# RISK MANAGEMENT PRACTICES OF SMALL FARMERS

## A FEASIBILITY STUDY FOR INTRODUCING R4 RURAL RESILIENCE INITIATIVE IN PUNJAB



SDPI
Sustainable Development Policy Institute
25 Years 1992-2017

Punjab Social Protection Authority
Government of The Punjab

Oxfam

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World Food Programme

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OXFAM

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Drawing insights from the analysis of agriculture risks and management strategies thereunto in the Southern Punjab region of Pakistan, this feasibility study aims to provide a technical guidance for the implementation of R4 Rural Resilience Initiative to reduce and transfer the agricultural risks faced by small farmers of the region.

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# ACRONYMS

**ARM:** Agriculture Risk Management
**AWS:** Automatic Weather Station

**BISP:** Benazir Income Support Programme

**CFIs:** Commercial Financial Institutions
**FAO:** Food and Agriculture Organization
**FGDs:** Focus Group Discussions
**FY:** Fiscal Year
**GDP:** Gross Domestic Product
**GCRI:** Global Climate Risk Index HDI:

**ICA:** Integrated context analysis

**IDIs:** In-depth Interviews
**INR:** Indian Rupee
**IFAD:** International Fund for Agricultural Development
**KIIs:** Key-Informant Interviews
**MFBs:** Microfinance banks
**Mds/Acre** Maunds per acre
**MFIs:** Microfinance institutions
**MZFR:** Muzaffargarh
**NARC:** National Agricultural Research Council
**NGOs:** Non-Government Organizations
**PBM:** Pakistan Bait-Ul-Maal
**PDMA:** Provincial Disaster Management Authority
**PWP-1&11:** People Works Program-1&11
**PMD:** Pakistan Meteorological Department
**PMIC:** Pakistan Microfinance Investment Company Limited
**PPAF:** Pakistan Poverty Alleviation Fund
**PMFBY:** Pradhan Mantri Fasal Bima Yojana
**PSPA:** Punjab Social Protection Authority
**R&D:** Research and Development
**NRSPs:** National Rural Support Programmes
**RYK:** Rahim Yar Khan
**SDPI:** Sustainable Development Policy Institute
**SDGs:** Sustainable Development Goals
**WRS:** Warehouse receipts system
**WBCIS:** Weather Based Crop Insurance Scheme
**WFP:** World Food Programme
**WII:** Weather index insurance
**WQ:** Water Quality
**YBI:** Yield based insurance
**ZTBL:** Zarai Taraqiati Bank Limited

# EXECUTIVE SUMMARY

This study was carried out on the request of WFP and OXFAM Pakistan to assess the viability of integrated risk management approaches for enhancing the resilience of small farmers in Punjab. It looked at the relevance of WFP-Oxfam's global R4 Rural Resilience Initiative in the context of study areas and found the approach to be relevant. In particular, strategies relating to risk reduction and risk transfer, if implemented correctly, can significantly augment small farmers' capacities to withstand shocks. The study takes into consideration the various risks confronting smallholder farming systems and ways in which farmers cope with these risks. The study also attempts to map out relevant stakeholders, their key functions and programmes as further explained.

R4 aims to benefit agriculture sector which is mainstay of Pakistan's economy, as it contributes 19.82% of GDP and hosts 43.5% of the labor force. However, the sector is highly prone to seasonal contractions due to its exposure to a range of climatic and non-climatic risks. This peculiar nature renders agriculture a highly risky source of livelihoods.

Inadequacies in the input supply chain and absence of capital prevent farmers from accessing quality inputs at affordable rates and in a timely manner. On the other hand, weak linkages between research, extension and farmers decelerate the take up of efficient climate-smart technologies.

Climate-induced changes such as untimely rains, shortened winters, heat waves, and droughts are making agriculture produce highly unpredictable with serious implications for small agro-food producers.

Unable to meet the stringent requirements of financial institutions, small farmers often resort to the middlemen to meet the cost of cultivation or simply to cover regular household consumption requirements. Dependency on middleman for inputs or cash is historically deep-rooted and perpetuates the deeply entrenched poverty of smallholder farmers and tenants through highly imbalanced cost sharing and repayment arrangements. This system of dependencies has locked smallholders into subsistence farming, aggravated their fragility and compounded their vulnerability to climatic and market risks.

Agriculture Risk Management aims to build the adaptive capacity of farmers to cope with these risks. One of the internationally recognized risk management Programme is R4[1]. It is an integrated agriculture risk management model whose target beneficiaries are small farmers of developing countries like Ethiopia, Malawi, Senegal and Zambia. It is a known fact that the Punjab province has a pivotal share in agriculture output in Pakistan. In the production of wheat, cotton, sugarcane, maize and rice, the Punjab's share is 76, 72, 65, 81 and 51 per cent respectively. Majority of farmers (64%) in the Punjab have landholdings up to 5 acres and small holding naturally entails

[1] R4 is an alphanumeric that represents following four pillars of integrated risk management toolkit implemented by WFP-OXFAM:

i- Risk Reduction,
ii- Risk Transfer,
iii- Risk Reserves and
iv- Prudent Risk Taking.

Conditional Cash Transfers and Crop Insurance schemes are the frequently used interventions under R4 Programme. See Annexure 1 for further details on R4 Integrated Model

diseconomies of scale for farmers, exposing them to risks and vulnerabilities. Thus, at the outset, the Punjab offers a setting for rolling out R4 Programme.

Before replicating global experience, it is important to ascertain the viability and relevance of R-4 in the context of smallholder farming system in Pakistan. This feasibility study seeks to explore the Punjab agricultural landscape to the entry points for the potential rollout of R4 in smallholder farming system.

A mixed research methodology using secondary and primary data was used for the study which was carried out in agriculture production areas of districts Muzaffargarh and Rahim Yar Khan. The selection of districts was guided by the level of exposure to risks and concentration of smallholder subsistence farmers. We collected evidence on current set of risks facing the small farmers and how they were coping with those risks. This study also identifies stakeholders critical for designing and implementing R4 interventions for efficient risk transfer and mitigation. Scoping for insurance based risk management and policy narratives on rural resilience through integrated risk management was also carried out. In summary, the feasibility study had the following specific objectives:

i- Mapping of risks, their affects and the coping mechanisms.
ii- Stakeholder identification
iii- Identifying complementarities between R4 design and the existing risk management ecosystem in the Punjab.
iv- Recommendations for most feasible R4 entry points.

# Major Findings

Since the study areas have a high concentration of small farmers, most landholdings are up to 12.5 acres. A vast majority of the respondents (82.6%) were owners, 12% were owner-cum-tenants and only 5.4% reported to be practicing agriculture on tenancy basis. The study areas have a very high dependency on agriculture with farm-based incomes constituting 84% and 90% of the total household incomes in Rahim Yar Khan and Muzaffargarh respectively. Other sources of income include livestock, daily wage jobs and small-scale jobs at shops and industries. Only 7.5% respondents reported livestock as a major source of income. Majority of households (81%) earn less than Rs. 200,000 (USD 1,800) per year. This is below the annual HH national poverty line of Rs. 234,522 (USD 2,112) and much below HH per capita income of Rs. 1,099,776 (USD 9,900), thus implying the prevalence of resource constraints in procuring agriculture inputs and meeting other needs.

## *Most Common Risks and Their Consequences*

Most common risks confronting farmers with a landholding of up to 12.5 acres include a combination of climatic risks (untimely rains, windstorms, shortage of irrigation water) and non-climatic risks (non-availability and non-affordability of quality inputs), market risks ( hegemony of middleman) and institutional risks (lack of advisory services from public sector departments).

| 0-5 Acres | 5-12.5 Acres |
|---|---|
| - Untimely rains,<br>- Non-affordability of quality fertilizers,<br>- Non-availability of quality pesticides<br>- Non-availability of cheap borrowing resources<br>- Shortage of canal water<br>- Lack of Advisory Service from Plant Protection Department<br>- Monopoly of Middlemen | - Untimely rains<br>- Shortage of Canal Water<br>- Windstorms<br>- Non-availability and non-affordability of quality fertilizers<br>- Non-availability and non-affordability of certified seeds |

Because of the above-mentioned risks, farmers believe they cannot achieve their potential yields or withstand crop losses. For them, a 'poor growing season' is when per acre yield is 6-10 *Maunds*[2] (240-400 kg) less than the average yield. And in the recent years, every alternative year has been a poor growing season due to one or more risks.

There is a direct and positive correlation between the size of landholding and the ability to acquire farming inputs. Small farmers often find it difficult to purchase inputs on cash. Owing to lack of access to formal credit, small farmers heavily depend on middleman for loans and cash to source inputs or cope with food shortages arising from poor harvest, life-cycle events or disasters. These debts are settled upon harvest whereby the middleman deducts the loan payment upfront and offers the rest to the farmer, if at all there is a surplus. Additionally, if the yields are low, debt servicing often leaves small farmers with little or nothing for the entire season. In which case, farmers have no choice than to obtain further loans against the next harvest – thus compounding debt from one season to the other. Natural disasters such as untimely rains, windstorms and floods plunge them deeper into poverty and fragility. In some cases, it takes several years to recover from these losses.

Moreover, farms operating on credit terms are often subjected to unfavorable terms of trade that are heavily skewed in favor of the creditors. Firstly, inputs acquired on credit are often accompanied by a high mark-up, which needs to be settled at the time of harvest. Secondly, in most cases, the debt is settled at the farm-gate with the creditor buying the produce at price much lower than the support price.

The farmers were highly concerned about the quality of inputs being provided. Nearly one third reported the non-availability of quality inputs as a major challenge confronting them. They expressed serious concerns over the quality of inputs available in the local markets. Although

[2] Maund is a traditional unit of measurement in Pakistan's farming system. Typically, 1 Maund = 40 Kilograms

production increases significantly with the application of fertilizers, the obtained yields are far below their expectations.

Increase in temperatures, lengthier summer season, and shorter monsoon include some of the common climate-induced changes that farmers believe are taking place in the region. Nearly 90% farmers reported that crop pests and diseases have increased due to change in climatic conditions, particularly because of increasing temperatures. In addition to these long-term climatic changes, the sudden environmental threats like untimely rains and windstorms are frequently found amongst the farmers' risk matrix. These two can potentially destroy whole crop depending upon their severity.

In most of the cases, a positive response was recorded regarding services of Livestock and Irrigation Department. However, very few farmers reported that they were receiving the mandated services from Agri-Extension Department and Plant Protection Department.

As small farmers were the focus of the study, a deliberate attempt was made to assess their level of food security. Almost one third of household were reported as food deficient. It was learnt that they were unable to produce enough food or source the required quality and quantity of food on the market - suggesting poor access and affordability.

### *Risk Coping Strategies*

While reviewing the risk coping mechanisms, it was found that there are some risks which farmers fail to manage. These include poor quality of inputs, windstorms, untimely rains. Second category is of partially manageable risk which include middleman trap[3]. On the other hand, there are some risks which farmers try to manage within their limitations. Those include lack of monetary resources, unaffordability of quality inputs, food insecurity, shortage of canal water and lack of advisory services. However, the suitability of coping measures for those risks is apocryphal.

For instance, lack of monetary resources is managed mostly through informal credit source like middleman on exploitative terms. However, the flip side of argument about middleman exploitation was also offered by the farmers when they shared that going to middleman was easier for them rather than approaching formal banking channels. Middleman offers the credit without any cumbersome documentation process and without any collateral. Similar argument was made by middlemen too. They consider that their dealing with farmers is according to the basic market principles. They provide service to farmers. They must bear labor costs, transport costs and other grain markets charges. That is why they offer such price to agri-producers, which is lower than the support price. They indirectly share the risk of farmers when they lend money for inputs and then

[3] It is partially manageable because now Mark-up free loans are being provided by the Govt. of Punjab for both owners and tenants. They have flexible collateral requirements. It can be hoped that provision of zero interest rate loans (with flexible collateral requirements) can incentivize the farmers towards adoption of formal credit sources and break free from the middle man trap. Thus in future, middleman trap can become a manageable risk instead of remaining partially manageable.

wait till the period of harvest. Thus, they have a right to charge some price for service provision and risk sharing.

Food insecurity is mostly met through sale of assets, consumption of less expensive food, short term borrowing from friends, reduction in frequency of meals and compromise on quality of food consumed.

Shortage of canal water is mostly addressed by pumping groundwater. This not only increases the cost of irrigation but also results in the depletion of groundwater aquifer and brackishness of groundwater in the absence of insufficient recharge. Adaptation usually centers around planting decisions, i.e. what to grow, when to grow and how to grow. Other measures include the plantation of trees to address heat waves. Lack of advisory services from Plant Protection Department leaves the farmers to resort to advice of sales agents of pesticide companies. As different sales agents are competing for larger market share, the advice offered by them is mostly business oriented rather than being farmer-friendly.

When incomes of farmers are affected due to yield losses, then they often resort to compromising expenditures on children education, household health services need and household food consumption. Although major source of HH income is agriculture, they are now encouraging the young members to adopt alternative livelihoods in the urban centers. However, the decision is dependent upon the household's human resources available for farm labor.

Regarding risk transfer instruments like crop insurance, it was reported that currently there was no direct crop or livestock insurance scheme available in the study districts. Farmers expressed willingness to buy insurance products but at a reasonable insurance premium. Only 13.8% farmers were willing to pay a lump sum premium of Rs. 3,500 which would be the minimum premium amount for a farm of 5 acres[4].

### *Existing Social Protection and Agricultural Schemes*

As one of the objectives of the study was to find areas of complementarities between R4 approach and the existing public-sector projects/schemes, the farmers were inquired about current ecosystem of agriculture specific social protection instruments and other projects/schemes. They were mostly aware about the Benazir Income Support Programme (BISP), which is not an agriculture specific intervention by design. Rather it is a poverty alleviation tool relying on cash transfers. The inclusion criteria under BISP is such that the landed farmers are ineligible to become beneficiaries of the programme. However, as third-party observers they admired the fact that BISP beneficiaries around them are benefitting from the cash transfers. Thus, they think that social program needs to be tailored for agriculture programs as existing program tend to exclude farming community, particularly those owing land, by considering them ineligible to receive social protection support.

[4] Refer to Section 4.7 for calculations.

In addition to BISP, they acknowledged Watan Card Scheme offered post 2010 floods. However, the farmers expressed some concerns over the coverage of Watan Card schemes.

As majority of agriculture specific schemes (including the Zero Mark-up Loans) are being offered under the umbrella of Kissaan Package (initiated in 2016), the farmers were inquired whether they were availing the public services being offered under the Kissaan Package. Majority were aware about Kissaan Package but didn't access due to procedural issues (like registration under Kissaan Package).

It can be concluded that small farmers of study locale face a 'mixed' set of risks like market, climatic and institutional risks. The effects of these risks and the risk coping strategies are reminiscent of the argument that 'insecurities breed insecurities'. Antithesis to this argument is that 'securities breed securities'. For providing securities in the form of risk transfer and risk reduction, it is feasible to introduce R4 Programme in the study locale, preferably Muzaffargarh because it is relatively poorer than Rahim Yar Khan. When even one security (antithesis) condition i.e. risk transfer instrument is met then it breed further securities. In other words, long term resilience and livelihood security can be achieved. If farmers avail themselves of the risk reduction tools being offered under Kissaan Package (soil testing, subsidy for relay crops, zero mark-up loans) then the process of resilience building can further speed up.

# Programmatic Recommendations

The Programme should first focus on assisting the farmers in reducing and transferring the risks. The other two ***R****s*, i.e. risk reserves and prudential risk taking will be the outcome ***R****s* if the programme is successful in generating sustainability of livelihoods and assets holding through transfer and reduction of the risks.

## *Risk Transfer*

Higher incidence of agricultural risks (climatic and non-climatic) warrant the provision of crop insurance product to farmers for **transferring** their risks. As small farmers lack the ability to pay premium, R4 Programme can assist them with the provision of subsidy on the insurance product via yield based or weather based index micro insurance system.

Insurance can provide smallholder farmers – a group that is typically excluded from the most basic financial services – with an affordable tool to transfer risk deriving from climate variability, allow them to make investments, and reduce their vulnerability to shocks.

For selection of beneficiaries, the data of farmers registered under Kissaan Package (Punjab Govt.) should be cross-tabulated with the data of Poverty Scorecard (BISP). Service delivery under R4 programme should be digitized (e.g. use of Asaan mobile accounts for conditional cash transfers for paying insurance premium).

*Risk Reduction*

For reduction of non-climatic risks, it is recommended that R4 links up with the Punjab government in its existing initiatives/schemes (related to improving market access, markup free loans, high efficiency irrigation systems, soil sampling, etc.) aimed at reduction of risks and complement the micro insurance initiative by ensuring mandatory coverage of the recipients of micro insurance under those schemes/initiatives too. To ensure coverage, there is a need for awareness raising amongst the micro-insurance beneficiaries about risk reducing schemes introduced by the Government of Punjab.

To ensure timely provision of quality inputs, WFP can think of using Mobile Delivery Unit in collaboration with extension department.

For reducing institutional risks, there is a need for trust building between public service providers and the farmers. For that public-private partnerships should be encouraged. Private sector can support the government in filling the human resource gaps. It can assist by training the farmers on pest protection, crop diversification, mechanization, etc.; providing agriculture services like pest scouting, livestock checkups, etc. and assisting the uptake of recent agriculture research. Moreover, R4 Programme should strengthen collaborative efforts by Agriculture Department, Meteorological Department, Private Sector, Irrigation Department and Multilateral Development Agencies so that they can share their experiences, which is essential for integrated risk management.

It has been argued earlier that middleman is both a source and a risk, and also a medium for transferring and reducing risks. It would be ideal if the Programme provides and alternative of middleman trap by offering a formal liquidity arrangement. Similarly, advocacy efforts should be made to gain buy-in of the government regarding minimization of middleman exploitation through the enforcement of some ceilings on the commission/profit charged by him on purchase of output from farmers. In this way, the term of trade would become favorable for small farmers.

# General Recommendations

i- The government needs to ensure low cost borrowing windows for private enterprises so that they could invest in the indigenization of the latest climate smart technology. Indigenization would facilitate the provision of that technology to small farmers at affordable rates.

ii- There is a need for trust building between public service providers and the farmers. For that, public-private partnerships should be encouraged. Private sector can support the government in filling the human resource gaps. It can assist by training the farmers on pest protection, crop diversification, mechanization, etc.; providing agriculture services like pest scouting, livestock checkups, etc. and assisting the uptake of recent agriculture research.

iii- There is a need for revision of agro-ecological zones by PARC according to changing climatic and crop patterns. New zones should be more localized and Agriculture extension departments should plan accordingly.

iv- The Food Department should make its wheat procurement process more farmer friendly. During Wheat harvest season, the services of Food Department should be accessible to farmers at the village level.

v- There is a need for promoting farming cooperatives. Existing literature provides the evidence that cooperative farming results in increased yields and reduced costs. Such benefits should be capitalized by forming cooperatives at the village or union council level. The government should provide policy and regulatory support to new cooperatives like allowance for claiming full depreciation of equipment in the first year, easing of registration process, etc.

vi- There is a need for balanced focus on income enhancement and food security enhancement. The Punjab government should encourage the sowing of cash crops as intercrops and provide insurance on them. Once farmers receive benefits of cash crops, they would divert from traditional crops to the cash crops.

# CHAPTER 1: INTRODUCTION

Agriculture is the key component of Pakistan's economy as it contributes 19.82% of GDP and hosts 43.5% of employed labor force. Food group accounts for 17.76% of Pakistan's Exports and 11.76% of its Imports[5]. But uncertainties associated with farming like weather related hazards, input shortages render, price fluctuations render it a riskier occupation. Agriculture sector's typical reliance on natural environment has rendered it a relatively riskier enterprise in the context of climate change. Risk management decisions, available options and adopted strategies have broader implications for rural households in Pakistan who are mainly dependent on agriculture for livelihood. The resilience of farmers and farms is both at much higher stakes than ever before.

An overwhelming majority of farm holdings (68%) in the Punjab are less than 5 acres with GINI Co efficient for inequality in land ownership being 0.59[6]. Small holding naturally entails diseconomies of scale for farmers. Small holders usually lack liquid cash required for procuring the inputs (quality seeds, fertilizers and pesticides) and implements. Such impediments render them wanting contingency resources to mitigate the agricultural risks and adapt to their repercussions. They are in need of a multidimensional risk management strategy that can help improve the resilience and reduce poverty, consequently.

The R4 Rural Resilience Initiative is one such innovative response to impediments faced by small landholders in efficient and effective risk management. It is a strategic partnership between the United Nations World Food Programme and Oxfam America to enable the vulnerable rural households to increase their food and income security in the context of increasing climate risks. The Initiative is built on an innovative model that combines four risk management strategies: disaster risk reduction, micro insurance, access to credit, and savings. R4 is an alphanumeric that represents following four pillars of integrated risk management toolkit implemented by WFP-OXFAM:

i- Risk Reduction,
ii- Risk Transfer,
iii- Risk Reserves and
iv- Prudent Risk Taking.

WFP-OXFAM are in a preparatory phase of rolling out R4 Programme in the Punjab. However, for a successful R4 design, a feasibility study was quintessential to identify the effective entry points for it. The study takes stock of farmers' perception of risks, their current risk management strategies of farmers, relevant stakeholders for efficient risk transfer, role of middleman in risk management/mismanagement, scope for insurance based risk management and policy narratives on rural resilience through integrated risk management. Findings of this study will help understand the

[5] Government of Pakistan. 2017. Pakistan Economic Survey 2016-17
[6] Zaidi, S.A. and Jamal, H. 2016. An overview of Inequality in Pakistan. Development Advocate Pakistan. Volume 3, Issue 2.

risk management in agriculture sector and shall help customizations in scheme of actions followed during implementation of R4.

## 1.1. Scope of study

The overarching theme of the study is to suggest the most feasible entry point for R4 in Pakistan with a focus on small farmers of two districts of South Punjab i.e. Muzaffargarh and Rahim Yar Khan. Small farmers include landholders having land up to 12.5 acres or tenants and sharecropper working on farms up to 12.5 acres. The study specifically focuses on climate induced risks to farming.

## 1.2. Objectives of Study

Overarching aim of this feasibility study is to provide technical guidance and recommendations to WFP on most feasible entry points for integrated risk management and designing. WFP envisages to use the findings of this feasibility study to inform and guide the formulation of a full-fledged proposal aimed at carrying out a risk management project for climate vulnerable small farmers in Punjab along the lines of global R4 initiative. With the above overarching objective, this feasibility was conducted to achieve following specific objectives:

i. Mapping the major types of risks facing the farmers with particular focus on environmental risks.
ii. Assessing the perceived impact of environmental risk (climate change) on major crop production and its corresponding impact on smallholders' livelihoods.
iii. Documenting farmers' perceptions of risk transfer instruments and their preferred risk management strategies/instruments.
iv. Assessing the barriers facing farmers in crop insurance.
v. Assessing the role of extension services, agricultural infrastructure including R&D in mitigating the environmental risk.
vi. Reviewing the best international practices of risk management in agriculture for comparing with R4 initiative and contextualizing it to Pakistan.
vii. Reviewing the role of social protection systems of Punjab in rural agriculture sector and identifying the opportunities for developing linkages with social safety nets.
viii. Providing technical guidance and recommendations to WFP on most feasible entry points for integrated risk management.

Against these specific objectives, this study provides the situation analysis of current practices of farmers for risk management. Also, the analysis extended to farmers' perceptions regarding available strategies of risk management. The inquest also involved identifying the barriers to risk management. Lastly, the analysis was designed to guide WFP's interventions for improving resilience of rural farming households through using Social Safety Nets in Punjab, Pakistan.

## 1.3. Structure of the Report

The rest of the report is structured as follow; the chapter that follows immediate provides the methodological and analytical frame work adopted for the analyses. Chapter 3 exclusively discusses the socioeconomic and agro-ecological profiles of the selected districts. Chapter 4 details the findings emerging from analysis with central concentration on environmental/climate related risks. The analysis in this chapter is structured around five major themes namely i) Agricultural risks to small farmers; ii) Climate induced agricultural losses; iii) Role of social safety nets in building resilience of small farmers iv) best international practices of agricultural risk management with a focus on crop insurance and v) Crop insurance perceptions and applicability in Punjab. Last section of chapter 4 provides the key conclusions emerging from a range of assessments. Chapter 5 suggests the ways forward outlining the most feasible option to be adopted under the R4 umbrella which could be well aligned with existing government projects and policies. Given the objectives of study, the report focusses on climate induced risks particularly while outlining the way forward.

# CHAPTER 2: METHODOLOGY[7]

Qualitative and quantitative analyses were used to undertake the feasibility study. Both were carried out in two different phases. In the first phase, qualitative inquiry was held in districts Muzaffargarh (MZFR) and Rahim Yar Khan (RYK). Qualitative analysis includes in depth interviews, key informant interviews and focus group discussions with stakeholders. It was identified through qualitative inquiry that MZFR had relatively higher poverty than RYK, thus higher risk of food insecurity. Data from 167 households were then collected from MZFR using structured questionnaire.

Secondary data support was also used in the study to corroborate the primary data findings, as and when necessary. Stakeholders, policies and projects and socio-economic indicators were also discussed that may hinder or support the access, acceptability and implementation of the R4 project.

## 2.1. Qualitative Analysis

The feasibility study was conducted by using qualitative research methods including: (i) desk review, (ii) in depth interviews, (iii) key informant interviews and (iv) focus group discussions (FGDs). Primarily, the qualitative inquest helped in assessing the capacity of potential supply side (PSPA, Meteorological Dept. and Agriculture Extension Department) stakeholders of R4 implementation. Key informant interviews and in-depth interviews were used as research tools for this purpose. During consultations with respondents of in depth interviews, their expert opinion for effective implementation designs – specifically for crop insurance – were also solicited. On the other hand, demand side's (farming community) potential and suggestion were assessed through FGDs.

## 2.2. Quantitative Analysis

After conducting qualitative field study in Muzaffargarh and Rahim Yar Khan, it was decided to conduct a household survey for corroborating the qualitative information with household level information. Muzaffargarh, facing higher risk of food insecurity, was selected for further propping at household level. A structured questionnaire was developed for the collection and analysis of primary data from farming households to quantify the risk perceptions and associated preferred risk management strategy. The quantitative analysis primarily probed into providing the situation analysis of the existing risk management strategies and identifying the financial, fiscal and capacity gaps of farming community of Muzaffargarh.

[7] Detailed Methodology is given in Annexure 2.

# CHAPTER 3: BRIEF PROFILES OF SELECTED DISTRICTS

The population of Punjab province is about 110,012,442 - more than half of the country's total population of 207,774,520[8]. The province has the lowest poverty rate (31%) but hosts the largest number of poor people in the country (i.e. 19.5 million out of 29.5 million). A majority of Punjab's poor population reside in rural areas and depend on agriculture for food security, income generation and livelihoods. Although small landholders and sharecroppers constitute an overwhelming majority of the Punjab's farming population, land distribution remains heavily skewed in favor of large landlords. Because of its endowments and higher labor productivity, Punjab accounts for two-thirds of the country's agricultural output. However lately, the sector's productivity has been seriously threatened by environmental degradation, unabated conversion of agricultural land due to 'urban sprawl', and increasing frequency of climate-induced disasters.

**Muzaffargarh:** Human Development Index (HDI) for Muzaffargarh district is 0.53 for year 2013 which lies in category of Low human development. Muzaffargarh (MZFR) lies on the banks of Chenab River on its east side. The district is home to 4,322,009 people. The district is divided into four tehsils namely Alipur, Jatoi, Kot Addu and Muzaffargarh and 93 Union councils. Rural population comprises of almost 87% of the total population. District is spread over an area of 8345 $km^2$ and the area is diverse in its terrain with plain/fertile area, riverine belts and sandy terrains. Due to presence of deserted area, almost half of the land is uncultivated (364,000 Hectares).

Besides agriculture as major economic activity the district is home to several industries like cotton ginning and pressing, flour mills, oil, paper/paperboard articles, petroleum products, power generation, solvent extraction, sugar and textile composite among various others. According to Agriculture census 2010, average landholding in district is 5 acres with small farmers at almost 93% of total farmers. Major crops grown in district are wheat, cotton, sugarcane, lentils, mango, pomegranate and dates. The production of cotton and pomegranate has decreased over the past 3-4 years while production has been increased for other crops, including Wheat and Sugar Cane in Muzaffargarh.

During the period 1981-2016 (36 years) Average Annual Precipitation in MZFR was 217.4 mm. Average Annual Temperature, for the same period, has been 26.45 °C in MZFR and Average Annual Maximum Temperature has been 32.5 °C while Average Annual Minimum Temperature has been 18.46°C. Major crops of the district are Cotton, Wheat, Sugar cane and Pulses. The district also produces mango, pomegranate and dates. In MZFR, Average Precipitation has decreased in the months of November and January during the last ten years as compared to the 36 years average. These months correspond to the Wheat growth stage and decrease in precipitation in them can entail losses for wheat productivity

[8] Pakistan Population Census, 2017.

**Rahim Yar Khan:** With the Human Development Index (HDI) ranking of 0.37, Rahim Yar Khan is ranked amongst the least developed districts in Punjab. It is one of the largest districts of southern Punjab with an area of 11880 $km^2$ and a population of 4,841,006. The district comprises four Tehsils namely Rahim Yar Khan, Sadiqabad, Liaquatpur and Khanpur and 122 Union Councils therein. The geography of area is diverse with riverine, canal irrigated and deserted terrains. Most part of the districted is cultivated (635,000 Hectares). Major industries include fertilizer, cosmetics, glass manufacturing, cotton production and processing, large textile units, flour mills, sugar and oil mills and large-scale power generation projects. Major crops grown in the district are wheat, cotton, sugarcane, lentils, mango, pomegranate and dates. The production of cotton and dates has decreased over the past 3-4 years while production has been increased for other crops, including mango and sugar cane while there is normalized trend for wheat production. Detailed yields data of major crops are presented in Annexure 3.

*Table 3.1: Demographics of Muzaffargarh (MZFR) and Rahim Yar Khan (RYK)*

| | MZFR | RYK |
|---|---|---|
| **Population** | 4,322,009 (Census 2017)[9] | 4,814,006 (Census 2017) |
| **Households** | 667,515 (Census 2017) | 701,520 (Census 2017) |
| **Population Average Annual Growth Rate (1998-2017)** | 2.63 | 2.27 |
| **Total area** | 8,435 square kilometers | 11,880 square kilometers |
| **Administrative units** | Four Tehsils, 93 union councils | Four Tehsils ,122 union councils |
| **Geography** | Riverine, canal irrigated and desert | Riverine, canal irrigated and desert |
| **Land use (Thousand Hectares)** | 466 cultivated and 364 un-cultivated | 635 cultivated and 182 un-cultivated |
| **Key economic activities** | Industries (cotton ginning and pressing, flour mills, oil, paper/paperboard articles, petroleum products, power generation, solvent extraction, sugar, textile composite) and Agriculture | Industries (fertilizer, glass manufacturing, cotton production and processing, large textile units, flour mills, sugar and oil mills) and Agriculture (Cotton and Mango) |
| **HDI ranking national** | 0.53 (2013) | 0.37 (2013) |

[9] District Wise Results, Pakistan Population Census, 2017
http://www.pbscensus.gov.pk/sites/default/files/DISTRICT_WISE_CENSUS_RESULTS_CENSUS_2017.pdf

| | | |
|---|---|---|
| **% of Small farms (<12.5 acres)** | 93 | 90 |
| **Average land holding** | 5 acres | 5 acres |

Sources:- Bureau of Statistics Punjab, Lahore, 2016 Statistical pocket book of the Punjab, Land Utilization Statistics by Division (SDPC) and District The Punjab: 2013-14, Agricultural census 2010 and Social Development In Pakistan Annual Review 2014-15

During the period 1981-2016 (36 years) Average Annual Precipitation in RYK was 286.62 mm. Average Annual Temperature, for the same period, has been 26.45 °C and Average Annual Maximum Temperature has been 33.29 °C while Average Annual Minimum Temperature has been 17.43 °C. Some very high precipitations were observed in the month of August in 2003, 2008, 2010 and 2015 of 148 mm, 119.2 mm, 276.1 mm and 307.5 mm. Farmers had reported that excessive rain during the months of August and September have been affecting their cotton crop which is at later stages of growth then.

The seasonal calendar of major crops of MZFR and RYK is being presented below. Detailed agricultural and climatic trends of both the districts are given in Annexure 3.

*Table 3.2: Crops Seasonal Calendar*

| Crop | Period (Sowing to Harvesting) |
|---|---|
| **Wheat** | Mid-November till End of March (04 to 04.5 months) |
| **Sugarcane** | Fall Planting: September-November to November-December (12-13 months)<br>Spring Planting: February-March to December-January (11-12 months) |
| **Cotton** | Mid-April to End of September (Around 06 months) |

# CHAPTER 4: FINDINGS AND DISCUSSIONS

This chapter provides an overall picture of risks[10] facing the small farmers and corresponding risk management strategies. The findings from this chapter will guide the recommendations (in Chapter 5) for feasible R4 entry points in the Southern Punjab region. Further, the chapter furnishes thematic discussions on changing climate, and a special focus on crop insurance applicability and issues. Also, we provide detailed roles and capacities of identified stakeholders for the R4 project implementation.

First five sections of this chapter synthesize findings from qualitative analysis (for both MZFR and RYK districts). Section (4.6) provides a discussion of the findings from household based survey conducted in the MZFR district. Section 4.7 discusses crop insurance in detail, with a focus upon lessons learning from Indian crop insurance model as insurance is one of the frequently prescribed climate risk transfer tools worldwide. Section 4.8 briefly examines the agriculture risk management strategies in practice globally.

## 4.1 Sample Population Statistics Derived from FGDs Information Rosters

Table 4.1 displays the information about crops, average yields, average costs and earnings from agriculture of small holders. As discussed in above sections that almost above 90% of farmers are small farmers in both the districts. According to the information collected majority of land holding ranges between 5-8 acres for both the districts. Major crops sown are wheat, cotton, moongi and an increasing shift towards sugarcane cropping.

Average yields in past 15-20 years for wheat crop ranged between 32-45 Mds/acre [3162-4447 kg/ha] where some farmers reported increase while some were of view that yields have been decreased over the span of 20 years. Reasons of decline in both districts were attributed to decline in water availability and degrading quality of inputs and seeds while increase in yields by were majorly because of subsidized fertilizers and variety of seeds. Average yields of wheat, cotton, sugarcane and moong in Muzaffargarh were 37, 17,800 and 5 Mds/acre respectively [3657, 1680, 79073 and 494.21 kg/ha respectively] while in Rahim Yar Khan they were 45,28,1000 Mds/acre for wheat, cotton and sugarcane respectively [4448, 2768 and 98842 kg/ha respectively].

[10] The production figures reported on the basis of secondary (in Section 3.1.2) and primary data (in Sections 4.1 and 4.6) might lead the reader to question that why are the farmers having satisfactory production although they are also facing risks? The reader should keep in mind that risks identified/reported in this chapter are perceptions. More importantly, it is not necessary that only small landholders should have risk perceptions. Even large landholders can have risk perceptions. But their perceptions may vary as argumentatively and empirically reported in the Section 4.6.

Inputs usage was also inquired which varied from crop to crop and area to area. Average inputs usage in both districts was 4-5 bags per acre for wheat. Mostly they use 1 bag of DAP and 3-4 bags of Urea. Some farmers also reported that they used Zinc or Nitrogen occasionally. Sources of irrigation are canal water and tube wells with approximately 4-6 cycles of water required for wheat crop. Average household size varied between 8-9 persons with almost 4-5 persons (mostly male members of family) engaged in agriculture.

An average overall income for a household in Muzaffargarh according to farmers was Rs. 110,500 per annum while in Rahim Yar Khan it was Rs. 120,000 per annum. Proportion of income from agriculture was reported as 84% from Rahim Yar Khan and 90% from Muzaffargarh. While other sources of income were, livestock, daily wage jobs and small scale jobs at shops and industries.

Labor cost also varied from crop to crop and from farm to farm depending on the local rates. For Muzaffargarh labor costs were estimated at 96,000 per labor per annum and if calculated as per acre the labor cost would range between 19,000 per acre per annum and 1600 per acre per month. Similar estimates were given for Rahim Yar Khan by farming communities which were 90,000 per labor per annum cost while per acre that would be 18,000 per acre per annum and 1500 per acre per month labor costs. It is important to mention here that these are only the labor costs and input costs might vary as per crops and availability.

Lower yields and incomes in MZFR than RYK explain the higher recurrence of food insecurity in MZFR as compared to RYK as also reported in the section 2.2.3 (Integrated Context Analysis). Availability of canal water plays a significant role in higher yields in RYK. Cultivated area in RYK and MZFR is 635,000 hectares and 466,000 hectares respectively. RYK has higher water allowances i.e. 4.5 cusecs/1000 acres for non-perennial area and 5.5 cusecs/1000 acres for perennial area whereas MZFR has 3.00 cusecs/1000 acres for perennial area and 4.80 cusecs/1000 acres for non-perennial area. Nevertheless ground water quality is better in MZFR than RYK. But lack of affordability restricts its use.

Labor costs are also rising on annual basis due to supply and demand factors. Dynamics of this rise are different for different crops. Every year when the sugar mills are about to close, labor becomes short because all the farmers try to get their sugarcane harvested at the earliest. As a result, the labor colludes and raises the wage rates. When the next harvest season starts, the labor insists to have wages which they had gotten at the end of preceding harvest season.

In case of cotton, the small holders (holding 8-10 acres) inadvertently become the cause of spike in labor costs. When the cotton picking season starts, the small farmers in a hurry to complete the picking in his farms because he is under pressure from creditors to clear the due as soon as possible. Thus they compete for procuring labor. As a result cotton pickers (mostly females) increase the

wage rate. This raises the labor cost burden for holders of less than 5 acre land if they have to hire cotton pickers.

| Variables | MZFR | RYK |
|---|---|---|
| **Average Farm size in Village** | 5-8 acre | 5-7 acres |
| **Major Crops** | Wheat, Cotton, Moongi, Sugarcane | Cotton, Sugarcane, Wheat, Moongi |
| **Average yields of Wheat (15-20 years)** | 37Mds/acre [3162 kg/ha] | Yield ranged between 32-45 Mds/acre [3162-4447 kg/ha] on average during last 15-20 years. Yield has been increased in most areas while some reported losses in yield and some also reported no change in yields in past 20-20 years |
| **Reason of decline or increase in yield** | Losses in yields because of shortage of water, low quality seeds and inputs and frequent floods while increase because of improved technology and quality of seeds | Over the long run yield has increased. Most common reason of increase is excessive use of subsidized fertilizer and inputs while losses were attributed to low availability of water and more use of fertilizers. |
| **Average Yield Wheat** | 37 Mds/acre [3162 kg/ha] | 45 Mds/acre [4447 kg/ha] |
| **Average Yield Cotton** | 17 Mds/acre [1680 kg/ha] | 28 Mds/acre [2767 kg/ha] |
| **Average Yield Sugarcane** | 800 Mds/acre [79,073 kg/ha] | 1000 Mds/acre [98,842 kg/ha] |
| **Average Yield Moongi** | 5 Mds/acre [494 kg/ha] | - |
| **Inputs quantity and cost for Wheat Crop** | Urea, DAP, Nitro and Manure are used, 4 bags/acre | DAP, Urea and 5bags/acre with costs of 10,380/acre |
| **Sources of Irrigation** | Tube well, Canals | Tube well, Canals |
| **No of Irrigations for Wheat** | 5-6 | 4-5 |
| **Labor cost** | 96,000 per labor per annum | 90,000 per labor per annum |
| **Average Household Size (in village)** | 8 | 9 |
| **No of HH members engaged in farming** | 4-5 | 4-5 |
| **Average HH Income (for village)** | 110,500/annum | 120,000/annum |
| **Occupation other than agriculture** | Livestock, daily wage, shops, Government Job, Middleman | Daily wage jobs, livestock |
| **Proportion of income from agriculture** | 90% | 84% |

*Table 4.1: Roster Information Collected via FGD*

## 4.2 Major Agriculture Risks in Punjab (Muzaffargarh and Rahim Yar Khan) Identified Through Qualitative Study and Desk Review

Small farmers in Pakistan, specifically in the Punjab, have to face various types of risks. They are the most vulnerable community because they lack knowledge and finance and have less access to adaptation technologies. Out of total cultivated land in Pakistan, 38% is grappled with environmental issues such as water logging, salinity, erosion, and sodicity.

In this study, three levels of information were available to chalk out the agricultural risks to small farmers overall and specifically in the districts of Muzaffargarh and Rahim Yar Khan. Major identified risks are discussed below in two subsections, i.e. non-climatic risks (Section 4.2.1, Figure 4.1) and climatic risks (Section 4.2.2). Effects of climate change on women have been discussed separately in Section 4.2.3.

### 4.2.1 NON CLIMATIC RISKS

*a- Market Risk*

Now-a-days marketing of farm based products is considered vital to stability and security of farming community. A farm may be highly productive with its yield, but if the farmer is not able to market the products efficiently by minimizing market risks, then the farmer could not achieve financial stability hence creating risks for the future. Market risks exist because of variability in prices and unpredictable future trends. Market based risk management tools help farmers access market with minimum risks and stable price.

*Farmers don't usually get their inputs on time because of shortage in market, lack of access to certified seeds, lack of resources and lack of proper instruments, which are the major risks. Regulating markets would solve all the problems of small farmers.*

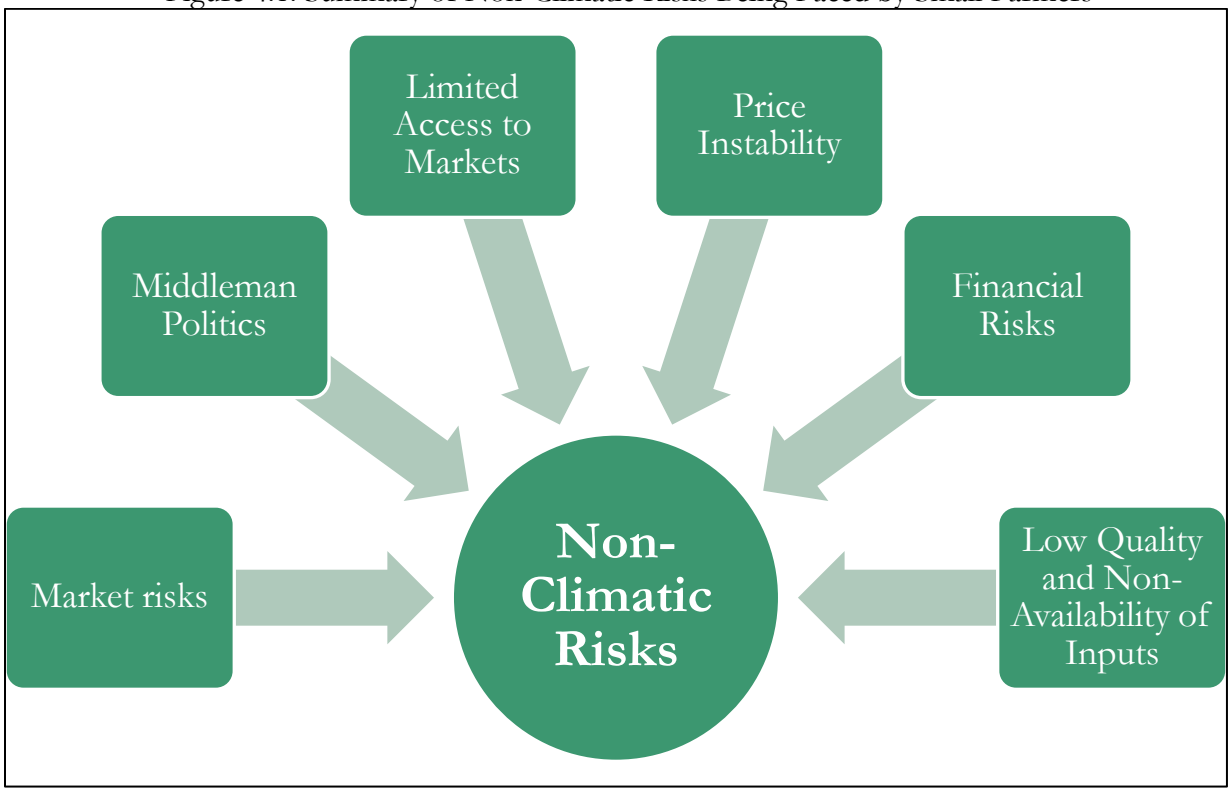
***Dr. Hafiz Akram, Ayub Agriculture***

In Pakistan, agricultural market infrastructure is made up of numerous market players, who play their role in transporting small farmers' produce to larger markets in urban areas. It can easily be said that in Pakistan, an agricultural produce from farmer to end user passes by seven to eight different hands. Markets are operated by both public and private sectors and act as major link between producer and consumer. Among the market players, role of middleman has always been remained as

most controversial in agriculture of Pakistan. General opinion had been developed about middleman exploiting small and marginal farmers and rip-off their legitimate share. Nevertheless, significance and role of middleman cannot be underestimated despite these allegations.

During the study, market risks were frequently mentioned in all three phases of IDIs, KIIs and FGDs. Identified market risks not only focus on middleman but concerns were also raised about maintaining and controlling the price of products by the government. Furthermore, small farmers also have limited access to large markets hence they have to rely on middleman for selling off their products. Major issues related to market which pose significant risks to small farmers, and identified by policy makers, stakeholders and farming community, are briefly discussed below.

Figure 4.1: Summary of Non-Climatic Risks Being Faced by Small Farmers




*b- Middleman Politics*

Perceptions about middleman vary in real life, in literature and from farmer to farmer. Majority perceive the middleman as the exploiter, money lender, charging unfair rates of interests and trapping farmers in vicious cycle of debt and poverty. For some, middleman is a person who fulfils their credit needs and provides sustainability to their livelihoods. Figure 4.2 explains the role of middleman in farming system of Punjab.

During the FGDs in Muzaffargarh and Rahim Yar Khan, farmers were asked specifically about their relations with middleman and how he helps in case of disaster. Farmers generally have a negative

perception about middle man. According to the farmers, middleman plays exploitative role, doesn't give any relief to small farmers, and most of the times prevents farmers to reach directly to the market. Owing to lack of resources, small farmers also have low accessibility to markets or main centers for buying of inputs. Middleman not only exploit at the time of buying produce but also at selling the inputs. It was reported by farmers that if the rate of a sack of manure was PKP 1,000 then they charged from farmers PKP 2000, Similarly, sack of fertilizers are sold at higher prices by middleman.

Small farmers depend on middleman for loans and cash in case of emergency or disaster. However, when the middleman receives the produce, he first cuts his own share and then gives the rest to farmer if there's some left. On top of that if the yields are low in that season then farmer gets nothing in return.

Hence farmer again has to rely on middleman for loans to sustain his livelihood. For selling their crops to market, small farmers again have to rely on middleman and it's the will of middleman that how much they will pay to the farmer. Also due to high interest loans from Microfinance banks and difficult procedure of acquiring interest-free loans from government, farmers eventually have no other choice than to rely on middleman for their livelihood stability.

FGDs were also conducted with middlemen to find their version of the story. Middlemen provide farmers with inputs without taking money and when the farmer at the end of the season comes for selling the produce, middleman cuts his share of inputs. Middleman often provides fertilizers and spray for a week, if some disaster comes. He provides farmers in that quantity which he knows farmer can easily return. Regarding charging high cost of risk sharing to farmers, middlemen were of the view that this was a business practice. By sharing farmers' risks they are actually putting themselves in risk too. Thus they have a right to charge some price for sharing risk of farmer.

> *Middleman in certain circumstances can give interest-free fertilizers, seeds, diesel, etc., so farmers can pay back after selling their products. In those cases some middlemen give more relief to farmers compared to the government.*
>
> ***President Trade Union Chak Sarwer (MZFR)***

Farmers of Mozah 96, UC Sultan Pur and Muzaffargarh reported that middlemen get their sign on blank cheques against the amount lent by the former. This gives them a tool to blackmail farmers.

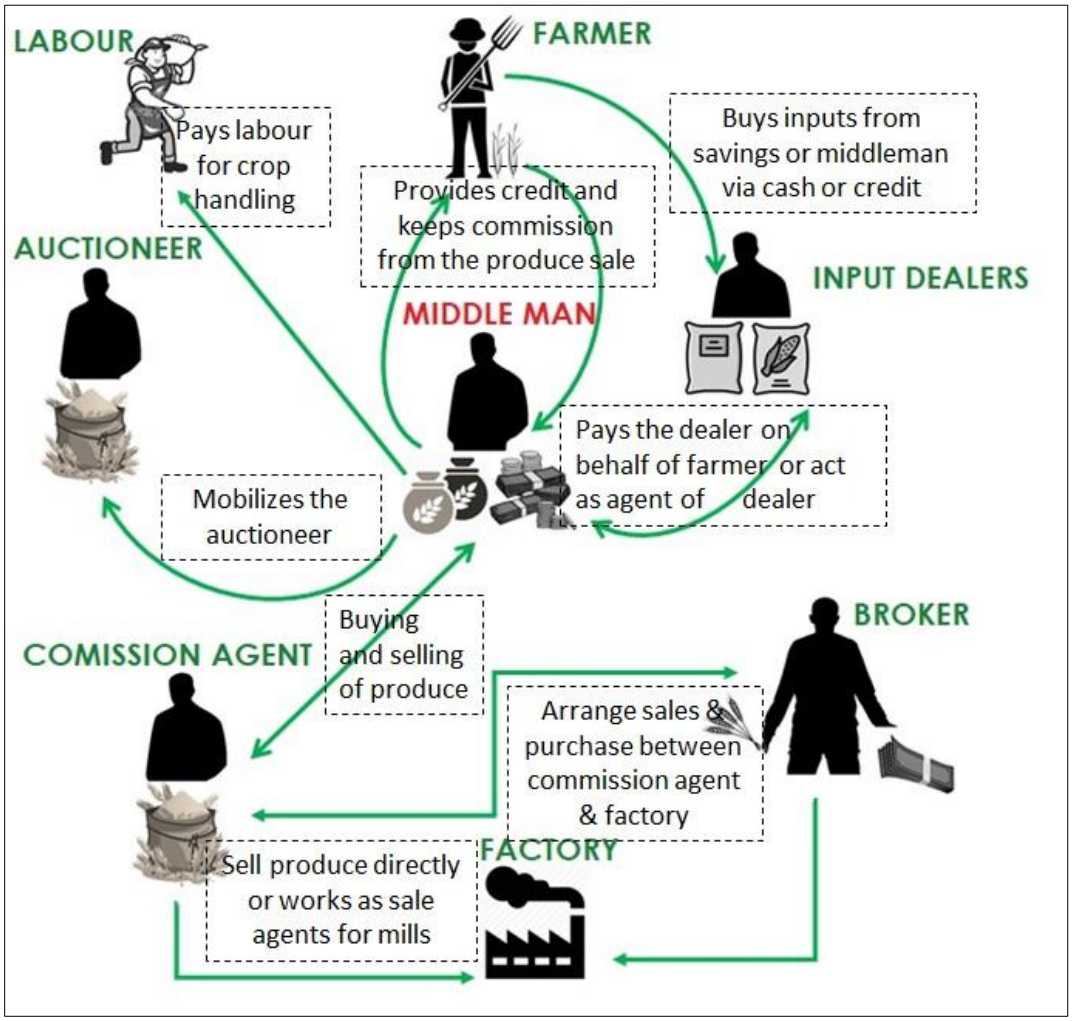



Figure 4.2: Role of Middleman in Farming System

*c- Price Instability and Restricted Access to Market*

Instability in prices of agricultural outputs and restrictions in farmers' direct access to markets were the next category of risk identified by policy makers, stakeholders and farming community iteratively. It was repeatedly pointed out by farmers that Government promises to give Rs 1300/per bag of wheat but the farmers mostly don't end up selling their wheat at the Food Department's Purchase Centers.

Plenty of explanations were generally narrated by the farmers for their reluctance to sell wheat to the Food Department at support price of Rs. 1,300. First, farmers don't want to undertake the hassle of obtaining *Baardana* (Jute Sacks provided by Food Department). Second, they reported that even if they do opt for selling their wheat to Food Department then it is quite likely that they would get lesser *Baardana* because it is provided according to the estimated acreage at which wheat has been

sown by a particular farmer. Those estimates usually don't match with the actual acreage at which the farmer grows wheat.

Third, diseconomy of scale also makes directly accessing the Food Department or grain market relatively costlier especially for the subsistence farmers. They don't own tractors or trolleys. So they can directly access by hiring some goods transport vehicle. To avoid those costs, they prefer to sell their produce to the middlemen in their fields.

Fourth, their creditors are in a hurry to get their money back. Creditors have their agents in the villages to inform them of the harvesting activity. So, whenever a farmer harvests his crop, the creditors rush towards him because their agents inform them. Middlemen also accompany them or in some cases; they themselves are having multiple businesses and they are middlemen themselves. They offer the farmer a rate lower than the support price, i.e. around Rs. 1,100-1,150. The farmer has no other choice but to sell the wheat at lower price. Nevertheless, if he has storage capacity, then he can sell the stored wheat at a better price in the off season.

Last, some farmers responded that they also liked leisure and ease. When the crop gets ready, they prefer to sell the produce in the easiest possible way to get the cash at the earliest possible even though they have to face a loss of Rs. 150-200 per Maund. In MZFR and RYK, per acre yield of wheat was 37 and 45 Maunds per acre respectively. Thus, in monetary terms farmers incur an average per acre loss of Rs 5,550 to Rs. 7,400 in MZFR and Rs. 6,750 to Rs. 9,000 in RYK.

Moreover, timely non-availability of rightly priced inputs is the biggest concern of farmers. As a significant proportion of farmers buy inputs on credit, the terms and conditions entailing that credit render the input prices instable even if government tries to keep the prices stable by giving subsidies or by fixing the prices of inputs. Normally, farmers purchase the inputs on credit from the same supplier. What happens is that terms and conditions for credit are dependent upon the previous relationship. If the supplier trusts the farmer then he may charge low profit or vice versa. For instance, price of one bag of Urea is Rs. 1,300. The supplier will enter into an agreement with the farmer that after the sale of produce, farmer will pay him Rs. 1,600 to 1,800 depending upon the previous business relation.

### *d- Financial Risks*

The average small holder household depends on informal credit and loaning in case of a disaster or emergency in Pakistan. Complex procedures and strict conditions of formal loaning system make small farmers reluctant to adopt them. FGDs conducted for the study reveals that majority of farmers rely on middleman or large farmers of that area for their financial needs. Lack of access to timely credit and saving facility is the biggest challenge that small farmers of Muzaffargarh and Rahim Yar Khan are facing. They are trapped in never ending cycle of loan and debt from middleman.

### *e- Inputs quality and availability*

Agricultural inputs refer to a range of products used for enhancing agricultural productivity. Fertilizers, pesticides and seeds are the most important of all inputs. Agricultural inputs are fundamental part of modern agriculture. According to reported data by Agricultural census 2010[11], 64%, 50% and 48% farms were using fertilizers, pesticides and herbicides respectively in district Muzaffargarh. Similarly, in district Rahim Yar Khan, 72%, 68% and 57% of total farms were using fertilizers, pesticides and herbicides respectively. Data also disclosed the use of manure in some farms. The government has initiated several subsidy programmes for inputs in the past. But, still the quality and access to inputs remain one of the major risks for small farmers in the selected districts.

*Large land holders usually have access to weather applications and advisories, which help them in planning before any calamity could happen while small land holders don't have access to such information, thus they are more vulnerable to climate induced risks.*

***Hamid Ullah Malik PDMA-Punjab***

Farmers in FGDs explained as to how the inputs are forged while they are transported from producer to end user, i.e. a small farmer. When stock of seed is short in the market then people start mixing them in the seeds and fertilizers. Sacks are opened and mixed with pebbles and other materials and then sold at the original price. Hybrid seeds are not effective as well as they are also forged and mixed with low quality seeds but they are sold at their original price. Similarly, simple soil is sold in the name of manure. Pesticides and sprays used for pests are ineffective as they are also not up to the quality hence more cycles of sprays needed to kill the pests. Farmers also reported the use of 4 bags of Urea instead of 2 bags used in the past. The quality of inputs greatly affects the yields of crops in the studied districts and it was one of the most major concerns of small farmers.

### 4.2.2 CLIMATIC RISKS

*a- Impact of Climate Change on Crops – Literature review findings*

Climate change is considered to be a global phenomenon, which is affecting the overall environment of Pakistan; however developing countries are indicated to be more effective due to their vulnerabilities and lack of coping strategies to climate change[12]. Agriculture dependent nations are the most affected because climate change directly impacts the agricultural production and Pakistan is one of those countries which are facing agricultural damages due to climate change. Change in rainfall pattern, floods, drought and extreme temperatures led to the loss of agricultural productivity. Various studies have proved the fact that climate change has reduced the agricultural productivity which has led to serious food security issues in vulnerable areas[13][14][15]. Several predictions have been

[11] Agricultural Census 2010 - Pakistan Report. (Punjab Data Tables)
[12] IFAD: Climate change impacts, South Asia, http://www.ifad.org/events/apr09/impact/seasia.pdf 2010.
[13] Kurukulasuriya, P. and R. Mendelsohn. 2008. A Ricardian analysis of the impact of climate change on African crop land. Afri. J. Agric. Resour. Econ. 2(1): 1-23.

made on declining yield of crops in South Asia. For example, from 2001 to 2059 in South Asia, per hectare cereal yield will decline up to 30% along with an up to 37% loss of gross per capita water[16], thus increasing the number of food insecure population in South Asia. On top of that South Asia is also considered the most vulnerable region to climate change[17].

Agriculture is the mainstay of rural population (70%) living in South Asian countries and almost 75% of these people, dependent on agriculture for their livelihood, are poor[18]. Recent extreme weather events (Floods in Pakistan and India) also indicate the link to climate change and these events will likely keep the poor in a constant poverty trap. Agricultural activities are directly dependent on the climate variability such as rain patterns, change in water; biodiversity and land resources which will lead to alteration in trade dynamics which will eventually affect the global economics thus threatening the risk of food security and capacity to nourish 9 billion people by 2050. Climate change will not only effect the rain fed agriculture but it will also be affecting irrigated crops as high temperatures will increase the irrigation requirement and according to an estimate by 2070s or 2080s South-East Asian irrigation requirements could increase by 15 %[19].

Various studies have placed Pakistan in the list of countries most vulnerable to climate change. Pakistan was ranked 8$^{th}$ by Global Climate Risk Index (GCRI) in terms of exposure to extreme weather events from 1995–2014[20]. Pakistan is experiencing some very extreme events from past decade including floods, drought, and shortage of water, changed rainfall pattern and extreme temperatures. The ranking of Pakistan in the list of vulnerable countries is alarming as it stood 10$^{th}$ in Global Climate Risk Index, 2015 which is now moved up to 8$^{th}$ position. Flooding is the hazard to which Pakistan is at risk from the most. Melting of the glaciers from Northern Pakistan swells up the Indus and its tributaries which is causing inundation and floods since 2010. Since these tributaries are the main source of irrigation for the crops, glacial recession is expected to decrease the water flow within next 2 to 3 decades which translates in to high risk for the entire country as agriculture industry would be devastated without irrigation. Since Pakistan has a varied environment and climate from below zeros to above 50 $^{o}$C, the impact of climate change vary from crop to crop and area to area. Various studies have used models to assess the impact of climate change on several

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[14] IISD (International Institute for Sustainable Development). 2009. Community based adaptation to climate change Bulletin. A Summary of the Second International Workshop on Community Based Adaptation to Climate Change. 135(2): 1-23.

[15] Siddiqui, R., Samad, G., Nasir, M., & Jalil, H. H. (2012). The impact of climate change on major agricultural crops: evidence from Punjab, Pakistan. The Pakistan Development Review, 261-274.

[16] Parry, M. L.: Climate Change 2007: impacts, adaptation and vulnerability: contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2007

[17] Bandara, J.S.; Cai, Y. The impact of climate change on food crop productivity, food prices and food security in South Asia. Econ. Anal. Policy 2014, 44, 451–465.

[18] The World Bank (WB). World Bank Health Nutrition and Population Statistics. 2012. Available online: http://databank.worldbank.org/data/home.aspx.

[19] Döll P. 2002Impact of climate change and variability on irrigation requirements: a global perspective. Climate Change 54, 269–293

[20] Global Climate Risk Index, 2016. German Watch

crops in agro-ecological zones. A study conducted in 2011 surveyed farmers' observation about climate change[21]. 94% of the farmers observed changes in agricultural production due to climate change while 6% did not observe any change. Rains have reduced causing dramatic changes in agricultural production. Whereas few of the farmers informed that temperature increase had a positive impact on crop production. 65% of the farmers informed that there was a severe loss in wheat production due to climate change. Increasing temperature and decreasing rainfall will have alarming effect on wheat production as wheat is highly sensitive to climatic conditions. Another study from the Punjab displayed results about farmers' perception about climate change and adaptation strategies[22]. The study result indicated that majority of farmers observed increase in temperature in winters and summers, decrease in precipitation in winters and summers, increase in growing length for *rabi* season and no change in growing season length for *kharif*. The farmers' perceptions were in accordance to the displayed actual trends of temperature and precipitation in the study. Projected changes in hydrological parameters in Pakistan would have considerable direct and indirect effects on agricultural productivity. On field observations of climate change from farmers remains crucial indicator of adaptation process.

If we study the global trends, it could be observed that pieces of land cultivated for wheat, barley, maize, rice and soya bean have all been affected by drought as defined by Palmer Drought Severity Index[23]. The drought index has been increased from 5–10% in 1960s to 15-25% approximately[24]. It has also been estimated that drought derived yield reductions of major crops would increase by 50% till 2050[25], hence increasing the risk of severe food security. On the other hand, too much precipitation and melting of glaciers can cause flooding which would result in wiping out the entire cultivated areas in the river basin. Other than crop loss, floods also destroy soils, cause water logging and reduce the soil fertility, collectively, which will result in loss of agricultural productivity. The amount of rainfall is expected to be increasing day by day as the climate continues to warm. Although various studies have also estimated via Modelling and analysis that increase in rainfall could be beneficiary for agricultural production[26,27,28]. Effect of rainfall becomes pronounced

[21] Usman Shakoor, Abdul Saboor, Ikram Ali, and A.Q. Mohsin, 2011. Impact of Climate Change on Agriculture: Empirical Evidence from Arid Region. Pak. J. Agri. Sci., Vol. 48(4), 327-333; 2011

[22] Abid, M., Scheffran, J., Schneider, U. A., & Ashfaq, M. (2015). Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab province, Pakistan. Earth System Dynamics, 6(1), 225.

[23] Palmer, W. C. 1965 Meteorological drought. Research paper 45. Washington, DC: US Weather Bureau

[24] Li, Y. P., Ye, W., Wang, M. & Yan, X. D. 2009 Climate change and drought: a risk assessment of crop-yield impacts. Clim. Res. 39, 31–46.

[25] Li, Y. P., Ye, W., Wang, M. & Yan, X. D. 2009 Climate change and drought: a risk assessment of crop-yield impacts. Clim. Res. 39, 31–46.

[26] Siddiqui, R., Samad, G., Nasir, M., & Jalil, H. H. (2012). The impact of climate change on major agricultural crops: evidence from Punjab, Pakistan. The Pakistan Development Review, 261-274.

[27] Mahmood, N., Ahmad, B., Hassan, S., & Bakhsh, K. (2012). Impact of temperature and precipitation on rice productivity in rice-wheat cropping system of Punjab Province. JOURNAL OF ANIMAL AND PLANT SCIENCES, 22(4), 993-997.

[28] Usman Shakoor, Abdul Saboor, Ikram Ali, and A.Q. Mohsin, 2011. Impact of Climate Change on Agriculture: Empirical Evidence from Arid Region. Pak. J. Agri. Sci., Vol. 48(4), 327-333; 2011

depending on the particular time period of crop growth. For example, during the wheat grown season if the rainfall is above average, it will give a better yield but if the rainfall exceeds during grain formation period, it will destroy the crops and thus low yields would be obtained.

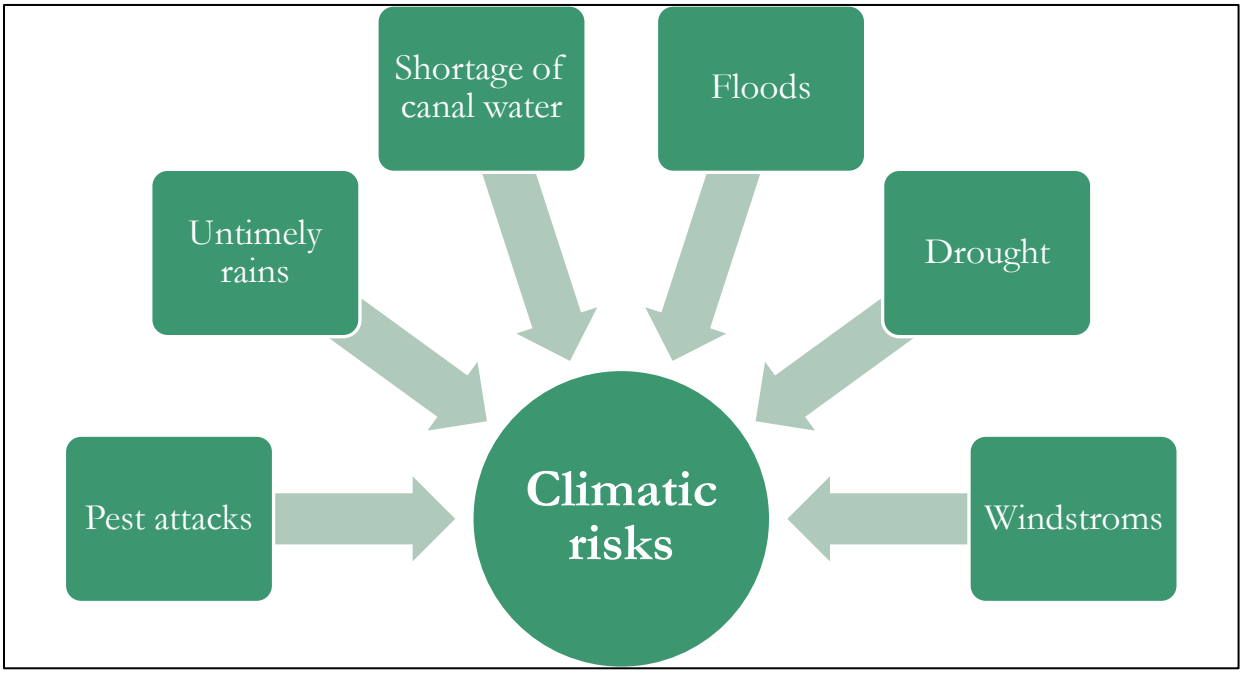
### *b- Findings from Field Study*

Productivity in agriculture greatly depends on stable and suitable climate. Along with effects on crop yields, water deficiency is also one of the results of climate change which will have direct impact on agricultural productivity in the Punjab. During the study, farming community and stakeholders mentioned climatic impact as one of the major risks that directly impacts the agricultural productivity of selected districts. Among climatic risks, unpredictable precipitations especially hailstorms were reported to be the most disastrous as they destroy the whole standing crops. Similarly, farmers also reported unpredicted rains which have been affecting the cotton crops where if the flowers become wet the whole crop is of no use and farmers have to work again from the starting. Another climate related risk is increased pest attacks, where farmers are reporting that due to increase in temperature, every year new pests are coming and the pesticides available in the market are not effective for these new pests. In Rahim Yar Khan, farmers reported that increasing temperatures make the crops dryer and the flowers get destroyed because of heat. Figure 4.3 displays the major climatic risks which were identified in this study.

#### i. Stakeholder and Policy Makers' Perceptions about Climate Risks

Climate plays an important part in the production of sustainable yields. Majority respondents of Key Informant and In-depth interviewees were of the view that climate change not only has adverse impact on crop yields but in some cases also causes increase in yields. With the increasing temperature, farmers are facing new risks everyday form pests, herbs and weeds. Selected districts are prone to not only floods but also droughts as most of the time periods average precipitation is below than required for the growth of a crop. Lack of proper and defined agro-ecological zones is also one of the problems in devising strategies and policies to mitigate the impact of climate change because every agro-ecological zone has its own climate and agricultural conditions. It has also been observed that people are shifting to other crops because of change in seasons but we cannot solely blame climate change for that. For example, farmers are shifting to sugarcane not only because of climate change but due to the less hard work required for the crop. Representatives of plant protection and grain market identified the increase in attack of pests every 2, 3 years which could possibly be because of changing climatic conditions.

Figure 4.3: Summary of Climatic Risks Being Faced by Small Farmers




Increased pest attacks were majorly attributed to changing climate during the study. According to literature, pest attacks are directly or indirectly influenced by changing climate[29][30]. In countries like Pakistan, where there are average winter temperatures, would experience longer periods of suitable climate for pests which is usually ranging between 30-50°C and humid conditions. Similarly early onset of summers would mean early threats from pests for a long period of time. Moreover, extreme or untimely precipitations also result in longer suitable environment for most of the pests of cotton, sugarcane, mango and wheat. Also some studies suggest that, increased carbon dioxide levels, will accelerate the reproduction rates of pest hence more generations per season[31]. This will result in increased resistance to pesticides and sprays. In the Punjab, the most widespread attack is being caused by Whitefly, which grows in hot and dry conditions. Farmers reported that if Whitefly attacks their cotton crops then that can cause losses to their crops up to the tune of 60-70%. In addition, Pink Bollworm attacks sugarcane as well as cotton. Details of other pests that attack crops in the Punjab are tabulated below:

*Table 4.2: Pest Attacks in Punjab (2016)*

| Months | Pests and weeds | Crops effected |
|---|---|---|
| **January** | Nothing to report | |
| **February** | Aphid | Wheat |

[29] Curtis Petzoldt and Abby Seaman. Climate Change Effects on Insects and Pathogens. http://www.panna.org/sites/default/files/CC%20insects&pests.pdf

[30] Climate Change: Impact on Crop Pests. Prakash, Anand, Jagadiswari Rao, Arup K. Mukherjee, J. Berliner, Somnath S. Pokhare, Totan Adak, Sushmita Munda, and P. R. Shashank. Applied Zoologists Research Association (AZRA), Central Rice Research Institute, 2014.

[31] Climate Change and Crop Pests, Weeds and Disease: A Concern for Today and Tomorrow?. https://businesswales.gov.wales/farmingconnect/sites/farming/files/climate_change_crop_pests_weads_and_disease.pdf

| | | |
|---|---|---|
| **March** | Top Borrer, Aphid | Sugar cane, Wheat |
| **April** | Stem Borrer, Root Borrer, Black Bug, Pink Bollworm, Aphid, Dusky cotton bug | Sugar cane, Wheat |
| **May** | Top Borrer, Stem Borrer, Black Bug, Red Mites, Pink Bollworm, Dusky cotton bug | Sugar cane, Mango |
| **June** | Stem Borrer, Root Borrer, Gurdaspur Borer, Red Mites, Jassid, Pink Bollworm, Mango Mealybug, Thrips, Dusky cotton bug, American Bollworm | Sugar cane, Cotton, Mango |
| **July** | Top Borrer, Stem Borrer, Gurdaspur Borer, Red Mites, Jassid, Spotted Bollworm, Pink Bollworm, Mango Mealybug, Thrips, American Bollworm | Sugar cane, Cotton, Mango |
| **August** | Top Borrer, White Mite, White fly, Jassid, Spotted Bollworm, Army worm, Pink Bollworm Mango Mealybug, Thrips, American Bollworm | Sugar cane, Cotton, Mango, |
| **September** | White Mite, White fly, Jassid, Aphid, Spotted Bollworm, Army worm, Pink Bollworm | Sugar cane, Cotton, Mango |
| **October** | Root Borrer, White fly, Jassid, Aphid Spotted Bollworm, Army worm, Pink Bollworm | Sugar cane, Cotton, Mango |
| **November** | Jassid | Cotton |
| **December** | Nothing to report | |

Source: Pest Situation 2016, Agriculture Department Punjab[32]

Pest scouting reports of 2017 indicate that the attacks of Pink Bollworm will become very frequent in this season[33].

During FGDs, farmers of RYK reported an increase in Wheat yield during the past two years. Increase in the yield of Wheat was attributed to the relatively increased temperatures in the month of December observed during past few years. Scientific studies have also concluded that increase in temperature during the growing stage has positive impact on the yield.

Temperature plays a critical role in the growth of the wheat crop. The photosynthesis process of the plant is sensitive to temperature and a 1 degree Centigrade change in temperature can impact the overall crop yields of a country. During growth season, wheat requires low temperature and moisture while harvesting period is constrained by dry and warm weather. The mean temperature required during sowing is 10°C to 15°C and during harvesting, it requires a higher temperature, but sudden rise of temperature is harmful and can adversely affect its growth. The higher temperatures at growing usually speed up the wheat development cycle so that it matures sooner, thus shortening the duration of grain filling period. Studies in Pakistan have focused on the impact of climate change on wheat crops. Findings of the study suggests that rise in temperature in a specific time of crop cycle can actually increase the yields. For example, a study has found following effects of temperature variability on wheat productivity at different stages of growth[34]:

[32] Pest situation on cotton crop in Punjab during 3rd week of May, 2016. http://pestwarning.agripunjab.gov.pk/system/files/Cotton%203rd%20Obser%20May%2C%202016.pdf

[33] http://www.agripunjab.gov.pk/system/files/26-09-2017%20%28Pest%20scouting.pdf

[34] Ashfaq, M., Zulfiqar, F., Sarwar, I., Quddus, M.A. and Baig, I.A., 2011. Impact of climate change on wheat productivity in mixed cropping system of Punjab. Soil & Environment, 30(2).

| Increase in Temperature | Effect on Wheat Yield |
|---|---|
| **Increase of 1°C in Mean Minimum Temperature During Sowing Stage** | Increase by 146.57 kg per hectare |
| **Increase of 1°C in Mean Maximum Temperature During Vegetation Stage** | Reduction in yield due to higher vegetative growth but reduction in grain development period |
| **Increase of 1°C in Mean Maximum Temperature During Maturity Stage** | Increase by 136.63 kg per hectare |

Similar results were obtained by Weber and Hauer (2003), Mendelsohn and Reinsborough (2007) and Knight et al. (1978)[35].

Another study used Fixed Effect Model to explain the impact of climate on different crops. The results of this model show that temperature affects wheat crop non-linearly only at the first stage of production. Surprisingly, this non-linear relationship is of U-shaped type. This means that after the temperature of 14.76°C, further increase in temperature will positively affect wheat crop hence increasing the yields[36].

However, this increase can be neutralized if there is shortage of canal water or precipitation or the farmer doesn't have the resources to use adequate inputs like fertilizers and pesticides. Thus net increase or decrease in the yield of a crop is a function of multiple factors, i.e. quality seeds, inputs, water and suitable temperature conditions.

## ii. Farming Community's Perceptions[37] about Climate Risk

In general, timely availability of water is necessary for growing higher yield crops, but if the precipitation is untimely, it can cause great losses to the yields. FGDs from Rahim Yar Khan, revealed that lately untimely and unpredictable precipitation damage the growth ability of cotton crop and once the flowers are wet from water the plant is destroyed. The cotton is ready to be harvested from 20th august to 20th September and sudden rains, or heavy winds can affect and damage the whole crop and there is nothing left. Cotton crop has been lately affected not only by untimely rains but also high temperature reduces the flower size. According to farming community in Rahim Yar Khan, rising temperature is affecting almost all the crops.

[35] Ibid.
[36] Ibid., 22
[37] Perceptions are based on information obtained through FGDs

The government has started introducing now heat resistant seeds; however there are still problems for small farmers to access those seeds. High temperatures are specially impacting the crops at flowering stage because flowers cannot bear the elevated temperatures and they dry up. This year farmers witnessed a different type of climate change that in winters (February), the temperatures suddenly rose to 30°C. This caused shedding of flowers from the Mango trees. Mango and cotton flowers are especially reported to be affected.

Also farmers were of view that there is a shift in seasons and now summers come earlier and last longer. Flowers of cotton crop tend to fall if summers get intense at the earlier stage, i.e. in April and May. Similar case is with wheat crop where early summers can result in pre-mature growth of wheat grain.

Another impact of climate change identified by farmers of Rahim Yar Khan was that increased humidity also affects the flowers of cotton crops. Some villages in Rahim Yar Khan have faced low precipitation and dry period for almost seven years and these short span untimely rains after seven years have increased the humidity which reportedly resulted in increased attacks of viruses and new pests. Frequency of hailstorms and windstorms has also increased and farmers attribute them to low forest cover. Mango fields are also prone to be damaged from hailstorms.

Cropping pattern in RYK has also shifted from cotton to sugarcane because of certain reasons. One was pre-monsoon, which was damaging cotton crop but it was beneficial for sugarcane. In Muzaffargarh, there were great losses to cotton crops because of untimely rains during past years. Frequent floods have also caused damages to the standing crops in Muzaffargarh from year 2010 onwards. Untimely rains also cause humidity which brings various viruses and pests and the wheat crops get dried because of that.

Farmers affected by 2010 flood were of the view that it had pushed those 6-7 years back in terms of livelihoods and asset holding. They were much concerned about the public service delivery (Extension, Livestock, and Health) in their villages.

Villagers of Mauzah Faizabad in RYK also complained about the ineffectiveness of flood warning system. They said that in 2015 they were reluctant to migrate to safer places after flood warning. However, after being forced by the state institutions, they travelled to the safer places. They said they were not allowed to come back to their villages for 20 days. "Luckily flood water didn't come over the banks of the Indus River, so their homes remained safe but their crops were affected indirectly. Since they couldn't irrigate their cotton crop (which needed irrigation 10 days after they were made to leave the village), the crop had dried up and they suffered losses due to ineffective flood warning and assessment system."

*c- Rising Water Requirements*[38]*:*

Agriculture in Pakistan not only relies on water from precipitation but it also greatly depends on water coming from glaciers and mountains, ice melting into rivers and canal system. Most part of the agricultural land in the Punjab is dependent on the canal water system. Owing to increasing temperature and climate change, glaciers and ice is melting at alarming rates thus decreasing the water reserve for future use. Owing to increased evapotranspiration, the water requirements of major crops also rise.

*Table 4.3(a): Month Wise Normal and Projected Evapotranspiration with Temperature Increments of 1°C 2°C and 3°C in Southern Half of Pakistan*

| Months | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Normal** | 36 | 50.6 | 85.7 | 127.4 | 170.4 | 182.5 | 165.9 | 147.8 | 118.6 | 82.5 | 47 | 33.2 |
| **1°C Rise** | 38.1 | 53.3 | 89.5 | 130.6 | 175.9 | 187.4 | 170.7 | 152.7 | 122.6 | 86 | 49.1 | 34.9 |
| **2°C Rise** | 40 | 55 | 92 | 135.3 | 179.9 | 191.4 | 174.2 | 155.4 | 124.8 | 87.6 | 50.4 | 38.6 |
| **3°C Rise** | 42.2 | 56.2 | 94.1 | 138.1 | 183.5 | 194.5 | 178 | 159 | 128.4 | 90 | 51.8 | 40.2 |

Source: Naheed and Rasul (2010)[39]

Wheat crop is usually planted in mild temperature. Low humid areas and high precipitations there can cause diseases and interferes the planting to harvesting stages thus lowering the overall yields. Wheat sowing if delayed till middle of December or advance sowing in last week of November could reduce the yields up to 15-20 Kg/acre. Water availability is critical in two stages of wheat crop, i.e. the period from the development of adventitious roots to the start of tillering and the period from anthesis to the milk maturity stage. A study on water requirements for wheat in Pakistan displays the areas of South Punjab as "dry" where the condition is severe moisture stress and 12.5% available soil moisture[40]. Hence irrigation is badly needed in these areas to properly grow the crops. In the months of November till January, the study area of Muzaffargarh and Rahim Yar Khan would heavily rely on only irrigation water for sowing and growing period. In February, water requirement exceeds the previous month's requirements because of flowering stage. Owing to substantial rainfall in February and March almost moisture content is reached till 25% but still 75% needs to be fulfilled via irrigation for the study areas and in April, the wheat is harvested.

About 80% of cotton is grown in Punjab province and it contributes about 3.2% to national GDP. Cotton crop is planted in mid-May to mid-July and harvested in October to December. Cotton growing areas of Muzaffargarh and Rahim Yar Khan are categorized as "dry" region depending on

[38] Water issue is not exclusively a climatic issue. It is also mired in governance related issues. But climate change is further exasperating this issue. That is why it has been included in the climatic risk section.

[39] Naheed, G. and Rasul, G., 2010. Projections of crop water requirement in Pakistan under global warming. Pakistan Journal of Meteorology, 7(13), pp.45-51.

[40] Naheed, Ghazala, and Arif Mahmood. "Water requirement of wheat crop in Pakistan." Pakistan Journal of Meteorology 6, no. 11 (2009): 89-97.

the water availability via precipitation[41]. From May to December, these areas remain water stressed and only precipitation cannot fulfill the requirements of water for cotton crop, requiring proper irrigation and water supply to sustain cotton yields. Water requirement for cotton is observed highest for the months September-November. It increases over the period. Water requirement is calculated by keeping in view different factors like soil heat flux density, net radiation at the crop surface, reference evapotranspiration, mean daily temperature at 2m height, saturation vapor pressure, actual vapor pressure, etc. Estimations made through FAO Penman-Monteith methods show that water requirement for cotton increased during the period 1971-2000 than the period 1961-1990 in the Punjab.

*Table 4.3(b): Quantitative Increase of Water Requirement during the Period (1971-2000) than the Period (1961-1990)*

| Months | Punjab (mm/month) | Sindh (mm/month) |
|---|---|---|
| **May** | 7.7 | 7.4 |
| **Jun** | 12.3 | 3.0 |
| **Jul** | 26.1 | 24.2 |
| **Aug** | 3.4 | 24.9 |
| **Sep** | 39.6 | 36.2 |
| **Oct** | 35.4 | 32.3 |
| **Nov** | 34.2 | 34.9 |
| **Dec** | 13.9 | 20.1 |

### *d- Decreasing Water Availability*

Agriculture sector heavily depends on water availability from canal systems, precipitation and groundwater sources. Water quality and availability has been on the decline in the recent years for small farmers in Pakistan. Small farmers greatly depend on irrigation water because groundwater is usually costly for them (due to diesel and electricity expenses used to run generators). Small farmers in both the districts complained about the shortage of water. In particular, the farmers at tail of the canals face severe water shortages. They said that farmers along the stream steal water depriving the former from their fair share of water. If there is some large landholder at the tail, he uses his influence to utilize maximum water available at the tail thus further affecting the small landholders there.

There is a village in Rahim Yar Khan where people don't have access to canal water and thus they are left with no other option but to use sewage water for their crops. But, they have to pay for that sewage water. Low rainfall has also increased the problems of small farmers. Water is provided through schedules. In first schedule, the farmers get the whole share but in the second schedule the amount is halved and in third schedule they get no water. Also, the farmers near the canals control the water and hence share of small farmer is more shrunk. Some farmers also said that when the canals enter to Rahim Yar Khan, they are cut-off and water is given to Sindh from there.

[41] Naheed, Ghazala, and Ghulam Rasul. "Recent water requirement of cotton crop in Pakistan." Pak. J. Meteor 6, no. 12 (2010): 75-84.

In Muzaffargarh too, small farmers complained the most about the shortage of water. There are areas which are not canal-fed and farmers living there have to rely only on tube wells and precipitation which makes their condition graver. In areas where there is a canal system, water is supplied 0only 7 months of a year. It was also observed that whenever a flood comes in other areas with canal system the canal water of Muzaffargarh was also cut off. Farmers are also reluctant to grow crops with high water demand such as sugarcane. Farmers in Muzaffargarh were of view that people from behind steal their share of water. They said if they are committed to be provided 15 days water, they get only 8-day water because of water theft. Soil conditions are such that they have to give double water compared to other areas hence leaving more burden on small farmers. Use of water from tube wells has eventually increased the burden of loans on small farmers and also some farmers complained about the low quality groundwater which is further declining the yields.

In the Kharif season 2017, there was an overall shortage of 2% in canal water distribution in the Punjab against the demand. Alarmingly the shortage during early Kharif period was 12%. Shortage at that stage has adverse effect on the initial vegetative growth of cotton crop. Moreover, it also affects the cropping decisions of farmers. They may decide to sow fodder crop instead of cotton so that they can at least nourish their livestock. Livestock often serves as the buffer asset during times of natural shocks for them. It's easier and sustainable to sell livestock. But selling livestock is neither an easier nor a sustainable solution, and selling of land affects their livelihood adversely.

It is also important to note that the average usage had been established on the basis of demand during 1977-82. However, the actual water demand has grown as compared to that period. The only reason that RYK has turned into a sugarcane zone from a cotton zone is water requirements are more than double in case of cotton crop. If current usages are taken into account then it is quite possible that the excess being reported in the difference column of table below would become shortage and the shortage being reported in that column would increase at least twofold. Detailed statistics about the distribution of Actual and Tentative Distributions in both the districts for Kharif and Rabi 2016-17 are presented in Annexure 3.2.

*Table 4.4 (a) Distribution Programme Kharif 2017 – Punjab*

| Period | Average Uses (1977-82) | Allocated Share | Difference |
|---|---|---|---|
| **Early Kharif Period 2017 (April 01 – June 10)** | 11.613 MAF | 10.248 MAF | Shortage (-) 12 % |
| **Late Kharif Period 2017 (June 11 – Sep 30)** | 23.035 MAF | 23.680 MAF | Excess (+) 2% |
| **Total Kharif Period (April 01 – Sep 30)** | 34.648 MAF | 33.927 MAF | Shortage (-) 2% |

Source: Punjab Irrigation Department[42]

[42] Distribution Programme Kharif 2017. Punjab Irrigation Department. http://irrigation.punjab.gov.pk/data/Distribution%20program%20kharif%202017.pdf

In Rabi 2016-17 distribution plan, there was a water shortage of 17.6% in the Punjab with respect to average uses during the period 1977-1982. For the Rabi season 2017-18, the anticipated water shortage will be of 20% as compared to the average usage, which is highest during the past seven years and it doesn't bode well for the wheat crop.

*Table 4.4 (b) Water Shortages during Rabi Seasons (2010-18)*

| Rabi Season | Water Shortage With Respect to Average Uses During the Period 1977-82 |
|---|---|
| **2010-11** | 11.10% |
| **2011-12** | 9.40% |
| **2012-13** | 17.20% |
| **2013-14** | 14.70% |
| **2014-15** | 3.80% |
| **2015-16** | 13.50% |
| **2016-17** | 17.20% |
| **2017-18** | 20% |

Source: Punjab Irrigation Department

RYK Canal Circle falls in Bahawalpur Irrigation Zone. RYK district is irrigated by distributaries of Panjnad Main Line Canal and Abbasia Link Canal. Distributaries of Panjnad Main Line are Minchin Branch, Abbasia Canal RYK Branch, Sadiqabad Branch and Dallas Branch. RYK canal circle is at the tail Command of Tarbela Dam. Distributions during Kharif 2017 in the RYK irrigation circle are tabulated below in Annexures.

MZFR district is irrigated by Muzaffargarh Canal of Haveli Canal System and Rangpur Canal of Rangpur Canal System. Both fall in DG Khan Irrigation Zone. Water allowances for Perennial canals in HCS are 3.00 Cs/1000 acres and for non-perennial canals it is 4.80 Cs/1000 acres. Muzaffargarh canal is a perennial one. Rangpur canal is a non-perennial one having water allowance of 4.80 Cs/1000 acres[43]. Like the canals of RYK, the Muzaffargarh canal also received high distributions in late Kharif, which is also the post monsoon period.

### *e- Deteriorating Water Quality*

Along with the shortage of water, there is also an issue of water quality. Farmers usually fill the gaps in canal water supply through extraction of water by tube wells. There are 59,320 tube wells in MZFR and 47,761 in RYK. Water discharge through tube wells has affected the groundwater quality and rendered it unfit. Water quality issue is more aggravated in perennial areas, which is also the area of 'pakka', a vernacular term. Farmers of non-perennial area, which is also the area of 'kaccha' have fit and sweet groundwater. Respondents of Village 106 of UC 51 in RYK reported that due to excessive shortage of canal water and unfit groundwater quality, they started using the sewage water

[43] Multan Irrigation Zone. Punjab Irrigation Department. http://irrigation.punjab.gov.pk/mtnzone.aspx

coming from RYK city for irrigation purpose without knowing the repercussions. According to Water Quality Maps of Punjab 2013, during pre-monsoon 2013, water quality was unfit at 262 WQ Monitoring Points and fit at 183 WQ Monitoring Points of Bahawalpur Irrigation Zone. After monsoon, it was fit at 187 points and unfit at 258 points. Figure 4.4 and 4.5 show post and pre monsoon water quality maps of Bahawalpur respectively. Region in pink shade has unfit groundwater and the one in blue has fit groundwater.

Figure 4.4: Water Quality Map – Bahawalpur (Post Monsoon, 2013)

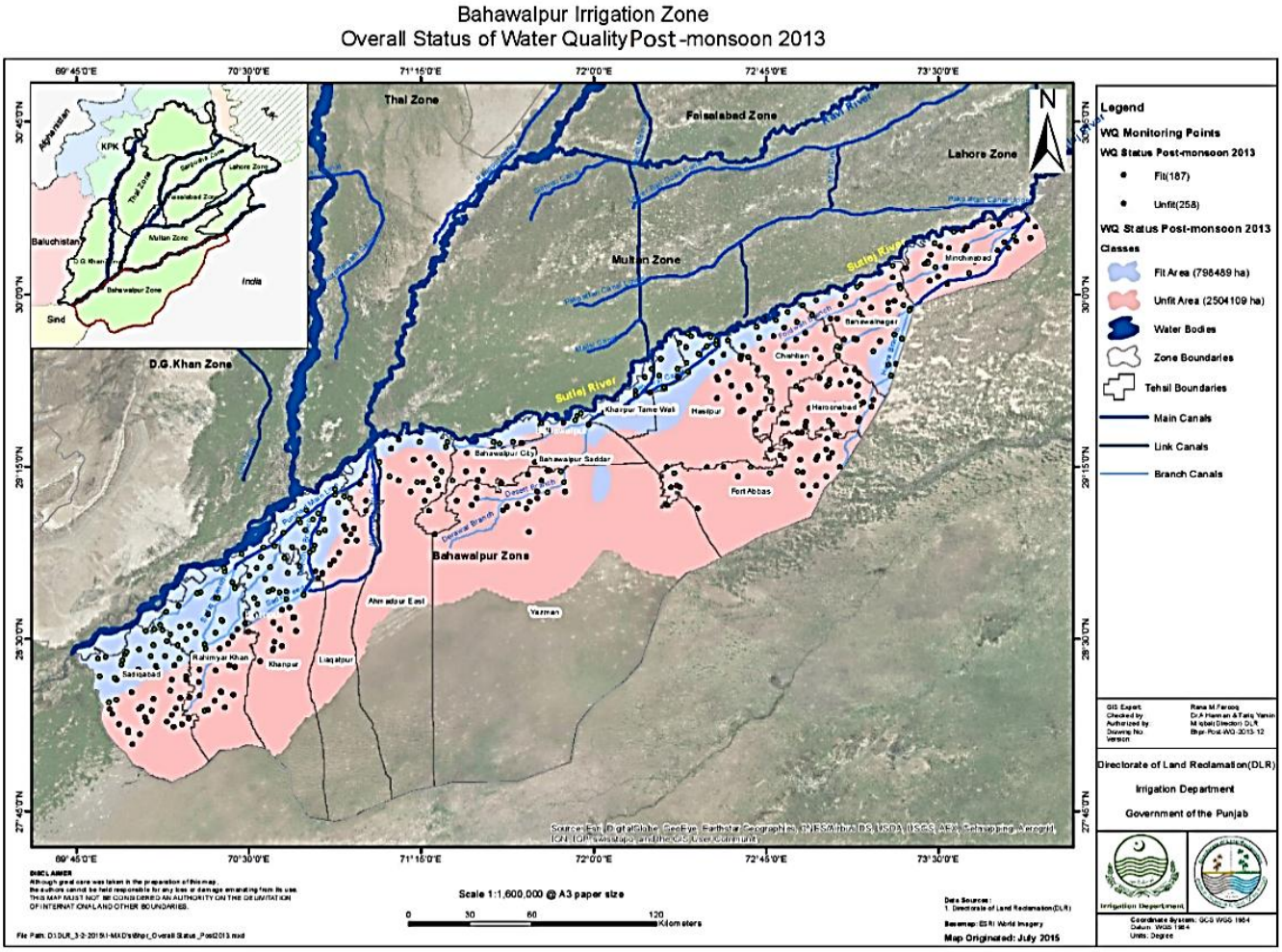
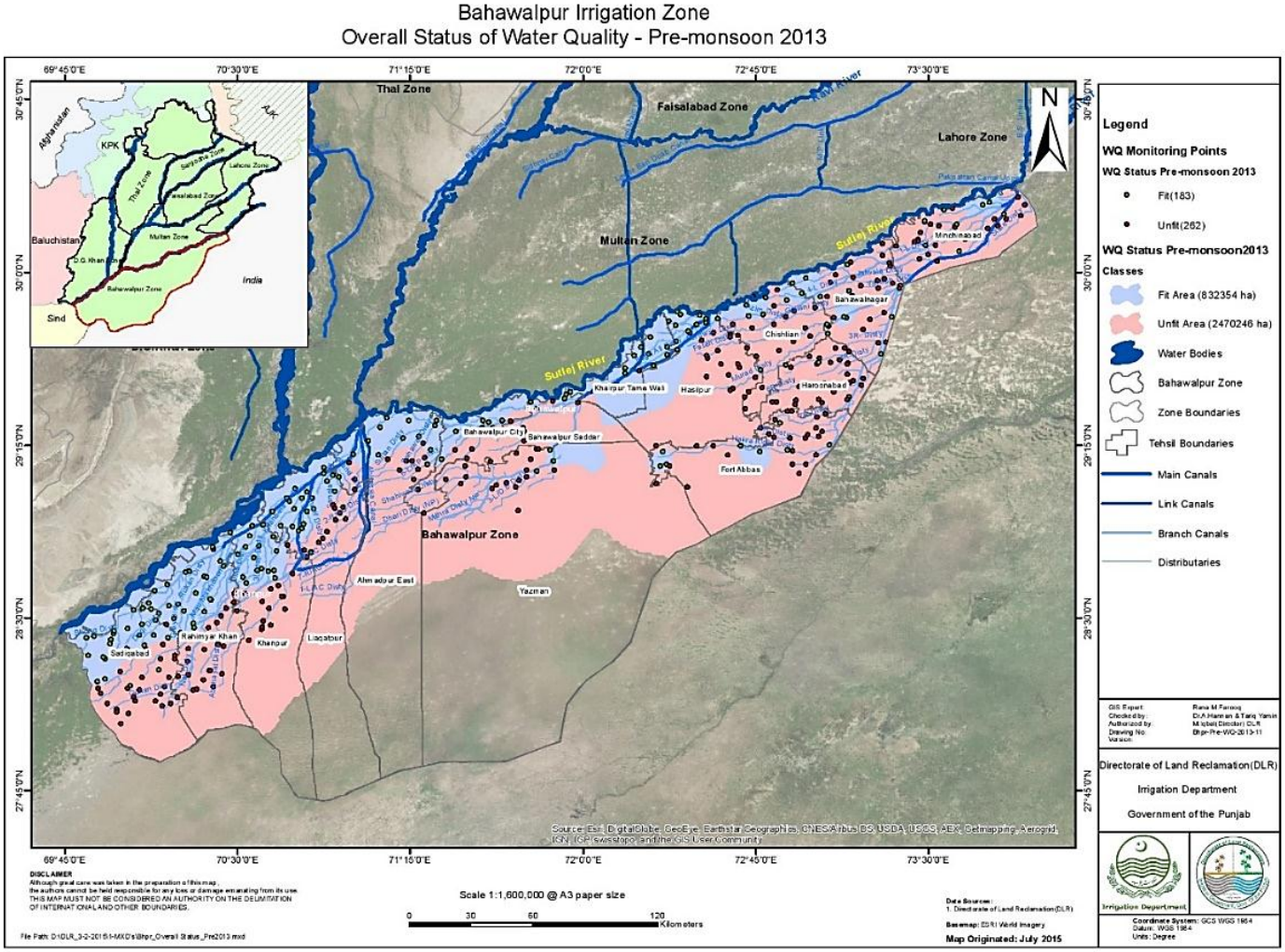


Figure 4.5: Water Quality Map – Bahawalpur (Pre Monsoon, 2013)




In DG Khan Zone, during pre-monsoon 2013, water quality was fit at 186 WQ Monitoring Points and unfit at 130 points. After monsoon 2013, it was fit at 188 points and was unfit at 128 points. As Muzaffargarh is surrounded by Chenab River on the East and Indus River on the West, groundwater recharge is higher in MZFR as compared to RYK. RYK's eastern part is away from the Indus. Therefore, due to very low river induced water recharge, that part has serious ground water quality issue. Figure 4.6 and 4.7 show pre and post monsoon water quality maps of MZFR.

Figure 4.6: Water Quality Map – DG Khan (Post Monsoon, 2013)

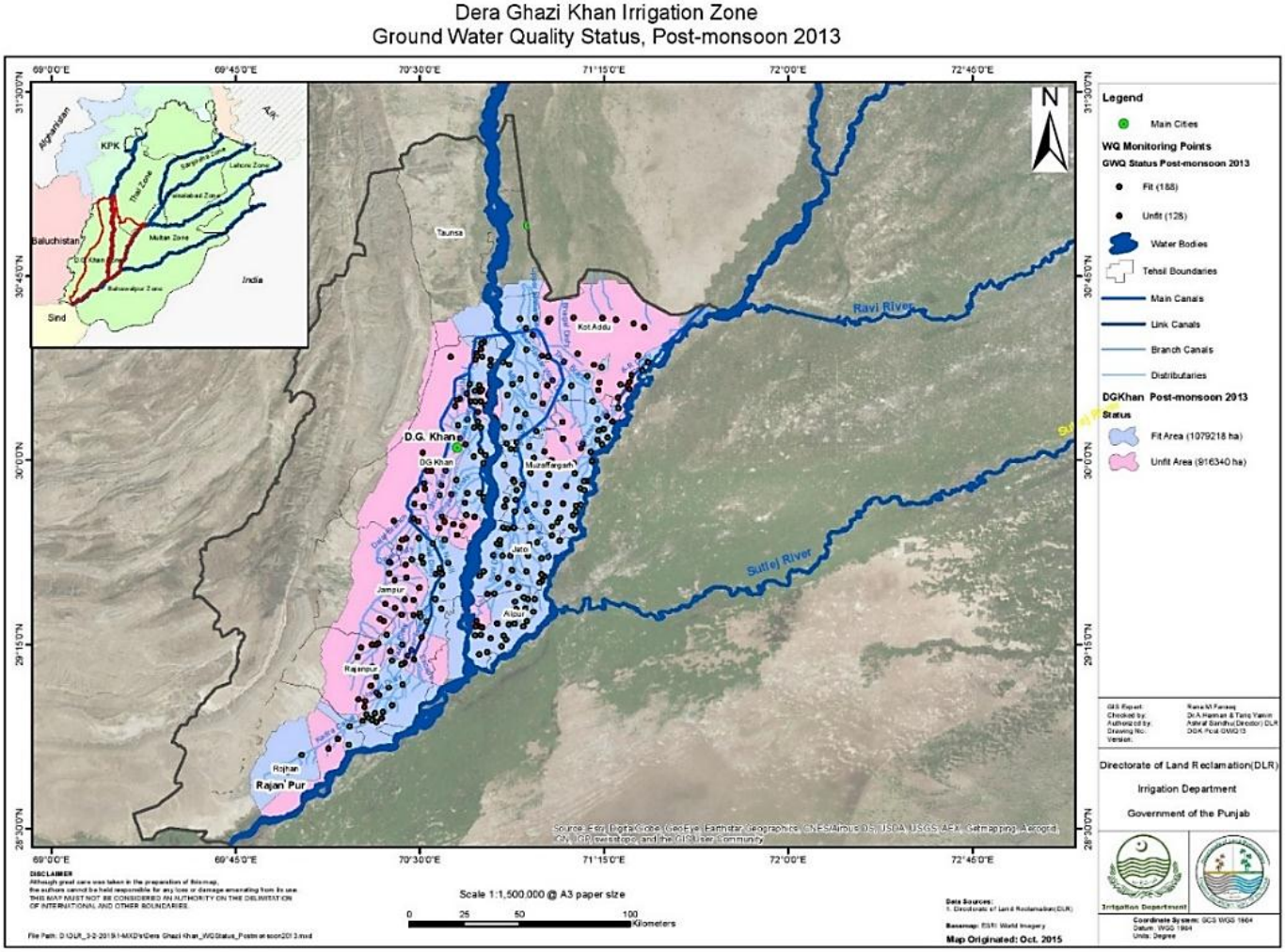
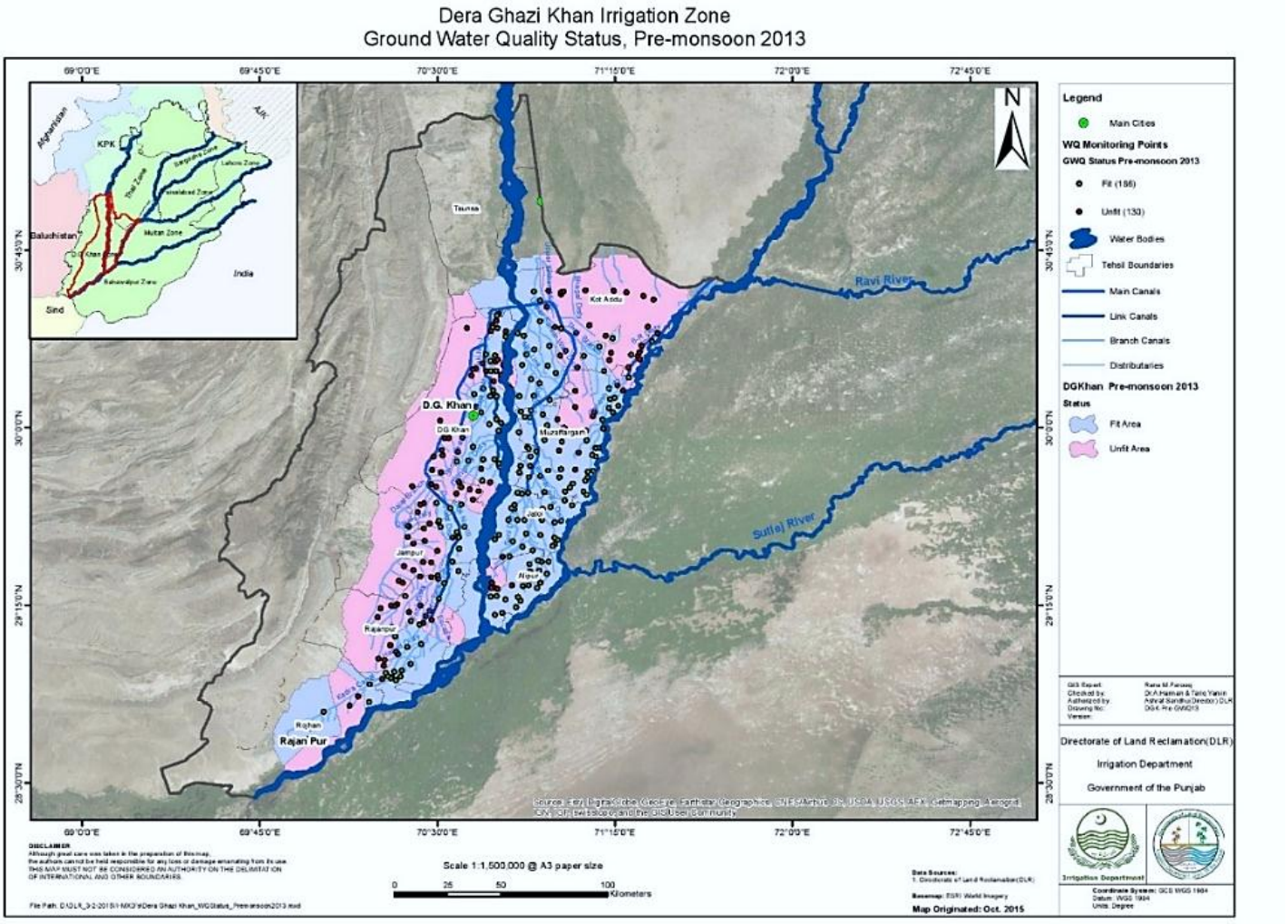


Figure 4.7: Water Quality Map – DG Khan (Pre Monsoon, 2013)



### 4.2.3 CLIMATE CHANGE AND WOMEN

Literature finds out that although climate change is a gender neutral concept, it differentially impacts women because of lack of resources, lack of land ownership and greater work pressure and oppression[44]. Women of a cotton zone like MZFR and RYK have a very significant role in the cotton value chain as cotton pickers. They are prone to hazards associated with pests and pesticides. There is an evidence that they pick cotton even during pregnancy, thus exposing the unborn offspring to those risks too[45]. They face recurring headaches, skin and eye ailments and in some cases end up spending a third of their monthly income on health bills[46].

Nevertheless, two trends have been found out regarding the cotton pickers in a study conducted by SDPI on the impact of climate change on cotton value chain[47]. First is that as more girls are getting educated, their tendency to work in fields is declining. Secondly, those who work, they tend to work as industrial laborers in cotton processing industries at a relatively better wage as compared to cotton picking. However, working conditions for women are difficult in the manufacturing sector. They mostly work in the trash removal units and are prone to allergies caused by cotton fiber.

Another study of SDPI[48], focusing on climate change induced migration found decline wheat yields and out-migration to be major implications of heat waves. It was also found that these two effects would further exacerbate the situation of already socioeconomically deprived women. With males out-migrating to urban centres for secure livelihoods, the female household members left behind are likely to be affected in terms of traditional household chores (like securing energy and water supply), additional male-dominated tasks they need to acquire in the absence of males and their overall socioeconomic wellbeing (likely to be affected due to low education status, lack of job opportunities and limited mobility).

During FGDs for this feasibility study too, while discussing the labor issues, it was acknowledged by a few farmers that since their daughters were getting education, it was hard to find them picking cotton. One farmer said that even his daughter-in-law is educated. She also doesn't go for cotton picking. These claims, on one hand, reflect the misogynist nature of our rural community and on the other hand present some silver lining for women development.

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[44] Denton, F., 2002. Climate change vulnerability, impacts, and adaptation: Why does gender matter?. Gender & Development, 10(2), pp.10-20.

[45] Alavi, H., 1991. Pakistani women in a changing society. In Economy and Culture in Pakistan (pp. 124-142). Palgrave Macmillan UK.

[46] Women pickers toil unprotected in Pakistan's cotton fields. Https://www.reuters.com/article/us-pakistan-women-cotton/women-pickers-toil-unprotected-in-pakistans-cotton-fields-iduskcn1bl003

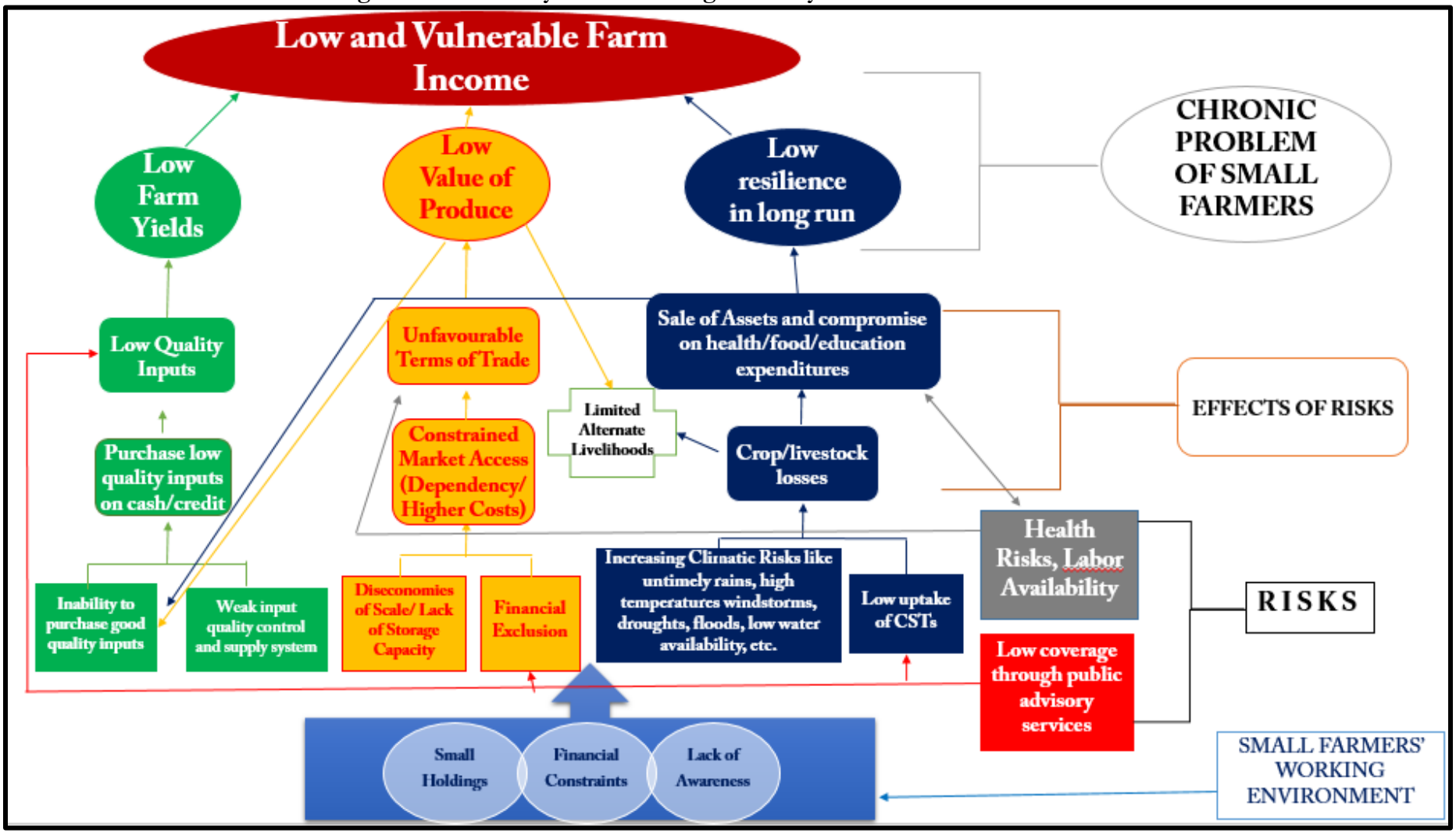
[47] Batool, S. and Saeed, F., 2017. Mapping the cotton value chain in Pakistan: A preliminary assessment for identification of climate vulnerabilities & pathways to adaptation. PRISE Working Paper.

[48] Saeed, F., Salik, K.M. and Ishfaq, S., 2016. Climate Induced Rural-to-Urban Migration in Pakistan. PRISE Working Paper.

The villagers close to the river bank reported that the woes of women increase in the situation of flood in different ways. Firstly, they have to carry the necessary household items while evacuating the homes in emergency situation. Secondly, they have to manage the household affairs like cooking, bathing children, etc. in temporary shelter homes. Thirdly, they might resort to open defecation which is a disgraceful experience. Fourthly, incidence of child diseases also increases in flood situation.

During the HH survey (results presented in detail in Section 4.6), it was reported by half of the farmers that they used up savings of women in time of climate related shocks. Moreover, they also reported reduction in HH food, clothing and health expenditures, which ultimately affect the female HH members too.

Figure 4.8: Summary of Risks Being Faced by the Small Farmers



## 4.3. Risk Management Tools Identified In Qualitative Study

Small farmers in southern Punjab tend to rely more on informal and farm based risk management practices. The most common practice for managing risk is selling off the livestock to recover from initial losses. Livestock are kept by farmers of Rahim Yar Khan and Muzaffargarh to be used as buffer asset at time of shocks. Similarly, timber is also used for managing the initial losses. Taking credit on high interest is also one of the most common practices of small farmers to better manage their risks. Sometimes these loans are acquired from MFIs and sometimes from middlemen and large farmers. In both cases, small farmers are trapped in high interest rates. Some farmers are also practicing the use of new seeds which are heat resistant hence avoiding the climatic risks, but the heat resistant seeds are not accessible to most of the farmers.

Livelihood diversification measure like migration of one or two family members to large cities like Karachi or Lahore or even to Middle East is a relatively less frequent and off-farm risk coping strategy in most of the farming families.

Farmers participating in the FGDs said that they adopt following risk management strategies to cope with the risks faced by them:

- Enhanced use of fertilizers and pesticides,
- Advance selling to the middlemen,
- Buying inputs on credit,
- Getting agri-credit from Specialized Financial Institutions (such as ZTBL), Banking Financial Institutions (such as UBL, HBL, ABL, etc.) or Microfinance Institutions (such as NRSP Bank, Khushhali Bank) and
- Crop loan insurance.
- Forward contracting with mills.
- Adopting new seed varieties.
- Searching for alternate livelihoods.
- Keeping livestock for food (milk) and commercial purposes.
- Cleaning of water channels
- Replacing Cotton (and wheat) with Sugarcane

### 4.3.1. ENHANCED USE OF FERTILIZERS AND PESTICIDES

Although the farmers complained about the low quality of fertilizers, when asked about the reasons of increase in yields during last twenty years, they attributed some of the increase in that yield to enhanced use of fertilizers like Urea and DAP. Some farmers said that they had applied zinc to their fields and it had improved the yield.

Like fertilizers, the farmers also acknowledged the increased use of pesticides. However, farmers are using different quality of fertilizers according to their financial position. Those who can afford the higher price, they were using the best quality pesticide available in the market.

### 4.3.2. ADVANCE SELLING OR PURCHASE OF INPUTS ON CREDIT

Advance selling or purchase of inputs on credit becomes a risk management strategy for those farmers who don't have adequate resources to purchase the inputs on cash. Even if they have some cash then they try to save it for their daily usage or precautionary measures.

Advance selling serves as quasi futures market. By selling in advance, farmers borrow money from middlemen or traders. But, most importantly, it leaves margin for middleman or traders to exploit the farmer. They earn profit on the lent money. Second option is to purchase the inputs on credit from fertilizers or pesticide sellers. Like advance sale, purchase of inputs on credit also entails payment of high markup rates by farmers at the time of selling their produce. And like any bank based lending activity, the profit rate fixed by the middlemen or traders is higher when the money lent by them is of low amount or the payback period is small.

Here, it is important to emphasize the need for co-operatives. Mostly small farmers sell their crops to middle men at a rate lower than market rate because they don't have produce in such a quantity that its transport to food department is economical for the farmers themselves. If they hire a transport vehicle then its cost is not bearable for them. Moreover, unjust practice of traders in the grain market also disappoints them and they decide to sell the produce on the farm. Traders, for instance, have different rates of labor for loading and unloading. They charge farmer a higher labor rate for unloading his produce than the loading price they charge the buyers of their grain. It is a common sense that unloading is an easier task. Its cost should be lower. But this is not the actual practice.

However, if small farmers adopt informal group farming or become member of some cooperative then they can overcome the diseconomies of scale hindering their agronomic practices.

### 4.3.3. AGRI-CREDIT

Getting loans from Zarai Taraqiati Bank, Khushhali Bank, NRSP Bank and other commercial banks is the most frequent alternative to purchase of inputs on credit. Different markup rates are charged on those loans by the Banks starting from 12.5% to 35% depending upon the loan period, loaned amount, number of payback installments and collateral requirements.

### 4.3.4. CROP LOAN INSURANCE SCHEME (CLIS)

State Bank of Pakistan has made crop loan insurance mandatory for major crops, i.e. wheat, rice, cotton, sugarcane and maize to avoid risk of losses due to natural calamities in war-affected areas while borrowers from other areas can also exercise the option. For livestock sector, State Bank of Pakistan encourages banks involved in livestock lending to cover all livestock loans up to the tune of Rs 5 million. Imperils insured under that scheme include death due to disease/nature; death due to

flood, heavy rains, windstorm and accidental health. Banks usually involve private sector insurance companies like Al-Falah Insurance, United Insurance, etc. for implementing CLIS.

However, both crop loan insurance and livestock borrowers' insurance are available to those farmers only who tend to borrow agri-credit as a risk aversion tool. Moreover, the insured sum is only up to the amount of loan extended. Thus, virtually the CLIS is actually a measure to prevent default on loans and it benefits the banks only. It's a 'loan insurance', not 'crop insurance'. Another issue with the CLIS is that it is triggered only when the Deputy Commissioner declares an area as disaster affected. This administrative requirement sometimes becomes a sort of 'red tape'. Nevertheless, adoption of agriculture credit as a risk management strategy depends upon multiple factors like availability of liquid monetary resources for buying inputs, experience, education/awareness, access to credit sources and collateral requirements.

### 4.3.5. FORWARD CONTRACTING WITH MILLS

This practice is mostly used for sugarcane crop, but not at a large scale. To increase their profitability, some sugar mill owners of South Punjab region grows sugar cane on their own too besides purchasing the sugarcane from farmers. They do the former by leasing land or in some cases they enter into forward contracting too. Under the contract, mill owners provide necessary financial resources for purchase of inputs. Those resources are provided on interest. But, they mostly enter into contract with medium or large farmers having good quality land and better access to surface and underground water.

### 4.3.6. ADOPTING NEW/HIGH YIELD SEED VARIETIES

Farmers are willing to adopt new seed varieties. But, they are skeptic about the quality of new varieties. Moreover, they have to face difficult trade off situations when trying new seeds. For instance, FH 114 is high yield producing cotton variety that is heat tolerant. But, it is responsive to high inputs and is not drought tolerant. Small holders can't afford intensive inputs and if they are at the tails then shortage of water can adversely affect the growth. Other high yield cotton seeds reported by farmers were IUB 13 and Kot 10. During the FGDs, mixed levels of shared knowledge were observed amongst the farmers. When one farmer would tell about a particular high yield variety then both cases were observed where either other farmers knew about it or didn't know about it. Figure 4.9 gives an overview of wheat yields of various seed varieties for the year 2014-15.

Those farmers who have high yields of wheat were sowing AAS or Abdul Sattar variety. The Punjab Government has also found these two varieties to be high yielding.

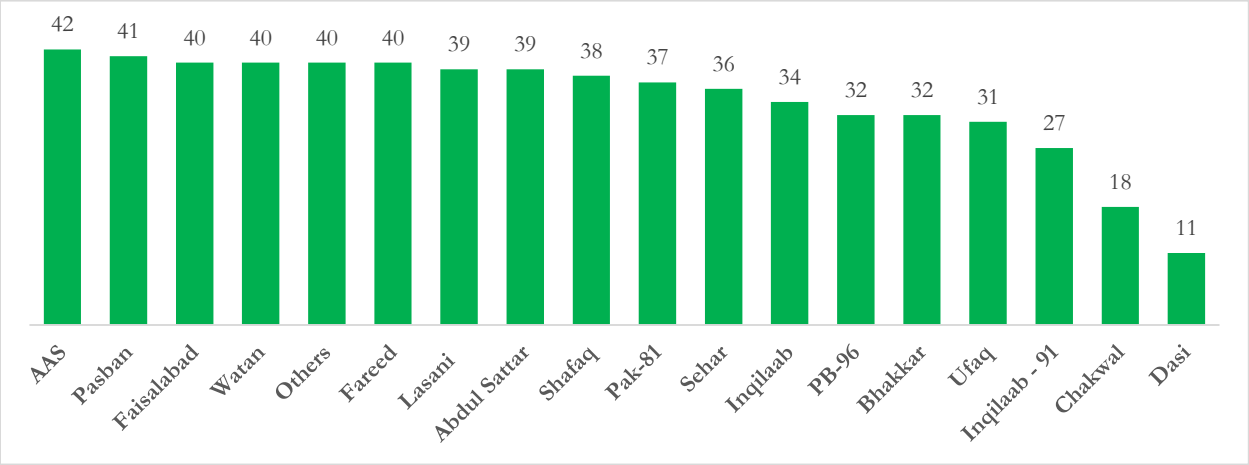



Figure 4.9: Average Yield of Wheat for Different Seed, 2014-15 (Mds/acre)
Source: Crop Reporting Service, Agriculture Department, Punjab[49]

## 4.3.7. ALTERNATIVE LIVELIHOODS

With rapid urbanization, households are encouraging one or two members (preferably young) to get employment in the cities. Adults are working as security guards, salesmen, vendors, etc. Some are also going for skilled labor like mobile phone repairing, electricians, automobile mechanics, tailors, etc. In some cases, it leads to shortage of HH farm labor if the HH size is less. The shortage is minimum if their HH member is/are working in nearby urban centre because in that case he is still somehow engaged for the farm labor when needed most (more labor is needed at the time of sowing or harvesting).

## 4.3.8. LIVESTOCK KEEPING

Depending upon the land holding and capacity, the small land holders tend to keep livestock (cattle, buffaloes, lambs). On average, a famer with less than five acres has 2-3 cattle/buffaloes or/and 4-5 lambs. Livestock is so important for them that when they get water after long halts, they prefer to irrigate the fodder crops first and then irrigate the cotton or sugarcane crop. Livestock serves as a buffer asset for farmers in times of weather induced or market induced shock to crop[50]. They meet their subsistence needs by selling livestock.

Livestock has also another advantage for small farmers. During the field study, KIIs were held with *Nambardars* of villages who are normally medium or large landholders. Few of them had responded that small farmers can generally toil for livestock on their own. But, the better off farmers, i.e. medium and large holders find difficulty in sustaining labor for livestock. This can create space for small farmers in the dairy sector.

[49] https://crs-agripunjab.punjab.gov.pk/system/files/Wheat Analysisu.pdf
[50] Livestock is also prone to becoming a risk itself because of extreme weather. Heat waves may end in deaths of livestock.

### 4.3.9. CLEANING OF WATER CHANNELS

Though, it is the responsibility of Irrigation Department to clean the water channels, the farmers, in some instances, get them cleaned through self-initiative. They pool resources from their own pockets and get water channels cleaned. This behavior implies strong prospects of community based rural support initiatives.

### 4.3.10. REPLACING COTTON (AND WHEAT) WITH SUGARCANE

Owing to both market and climatic factors, farmers are replacing cotton (and wheat) with sugarcane. Cotton is the worst affected crop due to extreme weather conditions. When the seed cotton is affected in terms of quality, then farmers don't get good price. On the other hand, sugarcane is a climate resistant crop. It fetches relatively good price[51]. As compared to subdued textile sector, the number of sugar mills is increasing. Unlike cotton, there is lower risk of price fall in times of bumper sugarcane crop. Rather prices of sugarcane depend upon the level of existing sugar stock in the mills which in turn depends upon the export volumes of sugar after the preceding season.

However, decision to cultivate sugarcane depends upon three very important factors:

i- The farmer has the capacity to forego his income for the whole year because if he decides to cultivate sugarcane then he will not cultivate Wheat and Cotton. So he wouldn't get the income he was supposed to get from Wheat in month of March of April. He would get the income from sugarcane around November. But the farmers of RYK are easily making this trade off. The reason is that RYK's environment favors sugarcane crop. If they sow sugarcane once then that crop can continue for two to three years without the need of sowing again after every year. In the succeeding year, they only have to bear costs of irrigation and inputs and can avoid cost of seeds, etc.[52]

ii- The road infrastructure of the village should support the transport of sugarcane trolleys. For instance, Mouzah (Village) Baagh Waal of UC Sau Chak in RYK doesn't have a proper road through which they can transport sugarcane trolleys.

iii- Availability of ground and surface water has significant bearing upon the decision to shift from cotton to sugarcane because sugar cane is a water intensive crop.

Shift from cotton to sugarcane has very important implications for food security situation of the overall region in a sense that acreage of wheat crop will also reduce as the farmers opts for growing sugarcane. If the decreasing trend continues then wheat stocks may decline in the future.

[51] This was expressed by farmers in August and October 2017, before the start of sugarcane harvest season. However, the harvest season of 2017 was not good for farmers in terms of market/price. Thus, one may argue that the risk management practices are risky in themselves. Moreover, shifting from low delta crops to high delta crops is not a sustainable practice considering the increasing threat of water shortages.

[52] The costs avoided accumulate to around Rs. 18,600. Refer to Annexure 5.2.3 for details on costs.

## 4.4. Role of Government Departments in Building Resilience of Small Farmers

### 4.4.1. PUNJAB SOCIAL PROTECTION AUTHORITY

PSPA is a newly-developed department of the Government of Punjab. Within a span of few years, it has launched social protection schemes for the underprivileged and vulnerable populations. PSPA is currently involved in projects related to health, education, population welfare, and food supply. Some of their services are: Punjab Educational Endowment Fund, Daanish Schools, Health Services, Population Welfare Measures, Wheat Subsidy, Ashiana Housing Project, Transport, Water: Punjab Saaf Paani, Sanitation: Waste Management Companies, Ramazan Package, Livelihood Interventions (like Chief Minister Self-Employment Scheme, Punjab Youth Internship Program and Chief Minister's Youth Initiative), and various types of allowances.

Main functions of PSPA involves formulation of Social Protection policy for Punjab, making policies and legislation for the welfare and benefit of vulnerable populations, execution of social protection schemes for poor and needy persons and conducting research and development for new interventions and their execution.

With that a weakness which could be identified is that social protection and safety targeted towards small holder farmer only is still lacking from the schemes of PSPA. PSPA however is involved in giving subsides, but there still is a need to introduce targeted interventions to secure the livelihoods of poor farmers in Punjab.

### 4.4.2. PDMA PUNJAB

The Provincial Disaster Management Authority (PDMA) Punjab, which was constituted under National Disaster Management Act (2010), is an effort towards managing the natural or man-induced disasters at the provincial and local levels and securing lives and livelihoods of affected people. PDMA specializes in mitigation, preparedness and an organized response to a disaster. The most important role of PDMA lies in providing a platform for all provincial departments to come together and strategize management and response to disasters and calamities. PDMA operates to ensure timely and effective response to disasters.

Issues identified during the study about PDMA functioning was that PDMA is more focusing on response rather than adaptation and risk management. There are plans for disaster response but they give minimal importance to long term resilience or adaptation. Secondly, agricultural losses are not addressed in most of their plans hence lack of management plans for farming community in case of a disaster to save their crops and produce. Along with that the most important issue to address is the presence and proper functioning of disaster management authorities at sub-district and district level.

## 4.4.3. AGRICULTURE DEPARTMENT, PUNJAB

Agriculture department, Punjab aims at transforming the provincial agriculture into a market driven, diversified and sustainable sector through integrated technologies, transparency and value for money. There is a long list of attached departments but three of those are of most importance relevant to this study.

### *4.4.3.1 Extension and Adaptive Research Department:*

Dissemination of appropriate technology to the farmers is of vital importance. This task is carried out through agriculture extension system in the Punjab. The district level functions of the department are to implement and maintain technological and production targets, monitoring of diseases and input availability, providing advisory facilities to farmers, conducting village level trainings and implementation of approved projects.

At farm level, farmers are not really satisfied from the performance of Agriculture extension department. Farmers have complained that field officers from extension does not pay visits to the farms and advise about crops. It was also observed that extension workers only visit the large farmers that too after six months. Even if they visit they will just eat and sit in the village and will only give some oral instructions and advices. Moreover, it was also pointed out during KIIs and IDIs that extension department is not functioning properly because of its involvement in activities out of their mandate. Also, extension department lacks coordination with Research and Development institutes, whereas coordination is paramount for the betterment of farming community. Lack of resources, capacity and funding were identified as major reasons behind these complaints from the farming community.

### *4.4.3.2 On Farm Water Management (OFWM)*

On Farm Water Management (OFWM) program of Agriculture Department has been recognized as one of the four major driving forces for transforming the Punjab's agriculture into a science-based, vibrant, and internationally linked sector. The objective of OFWM is to maximize crop and water productivity by ensuring efficient conveyance, application and use of irrigation water vis-à-vis promoting improved water management interventions through user participation. The department offers various services to users which mainly includes Water Users' Associations, Watercourse Improvement, Irrigation Schemes, Precision Land Leveling, High Efficiency Irrigation Systems, Training and Capacity Building.

### *4.4.3.3 Agricultural Information Service*

The Directorate of Agricultural Information has been charged with responsibility to disseminate information through effective use of print and electronic media for transfer of technology to enhance agricultural productivity. Directorate provide services of technology transfer through Print Media and Electronic Media. In Print media they publish regular magazines, booklets, pamphlets, folders, posters, brochures, handbills etc. for technical guidance and education of farmers / stakeholders in adequate quantity round the year. Most of these informative publications are in Urdu

for better outreach. In electronic media, this department gives services via, Television, Radio, Video Films / Documentaries, Agriculture Helpline, SMS Helpline, Robo Calls / Voice Messaging & Text Messaging to Farmers, SMS / E-Mail Alerts and through website.

Agriculture Department of Punjab indeed has enough interventions to take out small farmers from their vulnerabilities but the only problem is outreach and targeting of these interventions. For example, in Rahim Yar Khan and Muzaffargarh, farmers had no idea of these services or programmes. So if enough effort is made to bring these interventions to every small farmer of Punjab, then half of the problems would be solved automatically.

#### *4.4.3.4 Farming Community's Perceptions about Agriculture Departments*

Farming community generally expressed dissatisfaction about government institutions. When they were asked whether Field Officers of Agriculture Extension Department or Livestock and Dairy Development Department visit them, negation was their general response. When perceptions of farming community were shared with government officials they generally gave two responses. First, farmers deliberately express dissatisfaction about the govt. institutions in front of third party researcher or monitoring officers. Secondly, they opined that govt. institutions were performing to their best within their given resources. Resource scarcity often affects their performance. For example there are vacant posts but new hiring/inductions are not being made. Similarly, staff is often engaged in additional duties which affect their functioning. For instance, staff of Extension Department is often engaged in managing the Ramazan Bazars which keeps them from performing their own duties. But those who engage them for Ramazan Bazars feel that the Extension staff avoids visiting fields during Ramazan. That is why they are engaged in managing Ramazan Bazars.

### 4.4.4. PAKISTAN METEROLOGICAL DEPARTMENT (PMD)

The Pakistan Meteorological Department is both a scientific and a service department and is responsible to provide meteorological service throughout Pakistan to wide range of institutes and public activities. Apart from meteorology, it is also involved in monitoring as well as investigating whether phenomenon's, astronomical events, hydrology, and research in astrophysics, climate changes, and studies on aeronautical engineering, renewable energy resources across various parts of the country. As of 2017, there are 111 meteorological, airborne, and astronomical observatories.

PMD plays a pivotal role when it comes to managing agricultural risks at small holder level. Unfortunately, PMD in Punjab is not capable to provide village or even sub-district level accurate and timely weather updates. Farmers make use of internet or television to keep them updated about the weather forecasts however, most of the farmers complained about the accuracy of those weather updates. Accurate updates can save farmers a lot of hard work and money and also will help farmers in managing the incoming disasters or natural calamity. Lack of resources, instruments, sub-district level observatories is major reasons identified in study for in competitiveness of PMD.

#### *4.4.4.1 Farming Community's Perceptions About Weather Updates/PMD*

Farmers reported that they lacked any government owned mechanism to get reliable weather updates. Similarly they don't have any interaction with PMD. They normally listen to weather updates on radio or the tech savvy youth updates them on weather using online information sources.

## 4.5. Ecology of Social Safety Nets (SSNS)

There are so many causes of poverty in Pakistan, which include governance issues, higher population growth, high cost of living, increasing joblessness, insufficient schooling, atmosphere deprivation, imbalanced allocation of capital especially agricultural land, etc. To overcome the problem of poverty various poverty alleviation programs were developed by governments. In Pakistan, recently two types of social safety nets are working, one of them is budgetary and others are non-budgetary social safety nets. The budgetary social safety nets are Pakistan Poverty Alleviation Fund(PPAF), Benazir Income Support Program (BISP), People Works Program-1&11 (PWP-1&11). The non-budgetary social safety nets include Pakistan Bait-ul-Mall, Zakat, Employees Old Age Benefits Institutions (EOBI), Workers Welfare Fund (WWF) and Microfinance Initiatives.[53] A brief description of the some of the major SSNs which are serving all over Pakistan is given below;

### 4.5.1. BENAZIR INCOME SUPPORT PROGRAMME-BISP

Benazir Income Support Programme (BISP) is basically cash transfer programme. Cash transfer programs could be used for emergency purposes in periods of crisis or could be used as short or medium-term poverty alleviation program. BISP caters to the needs of the 'poorest of the poor' of the society not only in terms of cash assistance for day to day subsistence but also enabling them to exit the vicious cycle of poverty. Its long-term objectives include meeting the targets set by Sustainable Development Goals (SDGs) to eradicate extreme and chronic poverty and empowerment of women. Since its inception in 2008, BISP has grown rapidly. It is now the largest single cash transfer program in Pakistan's history. The number of beneficiaries has increased from 1.7 million in FY 2009 to approximately 5.42 million at the end of March 2017.

### 4.5.2. PAKISTAN POVERTY ALLEVIATION FUND – PPAF

PPAF was born out of a realization that there existed a demonstrated need for a national level institution in the country that would serve poor, marginalized and disadvantaged households by facilitating their access to resources and opportunities. The idea was to set up a private sector institution which would work concomitantly in support of public policy but was envisioned to be independent and autonomous in its operations and allocation of resources while bringing private sector rigor and efficiency to grassroots development. PPAF enjoys facilitation and support from the government, World Bank, International Fund for Agricultural Development (IFAD), KFW (Development Bank, of Germany) and corporate donors. Outreach of PPAF now extends throughout Pakistan and its microcredit, water and infrastructure, drought mitigation, education, health and emergency response interventions have been widely recognized. Since its inception in April 2000 to March 2017, PPAF has disbursed an amount of approximately Rs. 184.94 billion to its 134 Partner Organizations in 130 districts across the country. During the same period, 8.4 million

[53] Miankhail, S (2009) Causes and Consequences of Poverty in Pakistan. Journal of Managerial Sciences, 2(1)

individuals availed the PPAF ***microcredit financing***; which could be used as a tool for agricultural risk management.

### 4.5.3. MICROFINANCE INITIATIVES

Microfinance industry is primarily engaged in empowering marginalized section of society through provision of credit and making them self-sufficient. The sector has been serving people near the poverty line by not only providing credit products but also through savings, insurance, and remittance services. The micro-credit outreach witnessed 22 percent growth during 2016, while Gross Loan Portfolio registered a 47 percent growth during the same year. Micro-savings, on the other hand, posted considerable growth under active savers by 65 percent and value of savings by 88 percent, which is attributable to increase in m-wallet accounts and taping higher ticket size. It is provided as a package through microfinance banks (MFBs), microfinance institutions (MFIs), Rural Support Programmes (RSPs), and others including Commercial Financial Institutions (CFIs) and Non-Government Organizations (NGOs). Microfinance credits could be used for risk transfers from vulnerable community of farmers.

### 4.5.4. PAKISTAN BAIT-UL-MAAL (PBM)

PBM was established in February 1992 under the provisions laid down in the Pakistan Bait-ul-Maal Act of 1991. It was created to work for the welfare of widows, orphans, disabled, needy and poor people irrespective of sex, caste, creed or religion. The primary purpose for establishment of the PBM was to provide assistance to the vulnerable segments of the society not covered by Zakat. The program categories are, Child Protection, Women Empowerment, Institutional Rehabilitation, Financial Assistance (IFA), Old Age and Disabled Friends.

### 4.5.5 FARMING COMMUNITY'S PERCEPTIONS ABOUT SSNS

During the FGDs, farming community was also inquired about the benefits and targeting of BISP. Most farmers were of view that BISP is benefiting the women especially the widowed women, but nevertheless it is not targeted towards small farmers hence there is no benefits in terms of agriculture. Some farming communities also complained about the biased and on favor distribution of BISP cards. There is currently no social safety net in Pakistan that is specifically targeted towards farmers. However, there are interventions within social safety nets like Watan card, Kissaan package or interest free loans for farmers. Farmers also have a negative view about these interventions as they are not reaching the deserving farmers and is usually given on political affiliations. Similarly the process involved in acquiring interest free loans is very difficult and complex, hence a small farmer living at a faraway place from main market finds easy to get a loan from middleman sitting in his village rather than going to city center and going through a complex process to acquire the loans.

## 4.6 Major Findings: Quantitative Analysis (HH Survey in Muzaffargarh)

This chapter provides findings that have emerged form household data. We surveyed 167 households from Muzaffargarh. Among them 109 farmers fell in 0-5 Acres category, 36 in 5.1 to 12.5 Acres category and 22 in 12.6 or above Acres category. The households were selected from 5 villages. Sample was representative of the study population, but we ensured a with-in sample variation so that the role of socioeconomic factors on outcomes, including risk faced, perception to climate change, adaptation measures, and agriculture yield can be studied. Table 4.5 displays the information related to education status of selected respondents from the 5 villages. Overall 34% respondents were lacking any type of education. A vide variation is evident across the villages. Highest ratio of respondents without any formal education is observed for Khanani [71%] while lowest [11%] for Rohari. Majority of respondents has completed their primary [13%] and matriculation [19%]. Only 19% of respondents have education higher than matriculation.

*Table 4.5 Education Profile of Respondents*

| Village | Education of Respondents (Village Wise) | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Uneducated | Primary | Middle | Matric | F.A | B.A | M.A | |
| CHAK 134 | 23% | 29% | 9% | 20% | 9% | 11% | | 100% |
| CHAK 142 | 20% | 9% | 14% | 29% | 14% | 11% | 3% | 100% |
| KHANANI | 71% | 3% | 10% | 6% | 6% | 3% | | 100% |
| RIND | 48% | 10% | 26% | 10% | 6% | | | 100% |
| ROHARI | 11% | 14% | 17% | 26% | 6% | 17% | 9% | 100% |
| Total | 34% | 13% | 15% | 19% | 8% | 9% | 2% | 100% |

*Table 4.6 Overall Distribution of Respondents by Tenancy Status*

| Tenancy Status | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Owner | 138 | 82.6 | 82.6 | 82.6 |
| Owner-cum-tenant | 20 | 12.0 | 12.0 | 94.6 |
| Tenant | 9 | 5.4 | 5.4 | 100.0 |
| Total | 167 | 100.0 | 100.0 | |

Interestingly, majority of the respondents own the land. Out of 167, as many as 139 [82.6%] cultivate on their own land while the ratio of owner-cum-tenant was only 12% [table 4.7]. Interventions sensitive to land-ownership status, for example insurance or loans, requiring collateral can be applied seem easily viable as the ratio of tenant is as low as 5.4%. One plausible explanation can come from the study under population-the small farmers. Generally, small farming is general on

self-owned lands. High input prices, lower yields, and poor economic and social collateral may leave small farmers to rent. Similar trends were observed when data were decomposed at village level [Table 4.7].

*Table 4.7 Village wise distribution of Respondents by Tenancy Status*

| Village | Owner | Owner-cum-tenant | Tenant | Total |
|---|---|---|---|---|
| CHAK 134 | 69% | 31% | | 100% |
| CHAK 142 | 94% | 6% | | 100% |
| KHANANI | 68% | 13% | 19% | 100% |
| RIND | 87% | 3% | 10% | 100% |
| ROHARI | 94% | 6% | | 100% |
| Total | 83% | 12% | 5% | 100% |

Village-wise distribution of tenancy status showed that CHAK 142 and Rohari equally possess the highest number of owners followed by RIND. Among respondents of CHAK 134, CHAK 142 and ROHARI, there were no tenants. Percentage of owner-cum-tenants ranged from 6%-31% among five villages as shown in Table 4.7.

**Income Profile:**

Majority of respondents [71%] earns more than Rs 50,000 and less than or equal to Rs 200,000 in a year suggesting that major share of agriculture households earns Rs 4,166 to 16,666 per month [Table 4.8]. Per capita figures fall between Rs 645 and 2583 per month, if we take average household size of 6.45 persons as reported in Pakistan Census 2017. Continuing simple arithmetic, per day per person income of 71% of population in the region falls between Rs 21.5 to Rs 86. This may clearly suggest the prevalence of resource constraints facing the agricultural community in the region. One can also read it for need of interventions to relax financial constraints. Only 8% of the farming households have income higher than 500,000 a year.

*Table 4.8 Village Wise Average HH income Per Year (% respondents within an income group in a village)*

| Village | Average HH income Per Year | | | | | Total |
|---|---|---|---|---|---|---|
| | 10,000-50,000 | 50,001-100,000 | 100,001-200,000 | 200,001-500,000 | 500,001 & Above | |
| CHAK 134 | 14% | 23% | 51% | 9% | 3% | 100% |
| CHAK 142 | 3% | 23% | 46% | 23% | 6% | 100% |
| KHANANI | 16% | 23% | 35% | 10% | 16% | 100% |
| RIND | 10% | 26% | 42% | 13% | 10% | 100% |
| ROHARI | 6% | 57% | 26% | 3% | 9% | 100% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total | 10% | 31% | 40% | 11% | 8% | 100% |

**Soil Fertility**

In the overall sample of 167 respondents, 21.45% said that their land had low fertility. Average and high fertility had almost similar proportion, i.e. 38.92% and 39.72% respectively. Landholders with <5 acres of had higher proportion [24.3%] with poorly fertile land as compared to those with 5.1-12.5 Acres [15.1%] or with >12.6 Acres [19%].

*Table 4.9 Soil Fertility With Respect to Land Size*

| Soil fertility | Land Size | | | Overall sample |
|---|---|---|---|---|
| | **0-5** (n=109) | **5.1-12.5** (n=36) | **12.6 & above** (n=22) | |
| Poor Fertility | 24.3% | 15.1% | 19% | 21.45% |
| Average Fertility | 37.5% | 43.4% | 40.5% | 38.92% |
| Good Fertility | 38.2% | 41.5% | 40.5% | 39.72% |

**Farm Location With Respect to Watercourse**

Regarding the location of farm with respect to water course, the respondents from two villages of Alipur Tehsil, i.e. KHANANI and RIND said that they were entirely dependent upon tube wells. During FGDs too, it was learnt that these were the only two villages out of five which were downstream of canal. Chak 134 and Rohari were upstream and Chak 142 was downstream of canal. In Chak 134, majority [52%] said that their farms were located on the tail-end of the watercourse. In Rohari village, (Muzaffargarh) too, majority [58%] said that their farms were on tail-end. In Chak 142 of Alipur Tehsil, majority [43%] reported that their farms were in the middle of the watercourse.

*Table 4.10 Farm Location on Watercourse*

| Village | Location of farm on watercourse | | |
|---|---|---|---|
| | Head of watercourse | Middle of watercourse | Tail of watercourse |
| CHAK 134 (Upstream of Canal) | 19% | 26% | 52% |
| CHAK 142 (Midstream of Canal) | 14% | 43% | 24% |
| ROHARI (Upstream of Canal) | 11% | 31% | 58% |

**Major Crops**

A look into cropping patterns shows that more than 90% of farmers grow wheat in Rabi irrespective of land size [Table 4.11]. It is also important to note that 109/167 [65%] farmers own land size less than or equal to 5 acres. Overall, 86% farmers fall in the definition of small farmers [=<12.5 acres].

Cotton is a major crop of Kharif grown by 58% of respondents followed by Guara 17%] which is mostly grown by large farmers [35%]-holding land size 12.6 acre or more [Table 4.12].

*Table 4.11 Major Crops in Rabi Season*

| Crop | Land Size | | | Total |
|---|---|---|---|---|
| | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) | |
| **Wheat** | 93% | 97% | 95% | 94% |
| **Barley** | 6% | 0% | 5% | 4% |
| **Spring** | 1% | 0% | 0% | 1% |
| **Tobacco** | 1% | 0% | 0% | 1% |
| **Lentil (Masoor)** | 0% | 3% | 0% | 1% |
| **Total** | 100% | 100% | 100% | 100% |

*Table 4.12 Major Crops in Kharif Season*

| Crops | Land Size | | | Total |
|---|---|---|---|---|
| | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) | |
| **Sugarcane** | 14% | 6% | 12% | 12% |
| **Cotton** | 59% | 61% | 41% | 58% |
| **Guara** | 13% | 19% | 35% | 17% |
| **Pulse(Mung)** | 1% | 10% | 0% | 3% |
| **Others crops** | 14% | 3% | 12% | 11% |
| **Total** | 100% | 100% | 100% | 100% |

Guara is sown for fodder purpose. With an increase in landholding, the acreage under Guara also increases, implying that large landholders keep more ruminants.

Majority (95.1%) respondents sow Wheat in November. 35% harvest it in April and 58.7% in May. 93.9% farmers sow the cotton in May. 69.5% harvest in October and 24.4% in November.

### Cropping Pattern of Wheat

Change in copping pattern has been observed over the time. Interestingly, almost equal number of respondents have increased [39.1%] and decreased [39.8%] wheat acreage over the last 10 years Table 4.13].

*Table 4.13 Wheat Acreage Change Over 10 Years Period*

| | |
|---|---|
| No change | 21.1% |
| Increase | 39.1% |
| Decrease | 39.8% |

More than half [52.6%] of farmers who own land [owner only] more than 5 acres but less than 12.5 increased the wheat acreage. Similar numbers hold true for owner cum tenants. Most importantly, however, a decline in wheat acreage is witnessed for large farmer, irrespective of landownership status. Highest ratio of farming household's increasing wheat acreage [71.4%] was observed for tenants having land size less than 5 acres [Table 4.14]. But these numbers should be read carefully, as size of the tenants is fairly small as ratio to respondents.

*Table 4.14 Change in Wheat Acreage According to Tenancy Status*

| Comparing wheat acreage between 2007 and 2017 | Owner only | | | | Owner cum tenant | | | | Tenant Only | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **0-5** | **5.1-12.5** | **12.6 & above** | **Total** | **0-5** | **5.1-12.5** | **12.6 & above** | **Total** | **0-5** | **5.1-12.5** | **Total** |
| Neutral | 17.6% | 10.5% | | 14.4% | 20.0% | | | 11.8% | 28.6% | 50.0% | 33.3% |
| Increase | 40.5% | 52.6% | 36.4% | 42.3% | 20.0% | 66.7% | 25.0% | 29.4% | 71.4% | 50.0% | 66.7% |
| Decrease | 41.9% | 36.8% | 63.6% | 43.3% | 60.0% | 33.3% | 75.0% | 58.8% | 0.00 % | 0.00% | 0.00% |
| Total | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % |

When asked about the reason of change in wheat acreage, market factors explain increase in acreage of wheat [Table 4.15]. Improved facilities and profits were the main reasons for increase in acreage while climate change related factor factors however emerge as major driver behind wheat acreage reduction.

*Table 4.15 Reasons for Acreage under Wheat*

| Top 3 Reasons for Increase in Wheat Acreage | Top 3 Reasons for Decrease in Wheat Acreage |
|---|---|
| Availability of more productive varieties in market | Increase in Temperature Extremes |
| Relatively Profitable | Increase in the Frequency of Dry Period |
| Improved Irrigation Infrastructure | Deterioration of Irrigation Infrastructure |

### Average Yield of Wheat

Agriculture produce makes major part of earnings of farm household. Crop yield not only reflects the earnings of a household, but also the level of adaptation to climate change. Higher average yield reflects better adaptation or lower climate change impact on agriculture. Average yield of wheat in study area varies between 38.25 and 46.24 Mds/acre for farmers holding less than 5 acres and more

than 12.6 acres respectively [Table 4.16]. Large farmers, having capacity to by quality inputs, opportunity for better mechanization and other adaptations have higher per acre yield.

*Table 4.16 Average Yield of Wheat*

| Average Yield of Wheat = 42.22 Mds/Acre [4173 kg/ha] | |
|---|---|
| Average Yield of Wheat by Land Size | |
| Land Size | Mds/Acre |
| 0-5 (n=109) | 38.25 |
| 5.1-12.5 (n=36) | 40.35 |
| 12.6 and above (n=22) | 46.24 |
| Average Yield of Wheat by Village | |
| **Village** | Mds/Acre |
| Village 134 ML (Kot Addu) | 51.35 |
| Village 142 (Kot Addu) | 37.18 |
| Village Khannani (Ali Pur) | 41.41 |
| Village Rind (Ali Pur) | 45.44 |
| Village Rohari (Muzaffargarh) | 35.78 |

Average yield of wheat for Muzaffargarh district is 42.22 Mds/Acre. Table 4.14 gives an overview of responses from household survey related to average yields. The Table shows that there is a slight difference in yields among land sizes. Among villages, CHAK 134 had the highest yield of 51.35 Mds/Acre. Lowest yields were from CHAK ROHARI with 35.78 Mds/Acre. Apparently, 51.35 Mds/acre may sound a bit on higher side when compared with national average of 28.75 Mds/acre 2016-17[54].

**Major Sources of Livelihood:**

Predominantly, agriculture is the biggest source of livelihoods. Agriculture serves as major source of livelihood for 78.2%, 87.5% and 88% respondents with land size 0-5, 5.1-12.5 and 12.6 and above respectively (Table 4.17). Importantly, only 7.5% respondent reported livestock as major source. This may seem is quite surprising. But to points need to bear in mind. First, it is about "major source" of income. Second, farmers reporting agriculture may be reporting it inclusive livestock. The findings however need a serious attention of stakeholders involved in designing interventions to promote livelihoods of people in the region. Table 4.17 also manifests that agriculture households in the region don't prefer doing any job, other than farming. Any program aiming to improve living standards of these households, therefore, has to be agri-based by definition.

[54] Pakistan Economic Survey 2016-17

*Table 4.17 Major Sources of Livelihood*

| Source of Income (Multiple options)[55] | Land Size | | | Total |
|---|---|---|---|---|
| | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) | |
| Agriculture | 104 | 35 | 22 | 161 |
| | 78.2% | 87.5% | 88.0% | |
| Livestock | 8 | 3 | 1 | 12 |
| | 6.0% | 7.5% | 4.0% | |
| Job | 1 | 0 | 0 | 1 |
| | .8% | 0.0% | 0.0% | |
| Others (Specify) | 20 | 2 | 2 | 24 |
| | 15.0% | 5.0% | 8.0% | |
| Total | 133 | 40 | 25 | 198 |

**Livestock Ownership by Land Size:**

Size of livestock holdings is skewed positively towards larger farmers [Table 4.18]. A typical larger farmer has about 10 goats, 9 cows and 7 Buffalos on average. Data on bulls show in interesting feature about agricultural practices. Only small farmers seem using bulls for ploughing. Larger farmers use mechanization, zero bulls. This may also partially reflect the yield differences across landholding size. Table 4.18 further suggests that goat was the most common livestock amongst households having land size 0-5 acres, followed by cattle and buffalo.

*Table 4.18 Livestock Ownership by Land Size*

| 0-5 Acres (n=109) | | | | | | |
|---|---|---|---|---|---|---|
| | Buffalo | Cattle | Bull | Goat | Lamb | Poultry |
| Mean | 3.26 | 4.07 | 2.60 | 7.07 | 0 | 23.33 |
| Median | 2.00 | 3.00 | 2.00 | 5.00 | 0 | 10.00 |
| Std. Deviation | 3.381 | 3.269 | 2.074 | 5.783 | 0 | 23.094 |
| **5.1-12.5 Acres (n=36)** | | | | | | |
| | Buffalo | Cattle | Bull | Goat | Lamb | Poultry |
| Mean | 4.85 | 5.83 | 2.75 | 10.57 | 0 | 10.00 |
| Median | 4.00 | 5.00 | 2.00 | 6.00 | 0 | 10.00 |
| Std. Deviation | 5.257 | 5.096 | 2.217 | 13.138 | 0 | 0 |
| **12.6 & above (n=22)** | | | | | | |
| | Buffalo | Cattle | Bull | Goat | Lamb | Poultry |
| Mean | 6.83 | 8.92 | 0 | 12.56 | 0 | 0 |
| Median | 5.50 | 7.00 | 0 | 11.00 | 0 | 0 |
| Std. Deviation | 4.355 | 6.127 | 0 | 7.860 | 0 | 0 |

[55] Due to multiple options possible, the averages may not sum to 100%

**Major Agricultural Risks:**

Dealing the central question of this feasibility study, farmers reported a wide range of risks facing them [Table 4.19]. Non-climatic risks, including market risks, emerged as major source of concern for the farmers irrespective of size of landholdings. More than 70% of marginal farmers with <5 acres landholdings reported unavailability of quality inputs as major risk facing them. While the ratio decline as the size of landholdings grows greater than 5 but less than 12.5. Higher ratio of large farmers reporting quality seed as risk needs to be interpreted carefully. Smaller sample may result in higher ratio, which plausibly should be smaller than ratio reported for marginal farmers[56].

*Table 4.19 Major Agricultural Risks*

| Major Agricultural Risks | | Land Size (Acres) | | |
|---|---|---|---|---|
| | | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) |
| Non-Climatic Risks | Non-Availability of Certified Seeds: | 70% | 61% | 82% |
| | Non-Affordability of Certified Seeds: | 71% | 61% | 82% |
| | Non-Availability of Quality Fertilizers: | 71% | 64% | 86% |
| | Non-Affordability of Quality Fertilizers: | 75% | 64% | 73% |
| | Non-Availability of Quality Pesticides: | 74% | 58% | 77% |
| | Non-Affordability of Quality Pesticides: | 71% | 58% | 77% |
| | Non-availability of Cheap Borrowing Sources: | 72% | 56% | 77% |
| | Non-Accessibility to Cheap Borrowing Sources: | 63% | 53% | 59% |
| Market Risks | Monopoly of Middlemen: | 72% | 61% | 77% |
| | Non-accessibility to markets: | 58% | 56% | 73% |
| | Higher transport/transaction costs: | 64% | 61% | 77% |
| | Volatility of Produce Prices: | 58% | 56% | 73% |
| | Volatility of Input Prices: | 55% | 56% | 73% |
| Climatic Risks | Droughts: | 49% | 31% | 23% |
| | Windstorms: | 66% | 67% | 82% |
| | Flood: | 42% | 36% | 32% |
| | Shortage of Canal Water: | 72% | 67% | 68% |
| | Untimely Rains | 72% | 69% | 82% |
| Institutional Risks | Lack of Advisory Service from Agriculture | 68% | 53% | 55% |

[56] Apart from smaller sample size, there can also be another reason – a political economic one – for higher proportion of large farmers reporting the risk like 'non-affordability' of seeds and fertilizers. Farmers in Punjab have had increasingly developed a resentment against the government regarding pricing of inputs. Large farmers are relatively more educated and well informed. They have the perception that Indian inputs are very low cost. That is why India's farmers have higher profitability and India also enjoys a competitive advantage in export market. On 26th May 2017 too, farmers of Punjab had staged protests in Federal Capital as Budget 2017-18 was being presented in the National Assembly of Pakistan. Thus, the large landholding respondents of SDPI's survey might have reported this risk, anticipating that the findings of this study might eventually lead to decrease in the price of agri-inputs.

| | | | | |
|---|---|---|---|---|
| | Extension Department | | | |
| | Lack of Advisory Service from Plant Protection Department | 72% | 61% | 68% |
| | Lack of Advisory Service from Livestock Department | 67% | 53% | 55% |
| Human Resource Related Risks | Shortage of farm labor | 49% | 47% | 41% |
| | Non-affordability of farm labor | 56% | 58% | 68% |
| | Personal diseases | 63% | 61% | 73% |
| | Disease to labor | 54% | 58% | 68% |

Six most common risks for farmers of 0-5 acres were untimely rains [72%], non-affordability of quality fertilizers [75%], non-availability of quality pesticides [74%], non-availability of cheap borrowing resources [72%], shortage of canal water and non-availability of timely and quality inputs. Small farmers [5-12.5 acres land size], reported qualitatively similar risks including shortage of canal water, untimely rains, windstorms, non-availability and non-affordability of quality fertilizers and lack of advisory service from plant protection department.

Summarizing the table, we can observe that non-climatic risks which basically involve affordability and accessibility of quality inputs remain the biggest concern of farming households, irrespective of farm size. Followed by that, climatic risks like untimely rains and shortage of canal water were also reported as major risks. These results have implications for design of programs aiming to minimize the risks facing the farming community. Programs, in this region, need to focus more on non-climatic factors. Data on impact of major agriculture risks strengthens the argument further [see annexure 3.6].

Table A4.1, characterizes the responses reporting severity of impact by land size. For the farmers with farm size less than 5 acres, most of the risks had moderate effects on yields and income. Non-availability and non-accessibility of certified and quality seeds, fertilizers and pesticides had are reported having severe impacts. Access to market, monopoly of middleman, untimely rains and shortage of canal water were also one of the risks identified which have moderate to severe impacts.

Farmers of 5-12.5 acres, listed non-climatic risks having severe impacts on yields and income, market risks and climatic risks were considered to be having moderate to severe risks, among climatic risks, while institutional and human resource related risks were found to have moderate effects on yields and income. Farmers from 12.5 and above acres also followed the similar trend. Overall non-climatic, climatic and market risks are considered to have severe to moderate impacts on agricultural yields and farm income. The lower number of respondents reports severe impact of droughts, windstorm and floods across all farm sizes [Table A4.1].

**What actually poor growing season means to farmers?**

When every farmer was talking that we are having poor growing season, we wanted to know what does actually it means to them. We asked respondents identify us poor growing season in terms of both income and yield. Respondents were offered 3 levels, in case of income [Table 4.20]. For 84% of farmers a season is counted as poor growing when they can't recover their costs but have some savings to cultivate the new/next crop. Only 16% farmers will not count this situation as poor growing season and will go to level 2 and 3 for declaring the season poor growing.

*Table 4.20 Defining the Poor Growing Season*

| What is a poor growing season according to farmers? | Farmers' response |
|---|---|
| Level 1: When they can't recover their costs but have some savings to cultivate the new/next crop? | 84% |
| Level 2: When they can't recover your costs but have to borrow money for cultivating new/next crop? | 12% |
| Level 3: Either 1 or 2 plus they can't meet the food and other daily needs (clothing, education, health) of their household | 4% |

To get clearer picture, we asked farmers to opt their definition of poor growing season in terms of yield [Table 4.21]. Respondents were asked to choose from the option showing loss of wheat yield relative to average yield. Roughly 57% farmers, across all land sizes, count a season poor growing if the yield is 6-15 Mds/acre less than average yield [ratio is 60% for farmers holding less than 5 acres]. 36% small farmers, farm size more than 5 acre but less than or equal to 12.5, count the season poor growing if the yield drops by more than 20 Mds/acre than the average yield.

*Table 4.21 Defining Threshold Level of a Poor Growing Season*

| Threshold Level of Deciding a Poor Growing Season | | | | |
|---|---|---|---|---|
| At what level of yield do the farmers decide that they have faced a poor growing season? | Land Size (Acres) | | | Total |
| | 0-5 (n=109) | 5.1-12.5(n=36) | 12.6 & above (n=22) | |
| 1-5 Maunds less than the average yield | 15% | 14% | 30% | 17% |
| 6-10 Maunds less than the average yield. | 40% | 29% | 40% | 38% |
| 10-15 Maunds less than the average yield. | 20% | 21% | 10% | 19% |
| 15-20 Maunds less than the average yield | 8% | 0% | 0% | 6% |
| More than 20 Maunds less than the average yield | 17% | 36% | 20% | 20% |

| | | | | |
|---|---|---|---|---|
| Total | 100% | 100% | 100% | 100% |

More than definition of poor growing season, it is frequency of poor growing season which shapes livelihood situation in any region. So we asked respondents to mark last 5 years as poor growing season or not. The time cut was made purposefully so that farmers can have realistic recalls. Extending the time horizon might have over/underestimated the frequency. The majority of farmers reported 2013-14, and 2014-15 as poor growing [Table 4.22]. About one fifth small and large farmers reported 2015-16 as bad growing season for them. If this information is guide, almost every alternative year turns to be a poor growing season for on average for wheat growers.

It has serious implications for households dependent on agriculture as major source of income, particularly wheat growers. Volatile income sources pose a serious threat to food security and sustainable livelihoods. The impact grows sever when no vibrant agriculture credit market exists. Also, one can draw lessons for crop insurance and similar interventions aiming at insuring agriculture risks[57].

*Table 4.22 Frequency of Poor Growing Season*

| Frequency of Poor Growing Season for Wheat During Past 5 Years | | | | |
|---|---|---|---|---|
| Year | Land Size (Acres) | | | Total |
| | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) | |
| 2012-13 | 6 | 5 | 1 | 12 |
| | 4.8% | 13.5% | 4.0% | |
| 2013-14 | 61 | 18 | 8 | 87 |
| | 48.4% | 48.6% | 32.0% | |
| 2014-15 | 41 | 7 | 11 | 59 |
| | 32.5% | 18.9% | 44.0% | |
| 2015-16 | 16 | 7 | 5 | 28 |
| | 12.7% | 18.9% | 20.0% | |
| 2016-17 | 2 | 0 | 0 | 2 |
| | 1.6% | 0.0% | 0.0% | |
| Total | 126 | 37 | 25 | 188 |

**What risks count to poor growing season and at what stage it counts most?**

To assess role of different risks at different stages of crop, we asked farmers to respond on impacts of different risks on sowing to harvesting stages of wheat crop. Results are appended in Table A4.3 (in Annexure 4). Overall, canal water issue, poor quality of inputs and market factors remain the

[57] Similar results were reported for cotton crop [annexure A4-.2]

most impactful for all three stages of the wheat crop. At sowing stage canal water issues and poor growing previous seasons [showing resource constraints] were considered to have severe impacts on crop yield while climatic and market risks had somewhat to moderate effects at sowing stage. In the growing stage, canal water issue, poor quality inputs and previous poor growing season have the severe impacts while other factors mostly have somewhat to no effect on the growing stage of wheat. At the maturity stage, trend was more or less similar to sowing and growing stages [see Table A4.3]. Findings are robust to land size.

**Perceptions of Climate change:**

Adaptation to climate change is most effective tool combat vagaries of changing climate. This is particularly true for agriculture which requires constant adjusting to changing climate and weather patterns. Agricultural adaptations, in turn, are based on farmers' perceptions about climate change. We asked respondents about note their perceptions. Table A4.4 (in Annexure 4) summarizes the results by land size. We use land size a summary indicator of access to information, better resources etc. More than 95% of farmers perceive that summer seasons are now lengthier as compared to 1988 while every farmer [100%] perceived higher day and night summer temperature as compared to those in 1988. A slight change in ratios is observed for large farmers reporting on down side. Of small farmers, 45.4% perceive that number of hot nights in summer has decreased while the ratio is 19% for large farmers.

Regarding perceptions on precipitation, roughly 80% farmers find short monsoon as compared to 1988. Similarly, a decrease in monsoon rains is perceived by overwhelming majority [86.1% marginal farmers, 91.4% small farmers and 76.2% large farmers]. While in winters, the length of season, number of cool days, number of cool nights, length of winter rainy season, number of days with low and heavy rainfall and heavy rainfall at once has decreased according to the responses. Winter temperature at day and night time received mixed response of increase and decrease in last 3 decades.

**How does the changing pattern of Climate affect agriculture produce?**

Respondents were asked to choose on the impact of climate change on different crops, cost of living and income etc. a wide variation by land size is documented [Table 4.23]. This may partially reflect the effective adaptation. More than 50% respondents believe that changing climate has affected production of wheat negatively. 54% of farmers with less than 5 acre holdings find that changes in climate have resulted in decline in production of Pulses while only 29% of large farmers agree to it and 57% of them believe that production of pulses has actually increased compared to last 10 years. Similar variation is witnessed for other crops. Small farmers are found reporting negative impact of climate change on crop production. The difference may be an outcome of effective adaptation by large farmers while like thereof in small farming community. Also, a small sample for large farmers may result in these differences as well. Variation within small farmers, holding less than 5 acres and more than 5 acres, however indicates towards effective adaptation to some extent [Table 4.23].

*Table 4.23 Impact of Climate Change on Crops*

| Impact of Climate Change on crops and livelihood over past 10 years | | Land Size (Acres) | | |
|---|---|---|---|---|
| | | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) |
| Production of Wheat | Increased | 38% | 54% | 35% |
| | Decreased | 54% | 43% | 55% |
| | Unchanged | 8% | 3% | 10% |
| | Not Sure/Don't Know | 0% | 0% | 0% |
| Production of Pulses | Increased | 11% | 40% | 57% |
| | Decreased | 54% | 40% | 29% |
| | Unchanged | 0% | 0% | 0% |
| | Not Sure/Don't Know | 34% | 20% | 14% |
| Production of Cotton | Increased | 24% | 45% | 33% |
| | Decreased | 64% | 50% | 67% |
| | Unchanged | 9% | 0% | 0% |
| | Not Sure/Don't Know | 3% | 5% | 0% |
| Production of Sugarcane | Increased | 24% | 0% | 0% |
| | Decreased | 24% | 50% | 0% |
| | Unchanged | 0% | 0% | 0% |
| | Not Sure/Don't Know | 53% | 50% | 100% |
| Water Shortage | Increased | 56% | 59% | 71% |
| | Decreased | 27% | 16% | 18% |
| | Unchanged | 12% | 25% | 12% |
| | Not Sure/Don't Know | 5% | 0% | 0% |
| Human Disease | Increased | 79% | 93% | 80% |
| | Decreased | 19% | 4% | 10% |
| | Unchanged | 1% | 0% | 0% |
| | Not Sure/Don't Know | 1% | 4% | 10% |
| Cost of living | Increased | 86% | 81% | 73% |
| | Decreased | 10% | 19% | 20% |
| | Unchanged | 3% | 0% | 7% |
| | Not Sure/Don't Know | 0% | 0% | 0% |
| Income | Increased | 28% | 46% | 25% |
| | Decreased | 68% | 54% | 69% |
| | Unchanged | 4% | 0% | 6% |
| | Not Sure/Don't Know | 0% | 0% | 0% |
| Quality of life | Increased | 37% | 52% | 33% |
| | Decreased | 61% | 48% | 58% |
| | Unchanged | 2% | 0% | 8% |
| | Not Sure/Don't Know | 0% | 0% | 0% |
| Crop pests and diseases | Increased | 80% | 94% | 94% |
| | Decreased | 13% | 6% | 0% |
| | Unchanged | 0% | 0% | 0% |
| | Not Sure/Don't Know | 6% | 0% | 6% |

Overwhelming majority of farmers [ranging from 80%-94%], irrespective size of land holdings responded that crops pests and diseases have increased due to changing climate. Almost half of respondents [told that climate change has worsened the quality of life as compared to 10 years ago. Increase in human disease was reported by 79%, 93% and 80% of farmers holding <5 acres, between 5-12.5 acres and more than 12.5 acres respectively. Majority of farmers also finds higher cost of living as compared to 10 years ago and they think climate change is one major driver. This is counter conformed by higher diseases burden of climate change reported by farmers. Similar impacts of climate change on livestock were reported [Table 4.24]

*Table 4.24 Impact of Climate Change in Livestock*

| Impact of Climate Change on Livestock | | Land Size | | | |
|---|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above | Total |
| Reproduction/Fertility | Increased | 24% | 27% | 20% | 24% |
| | Decreased | 40% | 43% | 60% | 43% |
| | Unchanged | 24% | 30% | 10% | 23% |
| | Not Sure/Don't Know | 13% | 0% | 10% | 10% |
| Milk Production | Increased | 30% | 23% | 20% | 27% |
| | Decreased | 43% | 43% | 50% | 44% |
| | Unchanged | 24% | 23% | 10% | 22% |
| | Not Sure/Don't Know | 3% | 10% | 20% | 7% |
| Grazing Lands | Increased | 51% | 35% | 15% | 42% |
| | Decreased | 27% | 32% | 45% | 31% |
| | Unchanged | 11% | 6% | 5% | 9% |
| | Not Sure/Don't Know | 12% | 26% | 35% | 18% |
| Livestock Diseases | Increased | 34% | 16% | 40% | 31% |
| | Decreased | 33% | 59% | 35% | 39% |
| | Unchanged | 26% | 13% | 5% | 20% |
| | Not Sure/Don't Know | 7% | 13% | 20% | 10% |
| Livestock Deaths | Increased | 27% | 19% | 40% | 27% |
| | Decreased | 26% | 59% | 30% | 34% |
| | Unchanged | 30% | 13% | 5% | 23% |
| | Not Sure/Don't Know | 18% | 9% | 25% | 17% |

Different parameters have been set to define the trends of land size. Overall trends showed that climate change has significantly adversely affected livestock in terms of milk production and reproduction. While it has slightly positive impacts on grazing lands, reduction in livestock diseases and deaths. This may however be studied carefully as the farmers may attribute effects of technological, biological and other improvements to climate change. For example, a decline in

livestock diseases and deaths may be an outcome of better livestock care facilities, medicine, and breeds.

*Table 4.25 Sources of Information*

| Source of information | Response | Land Size | | | |
|---|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above | Total |
| Radio | Yes | 40% | 58% | 59% | 47% |
| | No | 60% | 42% | 41% | 53% |
| Newspaper | Yes | 40% | 58% | 55% | 46% |
| | No | 60% | 42% | 45% | 54% |
| Television | Yes | 59% | 69% | 82% | 64% |
| | No | 41% | 31% | 18% | 36% |
| Neighbor | Yes | 29% | 42% | 36% | 33% |
| | No | 71% | 58% | 64% | 67% |
| Family member | Yes | 37% | 47% | 64% | 43% |
| | No | 63% | 53% | 36% | 57% |
| Based on traditional knowledge | Yes | 50% | 64% | 68% | 56% |
| | No | 50% | 36% | 32% | 44% |
| Department of agriculture | Yes | 8% | 8% | 9% | 8% |
| | No | 92% | 92% | 91% | 92% |
| Don't care about weather predictions | Yes | 13% | 8% | 18% | 13% |
| | No | 87% | 92% | 82% | 87% |

Data of different sources of information has been tabulated in Table 4.25. It shows that media has played significantly positive role providing information among farmers. Television was reported to be most common major source of information [64%] followed by traditional knowledge [56%]. However, least number of farmers reported agriculture department [8%] as source of information. This may reflect lower approach of department to farmers.

**Climate Change Coping Strategies:**

We asked farmers how do they respond to changing climate based on their perceptions and associated negative effects and results are reported in Table 4.26. Less than 20% farmers reported income diversification as strategy to cope vagaries of climate change. As was evident from previous analyses that people in the region don't prefer any job other than agriculture, virtually no farmer reported changing profession and migration as coping strategy. 13% of large farmers used renting urban areas as hedge against climate change effects.

Change of crop and variety emerge as most commonly used coping strategies by all types of farmers. Change in crop and variety was reported by 67% and 63% farmers holding farm size less than 5 acres receptively. Similar numbers hold for farmers with landholding size higher than 5 acres.

*Table 4.26 Climate Change Coping Strategies*

| Coping Strategies | | Land Size | | |
|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above |
| Income diversification | Yes | 19% | 17% | 17% |
| | No | 81% | 83% | 83% |
| Changed profession (shifted from agriculture to other professions) | Yes | 2% | 0% | 0% |
| | No | 98% | 100% | 100% |
| Household level migration | Yes | 1% | 0% | 0% |
| | No | 99% | 100% | 100% |
| Rented out urban areas for off farm employment/business | Yes | 1% | 7% | 13% |
| | No | 99% | 93% | 87% |
| Labor on Other farms for wages | Yes | 3% | 7% | 7% |
| | No | 97% | 93% | 93% |
| Increased Farm areas by Renting In more Land | Yes | 6% | 7% | 13% |
| | No | 94% | 93% | 87% |
| Started Short Duration High Value Farm Enterprise | Yes | 13% | 10% | 13% |
| | No | 87% | 90% | 87% |
| Changed crop variety | Yes | 67% | 58% | 64% |
| | No | 33% | 42% | 36% |
| Change crop type | Yes | 63% | 59% | 67% |
| | No | 37% | 41% | 33% |
| Change planting dates (planting earlier) | Yes | 60% | 59% | 56% |
| | No | 40% | 41% | 44% |
| Change planting dates (planting later) | Yes | 45% | 35% | 56% |
| | No | 55% | 65% | 44% |
| Planted shaded trees in field | Yes | 49% | 55% | 53% |
| | No | 51% | 45% | 47% |
| Changed fertilizer | Yes | 45% | 56% | 53% |
| | No | 55% | 44% | 47% |
| Soil conservation | Yes | 11% | 15% | 11% |
| | No | 89% | 85% | 89% |
| Increased irrigation | Yes | 29% | 31% | 33% |
| | No | 71% | 69% | 67% |
| Crop diversification | Yes | 25% | 41% | 37% |
| | No | 75% | 59% | 63% |
| Used savings of the household | Yes | 54% | 39% | 55% |
| | No | 46% | 61% | 45% |
| Used savings of women | Yes | 54% | 53% | 45% |
| | No | 46% | 47% | 55% |
| Sold large ruminants | Yes | 64% | 39% | 55% |
| | No | 36% | 61% | 45% |

| | | | | |
|---|---|---|---|---|
| Sold small ruminants ) | Yes | 75% | 64% | 68% |
| | No | 25% | 36% | 32% |
| Bring Children Out of School | Yes | 50% | 50% | 60% |
| | No | 50% | 50% | 40% |
| Reduce expenditure on HH food | Yes | 72% | 58% | 81% |
| | No | 28% | 42% | 19% |
| Reduce expenditure on HH clothing | Yes | 69% | 48% | 60% |
| | No | 31% | 52% | 40% |
| Reduce expenditure on HH health | Yes | 71% | 61% | 81% |
| | No | 29% | 39% | 19% |
| Changed the feed | Yes | 41% | 58% | 67% |
| | No | 59% | 42% | 33% |
| Change the timing of feed | Yes | 32% | 39% | 52% |
| | No | 68% | 61% | 48% |
| Adopted better breeds | Yes | 34% | 61% | 48% |
| | No | 66% | 39% | 52% |
| Made open sheds | Yes | 12% | 34% | 38% |
| | No | 88% | 66% | 62% |

In context of the study, most shocking however was the ratio of farmers reporting bringing children out of school, reducing expenditure on food and health as coping strategies. It has real social face. Half of the farmers [50%-60%] brought their children out of school to compensate the negatives of climate change. The number is even higher for reduction of food expenditures [58%-81%]. The number of households cutting health expenditures varies between 61% and 81%. This is seriously alarming rate not only in itself but also to the fact that people are forced to cut health expenditures when they are facing higher disease rate [reported in perception section].

**Major Constraints:**

Table 4.27 corroborates the findings reported in Table 4.26 above. Maximum respondents [varying from 87% to 95%] faced lack of money as most binding constraint. Similar numbers reported the resource constraint. Most importantly however, in context of this feasibility study, is that very low number of respondents has received any support from BISP and other similar programs. This can be well understood in terms of criteria of qualification for these programs. For example, poverty score method will leave the households with agriculture land out of the list of potential benefices. This is very important to understand that social program needs to be tailored for agriculture programs as existing program may read farming community, particularly owing the land, not eligible for social program support.

*Table 4.27 Constraints in Risk Management*

| Constraints | | Land Size | | |
|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above |
| Lack of money | Yes | 87% | 94% | 95% |
| | No | 13% | 6% | 5% |
| Lack of information | Yes | 89% | 97% | 95% |
| | No | 11% | 3% | 5% |
| Shortage of resources | Yes | 88% | 94% | 95% |
| | No | 12% | 6% | 5% |
| Little guidance from Agriculture, Livestock and Irrigation Department | Yes | 77% | 76% | 76% |
| | No | 23% | 24% | 24% |
| No support from any Social Protection scheme (like BISP) | Yes | 85% | 73% | 86% |
| | No | 15% | 27% | 14% |

**Social Protection Coverage:**

When asked about Social Protection coverage, two Social Safety Nets were mostly reported by farmers i.e. Benazir Income Support Card and Watan Card. As landowners generally don't qualify for cash transfers under BISP, they were not in a better position to comment on its benefits. However, they were appreciative of BISP on the basis of observations. They were of the view that those who are getting cash transfers under BISP are actually benefitting and they should also get such cash based support. When we asked about coverage of only Watan card in the area, people were not well aware of other programs. Coverage rate of both the programs was much lower reaching to only one fifth of farmers [Table 4.26]. Majority of the respondents was unsatisfied with social programs [Table 4.27] and reported lower number of payments and administrative issues as the major concerns [Table 4.28].

**Agriculture Schemes Coverage:**

Respondents were asked to reflect on their coverage under agriculture schemes in the area. Majority reported that they were not availing subsidies under Kissaan Package. These findings imply that there is margin of improvement in social and agriculture schemes in the area.

*Table 4.28 Coverage under Agriculture Schemes*

| Agricultural Scheme | | Land Size | | |
|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above |
| Provision of Subsidized Spray Machines for Pest Management of Cotton Crop | Yes | 11% | 8% | 14% |
| | No | 89% | 92% | 86% |
| Subsidy on Sprinkler Irrigation and Solar Tube wells | Yes | 0% | 0% | 0% |
| | No | 100% | 100% | 100% |
| Zero Markup Loans (Kissan Package) | Yes | 1% | 0% | 6% |
| | No | 99% | 100% | 94% |
| Crop Loan Insurance Scheme | Yes | 4% | 0% | 0% |
| | No | 96% | 100% | 100% |

**Performance of Institutions:**

The public services of Agriculture Extension Department, Livestock and Dairy Development Department, Plant Protection Department and Irrigation Department have direct bearing upon the farming operations of farmers. Farmers were inquired about the reception of different services from these departments. In most of the cases a positive response was recorded regarding services of Livestock and Irrigation Department. However, very minimum number of farmers reported that they were receiving the mandated services from Agri-Extension Department and Plant Protection Department.

*Table 4.29 Performance of Institutions*

| Agriculture Extension Services | | Livestock and Dairy Development Department | | Plant Protection Department | | Irrigation Department | |
|---|---|---|---|---|---|---|---|
| **Services** | **%age of farmers receiving services** | **Services** | **%age of farmers receiving services** | **Services** | **%age of farmers receiving services** | **Services** | **%age of farmers receiving services** |
| Weather Advisory | 28% | Advisory service for best breeds | 53.70% | Pest Scouting | 1% | Channel Cleaning | 34% |
| Fertilizer Advisory | 24% | Vaccination service | 60.50% | Training Sessions | 1% | Water Conservation Advisory | 39% |
| Soil Testing Service | 6% | Disease diagnosis and treatment | 48.40% | Pesticide Advisory | 6% | Water Conservation Equipment/ Infrastructure provision | 0% |
| Seeds Advisory | 19% | Deworming service | 53.20% | Booklets or guidelines for disease protection | 2% | | |
| Advisory on Machine | 21% | Trainings for capacity building | 29.60% | | | | |
| Trainings on pests protection | 6% | | | | | | |
| Trainings on irrigation | 7% | | | | | | |
| Disaster Alert | 2% | | | | | | |

| | |
|---|---|
| Advice to change crops according to climate change | 19% |
| Booklets or guidelines for different crops | 1% |

**Food Security:**

As per ILO, food security holds *"when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*". We asked our respondents on status of food security. 63.4% of large farmers reported surplus production. About 40% of small farmers, owning <5 acres of land, reported having sufficient production. The number dropped below one fifth [23.3%] for farmers reporting that they were able to fill the deficit through buying from market. Overall, numbers in Table 4.30 suggest that about one third of farming households do not have sufficient production and also not able to buy it from market suggesting poor access and affordability.

*Table 4.30 Food Security Situation*

| **How do you rate your household's position in terms of food availability?** | Land Size | | |
|---|---|---|---|
| | 0-5 | 5.1-12.5 | 12.6 & above |
| Surplus Production | 8 | 0 | 14 |
| | 7.1% | 0.0% | 63.4% |
| Sufficient Production | 44 | 16 | 6 |
| | 39.3% | 44.4% | 27.3% |
| Sufficient only for few months | 31 | 16 | 2 |
| | 27.7% | 44.4% | 9.1% |
| Deficient but able to purchase from market | 26 | 4 | 0 |
| | 23.2% | 11.1% | 0.0% |

Majority [34.6%] of the farming households with less than 5 acre landholdings relies on less preferred and less expensive food as hedge against food insecurity [Table 4.31]. One fifth [20.9%] borrowed food or relied on help from friend in situation of food insecurity. A similar number [20.3%] reduced number of meals when they face food insecurity. Results for livelihood based strategies to cope food insecurity are reported in Table 4.32

*Table 4.31 Coping Strategies for Food Insecurity*

| Food Based Coping Strategies | Land Size | | |
|---|---|---|---|
| | 0-5 | 5.1-12.5 | 12.6 & above |
| Relied on less preferred, less expensive food | 34.6% | 24.5% | 16.1% |
| Borrowed food or relied on help from friends or relatives | 20.9% | 32.7% | 38.7% |
| Reduce number of meals eaten per day | 20.3% | 24.5% | 22.6% |
| Reduce portion size of meals | 14.4% | 10.2% | 9.7% |
| Reduction in the quantities consumed by adults/months for young children | 9.8% | 8.2% | 12.9% |

*Table 4.32 Livelihood Based Coping Strategies*

| **Livelihood based Coping Strategies** | | Land Size | | |
|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above |
| Sold household assets/goods | No, because I did not face a shortage of food | 16% | 13% | 6% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 44% | 50% | 59% |
| | Yes | 40% | 38% | 35% |
| | Not applicable | 0% | 0% | 0% |
| Purchased food on credit | No, because I did not face a shortage of food | 21% | 12% | 6% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 6% | 8% | 13% |
| | Yes | 71% | 81% | 81% |
| | Not applicable | 3% | 0% | 0% |

| | | | | |
|---|---|---|---|---|
| Spent savings | No, because I did not face a shortage of food | 18% | 20% | 0% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 2% | 0% | 13% |
| | Yes | 74% | 80% | 88% |
| | Not applicable | 6% | 0% | 0% |
| Borrowed money / food from a formal lender / bank | No, because I did not face a shortage of food | 19% | 13% | 6% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 24% | 58% | 63% |
| | Yes | 17% | 13% | 6% |
| | Not applicable | 40% | 17% | 25% |
| Sold productive assets or means of transport (sewing machine, wheelbarrow, bicycle, car, etc.) | No, because I did not face a shortage of food | 20% | 23% | 7% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 31% | 9% | 13% |
| | Yes | 37% | 64% | 60% |
| | Not applicable | 12% | 5% | 20% |
| Consumed seed stock held for the next season | No, because I did not face a shortage of food | 26% | 13% | 7% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 26% | 26% | 47% |
| | Yes | 26% | 26% | 7% |
| | Not applicable | 21% | 35% | 40% |
| Withdrew children from school | No, because I did not face a shortage of food | 20% | 13% | 0% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 22% | 4% | 0% |

| | | | | |
|---|---|---|---|---|
| | Yes | 29% | 22% | 27% |
| | Not applicable | 29% | 61% | 73% |
| Sold house or land | No, because I did not face a shortage of food | 20% | 13% | 0% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 24% | 17% | 20% |
| | Yes | 22% | 26% | 7% |
| | Not applicable | 35% | 43% | 73% |
| Begged | No, because I did not face a shortage of food | 18% | 13% | 0% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 13% | 4% | 0% |
| | Yes | 9% | 17% | 7% |
| | Not applicable | 60% | 65% | 93% |
| Sold last female animal | No, because I did not face a shortage of food | 20% | 13% | 0% |
| | No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it | 20% | 13% | 20% |
| | Yes | 44% | 65% | 80% |
| | Not applicable | 15% | 9% | 0% |

The ratio of households selling assets/goods to finance the food shortage falls in range of 35% to 44% across different size of landholdings. However, on average more than 50% of the rest were not able to sell any assets as they have already sold it. This result reaffirms the frequency of bad growing season and poor resource availability. 71% of farmers with less than 5 care landholdings purchased food on credit while the number is 81% for farmers with landholdings more than five acres. Similar results are reported for spending saving as coping strategy. Formal borrowing remains less practiced and only 17% of small farmer, < 5 cares, borrowed money from bank. One reason behind these lower ratios is that farmers don't have collateral and the assets able to serve collateral has already been sold. Majority of farmers sold productive assets or means of transport (sewing machine, wheelbarrow, bicycle, car, etc. one fifth of small farmers sold their land to finance food security gap. Finally, 44% of farmers with less than 5 acre land size and 65% with landholdings between 5-12.5

acres sold the last animal in the face of food insecurity. The higher ratios reported by large farmers need to be carefully interpreted as the sample size was smaller.

**Cooperatives, Group Farming and Other (Informal) Risk Coping Strategies**

Farmers were categorically inquired whether they were part of any farming cooperative or did they ever practiced group farming. Almost all the farmers responded in negation. Some discussion has been made regarding benefits of both of them in Section 4.8.1.4. Reader may refer to that section. Keeping in view those benefits, it has been recommended in Section 5.4.1 that any risk transfer or risk reducing scheme introduced under R4 programme should also consider the introduction of farming cooperatives.

The farmers were also inquired whether they had any informal risk coping mechanism at the village level like pooling their resources for hard times? To this question also, nearly all the farmers responded in negation.

When asked whether borrowing was an option for purchasing of inputs, 38% farmers responded affirmatively. Out of these, 86% opted for borrowing i.e. buying the inputs on credit rather than borrowing from formal banking institution. However, they had to pay higher price when purchasing the inputs on credit. Average original price of a DAP bag is Rs. 3202.83. Whereas if it is purchased on credit then farmer has to pay Rs. 3942.14 on average, 23% higher than the original price. Similarly a bag of urea costs 37.8% higher when purchased on credit.

*Table 4.33 Changes in Prices under Credit Purchase*

| | Average (in Rs.) |
|---|---|
| Original Price DAP (per bag) | 3202.83 |
| Marked up Price DAP (per bag) | 3942.14 |
| Original Price Urea (per bag) | 1369.49 |
| Marked up Price Urea (per bag) | 1888.14 |

**Different Willingness of Farmers to Buy Insurance Product at Different Amount of Per Acre Premium**

Finally, the farmers were asked for their willingness to accept crop insurance and the results are reported in Table 4.34 and 4.35. The farmers growing wheat, cotton and Pulses urgently needed insurance product in every season [Table 4.34]. The demand is robust to all farmers irrespective to landholding size. This shows that crop specific crop insurance can be a one viable option as it has greater demand.

*Table 4.34 Crop Wise Need of Crop Insurance Product*

| Crop | | Land Size | | |
|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above |
| Wheat | Urgently needed in every season | 85.7% | 93.9% | 100.0% |
| | Occasionally Needed | 8.2% | 3.0% | 0.0% |
| | No need at all | 6.1% | 3.0% | 0.0% |
| Cotton | Urgently needed in every season | 81.2% | 94.7% | 100.0% |
| | Occasionally Needed | 14.5% | 5.3% | 0.0% |
| | No need at all | 4.3% | 0.0% | 0.0% |
| Sugarcane | Urgently needed in every season | 0.0% | 0.0% | 0.0% |
| | Occasionally Needed | 0.0% | 0.0% | 0.0% |
| | No need at all | 100.0% | 0.0% | 0.0% |
| Pulse (if planted) | Urgently needed in every season | 83.3% | 100.0% | 100.0% |
| | Occasionally Needed | 0.0% | 0.0% | 0.0% |
| | No need at all | 16.7% | 0.0% | 0.0% |
| Oilseed (if planted) | Urgently needed in every season | 0.0% | 0.0% | 0.0% |
| | Occasionally Needed | 0.0% | 0.0% | 0.0% |
| | No need at all | 100.0% | 0.0% | 0.0% |
| Fodder crop (if planted) | Urgently needed in every season | 25.0% | 0.0% | 0.0% |
| | Occasionally Needed | 0.0% | 0.0% | 0.0% |
| | No need at all | 75.0% | 0.0% | 0.0% |

Most importantly however, the willingness to by crop insurance seems on a lower side as farmers were willing to pay a low per season premium [table 4.34]. Only 13.8% of respondents were willing to a premium above Rs. 3500 [lump sum per season]. A look into willingness to premium by landholding size shows that 19% of the farmers holding less than 5 acres were willing to pay premium above Rs. 3500 [table 4.36]. This may indicate the seriousness of resource constraints facing this group as well as higher marginal value of loss. Also, it may be an outcome of frequent poor growing season facing the bottom of small farmers.

*Table 4.35 Willingness to Pay Premium (all farmers)*

| Premium (Lump Sum per crop season in Rs.) | Percent Willing |
|---|---|
| **1500** | 37.1 |
| **1501-2500** | 30.5 |
| **2501-3500** | 18.6 |
| **3501-4500** | 13.2 |
| **4501-5500** | 0.6 |

*Table 4.36 Willingness to Pay Premium (By Land Size)*

| Premium (Lump Sum per crop season in Rs.) | Land Size | | |
|---|---|---|---|
| | **0-5** | **5.1-12.5** | **12.6 & above** |
| 1500 | 32.1% | 38.9% | 59.1% |
| 1501-2500 | 29.4% | 41.7% | 18.2% |
| 2501-3500 | 18.3% | 16.7% | 22.7% |
| 3501-4500 | 19.3% | 2.8% | 0.0% |
| 4501-5500 | 0.9% | 0.0% | 0.0% |

**Conclusion**:

Wheat is the major crop in the area. Market factors, improved facilities, and profits were the main reasons for increase in acreage while climate change related factors however emerge as a major driver behind wheat acreage reduction. Majority of the farmers cultivate their own pieces of land. Interventions sensitive to land-ownership status, for example insurance or loans, requiring collateral can be applied, as the ratio of tenant is as low as 5.4%. We conclude that high input prices, lower yields, and poor economic and social collateral may leave small farmers to get lands on rent hence lowering tenancy rate. Interventions relaxing the financial and resource constraints are seriously required. Per day per person income of 71% of farming population in the region is between Rs 21.5 and 86. This may clearly suggest the prevalence of resource constraints facing the agricultural community in the region.

Average yield of wheat in the study area varies between 38.25 and 46.24 Mds/acre for farmers holding less than 5 acres and more than 12.6 acres respectively. Farmers in Muzaffargarh, on

average, are producing a yield 27 Mds/acre less than country average. Agriculture serves as major source of livelihood for 78.2%, 87.5% and 88% respondents with land a size of 0-5, 5.1-12.5, 12.6 and above respectively. Poor growing seasons are frequent. Agriculture households in the region don't prefer doing any job other than farming. Any program aiming to improve living standards of these households, therefore, has to be agri-based by definition

Non-climatic risks, including market risks, emerged as the major source of concern for the farmers irrespective of the size of landholdings. More than 70% of marginal farmers with <5 acres landholdings reported unavailability of quality inputs as major risk facing them. Non-climatic risks which basically involve affordability and accessibility of quality inputs remain the biggest concern of farming households, irrespective of farm size. Of climatic risks, untimely rains and shortage of canal water were also reported as major risks. Programs, in this region, need to focus more on non-climatic factors. Programs focusing on climatic factors need to keep in mind that overwhelming majority of farmers [ranging from 80%-94%], irrespective of the size of land holdings responded that crop pests and diseases have increased due to changing climate.

Change of crop and variety emerge as the most commonly used coping strategies by all types of farmers. Change in crop and variety was reported by 67% and 63% farmers holding farm size less than 5 acres receptively. Half of the farmers [50%-60%] brought their children out of school to compensate the negatives of climate change. The number is even higher for reduction of food [58%-81%] and health expenditures [61% -81%]. About one third of farming households do not have sufficient production and also not able to buy it from market suggesting poor access and affordability. The designed program, therefore, needs to be tailored with this social face of coping strategies].

While designing any interventions highly relying on these programs, one must bear two pints in mind Rural farming community primarily faces the lack of financial resources coupled with low coverage of social protection and agricultural scheme. Literally speaking, the coverage of agriculture programs is almost zero. This also shows the margin of improvement of social and agriculture schemes in the area. Intervention building on increasing the coverage of already existing programs must focus on administrative issues of these schemes and programs. Also, social program needs to be tailored for agriculture community as existing program may read farming community, particularly owing the land, not eligible for social program support. Interventions aiming to expand coverage of formal credit market for farmers keep in mind that formal borrowing remains less practiced and only 17% of small farmer, < 5 cares, borrowed money from bank. The major reason behind lower formal borrowing is that farmers don't have collateral and the assets able to serve collateral has already been sold. The farmers growing wheat, cotton and pulses urgently needed insurance product in every season. In this regard however, premium payment needs to be considered as only 13.8% of respondents were willing to a premium above Rs. 3500 [lump sum per season].

## 4.7. Crop Insurance

Although crop insurance has been touched upon in the Sections 4.4 and 4.6, this entire section is exclusively dedicated around crop insurance because it is one of the key tool of R4s overall toolkit of interventions. In fact, crop insurance has been identified and proposed as an entry point for R4 in the Punjab in the Section 5.4.

### 4.7.1 PERCEPTIONS ABOUT CROP INSURANCE AND PREMIUM:

Crop insurance is rather a new concept in agriculture of Pakistan as this tool of risk management was not practiced in the country earlier. During the study, most farmers were found reluctant to take this option. Nevertheless, awareness and public outreach could help build a positive perspective of farmers. In Muzaffargarh and Rahim Yar Khan, farmers were asked if they were offered any crop insurance plan by any company or programme by any governmental and non-governmental organizations. Almost all the farmers and market communities replied that this type of scheme has never been offered before. However, they said they would like to take insurance as it will be very beneficial for the farmers because they will have a payback guarantee if there are losses on the part of their hard work. Nonetheless farmers as well as representatives of research community and policy makers were all of the view that small farmers would not be able to pay the premiums. Small farmers are already under the burden of debts and high interest loans that it is nearly impossible for them to take out extra money for premiums. Some farmers were willing to pay half the premiums if government support them and pay the other half. Farmers also said that if they were to give at least Rs. 5000[58] in premium then would prefer to use that money for irrigating their crops by operating tube well. Some suggestions were also made during the interviews as well as FGDs listed below:

- The government could help them by paying half or 4/5 of the premiums or full premium for the first year
- Bank loans are taken by farmers and premiums could be incorporated in that loan
- Premium packaging
- Premium can be adjusted according to units used in electricity
- Can be adopted with option that if a crop does not face any damage then the paid premium/some part of it by the farmer would be returned to him (also practiced by PMIC-PPAF in some cases)

Literature suggests that farmers perceive crop insurance premium as some sort of tax. Moreover, their willingness to pay premium depends upon landholding and farm income. While willingness to

[58] This figure was calculated for a farm of 5 acre having wheat crop with yields ranging between 30-40 Mds/acre. Total yield of that 5 acre farm would be 120-150 Mds. In monetary terms it becomes Rs. 195,000 to 260,000 (taking current support price of Rs. 1300 per 40 kg). Suppose that indemnity is 100%. At 3% premium rate the insurance premium would range between Rs. 5,850 – 7,800 per crop. 3% is the rate charged by PMIC on average. In India, the average actuarial premium rate charged during Kharif 2016 was 12.55%.

adopt a crop insurance product depends upon loss experience, land tenure, landholding, farm income, and expected yields[59].

Another study[60] used Propensity Score Matching to determine the effect of Index Based Insurance in Soon Valley and Talagang (rain-fed areas) and found that farmers participating in the index based insurance strategy would be more satisfied as compared to the non-participants. The willingness to adopt that product was dependent upon factors like economic status, household assets and membership of community organization. It also concluded that once there is crop insurance for cash crops, the farmers may shift their cropping patterns from traditional food crops to the cash crops. They would specialize in those crops and maximize profits instead of diversifying the risks.

Mixed views were obtained from our public sector interviewees. At Ayub Agriculture Research Institute and Planning and Development Department a need for crop insurance was expressed during the in-depth interviews. Chief Agriculture had even hinted that Punjab Govt. was also doing some spade work for introducing crop insurance in Punjab in collaboration with World Bank. However, during a key informant group discussion held at Deputy Commissioner Office Rahim Yar Khan, the participants (Director Agri-Extension, Director Environment Department, Official from Crop Reporting Service Department and Additional Deputy Commissioner) it was suggested that instead of introducing micro-level scheme like subsidized crop insurance, the focus should be directed towards macro level measures like construction of dams. Interviewee from Punjab Disaster Management Authority also indicated that it was planning to introduce disaster insurance. However, it was apprehensive because of the implementation challenges like lack of data and myriad of complexities associated with index based insurance products. According to him, PMD was not in a position to provide localized accurate data which is a pre-requisite for an Index Based Insurance product.

### 4.7.2. SUGGESTED SCHEMES FOR APPLICABILITY OF CROP INSURANCE:

It was suggested that it would be difficult to differentiate between irrigated and rainfed cropping. Farmers on irrigated land can use additional water to make their yield better but rain fed areas would solely depend on rain. So, it will be more applicable/suitable on rain-fed areas. However, we have reported in the previous section that untimely rains and windstorms are frequently faced climatic risks faced by the small farmers. And they also face issues with shortage of canal water and poor quality of ground water. Thus insurance is applicable and needed in the irrigated areas too. Applicability of Weather Based Insurance was one of the key question before us when we interviewed respondents of PMD and PDMA. PMD's response was that WBI is dependent upon

[59] Ghazanfar, S., Wen, Z.Q., Abdullah, M., Ahmad, J. and Khan, I., 2015. Farmers' Willingness to pay for Crop Insurance In Pakistan. Journal of Business Economics and Finance, 4(2).

[60] Ali, A., 2013. Farmers' Willingness to Pay for Index Based Crop Insurance in Pakistan: A Case Study on Food and Cash Crops of Rain-fed Areas. *Agricultural Economics Research Review*, *26*(2).

localized weather data and PMD is not in a position to provide accurate and targeted weather information. Similar views entailed discussion in PDMA. They both stressed that prior to launch of WBI, investment was required for installation of automatic weather stations in the location where it is piloted.

On the other hand, Yield based insurance and insurance based on cost of production per acre (district wise) could be alternative to weather based insurance. Another suggestion was that insurance should be given for all the costs including input, labor and products and not only crop, this will make small farmers more resilient to all types of agricultural risks.

### 4.7.3. PMIC PILOT CROP INSURANCE-CASE STUDY

In Pakistan, crop insurance was pioneered by Pakistan Microfinance Investment Company (affiliated with Pakistan Poverty Alleviation Fund). PMIC has been setup jointly by, Pakistan Poverty Alleviation Fund (PPAF), Department for International Development (DFID) through Karandaaz Pakistan and the German Development Bank (KFW) to catalyze growth in the microfinance sector of Pakistan in 2016. Considering the vital role of microfinance sector in Pakistan in enhancing financial inclusion, the establishment of PMIC was envisaged as part of the National Financial Inclusion Strategy developed for Pakistan. Being PPAF's initiative, its microfinance products deal with:

- Technical Advisory Services
- Value Chains
- Micro-Insurance
- Renewable Energy
- Housing finance for Microfinance clients
- Education through Microfinance.

The Pakistan Credit Rating Agency has assigned entity ratings of "AA/A1+" with a Stable Outlook to Pakistan Microfinance Company Limited (PMIC). PACRA has stated that the ratings of PMIC take into account the strong support of the sponsoring institutions; Pakistan Poverty Alleviation Fund (PPAF), Karandaaz Pakistan — funded by UK's Department for International Development (DFID) — and the KfW Development Bank, a government owned German development bank.

PPAF piloted Weather Index Based Insurance in Soon Valley and Talagang which are both rain fed areas around 2012. Moreover, Yield Based Insurance had also been introduced in the district Bahawalpur. After PPAF setup PMIC, the micro-insurance products got being managed by PMIC.

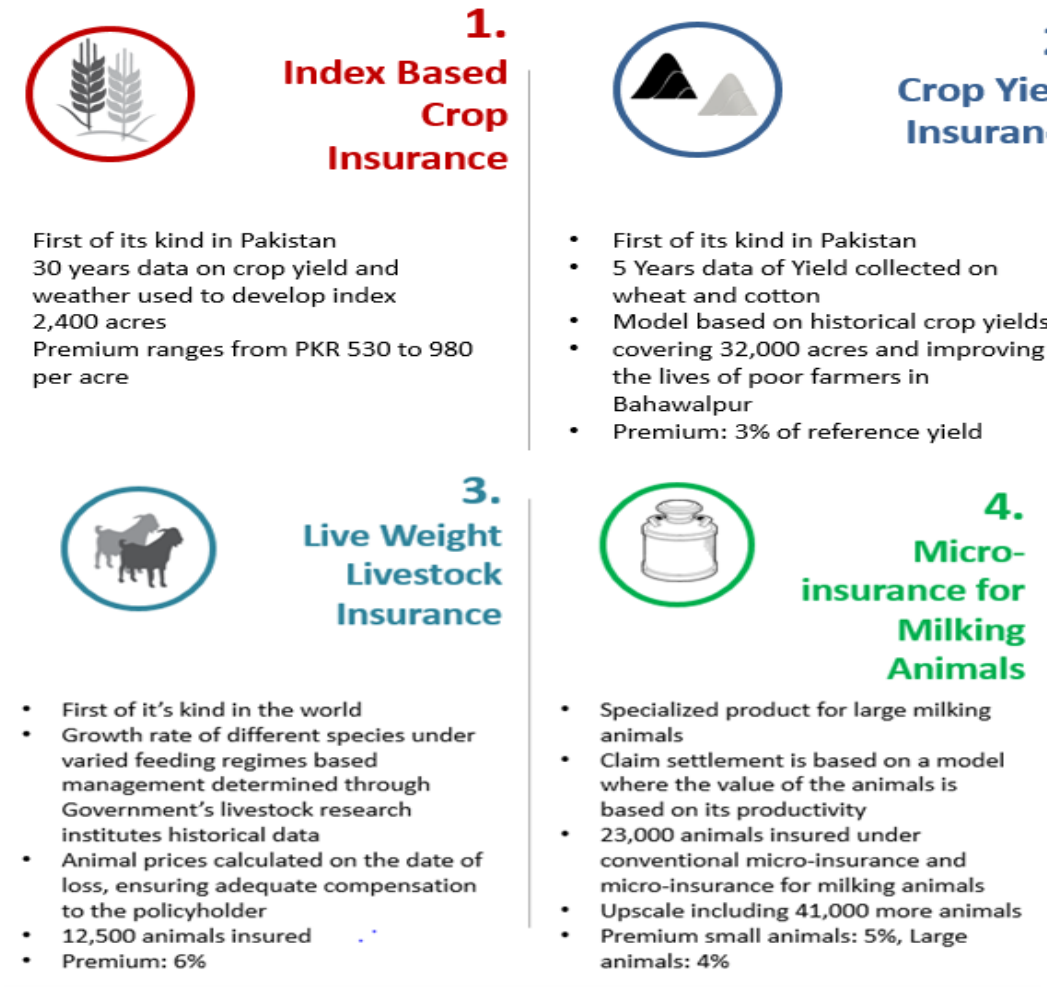
1- PPAF-PMIC had collaborated with NARC, PMD and to develop the weather based index by using the weather and yield data of past 30 years. After developing the index when they held the community meetings, the members of community were not exactly satisfied with the trends being shown by the Index. In particular they differed with the trends of past 5 to 6 years period (2008-2013).

2- ICICI Lombard (India) was also partnered with to get their inputs on Index Based Insurance.
3- For weather data collection, Automatic Weather Stations were imported from USA. According to their specifications, they could generate data of about 20 km. But in the Pothohar region, AWS did not work very effectively. Some AWS could give reliable data of only 3-4 km.
4- Index Based Insurance can't be implemented without any human resource presence at all. Some sort of random monitoring and checks have to be incorporated. For instance, if a farmer does not use good quality prescribed seed then automatically his yield will be low. In such cases yield loss can't be attributed to climate variability exclusively.
5- That is why PMIC-PPAF coupled Insurance with Good Agriculture Practices initiatives like supplying seeds, fertilizers, etc. This model is close to the expected plan of R4.
6- They have provided insurance for unexpected rain, hail storm, wind storm, pest attack, fire and drought.
7- PMIC responded that due to data issues and interdependencies of many factors, it is using hybrid insurance model in Bahawalpur and Saanghar. Hybrid insurance implies coverage of multiple perils. PMIC has partnered with NRSP in Bahawalpur. The Local Support Organization members serve as monitoring agents for crop loss verifications. 'Same model should be applied in Rahim Yar Khan and Muzaffargarh', he recommended.
8- Currently Weather Index based Insurance is not operational in Soon Valley and Talagang. However, livestock insurance is active there.
9- In October 2017, PMIC signed an MoU with Alfalah Insurance to roll out **yield based** crop and livestock insurance products in Tharparkar, Nawabshah, Sanghar, Tando Allah Yar districts of Sindh and Gujranwala, Nankana Sahib, Narowal and Sheikhupura districts of Punjab province.
10- In case of Crop Loan Insurance Scheme, sum insured is the borrowed amount, which is normally up to 40-50 thousand rupees for land holders up to 5 acres. That amount is lower than the actual worth of crop grown in a farm up to 5 acre. Therefore the problem of moral hazard doesn't exist in case of CLIS.
11- Livestock insurance could be very helpful for the small farmers. Currently, PMIC provides livestock insurance policy to farmers in such a way that perils caused two months before and after Eid ul Azha are not covered.
12- The insurance companies engaged by PMIC, for its Crop Micro Insurance projects, include:
    i- United Insurance
    ii- Askari Insurance
    iii- Jubilee Insurance
    iv- Adam Jee Insurance
    v- Alfalah Insurance

*Table 4.37 Statistics of PMIC-PPAF Pilot Crop Insurance Projects*

| | Weather based | Yield based |
|---|---|---|
| Data collected | 30 years | 5 years |
| Area coverage | 2400 acres | 32,000 acres |
| Premium | Rs. 580 to 930 per acre | 3% of reference yield |

Figure 4.10: Some features of PPAF Insurance Products Launched at the Pilot Phase in 2012[61]




The Figure 4.10 above shows basic features on PPAF insurance products piloted around 2012 in different regions of Punjab. Out of the four products mentioned above, now index based insurance

[61] State Bank of Pakistan, Innovations in Managing Catastrophic Risk in Agriculture Finance – Strategy & Actions - PPAF

has become out of practice due to data complexities. Also, micro-insurance products are now mostly managed by PMIC.

In addition to PMIC, crop insurance initiative has also been recently taken in district Badin (Sindh) on pilot basis by FAO. At the pilot stage full subsidy has been provided for premium. 300 acres have been insured at the initial phase. Purpose of the project is to provide safeguard to farmers who have suffered from floods in past few years. Other perils like fire, extreme temperature and pest attacks have also been covered. FAO has procured the services of United Insurance for this initiative.

### 4.7.4. INSURANCE SCHEMES OF GOVERNMENT OF PAKISTAN

On the directions of Ministry of Finance, Govt. of Pakistan, two mandatory loan insurance schemes are in practice. Crop Loan Insurance Scheme is mandatory for all banks in lieu of loans extended for five major crops i.e. wheat, rice, cotton, sugarcane and maize to avoid risk of losses due to natural calamities. It was mandatory in 2008 vide order SRO No. 1(13)-Inv. II/2008 by Ministry of Finance, Govt. of Pakistan[62]. Initially it was compulsory only for loans extended to farm holders with less than 12.5 acres of land. Last year its scope was extended to land holders having up to 25 acres of land. Banks pay the insurance premium at 1.3% for farmers having less than 25 acres of land and get the reimbursement from Govt. of Pakistan. Maximum loan limit insured under this scheme is Rs. 500,000. In the Federal Budget 2017-18, Rs. 700 million have been allocated for Crop Loan Insurance Scheme. In Budget 2016-17, it was Rs. 500 million. These figures indicate the extent of financial resources needed for introducing a direct Crop Insurance project. Perils covered include Excessive rain, Flood, Drought, Hailstorm, Frost, Locust attack and Insect attack[63].

Second mandatory loan insurance scheme is Livestock Insurance Scheme for Borrowers. Maximum loan covered under this scheme is Rs. 5 million. Perils covered include death due to disease, death due to floods, rains and windstorm and accidental death[64].

In addition, Banks/DFI are also required to ensure that the tractors financed by them are insured[65]. Farmers generally lack awareness about crop loan insurance scheme (CLIS). In most of the cases, only those farmers are aware about CLIS who have obtained agriculture credit from formal source i.e. banks/DFIs or those who are educated[66].

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[62] State Bank of Pakistan, 2014. Prudential Regulations for Agriculture Financing. http://www.sbp.org.pk/publications/prudential/PRsAgriApproved.pdf

[63] Zarai Taraqiati Bank Limited. Terms and Conditions for Crop Insurance Scheme.

[64] State Bank of Pakistan, 2013. Livestock Insurance Scheme for Borrowers. http://www.sbp.org.pk/acd/2013/C1-Annex.pdf

[65] Ibid,. 66.

[66] Ghazanfar, S., Qi-wen, Z., Abdullah, M., Ahmad, Z. and Lateef, M., 2015. Farmers' Perception and Awareness and Factors Affecting Awareness of Farmers Regarding Crop Insurance as a Risk Coping Mechanism Evidence from Pakistan. Journal of Northeast Agricultural University (English Edition), 22(1), pp.76-82.

A study conducted in 2015, exploring the factors hindering farmers' willingness to adopt crop insurance, found out that amongst other factors like inability to pay premium and lack of knowledge, dissatisfaction with the crop loan insurance scheme also hampers the farmers from adopting crop insurance[67]. Thus, CLIS has not been a complete success story in Pakistan. Some of the issues identified with CLIS are that:

i- It is limited only to the outstanding amount of loan. The amount of loan is definitely less than the value of crop. In case of crop loss, the claim is paid only up to the amount of loan, not according to the actual loss incurred.

ii- The amount of premium defined is universal irrespective of crops and irrespective of risk probability.

iii- The claim is not triggered unless calamity is declared by the local Revenue Department. Although this mechanism is somewhat similar to the Indian model. But in Pakistan, this mechanism faces the efficiency issues. Normally calamity is declared only if a wide scale loss in a Tehsil of District is incurred because of a disaster. If a small area (2 to 3 villages) suffers then the relevant authority is reluctant in declaring the calamity.

iv- In some cases the premium is charged at a rate higher than the ceiling of 3% prescribed by the Government of Pakistan.

### 4.7.5 INDIAN CROP INSURANCE SCHEME- A CASE STUDY

Historically, crop insurance has been criticized by the pro WTO or pro-invisible hand club as an expensive risk sharing tool which is distortive to the markets and that it does not significantly affect the crop decisions. Yet crop insurance is expanding globally, particularly to transfer the risk associated with climate extremes. In India, crop insurance began in 1985 with announcement of Comprehensive Crop Insurance Scheme. Since then it has taken different shapes and modes and since 2016 there are only two crop insurance schemes in India i.e. Pradhan Mantri Fasal Bima Yojana (PMFBY) and Restructured Weather Based Crop Insurance Scheme (RWBCIS). Since 1985, the insurance schemes of India have insured 369 million farmers and 513 million hectare area. Total premium collected during that period was INR 313,008 million and claims of INR 587,114 million were paid out. Total 135 million farmers benefitted from different crop insurance schemes of India[68]. The schemes are operational in 21 States/Union Territories of India. Basic features of both schemes are included in Table 4.38. They are compulsory for loaned farmers and optional for non-loaned farmers. Sum insured is decided on the basis of Scale of Finance (cost of cultivation plus some profit).

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[67] Ghazanfar, S., Qi-wen, Z., Abdullah, M., Ahmed, J., Khan, I. and Ahmad, Z., 2015. Factors Hindering Pakistani Farmers' Choices towards Adoption of Crop Insurance. Journal of Northeast Agricultural University (English Edition), 22(2), pp.92-96.

[68] Bhushan, C. and Kumar, V., 2017. Pradhan Mantri Fasal Bima Yojana: An Assessment.

*Table 4.38 Basic Features of Insurance Schemes in India*

| Feature | PMFBY[69] | RWBCIS[70] |
|---|---|---|
| **Coverage of farmers** | All farmers including tenants and sharecroppers growing the notified crops. Both loaned and non-loaned farmers can apply. Loaned farmers are covered compulsorily. Optional for non-loaned farmers. | Same as in PMFBY |
| **Premium** | 1.5-5%, premium subsidy for all crops | Same as in PMFBY |
| **Coverage of crops** | 1) Food crops (Cereals, Millets and Pulses),<br>2) Oilseeds<br>3) Annual Commercial / Horticultural crops | Same as in PMFBY |
| **Coverage of risks** | a) Prevented Sowing/ Planting Risk: Insured area is prevented from sowing/ planting due to deficit rainfall or adverse seasonal conditions<br>b) Standing Crop (Sowing to Harvesting): Comprehensive risk insurance is provided to cover yield losses due to non- preventable risks, viz. Drought, Dry spells, Flood, Inundation, Pests and Diseases, Landslides, Natural Fire and Lightening, Storm, Hailstorm, Cyclone, Typhoon, Tempest, Hurricane and Tornado.<br>c) Post-Harvest Losses: coverage is available only up to a maximum period of two weeks from harvesting for those crops which are allowed to dry in cut and spread condition in the field after harvesting against specific perils of cyclone and cyclonic rains and unseasonal rains.<br>d) Localized Calamities: Loss/ damage resulting from occurrence of identified localized risks of hailstorm, landslide, and Inundation affecting isolated farms in the notified area. | Following major weather perils, which are deemed to cause "Adverse Weather Incidence", leading to crop loss, shall be covered under the scheme:<br>a) Rainfall – Deficit Rainfall, Excess rainfall, Unseasonal Rainfall, Rainy days, Dry-spell, Dry days<br>b) Temperature– High temperature (heat), Low temperature<br>c) Relative Humidity<br>d) Wind Speed<br>e) A combination of the above<br>f) Hailstorm, cloud-burst may also be covered as Add-on/Index-Plus products for those farmers who have already taken normal coverage under WBCIS. |
| **Coverage Area** | The scheme operates on the principle of 'Area Approach' in the defined areas called Insurance | Same as for PMFBY |

[69] Operational Guidelines: Pradhan Mantri Fasal Bima Yojana. Department of Agriculture, Cooperation and Farmers Welfare. Ministry of Agriculture and Farmers Welfare, Government of India.
[70] Operational Guidelines: Restructured Weather Based Crop Insurance Scheme. Department of Agriculture, Cooperation and Farmers Welfare. Ministry of Agriculture and Farmers Welfare, Government of India.

| | | |
|---|---|---|
| | Unit. | |
| **Sum Insured** | Scale of Finance (Cost of Cultivation plus some profit) | Same as for PMFBY |
| **Loss Assessment** | On the basis of average yields calculate from Crop Cutting Experiments (CCEs). In those areas where both PMFBY and WBCIS are being implemented the data of CCE is used by insurance providers to develop correlation between yield and weather parameters to help design better weather insurance products, standardization and benchmarking of products. | On the basis of weather data of notified Reference Weather Stations (RWS), Back up Weather Station (BWS) and Automatic Rain Gauge (ARG). |

These schemes are not completely void of loopholes/drawbacks. They have issues like non-usage of innovative technologies, corruption, lack of trained outsource agencies, bogus crop cutting experiments, irrational number of crop cutting experiments[71].

Location of weather stations is very critical for functioning of WBCIS. Impact evaluation of Pilot WBCIS in 2011 revealed that 68% of the policy holders under WBCIS were not satisfied with the location of weather station. 44% were not satisfied with the mechanism to redress grievances. Results of impact evaluation are tabulated in Table 4.39.

*Table 4.39: Results of Impact Evaluation of Pilot WBCIS*

| Index | Satisfied (%) | Partly satisfied (%) | Not Satisfied (%) |
|---|---|---|---|
| Quantum of Sum Insured | 31 | 35 | 34 |
| Types of Risks Covered | 28 | 45 | 27 |
| Period of Risk Coverage | 29 | 31 | 41 |
| Convenience in Enrollment under WBCIS | 54 | 14 | 32 |
| Weather as a Basis for Crop Insurance | 30 | 49 | 21 |
| Location of Weather Station | 2 | 30 | 68 |
| Design of WBCIS Policy | 15 | 50 | 35 |
| Responsiveness of Insurance Intermediary | 6 | 56 | 38 |
| Mechanism regarding Grievance Redress | 19 | 37 | 44 |

[71] Ibid,. 67.

| | | | |
|---|---|---|---|
| Reliability of Weather Station & Data | 22 | 58 | 20 |
| Time Taken for Intimation or Receipt of Claims | 38 | 44 | 18 |
| Effectiveness of WBCIS as Protection against Crop Losses & Climate Change | 15 | 62 | 23 |

Source: Report on Impact Evaluation of Pilot Weather Based Crop Insurance Scheme[72]

## 4.7.6 A BRIEF PROFILE OF PAKISTAN'S INSURANCE INDUSTRY

Pakistan's insurance industry is divided into two major components i.e. non-life insurance and life insurance. 27 companies deal with non-life insurance, 07 companies deal with life insurance and there is only one re-insurance company[73]. Life insurance accounts for 80.9% of total insurance sector. In the past few years Life Insurance has shown phenomenal growth. In 2016, it grew by 20%.

Within non-life insurance, E.F.U General Insurance Ltd, Adamjee Insurance Company Ltd, Pakistan Reinsurance Company. Ltd, Jubilee General Insurance Company and Premier Insurance Company Ltd shared 59.78% market share[74].

Table 4.40 below shows basic annual financial indicators of the Insurance Industry of Pakistan like Net Premium Revenue, Net Claims, Net Claims Incurred to Net Premium Ratio and Return on Equity Percentage. A point of concern here is that returns on equity (RoE) in Non-Life insurance is nearly less than half as compared to the RoE in Life Insurance. This may be attributed to the higher ratio of net claims incurred to net premium in case of Non-Life Insurance as compared to Life Insurance.

In Section 4.6 we have reported the frequency of poor growing season as identified by the farmers. That frequency revealed that farmers face rough two out of five seasons to be of poor growth. Using that frequency it can be implied that the net claims to net premium ratio in case of crops would be 0.4 (2/5), which is lower than the average of 0.52 for Non-Life insurance sector.

*Table 4.40 Basic Financial Indicators of Insurance Industry of Pakistan*

| | | 2016 | 2015 | 2014 | 2013 | 2012 |
|---|---|---|---|---|---|---|
| **Overall Insurance Industry** | Net Premium Revenue (Rs. in Million) | 215186.5 | 193279 | 159696 | 138187 | 118760 |
| | Net Claims (Rs. in Million) | 95602.8 | 77789.69 | 64918 | 55194.05 | 49155.59 |
| | Claims incurred to net premium (ratio) | 0.44 | 0.4 | 0.4 | 0.39 | 0.41 |

[72] Report on Impact Evaluation of Pilot Weather Based Crop Insurance Scheme, 2011 Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.
[73] Insurance Association of Pakistan, Year Book 2016-17.
[74] State Bank of Pakistan, Financial Statements Analysis of Financial Sector 2012-2016.

| | | | | | | |
|---|---|---|---|---|---|---|
| | Return on Equity (%) | 16.25 | 18.29 | 15.08 | 14.73 | 13.27 |
| **Life Insurance** | Net Premium Revenue (Rs. in Million) | 169155 | 152550.5 | 122919.1 | 105006.7 | 85942.53 |
| | Net Claims (Rs. in Million) | 71720 | 56758 | 45334.84 | 36533.51 | 31095.12 |
| | Claims incurred to net premium (ratio) | 0.42 | 0.37 | 0.37 | 0.35 | 0.36 |
| | Return on Equity (%) | 34.35 | 31.98 | 28.81 | 29.43 | 31.56 |
| **Non-Life Insurance** | Net Premium Revenue (Rs. in Million) | 43497.06 | 38457.37 | 34689.33 | 31357.86 | 31534.55 |
| | Net Claims (Rs. in Million) | 22323.87 | 19624.13 | 18134.23 | 17533.86 | 17266.54 |
| | Claims incurred to net premium (ratio) | 0.51 | 0.51 | 0.52 | 0.55 | 0.55 |
| | Return on Equity (%) | 13.91 | 17 | 13.32 | 13.1 | 11.81 |
| **Al-Falah Insurance**[75] | Net Premium Revenue (Rs. in Million) | 916.58 | 780.18 | 705.32 | 563.74 | 454.4 |
| | Net Claims (Rs. in Million) | 493.07 | 429.29 | 410.81 | 317.37 | 262.36 |
| | Claims incurred to net premium (ratio) | 0.54 | 0.55 | 0.58 | 0.56 | 0.58 |
| | Return on Equity (%) | 13.87 | 14.31 | 17.32 | 17.48 | 20.14 |

Source: State Bank of Pakistan[76]

[75] The values of Al-Falah Insurance have been deliberately reported because it has recently partnered with PMIC for rolling out micro-insurance (crop and livestock) in seven districts of Pakistan.

[76] Ibid., 99

## 4.8. Best International Practices for Agricultural Risk Management

This section summarizes the best international practices used for Agriculture Management worldwide. Review of literature served as the source of information for this section.

At the outset, the literature suggests that projected increase in food demand, feed and fiber will intensify competition among nations for water resources thus increasing water stress and vulnerability to water resources. Increasing conversion of agricultural land to urban areas and climate change resulting in droughts and floods are the growing concerns for farming community. These concerns will eventually cause in loss of agricultural production thus leading to extreme food security in agricultural based economies of the world. Changing climate will likely increase the incoming floods and droughts in most of the regions thus worsening the challenge of managing the agricultural risks.

Managing risks in agriculture is highly complicated as multiple sources of risks are correlated and this usually results in effecting the whole community at the same time. Financial recovery at this scale is usually challenging and difficult. Most of the times Government of developing countries are unable to activate safety nets and rebuild the infrastructure effected by the risk. Farmers tend to shift their source of livelihood by selling off their lands at cheap prices. Over the years, agriculture industry has become increasingly risky due to market liberalization and globalization. Smallholder farmers have become the most vulnerable community in agriculture industry due to overgrowing risks. Build on these facts we can say that agricultural risk management has become more significant than before.

Risk management is an approach which firstly identify the risk and then manages that risk. Major objective involved behind risk management practices is to identify, quantify, manage and control the potential sources of agricultural losses. There could be various risk management strategies for coping with risks caused to agriculture at different levels. Risk management practices can be of three categories[77]; prevention strategies which will reduce the probability of a disastrous event, mitigation strategies would reduce the potential impacts of that event and coping strategies to relieve the impacts of event once it has occurred. Strategies can also be categorized according to institutional level; farm and community based, market based mechanism, government policies and finance related risk management tools. We will look into these risks management categories and explore the practices and countries implementing these tools for their agriculture.

### 4.8.1. FARM AND COMMUNITY BASED RISK MANAGEMENT TOOLS

Management of agricultural risks due to several circumstances is a crucial task for farmers globally. Many strategies and tools (production, market and financial) can be developed at farm and community based level, however a farmer/community has to choose the best combination of tools

[77] Holzmann, R. and Jørgensen, S., 2001. Social risk management: A new conceptual framework for social protection, and beyond. International Tax and Public Finance, 8(4), pp.529-556.

that best suit their farmlands and crops. Farmers around the world cope with inherent risks by selecting traditional as well as modern day practices. Sometimes these practices also need government and community policy makers. Farmers should be empowered enough to take necessary actions of risk management. Most of the time farm management tools can be taken as risk management tools as well.

#### *4.8.1.1. Climate smart agriculture (CSA)*

CSA is as defined by FAO "an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible"7879. CSA tools when used individually or in combination will lead to stable yields, climate change adaptation and mitigation which will result in reduced risks. Three major practices can be considered as CSA; conservation agriculture which involves tillage, crop rotations, intercropping etc.; soil and water conservation which involves rain water harvesting, using water efficient crops and irrigation systems and improved manuring which will reduce the risk of soil degradation and erosion. CSA can be practiced all over the world by small holders as well as large-scale farmers. This tool can specially be useful where the area has risk of water shortages and soil erosion. However, implementation of CSA involves technical and management skills and it also depends on farmers' willingness and access to financial assets. CSA tool was implemented in Lower Nyando, Kisumu, Kenya by World Bank which was known as Climate smart Village (CSV)80. Small holder farmers there were facing changing climate, financial crisis and ever increasing population. Stakeholders tested the delivery of climate smart services such as weather agro-advisories which were carried out through the use of ICT services which also enabled farmers to buy index based insurance for future extreme weather events.

#### *4.8.1.2. Agricultural diversification*

It is a tool which takes account of modern farming systems at farm/community level, so that risks can be reduced and sustainability and resilience of farming community is increased. It majorly consists of crop diversification and enterprise diversification, both of which are practiced all around the world. Crop diversification usually involves multiple crop cultivation which will reduce the risk of production loss due to climate change and other factors (financial, market based and pests). Enterprise diversification is the most adaptable and easy going tool for farmers. It basically refers to broader farm operations where farm can be used for not only growing food crops but also growing cash crops, livestock, aquaculture and other basic farm level activities. This tool can be used by all farmers specially those which own large farm area. Many smallholder farmers around the world use

[78] FAO. 2013a. Climate-Smart Agriculture Sourcebook. Rome, FAO.
[79] FAO. 2013b, Climate-Smart Agriculture? A review of current practice of agroforestry and conservation agriculture in Malawi and Zambia by Kaczan, D., Arslan, A., & Lipper, L. ESA Working Paper No. 13-07. Rome, FAO.
[80] World Bank. 2015. Climate-smart Agriculture in Kenya, Climate Smart Agriculture Profiles. Page 10. http://sdwebx.worldbank.org/climateportal/doc/agricultureProfiles/CSA%20KENYA%2NOV%2018%202015.pdf

the integration of livestock and other crops to reduce the risk and improve their efficiency sustainability. However sometimes this diversification of crops and enterprise may further increase the risk instead of decreasing.

#### *4.8.1.3. Assets and Income Based Strategies*

Income generated from farms and assets are traditionally used to protect the family from risks and shocks and serve the purpose of livelihood as well. This tool is used to diversify asset and income to reduce and mitigate the risk at farm or community level. Asset diversification usually involves maintaining a balance between productive assets such as land, machines, livestock, food reserves, irrigation system etc. and assets such as jewelry, savings, small animals, etc. While income diversification is to maintain the income flow through alternative farming and non-farming activities. This tool can be applied at farm level as well as community level where it needs to develop off farm income generating activities such as processing of crops, agribusiness and other agricultural/industrial activities, so that a natural disaster such as drought or flood does not wipe out the whole community. Farmers having income from an off-farm source would be willing to make investments on farm which would increase their resilience towards risks and shocks and making the farm more productive and stable. Several studies in the literature[818283] have shown that the rural non-farm economy (RNFE)[84] plays a critical role in generating the income of rural households and therefore in food security as well. Farming, processing and supplying sectors if linked can create opportunities and off-farm activities for farmers which will only result in increased productivity and better income for farmers. Thus, diversified rural economy will help increase the productivity and resilience towards risks and disasters and help mitigate the impacts. However, this tool can be of no use when farmers don't have physical access to markets and are not skilled enough to carry out alternative off-farm activities. This tool was implemented in India[85], Africa[86] and Tanzania[87] where agricultural income and productivity was increased with an increase in rural off-farm incomes.

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[81] Carletto, G., Covarrubias, K., Davis, B., Krausova, M., Stamoulis, K., Winters, P., & Zezza, A. 2007. Rural Income Generating Activities in Developing Countries, Journal of Agricultural and Development Economics, 4(1), 146-193.

[82] Barrett, C. B., Reardon, T., Webb, P. 2001, Aug. Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications, Food Policy 26(4) pp.315-331

[83] World Bank. 2014, Nov. Income diversification patterns in rural Sub-Saharan Africa: Reassessing the evidence, by Davis, B., Giuseppe, S. D., Zezza, A. Policy Research Working Paper 7108

[84] According to Davis (2004) "the rural non-farm economy (RNFE) may be defined as comprising of all those non-agricultural activities which generate income to rural households (including income in-kind and remittances), either through waged work or self-employment." Although there can be some distinction between the off-farm and non-farm income earning activities, for practical purposes they are used interchangeably in this report.

[85] P. Hazell and S. Haggblade. 1991. Rural-urban growth linkages in India. India Journal of Agricultural Economics, 46(4): 515-529.

[86] S. Haggblade, P. Hazell and J. Brown. 1989. Farm-nonfarm linkages in rural sub-Saharan Africa. World Development, 17(8): 1173-1201

[87] FAO (2011), Processing for prosperity. Diversification booklet number 5, 2nd edition, by Peter Fellows. http://www.fao.org/3/a-i2468e.pdf

#### *4.8.1.4 Cooperative Farming*[88]

Small farmers face the 'curse of smallness' which traps them and restricts their productivity[89] due to difficulties with access to sales channel for market products, with access to supply channels for farm inputs, with purchase of farm machinery and equipment, with access to information and advisory services and with access to credit. World's experience suggests that cooperatives provide the most effective way of improving small farmers' access to market services where there are no private intermediaries (middlemen) or where the intermediaries exploit the farmers[90]. Cooperatives purchase farm inputs for all members in bulk at better negotiated prices, sale outputs in bulk with reduced transport cost and with ability to break minimum quantity barriers imposed by large buyers, maintains a pool of farm machinery and negotiate with banks relatively large amount of credit for entire contingent of members[91].

A study on Punjab found that per acre use of inputs and output yields for all cash crops is higher for cooperatives than non-cooperatives. Benefit to cost ratio for cooperatives is 38% higher for cooperatives than non-cooperatives. However, the cooperative could not sustain for longer time due to lack of education and conflicts between the members[92].

As compared to traditional collective farming model, the modernized service cooperatives are more capital intensive. Asian farms are relatively low capital intensive. Keeping in view the dwindling farm labor supply due to rural to urban migration, the availability of adequate food supply is largely dependent on cooperatives. 'Using less labor, and more capital and technology, the Asian farms can produce enough food to feed everyone in the region. Cooperatives are one way to make this vision a reality. Only then will food shortages truly be a thing of the past.'[93]

### 4.8.2 MARKET BASED RISK MANAGEMENT TOOLS

Now a days marketing of farm based products play a vital role in stability and security of farming community. A farm may be highly productive with its yield but if farmer is not able to market the products efficiently by minimizing market risks, then the farmer could not achieve financial stability hence creating risks for the future. Market risks exist because of variability in prices and unpredictable future trends. Market based risk management tools help farmers to access market with minimum risks and stable price.

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[88] Small farmers of MZFR and RYK generally reported the absence of cooperatives in their districts. However, experts of OXFAM reported the existence of a functional cooperative in Multan.

[89] Abele, S. and Frohberg, K., 2003. Subsistence agriculture in Central and Eastern Europe: how to break the vicious circle? (No. 22). Studies on the Agricultural and Food Sector in Central and Eastern Europe.

[90] Cobia, D.W. ed., 1989. Cooperatives in agriculture. Prentice Hall.

[91] Lerman, Z., 2013. Cooperative development in Central Asia. Policy Studies on Rural Transition, (2013-4).

[92] Sabir, H.M., Tahir, S.H., Arshad, S. and Nasir, S.B., 2012. Future of cooperative farming in Pakistan. Future, 2(6).

[93] Ahmed, M., 2017. Asia's Future Farms. Project Syndicate. https://www.project-syndicate.org/commentary/asia-cooperative-farming-by-mahfuz-ahmed-2017-07

### *4.8.2.1 Contract Farming*

Farmers can share the risk related to production and marketing with firms/buyers under contractual agreement. These contracts can be referred as contract farming, marketing contract or collective marketing arrangements. These contracts improve the linkages between farmers and buyers thus reducing the risk of variability in prices and other market based risks. *Contract farming* usually refers to "a particular form of supply chain governance adopted by firms to secure access to agricultural products, raw materials and supplies meeting desired quality, quantity, location and timing specifications."[94] In this tool the buyer or the firm would set a price based on given quality at a specified time. Terms and conditions of contract may vary in particular with regard to prices. Contract farming can be very broad depending upon the type of agreements, which may include traditional contract farming, multinational chains contracting a team of farmers, out-grower scheme and collective farming. Contract farming could be a very important tool for farmers to manage the agricultural risk. Though, the benefits of the specific contract depend on the details of the contract, the existence of loopholes, how well they are implemented and the overall legal/regulatory framework to govern the regime.

To be sustainable, contractual marketing arrangements should be advantageous for both the farmers and buyers. But still there is a need by public private partnership in designing and implementing programs under this tool. Contract farming and marketing contracts are usually suitable for cash crops rather than staple crops. Contract farming is implemented mostly in all parts of the world at different scales. In Egypt small holders were involved in horticultural export value chain and fruit and vegetable processing through contract farming arrangements. The stakeholders of this project are farmers, farmer associations, exporters, processors, the Government and the donors (the German Agency for Technical Cooperation, USAID, and IFAD)[95]. The results of this project revealed that smallholder farmers experienced substantial increase in their income thus enhancing resilience of farmers.

Experts are of the view that if China Pakistan Economic Corridor (CPEC) bring contract farming into Pakistan coupled with technology transfer then Pakistan can have incredible spillover effects. Number of small farms is increasing and to enhance their productivity uptake of technology by their holders is quintessential[96].

### *4.8.2.2 Commodity Exchanges and Futures Markets*

Commodity exchange is a tool where different groups of participants trade commodities and commodity-linked contracts, with the underlying objective of transferring exposure to commodity

[94] UNIDROIT/FAO/IFAD Legal Guide on Contract Farming. Rome. (2015) http://www.unidroit.org/english/documents/2014/study80a/wg03/s-80a-wg03-17-e.pdf

[95] IFAD. 2008. Egypt: Smallholder contract farming for high-value and organic agricultural exports. Pages 6-9. http://www.ifad.org/pub/pn/egypt.pdf

[96] Business Recorder Research. 2017. Pakistan Needs Contract Farming or Effective Cooperatives to Boost Productivity. http://fp.brecorder.com/2017/01/20170113122857/

price risks[97]. A large numbers of sellers and buyers place their legally and financially binding offers/orders of a specific quantity and quality of a commodity at the exchange. This process leads to more accurate pricing and efficient marketing. More advanced commodity exchanges also handle futures contracts, providing farmers a mechanism to shift risks to entities that are in a better position and are more willing to bear them. Commodity exchange usually comprise of following type of contracts:

- A formal spot market with the physical exchange of commodities,
- A formal spot market with links to warehouse receipts (certificates),
- Forward Contracts,
- Futures Contracts, and
- Futures Option Contracts

In Africa, since 1990, a number of commodities exchanges were established. However, there are only three that are currently in operation, namely in South Africa (SAFEX established 1996 and deals with futures and stock contracts), Malawi (ACE/2004), deals with forward contracts, warehouse receipts) and Ethiopia (ECX/2008), deals with warehouse receipts, spot contracts[98].

#### *4.8.2.3 Warehouse Receipts System*

Warehouse receipts system (WRS) is a relatively modern innovation which involves variation of traditional storage strategies. This tool has been implemented in several developing countries. This system involves a formal agreement between storage facility operator and depositor (farmer in most cases) which allows the farmer to store their commodities in storage facility for a specific period of time. This agreement is known as Warehouse Receipt which could be used by farmer to obtain funding from lending institution or input suppliers. This tool is ideal to forge effective public private partnerships in designing and implementing underlying activities. IFAD-supported WRS market development program[99] is helping farmers in Tanzania to build their resilience to better cope with risks they face in farming.

#### *4.8.2.4 Innovative Agriculture Input Marketing in India*

'In the recent past, there have been many experiments in the agro-input sector in terms of new distribution and marketing channels and some players have attempted to deliver total solutions to farmers including farm and allied inputs. These new channels range from marketers own outlets to supermarkets to franchised outlets besides traditional mainstream channel of selling through distributors and dealers/retailers. The major ones include: ITC's Choupal Sagar, Khushali KrishiKendras of Hydric, Champion Agro, and Mana Gromor of Coromondal Group. They also operate in/across different states of India. There are also agri startup firms like Green Agrevolution and Zamindara Farm Solutions which also attempt same objectives for small farmers.

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[97] United Nations Conference on Trade and Development (UNCTAD), 2009. Development Impacts of Commodity Exchanges in Emerging Markets, Adam Gross and Leonela Santana –Boado.

[98] Jayne et al. (Oct 2014). Agricultural Commodity Exchanges and the Development of Grain Markets and Trade in Africa: A Review of Recent Experience. Pages 17-21. http://fsg.afre.msu.edu/gisaia/Ag_Commodity_Exchange_Report_FoodTrade.pdf

[99] IFAD http://www.ruralpovertyportal.org/country/voice/tags/tanzania/warehouse

Further, there is another parallel trend of custom rentals of farm machinery which started in Punjab in late 2000s and has spread quickly across many villages supported by the state government to cut down cost of cultivation for small farmers. Besides, there are many private initiatives in this space where it is being attempted as business model and the only way to promote cost effective mechanization in smallholder dominated context.'[100]

## 4.8.3. FINANCE BASED RISK MANAGEMENT PRACTICES

Since ages countries have tried to solve the commodity problems and risk by controlling and manipulating demand and supply. This way of managing is not only very ineffective in mitigating the risk but also very inefficient and costly. Modern solutions are now focusing on involvement of farmers, government, donors and policy makers to deal with market sector actors. This has led to introduction of microfinance institutions, weather index insurance schemes, micro insurance, etc. along with traditional agricultural credit and insurance. These tools are used and developed on the basis of risk sharing between stakeholders. These schemes are usually applied at a larger scale where number of farmers and other stakeholders are involved at city or district level. Government and insurance companies provide potential compensation in case of a disaster in exchange of premiums paid by or on behalf of the farmers. There are several tools available for finance based risk management for agriculture but some of the most applicable tools are discussed below.

### *4.8.3.1 Agricultural Insurance*

Insurance is a process in which a specified risk is transferred to the insurer or third party by insured. The insured pays a premium to the insurer which in return provide insured the indemnity (compensation for suffered and assessed losses) that occurs according to the terms and conditions of the insurance policy. Agriculture insurance is a tool to insure the productivity of farm and ensure its income and sustainability over the years. Agricultural insurance can be of different dimensions.

Crop insurance is a very useful tool which protects the farmer from any impacts by unforeseen disaster (drought or flood) and stable the income over years. However its application in developing countries have proven to be very low and complex. There is a challenge in form of acceptance of insurance from farmers as they don't regard this as trusted tool for their protection. Crop insurance is by far the most used tool among all the agriculture insurance tools. It was used in US by crop producers in 2003 with covering more than 200 million acres with a total premium paid by farmers of over $3 billion against low yields and revenue drops[101]. A new risk management tool was introduced which was implemented from 2016 known as Margin Protection Plan[102], which started with corn, rice, soybeans, and spring wheat. Under this protection plan farmers can protect their per acre net operating income thus covering the change in yield, price and costs at a specified level.

[100] Singh, S., 2016. Innovative Agricultural Input Marketing Models in India: Performance and Potential. Final Report. Centre for Management in Agriculture Indian Institute of Management. Ahmedabad, India.
[101] Babcock, Bruce A. Hart, Chad E. And Hayes, Dermot J. 2004.Actuarial Fairness Of Crop Insurance Rates With Constant Rate Relativities. Amer. J. Agr. Econ. 86(3) (August 2004): 563–575.
[102] USDA, 2015. Margin Protection for Corn, Rice, Soybeans and Wheat. http://www.rma.usda.gov/policies/mp/

Agriculture insurance can be used to insure not only yield and production but also revenue in some cases. In developing countries many programs have been developed targeting the small holder farmers. In recent years, however, with new and innovative programs popularity are on the rise like index based insurance, crop and livestock insurance. According to the Micro Insurance Centre, a total of 1.1 million people in the agriculture sector (including government subsidized insurance) in Africa were insured in 2014.

This tool of insurance can be used by all farmers especially those who are vulnerable to frequent disasters such as floods and drought. Agricultural finance is the most efficient way of managing production risks as it offers benefits over other tools. Poor producers or small holders can benefit from this by choosing the affordable insurance policy. These producers and farmers are less likely to invest in technologies or fertilizer thus insurance policy that cost low such as index-based can be seen as a preferred public policy intervention instrument preferably when combined with social safety nets to improve the livelihoods of rural population. Sometimes the linkages between banks and agriculture insurance are not well developed which could be problematic in implementation.

There are several examples of implementation of agriculture insurance in several countries. On 14 January 2016 Indian Government announced a new insurance program, called the Prime Minister Crop Insurance Scheme, under which farmers will pay between 1.5 and 2 % premiums for food grains and oilseeds and up to 5% for horticultural and cotton crops. The Government's target is to cover nearly 50% of farmers all over the country[103]. Similarly, crop insurance programme was implemented in Zambia where small holders were the stakeholders and different organizations and institutes were providing insurance against natural hazards such as droughts, lighting, floods, hailstorm, and fires. During the six years of implementation of this program there is a significant increase in number of farmers and hectares covered. Agricultural insurance however is not the only solution to all the problems and risk that farming community face. It can only solve some part of losses and cannot substitute on farm management tools and technologies. Agricultural insurances should only be practiced when basic agricultural services are in place like timely availability of inputs, extension services and efficient marketing channels.[104]

*Table 4.41: Overview of Index Insurance case studies around the world*

| Country | Year | Policy holder | Project name | Instrument | No. of beneficiaries | Notes |
|---|---|---|---|---|---|---|
| Brazil | 2001 | Participants in government seed program | Agro Brasil | Area-based yield Index | 15,000 | Government pays 90% of premium |
| India | 1999 | Small farmers | National Agricultural | Area-based yield | 16.79 million | State-subsidized insurance programmes, |

[103] http://pmjandhanyojana.co.in/pradhan-mantri-fasal-bima-crop-insurance-scheme/
[104] World Bank. 2010b. Government Support to Agricultural Insurance: Challenges and Options for Developing Countries by Olivier Mahul and Charles J. Stutley. Washington, DC.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Insurance Scheme | Index | | bringing insurance to millions of farmers through a link with agricultural credit |
| India | 2003 | Farmers | Weather Based Crop Insurance Scheme | Rainfall index | 13.62 million (2013) | Ongoing |
| Ethiopia | 2007 | Teff and bean farmers | HARITA | Rainfall index | 300 | Ongoing |
| Kenya | 2009 | Smallholders | Rockefeller | Rainfall index | 500 | Pilot stage |
| Malawi | 2004 | Maize and groundnut | World Bank, Opportunity Intl, others | Rainfall index | 1700 | |
| Malawi | 2008 | Maize, tobacco farmers | MicroEnsure, others | Rainfall index | 2500 | Initially maize, moved to tobacco; ongoing |
| Rwanda | 2009 | Smallholders | MicroEnsure | Rainfall index | 500 | Ongoing |
| Tanzania | 2009 | Smallholders | MicroEnsure | Rainfall index | 400 | Ongoing |
| Thailand | 2007 | Smallholders | BAAC | Rainfall index | 400 | Ongoing |

### *4.8.3.2. Weather Index Based Insurance*

Weather index based insurance is alternative to traditional crop insurance which has been implemented in developing countries. In recent years weather based index insurance has been used in pilot projects and the results have been both positive indicating at upscaling as well as negative pointing total failures. Index based insurance can be of several types area-yield index, weather based index and index-based mortality insurance for livestock. Out of all these weather based index insurances (WII) have gained the highest popularity. Successful implementation of WII involves strong involvement and participation from Farmers, governments, donors and insurance companies.

WII is same as other type of insurance except that it follows a simplified procedure in which insurance payments (compensation for damages or loss) are based on values which have been obtained from that could be served as proxy for all the losses by farmers. This will remove the need of assessment of actual damages of individual insurance policy holder. WII is based on this assumption that crop yield of insured farmer and a weather parameter (temperature or rainfall) are greatly correlated. For transparency and avoiding unbiased approach, terms and conditions of policy are mutually agreed upon which also includes index values, pay off amounts etc. The amount of insurance is based on the level of index for example increasing from trigger point (200 mm rainfall) to maximum pay out (1000 mm). The total sum of insured amount is usually based on the cost of production and cultivation. Contract may also mention the trigger and full payments levels of the index during specific time periods of the year for example harvesting time, vegetative and crop flowering stages. In reality there are several complexities involved in rainfall based index insurances.

A recent World Bank/IFC study (2015)[105] explains the nature of WII as follows: "From a behavioral perspective, index-based insurance is akin to a lottery or gambling on the weather. To sell traditional insurance, a potential customer must be convinced that there is a reasonable probability of a loss that must be covered. On the other hand, the customer only needs to believe that the weather is variable and unpredictable in order to find index-based insurance attractive. From an economic perspective, index-based insurance provides a buffer to protect the farmer against shocks that is similar to having savings. However, savings would be less convenient for weather protection if the farmer has not accumulated sufficient amount to cover their losses in the event of a drought".

This tool is applicable in developing countries where crop or livestock insurance are usually not used and small holders lack financial and technological facilities to cope with climatic risks. WII policies are usually bought by small holder farmers, households or small business entities and they can also be distributed by aid agencies, financial service providers, farmers' associations, input suppliers, processors or NGOs and implementing agencies. But on the other hand if the insurance scheme is based on a clear social objective and aimed to help in making farmers stable would require special subsidies and special channels through which this tool would be implemented.[106] This tool of WII usually involves public private partnership to be successfully implemented. Based on the fact that this tool requires transparent process and timely data which could be verified by third party, which makes it more suitable for temperature and precipitation index.

Some of the disadvantages of WII were identified by a study[107] which were basis risk which means that a farmer experience a yield loss but pay-out was not triggered. Other disadvantages of WII would be limited perils, considerable technical work required in its implementation and lack of production and yield data.

In Senegal, R4 Rural Resilience Initiative was implemented which helped farmers build resilience to climate shocks through resource management and index insurance with other financial tools. The same initiative was introduced in Ethiopia where 12,200 farmers benefited from drought protection through insurance payouts and the payouts were triggered by rainfall. R4 currently operates in Ethiopia, Senegal, Malawi and Zambia reaching over 41,000 vulnerable farmers and their families and the project is jointly implemented by United Nations World Food Programme and Oxfam America[108].

[105] World Bank/International Finance Corporation. 2015. Kilimo Salama - Index-based Agriculture Insurance: A Product Design Case Study. Washington, DC.
[106] World Bank. 2011a. Weather index insurance for agriculture: Guidance for development practitioners. Agriculture and Rural Development Discussion Paper 50, Washington D.C.
[107] Swain, Mamata. Dec. 2015. Performance of Crop Yield and Rainfall Insurance Schemes in Odisha: Some Empirical Findings. Agricultural Economics Research Review. Vol. 28 (2); pp 201-211.
[108] https://www.wfp.org/climate-change/initiatives/r4-rural-resilience-initiative

#### *4.8.3.3. Agricultural Finance and Microfinance*

Having access to credits is vital for small holders and rural population to cope with climate change induced losses. Financial services like basic savings account play an important role in reducing poverty rate and managing risks. Permanent access to these facilities will make the life of poor people easy and stable. Farmers need to borrow, save, invest and protect their farms and incomes from risks. Access to secure credit can be served as a risk management practice. Banking and other financial services are not easily accessible to farmers, entrepreneurs and small businesses in remote rural areas or low income clients throughout the country. Microfinance institutions (MFI) were established to provide the access of credits to the farmers and vulnerable community. MFIs provide financial services to individual clients or groups like savings, loans etc. MFIs have become popular among developing countries where in some cases NGOs evolved to serve the community as MFI. In Africa, MFI are expanding and their turnover is increasing. For instance, the Central Bank of French Western Africa in 2009 reported that microfinance plays a key role in grassroots financial tools with about 400 institutions operating in West African countries[109]. Microfinance is also said to benefit from a further strong rise in socially responsible investments. Based on the scale, efficiency, risk and returns criteria, Bangladesh and India had 7 each in the top 50, followed by Bosnia and Herzegovina, Morocco and Peru with four each and Colombia with three. Among African countries only Egypt, Ethiopia and Morocco were listed as having MFI(s) in the top 50. Microfinance is also seen as a tool which declines the inequalities and help in reducing poverty and get the poor to be a part of economy.

[109] Allen F, Otchere I, Senbet L. W, (2011). "African financial systems: A review". Review of Development Finance

# CHAPTER 5: CONCLUSION AND WAY FORWARD

Small farmers of study locale face a 'mixed' set of risks like market, climatic and institutional risks. The effects of these risks and the risk coping strategies are reminiscent of the argument that 'insecurities breed insecurities'. Antithesis to this argument is that 'securities breed securities'. For providing securities in the form of risk transfer and risk reduction, it is feasible to launch R4 Programme in the study locale, preferably Muzaffargarh because it is relatively poorer than Rahim Yar Khan. When even one security (antithesis) condition i.e. risk transfer instrument is met then it breed further securities. In other words, long term resilience and livelihood security can be achieved. If farmers avail themselves of the risk reduction tools being offered under Kissaan Package (soil testing, subsidy for relay crops, zero mark-up loans) then the process of resilience building can further speed up.

A rational way forward can be designed by having in mind four important questions i.e. (i) What do the Farmers Need? (ii) What is the Govt. of Punjab currently offering to Farmers? (iii) What are the linkages with R4 Approach with farmers' needs and current government's schemes?, and (iv) What can be done to address gaps and how? Based on the quantitative and qualitative information gathered from our study areas, the above mentioned questions are addressed in the following sections.

## 5.1 What do the Farmers Need?

The agriculture risks being faced by the farmers have been discussed in details in sections 4.2 and 4.6. The common risks being faced by the farmers, identified through qualitative inquiry (in RYK and MZFR) and household based quantitative survey (in MZFR) can be summarized below.

| 0-5 Acres | 5-12.5 Acres | 12.6 Acres and above |
|---|---|---|
| - Untimely rains,<br>- Non-affordability of quality fertilizers,<br>- Non-availability of quality pesticides<br>- Non-availability of cheap borrowing resources<br>- Shortage of canal water<br>- Lack of Advisory Service from Plant Protection Department<br>- Monopoly of Middlemen | - Untimely rains<br>- Shortage of Canal Water<br>- Windstorms<br>- Non-availability and non-affordability of quality fertilizers<br>- Non-availability and non-affordability of certified seeds | - Non-availability of quality fertilizers<br>- Non-availability and non-affordability of certified seeds<br>- Untimely rains<br>- Windstorms |

In the context of above mentioned risks, small farmers of MZFR and RYK identified their needs as under:

i- **Good quality and low cost agro-chemicals:** Farmers are in dire need of supply of quality inputs (fertilizers, pesticides, soil supplements) at minimum possible cost. They consider current input subsidies to be positive but insufficient.

ii- **Seeds supply:** Along with quality agrochemicals, the farmers also demand for good quality seeds. They have concerns regarding the credibility of certified seeds. Skepticism was expressed by them about the seed suppliers. They felt that for supply of quality seeds institutional mechanisms should be strengthened further.

iii- **Implements Supply:** Small farmers can't afford to buy mechanical implements. Lack possession of farming implements. They have to get them on rent which adds to the cost of production.

iv- **Modernized Farming Machinery/Equipment/Techniques:** They realized the need of modernized farming practices like use of solar powered sprinkler irrigations system, tunnel farming and in some cases hydroponics too. But lack of financial resources keeps them away from adopting these practices.

v- **Consistent Supply of Water:** It is a major need in canal irrigated districts in MZFR and RYK. They are so dependent upon the canal water that they bear costs for cleaning of water channels themselves.

vi- **Low Cost Credit supply:** Farmers recommended that agriculture loans should be markup free. Credit is used for procuring inputs. If the cost of credit is reduced then their cost of production will decline automatically and income level would rise.

vii- **Marketing and sale of produce:** As organized retails sector is booming in Pakistan[110], the farmers need direct linkages with organized retail outlets so that they can avoid the transaction costs associated with middlemen, commission agents, etc.

viii- **Crop Insurance:** Untimely rains and windstorms are the climatic risks amongst most common risks being faced by farmers. To deal with climate related risks, farmers need insurance based mechanism which can minimize the threat to incomes posed by climate risks. Farmers expressed willingness to buy insurance policy but asserted their lack of ability to pay the insurance premium.

ix- **Veterinary Services:** They need consistent veterinary services so that they can rely on livestock as a consistent source of income.

## 5.2 Current Initiatives/Projects of Govt. of Punjab for Agriculture

Govt. of Punjab has taken following recent initiatives which can help address the above mentioned issues of farmers directly or indirectly[111]. Mostly, the initiatives are being undertaken under the umbrella of Khadim e Aalaa Kisaan Package.

[110] Sadiq, I., 2012. Economic Impact of Retailing in Pakistan. In School of Business and Economics, University of Management & Technology, Lahore, Proceedings of 2nd International Conference on Business Management.

**a-** Supply of Implements: Effective Pest Management In Cotton Crop Through Subsidized Provision Of Spray Machines In Core Cotton Districts of Punjab (Project Duration: April, 2017 to June, 2018)

**b-** Improved Markets: Improvement/ Modernization of Agricultural Produce Markets (Project duration: March 2017 to March 2018)

c- Agri-extension Services: Extension Service 2.O -Farmer Facilitation through Modernized Extension. (Project Duration: July 2015 to June 2020)

d- Improved Markets: Establishment Of Model Farms Linked With Improved Supply Chain And Value Addition For Promoting Exports of Agri-Products (January 2017 to June 2021)

e- Zero Cost Credit Supply: Markup Free Loans (Duration: 2016-2020)

f- Pest Scouting (Annual)

g- Pesticide Sampling (2017)

h- Soil Analysis (September 2017 to June 2018)

i- High Efficiency Irrigation Systems and Climate Smart Technology (Announced in September 2017)

j- Establishment of Modernized Implements Supply Centers (Announced in September 2017)

k- Provision of quality wheat seed to farmers through draw system.

l- Provision of subsidy on fertilizers in addition to the subsidy provided by the Federal Government.

m- Provision of subsidy to promote canola and sunflower sowing through vouchers in seed bags.

n- Pilot Testing - Crop Insurance for Small Farmers

## 5.3 Linkages/Gaps of Farmers' Needs and Government's Initiatives with R4 Approach

To reduce farmers' insecurities and vulnerabilities, WFP-OXFAM have introduced an integrated risk management called R4. This approach is based on:

- R1: Reduction of risks by helping households build sustainable and resilient livelihoods at household level.
- R2: Risk transfer through provision of insurance against agricultural perils.

[111] Details of all these initiatives are in **Annexure 5.1**. This list is not extensive. Details of all other agriculture related projects of Govt. of Punjab may be viewed at http://www.pndpunjab.gov.pk/pc_agriculturesector?page=1 or http://www.agripunjab.gov.pk/newschemes

- R3: Building the reserves of farmers by protecting gains households make with insurance.
- R4: Encouraging prudent risk taking by bring about a behavioral change in farmers to adapt to climate change.


**The R4 Rural Resilience Initiative Model**

Prudent risk taking is a behavioral change that can be inculcated in the farmers after the R4 Programme has been able to reduce their risks, transfer their risks and resultantly built reserves (savings) of the farmers. Thus reduction of risks and risk transfer are the first two steps of R4 approach. The needs of farmers linked with these two Rs are as follows:

| R | Farmers' Needs |
|---|---|
| **R1: Reduction of Risks** | i- Low cost and good quality agrochemicals,<br>ii- Seeds supply,<br>iii- Implements Supply,<br>iv- Modernized Farming Machinery/Equipment/Techniques,<br>v- Consistent water availability, vi- Low Cost Credit supply,<br>vi- Marketing and sale of produce, and viii- Veterinary Services |
| **R2: Risk Transfer** | Crop Insurance |

The initiatives/schemes of government mentioned in section 5.2 are all directly or indirectly related to reduction of risk. However, one can find a pilot crop insurance scheme introduced in the Budget 2017-18 by Agriculture Department Punjab. Rs. 36.125 million had been allocated for that scheme in the budget 2017-18. But, by December 2017, only Rs. 0.07 million had been spent upon the

scheme. Thus, implying that still there is room for cooperation regarding implementation of that scheme.

## 5.4 What Can be Done and How?

Keeping in view the discussion in previous sections of this chapter and scope of R4, two way forwards are being proposed in these section. Way Forward 1 has a specific focus on subsidized crop insurance and is linked with Risk Transfer. Way Forward II has a wider focus on overall functioning of Agriculture Department of Punjab and is linked with Risk Reduction.

The target beneficiaries for R4 programme can be identified by using Poverty Score Card (PSC) of BISP. The Nationwide Poverty Scorecard Survey, enables the BISP to identify eligible households through the application of a Proxy Means Test (PMT) that determines welfare status of the household on a scale between 0-100. Cut off level used for providing social protection is 16.17. BISP has identified 7.7 million households to be eligible for social protection. Only those farmers can be targeted which are registered under the Khadim-e-Punjab Kissan Package because they would be expectedly availing different facilities under that package that reduce plenty of their risks. This approach would also be in line with the R4's integrated risk management approach and PSPA's graduation model approach.

PSPA also identifies its target beneficiaries on the basis of data of PSC. It also uses cut off level of 16.17. It was hinted by PSPA representative that to provide support to a farmer specific scheme it will have to decide the cut off level around 30 because families below 16.17 level are extremely poor and landless. Hence they may not require any agriculture specific social protection. Raising the cut off level to 30 would include poor farmers deserving social protection coverage and would also automatically include the farmers falling below 16.17 if any.

### 5.4.1 Way Forward- I: Subsidized Crop and Livestock Insurance **(Risk Transfer)**

In order to provide risk transfer instruments to small farmers, WFP-OXFAM and PSPA can launch a project of subsidized crop insurance in study areas in two ways. First is to start a yield based insurance in partnership with Pakistan Microfinance Investment Company or Agriculture Department Punjab. This could be done by building upon the previous experience of PMIC or Agri-Dept. regarding dynamics of crop insurance. Second is to introduce a crop insurance designed exclusively according to standard procedures of India's PMFBY (Pradhan Mantri Fasal Bema Yojana)[112] .

1- Currently PMIC aims to provide Crop Micro-insurance product in seven districts as mentioned in section 4.7.3. Muzaffargarh is not amongst those districts. However, it expressed willingness to start a micro-insurance initiative in MZFR. In the existing arrangement, PMIC plans to target 3,200 farmers in each district. It plans to provide subsidy of 40%, 50% and 60% on premium depending

[112] Standard Operating Procedures (SOPs) of PMIC and PMFBY have been explained in Section 4.7.

upon their area owned and poverty level. The target beneficiaries are decided on the basis of PSC. The cut off level is 40.

Currently, PMIC is managing the pilot stage through its own resources. However, its financial capacity is limited. After the first stage of pilot, PMIC will need financial assistance to scale up the Micro-insurance product at large scale. That phase will present dire need for financial help from WFP, OXFAM and PSPA.

**Sum Insured**: Currently, PMIC is deciding the sum insured on the basis of average yield. The premium is charged at 3% of average yield.
**Crops to be covered:** Cotton, Wheat and Pulses, Over 80% of respondents expressed the need for crop insurance on these 3 crops on urgent basis.
**Perils to be covered**: All the climate related risks already covered under the Crop Loan Insurance scheme.
**Partnerships**: As a startup, WFP-OXFAM could partner with PMIC for lending financial and technical support to its Good Agriculture Practices initiative and subsidizing Crop Micro-insurance products in the district Muzaffargarh.
Moreover, engaging Agri-Extension Dept. for local level technical knowledge will help bridge the trust deficit between farmers and government. If Agri-Extension Dept. is taken on board then an ideal trio of national development agency (PMIC), international development agencies (WFP-OXFAM) and government department (Agri-Extension Dept.) will be formed.
This initiative can also be supplemented by fostering **cooperatives** in district MZFR.
**Livestock:** Over 80% of respondents expressed need for livestock insurance on cattle, buffalo, lamb, goat and bull. Like crop insurance, PMIC is providing livestock insurance too on yield basis.

**Alignment of PMIC Approach with R4:** PMIC realizes that farmers' livelihood (good yield) is dependent on more than one factors including (but not exclusive to) weather patterns, soil condition, timely availability of quality and affordable agri-inputs, availability of water and availability of labor and other socio-economic factors. Micro-insurance covers only the volatility of weather and occurrence of extreme weather events. In order that micro-insurance achieves its desired results, agro service delivery needs to be strengthened so that it can provide effective and efficient support to farmers. Hence, PMIC ensures that crop insurance is coupled with some supplementary factors. For instance, it helps the farmers with soil testing or it gives the farmers some on-farm trainings in collaboration with the public sector departments. Livestock insurance policy holders are provided with the facility of getting their animals vaccinated or dewormed. .

This approach is aligned with integrated risk management approach of R4 as it also aims to reduce the risks in addition to ensuring the risk transfer. Therefore, if crop insurance is to be introduced in Muzaffargarh then it is advised that partnership should be made with PMIC and it should be provided financial support for providing subsidy to large scale farmers.

**Partnering with Agriculture Department Punjab:** If PMIC is not partnered with, then collaboration could also be made with the Agriculture Department Punjab and this feasibility study report can serve as a knowledge product under that scenario.

2- If WFP-OZFAM don't partner with PMIC or Agriculture Department, Punjab then an insurance product similar to Indian PMFBY[113] could be introduced in the Union Councils nearest to Sheikh Zayed Airport Observatory[114] or Khanpur Observatory in RYK or such location of district MZFR which is close to Multan observatory.

For adopting Indian model, information regarding 'scale of finance' would be needed. Punjab Government has already calculated the scale of finance for most of the crops (included in Annexure 5.2). Those calculations can be cross verified with farming community and farmers may be indemnified at different levels depending upon their risk situation.

**Some General Guidelines for Crop Insurance**: Whichever crop insurance model from above suggested models is adopted, some guidelines would have to be followed while designing or implementing any yield based or index based insurance in Punjab. The guidelines are as under[115]:

*Table 5.1 Crop Insurance – Which & How?*

| Type | How to Implement | Concerns during Interviews |
|---|---|---|
| ***Yield Based insurance*** | A) Local level institution is needed as management partner. PMIC is working in partnership with NRSP.<br>B) Threshold yield needs to be decided in consultation with the community. | A) It is more suitable for less frequency and high severity losses.<br>B) There could be problem of moral hazard.<br>C) Insurance companies try to agree on a low threshold yield so that they pay lesser claims.<br>D) The reason for community's validation of yield data is that yield data available at provincial or district level is averaged out. It also includes the higher average yields of large holders or progressive farmers. But small farmers usually have lesser yields. When the sum insured (threshold yield) is communicated to farmer, they always insist to agree on lower possible yield. Resultantly, insurance companies try to fix the threshold yield even lower than the level insisted by farmers. Lowest the threshold yield, least number of claims it will have to pay. Due to such manoeuvrings, sometimes crop insurance has no utility for the farmer. |
| ***Weather Index Based Insurance (WIBI)*** | A) At least 30 years data of weather and yield. Even after building the index, AWS have to be placed. The index will only give 30 years trends in the district that can help design the insurance policy. | A) PDMA and PMD categorically suggested that the data of PMD will not serve the purpose of an Index Based Insurance.<br>B) Some form of human resource will be needed to monitor and assess the interdependent factors. For |

[113] PMFBY has been explained in detail in section 4.7.
[114] SDPI research team had visited UC-52 RYK for conducting FGDs. It is almost 8 km away from Sheikh Zayed Airport Observatory.
[115] These guidelines are mainly based on discussions during In-Depth Interview at PMIC.

| | | |
|---|---|---|
| | B) To implement the policy, AWS will be needed. (PMIC had set up )<br>C) Once an index has been built, it still needs to be cross verified with the community of beneficiaries.<br>D) Experience of PMIC and SDPI's own field interaction with farmer tells that data is not exactly reflecting the ground reality.<br>E) Demonstration effect will have to be created by supporting this intervention for three years at least. | instance, even for WIBI, there is a pre-condition that quality seed is being used by the farmer. Here comes the role of WFP-Oxfam and PSPA. Insurance policy will have to be accompanied by a plan for introducing good agriculture practices.<br>C) It is more suitable for medium frequency and medium severity losses.<br>D) Currently PMIC is not implementing WIBI in the areas where it had piloted that. According to PMIC representative, 'it had to abandon WIBI because of reservations of Insurance Companies regarding credibility of data. Insurance companies always try to get re-insurance. But the reinsurers in international markets opt to provide reinsurance to only those insurance companies which are using reliable data, more preferably satellite imagery based data. Therefore, lack of reliable data and re-insurers resulted in abandoning the idea of WII by Pakistan's insurance companies. However, they are still providing livestock insurance.' |

Regarding the use of satellite imagery, it is submitted that Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) has the capacity of Satellite Remote Sensing. Remote sensing is also encouraged for PMFBY but until Kharif 2016 it was not use in India[116]. If the services of SUPARCO are utilized then the problem of engaging re-insurers may be minimized. SUPARCO has not been engaged by PMIC hitherto. SUPARCO issues a monthly Bulletin on Crop Situation and Weather Forecast[117]. Thus its technical capacity and operation activities make it a potential partner for R4 initiative in Punjab.[118]

### 5.4.2 Way Forward - II: Ensuring the Coverage of Micro-insurance Policy Holders Under Government Schemes/Initiatives **(RISK REDUCTION)**

As mentioned in the section 5.2 Punjab government has introduced number of projects/schemes that address the agriculture risks identified in this study. To ensure awareness and enhance scale/coverage of those initiatives, WFP-OXFAM and PSPA could coordinate with Agriculture Dept. regarding mandatory coverage of beneficiaries of micro-insurance under the government's agriculture risk reduction specific schemes/projects.

WFP-OXFAM should ensure that the micro-insurance beneficiaries are simultaneously covered under the current government schemes like zero markup credit, provision of quality seeds, subsidies on high efficiency irrigation system, pest scouting services, etc. In this way a complete package of integrated risk management will be provided to the farmers in a targeted manner.

[116] Ibid,. 67.
[117] All issues available at: http://suparco.gov.pk/webroot/pages/pak-scms.asp
[118] SDPI had not included SUPARCO amongst the list of In-Depth Interviewees. But SDPI's recommendation to partner with SUPARCO is based upon Desk Review.

But how can this mandatory coverage be achieved? It can be achieved if the Programme incorporates a component of awareness raising and connectivity. Through *awareness raising* farmers should be informed about the government's schemes and the related procedures. For informing, different tools like on farm trainings or recorded voice calls can be used. For *connectivity,* the social mobilization networks of Rural Support Programmes can be used whereby social mobilizers help the beneficiaries in completing the procedures and accessing the relevant department.

An alternative to mandatory coverage under government schemes is that the Programme uses voucher based approaches to provide the necessary agricultural services through market actors.

To ensure timely provision of quality inputs, WFP can think of using Mobile Delivery Unit in collaboration with extension department.

For reducing institutional risks there is need for trust building between public service providers and the farmers. For that public-private partnerships should be encouraged. Private sector can support the government in filling the human resource gaps. It can assist by training the farmers on pest protection, crop diversification, mechanization, etc; providing agriculture services like pest scouting, livestock checkups, etc. and assisting the uptake of recent agriculture research. Moreover, R4 Programme should strengthen collaborative efforts by Agriculture Department, Meteorological Department, Private Sector, Irrigation Department and Multilateral Development Agencies so that they can share their experiences which is essential for integrated risk management.

It has been argued earlier that middleman is both a source a risk and also a medium for transferring and reducing risks. It would be ideal if the Programme provides and alternative of middleman trap by offering a formal liquidity arrangement. Similarly, advocacy efforts should be made to gain buy in of the government regarding minimization of middleman exploitation through enforcement of some ceilings on the commission/profit charged by him on purchase of output from farmers. In this way the term of trade would become favorable for small farmers.

### 5.4.3 RELEVANT PARTNERS

| Relevant Programme Partners | Pakistan Microfinance Investment Company | Punjab Social Protection Authority | Punjab Agriculture Department | Punjab Planning and Development Department |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **Relevant Products/ Schemes** | Technical Advisory Services, Value Chains, Micro-Insurance, Housing Finance for Microfinance Clients, Education through Microfinance | Conditional cash transfers to school girls, Wheat subsidy | Agricultural schemes like Kissaan Package, etc. | Approval and initiation of Agricultural projects |
| **Expected Role** | Risk reduction through promotion of good agricultural practices. Risk transfer through Micro-insurance | Financial support for subsidizing insurance | Linking Micro-insurance beneficiaries with existing government schemes | Approval and support for R4 |
| **Capacity** | It has technical capacity to undertake agriculture risk reduction and risk transfer initiatives on the basis of previous experience with farmers at local level. It is mainly dependent upon donor money. | It has technical capacity to finalize and implement a social protection scheme for farmers. It is dependent upon Punjab government for inflow of financial resources. As compared to PMIC, it doesn't have an experience of working with farmers at grass root level. | It has the capacity to launch schemes, but faces shortage of human resource. The implementation partners of R4 can help address this need. | It has the capacity/authority to identify and initiate the agricultural projects in collaboration of Agriculture Department. |

In addition to these, a knowledge/data sharing partnership may also be made with Punjab Information Technology Board as it is championing all the e-communication based agriculture schemes of Punjab Govt. like interest free loans (Assan Account), e-voucher schemes for fertilizers. It is also an important stakeholder in automation of Land Records data.

### 5.4.4 CHALLENGES OF IMPLEMENTATION

1- First challenge would be of arranging financial resources for a large scale crop insurance subsidy. Providing a 50% subsidy on insurance product to even 1000 farmers with average land ownership of 3 Acres will cost around Rs. 1,500,000 (USD 13,650) per crop season if

per acre premium is Rs. 1,000. There are 42986, 66302 and 47152 farmers having land ownership of 0-1 Acres, 1-2.5 Acres and 2.5-5 Acres respectively in RYK. Similarly, in MZFR there are 74215, 81686 and 49465 farmers having land ownership of 0-1 Acres, 1-2.5 Acres and 2.5-5 Acres respectively. Therefore, the available resources should be put to best use in such a way that they are not thinly spread and target the most deserving farmers. If a strong demonstration effect is created then there would be two possible benefits. First is that, the small farmers, not directly benefitting from R4, but close to the field of influence of R4, would buy risk transfer product and also toil for adopting risk reduction strategies. Second is that exhibiting success in the initial phase would create buy in from other potential donors for scale up phase.

2- Exhibiting success of the Programme for target beneficiaries will need a strong M&E component with credible means of verification to be incorporated in the overall R4 design. If that M&E component could verify the improvement in resilience of R4 beneficiaries and quantify their resilience dividends then scale up of R4 would become easier. Support of Asian Development Bank, World Bank or even China Pakistan Economic Corridor could be solicited for that scale up phase.
3- Crop insurance is a new concept, so government might express buy in for this initiative. However, any initiative taken for risk reduction might be labelled as duplication of efforts by govt. To mitigate this challenge, all efforts should focus around 'increase of scale and effectiveness' of already existing initiatives of Punjab govt. for targeted coverage of micro-insurance beneficiaries under those initiatives.

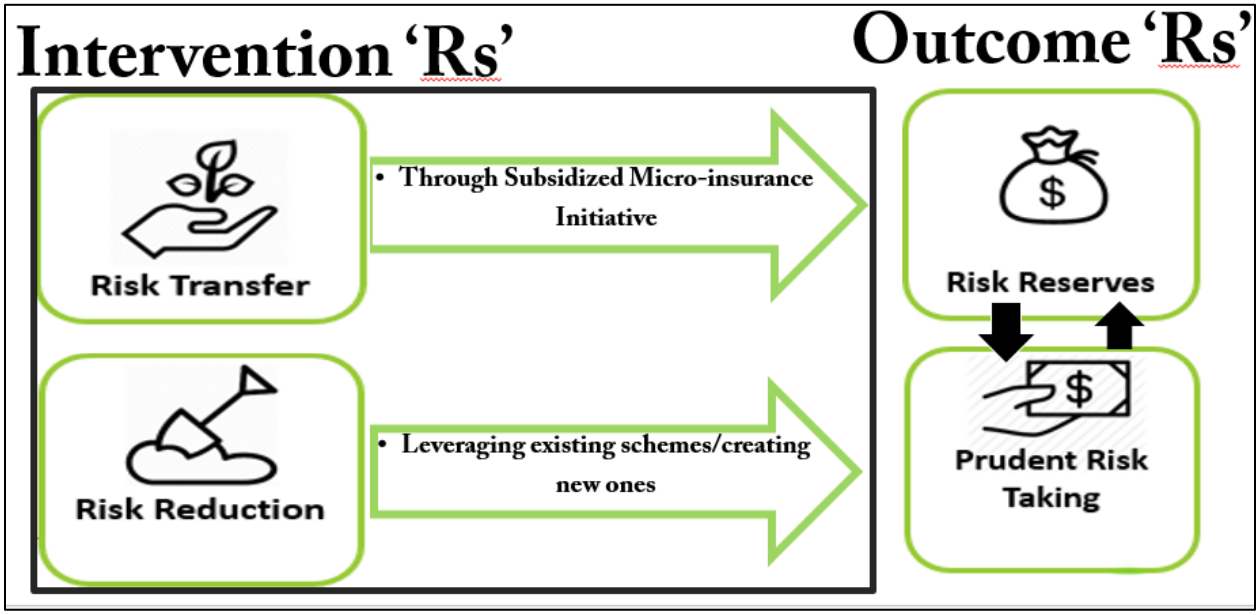
### 5.4.5 ON RISK RESERVES AND PRUDENT RISK TAKING

The provision of risk insurance will eventually improve their reserves position as well as assets position. Amongst various risk coping strategies, consumption of household or women savings was reported by over half of the respondents. Similarly, half of them also reported that they forced their children to dropout from school in times of disaster risk. They also reported sale of small/large ruminants in adverse situations.

Farmers also reported that mostly they took farm operations' based coping measures to mitigate risks, climate risks in particular. Thus if insurance is provided to them and they have satisfactory reserves/assets position then a behavioral change in terms of prudent risk taking can be considered plausible.

The discussion over way forward for R4 Programme has been summarized in Figure 5.1 below. In it we pictorially describe the recommendation that R4 should first design its interventions for Risk Reduction and Risk Transfer. Eventually, the other two Rs i.e. Risk Reserves and Prudent Risk Taking will be the outcome effects of achieving first two Rs.

Figure 5: Way Forward for R4 Programme




### 5.4.6 PREVIOUS WORK EXPERIENCE OF OXFAM AND WFP

Both WFP and OXFAM have the experience of providing flood relief assistance in district MZFR. WFP has been assisting the flood relief through Humanitarian Response Facility (HRF) in the flood affected areas. HRF's purpose is to improve the emergency response capacity of Pakistan's state. HRF's primary tool of assistance was provision of food to flood affected displaced people. WFP has an HRF in Muzaffargarh too which is now managed by National Disaster Management Authority.

OXFAM has also been involved in flood relief work in district MZFR. It has been reported in its evaluation study that those who were under its Community-based Disaster Risk Management and Livelihoods (CBDRML) Programme were better off in terms of managing the flood related risk as compared to those who are outside the Programme in districts Muzaffargarh and Rajanpur. OXFAM GB has also worked in districts MZFR and RYK for enhancing girls' enrolment in schools. Similarly, OXFAM GB also worked in MZFR for improving the dairy practices of small farmers.

## 5.5 General Recommendations

Sections 5.1-5.4 deal with the prescriptive part for R4 Programme per se. In this section, non-programmatic recommendations for agriculture development are being listed. These recommendations present a synthesis of suggestions recorded during the study:

i- Government needs to ensure low cost borrowing windows for private enterprises so that they could invest in the indigenization of the latest climate smart technology. Indigenization would facilitate the provision of that technology to small farmers at affordable rates.

ii- There is need for trust building between public service providers and the farmers. For that public-private partnerships should be encouraged. Private sector can support the government in filling the human resource gaps. It can assist by training the farmers on pest protection, crop diversification, mechanization, etc; providing agriculture services like pest scouting, livestock checkups, etc. and assisting the uptake of recent agriculture research.

iii- There is a need for revision of agro-ecological zones by PARC according to changing climatic and crop patterns. New zones should be more localized and Agri-Extension departments should plan accordingly.

iv- The Food Department should make its wheat procurement process more farmer friendly. During Wheat harvest season, the services of Food Department should be accessible to farmers at the village level.

v- There is a need for promoting farming cooperatives. Existing literature provides the evidence that cooperative farming results in increased yields and reduced costs. Such benefits should be capitalized by forming cooperatives at the village or union council level. Government should provide policy and regulatory support to new cooperatives like allowance for claiming full depreciation of equipment in the first year, easing of registration process, etc.

vi- There is a need for balanced focus on income enhancement and food security enhancement. Punjab govt. should encourage the sowing of cash crops as intercrops and provide insurance on them. Once farmers receive benefits of cash crops, they would divert from traditional crops to the cash crops.

# ANNEXURE 1: R4 GLOBAL RESILIENCE MODEL

The R4 approach to managing rural risk integrates four risk management strategies to support poor rural households and small farmers to build resilience, achieve food security and develop and protect their livelihoods.

***Disaster Risk Reduction and Safety Nets***

R4 combines WFP's expertise and longstanding experience in disaster risk reduction (DRR) measures, safety nets and initiatives such as Food for Asset (FFA), which have been crucial in recent years to reduce risk from natural hazards, often through the improvement or the creation of DRR physical assets. FFA programmes, implemented by WFP worldwide, are the cornerstone of WFP's approach to resilience as they play a double role: acting as a safety net by providing transfers which enable the most vulnerable households to meet their immediate food needs as well as a tool for DRR, natural resource rehabilitation, and agricultural development by building natural assets which reduce the impacts of climate shocks, restore ecosystems, and enhance agricultural production.

***Risk Transfer (Insurance)***

Over the last decade, micro insurance, spurred by the development of new index-based products that have the potential to make insurance available to large numbers of small farmers, has increasingly been recognized as the key in helping the rural poor dealing with risk. Due to a combination of factors, the potential of crop insurance as a risk management instrument remains largely untapped with an abysmal 2.1 percent coverage. Since the concept of insurance and risk transfer is not adequately integrated in Pakistan's extension systems, existing products have limited uptake. The R4 approach empowers the poorest farmers to obtain weather insurances by contributing their labor to community risk reduction projects. These risk management products, when facilitated by payment through labor, reduce the uncertainty and impact of weather-related disasters and the livelihood threats that they pose. With well-designed micro-insurance products, compensation for weather-related losses enables productive assets to be replaced and stimulates faster recovery. The predictability of income can reduce negative risk coping strategies and stimulate rural households to invest in activities and technologies that offer a higher rate of return. But for risk transfer products to be attractive to small farmers, these need to be part of an integrated package that helps them reduce other risks and constraints.

***Prudent Risk Taking***

MFIs are reluctant to offer credit to farmers due to perceived high risk of default in bad seasons. As a result, farmers often rely on informal credit sources, such as community-based savings and lending groups that can only cater for smaller consumption needs, or unscrupulous money lenders who charge exorbitant interest rates. These programs are not always adequate to meet farmers' investment needs, nor are they consistently reliable and safe for the lender or the borrower. Insurance can unlock credit at better rates, giving farmers the ability to invest in seeds, fertilizers and new technologies to increase their agricultural productivity. Participants are offered increased access

to credit: they are empowered to take 'prudent risks' and to develop livelihoods that are less exposed to increasing climate risks.

***Risk Reserves***

Though many in the developing world do save, it is often in the form of risky assets such as livestock. This is partly due to the lack of access to more secure savings vehicles. The R4 approach helps participants establish small-scale savings to build 'risk reserves'. Food-insecure households need safer and more liquid ways to save to smooth income, make productive investments, pay for long term needs such as retirement and weddings, and build a buffer against shocks. Saving schemes are common in rural areas especially through local savings groups or SACCOs (Savings and Credit Cooperatives) and R4 aims to enable access of participants to them These schemes help farmers build saving reserves, while they also act as provide loans to the participants to cope with unexpected events.

## R4 INTEGRATED MODEL

The complex relation between climate risk and food security can only be appropriately addressed through an integrated risk management strategy that connects risk management tools contributing to build resilience in a much more comprehensive fashion. For instance, index based insurance can provide smallholder farmers – a group that is typically excluded from the most basic financial services – with an affordable tool to transfer risk deriving from climate variability, allow them to make investments, and reduce their vulnerability to shocks. On the supply side, an index-based instrument reduces exorbitant monitoring costs as well as the risk of moral hazard – the two key impediments to the growth of crop insurance until the introduction of index-based products. In this context, World Food Programme's decision to start its R4 Rural Resilience Initiative in Punjab offers a silver lining. This feasibility, in order to guide WFP's R4 programme, aims to provide the situation analysis of current practices of farmers for risk management. Also, the analysis extends to farmers' perceptions regarding available strategies of risk management. The inquest also involves identifying the barriers to risk management. Broadly, the analysis guides WFP's interventions for improving resilience of rural farming households through using Social Safety Nets in Punjab, Pakistan.

# ANNEXURE 2: DETAILED METHODOLOGY

## 1- Selection of Study Locale

The following four step district selection criteria was decided at the consultation meeting held in office of Punjab Social Protection Authority:

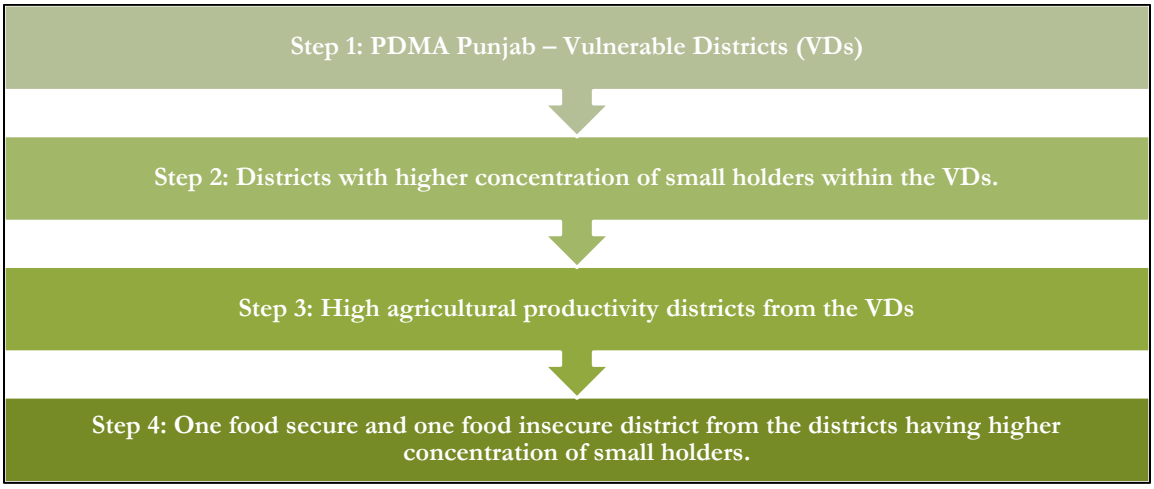



**Figure 2.1: District Selection Criteria**

In light of the above criteria, locale for conducting feasibility study was selected on the basis of:

i- PDMA's List of Vulnerable Districts
ii- Concentration of small holders
iii- District wise data of crop production (wheat) and
iv- Findings of Integrated Context Analysis

### 1.1. PDMA'S LIST OF VULNERABLE DISTRICTS

For this study, the list of risk prone districts in Punjab was based on PDMA's Contingency Plan 2015. The list arranges the districts of Punjab according to Low Risk, Medium Risk and High Risk Areas according to their vulnerabilities to flood. The list is given in Table 2.1 below:

*Table A2.1: List of Risk Prone Districts 2015*

| District | Risk | District | Risk | District | Risk | District | Risk |
|---|---|---|---|---|---|---|---|
| Bhakkar | A | Jhelum | A | Chiniot | B | Lodhran | C |
| D.G Khan | A | RY Khan | A | Attock | B | Khushab | C |
| Multan | A | Rajan Pur | A | Bahwalnagar | B | Okara | C |
| Mianwali | A | Gujranwala | B | Khanewal | B | Rawalpindi | C |
| Muzaffargarh | A | Lahore | B | Sheikhupura | B | Sargodha | C |
| Layyah | A | Gujrat | B | Sahiwal | C | TT Singh | C |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Jhang | A | Sialkot | B | Faisalabad | C | Vehari | C |
| MB Din | A | Hafizabad | B | Chakwal | C | Pakpattan | C |
| Narowal | A | Nankana | B | Qasoor | C | | |

| | | | | | |
|---|---|---|---|---|---|
| High Risk | A | Medium Risk | B | Low Risk | C |

However, during the final stages of this study, PDMA Punjab issued its Provincial Disaster Management Plan 2017. In that it has changed the pattern of reporting the vulnerable districts. According to the new list, districts have not been ranked according to the severity flood risk. Rather they have been segregated according to different risks without any ordinal aspect. R.Y. Khan has been placed in the drought prone districts along with Bahawalnagar and Cholistan (Bahwalpur). Both Muzaffargrah and R.Y. Khan have been included in the category of districts prone to the risk of riverine flood[119].

## 1.2. Concentration of Small Holders and District Wise Data of Crop Production to Identify Agricultural Districts

Our second criterion for selection of study districts was highest concentration of small holders. For this, data of farm holding in Agriculture Census 2010[120] was used which is tabulated below in Table 2.2. Also, wheat production has been taken as the proxy indicator for deciding upon agricultural districts because the actual purpose of Integrated Risk Management Project is reduction in vulnerability to food insecurity. Given the time and resource constrained we limit to one crop [wheat] so that meaningful comparisons of risk management practices can be made. Covering all the crops would have resulted in list of risk and corresponding management larger enough generating very low frequency in each category of respondents [from sample of 167][121]

*Table A2.2 Farm Holding and Wheat Production in Punjab (Top Six Districts)*

| No of Farms less than 12.5 acres | Wheat Production in 2015-16 (Total Yield (ooo Tones)) |
|---|---|
| **Muzaffargarh (272274)** | Bahawalnagar (1132.48) |
| **Rahim Yar Khan (207527)** | Rahimyar Khan (1015.97) |
| **Faisalabad (197178)** | Bahawalpur (969.03) |
| **Bhakkar (187405)** | Faisalabad (944.83) |
| **DG Khan (178399)** | Vehari (885.94) |
| **Sargodha (169516)** | M. Garh (876.21) |

Sources: Punjab Province Tabulation Agricultural Census, 2010 and Crop Reporting Service, Punjab

[119] Punjab Disaster Response Plan 2017, Provincial Disaster Management Authority, Punjab
[120] It is the latest available

[121] Detailed wheat production by districts is given in Annexure 3.1.

## 1.3. INTEGRATED CONTEXT ANALYSIS (ICA)

For robustness of selection of districts, we used also ICA framework. ICA is a corporate programming tool designed by WFP, VAM and OMEP staff at country, regional and HQ levels. In the context of Pakistan, WFP has partnered with National Disaster Management Authority for ICA.

| Risk of Exposure to Natural Shocks | Recurrence of Food Insecurity | | |
|---|---|---|---|
| | LOW | MEDIUM | HIGH |
| LOW | Area 5 | Area 3 B | Area 3 A |
| MEDIUM | Area 4 B | Area 2 B | Area 1 B |
| HIGH | Area 4 A | Area 2 A | Area 1 A |

The output of ICA is in the form of district level segregation according to joint risk of exposure to natural shocks (flood and drought) and vulnerability to food insecurity measured by recurrence of food insecurity. On the basis of intensity of both natural shock and food security recurrence risks, ICA has divided the districts into 9 categories.

***Districts of Punjab According to Risk of Exposure to Natural Shocks and Recurrence of Food Insecurity***

As it can be seen above that ICA Analysis has already clubbed the Step 1 and Step 4 of District Selection Criteria. So in order to finalize two districts from around more than 5 districts meeting the selection criteria, we resorted to findings of ICA Analysis at the fourth step. Vulnerability to food insecurity analysis of ICA is based upon district level Multidimensional Poverty Index of Pakistan. Therefore, it has indirectly covered our concerns on poverty levels.

Based upon the above information, the two districts mutually agreed upon for the purpose of feasibility study were:

i- Muzaffargarh
ii- Rahim Yar Khan

| District | Risk of Exposure to Natural Shocks | Recurrence of Food Insecurity | Number of Farm holders with less than 12.5 acres of land | Wheat Production (in '000' MT) in 2015-16 |
|---|---|---|---|---|
| **Muzaffargarh (Area 1B)** | Medium | High | 272,274 | 876.21 |
| **Rahim Yar Khan (Area 2A)** | High | Medium | 207,527 | 1015.97 |

An additional purpose of selecting the districts with transversal characteristics viz. risk of exposure to natural shocks and recurrence of food insecurity was to assess the underlying reasons behind those thwart wise characteristics. We wanted to ascertain whether different levels of risks of natural shocks and food insecurity were due to factors beyond the control of farmers or they could manage those factors.

## 2- Desk Review[122]

Desk review involved a review of national and international literature related specifically to:

a- Identifying the best international practices for agricultural risk management- International reports and country specific reports were reviewed for this part.[123]

b- Assessing the poverty reduction impact of improved resilience with particular focus on climate induced loses at smallholder level- Country specific as well as international reports and research publications were reviewed for the impacts of climate change on small holder and their livelihoods.[124]

c- Developing cognizance of the current agriculture risk responsive social safety nets in Punjab while putting it in comparisons to international practices- For social safety nets in Pakistan online data bases were assessed of social safety programs currently working in Pakistan with special focus on programmes and interventions in Punjab, with that projects and programmes targeted towards farming community were also reviewed and are presented in the study[125]

d- Mapping of all relevant stakeholders and their existing roles and responsibilities with specific weaknesses/ potential strengths- Online data bases of Stakeholders identified in the study were accessed.[126]

***Box-1***

- **Punjab Social Protection Authority**
- **Planning and Development Department Punjab**
- **Agriculture Department Punjab**
- **National Agriculture Research Council (NARC)**
- **Agriculture University and Ayub Agriculture Research, Faisalabad**
- **Provincial Disaster Management Authority, Punjab.**
- **OXFAM**
- **Food and Agriculture Organization**
- **Environment protection Department, Punjab**
- **Pakistan Microfinance Investment Company-(PMIC)**

[122] Findings of desk review are embedded in relevant sections.
[123] For example; Addressing Risk in Agriculture by Daren Bakst, ed. (2016).
[124] For example; the poverty implications of climate-induced crop yield changes by 2030 by Thomas W. Hertel (2010).
[125] For example; Poverty and Social Safety Nets: A Case Study of Pakistan by Mohammad Irfan).
[126] (for example; Website of PSPA http://www.pspa.punjab.gov.pk/overview )

# 3- Qualitative Analysis

***Box-2***

- **Punjab Agriculture Extension Department**
- **Nambardar of each village**
- **Presidents of Traders Union of Grain Market (Two from each district)**
- **Union Council Chairman**
- **Agricultural input providers**

## 3.1. IN DEPTH INTERVIEWS (IDI)

In-depth interviews were conducted with the policy makers at federal and provincial level institutions, listed in Box 1. They were shortlisted keeping in view the scope of R4 programme. This helped us knowing the overall mechanism and situation with regard to agricultural risks and status of small holders in the province. Also we were able to document the reflections of respondents on inter-sectoral collaboration between the social safety nets and agriculture associated departments/ministries.

## 3.2 KEY INFORMANT INTERVIEWS (KII)

KIIs were conducted to record the views of relevant stakeholder institutions on implementation side. Institutions covered for KIIs are listed in Box-2. It is important to gauge the situation of available options for risk management and implementation thereof. R4's implementation design in mind, we had KIIs with officials from the departments mentioned in box 2.

## 3.3. FOCUS GROUP DISCUSSIONS (FGDS)

Focus group discussions were conducted with the residents of five villages from each districts. In total 12 FGDs were held in selected two districts.

a- One FGDs was held in each village with 8-10 participants in every FGD. Further, one FGD was held in each district with 8-10 participants including middlemen, traders, etc. Among other aspects, FGDs majorly covered the following components:

i- Farming communities' perceptions and preferences about risk transfer;

ii- Farmers' intention and ability to manage agricultural risks through crop insurance in general (and weather-index based insurance in particular);

iii- Their level of satisfaction with existing social safety nets and

iv- Farmers' capacity to adopt climate smart technologies offered by the Agriculture Extension Department.

| Tehsil of Muzaffargarh | Village Names | Tehsil of Rahim Yar Khan | Village Names |
|---|---|---|---|
| Kot Addu | Village 134 ML UC Pattal Munda, Kot Addu | Rahim Yar Khan | Village Number 106P, UC 52, RYK |
| Kot Addu | Village 142/ML, UC 518, Kot Addu | Liaqatpur | Basti Rao Shabbir Hussain, UC Kotla Nawab, Liaqatpur |

| | | | |
|---|---|---|---|
| Ali Pur | Village 96/UC Sultanpur, Alipur | Rahim Yar Khan | Faizabad Chachar |
| Ali Pur | Village Khanan, UC Seet Pur, Ali Pur | Rahim Yar Khan | Mouzah Bagh Wal, UC Sirchaak |
| Muzaffargarh | Village Rohalri UC40 Talairi, Muzaffargarh | Khanpur | Village 97 1L, UC Baghobahar, Khanpur |

# 4- Quantitative Analysis

2.2.1 Structured Questionnaire (Household Survey)

a- Data on risk perceptions and risk management strategies was collected through structured questionnaire based survey. The survey was conducted in district Muzaffargarh of Punjab Province.

- According to Pakistan Agriculture Research Council's Agro-Ecological Zones and Cropping Zones of Punjab, Muzaffargarh falls in Irrigate Plains Zone and Cotton-Wheat Zone. According to NDMA's Risk Maps, it has High Drought Risk and Very High Flood Risk district. The guiding principle behind selection of study area is that it is more vulnerable in terms of food security, poverty and climate change.

- 167 households were surveyed from five villages of three union councils in district Muzaffargarh. The survey was carried out in pre-defined villages in Qualitative analysis Phase of the study. From each village 31-35 households were reached. Union councils were not adjacent to one another. Similarly two adjacent villages were not chosen.

| Village Name | Respondents |
|---|---|
| CHAK 134 | 35 |
| CHAK 142 | 35 |
| KHANANI | 31 |
| RIND | 31 |
| ROHARI | 35 |

b- The data collected through survey were subjected to Exploratory Data Analysis (EDA) to providing information on socioeconomic determinants of risk perceptions and risk management strategies and to assess risk management preferences of respondents. Analysis was disaggregated by land size, village and education.

# Annexure 2.1 Provincial Production of Wheat

*Table A3.1.1: Wheat Production (in '000' MT)*

| Year | 2012-13 | | | 2013-14 | | | 2014-15 | | | 2015-16 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **District** | **Irri.** | **Un-Irri.** | **Total** | **Irri.** | **Un-Irri.** | **Total** | **Irri.** | **Un-Irri.** | **Total** | **Irri.** | **Un-Irri.** | **Total** |
| **Total** | **17705** | **882.1** | **18587** | **18874** | **864.9** | **19739** | **18251.95** | **1029.98** | **19281.93** | **18475.8** | **1050.87** | **19526.67** |
| **Bahawalnagar** | 998.4 | 3.7 | 1002.1 | 1085.5 | 4 | 1089.6 | 1153.44 | 7.76 | 1161.2 | 1124.18 | 8.3 | 1132.48 |
| **Rahimyar Khan** | 925.1 | 4.8 | 930 | 984.8 | 3.8 | 988.6 | 1017.53 | 8.05 | 1025.58 | 1010.67 | 5.3 | 1015.97 |
| **Bahawalpur** | 794.6 | 1.6 | 796.2 | 879.4 | 1.9 | 881.3 | 902.24 | 2.87 | 905.11 | 965 | 4.03 | 969.03 |
| **Faisalabad** | 864.9 | - | 864.9 | 949.9 | - | 949.9 | 977.57 | | 977.57 | 944.83 | | 944.83 |
| **Vehari** | 821.3 | - | 821.3 | 884.4 | 0.5 | 884.8 | 898.67 | | 898.67 | 885.94 | | 885.94 |
| **M. Garh** | 806.9 | 10.1 | 816.9 | 868.9 | 9.9 | 878.7 | 855.54 | 19.09 | 874.63 | 855.59 | 20.62 | 876.21 |
| **Jhang** | 770.9 | 0.7 | 771.5 | 892.9 | 0.9 | 893.8 | 931.5 | | 931.5 | 868.65 | 1.02 | 869.67 |
| **Lodhran** | 609.7 | - | 609.7 | 681.2 | - | 681.2 | 636.77 | | 636.77 | 688.02 | | 688.02 |
| **Gujranwala** | 736.1 | - | 736.1 | 753.3 | 2.7 | 756 | 630.88 | 2.57 | 633.45 | 665.37 | 1.18 | 666.55 |
| **Khanewal** | 628.1 | 1.3 | 629.4 | 681.2 | 1.3 | 682.5 | 638.5 | 3.4 | 641.9 | 656.35 | 0.99 | 657.34 |
| **Okara** | 765.6 | - | 765.6 | 814.5 | - | 814.5 | 711.34 | | 711.34 | 651.01 | | 651.01 |
| **Sheikhupura** | 672.3 | - | 672.3 | 690.4 | - | 690.4 | 712.2 | | 712.2 | 630.21 | | 630.21 |
| **Layyah** | 498 | 0.3 | 498.3 | 584.3 | 2.6 | 586.9 | 584.41 | 9.09 | 593.5 | 600.82 | 3.54 | 604.36 |
| **Toba Tek Singh** | 505.9 | - | 505.9 | 568.1 | - | 568.1 | 553.66 | | 553.66 | 569.97 | | 569.97 |
| **Multan** | 502.5 | 1 | 503.5 | 543.8 | 1 | 544.8 | 576.1 | 1.12 | 577.22 | 564.5 | 1.55 | 566.05 |
| **Pakpattan** | 530.2 | - | 530.2 | 560.4 | - | 560.4 | 514.26 | | 518.77 | 555.13 | | 555.13 |
| **Sargodha** | 577 | - | 577 | 513.4 | - | 513.4 | 509.89 | | 509.89 | 539.35 | | 539.35 |
| **Rajanpur** | 412.3 | 17.9 | 430.2 | 446.7 | 14.6 | 461.2 | 475.46 | 19.6 | 495.06 | 529.35 | 5.11 | 534.46 |
| **D.G. Khan** | 444.2 | 27.6 | 471.7 | 480.8 | 34.7 | 515.5 | 547.87 | 10.16 | 558.03 | 505.33 | 22.36 | 527.69 |
| **Sialkot** | 609.6 | - | 609.6 | 628.7 | 4 | 632.7 | 361.61 | | 361.61 | 504.4 | | 504.4 |
| **Sahiwal** | 422.1 | - | 422.1 | 463.7 | - | 463.7 | 462.31 | | 462.31 | 490.97 | | 490.97 |
| **Kasur** | 536.3 | - | 536.3 | 548.1 | - | 548.1 | 513.94 | 0.32 | 514.26 | 478.93 | 0.56 | 479.49 |
| **Hafizabad** | 472.8 | - | 472.8 | 486.9 | - | 486.9 | 498.94 | | 498.94 | 479.33 | | 479.33 |
| **Bhakkar** | 401.5 | 7.9 | 409.4 | 427.8 | 8.3 | 436.1 | 382.45 | 29.25 | 411.7 | 398.5 | 13.18 | 411.68 |
| **Nankana Sahib** | 367.7 | - | 367.7 | 387.3 | - | 387.3 | 420.28 | | 420.28 | 400.94 | | 400.94 |
| **M.B. Din** | 389.3 | 3.8 | 393 | 367.2 | 3.1 | 370.3 | 350.87 | 1.57 | 352.44 | 380.72 | 1.58 | 382.3 |
| **Mianwali** | 412.5 | 21.7 | 434.1 | 423.1 | 22.7 | 445.8 | 293.88 | 29.61 | 323.49 | 319.92 | 33.71 | 353.63 |
| **Attock** | 36.2 | 128.3 | 164.5 | 31.3 | 187.1 | 218.3 | 35.2 | 265.74 | 300.94 | 43.37 | 291.86 | 335.23 |
| **Chiniot** | 298.9 | - | 298.9 | 376.7 | - | 376.7 | 347.9 | | 347.9 | 316.61 | | 316.61 |
| **Narowal** | 327.9 | 68.9 | 396.8 | 339.2 | 66.1 | 405.3 | 226.93 | 60.99 | 287.92 | 264.85 | 42.13 | 306.98 |
| **Gujrat** | 187 | 103.8 | 290.9 | 169.4 | 106 | 275.4 | 148.99 | 94.73 | 243.72 | 171.68 | 85.55 | 257.23 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Chakwal** | 10.7 | 180.7 | 191.5 | 11.2 | 146.4 | 157.6 | 9.19 | 188.55 | 197.74 | 12.19 | 221.69 | 233.88 |
| **Khushab** | 142.2 | 25.3 | 167.5 | 125 | 23.8 | 148.8 | 148.56 | 22.88 | 171.44 | 167.3 | 21.71 | 189.01 |
| **Rawalpindi** | 6.7 | 204.6 | 211.3 | 7.9 | 156.7 | 164.6 | 7.47 | 171.49 | 178.96 | 6.91 | 176.91 | 183.82 |
| **Lahore** | 174.1 | 3.1 | 177.3 | 172.5 | 1.5 | 174 | 164.06 | | 164.06 | 170.15 | | 170.15 |
| **Jhelum** | 45.5 | 43.3 | 88.8 | 44.2 | 43.6 | 87.8 | 47.03 | 59.81 | 106.84 | 58.76 | 68.61 | 127.37 |
| **Islamabad** | - | 21.8 | 21.8 | - | 17.9 | 17.9 | 7.47 | 21.33 | 21.33 | 6.91 | 19.38 | 19.38 |

**Source: Agriculture Management Information System, Punjab_and Rabi Crop Estimates (2015-16), Crop Reporting Service, Punjab.*

*Table A3.1.2: District Wise Wheat Production in 2015-16 in Decreasing Order*

| District | Total Yield (ooo MT) | District | Total Yield (ooo MT) | District | Total Yield (ooo MT) |
|---|---|---|---|---|---|
| **Bahawalnagar** | 1132.48 | Layyah | 604.36 | Nankana Sahib | 400.94 |
| **Rahimyar Khan** | 1015.97 | Toba Tek Singh | 569.97 | M.B. Din | 382.3 |
| **Bahawalpur** | 969.03 | Multan | 566.05 | Mianwali | 353.63 |
| **Faisalabad** | 944.83 | Pakpattan | 555.13 | Attock | 335.23 |
| **Vehari** | 885.94 | Sargodha | 539.35 | Chiniot | 316.61 |
| **M. Garh** | 876.21 | Rajanpur | 534.46 | Narowal | 306.98 |
| **Jhang** | 869.67 | D.G. Khan | 527.69 | Gujrat | 257.23 |
| **Lodhran** | 688.02 | Sialkot | 504.4 | Chakwal | 233.88 |
| **Gujranwala** | 666.55 | Sahiwal | 490.97 | Khushab | 189.01 |
| **Khanewal** | 657.34 | Kasur | 479.49 | Rawalpindi | 183.82 |
| **Okara** | 651.01 | Hafizabad | 479.33 | Lahore | 170.15 |
| **Sheikhupura** | 630.21 | Bhakkar | 411.68 | Jhelum | 127.37 |

# Annexure 2.2 Qualitative Survey Questionnaire(s) for R4 Feasibility Study[127]

## IN DEPTH INTERVIEW QUESTIONS

1- (a) What barriers do the small farmers face in their agricultural practices?
(b) What sort of agriculture risks are the small farmers facing and how are they differentiated according to ecological zones of Punjab?

2- (a) To what extent, the environmental risks have increased in Punjab over the past two decade due to climate change?
(b) How has the climate change affected crop and livestock yields over the past two decades?
(c) How are the climate induced risks affecting livelihoods of small farmers?

3- (a) What do you think are climate risk management strategies that can be effective for Agriculture sector of Punjab?
(b) What are the perceptions of farmers regarding climate risk management strategies?
(c) How receptive are the small holders to such instruments/strategies and which ones do they prefer to adopt?
(d) How effective a risk management strategy can cooperatives be?

4- (a) Which government departments are the most relevant in assisting the farmers to mitigate and adapt with the climate induced risks?
(b) What role are the following departments playing:

i- Irrigation Department
ii- Agriculture Extension Department
iii- Livestock and Dairy Development Department
iv- Pakistan Meteorological Department

5- (a) Which agricultural specific programmes/schemes are in practice now in Punjab?
(b) What significant impacts have been achieved by Federal Government's Kissan Package, Khadim e Punjab Kissan Package, Watan Card, etc.?

6- (a) Which Social Safety Nets do the small farmers have access to?
(b) How effective are they in building resilience (response and adaptive capacities) of small farmers?
(c) Do you think that the social safety nets can boost the uptake of climate smart technologies and practices?
(d) Do the farmers have access to any social safety nets that are particularly responsive to agricultural risks, in particular environmental risks (flood, drought, excess rainfall, pest attacks)?

[127] Quantitative survey was more comprehensive than qualitative survey. Due to paucity of space, the quantitative survey hasn't been added in the report.

7- (a) How are the Crop Loan Insurance Scheme and Livestock Insurance Scheme for Borrowers helping farmers in coping with the environmental risks?
(b)What is the scope for climate insurance in Pakistan?
(c) Which type of crop insurance would be better amongst these and why?
i- Indemnity based agricultural insurance (Named Peril and Multiple Peril)
ii- Index based agricultural insurance (Area Yield Index, Crop Weather Index Insurance, Normalized Deviation Vegetation Index Insurance, Livestock Mortality Index Insurance, Forestry Fire Index Insurance)
iii- Crop Revenue Insurance

## KEY INFORMANT INTERVIEWS

1- What is your mandated role in assisting the small farmers and what programs are you implementing to fulfill that role?
2- How effective do you think those programs are?
3- What constraints are you facing in implementing those programs from provincial government's side and from the farmer's side?
4- What specific programs address the climate induced risks?
5- What successes have been achieved in managing the climate risks?
6- How easily accessible are they to the small farmers?
7- What are the criteria set by you in targeting the deserving beneficiaries?
8- How resilient (responsive and adaptive) do they think the small farmers are against the climate vagaries?
9- What role can the social safety nets play in resilience building?

## FOCUS GROUP DISCUSSIONS

1- Which crops do you cultivate?
2- (a) What barriers or risks are you facing in your agriculture activities?
(b) Which factors have been detrimental for agriculture during the past twenty years?
(c) Have the crop and livestock yields witnessed losses during the past twenty years? If yes, then how much and due to which reason?
2- (a) What strategies do you adopt for your survival against the agricultural risks?
(b) How do you meet your daily needs (food, shelter, health, education) in the case of damage to your crops?

3- (a)Which schemes does the government offer to you for overcoming the agriculture risks – in particular environmental risks like drought, flood and pest attacks?

(b) Which schemes have been the most effective ones?

(c) What barriers do you face in accessing them?

4- (a) Is there any system of government through which it provides weather updates to you?

(b) If yes then is it easily accessible for you?

(c) How can the timely information help you in managing the climate induced risks?

5- (a) Are you registered under any Social Protection Scheme?

(b) Does it help in resilience building?

6- (a) Which crop or livestock insurance schemes do you have access to?

(b) If a crop insurance scheme is offered to you then how much premium will you be willing to pay?

(c) Which sort of CIS would you prefer out of following?

i- Indemnity based agricultural insurance (Named Peril and Multiple Peril)
ii- Index based agricultural insurance (Area Yield Index, Crop Weather Index Insurance, Normalized Deviation Vegetation Index Insurance, Livestock Mortality Index Insurance, Forestry Fire Index Insurance)
iii- Crop Revenue Insurance

7- (a) What is your harvest practice: Do you use the produce for your own needs or do you sell it? What proportion do you sell?

(b) Which mechanism do you adopt for selling the produce?

(c) Do you rely on middleman for selling the produce?

(d) What sort of relationship exists between you and the middleman?

(e) What is the role of middle man in sharing your risks?

## ROSTER INFORMATION FOR FGDS

Village Name _____

Average Farm Size in the village _____

Major Crops (maximum three) _____

Average Yield (Crop 1) _____

Average Yield (Crop 2) _____ Average Yield (Crop 3_

Average yield of Wheat (15-20 years ago)

What has caused the change?

Inputs

Average Number of fertilizer bag (per Wheat acre)

Sources of Irrigation

Average Number of irrigations (wheat crop)

Average costs of irrigation

Cost of per unit of labor (if employed then own cost and if not employed than average labor rate in the village) _____

Average Household Size (in village) _____ No of HH members engaged in farming _____

Average HH Income (for village) _____

Occupation other than agriculture? 2-3 major

Proportion of income from agriculture _____

# ANNEXURE 3: SOCIO-ECONOMIC AND AGRO-ECOLOGICAL PROFILES OF SELECTED DISTRICTS

In this chapter, detailed profiles of selected districts from Punjab are provided for the ease of reader.

## A3.1. SOCIO-ECONOMIC PROFILES

Detailed general profiles of districts are given in Table A3.1. Muzaffargarh (MZFR) lies on the banks of Chenab River on its east side. The district is home to 4,322,009 people. The district is divided into 4 tehsils namely Alipur, Jatoi, Kot Addu and Muzaffargarh and 93 Union councils. Rural population comprises of almost 87% of the total population. District is spread over an area of 8345 $km^2$ and the area is diverse in its terrain with plain/fertile area, riverine belts and sandy terrains. Due to presence of deserted area, almost half of the land is uncultivated (364,000 Hectares).

Besides agriculture as major economic activity the district is home to several industries like cotton ginning and pressing, flour mills, oil, paper/paperboard articles, petroleum products, power generation, solvent extraction, sugar and textile composite among various others. According to Agriculture census 2010, average landholding in district is 5 acres with small farmers at almost 93% of total farmers.

District Rahim Yar Khan (RYK) remains one of the largest districts of southern Punjab with an area of 11880 $km^2$. Population of RYK district is 4,841,006. District comprises of four tehsils namely Rahim Yar Khan, Sadiqabad, Liaquatpur and Khanpur and 122 union councils. The geography of area is diverse with riverine, canal irrigated and deserted terrains. Most part of the districted is cultivated (635,000 Hectares). Major industries include fertilizer, cosmetics, glass manufacturing, cotton production and processing, large textile units, flour mills, sugar and oil mills and large-scale power generation projects.

*Table A3.1: Demographics of Muzaffargarh (MZFR) and Rahim Yar Khan (RYK)*

| | MZFR | RYK |
|---|---|---|
| **Population** | 4,322,009 (Census 2017)[128] | 4,814,006 (Census 2017) |
| **Households** | 667,515 (Census 2017) | 701,520 (Census 2017) |
| **Population Average Annual Growth Rate (1998-2017)** | 2.63 | 2.27 |
| **Total area** | 8,435 square kilometers | 11,880 square kilometers |
| **Administrative units** | Four Tehsils, 93 union councils | Four Tehsils ,122 union councils |

[128] District Wise Results, Pakistan Population Census, 2017
http://www.pbscensus.gov.pk/sites/default/files/DISTRICT_WISE_CENSUS_RESULTS_CENSUS_2017.pdf

| | | |
|---|---|---|
| **Geography** | Riverine, canal irrigated and desert | Riverine, canal irrigated and desert |
| **Land use (Thousand Hectares)** | 466 cultivated and 364 un-cultivated | 635 cultivated and 182 un-cultivated |
| **Key economic activities** | Industries (cotton ginning and pressing, flour mills, oil, paper/paperboard articles, petroleum products, power generation, solvent extraction, sugar, textile composite) and Agriculture | Industries (fertilizer, glass manufacturing, cotton production and processing, large textile units, flour mills, sugar and oil mills) and Agriculture (Cotton and Mango) |
| **HDI ranking national** | 0.53 (2013) | 0.37 (2013) |
| **% of Small farms (<12.5 acres)** | 93 | 90 |
| **Average land holding** | 5 acres | 5 acres |

Sources:- Bureau of Statistics Punjab, Lahore, 2016 Statistical pocket book of the Punjab, Land Utilization Statistics by Division (SDPC) and District The Punjab: 2013-14, Agricultural census 2010 and Social Development In Pakistan Annual Review 2014-15

## A3.2 AGRO-ECOLOGICAL PROFILE

Both MZFR and RYK are located in the semi-arid Southern Punjab region. During the period 1981-2016 (36 years) Average Annual Precipitation in MZFR was 217.4 mm and in RYK it was 286.62 mm. Average Annual Temperature, for the same period, has been 26.45 °C in MZFR and in RYK. Average Annual Maximum Temperature, for the same period, in MZFR has been 32.5 °C and for RYK it has been 33.29 °C. Average Annual Minimum Temperature, for the same period, in MZFR has been 18.46°C and for RYK it has been 17.43 °C. Major crops of both the districts are Cotton, Wheat, Sugarcane and Pulses. They also produce Mango, Pomegranate and Dates.

Data for major crops grown in both districts are given below in Tables A3.2 and A3.3. Cultivated area, production and average yields for Wheat, cotton, sugarcane, moong, mash, mango, pomegranate and dates are given for both districts for 4 years from 2017-2013. Increase in shift to sugarcane can be observed as the yields and number of acres cultivated for sugarcane in both districts increase every year. Yields for cotton and wheat are fluctuating and are not giving a clear increasing or decreasing trend. Other crops are also not displaying a linear trend over the span of 4 years. Table A3.4 presents the area, production and yields data of major crops in Punjab Province.

It can be clearly noticed that there is a perceptible decrease in area and production of cotton crop in Punjab while we can see an increase in production and area of sugarcane crop. This trend is alarming as sugarcane might be beneficial to grow for farmers and sugar mills but if we focus on future, sugarcane have great potential to alter local water resources and cause water deficiency in the future.

In India which is the second largest Sugarcane producer, irrigated sugarcane has caused severe scarcity of ground and surface waters in several river basins.[129][130]

*Table A3.2: Area, Production and Yields data of major crops of Muzaffargarh District*

| Crops | 2016-2017 | | | 2015-2016 | | | 2014-2015 | | | 2013-2014 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre | Area | Production | Yield MDS/acre | Area | Production | Avg. Yield MDS/acre |
| **Wheat** | NA | NA | NA | 751,000 acres | 876,000 MT | 31.54 | 774,000 acres | 874,000 MT | 30.28 | 772,000 acres | 878,000 MT | 30.5 |
| **Cotton** | 336,000 acres | 429,000 bales | 16.45 | 360,000 acres | 317,000 bales | 11.35 | 350,000 acres | 631,000 bales | 23.2 | 379,000 acres | 549,000 bales | 18.64 |
| **Sugarcane** | 131,000 acres | 3544,000 MT | 725 | 105,000 acres | 2664,000 MT | 680 | 112,000 acres | 2633,000 MT | 630 | 115,000 acres | 2790,000 MT | 650 |
| **Moong** | 15773 acres | 4487 MT | NA | 22218 acres | 3630 MT | NA | 12056 acres | 3773 MT | NA | 8541 acres | 3267 MT | NA |
| **Mash** | 422 acres | 32 MT | NA | 25 acres | 3 MT | NA | NA | NA | NA | 80 acres | 14 MT | NA |
| **Mango** | 47025 acres | 269104 MT | NA | 47025 acres | 231702 MT | NA | 47000 acres | 243508 MT | NA | 47050 acres | 232703.6 MT | NA |
| **Pomegranate** | 1250 acres | 3500 MT | NA | 1295 acres | 3700 MT | NA | 1340 acres | 3876 MT | NA | 1350 acres | 3905.1 MT | NA |
| **Dates** | 8150 acres | 26161 MT | NA | 8148 acres | 25549 MT | NA | 8150 acres | 26161 MT | NA | 8150 acres | 25950.9 MT | NA |

Source: The Crop Reporting Service, Agriculture Department Punjab (Annual reports from 2013-2017) http://crs.agripunjab.gov.pk/reports; NA; Data not available

*Table A3.3: Area, Production and Yields data of major crops of Rahim Yar Khan District*

| Crops | 2016-2017 | | | 2015-2016 | | | 2014-2015 | | | 2013-2014 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre |
| **Wheat** | NA | NA | NA | 764,000 acres | 1015,000 MT | 35.65 | 803,000 acres | 1025,000 acres | 34.22 | 725,000 acres | 988,000 MT | 36.53 |
| **Cotton** | 419,000 acres | 754,000 bales | 23.17 | 511,000 acres | 743,000 bales | 18.72 | 542,000 acres | 1034,000 bales | 24.54 | 509,000 acres | 910,000 bales | 23 |

[129] Sustaining sugarcane productivity under depleting water resources. Ashok K. Shrivastava, Arun K. Srivastava and Sushil Solomon. Current Science, Vol. 101, No. 6, 25 September 2011

[130] Satellite Based Estimates of Groundwater Depletion in India. Matthew Rodell, Isabella Velicogna & James S. Famigliett. Nature, 2009.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sugarcane** | 386,000 acres | 12303,000 MT | 854 | 342,000 acres | 10569,000 MT | 828 | 310,000 acres | 9337,000 MT | 807 | 325,000 acres | 9825,000 MT | 810 |
| **Moong** | 2054 acres | 520 MT | NA | 4263 acres | 662 MT | NA | 1541 acres | 420 MT | NA | 735 acres | 125 MT | NA |
| **Mash** | 2 acres | * | NA | 32 acres | 6 MT | NA | 53 acres | 11 MT | NA | 25 acres | 5 MT | NA |
| **Mango** | 59400 acres | 310391 MT | NA | 59400 acres | 221508 MT | NA | 60000 acres | 259779 MT | NA | 60254 acres | 226559.7 MT | NA |
| **Pomegranate** | 185 acres | 690 MT | NA | 185 acres | 510 MT | NA | 185 acres | 498 MT | NA | 185 acres | 479 MT | NA |
| **Dates** | 200 acres | 300 MT | NA | 200 acres | 250 MT | NA | 200 acres | 412 MT | NA | 200 acres | 408 MT | NA |

Source: The Crop Reporting Service, Agriculture Department Punjab (Annual reports from 2013-2017)
http://crs.agripunjab.gov.pk/reports; NA; Data not available

*Table A3.4: Area, Production and Yields data of major crops of Punjab Province*

| Crops | 2016-2017 | | | 2015-2016 | | | 2014-2015 | | | 2013-2014 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre | Area | Production | Avg. Yield MDS/acre |
| **Wheat** | NA | NA | NA | 17085,000 acres | 19526,000 MT | 30.62 | 17247,000 acres | 19281,000 MT | 29.95 | 17054,000 acres | 19738,000 MT | 31.01 |
| **Cotton** | 4486,000 acres | 6978,000 bales | 20 | 5542,000 acres | 6343,000 bales | 14.72 | 5740,000 acres | 10277,000 bales | 23.02 | 5434,000 acres | 9145,000 bales | 21.64 |
| **Sugarcane** | 1922,000 acres | 49613,000 MT | 691.59 | 1743,000 acres | 41968,000 MT | 645 | 1756,000 acres | 41074,000 MT | 627 | 1870,000 acres | 43704,000 MT | 626 |
| **Moong** | 404484 acres | 120920 MT | NA | 328860 acres | 93862 MT | NA | 279296 acres | 89581 MT | NA | 279591 acres | 81551 MT | NA |
| **Maash** | 31402 acres | 3558 MT | NA | 37839 acres | 4921 MT | NA | 41233 acres | 5415 MT | NA | 39891 acres | 5938 MT | NA |
| **Mango** | 262023 acres | 1375028 MT | NA | 264320 acres | 1227951 MT | NA | 264543 acres | 1313612 MT | NA | 264996 acres | 1251967 MT | NA |
| **Pomegranate** | 3281 acres | 8873 MT | NA | 3485 acres | 9345 MT | NA | 3568 acres | 9762 MT | NA | 3792 acres | 10325 MT | NA |
| **Dates** | 14274 acres | 43548 MT | NA | 14291 acres | 42932 MT | NA | 14285 acres | 44041 MT | NA | 14312 acres | 43850 MT | NA |

Source: The Crop Reporting Service, Agriculture Department Punjab (Annual reports from 2013-2017)
http://crs.agripunjab.gov.pk/reports; NA; Data not available

## A3.3. CLIMATIC PROFILE OF STUDIED DISTRICTS

Based on calculations made from data obtained from Pakistan Metrological Department, Month wise 36 years average (1981-2016) - **A**, Last 10 years' average (2007-16) - **B** and First 10 Years Average (1981-90) - **C** of Precipitation, Maximum Temperature and Mean Temperature for both

districts have been graphed in Figures A3.1 to A3.6. Calculation of **B** and **C** was prompted by responses from farmers regarding their perceptions of climate change. When they were asked if temperature has risen or climate has changed in the past ten years then they generally responded in affirmative. But when their response was followed by the question if they thought climate has changed over the past 30-40 years then they generally responded that there was some climate cycle that was being repeated. The weather that existed 30-40 years back had just come back. Apparently, both of these responses imply that farmers perceive climate change to be a recurrent phenomenon rather than a new phenomenon. Nevertheless, Figures A3.1 to A3.8, Tables A3.6 to A3.11 and the discussions therewith suggest that weather patterns have altered over the past few years as compared to climate conditions existing 40-50 years back, also posing a threat to the crops.

Before delving into the detailed climatic profile discussion the seasonal calendar of major crops of MZFR and RYK is being presented below for the ease of readers. The discussion on variations in climatic variables in a particular month can be read by linking it with crop seasons.

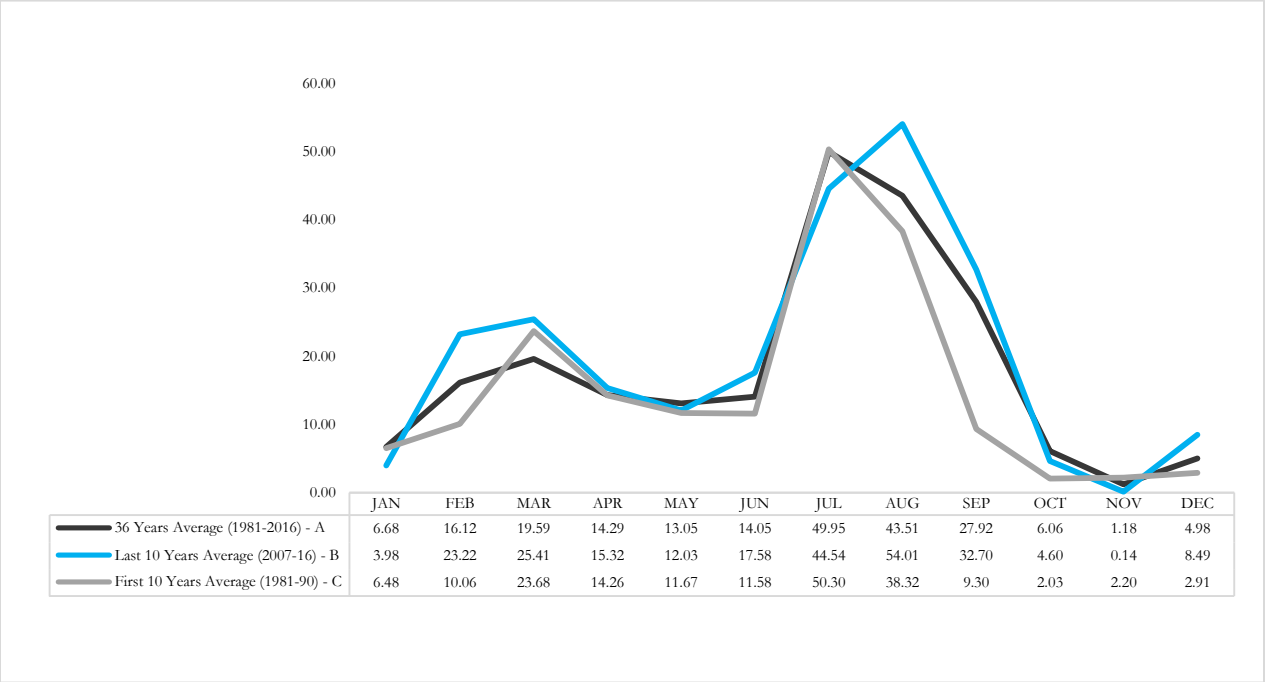
*Table A3.5 Crops Seasonal Calendar*

| Crop | Period (Sowing to Harvesting) |
|---|---|
| **Wheat** | Mid November till End of March (04 to 04.5 months) |
| **Sugarcane** | Fall Planting: September-November to November-December (12-13 months)<br>Spring Planting: February-March to December-January (11-12 months) |
| **Cotton** | Mid-April to End of September (Around 06 months) |

### *3.3.1 (A) Average Monthly Precipitation in Muzaffargarh and Rahim Yar Khan*

It can be seen in the Figure 3.1 that, in MZFR, Average Precipitation has decreased in the months of November and January during the last ten years as compared to the 36 years average. These months correspond to the Wheat growth stage and decrease in precipitation in them can entail losses for wheat productivity if there isn't enough canal water. Last 10 years average precipitation during December is higher than other two averages. This is because of unexpectedly high precipitation during December 2008 i.e. 77.8 mm.

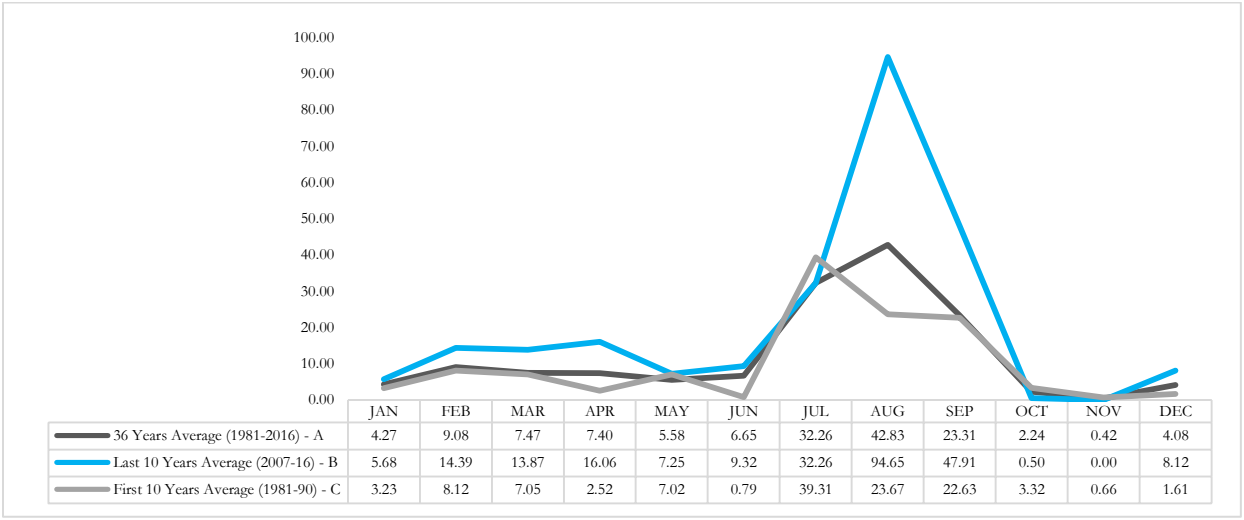
Average Precipitations increased during the last ten years in the month of March as compared to other two averages for March. Precipitations at those stages are very helpful for Wheat but become detrimental if coupled with windstorms. Average Precipitations have also increased a lot during the months of August and September during the Last 10 years. Excessive rains in those months are adverse for the cotton crop if coupled with windstorms. Cotton crop is a very sensitive crop. Persistently high temperature, lack of proper irrigation and flash rains all affect the yield of cotton crop. Precipitations for July have declined in the Last 10 years as compared to other two averages.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 6.68 | 16.12 | 19.59 | 14.29 | 13.05 | 14.05 | 49.95 | 43.51 | 27.92 | 6.06 | 1.18 | 4.98 |
| Last 10 Years Average (2007-16) - B | 3.98 | 23.22 | 25.41 | 15.32 | 12.03 | 17.58 | 44.54 | 54.01 | 32.70 | 4.60 | 0.14 | 8.49 |
| First 10 Years Average (1981-90) - C | 6.48 | 10.06 | 23.68 | 14.26 | 11.67 | 11.58 | 50.30 | 38.32 | 9.30 | 2.03 | 2.20 | 2.91 |

Figure A3.1: Average Monthly Precipitation (mm) - Muzaffargarh

Figure A3.2 below shows a different pattern of precipitation in Rahim Yar Khan. Some very high precipitations were observed in the month of August in 2003, 2008, 2010 and 2015 of 148 mm, 119.2 mm, 276.1 mm and 307.5 mm. Farmers had reported that excessive rain during the months of August and September have been affecting their cotton crop which is at later stages of growth then. Similarly, they also reported that excessive rains during those months also affected the Moongi (Lentil) crop. Including August, the Last 10 Years Average of Precipitation are higher than the other two averages in all months except in October and November.

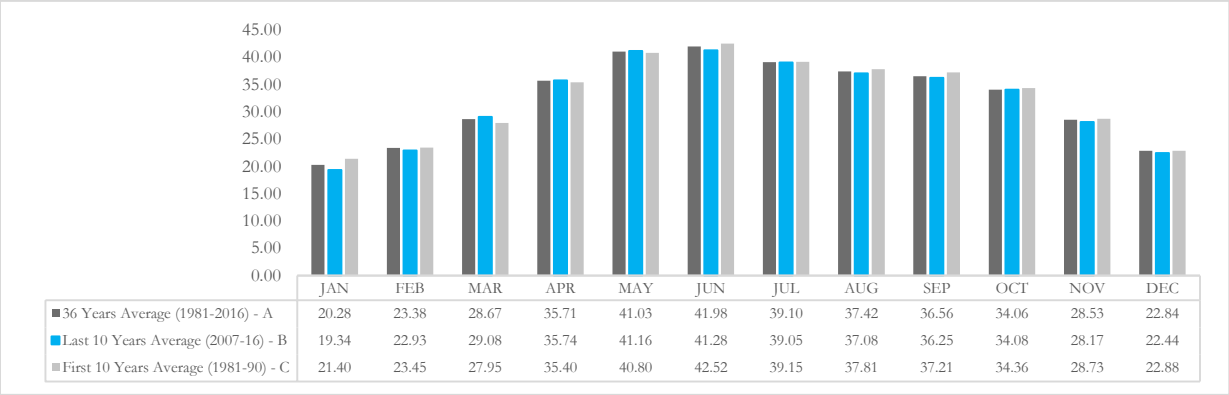



| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 4.27 | 9.08 | 7.47 | 7.40 | 5.58 | 6.65 | 32.26 | 42.83 | 23.31 | 2.24 | 0.42 | 4.08 |
| Last 10 Years Average (2007-16) - B | 5.68 | 14.39 | 13.87 | 16.06 | 7.25 | 9.32 | 32.26 | 94.65 | 47.91 | 0.50 | 0.00 | 8.12 |
| First 10 Years Average (1981-90) - C | 3.23 | 8.12 | 7.05 | 2.52 | 7.02 | 0.79 | 39.31 | 23.67 | 22.63 | 3.32 | 0.66 | 1.61 |

Figure A3.2: Average Monthly Precipitation (mm) - Rahim Yar Khan

### *3.3.1 (B) Average Monthly Maximum Temperature in Muzaffargarh and Rahim Yar Khan*

Figure A3.2 shows that the last 10 years average for maximum temperatures during January, February, June, July, August, September, November and December is lower as compared to the 36 Years average for maximum temperature. The Table A3.3 below more clearly presents the rise or fall in averages. Positive difference shows fall and negative difference shows rise. Rise has been observed in case of July.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 20.28 | 23.38 | 28.67 | 35.71 | 41.03 | 41.98 | 39.10 | 37.42 | 36.56 | 34.06 | 28.53 | 22.84 |
| Last 10 Years Average (2007-16) - B | 19.34 | 22.93 | 29.08 | 35.74 | 41.16 | 41.28 | 39.05 | 37.08 | 36.25 | 34.08 | 28.17 | 22.44 |
| First 10 Years Average (1981-90) - C | 21.40 | 23.45 | 27.95 | 35.40 | 40.80 | 42.52 | 39.15 | 37.81 | 37.21 | 34.36 | 28.73 | 22.88 |

Figure A3.3: Average Monthly Maximum Temperature °C - Muzaffargarh

It can be noted in the Column A-B that negative difference exist in March, April and May which indicate the arrival of early summer which can affect Mango. As told by farmers, early summer may also affect wheat productivity by causing wheat grain to grow pre-maturely.

However, literature suggests that rise of temperature in March and May doesn't have any significant impact on Wheat productivity. Rise of 1°C during sowing stage (November and December) can reduce the yield by 7.4%. Rise of 1°C during growing stage (January and February) increases the yield up to 6.2%. Short run deviations in Mean Temperature from the long run (historic mean) i.e. Weather Shocks don't affect the crop significantly. Short run deviations in the precipitation positively affect the Wheat crop[131].

Farmers in MZFR were of the view that temperature increase during summers was favoring the pest attacks on cotton crop. Particularly the attack of White Fly has increased over the past few years.

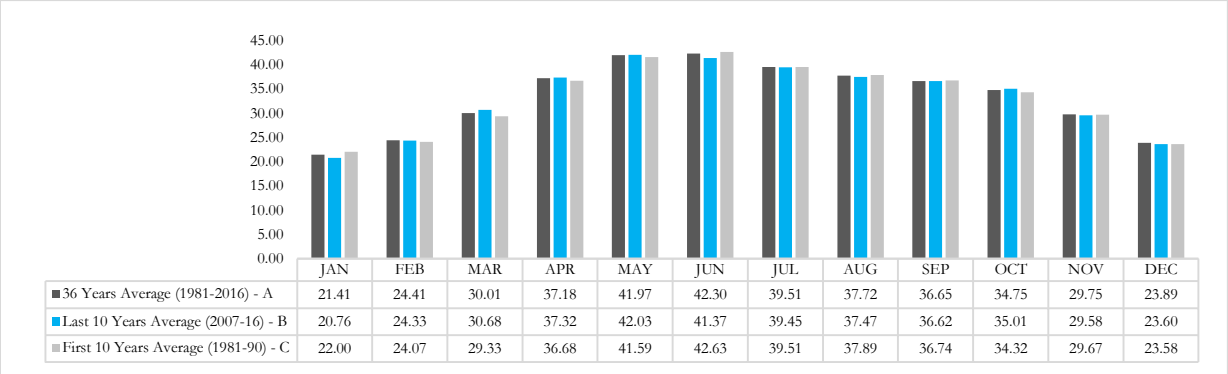
*Table A3.6: Differences between different averages of monthly maximum temperature in Muzaffargarh*

| Months | Difference Between 36 Years Average and Last | Difference Between First 10 Years Average and Last | Difference Between 36 Years Average and First |
|---|---|---|---|

[131] Ahmad, M., Siftain, H. and Iqbal, M., 2014. Impact of climate change on wheat productivity in Pakistan: A district level analysis. Working Paper No 1. Climate Change Working Paper Series. Pakistan Institute of Development Economics.

| | 10 Years Average (A - B) | 10 Years Average (C - B) | 10 Years Average (A - C) |
|---|---|---|---|
| **JAN** | 0.94 | 2.06 | -1.12 |
| **FEB** | 0.45 | 0.52 | -0.07 |
| **MAR** | -0.41 | -1.13 | 0.72 |
| **APR** | -0.03 | -0.34 | 0.31 |
| **MAY** | -0.13 | -0.36 | 0.23 |
| **JUN** | 0.71 | 1.24 | -0.54 |
| **JUL** | 0.046 | 0.10 | -0.05 |
| **AUG** | 0.34 | 0.72 | -0.39 |
| **SEP** | 0.31 | 0.96 | -0.65 |
| **OCT** | -0.024 | 0.28 | -0.30 |
| **NOV** | 0.36 | 0.56 | -0.20 |
| **DEC** | 0.40 | 0.44 | -0.04 |

Last 10 Years Average of Monthly Maximum Temperature is higher as compared to the 36 Years Average in the months of March, April, May and October. However, as compared to the First 10 Years Average, the Last 10 Years Average is higher in six months i.e. February, March, April, May, October and December. Maximum precipitation requirement for cotton in Pakistan is 40mm. A deviation of 1mm from the historical average can reduce the cotton yield by 500 bales[132]. In case of Rahim Yar Khan it can be seen that the deviation in precipitations are much higher than just 1mm in the months of August and September, suggesting a loss in cotton crop production.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 21.41 | 24.41 | 30.01 | 37.18 | 41.97 | 42.30 | 39.51 | 37.72 | 36.65 | 34.75 | 29.75 | 23.89 |
| Last 10 Years Average (2007-16) - B | 20.76 | 24.33 | 30.68 | 37.32 | 42.03 | 41.37 | 39.45 | 37.47 | 36.62 | 35.01 | 29.58 | 23.60 |
| First 10 Years Average (1981-90) - C | 22.00 | 24.07 | 29.33 | 36.68 | 41.59 | 42.63 | 39.51 | 37.89 | 36.74 | 34.32 | 29.67 | 23.58 |

Figure A3.3: Average Monthly Maximum Temperature °C - Rahim Yar Khan

Table A3.3 shows positive differences in Column A-B for the months of November, December, January and February. Temperature beyond 14.76 °C during the first stage of Wheat positively

[132] Siddiqui, R., Samad, G., Nasir, M. and Jalil, H.H., 2012. The impact of climate change on major agricultural crops: evidence from Punjab, Pakistan. The Pakistan Development Review, pp.261-274.

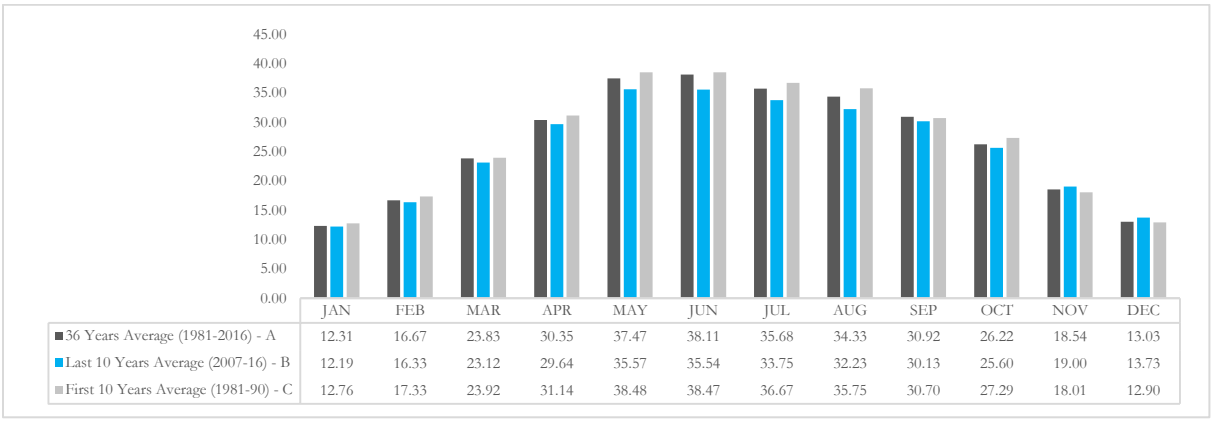
affects the productivity[133]. Although temperature during this stage has declined, it did not go below 14.76 °C. Maximum Temperature requirement for cotton is 32 °C during its production stage and rise of 1 °C above it can cause a loss of up to 42,330 bales. Just like precipitations, it can be seen that in RYK the highest short run deviation from maximum requirement of 32 °C is in the month of June.

*Table A3.7: Differences between Different Averages of Monthly Maximum Temperature in Rahim Yar Khan*

| Months | Difference Between 36 Years Average and Last 10 Years Average (A - B) | Difference Between First 10 Years Average and Last 10 Years Average (C - B) | Difference Between 36 Years Average and First 10 Years Average (A - C) |
|---|---|---|---|
| **JAN** | 0.65 | 1.24 | -0.59 |
| **FEB** | 0.08 | -0.26 | 0.34 |
| **MAR** | -0.67 | -1.35 | 0.68 |
| **APR** | -0.14 | -0.64 | 0.50 |
| **MAY** | -0.06 | -0.44 | 0.38 |
| **JUN** | 0.93 | 1.26 | -0.33 |
| **JUL** | 0.06 | 0.06 | 0.00 |
| **AUG** | 0.26 | 0.43 | -0.17 |
| **SEP** | 0.03 | 0.12 | -0.09 |
| **OCT** | -0.27 | -0.69 | 0.43 |
| **NOV** | 0.17 | 0.09 | 0.08 |
| **DEC** | 0.29 | -0.02 | 0.31 |

### *3.3.1 (C) Average Monthly Mean Temperature in Muzaffargarh and Rahim Yar Khan*

Figure A3.4 shows averages of monthly mean temperature. Unlike monthly maximum temperature, last 10 years average was higher only in the case of November and December. As compared to the first 10 years average, the last 10 years average for mean monthly temperature was lower in all the months except November and December. This implies that the monthly minimum temperatures must have risen in those months because monthly maximum temperatures for these two months show lower averages during the last 10 years as compared to the other two averages.




[133] Ibid., 6

Figure A3.4: Average Monthly Mean Temperature °C - Muzaffargarh

Table A3.8 below shows differences in different averages of monthly mean temperature. Highest number of negative differences can be seen in the Column (A-C). It shows that there is an on average increase of 0.12 °C and 0.34 °C in January and February. Temperature rise by 1°C in these months increase Wheat yield by 6.2%[134]. So, 0.12 °C and 0.34 °C average rise implies 0.75% and 2.11% increase respectively.

However, more alarmingly, there is a rise of 0.46 °C and 0.70 °C in average monthly mean temperature during Last 10 years in the months of November and December. Temperature rise by 1°C in these months reduces Wheat yield by 7.4%. So, 0.46 °C and 0.70 °C average rise implies 3.40% and 5.18% loss respectively.

Temperature rise during March and April hasn't been found to be significantly impacting Wheat yield in the literature (but farmers did communicate that temperature rise during those months also affects Wheat yield)[135]. To sum up there could be on average net loss of 5.72% (3.4 + 5.18 – 0.75 – 2.11 = 5.72) in Wheat yield in Muzaffargarh during the last 10 years. Notwithstanding the possibility of yield losses due to variations in mean temperature, the use of inputs always has a robust positive impact[136] that can in fact neutralize the loss due to climate variability. The farmers were generally skeptic about the quality and effectiveness of inputs. However, majority attributed the rise in yield to use of inputs.

*Table A3.8: Differences between Different Averages of Monthly Mean Temperature in Muzaffargarh*

| Months | Difference Between 36 Years Average and Last 10 Years Average (A - B) | Difference Between First 10 Years Average and Last 10 Years Average (C - B) | Difference Between 36 Years Average and First 10 Years Average (A - C) |
|---|---|---|---|
| **JAN** | 0.12 | 0.58 | -0.45 |
| **FEB** | 0.34 | 1.003 | -0.66 |
| **MAR** | 0.71 | 0.80 | -0.092 |
| **APR** | 0.71 | 1.50 | -0.79 |
| **MAY** | 1.90 | 2.91 | -1.01 |
| **JUN** | 2.58 | 2.93 | -0.35 |
| **JUL** | 1.93 | 2.92 | -0.98 |

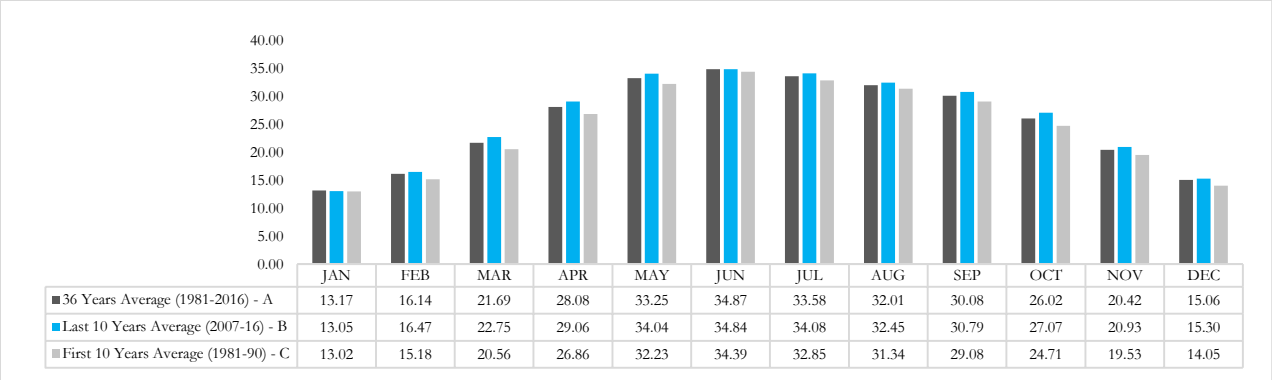
[134] Ibid., 3

[135] Findings of Barlow et al. (2015) resonate with farmers claim. The study concluded that excessive heat causes reduction in grain number and reduced duration of the grain-filling period.
Barlow, K.M., Christy, B.P., O'leary, G.J., Riffkin, P.A. and Nuttall, J.G., 2015. Simulating the impact of extreme heat and frost events on wheat crop production: A review. Field Crops Research, 171, pp.109-119.

[136] Amin, S., Ahmad, M. and Iqbal, M., 2013. Impact of climate change on agriculture in Pakistan: A district level analysis. Working Paper No 3. Climate Change Working Paper Series. Pakistan Institute of Development Economics.

| | | | |
|---|---|---|---|
| **AUG** | 2.10 | 3.52 | -1.42 |
| **SEP** | 0.78 | 0.57 | 0.21 |
| **OCT** | 0.61 | 1.69 | -1.07 |
| **NOV** | -0.46 | -0.99 | 0.53 |
| **DEC** | -0.70 | -0.82 | 0.13 |

Unlike the higher Last 10 Years Average of Monthly Maximum Temperature during only four months, the Last 10 Years Average of Monthly Mean Temperature is higher during 11 months as compared to the 36 Years Average. This implies a significant increase in the Monthly Mean Temperature in Rahim Yar Khan during all the months.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 13.17 | 16.14 | 21.69 | 28.08 | 33.25 | 34.87 | 33.58 | 32.01 | 30.08 | 26.02 | 20.42 | 15.06 |
| Last 10 Years Average (2007-16) - B | 13.05 | 16.47 | 22.75 | 29.06 | 34.04 | 34.84 | 34.08 | 32.45 | 30.79 | 27.07 | 20.93 | 15.30 |
| First 10 Years Average (1981-90) - C | 13.02 | 15.18 | 20.56 | 26.86 | 32.23 | 34.39 | 32.85 | 31.34 | 29.08 | 24.71 | 19.53 | 14.05 |

Figure A3.5: Average Monthly Temperature °C - Rahim Yar Khan

Table A3.9 below shows the negative difference (rise) in Column A-B for eleven months. Positive difference is observed only in the month of June in Column A-B whereas differences are higher in Column C-B than Column A-B. Moreover negative differences exist for all twelve months in Column C-B. Average loss to Wheat yield during last 10 years in RYK could be 3.65%[137].

*Table A3.9: Differences between Different Averages of Monthly Mean Temperature in Rahim Yar Khan*

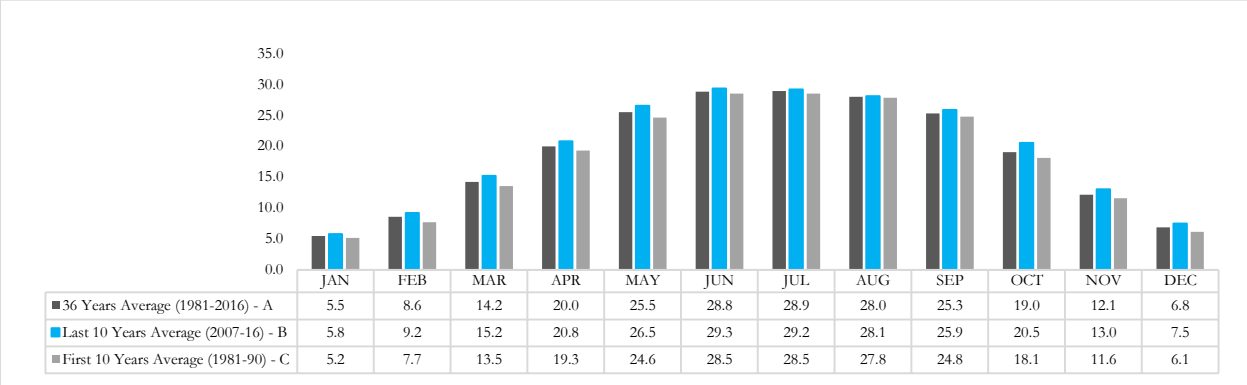
| Months | Difference Between 36 Years Average and Last 10 Years Average (A - B) | Difference Between First 10 Years Average and Last 10 Years Average (C - B) | Difference Between 36 Years Average and First 10 Years Average (A - C) |
|---|---|---|---|
| **JAN** | 0.12 | -0.03 | 0.15 |
| **FEB** | -0.32 | -1.29 | 0.96 |
| **MAR** | -1.06 | -2.19 | 1.13 |
| **APR** | -0.98 | -2.20 | 1.22 |
| **MAY** | -0.80 | -1.81 | 1.02 |
| **JUN** | 0.03 | -0.46 | 0.49 |

[137] (0.52*7.4 + 0.24*7.4 – 0.32*6.2 = 3.85 + 1.78 – 1.98 = 3.65)

| | | | |
|---|---|---|---|
| **JUL** | -0.50 | -1.23 | 0.73 |
| **AUG** | -0.43 | -1.11 | 0.68 |
| **SEP** | -0.71 | -1.71 | 1.00 |
| **OCT** | -1.06 | -2.37 | 1.31 |
| **NOV** | -0.52 | -1.40 | 0.89 |
| **DEC** | -0.24 | -1.25 | 1.01 |

### *3.3.1 (D) Average Monthly Minimum Temperature in Muzaffargarh and Rahim Yar Khan*

Figure A3.6 below shows higher Last 10 Years Average of Monthly Minimum Temperature as compared to the 36 Years Average of First 10 Years Average in MZFR. This rise has occurred in all the months.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 5.5 | 8.6 | 14.2 | 20.0 | 25.5 | 28.8 | 28.9 | 28.0 | 25.3 | 19.0 | 12.1 | 6.8 |
| Last 10 Years Average (2007-16) - B | 5.8 | 9.2 | 15.2 | 20.8 | 26.5 | 29.3 | 29.2 | 28.1 | 25.9 | 20.5 | 13.0 | 7.5 |
| First 10 Years Average (1981-90) - C | 5.2 | 7.7 | 13.5 | 19.3 | 24.6 | 28.5 | 28.5 | 27.8 | 24.8 | 18.1 | 11.6 | 6.1 |

Figure A3.6: Average Monthly Minimum Temperature °C - Muzaffargarh

The Table A3.10 below shows that during the Last 10 years average of monthly minimum temperature has increased for all the months as compared to the other two averages.

*Table A3.10: Differences between Different Averages of Monthly Minimum Temperature in Muzaffargarh*

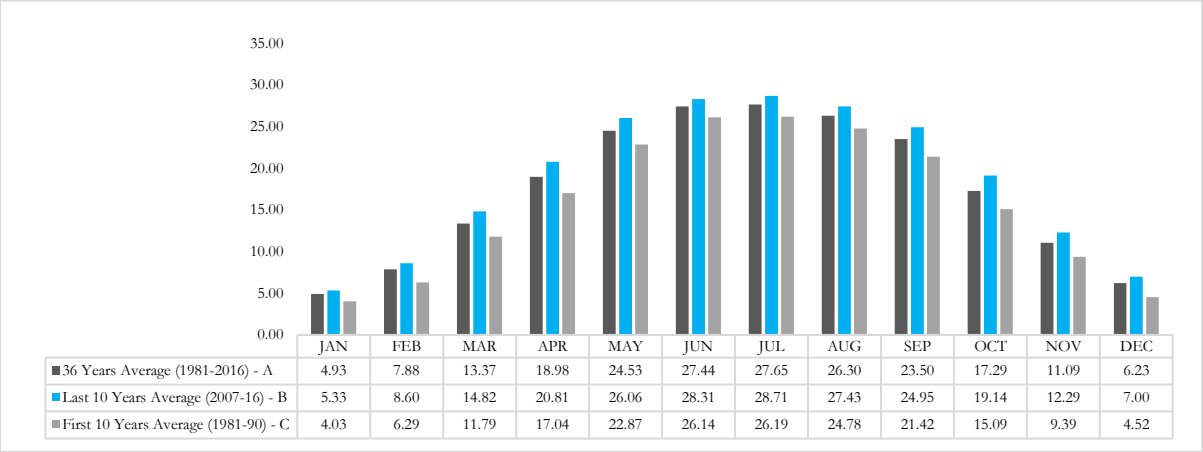
| Months | Difference Between 36 Years Average and Last 10 Years Average (A - B) | Difference Between First 10 Years Average and Last 10 Years Average (C - B) | Difference Between 36 Years Average and First 10 Years Average (A - C) |
|---|---|---|---|
| **JAN** | -0.31 | -0.6 | 0.29 |
| **FEB** | -0.63 | -1.49 | 0.86 |
| **MAR** | -1 | -1.66 | 0.66 |
| **APR** | -0.83 | -1.53 | 0.71 |
| **MAY** | -1.03 | -1.91 | 0.88 |
| **JUN** | -0.51 | -0.82 | 0.3 |
| **JUL** | -0.28 | -0.69 | 0.42 |
| **AUG** | -0.11 | -0.26 | 0.15 |

| | | | |
|---|---|---|---|
| **SEP** | -0.61 | -1.13 | 0.52 |
| **OCT** | -1.48 | -2.41 | 0.94 |
| **NOV** | -0.86 | -1.44 | 0.57 |
| **DEC** | -0.62 | -1.34 | 0.72 |

Figure A3.7 shows increase in Minimum Temperatures is higher than the Maximum Temperatures. 'Maximum temperatures are affected by local conditions, especially soil water content and evaporative heat loss as soil water evaporates, minimum air temperatures are affected by mesoscale changes in atmospheric water vapor content[138].' Hence, in areas where changing climate is expected to cause increased rainfall or where irrigation is predominant, large increases of maximum temperatures are less likely to occur than in regions prone to drought[139]. This is what can be observed through comparison of Averages of Maximum and Minimum temperatures of MZFR and RYK. Minimum Temperatures present more likelihood of increase than the Maximum Temperature.

International literature tells us that Minimum Temperature is more likely to increase due to climate change and is going to adversely affect the crop yield[140][141]. On the other hand national literature tells us that Maximum Temperature adversely affects the Wheat crop while Minimum Temperature has positive relation with Wheat crop[142].

[138] Alfaro, E.J., Gershunov, A. and Cayan, D., 2006. Prediction of summer maximum and minimum temperature over the central and western United States: the roles of soil moisture and sea surface temperature. Journal of Climate, 19(8), pp.1407-1421.
[139] Hatfield, J.L. and Prueger, J.H., 2015. Temperature extremes: effect on plant growth and development. Weather and Climate Extremes, 10, pp.4-10.
[140] Meehl, G.A., Stocker, T.F., Collins, W.D., Friedlingstein, A.T., Gaye, A.T., Gregory, J.M., Kitoh, A., Knutti, R., Murphy, J.M., Noda, A. and Raper, S.C., 2007. Global climate projections.
[141] Hatfield, J.L., Boote, K.J., Kimball, B.A., Ziska, L.H., Izaurralde, R.C., Ort, D., Thomson, A.M. and Wolfe, D., 2011. Climate impacts on agriculture: implications for crop production. Agronomy journal, 103(2), pp.351-370.
142 Ali, S., Liu, Y., Ishaq, M., Shah, T., Ilyas, A. and Din, I.U., 2017. Climate Change and Its Impact on the Yield of Major Food Crops: Evidence from Pakistan. Foods, 6(6), p.39.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 Years Average (1981-2016) - A | 4.93 | 7.88 | 13.37 | 18.98 | 24.53 | 27.44 | 27.65 | 26.30 | 23.50 | 17.29 | 11.09 | 6.23 |
| Last 10 Years Average (2007-16) - B | 5.33 | 8.60 | 14.82 | 20.81 | 26.06 | 28.31 | 28.71 | 27.43 | 24.95 | 19.14 | 12.29 | 7.00 |
| First 10 Years Average (1981-90) - C | 4.03 | 6.29 | 11.79 | 17.04 | 22.87 | 26.14 | 26.19 | 24.78 | 21.42 | 15.09 | 9.39 | 4.52 |

Figure A3.7: Average Monthly Minimum Temperature °C - Rahim Yar Khan

*Table A3.11: Differences between different averages of monthly minimum temperature in Rahim Yar Khan*

| Months | Difference Between 36 Years Average and Last 10 Years Average (A - B) | Difference Between First 10 Years Average and Last 10 Years Average (C - B) | Difference Between 36 Years Average and First 10 Years Average (A - C) |
|---|---|---|---|
| **JAN** | -0.41 | -1.30 | 0.90 |
| **FEB** | -0.73 | -2.31 | 1.59 |
| **MAR** | -1.45 | -3.03 | 1.58 |
| **APR** | -1.82 | -3.77 | 1.94 |
| **MAY** | -1.53 | -3.19 | 1.66 |
| **JUN** | -0.87 | -2.17 | 1.30 |
| **JUL** | -1.05 | -2.52 | 1.46 |
| **AUG** | -1.12 | -2.65 | 1.52 |
| **SEP** | -1.45 | -3.53 | 2.08 |
| **OCT** | -1.84 | -4.05 | 2.20 |
| **NOV** | -1.20 | -2.90 | 1.70 |
| **DEC** | -0.76 | -2.48 | 1.71 |

It is evident that in RYK the differences between 36 years averages and Last 10 years' averages are higher than MZFR both in terms of incidences and intensity for all the climatic variables. Probably this explains the reason why it has high risk of exposure to natural shocks as also reported in the section 2.2.3 (Integrated Context Analysis)

## A3.4 LIMITATIONS OF AGRO-CLIMATIC DATA

There is no observatory of Pakistan Meteorological Department in MZFR. Hence, the climatic profile of MZFR is based on data of Multan observatory, as advised by PMD. Multan observatory is the closest to MZFR. The climatic profile of RYK is based on data of Khanpur observatory. Khanpur is a Tehsil of RYK district and is adjacent to RYK Tehsil. RYK also has an observatory at the Sheikh Zayed Airport. It was established in 1995. PMD didn't share the data of that observatory with us because minimum 30 years data is required for any climate related research. However during the visit to observatory at Sheikh Zayed Airport, the field researcher requested the concerned staff to share data. The staff was reluctant to share the data due to the same reason that it is short term data. They agreed to allow the researcher to have a look at the 16 years averages (2001-16) of Monthly Precipitation and Monthly Mean Temperature. Upon further request, they allowed to note down those figures but forbade reporting the figures.

To underscore the importance of Weather Stations in reliable forecasting and management of Weather Index Based Insurance, the authors can assure the readers that there is significant difference between the 16 Years Averages of Monthly Precipitation and Monthly Mean Temperature calculated from Khanpur observatory data and the averages given by RYK Airport observatory. Authors are giving this importance to location of weather stations following the experience of India regarding Weather Bases Crop Insurance Scheme.

Here it is also important to mention the experience of Pakistan Microfinance Investment Company (PMIC) which launched the Crop Insurance Scheme in Pakistan. According to PMIC's respondent, no matter how rigorous index is made on the basis of agriculture or climatic data, it will not reflect the ground reality. Farmers tell a different story regarding yields and weather. So when PMIC-PPAF had tried to launch Weather Index Based Insurance in Talagang and Soon Valley, they had to revise the Index values after consultation with the community.

Table A3.10 shows the Roster information collected from farmers in the field. The yields reported by them differ from the yields reported by the Crop Reporting Service as presented in the Tables A3.2 and A3.3.

## A3.5 MAJOR CLIMATIC EVENTS

Record of floods could only be obtained from the secondary sources. Both MZFR and RYK were adversely hit by floods in 1993, 2010 and mildly hit in 2013.When anecdotal evidences were sought from farmers regarding incidences of drought and windstorms/hailstorms, they only reported that windstorms/hailstorms are a more frequent phenomenon than droughts.

### *3.5.1 Seasonality of Shocks*

From a seasonal point of view, the farmers reported that they faced dry spells and extreme temperature mostly in the months of June and July, which may detriment the Cotton crop and in some cases Mango too.

Windstorms, hailstorms and untimely rains, they consider, are difficult to restrict to a particular season. They are more frequent and more erratic.

# ANNEXURE 4: QUANTITATIVE ANALYSIS

**(Continued from Section 4.6)**

*Table A4.1 Impacts of Agriculture Risks on Farm Yields and Income*

| Impact of Major Agriculture Risks on Farm Yield and Income | | | Land Size (Acres) | | |
|---|---|---|---|---|---|
| | | | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) |
| Non-Climatic Risks | Non-Availability of Certified Seeds | Negligible Effect | 3% | 0% | 0% |
| | | Moderate Effect | 62% | 41% | 44% |
| | | Severe Effect | 36% | 59% | 56% |
| | Non-Affordability of Certified Seeds: | Negligible Effect | 1% | 0% | 0% |
| | | Moderate Effect | 55% | 36% | 44% |
| | | Severe Effect | 43% | 64% | 56% |
| | Non-Availability of Quality Fertilizer: | Negligible Effect | 1% | 0% | 0% |
| | | Moderate Effect | 59% | 35% | 47% |
| | | Severe Effect | 39% | 65% | 53% |
| | Non-Affordability of Quality Fertilizers: | Negligible Effect | 1% | 4% | 0% |
| | | Moderate Effect | 60% | 26% | 50% |
| | | Severe Effect | 39% | 70% | 50% |
| | Non-Availability of Quality Pesticides: | Negligible Effect | 1% | 0% | 6% |
| | | Moderate Effect | 55% | 33% | 29% |
| | | Severe Effect | 44% | 67% | 65% |
| | Non-Affordability of Quality Pesticides: | Negligible Effect | 1% | 0% | 0% |
| | | Moderate Effect | 55% | 33% | 41% |
| | | Severe Effect | 44% | 67% | 59% |
| | Non-availability of Cheap Borrowing Sources: | Negligible Effect | 5% | 0% | 6% |
| | | Moderate Effect | 66% | 50% | 65% |
| | | Severe Effect | 29% | 50% | 29% |
| | Non-Accessibility to Cheap Borrowing Sources: | Negligible Effect | 0% | 0% | 0% |
| | | Moderate Effect | 64% | 47% | 69% |
| | | Severe Effect | 36% | 53% | 31% |
| Market Risks | Monopoly of Middlemen: | Negligible Effect | 5% | 5% | 0% |
| | | Moderate Effect | 54% | 36% | 29% |
| | | Severe Effect | 41% | 59% | 71% |
| | Non-accessibility to markets: | Negligible Effect | 2% | 0% | 0% |
| | | Moderate Effect | 57% | 25% | 31% |
| | | Severe Effect | 41% | 75% | 69% |

| | | | | | |
|---|---|---|---|---|---|
| | Higher transport/transaction costs: | Negligible Effect | 3% | 5% | 0% |
| | | Moderate Effect | 69% | 45% | 35% |
| | | Severe Effect | 29% | 50% | 65% |
| | Volatility of Produce Prices: | Negligible Effect | 8% | 0% | 0% |
| | | Moderate Effect | 65% | 50% | 44% |
| | | Severe Effect | 27% | 50% | 56% |
| | Volatility of Input Prices: | Negligible Effect | 3% | 5% | 0% |
| | | Moderate Effect | 57% | 20% | 31% |
| | | Severe Effect | 40% | 75% | 69% |
| Climatic Risks | Droughts: | Negligible Effect | 13% | 18% | 0% |
| | | Moderate Effect | 60% | 36% | 40% |
| | | Severe Effect | 26% | 45% | 60% |
| | Windstorms: | Negligible Effect | 11% | 4% | 0% |
| | | Moderate Effect | 61% | 42% | 39% |
| | | Severe Effect | 28% | 54% | 61% |
| | Flood: | Negligible Effect | 9% | 15% | 0% |
| | | Moderate Effect | 70% | 23% | 29% |
| | | Severe Effect | 22% | 62% | 71% |
| | Shortage of Canal Water: | Negligible Effect | 1% | 0% | 0% |
| | | Moderate Effect | 49% | 33% | 20% |
| | | Severe Effect | 50% | 67% | 80% |
| | Untimely Rains: | Negligible Effect | 3% | 0% | 0% |
| | | Moderate Effect | 51% | 40% | 22% |
| | | Severe Effect | 46% | 60% | 78% |
| Institutional Risks | Lack of Advisory Service from Agriculture Extension Department: | Negligible Effect | 1% | 0% | 0% |
| | | Moderate Effect | 64% | 84% | 67% |
| | | Severe Effect | 35% | 16% | 33% |
| | Lack of Advisory Service from Plant Protection Department: | Negligible Effect | 1% | 0% | 0% |
| | | Moderate Effect | 62% | 73% | 73% |
| | | Severe Effect | 37% | 27% | 27% |
| | Lack of Advisory Service from Livestock Department: | Negligible Effect | 3% | 0% | 0% |
| | | Moderate Effect | 63% | 89% | 75% |
| | | Severe Effect | 34% | 11% | 25% |
| Resource | Shortage of farm labor: | Negligible Effect | 6% | 0% | 0% |
| | | Moderate Effect | 83% | 76% | 89% |
| | | Severe Effect | 11% | 24% | 11% |
| | Non-affordability of farm labor: | Negligible Effect | 3% | 0% | 0% |
| | | Moderate Effect | 89% | 90% | 80% |

| | | | | | |
|---|---|---|---|---|---|
| | | Severe Effect | 8% | 10% | 20% |
| | Personal diseases: | Negligible Effect | 4% | 0% | 0% |
| | | Moderate Effect | 68% | 36% | 44% |
| | | Severe Effect | 28% | 64% | 56% |
| | Disease to labor: | Negligible Effect | 5% | 5% | 0% |
| | | Moderate Effect | 66% | 38% | 53% |
| | | Severe Effect | 29% | 57% | 47% |

*Table A4.2 Frequency of Poor Growing Season for Cotton During Past 5 Years*

| Year | Land Size (Acres) | | | Total |
|---|---|---|---|---|
| | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) | |
| 2012-13 | 1 | 2 | 0 | 3 |
| | 1.4% | 7.4% | 0.0% | |
| 2013-14 | 21 | 4 | 0 | 25 |
| | 29.2% | 14.8% | 0.0% | |
| 2014-15 | 12 | 6 | 4 | 22 |
| | 16.7% | 22.2% | 36.4% | |
| 2015-16 | 27 | 10 | 5 | 42 |
| | 37.5% | 37.0% | 45.5% | |
| 2016-17 | 11 | 5 | 2 | 18 |
| | 15.3% | 18.5% | 18.2% | |
| Total | 72 | 27 | 11 | 110 |

*Table A4.3 Impact of Different Risks on Crops According to Stage of Crop*

| Risk Factors Wheat | | Land Size (Acres) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-5 | 5.1-12.5 | 12.6 & above | 0-5 | 5.1-12.5 | 12.6 & above | 0-5 | 5.1-12.5 | 12.6 & above |
| | | Sowing Stage | | | Growing Stage | | | Maturity Stage | | |
| Climatic Factors | No opinion | 6% | 6% | 5% | 7% | 12% | 0% | 11% | 9% | 0% |
| | No effect | 19% | 31% | 18% | 16% | 6% | 18% | 7% | 14% | 10% |
| | Somewhat Effect | 46% | 34% | 45% | 35% | 39% | 27% | 40% | 40% | 24% |
| | Moderate Effect | 25% | 28% | 27% | 36% | 27% | 41% | 22% | 11% | 33% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Severe Effect | 4% | 0% | 5% | 6% | 15 % | 14% | 20 % | 26% | 33% |
| Poor Quality of Inputs | No opinion | 10% | 14% | 10% | 8% | 29 % | 5% | 12 % | 18% | 10% |
| | No effect | 15% | 31% | 14% | 19 % | 15 % | 18% | 12 % | 26% | 15% |
| | Somewhat Effect | 30% | 20% | 19% | 31 % | 15 % | 9% | 36 % | 26% | 30% |
| | Moderate Effect | 23% | 9% | 19% | 24 % | 18 % | 27% | 21 % | 9% | 10% |
| | Severe Effect | 22% | 26% | 38% | 18 % | 24 % | 41% | 19 % | 21% | 35% |
| Market factors | No opinion | 19% | 20% | 5% | 16 % | 26 % | 5% | 11 % | 11% | 5% |
| | No effect | 15% | 23% | 25% | 16 % | 9% | 24% | 15 % | 14% | 15% |
| | Somewhat Effect | 31% | 37% | 25% | 37 % | 32 % | 29% | 28 % | 46% | 25% |
| | Moderate Effect | 15% | 3% | 5% | 17 % | 15 % | 0% | 22 % | 11% | 5% |
| | Severe Effect | 20% | 17% | 40% | 14 % | 18 % | 43% | 23 % | 17% | 50% |
| Non-availability of cheaper borrowing options: | No opinion | 45% | 46% | 29% | 44 % | 47 % | 18% | 42 % | 45% | 20% |
| | No effect | 24% | 17% | 14% | 29 % | 12 % | 18% | 27 % | 15% | 20% |
| | Somewhat Effect | 17% | 17% | 24% | 22 % | 21 % | 23% | 18 % | 18% | 25% |
| | Moderate Effect | 10% | 14% | 33% | 4% | 9% | 41% | 10 % | 15% | 25% |
| | Severe Effect | 3% | 6% | 0% | 1% | 12 % | 0% | 3% | 6% | 10% |
| Labor Related Issues | No opinion | 11% | 14% | 10% | 18 % | 12 % | 10% | 20 % | 21% | 16% |
| | No effect | 51% | 37% | 33% | 48 % | 45 % | 35% | 49 % | 33% | 32% |
| | Somewhat Effect | 24% | 34% | 38% | 23 % | 27 % | 30% | 18 % | 30% | 16% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Moderate Effect | 9% | 14% | 19% | 9% | 15 % | 20% | 10 % | 12% | 32% |
| | Severe Effect | 5% | 0% | 0% | 2% | 0% | 5% | 2% | 3% | 5% |
| Non-Availability of Machinery/Equipment: | No opinion | 6% | 12% | 10% | 12 % | 12 % | 10% | 12 % | 12% | 11% |
| | No effect | 34% | 26% | 29% | 44 % | 41 % | 43% | 33 % | 29% | 17% |
| | Somewhat Effect | 32% | 29% | 24% | 20 % | 12 % | 24% | 27 % | 24% | 22% |
| | Moderate Effect | 15% | 18% | 19% | 13 % | 21 % | 14% | 18 % | 18% | 17% |
| | Severe Effect | 12% | 15% | 19% | 10 % | 15 % | 10% | 10 % | 18% | 33% |
| Canal Water Issues | No opinion | 16% | 9% | 14% | 17 % | 18 % | 14% | 10 % | 12% | 21% |
| | No effect | 14% | 23% | 5% | 14 % | 21 % | 14% | 21 % | 18% | 11% |
| | Somewhat Effect | 13% | 9% | 5% | 12 % | 6% | 5% | 13 % | 18% | 5% |
| | Moderate Effect | 15% | 26% | 38% | 15 % | 21 % | 29% | 14 % | 18% | 26% |
| | Severe Effect | 41% | 34% | 38% | 41 % | 33 % | 38% | 43 % | 33% | 37% |
| Pest Attacks: | No opinion | 38% | 60% | 50% | 41 % | 63 % | 47% | 40 % | 66% | 53% |
| | No effect | 18% | 20% | 10% | 14 % | 13 % | 16% | 21 % | 21% | 12% |
| | Somewhat Effect | 7% | 3% | 10% | 14 % | 10 % | 11% | 9% | 3% | 12% |
| | Moderate Effect | 6% | 3% | 10% | 4% | 3% | 11% | 3% | 0% | 0% |
| | Severe Effect | 31% | 13% | 20% | 27 % | 10 % | 16% | 27 % | 10% | 24% |
| Poor growing season in the previous season: | No opinion | 22% | 26% | 24% | 27 % | 32 % | 30% | 22 % | 21% | 32% |
| | No effect | 18% | 26% | 14% | 17 % | 24 % | 20% | 21 % | 21% | 21% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Somewhat Effect | 5% | 9% | 19% | 8% | 18 % | 20% | 10 % | 15% | 11% |
| | Moderate Effect | 14% | 14% | 24% | 9% | 3% | 10% | 8% | 12% | 21% |
| | Severe Effect | 40% | 26% | 19% | 38 % | 24 % | 20% | 40 % | 32% | 16% |

*Table A4.4 Perceptions of Farmers About Climate Change*

| Perceptions of weather in recent year as compare to that in the years around 1988 | | Land Size (Acres) | | |
|---|---|---|---|---|
| | | 0-5 (n=109) | 5.1-12.5 (n=36) | 12.6 & above (n=22) |
| Length of the summer season has | Increased | 95.4% | 100.0% | 90.5% |
| | Decreased | 1.8% | 0.0% | 4.8% |
| | Unchanged | 2.8% | 0.0% | 4.8% |
| | Not Sure/Don't Know | 0.0% | 0.0% | 0.0% |
| Summer temperature at day time has | Increased | 100.0% | 100.0% | 95.2% |
| | Decreased | 0.0% | 0.0% | 4.8% |
| | Unchanged | 0.0% | 0.0% | 0.0% |
| | Not Sure/Don't Know | 0.0% | 0.0% | 0.0% |
| Summer temperature at night time has | Increased | 98.1% | 100.0% | 95.2% |
| | Decreased | 1.9% | 0.0% | 4.8% |
| | Unchanged | 0.0% | 0.0% | 0.0% |
| | Not Sure/Don't Know | 0.0% | 0.0% | 0.0% |
| Number of hot days in summer has | Increased | 100.0% | 100.0% | 95.2% |
| | Decreased | 0.0% | 0.0% | 4.8% |
| | Unchanged | 0.0% | 0.0% | 0.0% |
| | Not Sure/Don't Know | 0.0% | 0.0% | 0.0% |
| Number of hot nights in summer has | Increased | 84.3% | 69.4% | 81.0% |
| | Decreased | 14.8% | 30.6% | 19.0% |
| | Unchanged | 0.0% | 0.0% | 0.0% |
| | Not Sure/Don't Know | .9% | 0.0% | 0.0% |
| Length of the monsoon season has | Increased | 5.5% | 5.6% | 4.8% |
| | Decreased | 82.6% | 86.1% | 76.2% |
| | Unchanged | 7.3% | 5.6% | 9.5% |
| | Not Sure/Don't Know | 4.6% | 2.8% | 9.5% |
| Monsoon rainfall has | Increased | 7.4% | 0.0% | 19.0% |
| | Decreased | 86.1% | 91.4% | 76.2% |
| | Unchanged | 1.9% | 5.7% | 0.0% |

| | | | | |
|---|---|---|---|---|
| | Not Sure/Don't Know | 4.6% | 2.9% | 4.8% |
| Length of the winter season has | Increased | 10.2% | 5.6% | 14.3% |
| | Decreased | 81.5% | 91.7% | 81.0% |
| | Unchanged | 1.9% | 0.0% | 4.8% |
| | Not Sure/Don't Know | 6.5% | 2.8% | 0.0% |
| Winter temperature at day time has | Increased | 41.1% | 47.2% | 42.9% |
| | Decreased | 55.1% | 50.0% | 52.4% |
| | Unchanged | 3.7% | 0.0% | 4.8% |
| | Not Sure/Don't Know | 0.0% | 2.8% | 0.0% |
| Winter temperature at night time has | Increased | 41.2% | 46.7% | 47.4% |
| | Decreased | 49.5% | 40.0% | 47.4% |
| | Unchanged | 8.2% | 13.3% | 5.3% |
| | Not Sure/Don't Know | 1.0% | 0.0% | 0.0% |
| Number of cool days in winter has | Increased | 24.5% | 17.1% | 14.3% |
| | Decreased | 71.7% | 74.3% | 66.7% |
| | Unchanged | 2.8% | 5.7% | 14.3% |
| | Not Sure/Don't Know | .9% | 2.9% | 4.8% |
| Number of cool nights in winter has | Increased | 30.2% | 30.6% | 38.1% |
| | Decreased | 56.6% | 58.3% | 47.6% |
| | Unchanged | 9.4% | 8.3% | 9.5% |
| | Not Sure/Don't Know | 3.8% | 2.8% | 4.8% |
| Length of the winter rainy season has | Increased | 16.7% | 11.1% | 19.0% |
| | Decreased | 78.7% | 80.6% | 71.4% |
| | Unchanged | .9% | 2.8% | 4.8% |
| | Not Sure/Don't Know | 3.7% | 5.6% | 4.8% |
| In winter rain season, number of days with low rainfall has | Increased | 34.6% | 20.0% | 4.8% |
| | Decreased | 49.5% | 62.9% | 85.7% |
| | Unchanged | 2.8% | 2.9% | 0.0% |
| | Not Sure/Don't Know | 13.1% | 14.3% | 9.5% |
| In winter rain season, heavy rainfall has | Increased | 23.4% | 29.4% | 14.3% |
| | Decreased | 67.3% | 58.8% | 71.4% |
| | Unchanged | .9% | 5.9% | 4.8% |
| | Not Sure/Don't Know | 8.4% | 5.9% | 9.5% |

# ANNEXURE 5.1: INITIATIVES OF PUNJAB GOVERNMENT

## 1- Effective Pest Management In Cotton Crop Through Subsidized Provision Of Spray Machines In Core Cotton Districts Of Punjab [ Rs. 151.666 Million] April, 2017 To June, 2018

**Projects Objectives and Link with the Sector Objectives:**

Cotton production and area is continuously declining during last few years due to biotic and abiotic stresses and competition from other Kharif crops. The area and production of cotton during 2011-12 was 6.261 Million acres and 11.129 Million bales respectively which decreased to 5.582 Million acres (area) and 6.593 Million bales (production) during 2015-16 the area of cotton further decline to 44.388 million acres during 2016-17. Last 5 years data (given at **Annexure-ii**) revealed that fall of production in 2015-16, was drastic in area sown as well as yield in Punjab. Drastic fall in production and area of cotton was experienced during 2015-16 and 2016-17 respectively.

Therefore, this reduction in area is a threat to our economy and jobs of a significant number of populations as 1200 ginning factories, 400 textile mills, and 200 oil mills are working with cotton crop besides a huge population of farm workers from dibbling, weeding and picking at rural level. The traditional area of this crop in Punjab was around 6 million acres

A number of activities in Punjab have been started to rejuvenate the area under cotton crop through better offseason pest management, rain water management through establishment of water structures, distribution of gossyplures, lures and traps for Pink Bollworm, standardization of pesticides for pests having significance, registration of seed dealers, monitoring of farmers training programs, regular meetings of Cotton Crop Management Group and consultative groups, massive subsidy on agriculture inputs, ensuring quality of inputs. However, the most important factor to sustain cotton production is the correct use of pesticides through a proper spray having recommended pressure, nozzle, skilled spray man, correct pesticides after pest scouting etc. as under dosing cannot give the desired coverage and control needed. Overdosing is expensive as it wastes pesticide and increases the potential for groundwater contamination, development of resistance in insects against particular insecticides.

In spraying systems, nozzles break the liquid into droplets and form the spray pattern. Nozzles determine the application volume at a given operating pressure, travel speed, and spacing. Selecting nozzles that produce the largest droplet size, while providing adequate coverage at the intended application rate and pressure, can minimize drift. The hollow cone nozzles for effective spraying have been provided under the project "Promotion of Agriculture Mechanization in Punjab' in each cotton villages and a practical demonstration was also arranged to educate the farmers. However, it

has been found that the farmers are having poor quality spray machines with less pressure and there is a great demand of correct spray machines in cotton areas .The use of proper sprayer can help in effective control of cotton insects.

Therefore, this project has been proposed in continuity of the nozzle scheme to subsidize pesticide sprayers in Cotton crop districts. All the three types of spray machines; Hand prayer, power sprayer and tractor mounted boom sprayer will be offered to the farmers for effective control of cotton insects and ultimately its productivity enhancement. The envisaged project targets would be achieved through undertaking following activities:

I) Demonstration on management of insect pest, diseases and weeds through best spray application with sprayers.

II) Promotion of best sprayer application techniques through provision of hand sprayer, power sprayer and tractor mounted boom sprayers to farmers on subsidy in core and non-core Cotton districts.

III) Publicity through use of print and electronic media.

IV) Increased farmers income through increased crop productivity by effective control of insects and weeds, diversified agricultural practices.

**Location of Project:** 11 core cotton growing districts in Punjab Multan, Khanewal, Lodhran, Vehari, Bahawalpur, Bahawalnagar, **R.Y.Khan**, D.G.Khan, Layyah, **Muzaffargarh** and Rajanpur

**ESTIMATED BENEFITS OF SPRAY MACHINES FOR FIVE YEARS**

| Year | Name of spray machines of different categories | | | | Total Area to be Covered by Spray Machine (Acres) | Incremental production @ 5% (One Mds/Acre) | Monetary Value of Enhanced Production @ Rs.3000/Mds (Rs. In Million) |
|---|---|---|---|---|---|---|---|
| | Hand Sprayer | Power Sprayer | Tractor Mounted Sprayer | Total | | | |
| 1 | 3642 | 1516 | 758 | 5916 | 104640 | 104640 | 313.920 |
| 2 | 7284 | 3032 | 1516 | 11832 | 209280 | 209280 | 627.840 |
| 3 | 7284 | 3032 | 1516 | 11832 | 209280 | 209280 | 627.840 |
| 4 | 7284 | 3032 | 1516 | 11832 | 209280 | 209280 | 627.840 |
| 5 | 3642 | 1516 | 758 | 5916 | 104640 | 104640 | 313.920 |
| TOTAL | 29136 | 12128 | 6064 | 47328 | 837120 | 837120 | 2511.360 |

## 2- Improvement/ Modernization Of Agricultural Produce Markets (Phase-I) [Rs. 492.1 Million] March 2017 To June 2018

**Project Objectives**

The project is intended to strengthen the capacity of agriculture produce markets for catering the changing global scenario of agriculture produce marketing. The specific objectives of the project are as under.

i. To collect real time arrival data of the agriculture produce for information of growers through weighbridges and use the scientific data of weight for analysis and policy recommendations.
ii. To undertake pictorial evidence based market intelligence services expeditiously regarding supply and price situation of agricultural produce in different markets through android mobile phones.
iii. To improve security situation in agricultural produce markets for all the stakeholders of agriculture marketing system.
iv. To improve/ provide platforms and sheds (at platform) in agricultural produce markets.
v. Reduction in post-harvest losses in Paddy, Maize, Potato and Mango to the extent of 3 -5% through provision of value addition technology in target areas.
vi. Build and increase the farmers capacity to standardize agri. Produce and capability to reduce wastage of their produce in order to get maximum return in domestic as well as international market

**Relationship of the project with objectives of the sector**

The project is in line with the objectives of the sector as it promotes regulation of sale and purchase of agricultural produce through better market intelligence services, promotion of grading facilities. It also supports grower's sustainability through getting better returns from well graded agricultural produce. It also provides suitable and safe business environment in the markets for stakeholders of agricultural produce. The proposed project objectives also consistent with overall objectives of the agriculture sector for increasing farm quality product ensuring food security, enhancing farm returns, economic uplift of small farmers, and improving agricultural economy of the country as a whole. It is pertinent to mention that proposed project is in line with the Agriculture Sectoral Plan and Punjab Growth Strategy 2018 having strong relationship with the its growth objectives. Medium Term Development Framework (MTDF) of the P&DD envisages horizontal and vertical enhancement in crop productivity through resource conservation by promoting innovative value addition of agricultural products to increase the national and international marketing.

## 3- Extension Service 2.O -Farmer Facilitation Through Modernized Extension. [Rs. 4104 Million] July, 2015 To June 2020

**Project Objectives**

Soil analysis is not only critically required for accuracy in fertilizer applications but is also needed to increase the efficiency through soil sample information and soil test calibration that also reflect both crop and profit response. The goal of soil testing is to provide an accurate assessment of the soil's fertility status, which can be used to make fertilizer recommendations. Thus, in addition to creation of awareness about correct fertilizer application, soil tests can also be used to determine where fertilizers or manure should not be applied. Furthermore, development of soil database by using ICT tools such as GIS is also the need of the day to make this information public with more certainty and reliability.

Moreover, any such information or scientific research will have real impact on farm productivity and livelihoods only if this intervention and methodology is adopted. The increase in adoption process is linked with improvement in service delivery of the extension service. There are many frailties of this service which require a major overhauling to work according to the required level and expectation due to multifarious reasons e.g. devolution of extension service to the District Governments, abolition of training wing of extension service after devolution, increase in research-extension gap, descent in professional competency, non-operational fleet of field vehicles, non-provision of motorbikes to Field Assistants since long, lack of both provision and adaptation of modern ICT gadgets and tools, lack of connectivity of extension agents with crop specialists, lack of funding to refurbish the offices of field assistants in union councils etc. Therefore, new vision, decision and approaches are needed after situation analysis to improve service delivery through extension network. Thus, based on these observations the major objectives for the project to capture soil attributes and improvement in extension delivery system are as under:

I. Development of soil attributes database and its GIS mapping.

II. Strengthening of capacity of existing soil Laboratories

III. Identification of Crop Specialists from Universities, Research and Extension Organizations for on line advice to the extension agents and farmers.

IV. Improvement in Service Delivery, through Extension service by provision of missing facilities to the extension agents for field work to respond to the queries of the farmers through dedicated visits and establishment of dedicated monitoring system at each nodal point.

V. Registration of four farms from each village with regular expansion program to reach every farm within life of the project according to soil test plan

VI. Adoption of latest extension approaches and tools for regular interaction with registered and other farmers through field visits, plant clinics, farmer's training, inbound/outbound calls, and helpline/complaint line with IVR facilities.

VII. Provision of outbound survey call facility SMS/MMS query and SMS/MMS Broad casting service, pre-recorded calls/ Robot calls with response capture facility etc. and other mechanisms/technologies to connect with agriculture farmers.

VIII. Establishment of helpline with complaint management systems and it also includes provision of application/ portal management system for sending out the customized SMS messages and/or Robot calls to agriculture farmers.

IX. Redressal of farmer issues relating to agriculture technology and input management etc.

X Strengthening of the existing laboratories of Soil Survey of Punjab.

XI Strengthening of the Information System Unit, Soil Survey of Punjab.

## 4- Establishment Of Model Farms Linked With Improved Supply Chain And Value Addition [Rs. 3,261.191 Million] January 2017 To June 2021

**Project Objectives**

Main objective of the project is to establish model farms to produce quality selected agricultural products best quality products and enhance their export, especially in the high end markets of different countries demanding Pakistani products having quality, good taste and cosmetic beauty. Followings are the specific objectives of the proposed project:-

**i) Export promotion by addressing constraints of SPS and WTO,**

Since it is necessary to produce products for export promotion that are compliant to Sanitary & Phyto-Sanitary (SPS) standards, therefore, the main objective of the Project are to improve the quality of the produce so that they are fully complaint to international standards and are traceable in terms of their origin, quality, safety and hygiene. A brief about International Certifications having demand in the International Market is given in **Annexure-1.**

**ii) Development of supply chain infrastructure,**

It is proposed to build capacity of all the four stakeholders of supply chain for development of supply chain infrastructure, i.e. farm bases, suppliers/processors, logistics and traders/exporters in respective areas to acquire certification and (b) provide infrastructure to meet requirements of Global GAP and other certifications.

**iii) Incentive structure for private sector**,

The interventions for this purpose to upgrade the standards have been divided into two categories, i.e.

**a)** Software interventions comprising of capacity building services and certification audit for all the components of supply chain i.e. Farm Level, Processing Level, Logistic companies and traders / exporters.

**b)** Hardware interventions comprising of provision of machinery and equipment and civil works (if required) to improve quality of the produce.

**iv) Establishment of farmers and marketing linkages,**

Farmer's-marketing linkages will be ensured through integrated supply chain approach which has been designed in a way in which the supplier acts as the focal point who performs functions of a collection point (to receive products from farm bases) and trading platform (marketing after grading, packing or processing).

**v) Facilitate group marketing and business clusters for scale economies**.

It is proposed that farmers of a cluster will be encouraged for facilitation of group marketing and business clusters for scale economies to function as business entity and for the purpose, it is proposed to provide on-farm / off farm grading, packing, processing and storage facilities to 50 selected enterprises.

Marketing of the agricultural produce in the International markets and domestic markets is of prime importance and without an aggressive marketing strategy all the efforts of meeting SPS requirements and International certifications would go waste. International and National market linkage program will create a pull factor and create demand of certified produce at a better price thus creating attraction for the producers.

## 5- INTEREST FREE LOANS

In order to support Punjab Government efforts to increase agri. produce as well as to alleviate rural poverty among small and poor farming segment of the society, the Mark up free loan scheme has been launched in Punjab. The scheme is unique in terms of provision of subsidy (free of mark-up) by the Govt. of Punjab for provision of quality input loans to the farmers by facilitating them free of cost registration at Suhulat Centres to be maintained by Land Record Management Information System (LRMIS) in collaboration with Punjab Information Technology Board (PITB). The disbursement of the loan would be made to the farmers through open mobile wallets of Telcos linked with Assan Account.

**TERMS & CONDITIONS**

| Operational Jurisdiction | The scheme has been launched in all districts of Punjab province. |
|---|---|
| **Eligibility** | 1. The farmers having land ownership ranging from 2.5 acres up to 12.5 acres are eligible to apply. However, Mark-up subsidy would be paid by the GoPb up to 05 acres on timely repayment of loan.<br>2. The applicant farmer should be the resident of same rural union council where the land is located.<br>3. The borrower must have valid copy of CNIC.<br>4. Clear CWR<br>5. ORR rating up to 4 |
| **Tenure** | The scheme will be available for Rabi & Kharif crops for 05 years from 2016-17 to 2020-21. |
| **Documents Required** | 1. Loan Case File/Booklet.<br>2. E-Pass Book/Agri. Pass Book.<br>3. Khasra Girdawari, Copy of sanctioned mutation holding valid legal charge on property taken as security in favor of Bank.<br>4. Two recent photographs and valid copy of CNIC. |
| **Maximum Loan Limit** | The maximum loan limit for the scheme is Rs. 325,000/- per borrower/party for input/production loan which would be provided in three (03) installments on seasonal basis. Bifurcation of the same is given below:-<br><br>1. For Rabi crops up to Rs. 25,000/- per acre<br>2. For Kharif crops Rs. 40,000/- per acre. |
| **Collateral** | All types of tangible securities/properties acceptable to the Bank including agriculture land under Pass Book System/digitalized/e-Pass Book. |
| **Insurance** | As per Federal Government/SBP instructions regarding Crop Loan Insurance Scheme (CLIS), insurance coverage would only be allowed for four major crops namely, Wheat, Cotton, Rice & Maize under the scheme. |
| **Utilization** | Since the verification of processed loans will be conducted by the GoPb through chartered accountant firms hence utilization of loans should be vigilantly/timely checked by the respective MCOs, Branch Managers, Zonal Chiefs and Internal Auditors of the Bank as per prescribed criteria/ standing instructions of the Bank. |
| **Repayment Schedule** | The loan to be advanced for Rabi crops (to be disbursed from 1st October to 31th March) would be recoverable on 7th July and for Kharif crops (to be disbursed from 1st April to 30th September) on 7th January. |
| **Rate of Mark Up** | The loan for first two years would be free of Mark-up whereas for the third, fourth & fifth year the borrowers would bear 4%, 8% & 12 % Mark-up cost respectively. |
| **Monitoring & Evaluation** | Banks (NRSP, ZTBL, Akhuwat, Tameer and NBP) will facilitate the Audit Firm for verification of at least 10% of disbursed loans as appointed by the Department of Agriculture, Govt. of Punjab Lahore. |

## 6- PEST SCOUTING AND SAMPLING OF PESTICIDES

In the Kharif season 2017, Plant Protection Department conducted pest scouting for cotton crop over an area of 239,681 acres – 44,028 farms. 24,347 hot spot areas were identified. Pest control was ensured in the hotspot areas. Moreover, 9,989 samples of pesticides were examined. 574 (5.99%) were found to be of low quality[143].

## 7- SOIL TESTING

Agriculture Extension Department has set the target of testing 710,000 soil samples till June 2018. After the soil analysis farmers will be guided about the right nature and quantity of fertilizers and soil supplements they need to apply to their farms[144].

## 8- HIGH EFFICIENCY IRRIGATION SYSTEMS AND CLIMATE SMART TECHNOLOGY

Punjab government has announced subsidy of 60% on sprinkler irrigation system, 50% setting up of tunnels and 80% on installation of solar system for powering sprinklers. Total subsidy to be provided under this initiative is Rs. 2.25 Billion. In 2016-17 these three were installed on 11,000 acres, 350 acres and 1500 acres respectively[145].

## 9- ESTABLISHMENT OF HIGH TECHNOLOGY IMPLEMENTS/ MACHINERY SUPPLY CENTERS

Govt. of Punjab has announced a package of Rs. 1.8 Billion for establishment of high technology machinery service centres. Subsidies will be granted to desirous firms or cooperatives of **Rahim Yar Khan**, Sahiwal, Faisalabad, Bahwalnagar, Vehari, Sheikhupura, Bahwalpur, Gujranwala, Qasur, Jhang, Sargodha, Okara, Khanewal, **Muzaffargarh**, Lodhran, Multan, Chakwal and DG Khan[146].

## 10- PROVISION OF QUALITY WHEAT SEED THROUGH A LUCKY DRAW

The Rabi season 2017-18 is the second season in which this scheme is being practiced. Under this scheme quality wheat is provide to progressive farmers having land ownership of 2 to 25 acres. The draw is held in the village and is managed by local government representatives and Punjab Seed Corporation. The winner is bound to sow that seed in his field and not sell the produce in market. Rather he signs an undertaking to sell his produce to the fellow farmers so that the latter can use that as a seed in the next sowing season.

## 11- SUBSIDY ON DAP AND POTASH FERTILIZER

The subsidy is provided in the form of vouchers which are sealed in bags of DAP fertilizer. Farmers/stakeholders need to type voucher number along with their CNIC number and send it to 8070 through SMS. A verification message is sent to them and subsequently, the farmer will be able to avail a subsidy of Rs. 150 per voucher through mobile cash agents.

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[143] http://www.agripunjab.gov.pk/system/files/Pest%20Warning16-09-2017.pdf

[144] http://www.agripunjab.gov.pk/system/files/19-09-2017%20%28DGA%28R%29Health%20Card%29.pdf
http://www.agripunjab.gov.pk/system/files/18-09-2017%28%20CM%20Package-Climate%20Smart%20Tech%29.pdf

[145] http://www.agripunjab.gov.pk/system/files/18-09-2017%28%20CM%20Package-Climate%20Smart%20Tech%29.pdf

[146] http://www.agripunjab.gov.pk/system/files/Zarai%20Machinery_3.pdf

A farmer can get subsidy vouchers for up to 20 bags of DAP fertilizer. This subsidy is being provided to all farmers registered under the Kissan package.

Similarly, a subsidy of Rs. 500 and Rs. 800 is also being provided through e-vouchers on Potash fertilizers.

## 12- PROVISION OF SUBSIDY TO PROMOTE CANOLA AND SUNFLOWER SOWING

The Department of Agriculture has made a comprehensive plan for increase of area and production of oil seed crop in Punjab with a total subsidy of Rs. 500 Million. Therefore, Department Will subsidize 100,000 acres of sunflower and rapeseed @ Rs.5000-6000/bag of oil seed depending upon the difference between Cost of production and market price. Subsidy is provided through vouchers which are places in the seed bags. Farmers can cash the vouchers at branchless banking service centres.

## 13- PILOT TESTING - CROP INSURANCE FOR SMALL FARMERS

Natural factors affecting crop yield usually disturb farm budget resulting bad economic condition of poor farmers (2010 Flood, 2015 Kharif Crop Disaster etc.), therefore, Government wants to promote crop insurance for strengthening crop security, in addition to document crop economy.

# ANNEXURE 5.2: SCALE OF FINANCE

5.2.1 Cost of Production of Wheat Crop 2013-14 under Average Conditions and Sources in the Punjab.

| S.NO | Operation /Inputs | 2012-2013 | | | 2013-2014 | | |
|---|---|---|---|---|---|---|---|
| | | No of oprs/units/acre | (Rate/unit) Rs | Cost/Acre Rs | No of oprs/units/acre | (Rate/unit) Rs | Cost/Acre Rs |
| **1** | **LAND PREPARATION** | | | | | | |
| | 1.1 Deep ploughing | 0.3 | 1339.52 | 402 | 0.3 | 1420 | 426 |
| | 1.2 Ploughing/Cultivation | 2 | 589.68 | 1179 | 2 | 625 | 1250 |
| | 1.3 Planking | 2 | 294.32 | 589 | 2 | 312 | 624 |
| | 1.4 Leveling | | | | | | |
| | **Sub Total** | | | 2170 | | | 2300 |
| 2 | **SEED AND SOWING OPERATION** | | | | | | |
| | 2.1 Seed (Kg) | 50 | 37 | 1850 | 50 | 38 | 1900 |
| | 2.2 Seed treatment | | | 60 | | | 60 |
| | 2.3 SOWING | | | | | | |
| | 2.3.1 Ploughing /Cultivation | 2 | 589.68 | 1179 | 2 | 625 | 1250 |
| | 2.3.2 Planking | 2 | 294.32 | 589 | 2 | 312 | 624 |
| | 2.3.3 Bund making (Man Days) | 0.5 | 300 | 150 | 0.5 | 300 | 150 |
| | 2.3.4 Charges for Pora/Kera or Tracter with Drill | 1 | 589.68 | 590 | 1 | 625 | 625 |
| | Sub Total | | | 4418 | | | 4609 |
| **3** | **FERTILIZER: (bags)** | | | | | | |
| | 3.1 Urea | 1.5 | 1700 | 2550 | 1.5 | 1750 | 2625 |
| | 3.2 DAP | 1 | 3800 | 3800 | 1 | 3900 | 3900 |
| | 3.3 Transportation | 2.5 | 18 | 45 | 2.5 | 20 | 50 |
| | 3.4 Fertilizer Application (M.days) | 0.5 | 300 | 150 | 0.5 | 300 | 150 |
| | **Sub Total** | | | 6545 | | | 6725 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **4** | **INTERCULTURE** | | | | | | |
| | 4.1 Bar Harrow/Weeding | - | - | - | - | - | - |
| **5** | **PLANT PROTECTION** | | | | | | |
| | 5.1 Weedicides/Herbicides | | | 950 | | | 1000 |
| **6** | **IRRIGATION** | | | | | | |
| | 6.1 Canal (Water Rate) | | | 56.3 | | | 56.3 |
| | 6.2 Private tube wells(3Hrs@Rs315/ 334/ Hour) | 2 | 945 | 1890 | 2 | 1002 | 2003.4 |
| | **Subtotal** | | | 1946 | | | 2060 |
| **7** | **LABOUR FOR IRRIGATION** | | | | | | |
| | 7.1Watercourse cleaning (M.days) | 1 | 300 | 300 | 1 | 300 | 300 |
| | 7.2 Labour charges for irrigation (M.days) | 1 | 300 | 300 | 1 | 300 | 300 |
| | **Subtotal** | | | 600 | | | 600 |
| **8** | **Farm yard Manure including transport and application 50% (trolley load)** | | | - | | | - |
| | TOTAL 1 TO 8 | | | 16629 | | | 17294 |
| **9** | **Mark up on investment @9% on Rs 16572.70/17238 for 6 Months on items (1-8) excluding water rates(6.1)** | 6 | 16572.7 | 746 | 6 | 17238 | 776 |
| **10** | **HARVESTING** | | | | | | |
| | 10.1 Harvesting charges (40 Kg) | 3 | 950 | 2850 | 3 | 1200 | 3600 |
| | 10.2 Threshing charges (1/10 of produce) | 115.7 | 23.75 | 2748 | 119 | 28.13 | 3347 |
| | 10.3 Threshing charges (Manual M. days) | | | - | | | - |
| | **Sub Total** | | | 5598 | | | 6947 |
| **11** | **Land Rent for 6 months@15000 /17000 PA** | 6 | 1250 | 7500 | 6 | 1417 | 8502 |
| **12** | **Management charges for 6 months of a manager @ Rs.12000 /13000 PM for 100 acres** | 6 | 120 | 720 | 6 | 130 | 780 |
| **13** | **Agriculture Income tax :6 months** | | | 48.52 | | | 48.52 |
| **14** | **Gross Cost (Item 1 to 13 )** | | | 31301.52 | | | 34347.52 |
| **15** | **Value of bhoosa @RS 150/170 (per 40 Kg)** | | | 4338.75 | | | 5057.5 |
| **16** | **Net cultivation cost (item 14-15)** | | | 26962.77 | | | 29290.02 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **17** | **Yield per acre (Kg)** | | | 1157 | | | 1190 |
| **18** | **Cost per 40 kg at farm level** | | | 932.16 | | | 984.54 |
| **19** | **Marketing expenses: (Rs. /40 Kg)** | | | 28 | | | 30 |
| **20** | **Cost per 40 kg at mandi gate.** | | | 960.16 | | | 1014.54 |
| **21** | **Investment incentive @25%** | | | 240.04 | | | 253.63 |
| **22** | **Support price recommended** | | | 1200.2 | | | 1268 |

Source: Agriculture Marketing Information System, Directorate of Agriculture (Economics & Marketing), Lahore, Punjab

## 5.2.2 Cost of Production of Seed Cotton Crop Estimate under Average Conditions in the Punjab for the Year 2016-17

| S. No | Operations/Inputs | Average no of Oprs/units/acre | 2015-16 | | Average no of Oprs/units/acre | 2016-17 | |
|---|---|---|---|---|---|---|---|
| | | | Cost/Units (Rs.) | Cost/Acre (Rs.) | | Cost/Units (Rs.) | Cost/Acre (Rs.) |
| 1 | **LAND PREPARATION** | | | | | | |
| 1.1 | Deep ploughing | 0.2 | 1354 | 271 | 0.2 | 1238 | 248 |
| 1.2 | Ploughing /Cultivation | 2 | 591 | 1182 | 2 | 580 | 1160 |
| 1.3 | Planking | 1 | 296 | 296 | 1 | 290 | 290 |
| 1.4 | Ploughing + Planking | 3 | 677 | 2031 | 3 | 620 | 1860 |
| 1.5 | Levelling | 0.6 | 677 | 406 | 0.6 | 620 | 372 |
| | Sub Total | | | 4186 | | | 3930 |
| 2 | **SEED AND SOWING OPERATIONS** | | | | | | |
| 2.1 | Seed (Kgs)+Including delinting Cost | 8 | 350 | 2800 | 8 | 350 | 2800 |
| 2.2 | Seed Treatment | | | 35 | | | 35 |
| 2.3 | Sowing | | | | | | |
| 2.3.1 | Ploughing and Planking | 0.1 | 677 | 68 | 0.1 | 620 | 62 |
| 2.3.2 | Drilling | 0.9 | 591 | 532 | 0.9 | 580 | 522 |
| 2.3.3 | Man Labor for sowing, bund making and gap filling (man days) | 0.25 | 400 | 100 | 0.25 | 425 | 106 |
| | Sub Total | | | 3535 | | | 3525 |
| 3 | **IRRIGATION** | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3.1 | Canal Water rate (Abiania/acer) | | | 95.72 | | | 95.72 |
| 3.2 | Private Tubewell( 3 Hrs= One irrigation) | 3 | 930 | 2790 | 3 | 930 | 2790 |
| 3.3 | Mixed (Canal+ Tubwell) | 1 | 394 | 394 | 1 | 362 | 362 |
| 3.4 | Water course cleaning and application charges( M.days) | 4 | 400 | 1600 | 4 | 425 | 1700 |
| | Sub Total | | | 4880 | | | 4948 |
| 4 | I**NTERCULTURE** | | | | | | |
| 4.1 | With tractor / With bullocks | 3 | 591 | 1774 | 3 | 544 | 1632 |
| 4.2 | Manual weeding / thiningn (man days | 4 | 400 | 1600 | 4 | 425 | 1700 |
| | Sub Total | | | 3374 | | | 3332 |
| 5 | **PLANT PROTECTION INCLUDING APPLICATION (WEEDICIDE+PESTICIDE)** | | | | | | |
| | | | | 5500 | | | 5500 |
| 6 | **FARM YARD MANURE INCLUDING TRANSPORT AND APPLICATION** | | | | | | |
| | | 0.3 | 1150 | 345 | 0.3 | 1100 | 330 |
| 7 | **FERTILIZERS: (bags)** | | | | | | |
| 7.1 | UREA | 1.5 | 1850 | 2775 | 1.5 | 1840 | 2760 |
| 7.2 | DAP | 1.5 | 3750 | 5625 | 1.5 | 2800 | 4200 |
| 7.3 | Potash(MOP) / Folier Application | 0.2 | 3200 | 640 | 0.2 | 3300 | 660 |
| 7.4 | Fertilizer Transport & Application | 3.2 | | 200 | 3.2 | | 184 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Sub Total | | | 9240 | | | 7804 |
| G.Total (1 to 7) | | | | 31060 | | | 29369 |
| 8 | Land Rent for 8 Months @ Rs 25,000/25,000 PA | 8 | 2083 | 16667 | 8 | 2083 | 16664 |
| 9 | Agricultural Income Tax (8 Months) | | | 64.69 | | | 64.69 |
| 10 | Payment to Picker in Rs./Kg | 54.88 | 5.5 | 4840 | 880 | 5.5 | 4840 |
| 11 | Cutting of Cotton Sticks (In lieu of sticks) | | | 1500 | | | 1500 |
| 12 | Management Charges for 8 Month @ RS 14,000/15,000 PM for 100 Acres | 8 | 140 | 1120 | 8 | 150 | 1200 |
| 13 | **Gross Cost (Items 1 to 12)** | | | 55252 | | | 53638 |
| 14 | **Value of Cotton Sticks** | | | 2500 | | | 2500 |
| 15 | **Net Cultivation Cost (Item 13-14)** | | | 52752 | | | 51138 |
| 16 | **Yield Per Acre (Kgs)** | | | 880 | | | 880 |
| 17 | **Cost Per Quantal ( 100 Kgs) At Farm Gate** | | | 5994.55 | | | 5811.14 |
| 18 | **Cost Per Kg At Farm Gate** | | | **59.95** | | | **58.11** |
| 19 | **Cost Per 40 Kgs At Farm Gate** | | | **2511** | | | **2324** |
| 20 | **Marketing Expenses:(Rs /40 Kgs)** | | | 34 | | | 31 |
| 21 | **Cost Per 40 Kgs At Mill Gate /Mandi Gate.** | | | 2545 | | | 2355 |
| 22 | **Investment Incentive @ 25%** | | | 636 | | | 589 |
| 23 | **Indicative Price Recommended Per 40 Kgs** | | | **3181** | | | **2944** |

Source: Agriculture Marketing Information System, Directorate of Agriculture (Economics & Marketing), Lahore, Punjab

## 5.2.3 Cost of Production of Sugarcane Crop under Irrigated Conditions in the Punjab for the Year 2016-17.

| S.NO | Operations / Inputs | Average no. of oprs/units | 2015-16 | | Average no. of oprs/units | 2016-17 | |
|---|---|---|---|---|---|---|---|
| | | | cost/unit/Rs | cost/unit/Rs | | cost /acre Rs | cost /acre Rs |
| **1** | **PREPARATORY TILLAGE** | | | | | | |
| 1.1 | Deep Ploughing | 1 | 1346 | 1346 | 1 | 1238 | 1238 |
| 1.2 | Ploughing /Cultivator | 4 | 630 | 2520 | 4 | 580 | 2320 |
| 1.3 | Levelling | 1 | 674 | 674 | 1 | 620 | 620 |
| | **Sub Total** | | | 4540 | | | 4178 |
| **2.** | **SEED BED PREPARATION** | | | | | | |
| 2.1 | Ploughing /Cultivator | 2 | 630 | 1260 | 2 | 580 | 1160 |
| 2.2 | Planking | 2 | 315 | 630 | 2 | 290 | 580 |
| | **Sub Total** | | | 1890 | | | 1740 |
| **3.** | **SEED AND SOWING OPERATIONS** | | | | | | |
| 3.1 | Seed (Kgs) 60 % of 3200 Kgs | 1920 | 5 | 9600 | 1920 | 5 | 9600 |
| 3.2 | Sowing of Setts (Man days) | 8 | 400 | 3200 | 8 | 425 | 3400 |
| 3.3 | Ridging | 1 | 630 | 630 | 1 | 580 | 580 |
| 3.4 | Bund Making / Boarder making (Man Days) | 0.5 | 400 | 200 | 0.5 | 425 | 212.5 |
| | **Sub Total** | | | 13630 | | | 13792.5 |
| **4.** | **INTERCULTURE / HOEING** | | | | | | |
| 4.1 | Application of Herbicides with Tractor (Acre) | 1 | 1336 | 1336 | 1 | 1229 | 1229 |
| 4.2 | Interculture and Earthing up with tractor | 1 | 681 | 681 | 1 | 627 | 627 |
| | Sub Total | | | 2017 | | | 1856 |
| **5.** | **IRRIGATION** | | | | | | |
| 5.1 | Water courses Cleaning (Man days) | 2 | 400 | 800 | 2 | 425 | 850 |
| 5.2 | Labour Charges for canal Irrigation (Man days) | 3.5 | 400 | 1400 | 3.5 | 425 | 1487.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5.3 | Canal Water rate(Abiana/acre) | | | 135 | | | 135 |
| 5.4 | Private Tube well (3 Hrs= One irrigation) | 5 | 939 | 4695 | 5 | 930 | 4650 |
| 5.5 | Labour Charges( Additional irrigation man days) | 1 | 400 | 400 | 1 | 425 | 425 |
| | **Sub Total** | | | 7430 | | | 7547.5 |
| **6.** | **FERTILIZER (Bag)** | | | | | | |
| 6.1 | Urea | 2 | 1850 | 3700 | 2 | 1840 | 3680 |
| 6.2 | DAP | 1.5 | 3800 | 5700 | 1.5 | 2800 | 4200 |
| 6.3 | Potash (MOP) | 0.5 | 3500 | 1750 | 0.5 | 3300 | 1650 |
| 6.4 | Transportation | 4 | 22 | 88 | 4 | 20 | 80 |
| 6.5 | Fertlizer Application (Man days) | 0.5 | 400 | 200 | 0.5 | 425 | 212.5 |
| 6.6 | Farm Yard Manure (trolly) | 1 | 1100 | 1100 | 1 | 1100 | 1100 |
| 6.7 | Transportation & Spreading (F.Y.M) | | | 438 | | | 394 |
| | **Sub Total** | | | 12976 | | | 11316.5 |
| **7 PLANT PROTECTION** | | | | | | | |
| 7.1 | Treatment ( Granules + Labour) | | | 1400.00 | | | 1400 |
| | **G.Total (Item 1 to 7)** | | | 43883 | | | 41831 |
| | | 43780 | | 3937 | | | |
| **MARKUP ON INVESTMENT @9%for 12 months on items (1 to 7) excluding water rates (5.3)** | | | | | | | |
| **8** | **HARVESTING / STRIPPING & LOADING** | | | | | | |
| | 8.1 Harvesting of tops,trash,binding,stripping (40 Kg Md) | 581 | 11 | 6743 | 615 | 12 | 7380 |
| | 8.2 Loading of 24603 Kgs / 615 Mds | 581 | 3 | 1839 | 615 | 3 | 1845 |
| | **Sub Total** | | | 8582 | | | 9225 |
| 9 | Land Rent for 12 Month @25,000/25,000 PA | 1 | 25000 | 25000 | 1 | 25000 | 25000 |
| 10 | Agricultural Income Tax 12 Months | | | 97.04 | | | 97.04 |
| 11 | Management Charges for 12 Months of a Manager @Rs15,000 /15,000 PM for 100 Acres | 1 | 1500 | 1500 | 1 | 1800 | 1800 |
| 12 | Gross Cost (Item 1 to 11) Including Land Rent | | | 82999 | | | 77953 |
| 13 | Yield Per Acre (kgs) | | | 24507 | | | 24603 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 14 | COST PER 100 Kgs AT FARM GATE | | | | | | 317 |
| **15** | **COST PER 40 Kgs AT FARM GATE** | | | **135** | | | **127** |
| 16 | Marketing expenses:(Transport + Cess Fund ) | | | 13 | | | 13 |
| **17** | **COST PER 40 Kgs AT MILL GATE.** | | | **148** | | | **140** |
| 18 | INVESTMENT INCENTIVE @ 25 % | | | 37 | | | 35 |
| **19** | **INDICATIVE PRICE RECOMMENDED PER 40 Kgs** | | | **185** | | | **175** |

Source: Agriculture Marketing Information System, Directorate of Agriculture (Economics & Marketing), Lahore, Punjab

# ANNEXURE 6: SDPI TEAM IN THE FIELD