc. to gain more returns. This is another skill gap where farmers need training. There is need to develop a proper marketing information system as well.

18.0- Other Issues and Recommendations

Other issues related with cotton value chain have been divided into three categories. They include low yield, low prices and poor quality. Following sub-sections briefly discuss issues related with these areas and contain recommendations:

18.1- Low yield

Cotton yield in Pakistan is comparatively at lower end. Cotton yield in China is 111 percent higher than that in Pakistan. See Sections 4.2. Average yield in Pakistan is low owing to the skill gaps discussed below:

18.1.1- Poor Institutional Linkages:

There are poor linkages among the agricultural universities, research institutions, extension service providers and the farmers, in Pakistan to facilitate the farming community on up-to-date cotton management knowledge and information. Owing to weak linkages, productivity is not experiencing significant improvement. In countries like Australia, farmers have established strong linkages with universities, cooperative research centres, government departments, and industry. There is need to establish a backup support information system on quality seed, insect pests and diseases management, soil health issues management, harvest and post-harvest management, marketing information etc.

18.1.2- Research and Development

Continuous research work to evolve new/better varieties is pre-requisite for increasing the crop productivity on sustainable basis. Cotton growers are always looking for new varieties to obtain maximum yield with relatively less susceptibility to insect pests and diseases.

Owing to weak Research and development (R&D) system, Pakistan has not been able to bring any big breakthrough in the yield of cotton during last two decades. Moreover, performance audit of the research institutes has never been carried out. On the other hand, the competitors of Pakistan are investing huge resources on developing innovative technologies so as to produce cost effective, efficient and innovative cotton and textile products. For example, Indian Council of Agriculture Research and Department of Biotechnology (ICARDB) have assigned the task of developing transgenic cotton varieties to CICR, Nagpur, NRCPB, New Delhi, NBRI, Lucknow, ICGEB, New Delhi and UAS, Dharwad (Khadi, 2008). Similarly, Australia is working on several issues including Bt seed, and developing drought resistant, flame resistant and wrinkle-free cotton varieties (Cotton Australia, 2007b).

Pakistan would have to transform the research institutes to more proactive, efficient and cost effective organizations. This will require regular exercises of performance audit of the research institutions in the country. Moreover, it would be needed to evolve a sustainable source of funding for the research activities. It is proposed that a compulsory tax (may be labeled as cotton tax) should be imposed on the growers initially at the rate of Rs. 10 per 40 kg, that can fetch around Rs. 500 million per annum. Later stages, it can be gradually increased to Rs. 50 per 40 kg. Similar levy is in practice in Australia at the rate of AUS$ 2.25 / bale (Cotton Australia, 2007b). It is further proposed that Central Cotton Research Institute should be upgraded into Cotton and Textile Research Institute

(CTRI), and should be assigned the role of research and development relating to all the sectors of cotton, textile and clothing. The revenue collected under Cotton Tax may be given to the CTRI for meeting the funding requirements of the research. Proposed CTRI should have strong linkages and partnership programmes with other related institutions as well like University of Agriculture Faisalabad, Textile University, farmers and industry (Rehman & Ali, 2008, p. 9).

It is strength of the farming system in Pakistan that there is high level of adoptability among farmers. For example, CIM 496 variety had negligible share in the total area under cotton crop in Punjab, in 2003-04, but increased its share to 12.15 percent in 2004-05, and 32.03 percent in 2005-06 and finally in the year 2006-07 it was grown on 42.90 percent of the area. Share of neither of other varieties is in double digit (CCRI, 2007, p. 3)

18.1.3- Extension Network:

Pakistan has a well-established network exist for extension services but it lacks effectiveness and impact. Around 60 percent of the respondents did not avail any service from the Extension Department. See Section 13. Extension Department needs to be transformed into a proactive and results oriented service provider. Billions of rupees are spent on running the extension departments in the provinces. Alone, in Punjab Province total budget of the Agriculture, Food, Irrigation, Forestry & Fishing for the year 2008-09 has been estimated at Rs. 30.44 Billion (Government of Punjab, 2008, p. 22). However, there is hardly any evidence on the impact of the extension services provided by these departments. As suggested in Section 7.6 (

7.6- Relationship between Yield of Cotton and Level of Farmers' **Education**), extension programmes should be periodically evaluated to examine, whether such interventions have produced desired impact or not. The extension workers should be asked to demonstrate acceptable Returns on Investment (ROI).

18.1.4- Timely Availability of and adulteration in pesticides and fertilizers:

Adulterations in pesticides, fertilizers and seeds (Hassan, 2007) are also becoming important constraints in increasing the yield. This study has also identified issues related with adulteration of fertilizers and pesticides. See Section 11.3.2 and Section10.5.4.1. Moreover, timely availability of fertilizers remains a challenge, which results in delayed application of fertilizer. Eventually, yield of cotton crop suffers.

18.1.5- Rising Cost of Production

Rising Cost of Inputs: Increasing prices of agricultural inputs like seeds, fertilizers, pesticides, (Hassan, 2007), diesel, electricity etc. are continuously resulting in the escalation of the cost of production.

18.2- Poor Quality of cotton:

18.2.1- Lack of standards:

In USA, United States Cotton Futures Act of 1914 lead to the establishment of physical standards of cotton, on the parameters of colour grade, staple length and strength, and other qualities and properties (UNCTAD, 2005d). Existing standards of cotton in USA are available at http://www.ams.usda.gov/standards/cvrstd1.pdf. In Pakistan, it was as late as 1990s, when standards for cotton were developed. They still lack enforcement. Lack of enforcement is primarily due to governance issues.

18.2.2- Enforcement of cotton standards:

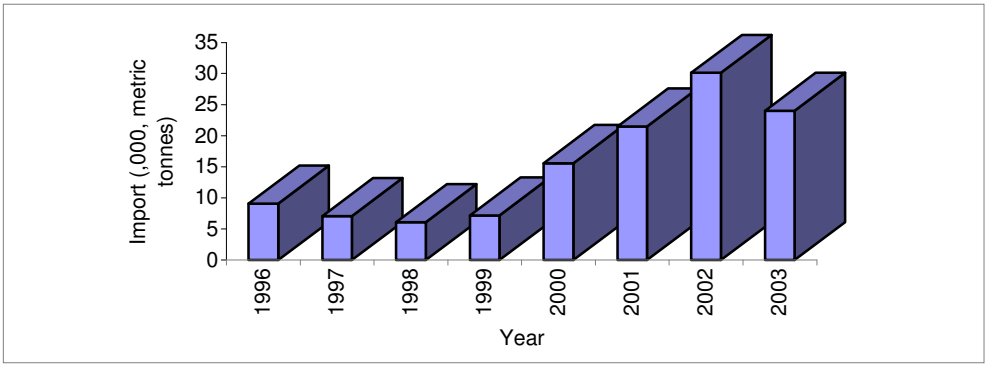
Government should evolve a comprehensive strategy for the enforcement of standards. Enforcement should begin right from the farm level. Farmers should be discouraged for mixing varieties, adding contaminations, selection of inappropriate timings for picking, storing cotton in sunny, dirty and wet places. For this purpose, a campaign would have to be launched to create awareness among the farmers and to build up their capacity in handling the produce in an appropriate way. Classification of cotton should be done at farm level and fixation of prices should

be done according to class / category. Unless, there is provision of premium for quality cotton, farmers will have least incentive to improve their practices.

18.2.3- Fibre Length:

Bulk of Pakistani cotton is of small fibre length and is generally suitable for low-to-medium sized count cotton yarn. Pakistan is not among the top ten extra-fine cotton producing. However, import of extra-fine cotton has gradually risen in recent years in Pakistan, which implies that market of extra-fine cotton is growing fast in the country, though; volume of imports by Pakistan remained far behind the India (Townsend, 2004). See Figure 6: Import of extra-fine cotton in Pakistan.

Figure 6: Import of extra-fine cotton in Pakistan



Data Source: Townsend (2004)

18.3- Low prices

18.3.1- Time for Announcement of Support Price

Support price for cotton is generally announced when crop has already been grown and is near the point of maturity, eventually, support prices hardly proves beneficial in term of the efforts of farmers in increasing either yield or bringing more area under the crop. It is proposed that support price should be announced about one month before the time of sowing of cotton.

18.3.2- Support price for the organic cotton

As discussed in Section 11.4, there are no incentives for the farmers to produce organic cotton; it is therefore proposed that a premium on support price should be announced for the organic cotton. Initially, there may be reluctance on the part of ginners, in procurement of organic cotton on price-with-premium. It is further proposed that the Government should take the responsibility of buying all organic cotton if the private sector does not come forward. However, later when market linkages are established, then the Government procuring agencies should gradually withdraw from the market.

18.4- Other related issues

18.4.1- Competition with Sugarcane Crop

Sugarcane (high delta crop) has substituted cotton crop in the cotton growing region owing to availability of incentives from the sugar industry.

18.4.2- Lack of advance technologies and agronomic practices:

Technology is very expensive and majority of farmers are poor who can not afford advanced technology. Owing to this phenomenon, farmers lack advance technologies (Hassan, 2007). Moreover, the technology is not developed keeping in view the need of the smallholder.

18.4.3- Crop Insurance:

Facility of insurance is available to most of the business ventures in the country; however, facility of insurance for crops is inadequate. Cotton crop is risky business as it heavily depends upon weather, availability of water and intensity of pests attack, etc. Concept of crop insurance is very much in practice in most of the countries; however, this facility is not available to Pakistani farmers. Hence, farmers remain hesitant of investing in new technologies and adopting capital intensive production practices. The insurance companies like United Insurance Company of Pakistan Limited are in the process of working out the

Pakistan would also have to evolve a mechanism for insuring cotton crop. India has a long history for insurance schemes for farmers. First scheme was launched in 1972. The Comprehensive Crop Insurance Scheme (CCIS) was implemented from Kharif 1985 to Kharif 1999. The National Agriculture Insurance Scheme was initiated in the Rabi season of 1999-2000 (Ifft, 2001).

Crop insurance is not a profitable venture, as is suggested from the world over experiences. For example, CCIS charged premiums of 1-2 percent, while total value of all claims made comes to about 9% of the sum insured (Ifft, 2001). However, some innovations in the crop insurance products may make it a financially viable venture.

18.4.4- Protection of farmers in USA and European Countries:

Farmers in USA and European Union are heavily protected. Farmers in USA are paid prices of cotton around 90 percent above the world cotton prices of 2001-02, in the form of subsidies. Similarly, in European Union this figure is as high as 154 percent. (UNCTAD, 2005b) So impact of these kind of protection policies badly hurt the interest of cotton producers in Pakistan.

18.4.5- Prices of cotton on downward trend in International Market:

Average price of cotton in the world market peaked in 1995 and reached 120 cents/lb (UNCTAD, 2005b). Since then, prices of cotton have been on downward trend in the international market. Current prices hover around 50 cents/lb.

18.4.6- Good Agricultural Practices (GAP):

Pakistan needs to adopt good agricultural practices for cotton production like the Australian BMP Model for improvement in the value addition. Australia has invested over US$ 6 billion in R&D relating to BMP (Cotton Australia, 2006). It is proposed that all the extension workers should be assigned to identify best practices at the farms, and document them. These best practices should be compiled regionally and nationally and then widely disseminated among the farmers and extension agents. In this connection, CTRI (the institution proposed above) would act as catalyst.

18.4.7- Capacity Building of Policy Analysts:

Capacity building at national and provincial levels should be done in undertaking policy analysis and evaluation of options. Capacity building of professionals assigned on the job of policy analysis and formulation may include Public Policy Analysis, Future Analysis, Scenario Analysis, Economic and Distribution Analysis, Cost-effectiveness Analysis, System Dynamics, Simulation Modelling, Stakeholder Analysis, Influence Analysis, Point of View Analysis, Participatory Policy Making Process etc. The capacity building programmes should initially target at Federal level, then at provincial level and finally at district level.

19.0- REFERENCES

Adhikari, R. and Weeratunge. R. C. (2006). Textile & Clothing Sector South Asia – Coping with Post quota Challenges. In Chimmi, B. S. Das, B.L., Kelegama, S., amd Rahman, M. (Eds.), South Asian Yearbook of Trade and Development 2006 (pp. 109-145). New Delhi: Wiley-India.

Ahmad, S. and Martini, R. P. (2000, May). *Agricultural Policy Analysis in Pakistan: Illustrations in the use of the Policy Analysis Matrix*. Working Paper No. 00-27. Lahore: Centre for Management and Economic Research, Lahore University of Management Sciences. Retrieved 11 September, 2007, from http://ravi.lums.edu.pk/cmer/upload/agricultural%20policy%20analysis.pdf

Bakhsh, K., Hassan, I. and Maqbool, A. (2005). Factors Affecting Cotton Yield: A Case Study of Sargodha (Pakistan). *Journal of Agriculture & Social Sciences,* 1(4), pp. 332-334. Retrieved 15 November, 2008, from http://www.fspublishers.org/jass/past-issues/JASSVOL_1_NO_4/10.pdf

Banuri, T. (1998, February). Global Product Chains: Northern Consumers, Southern Producers, and Sustainability - Cotton and Textiles In Pakistan (Draft). http://www.iisd.org/susprod/cotton.pdf

Briddon, R. W. and Markham, P. G. (2000, November). Cotton leaf curl virus disease. *Virus Research*, 71(1-2), pp. 151-159.

Central Cotton Research Institute (CCRI). (2007). *Annual Report 2006-07*. Retrieved June 14, 2007, from http://www.ccri.org.pk/Rep07/Intro.pdf

Chapagain, A.K., Hoekstra, A.Y., Savenije, H.H.G., & Gautam, R. (2005, September). The water footprint of cotton consumption. Research Report Series No. 18. Delft, the Netherlands: UNESCO, Institute of Water Education. Retrieved July 09, 2007, from http://www.waterfootprint.org/Reports/Report18.pdf

Chaudhry, R. A. (2006). *Cotton Production Practices*. International Cotton Advisory Committee. Retrieved 25 October, 2008, from http://www.icac.org/cotton_info/research/ProductionPractices/english.html

Cotton Australia (2007). Cotton Products. Retrieved July 9, 2007, from http://www.cottonaustralia.com.au/factSheets/resources/cotton%20products.pdf

Davidson, A.P., Ahmad, M., and Ali, T. (2001, July). Dilemmas of agricultural extension in Pakistan: Food for thought. Agricultural Research & Extension Network, *Network Paper No. 116*. Retrieved 24 November, 2008, from http://www.odi.org.uk/networks/agren/papers/agrenpaper_116.pdf

EURATEX [The European Apparel and Textile Organization]. (2002, March). European Research in the Textile and Clothing: Common Strategy Paper. Retrieved 19 July, 2008, from http://www.euratex.org/download/publications/papers/rd-3-2002a2_-_research_strategy_paper_final.pdf

Elbehri, A. and MacDonald, S. (2003). Transgenic cotton and crop productivity: A general equilibrium analysis for West and Central Africa. Paper prepared for presentation at the *6th International Conference on Global Economic Analysis*, The Hague, Netherlands, June 12-14, 2003. Retrieved 19 November, 2008, from https://www.gtap.agecon.purdue.edu/resources/download/1517.pdf

FAO. (2000). Towards a Strategic Framework for Sustainable Agricultural Development in the Near East Region. Twenty-Fifth FAO Regional Conference for the Near East. Beirut, Lebanon, 20 - 24 March 2000. Retrieved 29 August, 2007, from ftp://ftp.fao.org/unfao/bodies/nerc/25nerc/X4351e.doc

Government of Pakistan. (2005). Textile Vision 2005. Retrieved July 5, 2008, from http://www.tco.gov.pk/Webs/Material%20For%20Website/Reports/Report%20Textile%20Vision%202005.PDF

Government of Pakistan, 2006. *Pakistan Economic Survey 2006-07*. Islamabad: Economic Advisor's Wing, Finance Division, Government of Pakistan.

Government of Pakistan. (2008). *Pakistan Economic Survey 2007-08*. Islamabad: Finance Division, Economic Adviser's wing.

Government of Punjab (2008). Annual Budget Statement for 2008 – 2009. Lahore: Finance Department. Retrieved 11 October, 2008, from http://pportal.punjab.gov.pk/portal/docimages/14673ABS_0809.pdf

Hassan, I., Ali, A., Aslam, M. M. (2006). Effect of Globalization on the Major Crops and Income of the Farmers of Rice Zone of the Punjab-Pakistan. *Electronic Journal of Environmental, Agricultural and Food Chemistry,* 5(2), 1278-1285. Retrieved 11 September, 2008, from http://ejeafche.uvigo.es/index.php?option=com_docman&task=doc_view&gid=112

Ifft, J. (2001). Government vs Weather: The True Story of Crop Insurance in India. Research Internship Papers 2001, Centre for Civil Society, Retrieved 22 November, 2008, from http://www.ccsindia.org/ccsindia/policy/live/studies/wp0010.pdf

MEDI [Mennonite Economic Development Associates]. (2007, February, 15). Behind the Veil: Access to Markets for Homebound Women Embroiderers in Pakistan. Semi-Annual Report prepared for USAID (July 1 – December 31, 2006). Retrieved 22 July, 2008, from http://www.value-chains.org/dyn/bds/docs/468/MEDA%20Pakistan%20Semi%20An%20Dec%2006.pdf

Khadi, B. M. (2008, September). Biotech Cotton: Issues for Consideration. *Paper presented in the 4th Meeting of the Asian Cotton Research and Development Network, held in China from September 23-26, 2008*. Retrieved 15 November, 2008, from http://www.icac.org/tis/regional_networks/documents/asian/papers/khadi.pdf

Khan, M.A. and Iqbal, M. (2005, Winter). Sustainable Cotton Production through Skill Development among Farmers: Evidence from Khairpur District of Sindh, Pakistan. *The Pakistan Development Review*, 44(4-Part II), pp. 695–716.

Nayef, A. M. (2008). Organic Cotton Production in Syria. *Paper presented in the 4th Meeting of the Asian Cotton Research and Development Network, held in China from September 23-26, 2008*. Retrieved 15 November, 2008, from http://www.icac.org/tis/regional_networks/documents/asian/papers/al-salti.pdf

Planning Commission (2007). Annual Plan 2007-08. Islamabad: Government of Pakistan.

Rehman, A. U. and Ali, G. (2008, September). A Study of the Skills Gap along the Cotton Value Chain: Garments Segment. *Paper presented in the 4th Meeting of the Asian Cotton Research and Development Network, held in China from September 23-26, 2008*. Retrieved 15 November, 2008, from http://www.icac.org/tis/regional_networks/documents/asian/papers/ali.pdf

Rehman, A.U., Farooq, U. and Ahmad, M. (2007). Review of Pakistan Agriculture Crop Sector with Special Emphasis on Value Chain Analysis. *Background Paper Prepared for Designing National Agricultural Research Strategy for Pakistan*. Islamabad: Ministry of Food and Agriculture, Government of Pakistan.

Townsend, T. P. (2004). World Extra-Fine Cotton Outlook. Washington, DC: International Cotton Advisory Committee. Retrieved 11 December, 2008, from http://www.icac.org/cotton_info/speeches/Townsend/2004/pima_2004.pdf

Gruere, A. (2006). Long-term Trends in Irrigated and Rainfed Cotton Yields. Cotton: Review of the World Situation, 60(2), pp. 13-20. Retrieved 5 December, 2008, from http://haber.tobb.org.tr/uploads/1077_Dunya%20Pamuk%20Durumu.pdf

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