A FEASIBILITY STUDY

ASSESSING THE POTENTIAL FOR LARGE-SCALE AGRICULTURAL CROP AND LIVESTOCK INSURANCE IN PUNJAB PROVINCE, PAKISTAN

WORLD BANK GROUP

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ACRONYMS AND ABBREVIATIONS

AAL	Annual average loss
AYII	Area-yield index insurance
CADENA	Componente Atención a Desastres Naturales (Natural Disaster Response Component of the Ministry of Agriculture, Livestock, Rural Development, Fisheries, and Food in Mexico)
CCE	Crop cutting experiments
CLIS	Crop Loan Insurance Scheme
CTL	Constructive Total Loss
CRS	Crop Reporting Services
CV	Coefficient of variation
DoA	Department of Agriculture, Government of Punjab
GIC	General Insurance Corporation of India
GDP	Gross Domestic Product
GFDRR	Global Fund for Disaster Reduction and Recovery
GoP	Government of Pakistan
GoPunjab	Government of Punjab
GRP	Group Risk Plan
HBA	Historical burning cost rating analysis
IFAD	International Fund for Agricultural Development
LISB	Livestock Insurance Scheme for Borrowers
LTA	Long-term average
MFI	Microfinance Institution
mNAIS	modified National Agricultural Insurance Scheme (India)
MPCI	Multiple Peril Crop Insurance
MT	Metric ton
NAIS	National Agricultural Insurance Scheme
NDMA	National Disaster Management Authority
NDVI	Normalized Difference Vegetation Index
NPCI	Named Peril Crop Insurance
NRSP	National Rural Support Program
PDMA	Provincial Disaster Management Authority, Government of Punjab
PDRMA	Punjab Disaster Risk Management Agency
PforR	Program for Results
PKR	Pakistan rupee
PMD	Punjab Meteorological Department
PMFBY	Pradan Mantri Fasal Bima Yogana (Prime Minister's Crop Insurance Scheme, India)
PPAF	Pakistan Poverty Alleviation Fund
PPP	Public-Private Partnership
SBP	State Bank of Pakistan
SMS	Short message system
TSI	Total Sum Insured
TSU	Technical Support Unit
UAI	Unit area of insurance
US$	United States dollar
WFP	World Food Programme
WII	Weather Index Insurance
ZTBL	Zarai Taraqiati Bank Limited

Weights and Measures

1 ton = 1,000 kg

1 maund = 40 kg in Pakistan

Currency Exchange Rate Used in This Report

1 US Dollar (US$) = 100 Pakistan rupees (PKR)

EXECUTIVE SUMMARY

This report presents the findings and recommendations of a World Bank agricultural insurance feasibility study commissioned by the Government of Punjab (GoPunjab) for the design and implementation of large-scale crop and livestock insurance programs for Punjab's 5.2 million mainly small-scale farmers and livestock producers.[1] The crop and livestock insurance programs will be developed and rolled out under the World Bank financed US$300 million project for "Strengthening Markets for Agriculture and Rural Transformation in Punjab" Program-for-Results (SMART Punjab PforR) from 2018 to 2022.

The report consists of seven chapters, starting with the background and objectives of the feasibility study. Chapter 2 includes a review of crop and livestock production in Punjab Province, an assessment of the main natural and climatic risk exposures faced by the farmers, and the value of losses caused by climatic disasters. Chapter 3 presents a review of the existing crop and livestock products and schemes which are being implemented in Pakistan along with their issues and challenges along with an analysis of the flood disaster compensation payments made to farmers by the Provincial Disaster Management Authority (PDMA) Punjab. Chapter 4 presents options and proposals for new crop and livestock insurance products and programs for GoPunjab to consider, based on international best practice. This is followed in Chapter 5 by a review of the legal, institutional, and operational considerations and options for Punjab. Chapter 6 presents an outline of a five-year crop and livestock buildup plan and budget along with estimates of the potential costs of GoPunjab financial support to this program for premium subsidies and subsidies on insurance startups and operating costs. Finally, Chapter 7 deals with the next steps in designing and implementing agricultural insurance in Punjab, starting with the launch in Kharif (summer) season 2018 of a crop area-yield index insurance (AYII) program for small-scale semicommercial/progressive farmers.

IMPORTANCE OF AGRICULTURE IN PUNJAB

Agriculture is a key economic sector in Punjab. The agricultural crop, livestock, fisheries, and forestry sectors in Punjab account for 26 percent of Punjab's GDP and 40 percent of employment. In 2013–14 Punjab produced 19.7 million tons of wheat, equivalent to 76 percent of total wheat production in Pakistan. It is also a major producer of maize, cotton, sugarcane, rapeseed, and mustard. The province is also a very important producer of horticultural crops (fruits and vegetables). Livestock production for both milk and meat is very important in Punjab, and all farming families own some livestock.

[1]The Feasibility Study Report was presented to the GoPunjab in July 2017. Based on the report's findings and recommendations, GoPunjab decided to launch a pilot crop insurance program in Kharif 2018 and scale up the program over the next five years. At GoPunjab's request the Report was updated in 2018. The key changes to the earlier draft include Chapter 7, which has been updated to highlight key issues and challenges that were encountered in the launch of the pilot crop insurance program in April 2018 for the Kharif 2018 season.

There are a total of 5.25 million farms in Punjab (63.5 percent of the total 8.26 million farms in Pakistan) and the majority of these farms are small.[2] In Punjab, the 2010 census reported an average farm size of 5.6 acres: the small farm size is illustrated by the fact that 91 percent of all farms are under 12.5 acres (5 hectares) and 41 percent of farms are smaller than 2.5 acres (1 hectare). The very small size of farms poses major challenges for the design and operation of suitable crop and livestock insurance products and programs.

Agricultural growth is, however, lagging in Punjab and declined from 3.3 percent annual growth over the last decade to below 3 percent during 2011–2015, and zero growth in the financial year, 2016. Growth turned positive again in financial year 2017. Both crop and livestock productivity are low compared to levels achieved by semicommercial/progressive farmers and other Asian countries, and yield growth is largely flat for major crops such as wheat and rice.[3] Reasons forwarded for low agricultural growth include limited adoption of modern technologies, poor service delivery, inefficient irrigation water delivery and pricing, poorly functioning agricultural markets, and overreliance on provincial government subsidies on crop inputs and output (World Bank 2017).

Access to production credit appears to be a major constraint to increasing farm investments thus impacting productivity and yield gains in Punjab. According to the State Bank of Pakistan (SBP), currently there are about 1 million small farmers with less than 25 acres (or 12 percent of total farmers in Pakistan) who borrow credit from the banks and who are insured on a compulsory basis under the Crop Loan Insurance Scheme (CLIS). It is estimated that about 70 percent (700,000) of these farmers are located in Punjab. However, the majority (>85 percent) of farmers in Punjab do not have access to seasonal crop credit. Several commercial banks reported that they were reluctant to lend to farmers because of the high historical default rates.

Agricultural insurance could potentially play an important role in leveraging access to production credit by small farmers in Punjab. Where crop insurance is linked to credit provision, thereby reducing the risk exposure of default in the event of major climate-induced crop failure, financial institutions are more likely to extend production credit to small farmers to enable them to invest in improved seed and fertilizer technology and to increase their production and incomes.

CLIMATIC RISK EXPOSURE IN AGRICULTURE

Pakistan (including Punjab), whose risks are further exacerbated by a rapidly growing population, growing water scarcity, and uncontrolled urbanization is highly vulnerable to climate change. The country is ranked among the top ten most climate vulnerable countries in the world in the Global Climate Risk Index and has seen a considerable increase in frequency and intensity in extreme weather events and natural disasters, causing huge losses. A recent study by the World Bank established that the melting of the Hindu Kush-Karakoram-Himalayan glaciers could affect water flows into the Indus River system with implications for agricultural production.[4] Concerted efforts at adaptation to conserve water and build resilience in the agriculture sector are therefore required.

Monsoon flooding is a major risk exposure to crop and livestock production in Punjab, and can result in major loss of crop production and death of livestock. Other risks include drought in rain-fed areas of the province, localized windstorm and hail damage, and pests and diseases of crops and livestock. In the case of livestock severe flooding results in death of animals by drowning, but also starvation due to lack of fodder and grazing and disease outbreak. There is a significant risk of earthquakes, but this mainly causes loss of life and damage to urban private and public infrastructure and property rather than to agriculture.

In the 2010 floods, Pakistan incurred total direct and indirect flood damage estimated at Pakistan rupee (PKR) 854.8 billion (US$10.1 billion) of which 50 percent was incurred by agriculture, livestock, and fisheries. The floods affected more than 20 million people (over one-tenth of Pakistan's population) with over 1,980 reported deaths and nearly 2,946 injured; about 1.6 million homes were destroyed and thousands of acres of crops and agricultural lands

[2]The latest agricultural census (2010) is available at http://www.pbs.gov.pk/content/agricultural-census-2010-pakistan-report.

[3]Maize is one exception and the cultivated area, production, and yields have increased significantly in recent years on account of the strong demand for maize by the animal and poultry feed industries and adoption of high-yielding varieties (HYVs), especially hybrids.

[4]Yu et al. (2013).

were damaged. The total costs of reconstruction were estimated at between PKR 577.9 billion (US$6.8 billion) and PKR 757.8 billion (US$8.9 billion) while the costs of reconstruction of the agricultural sector were estimated at between PKR 21.9 billion (US$257 million) and PKR 89.1 billion (US$1,049 billion). Sind and Punjab Provinces were the most heavily flood damaged provinces in 2010: in Sind damages were valued at PKR 371.3 billion (US$4.4 billion) or 43.6 percent of the total value of damage (ADB and World Bank 2010).

In Punjab the 2010 flood damage was estimated at PKR 219.3 billion (US$2.6 billion) or 25.7 percent of total damage, and the costs of reconstruction were estimated at between PKR 93.5 billion (US$1.1 billion) and (PKR 117.6 billion (US$2.1 billion) (ADB and World Bank 2010).

Currently in Pakistan, the government operates ex-post natural disaster compensation programs for the affected population, but budget constraints mean that only a fraction of the lost value of agricultural crop production is compensated. Natural disaster management is coordinated at the national level by the National Disaster Management Authority (NDMA) and implemented by the Provincial Disaster Management Authorities (PDMAs). In the case of agriculture, post disaster relief is very restricted. For example, PDMA Punjab reports 3.3 million acres of crops damaged due to the severe floods of 2010 to 2013. The World Bank team estimates these crop losses at about US$1.6 billion; however, over this period, compensation payments to farmers in Punjab amounted to only US$67 million or just over 4 percent of the total flood losses. Agricultural insurance could play an important role in complementing the existing ex-post disaster compensation schemes.

GOPUNJAB GOALS TO TRANSFORM AGRICULTURE AND SMART PUNJAB PROGRAM

GoPunjab aims to stimulate growth in the agricultural sector by facilitating increases in crop and livestock productivity, enhancing resilience, increasing competitiveness in agriculture marketing and trade by providing a conducive climate for private investment, and improving supply chains and value addition. To achieve these aims government has allocated a US$3.90 billion capital budget for agriculture, livestock, and irrigation over five years (FY 2017 to FY 2021), out of which US$1.6 billion is allocated to agriculture and livestock (excluding the Kissan package).

The "Strengthening Markets for Agriculture and Rural Transformation in Punjab" Program-for-Results (SMART Punjab PforR) is a US$300 million loan from 2018 to 2022 by the World Bank to the Government of Pakistan (GoP) to assist the GoPunjab's programs to transform agriculture for the province's 5.25 million mainly smallholder farmers. The SMART Punjab PforR will assist the GoPunjab in three results areas: (1) increased on-farm productivity and value of crops and livestock to reduce unit production costs through improving agricultural research and extension systems and targeting subsidies to smallholders; (2) increased value addition and competitiveness of crops and livestock through modernizing the wheat marketing system, stimulating high-value agriculture, deregulating crop and livestock markets with increased private sector participation, improving livestock health and breeding, regulating food safety and inspecting and testing food quality, and developing agribusiness including post-harvest management and value-addition; and (3) enhanced resilience of smallholder farmers to climate change and natural disasters through improvements in the financial sustainability of surface irrigation systems through better water charge assessment and collection, regulation of groundwater use, and improved water service delivery, as well as improved climate resilience through crop insurance and introduction of CSA technologies.

This agricultural insurance feasibility study has been conducted under Results Area 3 of the SMART Punjab PforR project which seeks to introduce new innovative crop and livestock insurance products and programs to meet the needs of all sectors of Punjab's farming community.

AGRICULTURAL INSURANCE PROVISION

Private commercial agricultural crop and livestock insurance is poorly developed in Pakistan, and few farmers in Punjab are insured against loss of their crops and livestock. The largest crop insurance program in Pakistan is the Crop Loan

Insurance Scheme (CLIS), which was introduced in 2008 by the State Bank of Pakistan (SBP) in conjunction with a group of about 12 private local insurers. The CLIS is a "catastrophe loss of yield coverage," which is triggered when a disaster is declared by the provincial and/or district authorities and when crop losses exceed 50 percent of normal expected production and yields. CLIS consists of a Constructive Total Loss (CTL) Policy such that when crop losses exceed the 50 percent area yield threshold, the sum insured (outstanding seasonal crop production credit loan value) is settled in full to the lending institution. CLIS is mandatory for all farmers accessing seasonal loans from the commercial banks. Small loanee farmers with up to 25 acres of land qualify for 100 percent CLIS premium subsidies up to a maximum premium rate of 2.0 percent paid by SBP. Large loanee farmers with >25 acres do not qualify for CLIS premium subsidies. The main drawback of the CLIS is that although it protects the lending institutions against farmers defaulting on their loan repayments in times of catastrophe losses, the insurance program does not directly benefit farmers themselves.

In Punjab about 700,000 farmers (loanees) are automatically insured under CLIS, representing about 13 percent of all 5.2 million farmers in this province and approximately 25 percent of the 2.9 million smallholders (farmers having 2.5–25 acres). The CLIS does not, however, provide adequate protection for these farmers against loss of their production costs invested in growing their crops. There is currently no crop insurance coverage for high value vegetable crops (e.g., potatoes) and tree fruit crops (e.g., citrus, mangoes). Moreover, the insurance sector does not offer any protection for small and marginal farmers with less than 2.5 acres, which amounts to 2.2 million farmers or 42 percent of all farmers in Punjab.

Since 2011 SBP has also designed a livestock investment mortality coverage which attracts premium subsidies. Finally, there have been a few private sector crop index insurance pilot programs and livestock insurance initiatives.

CROP INSURANCE OPTIONS FOR PUNJAB

Chapter 4 of this report presents a detailed overview of the different types of individual farmer crop insurance products available in international markets and their potential suitability for introduction in Punjab. This includes traditional indemnity-based crop insurance products and new innovative index insurance products, details of which are summarized in Table ES1.

One size does not fit all, or in other words, crop insurance products must be tailored to the risk transfer needs of different types of farmer in Punjab including: medium and large commercial farmers, small semicommercial/progressive farmers, and subsistence farmers.

CROP INSURANCE PRODUCTS FOR MEDIUM AND LARGE FARMERS IN PUNJAB

For commercial farmers in Punjab who account for just 3 percent of all farming households and who have more than 25 acres of cropping, individual grower Multiple Peril Crop Insurance (MPCI) or named-peril crop insurance may be a suitable product for the largest of these farmers with more than 100 acres (40 hectares) of insured crops. Insurers can offer MPCI coverage to large farmers because the premium generated by each risk is adequate to cover the costs of pre-acceptance risk inspections, mid-season monitoring inspections, and end of season crop yield assessment (Table ES1).

CROP INSURANCE PRODUCTS FOR SMALL SEMICOMMERCIAL/ PROGRESSIVE FARMERS IN PUNJAB

Individual farmer MPCI is not a suitable product for small semicommercial/progressive farmers who typically own between 2.5 acres[5] and 25 acres and who account for 55 percent of all farmers in Punjab. These small-scale semicommercial farmers produce crops both for family consumption and for sale. They are increasingly accessing seasonal crop loans to invest in improved hybrid seed and fertilizer technology, and they face a financial exposure in the event of crop loss. For these farmers, an index-based insurance product such as weather index insurance (WII) or area-yield

[5]It should be recognized that there are also "semicommercial" farmers with less than 2.5 acres who are receiving crop production credit either through the Microfinance Institutions (MFIs) or GoPunjab's E-Kissan credit scheme. These farmers would also be targeted by commercial crop insurance products and services.

TABLE ES1: CROP INSURANCE PRODUCTS AND SUITABILITY FOR PUNJAB

Type of agricultural insurance product	Basis of insurance and indemnity	Availability	Suitability for Punjab
a. Indemnity-based crop insurance			
1. Named Peril Crop Insurance (NPCI)	Percent damage	Widespread	Possible (e.g., hail, frost, wind)
2. Multiple Peril Crop Insurance (MPCI)	Yield loss	Widespread	Only for large growers >40 ha cereals
3. Crop Revenue Insurance	Yield loss and price loss	Very restricted (USA)	Not available
b) Index-based crop insurance			
4. Crop Weather Index Insurance (WII) based on Ground Weather Stations	Weather index payout scale	Widespread	Limited weather station density (30 Punjab). Not best suited to microlevel insurance for small cereal farmers <2 ha. Possible applications for horticulture and fruit crops
5. Crop Weather Index Insurance (WII) based on Synthetic Satellite Rainfall	Weather index payout scale	Fairly widespread	Satellite data freely available. Not best suited to micro-level insurance for small farmers <2 ha
6. Crop Area Yield Index Insurance (AYII)	Area yield loss	Fairly widespread	Potential for small farmers (cereals, cotton, sugarcane) using Department of Agriculture/Crop Cutting Services (CCE) yield data
7. Specialist indexes, e.g., flood index Bangladesh	Flood index payout scale	Very restricted	Major research required to launch cover

index insurance (AYII) which do not require costly pre-inspections or individual field-by-field loss assessment, may offer solutions to their risk transfer needs.

In Punjab, the density of weather stations is very low and insufficient to support a provincial-level crop WII program for major crops grown by the majority of the province's 5.2 million farmers. The Punjab Meteorological Agency has a network of only 30 official synoptic weather stations or less than one weather station per district. This density is inadequate to develop a large-scale WII program for the 5.2 million farmers in Punjab. Alternatives exist to develop satellite indexes, including synthetic rainfall, evapotranspiration, or Normalized Difference Vegetation Index (NDVI) in certain crops, and under the SMART Punjab PforR project, opportunities to develop satellite index insurance may be explored further.

Starting in 2018, there appears to be considerable scope to design and implement AYII for semi-commercial/progressive farmers in Punjab who grow Rabi (winter) wheat and Kharif (summer) rice, maize, cotton and sugarcane. The key feature of an AYII product is that it does not indemnify crop yield losses at the individual farmer or field level. Rather, an AYII product makes indemnity payments to farmers according to yield loss or shortfall against an average area yield (the index) in a defined geographical area (e.g., a district or Tehsil or Union Council or Village).

The key advantages of the Area-Yield Index Insurance approach are that moral hazard and anti-selection are minimized and the costs of administering such a policy are significantly reduced, making this product suitable to offer to small-scale farmers. Under an AYII policy yield losses are settled against the area average yield index as opposed to settling losses on individual farmers' fields. This means that individual farmers cannot influence the yield out-come, for example by purchasing coverage only for fields in low lying areas which are subject to flooding and water logging (anti-selection) or by applying sub-optimal levels of husbandry and pest and disease and weed controls (moral hazard) in the expectation of then claiming the yield loss on their crop insurance policy. The costs of operating AYII are much lower than for a MPCI policy, especially because individual farmer pre-inspections and

in-field crop loss assessment are not required, and this offers the potential to market this product at lower premium costs to small and medium sized farmers.

The main disadvantage of an AYII policy is "basis risk," i.e., the difference in the actual yield outcome achieved by individual farmers on their own fields and the average area yield. For example, an individual farmer may incur severe crop production and yield losses due to localized perils, e.g., hail or flooding by a nearby river, but because these localized losses do not impact on the county or departmental average yield, the grower does not receive any indemnity.

To operate an AYII coverage, it is necessary to have (1) accurate historical yield data at the local area levels on which basis to construct a yield index, and (2) an objective and accurate method of establishing the actual average yield in the insured growing season to determine if a payout is due or not. In Punjab, the Crop Reporting Services (CRS) of the Department of Agriculture (DoA) has for many years been involved in implementing seasonal crop yield surveys based on a random selection of farmers and fields which are then subjected to randomly placed crop cutting experiments (CCEs) to estimate crop yields for major crops, including wheat, rice, maize, cotton, and sugarcane. It is proposed to base the AYII program on the CRS data from CCEs, recognizing that the density of those CCEs will have to increase significantly over time.

Chapter 4 describes the key contract design features of an AYII policy and explains the approach to setting insured yield coverage levels and methodology for rating such a coverage to derive technical and commercial premium rates. Some preliminary rating analysis is presented for the five major crops based on tehsil-level crop yield data for one district provided by CRS.

CROP INSURANCE PRODUCTS FOR SUBSISTENCE FARMERS WITH LESS THAN 2.5 ACRES IN PUNJAB AND WHO DO NOT HAVE ACCESS TO SEASONAL CROP CREDIT

AYII is also identified as a suitable insurance product that could be offered by GoPunjab as a social protection coverage to protect poor subsistence farmers with less than 2.5 acres and who do not have access to formal crop credit and who primarily produce crops for family consumption. These farmers account for 2.2 million farms or 42 percent of all farms in Punjab. AYII could be used as an ex-ante crop insurance coverage to trigger objective payouts to the large number of subsistence farmers in Punjab and could operate as a complementary disaster risk financing and insurance coverage to the government's existing natural disaster compensation program, which is operated through the Punjab Disaster Risk Management Agency.

CROP INSURANCE PRODUCTS FOR HORTICULTURE CROPS

In Punjab, there may be scope for developing Named Peril Crop Insurance (NPCI) to protect against specific perils such as frost, hail, and excess rain in high-value horticultural crops such as potato, or frost, hail, and wind damage in tree crops including mango and citrus. Potentially, hail and wind damage insurance could also be offered for cereals if there is a significantly high exposure in these crops, especially at the time of grain maturity and harvest. In addition, there may be scope for developing WII coverage for these crops in areas which are supported by ground weather stations (Chapter 4).

A phased program is proposed for the planning and design and implementation of the three large-scale crop insurance programs starting in Kharif 2018 with the AYII Program for semicommercial farmers. This would be followed in 2019 by the launch of the AYII program for small subsistence farmers and the NPCI program for tree fruit and vegetable farmers (Table ES2).

LIVESTOCK INSURANCE OPPORTUNITIES FOR PUNJAB

A preliminary assessment of opportunities to develop livestock insurance has been conducted as part of this feasibility study. Punjab province is a major dairy cattle and milk producer. GoPunjab has identified a major potential to increase the productivity of dairy farmers by introducing improved breeds of cattle coupled with modern husbandry and animal health practices, and improved milk marketing systems.

There may be opportunities for GoPunjab to promote individual animal accident and mortality

TABLE ES2: PROPOSED PHASED INTRODUCTION OF NEW CROP INSURANCE PRODUCTS AND PROGRAMS IN PUNJAB

Financial year	FY 2018–19		FY2019–20		FY2020–21		FY2021–22		FY2022–23	
Crop season	**Kharif**	**Rabi**	**Kharif**	**Rabi**	**Kharif**	**Rabi**	**Kharif**	**Rabi**	**Kharif**	**Kharif**
Crop insurance programs										
1. Area Yield Index Insurance for progressive farmers >2.5 Ac <25 Ac	Launch Kharif 2018									
2. Area Yield Index Insurance for subsistence farmers <2.5 Ac			Launch Kharif 2019							
3. Named Peril Crop Insurance for tree fruit and vegetable farmers			Launch Kharif 2019							
Livestock insurance programs										
1. Dairy Cattle Insurance (indemnity-based accident and mortality cover)			Launch in FY2019–20							

coverage for dairy cattle through the banks, dairy cooperatives, or (fresh) milk processors. For large commercial dairy herds, insurers may be willing to offer All Risk Mortality coverages (see Table ES2).

There do not, however, appear to be major opportunities at present to develop livestock index-based insurance (e.g., pasture drought NDVI coverage). The earliest date that livestock insurance could be rolled out would be in 2019 given the major commitments to designing the three crop insurance programs in 2018 and 2019.

INSTITUTIONAL AND OPERATIONAL CONSIDERATIONS FOR LARGE-SCALE CROP INSURANCE PROGRAMS IN PUNJAB

In the planning and design of the large-scale crop (and livestock) insurance programs for the Punjab, interested insurers will need to consider whether to (1) underwrite this business separately as they currently do for the CLIS, or (2) to form a coinsurance pool to collectively underwrite and settle claims on the programs. Coinsurance pools are common features of major national or regional Public-Private Partnership (PPP) agricultural insurance programs, including the Agroseguro Program in Spain, the Tarsim pool program in Turkey, and various regional coinsurance pools in China. Key features of the Spanish and Turkish agricultural insurance pool programs are presented in Annex 8. Similarly, several developing countries in Africa including Senegal, Malawi, Ghana, and Kenya have formed agricultural insurance pools in recent years.

There are potential advantages of pools which include: (1) cost sharing in the research and development and start-up stages, (2) cost savings in establishing a single underwriting unit, staffing and equipment, either within the lead coinsurer or as a separate underwriting entity (namely, a Special Purpose Vehicle), (3) ability for each company to select a share according to its risk appetite, and (4) major cost savings in purchasing reinsurance protection because of the effects of pooling risk and risk diversification.

In the short term it is unlikely that the participating insurers would want to create and incorporate a new pool insurance company for the specific purpose of insuring crops and livestock in Punjab. Rather, they are more likely to seek a simple coinsurance agreement which would allow each of them to take up an agreed share of the risk. In this case as the pool would not be a legal entity, it is likely that one company would be appointed to lead the pool and to issue policies on their own paper. The pool insurers would also

need to agree on how they would manage the business—either by (1) sharing the workload among themselves for the key functions of marketing and promotion, education and training, underwriting and policy issuance and premium collection and in claims settlement and processing, or (2) by appointing the lead insurer to conduct these activities on their behalves and to contribute to the lead insurer's operating expenses.

In Punjab there appear to be major opportunities to bundle the AYII program with the Kissan seasonal crop credit program, which is being promoted by GoPunjab through the rural and commercial banks. There appears to be a major need in Punjab to improve farmers' access to rural finance if they are to invest in improved seed and fertilizer technology and to thereby increase their production and yields and farm incomes. The bundling of crop insurance with credit and input supplies has been shown in many parts of the world to provide a win-win for farmers, credit providers, and insurers. The farmer gains access to seasonal crop credit and lending institutions are more willing to lend to small farmers because their loans are protected by crop insurance. In addition, the insurer benefits from (1) a reduction in anti-section, (2) less need for pre-inspections (3) reductions in the costs of promoting and marketing the agricultural insurance program, and (4) an insurance uptake and spread of risk and premium volume that is generally much higher than under a purely voluntary program.

The option of linking commercial crop AYII insurance for semicommercial/progressive farmers with the CLIS program should also be explored in the design phase of this program. In this instance the coverage would be a "top-up" coverage for the farmer to insure against yield shortfall from approximately 80 percent of the area yield down to 50 percent when CLIS would come in to ensure that the bank was protected for yield loss below 50 percent of insured yield. If such a proposal were to be adopted, the main changes that would need to be agreed with SBP and the participating insurers and GoPunjab authorities is that rather than declaring a calamity declaration to trigger payouts on the CLIS, the latter would agree to follow the terms and conditions of the AYII Policy including (1) the definition of the Unit Area of Insurance (UAI), (2) the average yield index for that UAI, and (3) to base any payouts on the objective CCEs that the CRS is conducting at the time of harvest and to only make payouts if the actual average yield falls short of 50 percent.

POTENTIAL ROLES FOR GOPUNJAB TO SUPPORT THE LARGE-SCALE CROP AND LIVESTOCK INSURANCE PROGRAMS

International experience from developing countries clearly demonstrates the importance of involving both government and the private sector in agricultural insurance initiatives for small farmers. When only private sector insurance companies provide agricultural insurance without government support, they seldom have the resources to design and implement crop and livestock insurance programs for small farmers. When the government alone offers agricultural insurance, its lack of infrastructure and expertise makes distributing policies, delivering payouts, and paying claims difficult. Experience from agriculture insurance schemes developed across the world (for example in India, Mongolia, Morocco, and Kenya) shows that public-private partnerships (PPPs) can overcome these challenges by building on the comparative advantages of the respective sectors.

Chapter 5 of this report identifies a series of areas where GoPunjab support to the crop insurance operations would be critical to the successful implementation of these programs, including:

1) **Data strengthening for crop insurance,** including most importantly designing and implementing a farmer electronic registration and database system and in providing the insurers with crop time series yield data at the tehsil level for the major crops.
2) **Strengthening of the CCEs for area yield estimation.** As noted in Chapter 5, areas for government support include: (1) significantly increasing the CCEs, to permit the UAI to be set at the Union Council or eventually at the individual village level, and (2) introducing mobile phone or electronic tablet technology to record the CCE data and to transmit this in real-time to insurance underwriters and other stakeholders. This technology has already been developed, tested, and is now under large-scale implementation in India as part of the Fasal Bima Yojana program.
3) **Investment in farmer awareness, education, and training in the role of crop insurance** and the operation of the various insurance products and programs. Farmer

insurance literacy creation is a key pillar to the sustainability of the Punjab crop insurance program under the SMART Punjab program.

4) **Monitoring and Evaluation (M&E).** It will be critical to implement a M&E system to assess the program's inputs and outputs, timeliness, effectiveness, and impact over time on semicommercial/progressive farmers input purchasing decisions and their crop production and yields and incomes. For subsistence farmers, M&E should focus on measuring whether the program enables them to maintain their consumption levels following major floods or droughts, and whether they are able to get back into production for the following season.

In addition, GoPunjab support to providing crop (and livestock) premium subsidies for small farmers will be very important in determining the demand for and scale-up of the program. GoPunjab has indicated its intention to support the introduction of crop insurance in Punjab through the provision of premium subsidies. The feasibility study suggests different premium subsidy levels to enable GoPunjab to establish its own budget for premium subsidies as per each of the three crop insurance programs:

Program 1: AYII for semicommercial/progressive farmers: 50 percent premium subsidy. The rationale is that small semicommercial/progressive farmers can afford to contribute toward the costs of their crop insurance premiums.

Program 2: AYII social protection program for subsistence farmers: 100 percent premium subsidies. GoPunjab would fully fund the premiums in recognition of the fact that poor subsistence farmers are unlikely to be able to afford to fund crop insurance premiums.

Program 3: NPCI for horticulture producers: 50 percent premium subsidy. These farmers tend to be larger commercial farmers producing high value cash crops for sale, and they can afford to contribute toward their crop insurance premiums.

For the 2018 Kharif Pilot Crop Insurance Program 1 (AYII coverage for semicommercial/progressive farmers), GoPunjab has subsequently advised the following farm size categories and premium subsidy levels:

a) Owner Farmers with <5 acres (100 percent premium subsidy); and

b) Owner Farmers between 5–25 acres (50 percent subsidy)

GoPunjab will need to establish an annual budget to cover the premium subsidies and contributions to start-up and operating costs, and appoint an institution that will be responsible for administering the premium subsidy regime on its behalf. The norm in most subsidized agricultural programs is that (1) the farmer is only charged the unsubsidized portion of the premium, and (2) the insurer then reclaims the premium subsidy amount from the entity appointed by the government, which is responsible for auditing and processing and repaying the premium subsidies.

CROP INSURANCE FIVE-YEAR BUILD-UP PLAN AND FINANCIAL BUDGET

Chapter 6 of this report presents a five-year (FY2018/19 to FY2022/23) crop insurance buildup plan and an indicative financial budget for GoPunjab to consider starting in the Kharif season 2018. The purpose of presenting the crop insurance buildup plan and budget (numbers of insured farmers, insured area, sums insured and premium projections) is to assist GoPunjab to develop its own five-year crop insurance plan and budget and to assess the fiscal costs of premium subsidy support and financial support for other operational activities. The buildup plan presents physical projections for the three crop insurance programs (1) AYII for semicommercial/progressive farmers, (2) AYII for subsistence farmers, and (3) NPCI coverage for fruit and vegetable growers, of the number of insured farmers by season and by year and the corresponding estimates of insured area, sums insured, and premium income based on a series of assumptions detailed in this chapter. A key variable is the pricing of the various crop insurance programs—for this budget exercise target average commercial premium rates of 5.0 percent for Kharif crops and 3.5 percent for Rabi crops are assumed.[6] The costings presented in this report will need to be scrutinized and confirmed by GoPunjab, and in the case of the indicative or target commercial premiums these will need to be calculated and confirmed by the insurance companies and their lead reinsurers. The main five-year insurance financial plan and budget for GoPunjab are presented in Table ES3, and in Chapter 6 these projections have been subjected to a further series of sensitivity analyses.

[6]Chapter 6 includes a sensitivity analysis assuming higher average premium rates of 7.5 percent for Kharif crops and 5.0 percent for Rabi crops.

TABLE ES3: PUNJAB FIVE-YEAR CROP INSURANCE PORTFOLIO SHOWING ESTIMATED NUMBER INSURED FARMERS, INSURED CROP AREA, SUM INSURED AND PREMIUM INCOME (US$)

Program / Item	FY2018/19	FY2019/20	FY2020/21	FY2021/22	FY 2022/23	Total
Number of Insured Farmers:						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	600,000	1,000,000	1,250,000	1,425,000	1,500,000	5,775,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		750,000	1,750,000	2,750,000	3,500,000	8,750,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		2,500	5,000	7,500	10,000	25,000
Total Insured Farmers	**600,000**	**1,752,500**	**3,005,000**	**4,182,500**	**5,010,000**	**14,550,000**
Insured Area (Acres)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	2,100,000	3,500,000	4,375,000	4,987,500	5,250,000	20,212,500
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		750,000	1,750,000	2,750,000	3,500,000	8,750,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250	12,500	18,750	25,000	62,500
Total Insured Area (Acres)	**2,100,000**	**4,256,250**	**6,137,500**	**7,756,250**	**8,775,000**	**29,025,000**
Sum Insured (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	717,500,000	1,207,500,000	1,522,500,000	1,741,250,000	1,837,500,000	7,026,250,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		125,000,000	300,000,000	475,000,000	612,500,000	1,512,500,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250,000	12,500,000	18,750,000	25,000,000	62,500,000
Total Sum Insured (US$)	**717,500,000**	**1,338,750,000**	**1,835,000,000**	**2,235,000,000**	**2,475,000,000**	**8,601,250,000**
Premium Income (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	30,362,500	51,712,500	65,887,500	75,643,750	80,062,500	303,668,750
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		5,125,000	12,750,000	20,375,000	26,687,500	64,937,500
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		625,000	1,250,000	1,875,000	2,500,000	6,250,000
Total Premium Income (US$)	**30,362,500**	**57,462,500**	**79,887,500**	**97,893,750**	**109,250,000**	**374,856,250**

The proposed five-year crop insurance program plan for Punjab is very ambitious. For the AYII program for semicommercial/progressive farmers, it is assumed that at full-scale implementation by year five, about 750,000 farmers would be insured in both the Kharif and Rabi seasons respectively (or 1.5 million farmers in total per year) (Table ES3). This represents a penetration (uptake rate) of about one in every four (26 percent) of all semicommercial/progressive farmers. For Program 2, the macro-level fully funded AYII program for subsistence farmers, the assumed uptake rate by year five would be 1.75 million farmers per season (Kharif and Rabi) or 3.5 million farmers per year, equivalent to an uptake rate of nearly 80 percent of this group of farmers, each with less than 2.5 acres. Finally, it is estimated that 10,000 fruit and vegetable farmers might be insured by year five.

The crop insurance budget shows that by year five (FY 2022/23) an estimated 8.75 million hectares will be insured on an annual basis (including both Kharif and Rabi seasons) with an estimated total sum insured of US$2.475 billion and estimated premium income of US$109 million. This represents a very significant requirement for underwriting capacity, and the local insurers or pool will need to attract significant support from international reinsurers.

The estimated costs of GoPunjab financial support to the crop insurance program is estimated at US$239 million over five years (Table ES4). This includes premium subsidies of US$220 million and subsidies on start-up and operating costs of US$19 million. By year five (FY2022/23) which is assumed to be full-scale implementation, the annual cost of government support to the program will be about US$73 million per year.

WORK PLAN AND TIMETABLE FOR AYII PROGRAM FOR SEMICOMMERCIAL/ PROGRESSIVE FARMERS IN KHARIF 2018

The final Chapter 7 sets out a detailed work plan and timetable for the major activities that need to be carried out in the design and planning of the AYII program between August 2017 and March 2018, the planned launch date of the program. The work plan identifies responsibilities for each organization or stakeholder which will be involved in this public-private partnership agricultural insurance initiative for Punjab. The six-month timeframe to complete all

TABLE ES4: INDICATIVE COSTS OF GOPUNJAB PREMIUM SUBSIDY SUPPORT AND OTHER FINANCIAL SUPPORT TO CROP INSURANCE PROGRAMS 2018/19 TO 2022/23 (US$)

Program / Item	FY 2018/19	FY 2019/20	FY 2020/21	FY 2021/22	FY 2022/23	Total
Premium Subsidies (US$)						
Program 1. Crop AYII for Commercial Farmers > 2.5 Acres	15,181,250	25,856,250	32,943,750	37,821,875	40,031,250	151,834,375
Program 2. Crop AYII Catastrophe Cover Small Farmers < 2.5 Ac.		5,125,000	12,750,000	20,375,000	26,687,500	64,937,500
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		312,500	625,000	937,500	1,250,000	3,125,000
Sub-Total Premium Subsidies	**15,181,250**	**31,293,750**	**46,318,750**	**59,134,375**	**67,968,750**	**219,896,875**
Other Financial Costs borne by Government (US$)						
Data strenthening for Crop Insurance	1,500,000	1,000,000	750,000	500,000	500,000	4,250,000
Strenthen Crop Cutting Experiments (mobile phone system)	300,000	1,200,000	1,500,000	1,800,000	2,100,000	6,900,000
Farmer insurance awareneness, education and training	1,200,000	1,000,000	1,000,000	1,000,000	1,000,000	5,200,000
Monitoring and Evaluation	250,000	400,000	400,000	400,000	1,000,000	2,450,000
Sub-Total Other costs	**3,250,000**	**3,200,000**	**3,250,000**	**3,300,000**	**4,600,000**	**18,800,000**
Total Budgeted Costs to Government of Punjab	**18,431,250**	**34,493,750**	**49,568,750**	**62,434,375**	**72,568,750**	**238,696,875**
Cost per insured farmer	**30.7**	**19.7**	**16.5**	**14.9**	**14.5**	**16.4**

design and planning tasks and to put in place all insurance operating systems and procedures is very tight and will require that all stakeholders ensure that the tasks and activities allocated to them are completed on time. Chapter 7 also highlights some of the operational issues and challenges that have arisen during the implementation of the Kharif 2018 pilot crop insurance program.

CHAPTER 1
INTRODUCTION AND OBJECTIVES OF THE STUDY

This report presents the findings and recommendations of a feasibility study for the introduction of large-scale crop and livestock insurance in Punjab, which is an essential component of the GoPunjab's strategy to transform agriculture in the province within the next five years. This introductory chapter summarizes the origins and objectives of the feasibility study. It describes the critical local and national importance of agriculture in Punjab and the factors that suppress growth in agricultural productivity, including the highly destabilizing effects of climatic risk. It moves on to discuss the importance of making crop and livestock insurance available on a wider scale for Punjab's farmers (who are mostly small-scale farmers). Better access to insurance could shield farmers from climatic risks, bolster agricultural productivity and investment, and contribute to the government's strategy to foster agricultural transformation. The chapter concludes by outlining the topics and analysis presented in subsequent chapters of the report.

1.1. THE IMPORTANCE OF AGRICULTURE AND AGRICULTURAL GROWTH IN PUNJAB

Punjab—the most densely populated province of Pakistan—consists of 36 administrative districts and covers 205,344 square kilometers. A large proportion of this area is arable, and because several major tributaries of the Indus River traverse the province from North to South, Punjab is one of the world's most heavily irrigated crop-producing areas. The total cultivated area in Punjab is 16.5 million hectares, of which 14.3 million hectares (87 percent) are irrigated (Government of Punjab 2015).

Agriculture is a key economic sector in Punjab. The agricultural crop, livestock, fisheries, and forestry sectors in Punjab account for 26 percent of Punjab's gross domestic product (GDP) and 40 percent of employment. Punjab delivers more than half of Pakistan's total GDP and population and, according to the 2010 census, has 5.2 million farming households—63.5 percent of Pakistan's farmers. It is important to note that the average farm size in the province is only 6.5 acres, and nearly two-thirds of farmers own or cultivate less than 2 hectares (5 acres).

BOX 1.1: AGRICULTURE'S LACKLUSTER PERFORMANCE IN PUNJAB

Nationally, agriculture accounts for 21 percent of GDP, employs 44 percent of the labor force, and directly and indirectly delivers nearly 80 percent of the total value of Pakistan's exports. Yet as noted, growth in Pakistan's agricultural sector fell from 3.3 percent over the last decade to nearly zero in FY2016, before recovering in FY 2017. Crop and livestock productivity are lower than in other Asian countries. Except for maize, crop yields have barely risen in decades.

In Punjab, growth in agriculture has been similarly low and highly erratic as well. This performance has occurred even though Punjab has a vast area of fertile land, about 14.3 million hectares under irrigation, and a wide array of natural resources and climatic conditions capable of supporting diversified and productive agriculture. Still, 90 percent of cultivated land remains used for under five major crops (wheat, rice, cotton, sugarcane, and maize), leaving only about 10 percent for horticulture and other high-value crops. Punjab has approximately 73 percent of Pakistan's national cropped area and 78 percent of national irrigated area. Approximately 60 percent of the province's cultivated area lies within the Indus Basin Water System.

The lack of progress in agriculture in Punjab has numerous causes. Perhaps most fundamentally, it reflects low growth in productivity at the farm level, which leads to high unit production costs and a lack of competitiveness, distorted cropping patterns, limited diversification into higher-value crop and livestock activities, and expanding populations of animals that are relatively unproductive. In crop production, large gaps exist between average yields, the yields obtained by progressive farmers, Punjab's potential yields, and the world's best averages. Agricultural growth is also held back by poor adoption of modern technologies, poor service delivery, and poorly functioning agricultural markets. Punjab could restore its agricultural competitiveness through innovations that renew growth in on-farm productivity and improve efficiency and quality throughout the post-harvest value chain. At 0.18 percent of agricultural gross domestic product (AgGDP), Pakistan's public expenditures on agricultural research are the lowest in a region that is already lagging behind others. Most agricultural research expenditures still go to food grains, sugarcane, and cotton, rather than to high-value crops and livestock products. Few resources are dedicated to post-harvest management, including value addition, quality, food safety, and nutrition. A high payoff could be gained by redirecting public expenditures and associated policies toward the best potential investments for outcomes, with a focus on reforms in wheat, irrigation, subsidies, and marketing, and concomitant investments to improve service delivery, agricultural research and development, and insurance.

Punjab is Pakistan's leading agricultural province, a major producer of a wide range of food, industrial, and horticultural crops, as well as milk and meat. In 2016–17, Punjab produced 19.6 million tons of wheat, equivalent to 74 percent of wheat production in Pakistan. It is also a major producer of maize (81 percent of national production), rice (51 percent of total production), and other food crops such as *jowar* (sorghum), *bajra* (millet), and gram. In that same year, Punjab also produced most of the nation's cotton crop (6.9 million bales, or two-thirds of national production), sugarcane (65 percent of national production), and rapeseed and mustard (72 percent of national production). The province is a very important producer of horticultural crops (fruits and vegetables), accounting for 97 percent of total citrus production, 76 percent of all guava production, and 75 percent of all mango production. Livestock production for both milk and meat is very important in Punjab. Virtually all farming families own some livestock: there are about 14 million cattle (49 percent of the total in Pakistan), 16 million buffaloes (65 percent of the total), 29 million sheep (24 percent of the total) and 68 million goats (37 percent of the total) (GoPunjab 2015).

At the same time, agricultural growth is lagging in Punjab (Box 1.1). Growth declined from 3.3 percent per year over the last decade to below 3 percent during 2011–15, and it fell to zero in 2016. Both crop and livestock productivity are low compared to levels achieved by semicommercial/progressive farmers and farmers in other Asian countries, and growth in yields is largely flat for major crops such as wheat and rice.[7]

Agricultural growth in Punjab is held back primarily by significant intervention from the Government of Punjab (GoPunjab) in both input and output markets, and a pattern of public spending on agriculture that is dominated by subsidies, estimated at US$1.25 billion in Punjab for fiscal year (FY) 2017. Other reasons for low agricultural growth include limited adoption of modern technologies, poor service delivery, inefficient irrigation water delivery and pricing, and poorly functioning agricultural markets (World Bank 2017). Climatic risks also threaten Punjab's capacity to increase agricultural growth in significant ways, as the next section will show.

[7]Maize is one exception: cultivated area, production, and yields have all increased significantly in recent years owing to strong demand for maize from the animal and poultry feed industries and the adoption of high-yielding hybrid maize varieties.

1.2. CLIMATIC RISKS TO CROP AND LIVESTOCK PRODUCTION IN PUNJAB

Punjab, like the whole of Pakistan, remains highly exposed to climatic risks. Pakistan is ranked among the top ten most climate vulnerable countries in the world in the Global Climate Risk Index. The country has witnessed an increase in the frequency and intensity of extreme weather events and natural disasters, which have caused significant agricultural losses. A recent study by the World Bank established that the melting of the Hindu Kush-Karakoram-Himalayan glaciers could affect water flows into the Indus River system, with implications for agricultural production.[8] These disturbances—which expose the agricultural sector to greater uncertainty and risk, and whose effects are being exacerbated by rapid population growth, increasing water scarcity, and uncontrolled urbanization—call for concerted efforts to help agriculture adapt and remain resilient.

Several major climate-related risks affect Punjab and unleash natural disasters. Risks include drought in the rain-fed (barani) areas of the province, localized damage from windstorms and hail, and incursions by crop and livestock pests and diseases. Monsoon flooding can result in costly major losses of crops and livestock. Severe floods not only drown animals but can cause them to starve when fodder supplies and grazing areas are destroyed and animal diseases break out.[9] The 2010 floods in Pakistan affected more than 20 million people (over one-tenth of Pakistan's population), with over 1,980 reported dead and nearly 2,946 injured; about 1.6 million homes were destroyed, and thousands of acres of crops and agricultural lands were damaged. The total direct and indirect flood damage was estimated at PKR 854.8 billion (US$10.1 billion at the exchange rate prevailing at the time), and half of that damage was incurred by agriculture, livestock, and fisheries. Costs of reconstruction were estimated at between PKR 577.9 billion (US$6.8 billion) and PKR 757.8 billion (US$8.9 billion), while costs of reconstruction in the agricultural sector were estimated at between PKR 21.9 billion (US$257 million) and PKR 89.1 billion (US$1,049 billion).

Sind and Punjab provinces suffered the most from the 2010 floods. Damages in Sind were valued at PKR 371.3 billion (US$4.4 billion) or 43.6 percent of the total value of damage (ADB and World Bank 2010). Damages in Punjab were estimated at PKR 219.3 billion (US$2.6 billion) or 25.7 percent of total damage. The costs of reconstruction were estimated at between PKR 93.5 billion (US$1.1 billion) and PKR 117.6 billion (US$2.1 billion) (ADB and World Bank 2010).

Current government programs operate in the wake of natural disasters to compensate the population that has been affected, but budget constraints mean that those programs provide compensation for a mere fraction of the agricultural production that is lost. Natural disaster management is coordinated at the national level by the National Disaster Management Authority (NDMA) and implemented in the provinces by the Provincial Disaster Management Authorities (PDMAs). An example from Punjab demonstrates the limitations on disaster relief compensation in agriculture. PDMA Punjab reported that 3.3 million acres of crops were damaged in the severe floods of 2010–13. These crop losses were estimated at about US$1.6 billion by the World Bank, yet over that same period, compensation payments to farmers in Punjab amounted to only US$67 million[10] or just over 4 percent of the total flood losses.

1.3. AGRICULTURAL INSURANCE FOR CROPS AND LIVESTOCK IN PAKISTAN

Private commercial agricultural crop and livestock insurance is poorly developed in Pakistan, and few farmers in Punjab are insured against the loss of crops and livestock to major floods. The largest crop insurance program in Pakistan is the Crop Loan Insurance Scheme (CLIS), introduced in 2008 by the State Bank of Pakistan (SBP) in conjunction with a group of private insurers. The CLIS is a "catastrophe loss of yield

[8]Yu et al. (2013).

[9]The earthquake risk is significant but mainly causes loss of life and damages urban private and public infrastructure and property rather than agriculture.

[10]Data provided by the Provincial Disaster Management Authority of Punjab (PDMA Punjab).

coverage" that is triggered when a disaster is declared by the provincial and/or district authorities and when crop losses exceed 50 percent of normal expected production and yields. Small-scale farmers[11] cannot obtain seasonal crop loans unless they participate in CLIS. SBP fully subsidizes the premiums for these farmers up to a maximum premium rate of 2.0 percent of the sum insured. The main criticism of CLIS is that although it protects the lending institutions against farmers who default on their loans in times of catastrophic losses, the insurance program does not directly benefit small farmers themselves.

In Punjab about 700,000 farmers (loanees) are insured under CLIS, representing about 13 percent of the 5.2 million farmers in the province. Since 2011 SBP has offered a livestock investment mortality coverage that also attracts premium subsidies. Finally, there have been a few private sector crop index insurance pilot programs and livestock insurance initiatives.

1.4. THE SMART PUNJAB PROGRAM TO TRANSFORM AGRICULTURE

GoPunjab aims to stimulate growth in the agricultural sector by facilitating increases in crop and livestock productivity, enhancing resilience, and increasing competitiveness in agricultural marketing and trade, by providing a conducive climate for private investment and improving supply chains and value addition.

To achieve these aims, GoPunjab has allocated a US$3.9 billion capital budget for agriculture and irrigation over five years (FY 2018 to FY 2022), out of which US$1.6 billion is allocated to agriculture. In addition, GoPunjab spends about US$1.25 billion per year on subsidies in the agricultural sector, including input subsidies on the cost of seed and fertilizer, subsidies on irrigation water pricing, subsidies on credit and power, and a major program for subsidized wheat procurement based on minimum prices that are well above world market prices for wheat (World Bank 2017).

The "Strengthening Markets for Agriculture and Rural Transformation in Punjab" Program-for-Results (SMART Punjab PforR) is a US$300 million loan from 2018 to 2022 by the World Bank to the GoPunjab to assist its programs to transform agriculture for the province's 5.2 million mainly smallholder farmers. The SMART Punjab PforR assists the GoPunjab's program aimed at increasing crop and livestock productivity, promoting diversification, adding value, increasing private sector engagement in farm and nonfarm businesses, deregulating crop and livestock markets, and enhancing resilience. The World Bank's Board of Directors approved the SMART Punjab PforR on December 15, 2017, and it became effective on February 2, 2018.

By focusing on three results areas, the SMART Punjab PforR will contribute to the following outcomes:

- **Results Area 1 (increased on-farm productivity and value of crops and livestock)**
  - Increased crop productivity.
  - Increased livestock productivity.
  - Improved functioning of the agriculture research system.
  - Removal of wheat market distortions and shift from wheat to high-value agriculture.
- **Results Area 2 (increased value addition and competitiveness of crops and livestock)**
  - Increased value addition of agricultural products.
  - Improved employment opportunities in value adding.
  - Deregulation of crop and livestock markets.
  - Improved food safety.
- **Results Area 3 (enhanced resilience of smallholder farmers to climate change and natural disasters)**
  - Improved sustainability of irrigation systems.
  - Improved access to crop and livestock insurance.
- Enhanced resilience of farmers to climate change.

1.5. GOVERNMENT OF PUNJAB REQUEST TO THE WORLD BANK GROUP FOR TECHNICAL ASSISTANCE

As part of its commitment to transform the agricultural and rural sectors, GoPunjab seeks

[11]Defined as farmers who own up to 25 acres of land (increased in 2015 from 12.5 acres) and who borrow seasonal production loans from a financial institution to cultivate any of five major crops (wheat, rice, maize, sugarcane, cotton).

to provide better access to improved agricultural crop and livestock insurance products and programs for the province's 5.2 million farmers, at affordable premium rates. The GoPunjab is seeking solutions for all segments of the farming population, including the important group of semicommercial/progressive farmers operating on a small scale (with 2.5 acres to 25 acres), who account for about 56 percent of all farmers in Punjab. This group could potentially benefit from a strategy to link crop insurance with the provision of credit, which will enable them to invest in fertilizer and improved seed of high-yielding varieties, which in turn should increase their production and incomes and further the government's aim of transforming agriculture in Punjab. GoPunjab is also seeking solutions for small subsistence farmers who have less than 2.5 acres and account for 42 percent of the farmers in Punjab, and for commercial fruit and vegetable farmers. Finally, GoPunjab is seeking improved livestock insurance products for producers of meat and dairy products.

GoPunjab aims to achieve rapid development and massive uptake of crop and livestock insurance in Punjab. GoPunjab has signaled its willingness to provide major financial support for this large-scale agricultural insurance program by subsidizing premiums and providing financial support for the program's start-up costs and ongoing operational costs.

1.6. SCOPE AND OBJECTIVES OF THIS FEASIBILITY STUDY

This agricultural insurance feasibility study was conducted as part of the process for preparing the SMART Punjab PforR. The objectives of the feasibility study, which started with a diagnostic mission focusing on agricultural insurance in Punjab in April 2017, were to: (1) assess the existing crop and livestock insurance programs in Punjab and the potential for improvement; (2) identify suitable crop and livestock insurance programs to meet the needs of each segment of the farming population according to the priorities identified by GoPunjab; (3) provide options and recommendation on the ways in which GoPunjab could support the implementation of crop and livestock insurance in Punjab; (4) identify a five-year implementation plan for agricultural crop and livestock insurance in Punjab and provide estimates of the financial costs of GoPunjab premium subsidies and other financial support to these programs; and (5) develop proposals for a pilot crop insurance program for implementation early in the course of the SMART Punjab PforR.

1.7. ORGANIZATION OF THIS REPORT

The remainder of this report is structured around the objectives of the feasibility study that have just been cited. Chapter 2 provides an overview of crop and livestock production in Punjab Province and presents an assessment of the main risk exposures faced by farmers in the province. Chapter 3 reviews the crop and livestock insurance products and schemes that are currently implemented in Pakistan, highlighting their issues and challenges. That chapter also contains an analysis of the flood disaster compensation payments made to farmers by PDMA Punjab. Chapter 4 presents options and proposals based on international best practice for new crop and livestock insurance products, and programs for the GoPunjab to consider. A review of the legal, institutional, and operational considerations and options for Punjab follows in Chapter 5. Chapter 6 outlines a five-year plan and budget to build up a crop and livestock insurance program; it also presents estimates of the potential costs of GoPunjab financial support to this program for premium subsidies and subsidies on insurance start-up and operating costs. Finally, Chapter 7 deals with the next steps in designing and implementing agricultural insurance in Punjab, starting with the launch in Kharif season 2018 of a crop area-yield index insurance (AYII) program for small-scale semicommercial/progressive farmers, as well as a review of some of the key challenges identified in launching and implementing the pilot program in Kharif 2018. Several technical annexes provide extensive background data for reference as well as information on international experience with agricultural insurance programs.

CHAPTER 2
KEY FEATURES OF AGRICULTURE IN PUNJAB AND THE AGRICULTURAL IMPACTS OF CLIMATIC AND NATURAL DISASTERS

This chapter delineates the key features of agriculture in Punjab to provide an understanding of the context in which the feasibility of a large-scale crop and livestock insurance initiative is being explored. For the same reason, the discussion also focuses on the major types of climatic and natural disasters that lead to agricultural losses in the province, along with data on their magnitude and impacts.

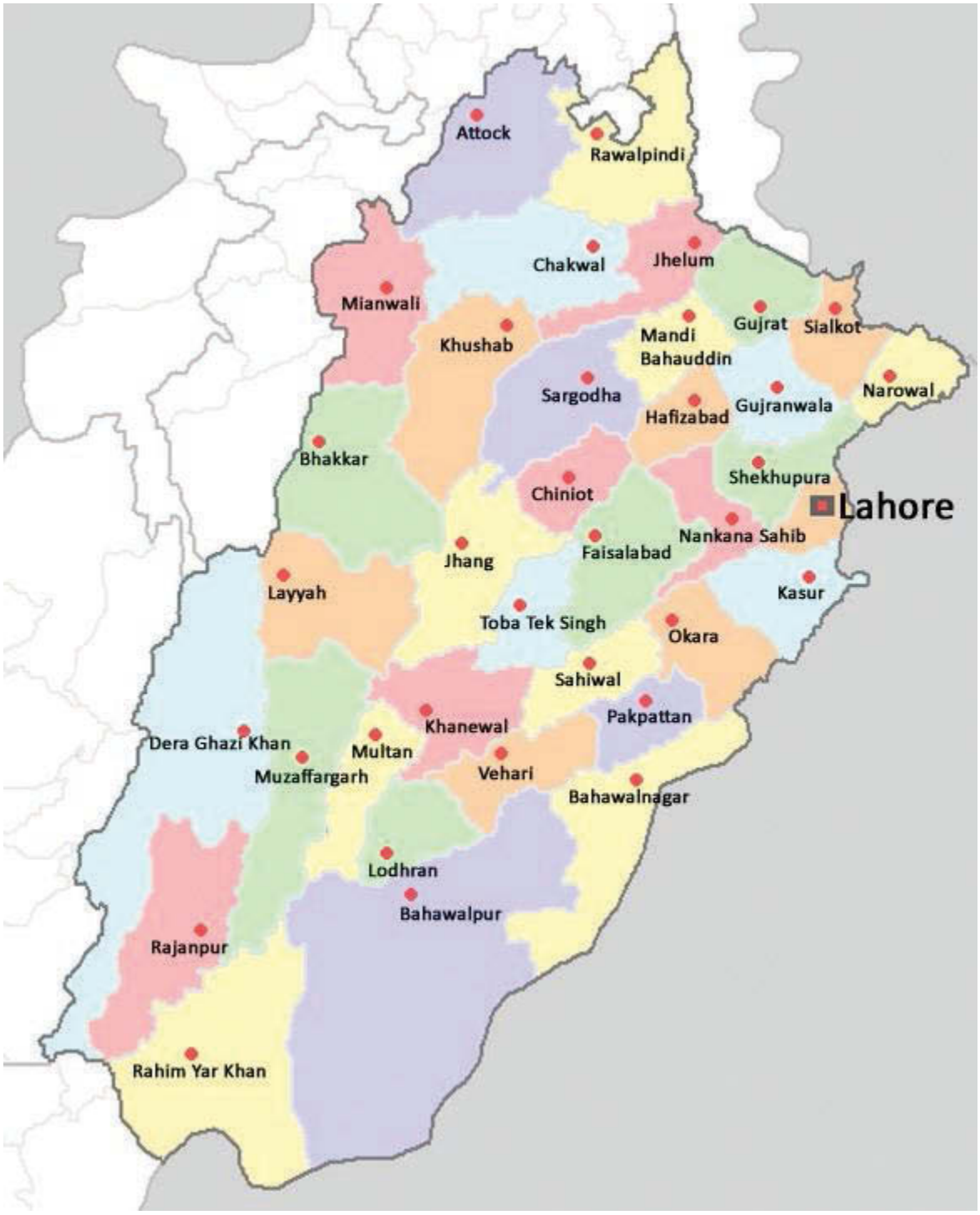
2.1. A DENSELY POPULATED PROVINCE WHERE SMALL FARMS PREDOMINATE

Punjab, with approximately 110 million people, is the most densely populated of Pakistan's six provinces. Lahore is the provincial capital. For administrative purposes, Punjab is divided into nine divisions and 36 districts (Figure 2.1). Each district is divided into smaller subdivisions or tehsils: there are 127 tehsils in Punjab.[12] The next administrative tier below the tehsil is the union council (sherwan), and below that is the village.

Punjab has 5.25 million farms (63.6 percent of the 8.26 million farms in Pakistan), and most of them are small.[13] The 2010 Agricultural Census reported an average farm size in Punjab of 5.6 acres: the small size of farms is illustrated by the fact that 91 percent of farms are under 12.5 acres (5 hectares), and 41 percent are smaller than 2.5 acres (1 hectare) (Table 2.1). According to the same census, 82 percent of the 5.25 million farms in Punjab are owner occupied; a further 9 percent are operated by owners-cum-tenants, and another 9 percent are operated by tenants.

[12] Source: https://www.punjab.gov.pk.
[13] The latest Agricultural Census (2010) is available at http://www.pbs.gov.pk/content/agricultural-census-2010-pakistan-report

FIGURE 2.1: PUNJAB: DISTRICT MAP



Source: PDMA.

In Punjab, the fact that so many farms are small presents major challenges for identifying (1) cost-effective delivery channels for credit, farm inputs, and crop insurance and (2) suitable crop insurance products for small farmers.

Chapter 4 presents a review and proposals of the types of crop insurance products and programs that may be suitable for most of the very small farmers in Punjab, and Chapter 5 examines the options for delivering these crop insurance programs to small farmers cost effectively.

TABLE 2.1: PUNJAB: NUMBER AND AREA OF FARMS BY SIZE OF FARM

Farm size (acres)	Number of farms	Percent of farms	Farm area (acres)	Percent of farm area	Average farm size (acres)
<2.5	2,203,102	42%	2,602,187	9%	1.2
2.5 < 5.0	1,144,394	22%	3,906,900	13%	3.4
5.0 < 12.5	1,411,353	27%	10,458,728	35%	7.4
12.5 < 25	360,467	7%	6,315,269	21%	17.5
25 < 100	121,741	2%	4,536,823	15%	37.3
100 & >	8,771	0%	1,986,621	7%	226.5
Total	**5,249,828**	**100%**	**29,806,528**	**100%**	**5.6**

Source: 2010 Census data reproduced in Agricultural Statistics of Pakistan 2014–15.

Note: Farm area has been converted by the authors from hectares into acres (1 hectare = 2.47 acres).

2.2. CROP AND LIVESTOCK PRODUCTION IN PUNJAB

2.2.1. MAJOR FOOD AND CASH CROPS AND TRENDS IN CROP PRODUCTION AND YIELDS

Punjab has two main crop growing seasons, the Kharif summer monsoon season, followed by the winter dry Rabi winter season. The sowing of summer (Kharif) crops starts in February for sugarcane, March–May for cotton, June–July for rice, and July–August for maize. The harvesting of Kharif crops starts in September and continues to December, except for sugarcane, which can be harvested until March or even beyond. Rabi crops, including most importantly wheat and barley, are sown during October–December and harvested during March–April. The planting of orchards and other trees is carried out in spring (February–March) or during the monsoon (July–August). Wheat, cotton, rice, sugarcane, and maize occupy most of the cropped land and are categorized as major crops. The remaining crops, grown on smaller areas, are categorized as minor crops.

Rabi is the principle cropping season, when 9.4 million hectares (of which 83 percent is irrigated) are cultivated. Wheat is the main Rabi crop, accounting for nearly three-quarters of this cultivated area. In the Kharif monsoon season, 6.4 million hectares are cultivated,[14] and supplementary irrigation is available on nearly 94 percent of the cropped area.

[14]The main Kharif crops include cotton (34 percent of cultivated area), rice (20 percent of area), and fodder (15 percent of area).

Punjab's irrigation infrastructure consists of 14 headworks and barrages that feed 21 different main canals. These canals, with their branches, run almost 4,000 miles to deliver water to more than 2,000 distributaries and minor canals. This vast network channels water to 20 million acres of irrigable land in the province. The fact that agriculture in Punjab is mainly irrigated means that the exposure to drought is relatively lower in Punjab than in other provinces. On the other hand, crops and livestock in much of Punjab are highly exposed to floods during the Kharif monsoon season.

Wheat is the most important crop grown in Punjab during the Rabi season, with total cultivated area of close to 17 million acres, followed by cotton (5.7 million acres) and rice (4.5 million acres). The other main crops (based on area cultivated in 2015–16) include gram (2.1 million acres), maize (1.8 million acres) and sugarcane (1.7 million acres). Wheat area has increased by about 0.5 million acres since 2010–11. The maize area has also increased significantly by about 0.4 million acres because of demand from the animal and poultry feed industry. Gram and rice area declined slightly over the ten years from 2006–07 to 2015–16 (Figure 2.2 and Annex 1).

Except for maize, agricultural production and yields have by and large stagnated over the past 10 years or more in Punjab. Annex 1 contains statistics on the 10-year (2006–07 to 2015–16) annual average yields in kilograms per acre at provincial and district levels in Punjab for the five major crops of wheat, cotton, rice, maize, and sugarcane, along with measures of the variation in mean annual yields as given by the standard

deviation and coefficient of variation (CV).[15] In the case of wheat, the average provincial production is about 18.4 million tons over the past 10 years, and yields have remained at an average of 1.1 metric ton (MT) per acre over this period. Rice yields are also low at 0.78 MT/acre and again have not increased significantly over the past decade, while average maize yields increased from about 2.0 MT/acre to 2.4 MT/acre over the corresponding period (Figure 2.2 and Annex 1). Reasons for this stagnation in the production of traditional food crops such as wheat and rice appear to include the land tenure system, which features a very high proportion of absentee landowners and land leased to tenant farmers and sharecroppers; declining soil fertility; lack of access to credit; suboptimal use of fertilizer and plant protection chemicals; and government policies focused on subsidies rather than investments in research, extension, irrigation maintenance, and other productivity enhancing activities.

In the case of Rabi winter wheat, which is mainly irrigated, the provincial CV is only 4.9 percent, and the range in district level CVs is from a low of 4.2 percent in M.B.Din District to a high of 27.5 percent in Chakwal District (Figure 2.3 and Annex 1). For wheat, the highest CVs are encountered in the most northerly parts of Punjab Province in Rawalpindi Division, where only 11 percent of the sown area is irrigated and which includes the districts of Rawalpindi (4 percent area irrigated), Chakwal (6 percent area irrigated), Attock (12 percent area irrigated), and Jhelum (33 percent area irrigated) (Figure 2.4 and Annex 1). In most districts with assured irrigation, however, the CV in annual wheat yields is extremely low, between 5 percent and 10 percent. There is a high degree of correlation (Pearson R^2 = 73 percent) between higher variability in district wheat yields and the percentage of sown area which is unirrigated (rain-fed) in the district (Annex 1). The differences between crop yield production and variability over time under irrigated and rain-fed conditions have major implications for the design and rating of an area-yield index insurance product, as explained in detail in Chapter 4.

Rice yields have also been very stable over the past 10 years with a CV of 4.2 percent in provincial yields. At the district level the range in CVs is from a minimum of 4.1 percent in Kasur to a maximum of 14.8 percent in Lodhran.

For cotton and maize, however, yields have been much more variable at the district level over the past ten years in Punjab. In the case of cotton, the CV in provincial-level annual yields has been 12.6 percent between 2006–07 and 2015–16, yet in individual districts, yields have been very variable, with CVs ranging from a low of 9.3 percent in Layyah to a high of 52 percent in Jhelum. In 2015–16, when the cotton crop in Punjab was severely affected by adverse climatic conditions, the average yield for the province was only 549 kg/acre—about one-third lower than in the previous year. Maize yields have also been more variable, as shown by the CV of 10.4 percent in provincial yields and CVs ranging from a low of 4.6 percent in Sahiwal District to a high of 70.6 percent in Bahawalpur District. The main reason for the higher variability in maize yields is the introduction of improved high-yielding varieties (mainly hybrids) and the significant increase in average yields over the past five years.

2.2.2. LIVESTOCK PRODUCTION IN PUNJAB

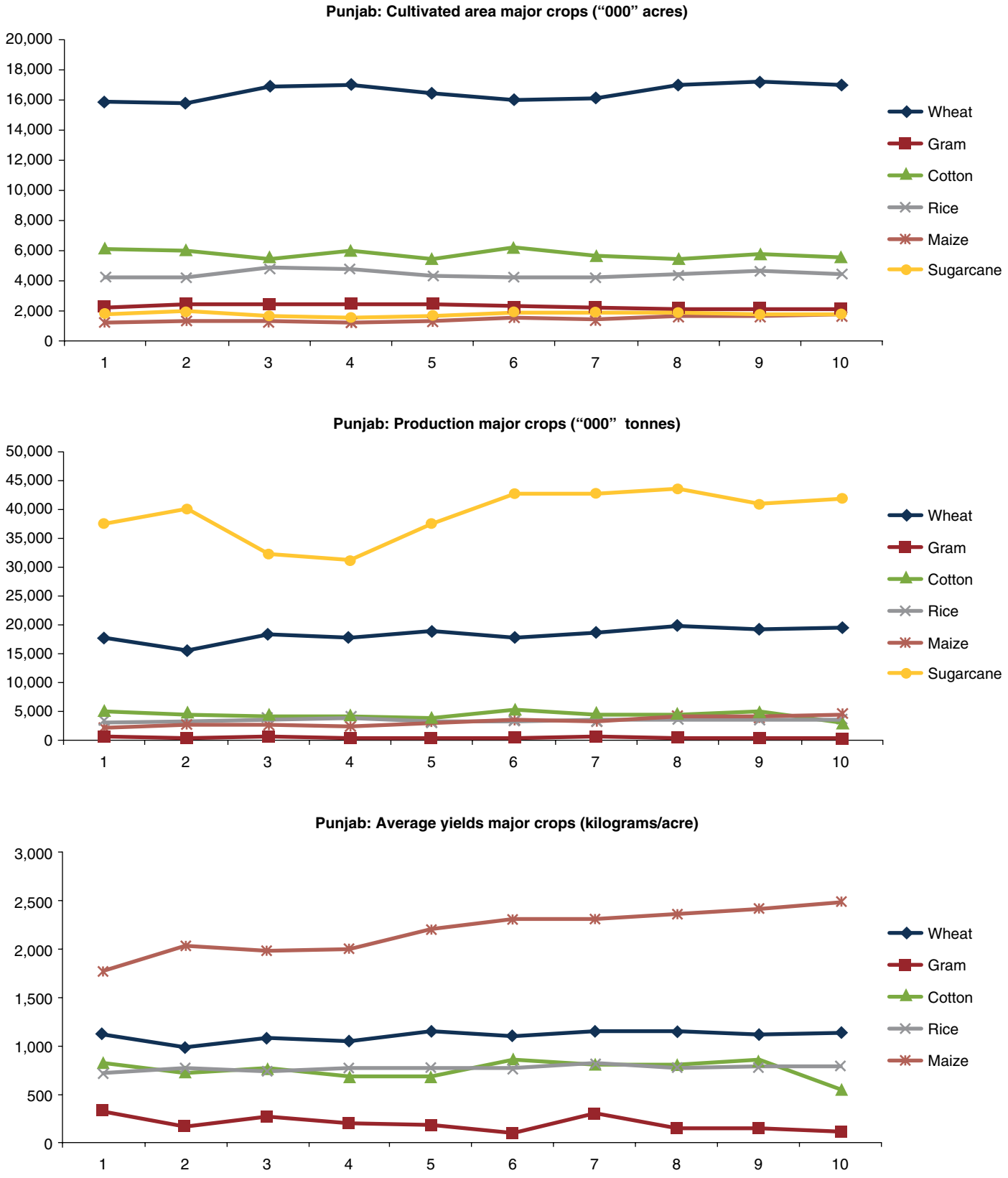
Livestock production is very important to the economy of Pakistan. The agricultural sector contributes 21 percent of the GDP of Pakistan: the relative contribution of the livestock sector is 56 percent compared to 44 percent for the crop sector. While the crop sector experienced major contractions in FY16 with a negative growth (–6.25 percent)—mainly because of major losses in cotton caused by adverse weather (–21.26 percent growth)—the livestock sector has consistently grown over the past seven years and recorded growth exceeding 3 percent percent in most years (Table 2.2).

Livestock production is very important in Punjab. Punjab Province has a cattle herd of 14.4 million head, or nearly half (49 percent) of all cattle in Pakistan. Punjab also accounts for 65 percent of all buffaloes, 24 percent of sheep, 37 percent of goats, and 35 percent of poultry in Pakistan (Table 2.3).

Historically, productivity in the livestock sector of Punjab has been low in terms of meat and milk output. Because GoPunjab recognizes the importance of livestock in the livelihoods of its farmers, and especially of poor landless households, it is implementing key initiatives to raise the sector's productivity. These initiatives include the "Save Buffalo-Calf" program, a calf fattening program, the provision of poultry units, free livestock vaccination programs, and registration of cattle farmers and their cattle, among others. In addition,

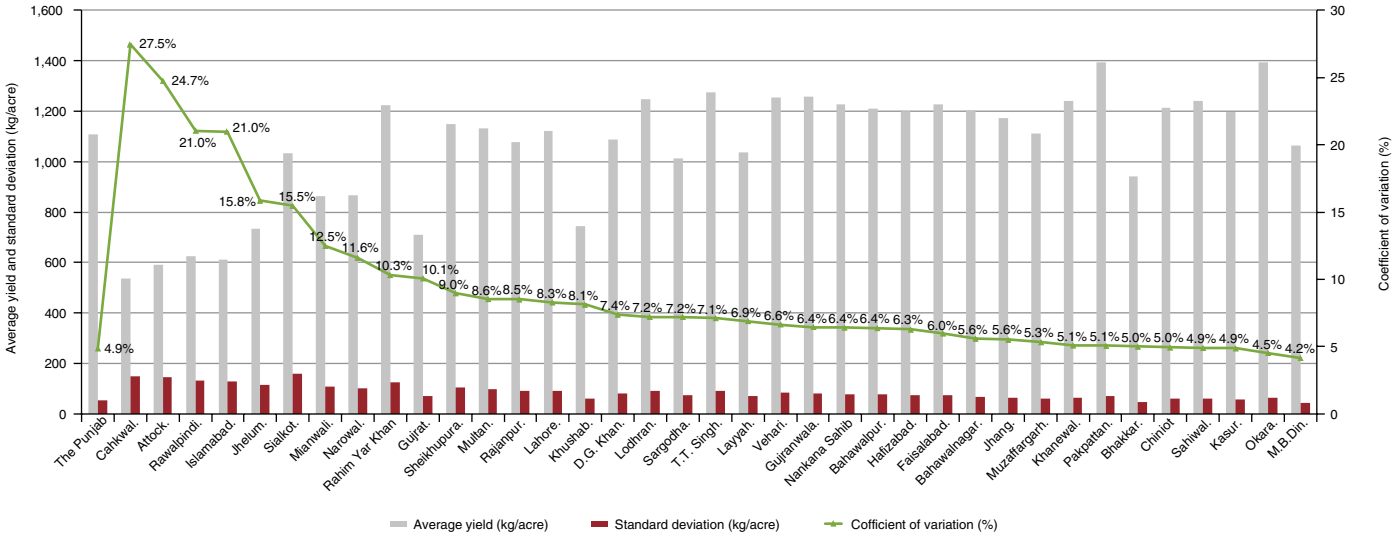
[15]The CV is equal to the standard deviation divided by the average (mean) and expressed as a percentage.

FIGURE 2.2: PUNJAB: AREA, PRODUCTION, AND YIELDS FOR MAJOR CROPS, 2006/07–2015/16



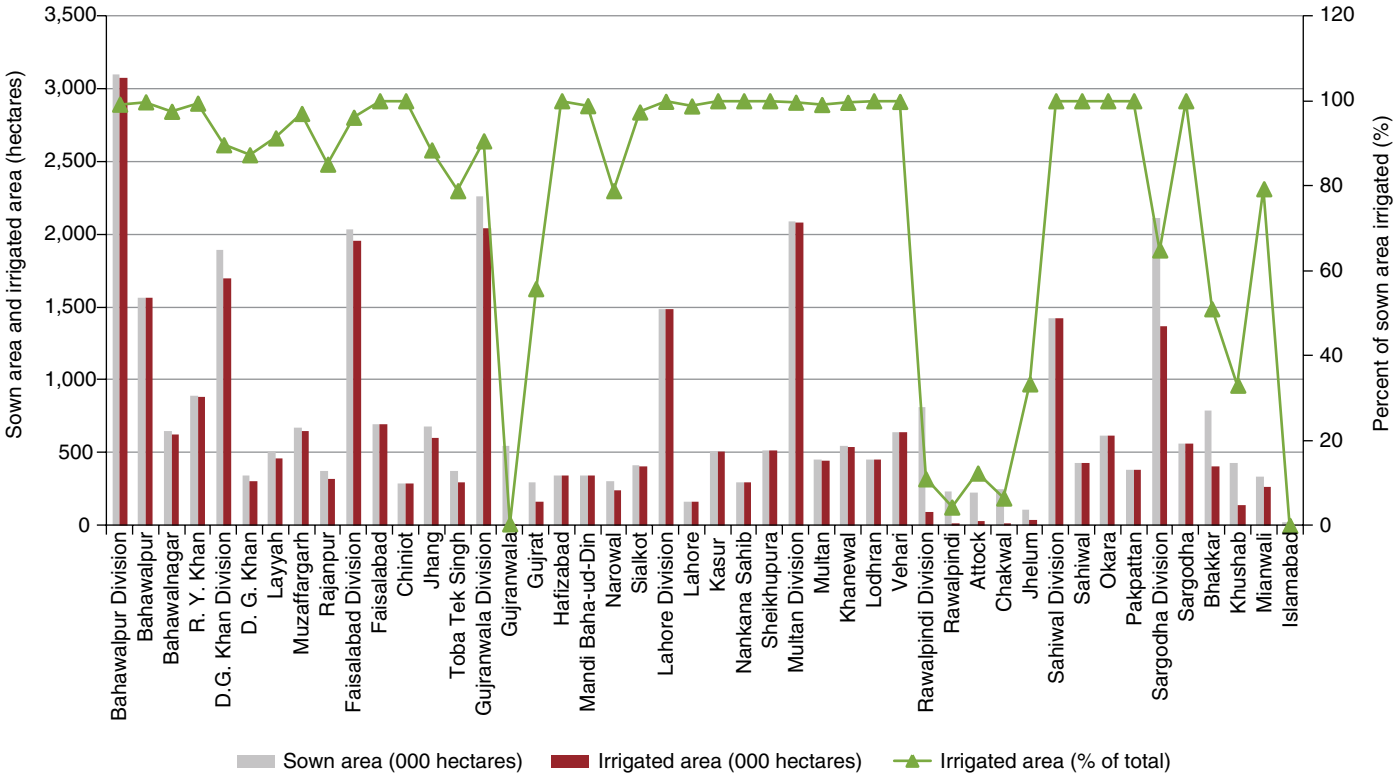
Source: CRS-DoA, GoPunjab, April 2017.

FIGURE 2.3: WHEAT IN PUNJAB: DISTRICT-LEVEL AVERAGE YIELD AND STANDARD DEVIATION (KG/ACRE), AND COEFFICIENT OF VARIATION FROM 2005–06 TO 2015–16



Source: CRS-DoA, GoPunjab, April 2017.

FIGURE 2.4: PUNJAB: SOWN AREA, IRRIGATED AREA, AND PERCENTAGE SOWN AREA IRRIGATED, 2013–14



Source: GoPunjab (Bureau of Statistics), 2014.

TABLE 2.2: PAKISTAN: AGRICULTURAL GROWTH PERCENTAGES (BASE = 2005–06)

Sector	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17
Agriculture	**0.23**	**1.96**	**3.62**	**2.68**	**2.5**	**2.53**	**0.15**	**2.07**
Crops	–4.16	0.99	3.22	1.54	2.64	1.04	–5.27	0.91
i) Important crops	–3.74	1.5	7.87	0.17	7.22	–0.52	–5.86	2.18
ii) Other crops	–7.24	2.27	–7.52	5.58	–76	3.09	0.4	–2.66
iii) Cotton ginning	7.29	–8.48	13.38	–2.9	–1.33	7.24	–22.12	5.58
Livestock	3.8	3.39	3.99	3.45	2.48	3.99	3.36	2.99
Forestry	–0.07	4.76	1.79	6.58	1.88	–10.43	14.31	–2.37
Fishing	1.4	–15.2	3.77	0.65	0.98	5.75	3.25	1.23

Source: Pakistan Bureau of Statistics.

TABLE 2.3: PUNJAB: LIVESTOCK AND POULTRY NUMBERS, 1960–2006

Animal	1960	1972	1976	1986	1996	2006	2006 as a percentage of total livestock, Pakistan
Cattle	9,673	8,226	8,108	8,817	9,382	14,412	49%
Buffaloes	6,129	7,413	7,979	11,150	13,101	17,748	65%
Sheep	5,583	6,280	8,037	6,686	6,142	6,362	24%
Goats	2,973	5,943	7,767	10,755	15,301	19,831	37%
Camels	266	365	338	321	187	199	22%
Horses	226	264	286	245	181	163	47%
Asses	897	1,063	1,139	1,657	1,948	2,232	52%
Mules	23	20	29	36	57	63	36%
Poultry	6,440	8,688	13,783	27,848	24,511	25,906	35%

Source: Agricultural Statistics of Pakistan 2014-15.

SMART Punjab contains a number of livestock-related policy reforms, such as the removal of price caps on milk and meat, the shifting of public funding for animal health away from curative care and toward preventive care, and an increased investment in breeding stocks of local animal breeds.

2.3. ACCESS TO AGRICULTURAL CREDIT

In Pakistan, public and private bank lending to the agricultural sector has tripled over the past eight years, and in FY2015/16 lending stood at PKR 598.3 billion. Table 2.4 shows that the main lenders were five commercial banks[16] accounting for 52 percent of all agricultural loans in 2015/16, followed by 14 domestic private banks[17] with a 21 percent market share. The former national agricultural development bank (Zarai Taraqiati Bank Limited, ZTBL) had a 15 percent market share, followed by microfinance institutions. The Punjab Provincial Cooperative Bank Limited (PPCBL) disbursed loans of PKR 10.3 billion in 2015–16 (1.7 percent share).

According to ZTBL, in Pakistan the gap between the demand for agricultural credit and the supply of credit has remained substantial over the years. This gap was about PKR 438 million in 2012–13. In 2015–16, ZTBL estimated that the total demand for agricultural credit was PKR 1,100 billion, against an

[16]Allied Bank Limited (ABL), Habib Bank Ltd (HBL), MCB Bank Limited (MCB), National Bank of Pakistan (NBP), and United Bank Ltd. (UBL).

[17]The 14 domestic private commercial banks are: (1) Askari Commercial Bank, (2) Bank Al-Habib, (3) Bank Al-Falah, (4) My Bank, (5) Faysal Bank, (6) Habib Metropolitan Bank, (7) PICIC Commercial Bank, (8) KASB Bank, (9) Prime Commercial Bank, (10) Saudi Pak Commercial Bank, (11) Soneri Bank, (12) Bank of Khyber, (13) Bank of Punjab, and (14) Standard Chartered Bank (Pakistan).

TABLE 2.4: PAKISTAN: SUPPLY OF AGRICULTURAL CREDIT BY LENDING INSTITUTIONS (PKR BILLION)

Year	ZTBL [1]	5 major commercial banks [2]	14 DPBs [3]	PPCBL [4]	MFBs [5]	Islamic banks [6]	Total
2007–08	66.94	94.75	43.94	5.93			**211.56**
2008–09	75.14	110.67	41.63	5.58			**233.01**
2009–10	79.01	119.61	43.78	5.72			**248.12**
2010–11	65.36	140.31	50.19	7.16			**263.02**
2011–12	66.07	146.27	60.88	8.52	12.11		**293.85**
2012–13	67.07	172.83	69.27	8.30	18.77		**336.25**
2013–14	77.92	195.49	84.81	8.81	22.80	1.53	**391.35**
2014–15	95.83	262.91	108.71	10.49	32.95	4.99	**515.87**
2015–16	**90.98**	**311.40**	**123.10**	**10.33**	**53.94**	**8.54**	**598.29**
% 2015–16	15.2%	52.0%	20.6%	1.7%	9.0%	1.4%	**100.0%**

Source: State Bank of Pakistan, Karachi.

[1] ZTBL—Zarai Taraqiati Bank Limited.

[2] Includes ABL, HBL, MCB, NBP, and UBL.

[3] DPB—Domestic Private Banks.

[4] PPCBL—Punjab Provincial Cooperative Bank Limited.

[5] Microfinance Bank included since July 2011.

[6] Three Islamic banks included since July 2013.

actual credit supply of PKR 598 billion (creating a gap of PKR 502 billion or 46 percent of total demand).

Limited access to production credit appears to be a major constraint on increasing farm investments and thus increasing productivity and yield gains in Punjab. According to SBP, currently about 1 million small farmers with less than 25 acres—only 12 percent of all farmers in Pakistan—borrow from banks and are insured on a compulsory basis under CLIS. About 70 percent (700,000) of these farmers are estimated to be in Punjab. Several commercial banks reported that they were reluctant to lend to farmers because of the high historical default rates.

Between 2007–16, because of natural calamities, 440 bank branches across Pakistan's six provinces had to reschedule agricultural loans with a total value of PKR 11,632.5 billion (about US$116 million). The two provinces that were most severely affected were Punjab, where 44 percent of all reported branches had to reschedule loans, and Sind, where 35 percent had to do so. In Baluchistan the major natural disasters causing loans to be rescheduled were drought (in 2007) and a tropical cyclone (2008); in all other years, heavy flooding and rains were the major reason for rescheduling. A record number of bank offices had to reschedule loans because of floods in 2010—135 branches in five of Pakistan's six provinces. The highest value of agricultural loans that banks had to reschedule was in 2012 (Table 2.5).

2.4. EXPOSURE OF AGRICULTURE TO CLIMATIC AND NATURAL DISASTERS

2.4.1. MAIN CLIMATIC AND NATURAL RISK EXPOSURES

Punjab is susceptible to a variety of natural disasters. Tornadoes, tropical cyclones, and earthquakes all occur, although not frequently. The Murree Hills and parts of Islamabad and Rawalpindi are located on or close to fault lines that can cause earthquakes, but the rest of Punjab is considered relatively safe from earthquake threats.

TABLE 2.5: AGRICULTURAL LOAN RESCHEDULING: NUMBER OF BRANCHES RESCHEDULING BY PROVINCE AND VALUE OF RESCHEDULED LOANS (2007–16)

S. No.	Year	Punjab	Sind	Baluch-istan	KP	AJK	Gilgit-Baltistan	Total	Loan Amount Rescheduled (PKR Million)	Reason for Calamity
1	2007	1	2	20				23	711.333	Flood, drought
2	2008	7	7					14	815.150	Flood, Tropical Cyclone
3	2009	1	2		9			12	1,788.701	Frost, Cloudy weather, rains
4	2010	38	49	14	25	9		135	1,305.995	Heavy Flood, Rains
5	2011	2	56	4				62	1,187.358	Heavy Flood, Rains
6	2012	10	27	7				44	2,336.852	Heavy Flood, Rains
7	2013	56			2			58	771.232	Heavy Flood, Rains
8	2014	55	10					65	714.280	Heavy Flood, Rains
9	2015	17	3					20	381.512	Heavy Flood, Rains
10	2016	7						7	1,621.049	Heavy Flood, Rains
Total		**194**	**156**	**45**	**36**	**9**	**0**	**440**	**11,633.462**	**Heavy Flood, Rains**
% of Total		44%	35%	10%	8%	2%	0%	100%		

Source: ZTBL 2017.

Note: KP = Khyber Pakhtunkhwa; AJK = Azad Jammu and Kashmir.

Punjab's geographic location, climate, and major river network make it very vulnerable to monsoon flash floods and riverine floods. Punjab is the basin for several major rivers that run North to South and originate in the Himalayas, including the Indus, Jhelum, Chenab, Ravi, and Sutlej rivers. Figure 2.5 shows the exposure in Punjab to flash flooding and riverine flooding. The likelihood that floods will occur, as well as their intensity, have increased significantly in the past decade or so. Punjab and other provinces of Pakistan experienced severe flooding in 2010, 2011, 2012, and 2014. The increased frequency and severity of flooding is believed to be linked to climate change.

Drought has become a frequent phenomenon in Pakistan. Drought is common throughout Pakistan; if the monsoon season fails to deliver rains, drought emerges. The drought of 1998–2002, considered to be the worst in 50 years, was identified by the Economic Survey of Pakistan as one of the factors precipitating poor growth performance during that period. Baluchistan, especially in its western and central areas, is very prone to drought. Punjab has two major sandy deserts, the Thal and Cholishtan, which are susceptible to drought. Agriculture in the rest of the province is relatively secure against drought because of its irrigation infrastructure.

Other climatic sources of crop losses include frost, wind, and hail. Frost in Punjab in December and January may induce crop losses and severely damage fruit and other horticultural crops. Localized wind storms between April and June also cause lodging in the wheat crop, grain shedding at maturity, and damage to tree fruit such as mangoes. Localized hailstorms also occur and can severely damage cereal and horticultural crops.

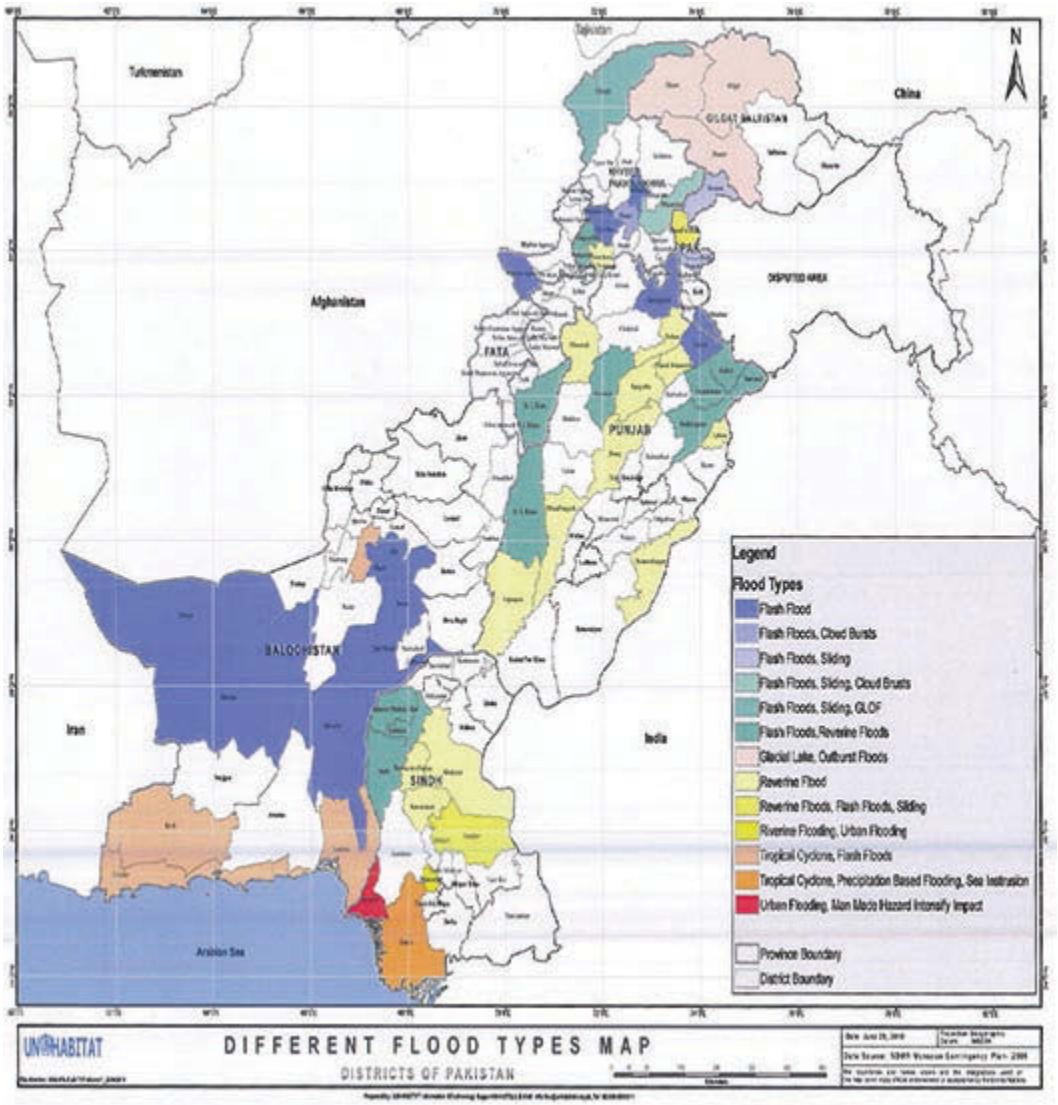
2.4.2. HISTORICAL EXPOSURE TO NATURAL AND CLIMATIC DISASTERS IN PAKISTAN AND PUNJAB

This section reviews the frequency and severity of natural and climatic disasters in Punjab. The analysis draws on two data sources: (1) NDMA and PDMA Punjab data for the 40 years from 1973 to 2012 (presented in World Bank 2015c) and (2) data collected by the Centre for Research on the Epidemiology of Disasters (CRED) for 1990–2017.

NDMA/PDMA Punjab 40-year Data

Between 1973 and 2012 in Pakistan, every year an average of approximately 3 million people were affected by natural catastrophes, predominantly floods. Floods affected 76.7 percent of all people affected by natural catastrophes, followed in order of severity by droughts (13.5 percent of all people affected), earthquakes (4.0 percent), windstorms (2.3 percent), and other perils such as avalanches and landslides (0.01 percent) (World Bank 2015c).

FIGURE 2.5: PAKISTAN: FLOOD MAP

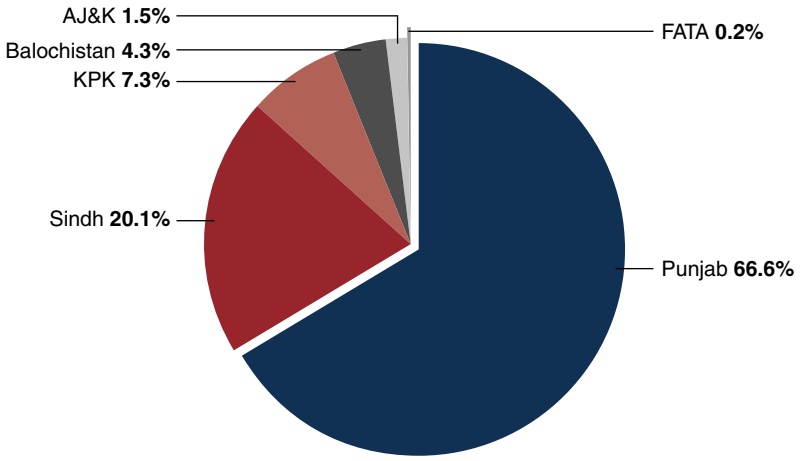


A very high proportion (67 percent) of all people affected by natural disasters between 1973 and 2012 were in Punjab (Figure 2.6). Punjab accounts for approximately 56 percent of the population of Pakistan, which suggests that people in this province are more exposed to and affected by natural catastrophes than people in the other provinces.

The CRED EM-DAT International Disaster Database

According to CRED EM-DAT data, 203 occurrences of natural disasters affected Pakistan between 1900 and 2017, and floods were by far the most frequent type of disaster. Floods occurred 94 times (representing 47 percent of all occurrences of natural disasters) over this period, and affected 79.3 million people (98 percent of all people affected by natural disasters). Earthquakes were the second most frequent event, with 31 occurrences (15 percent of total), but it was by far the largest cause of death, accounting for 143,734 fatalities (81 percent of all recorded deaths). Windstorms accounted for 12 percent of the events and landslides 11 percent. Only one drought was reported in Pakistan over this 117-year period; in this regard, it is important to note that drought is a slowly developing

FIGURE 2.6: PAKISTAN: GEOGRAPHIC DISTRIBUTION OF PEOPLE AFFECTED BY NATURAL DISASTERS, 1973–2012



Source: World Bank 2015c. Data from National and Provincial Disaster Management Authorities.

Note: KPK = Khyber Pakhtunkhwa; AJ&K = Azad Jammu and Kashmir; FATA= Federally Administered Tribal Areas.

peril that affects people's livelihood over a longer period and is seldom reported as an isolated natural disaster (Figure 2.7 and Annex 2).

The total estimated value of damage over the 117-year period was US$28.3 billion, and flood damage accounted for 74 percent of this value. The second most costly source of damage was earthquakes (19 percent), followed by storms (6 percent) and droughts (1 percent) (Figure 2.7 and Annex 2).

The earthquake of 2005 was the single worst event in terms of loss of life, with 73,338 reported deaths and economic losses of US$5.2 billion. The 2010 flooding was the worst event in terms of total numbers of people affected (20.4 million) and was also associated with the highest economic losses, estimated at US$9.5 billion (Annex 2).

There is clear evidence that the frequency and severity of natural disasters are increasing over time in Punjab. Figure 2.8 shows that between 1990–99 and 2000–09 the number of events dramatically increased, along with the number of people affected, which rose to over 35 million in the most recent decade. The value of damage has also risen dramatically in recent decades.

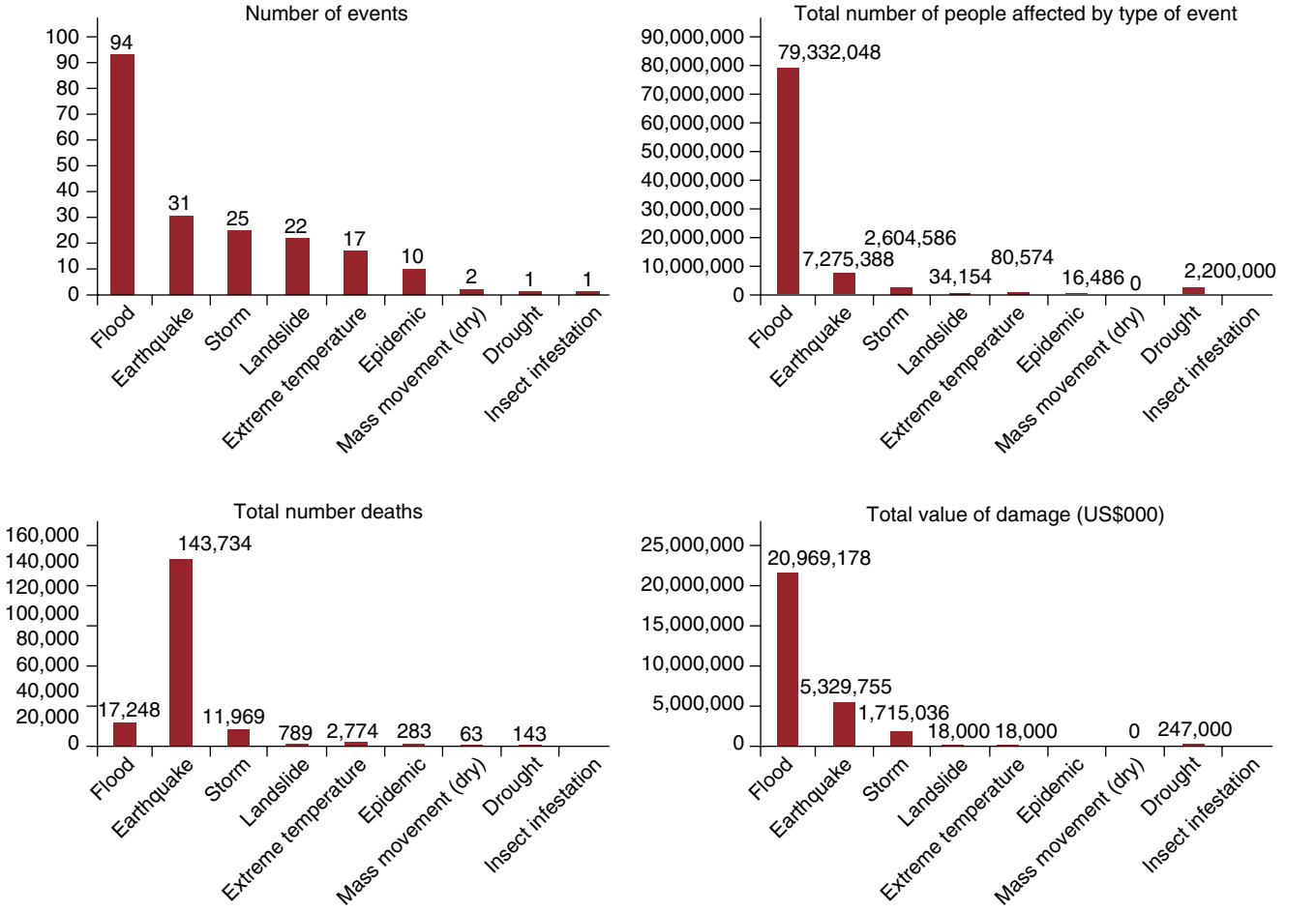
2.4.3. IMPACT OF NATURAL DISASTERS ON THE AGRICULTURAL SECTOR IN PUNJAB

In Punjab, monsoon floods cause severe damage to agricultural crops grown in the Kharif season. Between 2010 and 2013, PDMA Punjab estimates that floods affected 3.25 million acres of cropped area or an average of nearly 815,000 acres per year. In the worst flood year, 2010, monsoon floods affected 1.91 million acres or about 10.3 percent of all Kharif cultivated area in Punjab (Table 2.6).[18] Figure 2.9 shows districts and numbers of people affected by the 2010 floods in Punjab.

The World Bank has estimated the value of lost crop production (gross revenue) in Punjab due to flooding at an average of PKR 40.7 billion (US$407 million) per year between 2010 and 2013, with a maximum loss in 2010 of PKR 95.7 billion (US$957 million). This analysis assumes that (1) the crop area affected is 100 percent damaged, and (2) the average gross revenue for all affected crops, including rice, maize, cotton, sugarcane, vegetable crops, and tree fruit, is PKR 50,000 per acre. Over this four-year period, total flood damage to crops is estimated at

[18]In Punjab the total cropped area in the Kharif season is about 7.5 million hectares or 18.5 million acres (Bureau of Statistics, GoPunjab 2015).

FIGURE 2.7: PAKISTAN: RECORD OF DAMAGE BY TYPE OF NATURAL AND CLIMATIC EVENT, 1900–2017



Source: CRED EM-DAT.

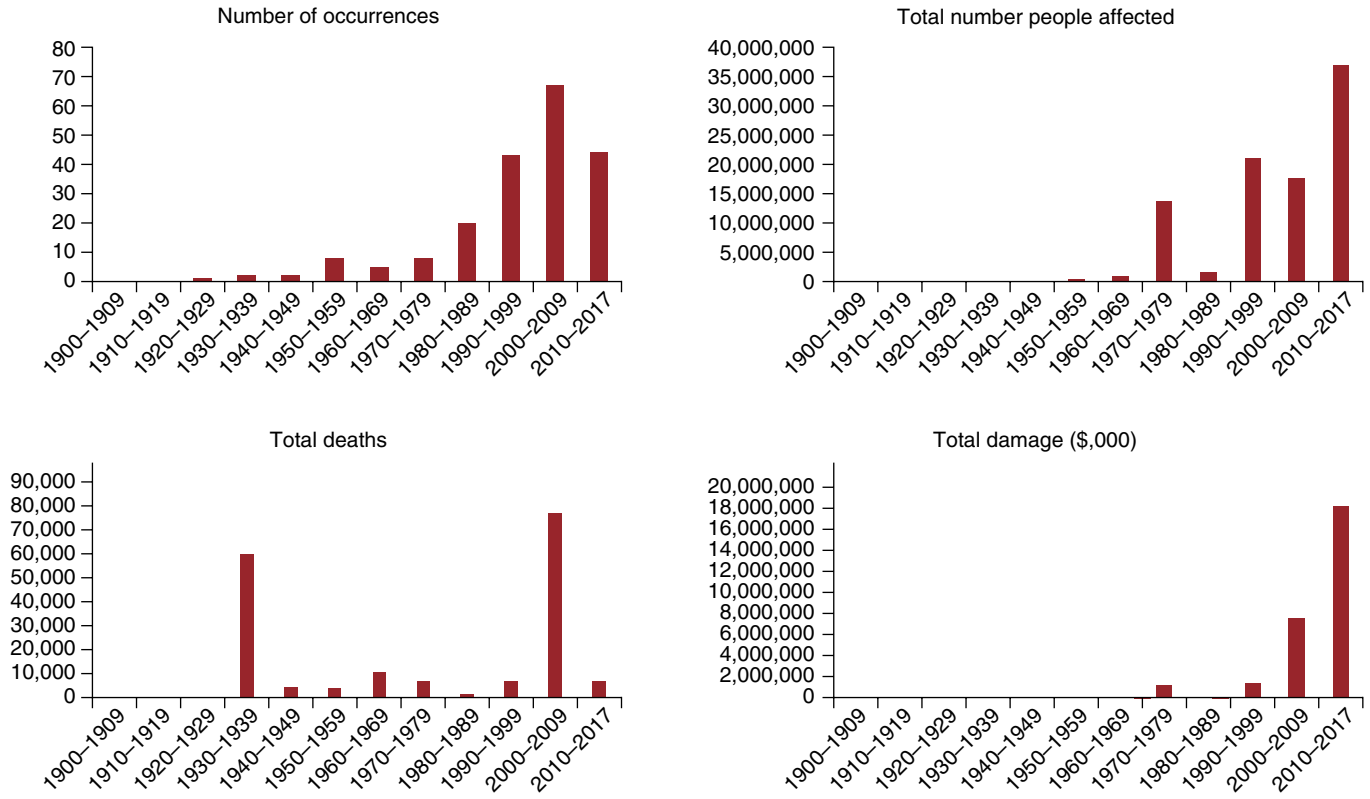
PKR 163 billion (US$1.6 billion). This loss is very substantial for the province and its farmers, especially small subsistence farmers (Table 2.7). Chapter 3 presents an analysis of the actual flood compensation paid to farmers by GoPunjab during the corresponding period.

The floods of 2010 caused livestock producers throughout Pakistan to lose about 1.2 million animals, including poultry, and severely affected producers in Punjab (see Figure 2.9 showing the extent of the 2010 floods in Punjab). In 2011, flooding mainly in Baluchistan and Sind provinces led directly to the death of 115,500 livestock but adversely affected a further 5 million animals due to migration from the flood-affected areas, disease outbreaks, and other related events.

2.4.4. EFFECTS OF CLIMATE CHANGE ON AGRICULTURAL CROP PRODUCTION AND YIELDS IN PUNJAB

It is now widely accepted that climate change threatens the stability of agricultural productivity and output as well as the increases in productivity and output required to meet future demand. Between 2010 and 2050, it is estimated that the world's population will increase from 6.7 billion to 9 billion, mostly in South Asia and Sub-Saharan Africa. As a result, total agricultural production will need to increase by an estimated 70 percent over that period. The long-term changes in patterns of temperature and precipitation that are part of climate change are expected

FIGURE 2.8: PAKISTAN: ANALYSIS OF NATURAL AND CLIMATIC DISASTER DAMAGE RECORDS BY DECADE, 1990–2017



Source: CRED EM-DAT.

TABLE 2.6: PUNJAB: LOSSES AND DAMAGES CAUSED BY FLOODS, 2010–13

Year	No. of District Affected	Villages Affected	Persons Affected	Area Affected (Acres)	Cropped Area Affected (Acres)	Houses Damaged	Person Died
2010	11	1,810	5,038,992	3,471,109	1,914,104	379,520	258
2011	12	335	26,393	136,758	125,513	1,284	4
2012	12	1,271	887,345	1,490,827	473,998	67,324	60
2013	22	2,994	184,147	945,541	745,655	20,411	111
Total	**57**	**6,410**	**6,136,877**	**6,044,235**	**3,259,270**	**89,019**	**175**
Annual Average	14	1,603	1,534,219	1,511,059	814,818	29,673	58

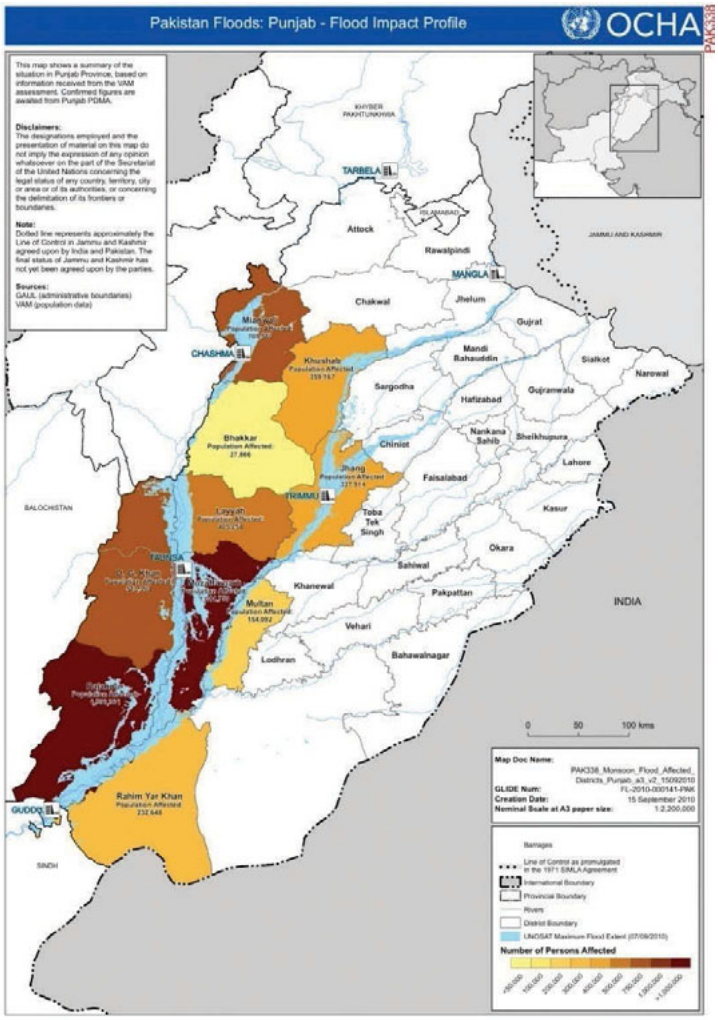
Source: PDMA Punjab 2014.

TABLE 2.7: PUNJAB: ESTIMATED VALUE OF FLOOD DAMAGE TO AGRICULTURE 2010–13

Year	Cropped area affected (acres)	Value of crop loss (PKR/acre)	Total value of crop losses (PKR)	Value of crop losses (US$)
2010	1,914,104	50,000	95,705,200,000	957,052,000
2011	125,513	50,000	6,275,650,000	62,756,500
2012	473,998	50,000	23,699,900,000	236,999,000
2013	745,655	50,000	37,282,750,000	372,827,500
Total	**3,259,270**		**162,963,500,000**	**1,629,635,000**
Annual Average	814,818		40,740,875,000	407,408,750

Source: Authors' analysis of PDMA Punjab flood damage data.

FIGURE 2.9: PUNJAB: DISTRICTS FLOODED IN 2010 AND NUMBER OF PEOPLE AFFECTED



to shift production seasons, alter pest and disease patterns, and modify the set of crops that can be produced. All of these changes will affect production, prices, incomes, and ultimately livelihoods and lives (FAO 2010).

Pakistan is vulnerable to climate change, including increased temperatures and more extreme droughts, rainfall, and flooding. There have been several studies on the effects of climate change on crop production and yields. Ali et al. (2017) examined the effects of climate change (such as maximum and minimum temperatures, levels of rainfall and relative humidity, and sunshine hours) on the major crops grown in Pakistan, including Rabi wheat, Kharif rice, maize, and sugarcane. Their findings differ for each crop type. For wheat, they found that increasing temperature leads to a significant yield reduction, and that excessive rainfall and relative humidity are also negatively correlated with wheat yields. In the case of rice and sugarcane, increasing temperature and relative humidity are associated with higher yields in these crops. Overall, climate change has adverse impacts on the yields of major food crops. The authors note that almost 60 percent of Pakistan's population is living below the poverty line, and as the population is growing rapidly, the country may face food security challenges in the near future.

Siddiqui et al. (2012) conducted a separate study of how changes in climate change indicators may affect production of four major crops in Punjab. Their results show that in the short run the increase in temperature is expected to reduce wheat yields, but in the long term the increase in temperature has a positive effect on wheat productivity. The increase in precipitation, however, has a negative impact on wheat yields in both the short and long terms. A rise in temperature is

beneficial for rice production initially, but beyond a certain optimal temperature, further increases in temperature become harmful for rice production. Interestingly, the increase in precipitation does not seem to harm rice productivity. It has been evident that the change in climate variables (temperature, precipitation) has a significant negative impact on production of cotton. Finally, the increase in temperature also harms sugarcane productivity in the long term.

2.4.5. POTENTIAL ROLE FOR AGRICULTURAL INSURANCE IN A CLIMATE CHANGE ADAPTATION STRATEGY

SMART Punjab is expected to generate considerable climate adaptation co-benefits. In Results Area 1, reorienting and increasing funding to agricultural research should result in more funding for agricultural research oriented toward climate resilience. Improvements in livestock health should increase animals' resilience to heat stress and diseases. The modernization of the wheat market includes improved wheat storage facilities, which should protect emergency wheat stocks from climatic effects, compared to the dilapidated storage facilities where stocks are currently stored. A shift to high-value agriculture will involve crop diversification, shorter growing cycles, and more efficient use of irrigation, which should reduce farmers' vulnerability to climate change. Results Area 2 of SMART Punjab, which provides incentives to agribusiness for investment in value addition, may finance improved storage facilities, which should improve the climate resilience of stored agricultural products. Results Area 3, which improves the sustainability of irrigation,[19] should help producers adapt to the impacts of climate change on water resources. The introduction of agricultural insurance and climate-smart agriculture assists farmers to make their operations more resilient to adverse weather events.

In addition, SMART Punjab is expected to generate climate mitigation co-benefits. Improved livestock breeding would reduce pressure on rangelands and benefit maintenance of carbon pools in rangeland areas. A shift to high-value agriculture is expected to lead to reduced fertilizer use, and increased investments in climate-smart agriculture are likely to lower emissions from agriculture.

The role of climate risk insurance, including agricultural insurance, as part of both a small farmer development strategy and a climate smart adaptation strategy has been enshrined under the 2016 Paris Agreement on Climate Change. The Paris Agreement identified a number of areas of cooperation between the international community of nations, including: early warning systems; emergency preparedness; slow onset events; comprehensive risk assessment and management; and risk insurance facilities, climate risk pooling, and other insurance solutions. Climate risk insurance is seen as a tool that can help the rural poor, including small farmers, to address loss and damage from the extreme weather events (such as storms, floods, or droughts) that are increasing in frequency and severity due to climate change. Climate risk insurance can also contribute to building resilience (or adaptation), as resilience measures can be incorporated into the design of the insurance, for instance by providing incentives such as lower premiums for undertaking activities such as planting trees or using seeds of drought-resistant varieties. Specific initiatives, such as the G7 InsuResilience initiative, have recently been launched to increase by up to 400 million the number of people in the most vulnerable developing countries with access to direct or indirect insurance coverage against climate change hazards by 2020 (RESULTS 2016).

Linking or bundling agricultural insurance with credit can improve small farmers' access to loans to enable them to invest in productivity-enhancing and climate-smart agricultural technology. Agricultural insurance can be a win-win for both the farmer and the lending institution. Many lending institutions are reluctant to lend to small farmers, whom they regard as poor risks; however, when credit is bundled with a crop or livestock insurance coverage, bank loans are protected against default in the event of major climate-induced crop failure or death of the animal. Where bundling is adopted, banks are generally more willing to extend loans to small farmers (as seen in India, Pakistan, Malawi, and Kenya). Farmers, in turn, benefit by gaining access to credit for investing in often riskier but higher yielding seed and fertilizer technology or in livestock breeds that can produce more milk, thereby benefiting from production and income gains, as well as the security that loans can be repaid if a crop fails or livestock die. Governments in many countries actively promote compulsory crop or livestock insurance for farmers who borrow from formal lending institutions. One example is India, where the National Agricultural

19 Irrigation is one of the most effective measures for enhancing crop production and yields, leading to gains of up to 130 percent in crop productivity over rain-fed cropping (FAO 2010). Irrigation can also help to reduce such adverse effects of climate change as reduced precipitation and higher variability in rainfall.

Insurance Scheme (NAIS) is mandatory for all such borrowers (loanees), and another is Pakistan, where CLIS is compulsory for small farmers to obtain seasonal loans (Chapter 3 reviews the performance of CLIS, and Chapter 4 reviews that of NAIS).

It will be very important to ensure that the proposed expansion of agricultural crop and livestock insurance in Punjab does not act as a disincentive for government and farmers alike to invest in climate-smart technology and practices. The potential downside of introducing agricultural insurance, especially where it is supply driven and heavily subsidized, is that farmers may be less willing to invest in and adopt climate-smart technologies and farming practices that reduce risk, as they are insured against climatic disasters. Little evidence in the insurance literature supports the argument that agricultural insurance is a disincentive to the adoption of climate-smart technology, but it will still be important that in Punjab the expansion of agricultural insurance is accompanied by insurance literacy campaigns and training and education about the role of insurance. It is also important for GoPunjab to recognize that agricultural insurance is not a substitute for social protection systems nor for investment in disaster risk reduction and climate change adaptation strategies.

CHAPTER 3
AGRICULTURAL INSURANCE PROVISION AND NATURAL DISASTER RELIEF PROGRAMS IN PUNJAB

The private sector insurance market is very small in Pakistan compared to neighboring countries. In 2014 the total life and non-life insurance premium in Pakistan was PKR 180 billion (US$1.8 billion), of which the life insurance market contributed 69 percent of premiums compared to the non-life market of only 31 percent. In Pakistan in 2014, the total expenditure on life and non-life insurance was US$9.60 per capita, which was equivalent to a market penetration of 0.71 percent of GDP, compared to an expenditure of US$488.96 per capita in Malaysia (4.34 percent of GDP), US$50.97 (3.14 percent of GDP) in India, and US$35.67 per capita (1.02 percent of GDP) in Sri Lanka (AXCO 2017).

Agricultural insurance is relatively undeveloped in Pakistan. Livestock insurance was introduced on a pilot basis in 1983 by two private insurers, Adamjee Insurance Company and the Eastern Federal Union Insurance Company. Crop insurance is relatively new, dating from 2008 under the public-private partnership (PPP) that established CLIS as a scheme with national scope.

3.1. CROP INSURANCE

3.1.1. CROP LOAN INSURANCE SCHEME: KEY FEATURES

Launched in the 2008 Kharif season, CLIS is an initiative of SBP. It is structured as a PPP between SBP, 22 of 36 public and commercial banks and microfinance institutions (MFIs) lending to farmers, and a group of 14 insurance companies, including (among others) New Jubilee, EFU General, National Insurance Company, UBL, Adamjee, United, Silver Star, Atlas, and Alfalah. CLIS is currently implemented throughout Pakistan but is concentrated in Punjab Province, because of its leading role in agriculture.

As mentioned, CLIS is a federal crop-credit insurance scheme that is compulsory for all farmers who obtain seasonal production loans from a commercial bank to cultivate any of five major crops (wheat, rice, maize, sugarcane, and cotton). The sum insured is based on the value of the seasonal crop loan provided to the farmer. In 2016–17, the maximum loan amount was fixed at PKR 40,000 per acre for Kharif food crops (rice, maize) and PKR 30,000 per acre for Rabi crops (wheat).

The CLIS policy insures again multiple perils that cause yield losses in crops: excessive rain, flood, drought, hailstorm, frost, crop pests (such as locusts), and crop viral and bacterial diseases.

The CLIS is also a catastrophic crop insurance product that pays out only if damage or losses as declared by the government are in excess of 50 percent of crop production and yields in the defined area (the district, tehsil, or village, for example). The scheme carries a two-stage indemnity procedure: first the Provincial Government/Board of Revenue[20] have to declare an agricultural disaster (Calamity Declaration) where localized crop losses at a village level or subdistrict level exceed 50 percent of the reference crop yield[21] for that area. This declaration must be notified in the Gazette. If a calamity is declared, the lending banks and insurers are then responsible for assessing actual damage at the individual farmer level for their own loanees/insured farmers. It is also important to note that the CLIS policy is a Constructive Total Loss Policy: if the assessed damage exceeds the 50 percent trigger, the sum insured (amount of outstanding crop loan owed by the loanee to the lending institution) is paid in full to the lending institution, and the farmer's outstanding loan is written off. This procedure contrasts with the more conventional approach taken by crop insurance policies, which is to indemnify losses on a proportional basis according to the actual amount of yield loss up to a 100 percent loss, when a full payout or indemnity payment is due.

The CLIS policy carries a maximum 2 percent commercial premium rate, which is fully subsidized by the Government of Pakistan (GoP) for small and marginal farmers with up to 25 acres of land. The insurance companies are free to set their own premium rates for the different crops in different regions for damages/losses which exceed 50 percent of the expected crop production and yields, subject to a maximum cap of 2 percent for the operation of federal government premium subsidies. The GoP, through SBP, pays 100 percent of the premiums for small and marginal farmers (defined as farmers owning or cultivating up to 25 acres; this limit was raised from 12.5 acres in 2015). Farmers with more than 25 acres who take out seasonal loans do not qualify for any government premium subsidies. The lending banks are responsible for paying the premiums to the insurance companies at the time of inception of coverage. The banks then reclaim the premium subsidies from SBP against the provision of premium bordereaux providing evidence of each loanee, their sum insured, premium rate, and amount of premium paid by the bank to the insurance company(ies).

A unique feature of CLIS is that it caps insurers' and their reinsurers' liability at a loss ratio of 300 percent per cropping season—in other words, in Kharif and Rabi seasons separately. The loss ratio is equal to the value of claims paid divided by the value of written premium expressed as a percentage. The 300 percent loss ratio cap on the CLIS means that the maximum claims liability borne by an insurer and its reinsurer(s) would be equal to three times the value of the premium they have received. The government's rationale for capping losses is (1) to encourage insurance and reinsurance companies to participate in this catastrophic crop insurance program, and where the covariate risk exposure is very high, especially for the perils of flood and drought; and (2) given that the premium rate is capped at 2 percent, the government decided to cap the losses as well. Further details of the CLIS are summarized in Table 3.1.

3.1.2. CROP LOAN INSURANCE SCHEME UPTAKE AND RESULTS

Scaling Up the Scheme

The CLIS has been operational for about a decade, and in 2016–17 the scheme insured about 1 million crop-credit recipients of whom about 70 percent (700,000 insured loanee farmers) were in Punjab.[22] Table 3.2 and Figure 3.1 show that over

[20]According to SBJ, up to 13 different government departments and the Disaster Relief Commissioner are responsible for conducting the estimation of post-event losses to assess whether a calamity should be declared. This area-based assessment takes into account the cause of loss and the loss of lives, damage to public property and private dwellings, and also damage to crops and livestock.

[21]The reference yield for each crop is based on the average of annual yields in the middle three of the past five years, discounting the years with the highest and lowest yields (SBP 2008).

[22]Estimate provided by SBP, April 2017.

TABLE 3.1: SBP TASK FORCE: CROP LOAN INSURANCE FRAMEWORK

Objective	To providing insurance coverage to farmers in the event of failure of crops as a result of natural calamities, floods, rains, pests, and diseases
Beneficiaries	All borrowers availing Agriculture Production Loans from banks/MFBs
Crops covered	Wheat, rice, sugarcane, maize, cotton
Coverage period	The insurance coverage would be for the period from sowing/transplanting of the crop to its harvesting, except in the case of sugarcane
Premium rate	Maximum 2% per crop per season inclusive of standard levies
Sum insured	Sum insured will be based on the per acre borrowing limits prescribed by the State Bank of Pakistan, subject to a maximum amount agreed between the banks/MFBs and insurance company.
Perils covered	Indemnity would be payable on the occurrence of production loss due to: (a) natural calamities like excessive rain, hail-storm, frost, cyclone, flood, and drought, etc.; (b) crop diseases like viral and bacterial attacks, or any other damage caused to the produce by infestation like locust attacks, etc.
Indemnification	A valid claim (as mutually agreed between the bank and the insurance company) under the scope of coverage will be payable subject to the following: (i) The insured crop is situated in an area declared as a calamity affected by the respective provincial government or revenue authority (ii) Damage to the crop was due to any of the insured perils
Main exclusions	» War, civil war, strikes, riots, terrorism, etc. » No utilisation/sowing » Earthquake or volcanic eruption » Loss before risk declaration or after harvesting » Price fluctuations and loss of market
Premium payment	The premium shall be paid up front by the banks in respect of farmers (with subsistence land holding or with land holdings up to 25 acres) at the time of disbursement of production loans.
Payment of the claims	Claims shall be payable to the banks/MFBs by the insurers for credit to the insured borrower's loan account. Insurance companies to ensure payment to banks/MFBs within 30 days after notification of calamity for ultimate credit to the loan accounts of the borrowers.

Source: SBP 2017.

the eight-year period from 2008/09 to 2015/16 the program insured 3.6 million farmers and generated a total premium of PKR 3,661 million, or an average premium of PKR 1,102 per insured farmer. In 2015–16 the CLIS portfolio increased very significantly to insure 885,852 insured farmers for a total premium of PKR 1,152 million (about US$11.5 million). In 2016/17, SBP estimated that the number of CLIS insured farmers had risen to 1 million, and that 70 percent (700,000) were in Punjab—in other words, about 13 percent of all farmers in Punjab were insured under CLIS.[23] Over this eight-year period the total sum insured (TSI) has amounted to PKR 242 billion, with an implied long-term average premium rate of 1.53 percent and average sum insured per insured farmer of about PKR 67,000.[24] The 2016–17 premium rates charged by CLIS insurers ranged between 1.5 percent and 1.7 percent.[25]

Underwriting Results for the CLIS

In the eight years from 2008–09 to 2015–16, CLIS paid claims valued at PKR 3.0 billion, with an implied long-term average loss ratio of 81 percent.[26] In other words, once the insurance companies have added their operating expenses, the CLIS only breaks even or is marginally profitable for them. So far, the worst losses occurred in 2010, when very serve monsoon floods in Khyber Pakhtunkhwa spread southward

[23]Adamjee Insurance Company estimates that CLIS farmers are distributed as follows: Punjab (70–75%), Sind (10–12%), KPK (5–6%), Federally Administered Tribal Areas (2%), and Baluchistan (<1%).
[24]SBP figures reported by DoA, GoPunjab, June 2017.
[25]For example, ZTBL insures its crop production loan portfolio of about PKR 60 billion with three CLIS insurers, Adamjee Insurance Company Limited, United Insurance Company Limited, and Asia Insurance Company Limited, with an average rate of 1.7 percent for the five crops (wheat, maize, rice, sugarcane and cotton) (ZTBL 2017).
[26]SBP data reported by DoA, GoPunjab June 2017.

TABLE 3.2: CLIS: NUMBER OF INSURED BORROWERS, PREMIUM, AND AVERAGE PREMIUM PER LOANEE PER SEASON AND YEAR, 2008/09–2015/16

Year/season	No. of insured borrowers	Premium amount (PKR)	Average premium/borrower (PKR)
Kharif 2008	94,386	44,385,009	470
Rabi 2009	200,928	112,534,187	560
Total 2008/09	**295,314**	**156,919,196**	**531**
Kharif 2009	191,442	135,795,437	709
Rabi 2010	246,026	143,714,756	584
Total 2009/10	**437,468**	**279,510,193**	**639**
Kharif 2010	214,157	147,222,573	687
Rabi 2011	277,414	203,073,769	732
Total 2010/11	**491,571**	**350,296,342**	**713**
Kharif 2011	207,873	148,750,526	716
Rabi 2012	246,538	208,084,877	844
Total 2011/12	**454,411**	**356,835,403**	**785**
Kharif 2012	188,148	132,698,994	705
Rabi 2013	224,317	211,779,219	944
Total 2012/13	**412,465**	**344,478,213**	**835**
Kharif 2013	165,678	145,942,057	881
Rabi 2014	176,324	225,697,113	1,280
Total 2013/14	**342,002**	**371,639,170**	**1,087**
Kharif 2014	141,048	207,326,337	1,470
Rabi 2015	188,104	442,248,104	2,351
Total 2014/15	**329,152**	**649,574,441**	**1,973**
Kharif 2015	351,741	394,031,203	1,120
Rabi 2016	504,111	757,800,665	1,503
Total 2015/16	**855,852**	**1,151,831,868**	**1,346**
Total Kharif	1,554,473	1,356,152,136	872
Total Rabi	2,063,762	2,304,932,690	1,117
Total all 8 years	**3,618,235**	**3,661,084,826**	**1,012**

Source: SBP data provided by DoA, GoPunjab, June 2017.

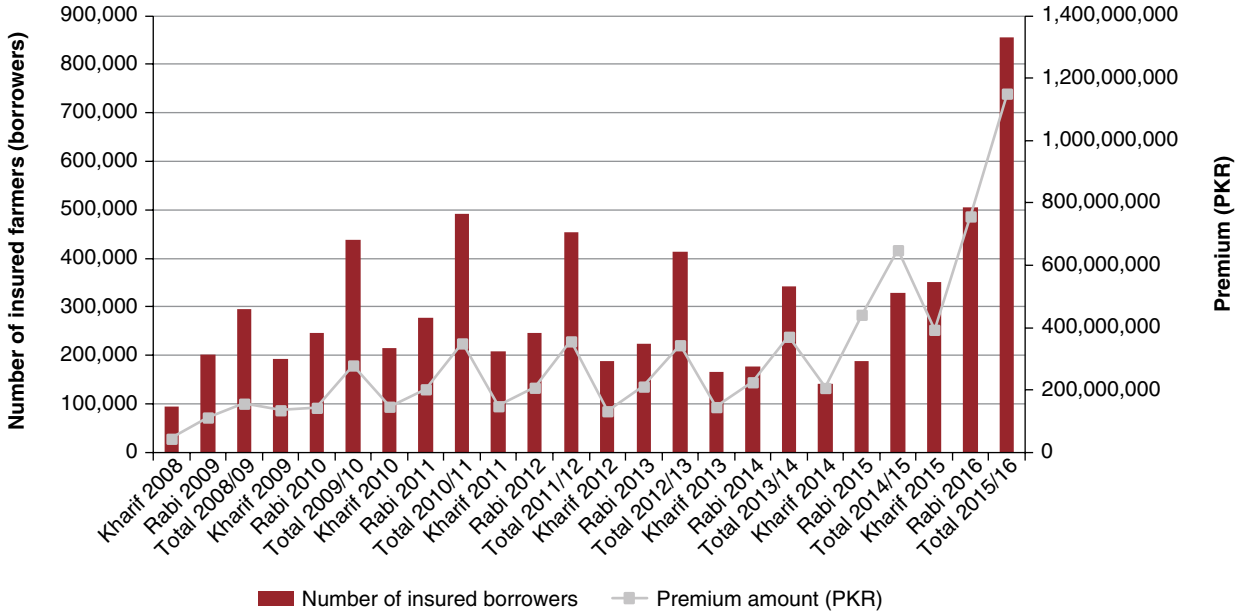
through Punjab, Baluchistan, and Sind. At its worst, the flooding covered about one-fifth of the land area of Pakistan; 18 million people were affected, 12 million houses were damaged or destroyed, 2.2 million hectares of crops were damaged or destroyed, and 450,000 head of livestock were lost.[27] The 2010 floods mainly damaged crops grown in southern Punjab and Sind provinces. The extent to which individual lending institutions incurred loss ratios in excess of 300 percent on their loan portfolios in the 2010 floods is not known. Flood losses were also incurred in 2011, 2012, and 2014.

In Punjab between 2008 and 2015, CLIS has made payouts to the banks for a total of 54,445 farmers (loanees) with a total value of claims of PKR 2,205 million. The average size of a claim over these eight years was PKR 40,508 per claimant (loanee farmer), but Figure 3.2 shows the variation across years. In the worst year (2010), claims valued at PKR 711 million were settled for 20,723 loanees; other challenging years were 2011 (10,865 claims valued at PKR 430 million) and 2012 (11,380 claims valued at PKR 377 million), followed by 2013 (4,654 claims valued at PKR 344 million) and 2014 (5,625 claims valued at PKR 272 million).

Since its inception, CLIS has been reinsured with international reinsurers. HannoverRe and SwissRe

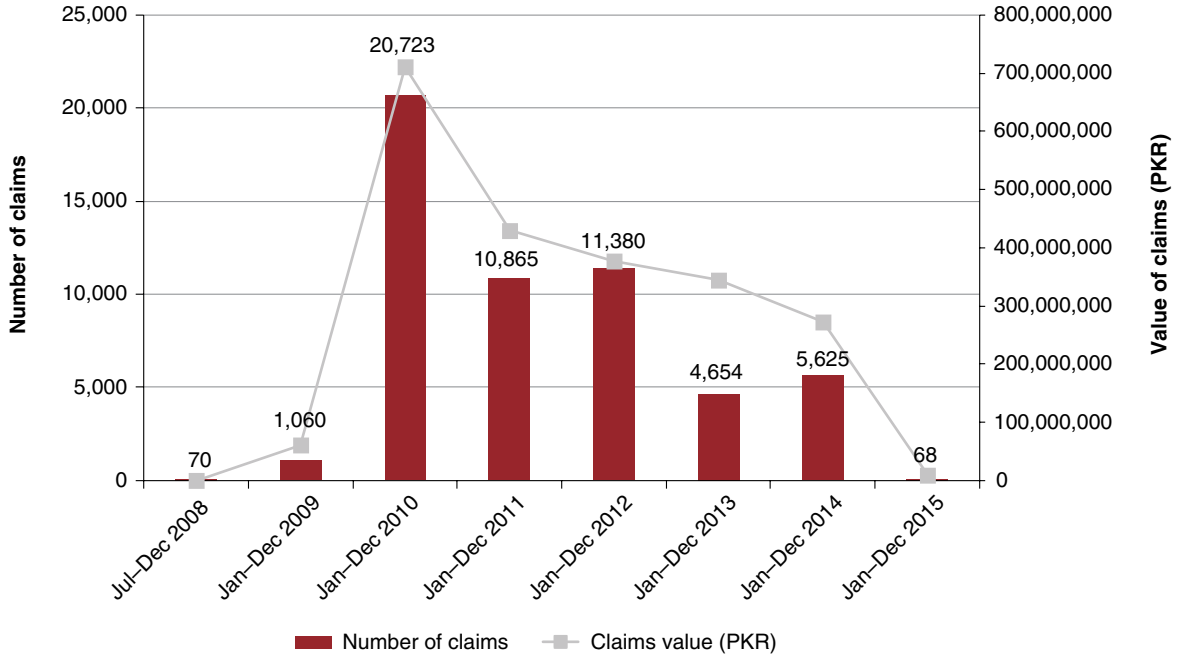
[27]See https://www.dec.org.uk/articles/pakistan-floods-facts-and-figures

FIGURE 3.1: CLIS: NUMBER OF INSURED BORROWERS AND PREMIUM INCOME, 2008–09 TO 2015–16



Source: SBP data provided by DoA, GoPunjab June 2017.

FIGURE 3.2: NUMBER AND VALUE OF CLIS CLAIMS IN PUNJAB, 2008–15



Source: DoA, GoPunjab June 2017.

are the main international reinsurers supporting CLIS, and they again enjoy the protection of the capped liability of a 300 percent loss ratio.

Following the major 2010 floods, and recognizing that only a relatively small proportion of Pakistan's 7 million farming households using formal credit were insured, in 2011 the GoP constituted a task force under the SBP to formulate a National Agricultural Insurance Scheme (NAIS). The NAIS was intended to extend CLIS coverage to provide automatic catastrophe protection to all farmers

in Pakistan, whether they were loanees or non-loanees; insured crops would include wheat, rice, maize, cotton and sugarcane (PPAF 2012). The estimated cost of premiums for the NAIS was about PKR 22 billion (US$220 million). The NAIS has not been implemented.

3.1.3. ISSUES AND CHALLENGES FACING THE CROP LOAN INSURANCE SCHEME

The drawbacks of the CLIS include:

a) **The direct beneficiaries of CLIS are the lending institutions, which receive the payouts to offset loans to farmers.** Therefore, although small-scale farmers remain credit worthy, they have no protection for the loss of the additional costs they have incurred in growing the crop or for the loss of crop income from the sale of their crop.

b) **CLIS is a catastrophe insurance product that pays claims only when crop damage exceeds 50 percent of the normal or average yield in a defined area** (such as the district, subdistrict, tehsil, or village) and when the government formally declares that a calamity has occurred. If crop damage exceeds 50 percent, the policy pays out the sum insured in full (as per a Constructive Total Loss policy). Where area damage is estimated at less than 50 percent of crop production and yield, neither the bank nor the insured farmer receives any form of compensation. The potentially very significant risk with this provision is that bankers may shy away from crop loans.

c) **The crop insurance policy does not indemnify the farmer (loanee) for crop losses.** Farmers who lose up to nearly half their expected crop still have to repay their loans to the banks out of the sale of their remaining harvest, which leaves farmers with little or no surplus to feed their families or to purchase seed and other inputs for the next crop season.

d) **The scheme insures losses only in five major Rabi and Kharif food and cash crops and does not protect banks/farmers for losses in high-value vegetable and tree fruit crops.** In Punjab, commercial banks lending to farmers growing high-value crops such as tobacco, potatoes, bananas, mangoes, or citrus cannot purchase coverage against excess rain and floods, frost, and hail in these crops.

e) **The declaration by local government of a disaster (calamity) appears to be subjective and open to interpretation.** The original SBP framework for CLIS recommended that a calamity should be declared where actual yield losses in the defined area exceed 50 percent of the actual average yield for that area in the past three out of five years. This actual objective assessment of area yields does not appear to be carried out consistently, however.

f) **Standardized or objective loss assessment procedures for the in-field measurement of actual damage by insurers and banks also appears to be lacking.** The costs of individual farmer field-level yield loss assessment on very small farms is extremely high and time consuming. Indeed, one MFI reported it did not adjust losses in the field, as it was cheaper to pay the full value of the sum of insured loans to the bank.

g) **Disputes appear to result in major delays in settling some claims**. According to SBP data, over the eight years from 2008–09 to 2015–16, the number of outstanding claims was 5,167 (9.5 percent of total claims), valued at PKR 220 million (10.0 percent of the total value of claims).[28]

h) **Because losses are capped at a 300 percent loss ratio each season, the lending institutions are highly exposed to losses arising from catastrophes.** This point applies particularly to regional banks or MFIs which, unlike larger lending institutions, cannot spread their risk geographically across the entire country. If losses exceed the 300 percent loss ratio, these lenders must bear the excess losses themselves. The lending institutions consulted in the course of this feasibility study expressed their desire that government amend the CLIS to ensure that losses surpassing the 300 percent loss ratio would be indemnified in full. ZTBL argues that the loss limit should be raised to either 400 percent or 500 percent; they calculate that doing so over the eight years from 2008–09 to 2015–16 would have added PKR 572 million to the actual CLIS claims cost (in case of a 400 percent loss ratio cap) or PKR 1.146 billion (in case of a 500 percent loss ratio cap). This analysis suggests that (1) many of the banks incurred uninsured losses in excess of

[28]According to DoA-GoPunjab, these outstanding payments belong to NIC clients.

TABLE 3.3: CLIS: INCREASED CLAIMS COSTS FOR 400 PERCENT OR 500 PERCENT LOSS RATIO CAP

Number of borrowers with claims (2009 to date)	Claim amount (2009 to date) (PKR million)	Claim if indemnity is 400 percent (PKR million)	Additional funds required if indemnity is 400 percent (PKR million)	Claim if indemnity is 500 percent (PKR million)	Additional funds required if indemnity is 500 percent (PKR million)
54,587	1,931	2,504	572	3,077	1,146

Source: ZTBL 2017.

the 300 percent loss ratio limit over the eight-year period and (2) premium rates would have to be significantly increased if the higher 400 percent or 500 percent loss limit were introduced to cover the increased claims cost (Table 3.3).

i) **The lending institutions are required to pre-finance the CLIS premiums and to pay these to the insurance companies at the time of coverage inception.** The lending institutions then have to reclaim the 100 percent premium subsidies from SBP/GoP. In practice, however, the lending institutions have experienced delays of between one and two years in being reimbursed the CLIS premiums by the government, which is a major bone of contention for these lenders. Banks are implicitly subsidizing the crop insurance program from their own funds, over and above the government's premium subsidy.

3.2. LIVESTOCK INSURANCE SCHEME FOR BORROWERS

3.2.1. KEY FEATURES OF THE SCHEME

Given the importance in Pakistan of livestock beef and dairy production (which together represent 55 percent of agricultural GDP and 11.4 percent of GDP),[29] and to promote increased access for producers to livestock investment credit, in 2014 SBP launched a Livestock Insurance Scheme for Borrowers (LIBS) backed by government premium subsidies. SBP adopted the same PPP model as for the CLIS, with private sector insurers assuming the underwriting risk, working closely with lending institutions (providing livestock investment loans to small-scale cattle, buffalo, and dairy producers) and the national government (providing premium subsidies to those small-scale livestock producers).

The GoP approved financial support to LIBS in the form of a 100 percent premium subsidy for a maximum premium rate of 4 percent for small farmers, financing the purchase of up to ten cattle (or buffaloes). The maximum loan size or sum insured is PKR 5 million per producer. Loans above the threshold of 10 animals do not qualify for any SBP/government premium subsidies, and the livestock producer must pay the full premium.

The LIBS Policy is a standard individual animal indemnity-based product that insures against the death of the animal due to named natural and climatic perils, accidental death, and vaccination failure leading to death by disease. The policy insures adult cows, bulls, and buffaloes from the ages of nine months to seven years. Animals must be properly tagged and vaccinated, and be in clean health to be insurable. The policy is an annual policy; Table 3.4 summarizes its key features.

The sum insured is based on the market price of the animal or the amount of credit loaned by the bank to purchase the animal. As noted, the maximum sum insured is PKR 5 million (US$50,000) per beneficiary. Therefore, assuming an insurer charges the maximum 4 percent premium rate, the maximum premium subsidy for a livestock producer with a PKR 5 million sum insured would be PKR 200,000 (US$2,000) per year. ZTBL (one of the leading Livestock Insurance Scheme for Borrowers [LISB] participants) is charged premium rates by the insurers (United Insurance, SPI Insurance, and Asia Insurance) of 2.15 percent for local breeds and 4 percent for imported/hybrid animals (ZTBL 2017).

[29] AXCO 2017.

TABLE 3.4: FRAMEWORK OF LIVESTOCK INSURANCE SCHEME FOR BORROWERS

Objective	To improve access to finance the livestock and dairy sector and to mitigate risk of losses to farmers in case of death or disease of animals due to natural calamities and accidents
Participants	All banks involved in livestock lending and all insurance companies interested to participate
Loan covered	All livestock loans up to PKR 5 million for the purchase of animals
Period of insurance	Yearly renewal insurance
Animals covered	» Cows, buffaloes, and bulls (age from 9 months to 7 years old) » All imported animals as per the terms and conditions of underwriting guidelines of the participating insurance companies
Insured perils	» Death due to disease/natural » Death due to floods, heavy rains, windstorms, and drought » Accidental death
Indemnity	» Up to the insured amount of loan or individual price of animal as declared by bank » Maximum sum insured is PRK 5,000,000 per borrower » 20 percent compulsory deductible each and every claim
Main exclusions	» Death due to Rinderpest, Blackquarter, Haemorrhagic Septicemia, Anthrax and Foot & Mouth disease if animal is not inoculated » Pre-existing diseases or injury » Change of location without prior permission in case of transport of animal by land vehicle beyond 25 km from the place of farming and others
Premium rate	» Up to a maximum of 4% per annum of amount insured » Bank will be responsible for collection and payment of premium to the insurer
Claim process	» Insured/branch will inform immediately to the company via e-mail, phone call, SMS, writing, etc., and will wait for at least 24 hours before disposing of the carcass » Insurance company shall arrange a veterinary doctor approved by Pakistan Veterinary Medical Council to investigate the cause of loss and issue a death certificate » The insured/branch will submit the claim form duly stamped and signed within 14 days » Insurance company shall settle the claim within 30 days of claim lodgment
Payment of the claims	Claims shall be payable to the bank by the insurers for credit to the insured borrowers' loan account

Source: SBP 2017.

In the event of a claim, the insured/bank is responsible for notifying the insurer within 24 hours, following which the dead animal must be inspected by an approved veterinary officer to confirm the cause of death was due to an insured peril(s). All claims carry a deductible of 20 percent of the sum insured, which is borne by the insured livestock producer. The deductible is set at this level to minimize moral hazard.

3.2.2. UNDERWRITING RESULTS FOR THE SCHEME

The LISB is one of the world's most profitable livestock insurance programs. Data provided by ZTBL show that LISB, in its first three years of operation (2014–16), insured 258,800 animals (Table 3.5). During that period, claims amounted to only 32 animals, representing a mortality rate of 0.012 percent, which is extremely low for an individual animal mortality insurance program. The TSI was PKR 28.7 million, against paid premiums of PKR 609.1 million, with an average premium rate of 2.1 percent, fully subsidized by SBP/GoP. The paid claims (PKR 1.6 million) represent an extremely low loss ratio of 0.27 percent.

The extremely favorable LISB underwriting results are not encountered anywhere else in the world on individual animal mortality insurance. While the number of natural disasters (floods, droughts, and so on) was low during 2014–16, the LISB's extremely low losses are unique in the world of livestock insurance and merit further investigation and validation. For comparison, Table 3.6 presents data from five individual animal livestock accident and mortality insurance schemes in Bangladesh. Under the best-performing scheme (PKSF, beef fattening livestock investment-credit insurance), the livestock mortality rate was 0.3 percent and

TABLE 3.5: LIVESTOCK INSURANCE SCHEME FOR BORROWERS: UNDERWRITING RESULTS, 2014–16

Year	Number insured animals	Sum insured (PKR)	Average sum insured per animal (PKR)	Premium paid (PKR)	Average premium rate (%)	Number of animals for which claim paid	Paid claim (PKR)	Loss ratio (%)
2014	32,497	2,815,009,929	86,624	61,400,135	2.2%	8	210,662	0.34%
2015	112,576	12,755,781,262	113,308	270,104,752	2.1%	16	838,248	0.31%
2016	113,727	13,138,369,309	115,526	277,589,561	2.1%	8	576,466	0.21%
Total	**258,800**	**28,709,160,500**	**110,932**	**609,094,448**	**2.1%**	**32**	**1,625,376**	**0.27%**

Source: ZTBL 2017.

TABLE 3.6: BANGLADESH: RESULTS OF FIVE FORMAL AND INFORMAL LIVESTOCK (CATTLE) INSURANCE PROGRAMS

Name of Program	Years Operational	No. Insured Policies	No. Insured Cattle	TSI (BDT 000)	Premium (BDT 000)	Premium rate %	Number of Cattle Deaths	% Mortality rate	Paid Claims (BDT 000)	Loss Ratio %
SBC [1]	1981 to 2008	1,026	7,591	162,107	5,734	3.54%	92	1.2%	3,221	56%
Proshika [2]	1990 to 2009	11,739	140,736	597,736	31,393	5.25%	4,855	3.4%	21,300	68%
Grameen [3]	2001 to 2008	n.a.	7,015	n.a.	n.a.	n.a.	194	2.8%	n.a.	n.a.
PKSF [4]	2014 (to Oct)	n.a.	343,508	n.a.	52,393	0.70%	953	0.3%	19,445	37%
Sajida Foundation [4]	2014 (To Dec)	n.a.	566	n.a.	108	0.70%	7	1.2%	174	161%

Notes:

[1] Traditional cattle accident and mortality insurance policy.

[2] Livestock-credit insurance policy for cattle and shoats and poultry (up to 2 years).

[3] Livestock-credit insurance policy for dairy cattle (up to 2 years).

[4] Livestock-credit insurance for beef cattle fattening program (6 months cover).

Source: World Bank 2015a.

the loss ratio was 37 percent. For the other programs, the livestock mortality rates ranged between 1.2 percent (SBC and Sajida) and a high of 3.5 percent (Proshika) of all insured animals, and the loss ratios range from 58 percent for SBC to 161 percent for the Sajida scheme.

3.3. INNOVATIONS IN CROP AND LIVESTOCK INSURANCE

The past decade saw very little innovation into new crop or livestock indemnity-based or index-based insurance products offered by the private sector in Pakistan. This lack of new products contrasts with the major expansion of weather index-based crop insurance as a micro-insurance retail product targeted toward small farmers in many developing countries in Asia (including China, India, Indonesia, the Philippines, and Sri Lanka) and Africa (e.g., Kenya, Ghana). This section briefly reviews some of the limited number of private crop and livestock initiatives that have been piloted since 2012 in Pakistan.

3.3.1. PILOTS OF CROP WEATHER INDEX INSURANCE AND AREA-YIELD INDEX INSURANCE

In 2011, the Pakistan Poverty Alleviation Fund (PPAF) and the International Fund for Agricultural Development (IFAD) assisted local stakeholders to design two projects to pilot crop

micro-insurance products for small and marginal farmers. These products included (1) a weather index-based crop insurance (WII) product for wheat and (2) an area-yield index insurance (AYII) product for wheat and cotton. These were the first pilots of micro-level or individual farmer crop index insurance in Pakistan.

The PPAF WII product for producers of rainfed wheat was piloted in collaboration with the World Food Programme (WFP) in two locations in Punjab: Talang (Chakwal District) and Soon Valley (Khushab District). The wheat policy was a rainfall deficit index coverage that extended over three vegetative phases from sowing (November/December) to crop maturity and harvest (March/April). The index was constructed on more than 30 years of daily rainfall data for single weather stations cited in each of the two pilot locations. Two insurers agreed to underwrite the WII pilot, Alfalah and United Insurance, and SwissRe provided technical support and reinsurance capacity (PPAF 2012).

The wheat WII coverage was promoted and marketed on a voluntary basis in the 2012 Rabi season to about 500 farmers in each of the locations by two local partners: the National Rural Support Program (NRSP) in Talang and the Soon Valley Development Program (SVDP) in Soon Valley. The total wheat area insured was 2,376 acres. The product carried a premium rate of PKR 531 per acre in Soon Valley and PKR 610 per acre in Talang. The donor (IFAD) agreed to subsidize 70 percent of the cost of premiums in the pilot start-up (NRSP 2017).[30]

In 2012 the wheat WII pilots were claims free, and farmers declined to renew coverage the next season. Based on discussions with PPAF, Alfalah Insurance, and NRSP, it appears that the index product was difficult for farmers and communities to understand. Some farmers did not fully trust that data recorded by the weather station would accurately reflect their own rainfall conditions, and they preferred a conventional indemnity-based crop insurance product that would cover losses on their own farms (NRSP 2017).

The AYII pilot for wheat and cotton producers in Bahawalpur and Sanghar districts of southern Punjab had more success. The AYII product, which was also launched in Rabi 2012, was a multiple peril loss of yield policy designed to protect marginal farmers with less than 4 acres of land. The insurance product was introduced in two phases, starting with wheat and followed by cotton. The premium rate was PKR 1,080 per acre for wheat and PKR 1,533 per acre for cotton. Donors also provided a 70 percent premium subsidy to make the AYII policy more affordable to marginal farmers. The pilot ultimately insured 14,095 farmers with a total insured area of 38,239 acres. Hailstorms and heavy rainfall during the monsoon season resulted in 238 claims, with payments valued at PKR 14.62 million.[31] The current status of the AYII program is not known.

3.3.2. PILOTS OF LIVE-WEIGHT LIVESTOCK INSURANCE AND INSURANCE FOR MILKING ANIMALS

PPAF and IFAD developed two livestock insurance products: (1) Live-weight Livestock Insurance and (2) Micro-insurance for Milking Animals. The live-weight livestock insurance, which was designed for livestock fattening programs, was the first of its kind in the world; its unique feature was that it linked the sum insured and insurance payout in the event of loss to an index of the weight gained by the animal during the coverage period. The coverage used historical data from the government-owned livestock research institutes to serve as the basis for determining growth rates (live-weight gain) for different species under different feeding regimes or forage-based management (PPAF 2012). The policy was offered for beef cattle, sheep, and goats. It carried a 6 percent premium rate and covered livestock mortality due to accidents, natural perils, poisoning, and diseases. Premiums cost PKR 800–1,250 per animal for cattle and 300–600 per animal for sheep and goats. The compensation was linked to the actual weight of the animal at the time of loss. The program was launched in 2013, and even though it was popular with farmers, it incurred high losses[32] and was withdrawn from the market after one year.

A specialized and modified livestock accident and mortality insurance product was also developed for milking animals, along with a conventional dairy cattle insurance product for poor herders located in Sind and Punjab. The average premium charged on

[30]Unnamed and undated MicroInsurance Briefing Note.

[31]The source for this information is an unnamed and undated Microinsurance Briefing Note.

[32]According to NRSP, 167 claims were processed, of which 152 were settled for a total payout to farmers of PKR 3.2 million.

milking animal insurance was about PKR 3,200 per animal. PPAF supported by IFAD initially funded 70 percent of the premium subsidies (later reduced to 50 percent).[33]

The live-weight milking animal, and conventional livestock micro-insurance products were piloted in 10 districts by about 15,000 insured livestock producers (of whom 40 percent were female herders) with a total of 70,528 insured animals. Claims payouts (including claims related to flood and drought losses) amounted to PKR 10.73 million.[34] As noted, the live-weight gain product was withdrawn after one year due to high claims. It is not known whether the milking animal insurance program and conventional livestock insurance program were also terminated.

3.4. NATIONAL AND PROVINCIAL DISASTER MANAGEMENT PROGRAMS

In Pakistan the catastrophe insurance market for risks like earthquakes and floods is relatively underdeveloped. According to AXCO[35] 2017, about 70 percent of property fire policies also include coverage for earthquakes but few commercial or private properties are insured. Flood is perhaps the greatest natural hazard in Pakistan, causing considerable damage to property and loss of life, but in most cases, losses resulting from floods are uninsured (Axco 2017; GFDRR 2015).

As a consequence of the very poorly developed catastrophe insurance market in Pakistan, after any disaster, the government has to bear the major share of the financial liability for relief and recovery activities, including private losses as well as public ones. Usually the GoP has to reallocate development budgets for disaster management and also has to depend on foreign aid for covering losses and reconstruction. After high-magnitude disasters, the government faces major financial challenges in providing assistance to the most vulnerable and poor urban and rural people in a timely fashion to restore infrastructure and services and their livelihoods.

The next section briefly reviews the roles of the National Disaster Management Authority (NDMA) and the Provincial Disaster Management Authorities (PDMAs) in disaster risk management and relief in Pakistan. An understanding of these agencies and their roles is essential to the discussion in the remainder of this report of the role of agricultural insurance.

3.4.1. DISASTER MANAGEMENT AT THE NATIONAL LEVEL

The NDMA is a federal agency created to manage and coordinate disaster risk management in Pakistan. NDMA was established under the National Disaster Management Act, 2010, and functions under the supervision of the National Disaster Management Commission (NDMC), which is headed by the Prime Minister of the Islamic Republic of Pakistan. NDMA manages the whole disaster management cycle, which includes preparedness, mitigation, risk reduction, relief, and rehabilitation.

The Global Fund for Disaster Reduction and Recovery (GFDRR) of the World Bank Group has actively assisted NDMA in recent years to develop a national disaster risk financing strategy for Pakistan. This strategy follows an operational framework of (1) assessing risk, (2) arranging financial solutions, and (3) delivering funds to beneficiaries. GFDRR has identified a series of seven strategic options for designing a National Disaster Risk Financing strategy for Pakistan; they are listed in Table 3.7.

3.4.2. DISASTER MANAGEMENT IN PUNJAB PROVINCE

GoPunjab established the PDMA in 2010. PDMA Punjab specializes in mitigation, preparedness, and 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 also acts as the authority that coordinates at post-disaster rescue and rehabilitation operations at the provincial, district, and local levels.

In the past 10 years, the GoPunjab has declared 70 disasters in Punjab, affecting 10,000 villages. In comparison, 10 disasters were declared in areas of Sind Province and 22 in Kyber Pakhtunkwa. Baluchistan was affected by drought for seven years (Saeed 2014).[36]

[33]Unnamed and undated Microinsurance Briefing Note.
[34]Unnamed and undated Microinsurance Briefing Note.
[35]AXCO Insurance Information Services (https://www.axcoinfo.com/).
[36]See http://news.trust.org/item/20140704055948-vj87s/

TABLE 3.7: PAKISTAN: SEVEN OPTIONS FOR A DISASTER RISK FINANCING STRATEGY

Time frame	Options for disaster risk financing
Short term	1. Develop a central database of disaster losses and expenditures to better predict future financial costs of disaster
Short term	2. Operationalize the National and Provincial Disaster Management Funds
Short term	3. Clarify contingent liability associated with post-disaster cash transfer programs and enhance the programs' financing sources to ensure efficient access to funds after a disaster
Short to medium term	4. Develop financial disaster risk assessment tools, including financial catastrophe risk models for the Ministry of Finance
Short to medium term	5. Develop models for improving financial response capacity to disasters
Medium term	6. Establish a robust catastrophe risk insurance program for public assets
Medium to long term	7. Promoto property catastrophe risk insurance for private dwellings

Source: World Bank 2015c.

TABLE 3.8: PUNJAB: PAYMENTS (PKR) TO DISTRICTS TO COMPENSATE FLOOD VICTIMS FOR LOSS OF LIVELIHOODS, HOUSING, AND CROPS, 2010–15

Districts	Deaths	Injuries	Livelihood	House damage	Crops	Total
Total			**13,311,350,000**	**21,133,860,000**	**6,704,201,163**	**41,149,411,163**
Percent of total			32%	51%	16%	100%
US$ equivalents			133,113,500	211,338,600	67,042,012	411,494,112
Annual average US$			22,185,583	35,223,100	11,173,669	68,582,352

Source: Punjab Natural Disaster Management Authority 2017 (file: "Data.xls").

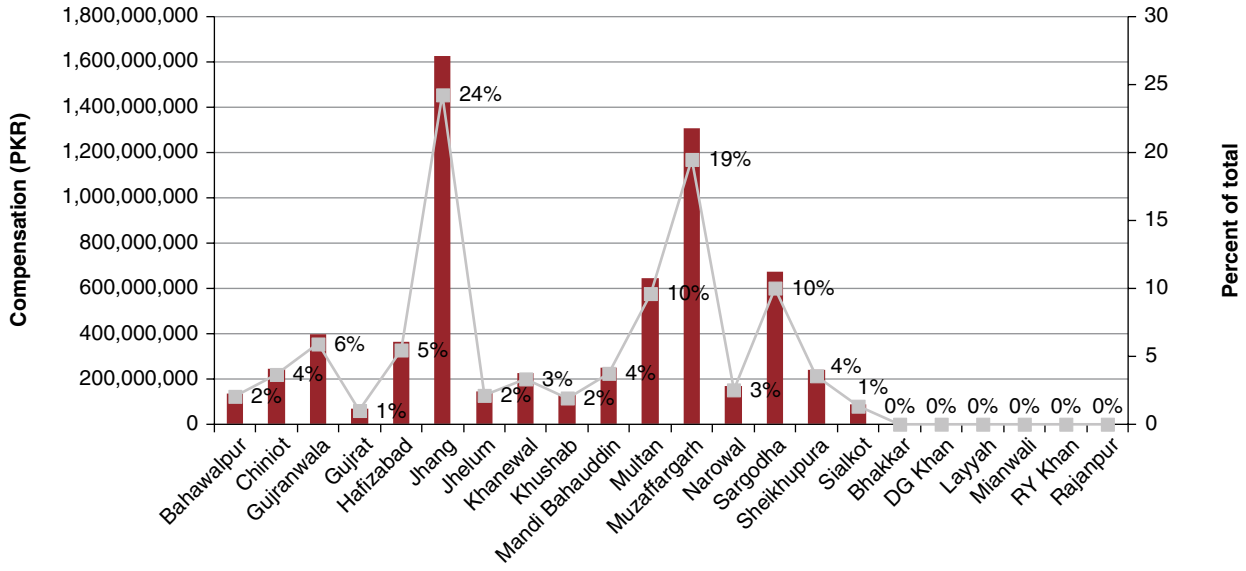
Between 2010 and 2015, PDMA Punjab paid PKR 41.1 billion (US$411 million) in disaster compensation to people affected by flooding (Table 3.8). The bulk of the compensation—PKR 21.1 billion (51 percent)—was allocated to rebuild damaged housing. PKR13.3 billion (32 percent) was paid in compensation for lost livelihoods, and farmers were compensated PKR 6.7 billion (16 percent) for the loss of their crops (an average of PKR 1.12 billion (US$11.2 million) per year). Over the six-year period, GoPunjab issued compensation payments in 22 of Punjab's 36 districts. Three districts together received more than half of those payments: Muzaffargarh (30 percent), Rajanpur (17 percent), and Jhahg (11 percent) (Figure 3.3 and Annex 3). Compensation specifically for crop losses went to farmers in 16 districts, with the highest payments going to Jhang District (24 percent of total crop compensation), followed by Muzaffargarh (19 percent) and Sargodha (10 percent).

Under the compensation programs, farmers typically receive a cash payment to enable them to purchase seed and fertilizer and resume crop production, but the value of the compensation is much lower than the value of the lost crop revenue. For example, as of October 1, 2014, the Khadim-e-Punjab Imdadi Package (KPIP) paid PKR 10,000 per acre for damaged crop area, up to a maximum of PKR 125,000 for 12.5 acres for any individual farmer.[37] Compare this payment to the World Bank estimate of the average value of crop output in Punjab (about PKR 50,000 per acre) in Chapter 2.

The gap between the budget for NDMA and PDMA to compensate producers for crop damages/losses and the actual value of the damage

[37]See PDMA Punjab website: http://pdma.punjab.gov.pk

FIGURE 3.3: PUNJAB: DISTRIBUTION OF CROP COMPENSATION PAYMENTS (PKR) BY DISTRICT, 2010–15



Source: Data provided to World Bank by Punjab Disaster Management Authority April 2017.

incurred by farmers is extremely wide. As noted in Chapter 2, floods affected 3.26 million acres of crops in Punjab in 2010–13. GoPunjab would have needed to allocate PKR 32.6 billion (US$326 million) to compensate farmers for that flood-damaged area at the level of PKR 10,000 per acre (the compensation paid under KPIP). The actual compensation payments shown in Table 3.8 of PKR 6.7 billion (US$67.0 million) were equivalent to only 18.5 percent of the required amount.[38]

Crop insurance may be one option for GoPunjab to consider in trying to close this funding gap.

No data are available on the GoPunjab expenditure on livestock in the aftermath of a natural disaster. Following a disaster, the Department of Livestock and Dairy Development (DL&DD) conducts a rapid assessment of damages to livestock and provides financial and technical resources to district livestock department offices for the immediate provision of medical and material relief. The DL&DD coordinates the provision of livestock feed and fodder at subsidized rates, as well as de-worming medicines and vaccines for animals in disaster areas.

[38]This disaster-relief compensation funding gap is very much larger if one uses a full-value estimate for the value of crop losses of PKR 50,000 per acre (US$500 per acre) presented in Section 2.4.3, which suggests that the true value of the flood losses in the 3.26 million acres could be nearer PKR 163 billion (US$1.63 billion). In this case, the actual compensation payments of PKR 6.7 billion amount only to 4.1 percent of the estimated full value of losses in agriculture.

CHAPTER 4
AGRICULTURAL CROP AND LIVESTOCK INSURANCE OPPORTUNITIES FOR PUNJAB

This chapter provides an overview of the different types of crop and livestock insurance products (coverage types) that are commercially available, along with an assessment of their potential suitability for introduction in Punjab over the next five years under the SMART Punjab PforR. The proposals set out here focus largely on short- and medium-term opportunities for providing crop insurance, with a brief review of livestock insurance opportunities for the government to consider.

4.1. CROP INSURANCE TYPES, OPPORTUNITIES, AND DATA NEEDS

4.1.1. TWO DISTINCT TYPES OF CROP INSURANCE AND THE NEED FOR TAILORED SOLUTIONS

Two distinct types of crop insurance product might be considered for farmers in the Punjab. The first type—***traditional indemnity-based crop insurance***—protects the individual farmer against actual physical damage or loss of yield to the crops he/she grows in his/her fields. This product involves in-field assessment of the losses. Three indemnity-based products are listed in Table 4.1—named peril crop insurance (NPCI), multiple peril crop insurance (MPCI), and crop revenue insurance—along with details on their availability and potential suitability for Punjab.

The second type—***new index-based insurance***—makes use of a proxy index that correlates closely with crop yield, such as the amount of rainfall as measured at a local weather station, and payouts are triggered when the actual amount of precipitation recorded during the crop growing season falls short of a previously agreed threshold. As such, an index coverage does not make payouts according to the actual crop losses experienced by individual farmers on their own fields. Crop index insurance products include WII, which makes use of ground-located weather stations and is typically designed to insure against a shortage or excess of rainfall; satellite-based weather indexes; AYII; and specialist indexes such as flood index insurance (Table 4.1).

TABLE 4.1: TYPES OF CROP INSURANCE PRODUCT AVAILABLE AND POTENTIAL SUITABILITY FOR PUNJAB

Type of agricultural insurance product	Basis of insurance and indemnity	Availability	Suitability for Punjab
a) Indemnity-based crop insurance			
1. Named Peril Crop Insurance (NPCI)	Percent damage	Widespread	Possible (e.g., hail, frost, wind)
2. Multiple Peril Crop Insurance (MPCI)	Yield loss	Widespread	Only for large growers >40 ha cereals
3. Crop revenue insurance	Yield loss and price loss	Very restricted (USA)	Not available
b) Index-based crop insurance			
4. Crop Weather Index Insurance (WII) based on ground weather stations	Weather index payout scale	Widespread	Limited weather station density (39 UNMA for all Uganda). Not best suited to micro-level insurance for small cereal farmers <2 ha. Possible applications for horticulture and fruit crops.
5. Crop Weather Index Insurance (WII) based on synthetic satellite rainfall	Weather index payout scale	Fairly widespread	Satellite data freely available. Not best suited to micro-level insurance for small farmers <2 ha.
6. Crop Area Yield Index Insurance (AYII)	Area yield loss	Fairly widespread	Potential for small farmers (cereals, cotton, sugarcane) using Department of Agriculture/Crop Reporting Services CCE yield data
7. Specialist indexes, e.g., flood index, Bangladesh	Flood Index Payout Scale	Very restricted	Major research required to launch coverage

Source: Authors.

An important consideration is that one size does not fit all: in other words, crop insurance products must be tailored to the risk transfer needs of different types of farmers. Figure 4.1 presents the three main categories of farmers in Punjab, classified by size of farm or cultivated landholding, alongside the suitability of traditional indemnity-based and or index insurance products.

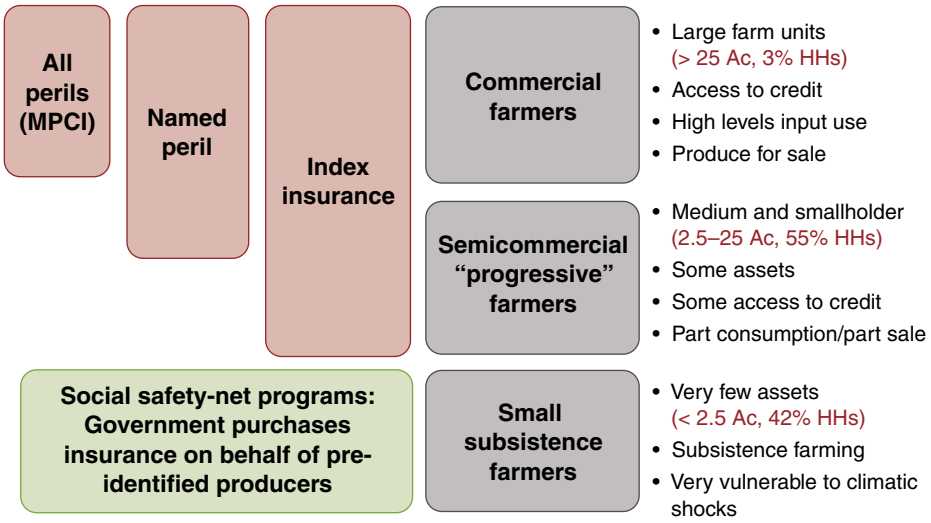
For commercial farmers in Punjab, who account for just 3 percent of all farm households and who have more than 25 acres, individual grower MPCI or NPCI may be suitable products for the largest of these farmers—those with more than 100 acres (40 hectares) of insured crops. Insurers can offer MPCI coverage to large farmers because the premium generated by each risk is adequate to cover the costs of pre-acceptance risk inspections, mid-season monitoring inspections, and end-of-season crop yield assessments. (Figure 4.1).

Individual grower MPCI is not, however, a suitable product for small semicommercial/progressive farmers, who typically own between 2.5 and 25 acres and who account for 55 percent of all farmers in Punjab. These farmers produce crops both for family consumption and for sale; they increasingly use seasonal crop loans to invest in improved high-yielding seed and fertilizer technology; and they face a financial exposure in the event of crop loss.[39] For these farmers, an index-based insurance product such as WII or AYII, which do not require costly pre-inspections or individual field-by-field loss assessment, may offer solutions to their risk transfer needs.

Since the early 2000s, WII has been heavily promoted by development agencies, NGOs, and academics as a low-cost insurance product that is suitable as a retail product for resource-poor small-scale farmers. The authors of this report argue however that individual farmer-based insurance

[39]This category of progressive farmer also includes some very small farmers with <2.5 acres, who receive seasonal crop credit from MFIs under the GoPunjab e-Kissan credit scheme.

FIGURE 4.1: SUITABILITY OF CROP AND LIVESTOCK INSURANCE PRODUCTS FOR DIFFERENT TYPES OF FARMER



Source: Authors.

Note: HH = households; MPCI = multiple peril crop insurance.

is not suitable to the risk management needs of subsistence farmers, whose priority is to smooth consumption and who do not face a financial exposure in the form of crop loans for growing their crops. In Punjab, subsistence farmers, defined as those with less than 2.5 acres of cultivated land, account for 42 percent of all households.[40] Rather than selling often costly individual crop insurance to these farmers, governments can develop social safety net programs in the form of conventional ex-post natural and climatic disaster compensation programs, which could be insured/protected through the purchase of ex-ante index insurance at the macro-level—that is, by the provincial or local government (Figure 4.1).

4.1.2. OPPORTUNITIES FOR INDEMNITY-BASED CROP INSURANCE PRODUCTS FOR PUNJAB

Named Peril Damage-based Policies

Named peril crop insurance (NPCI) is an individual farmer damage-based indemnity crop insurance policy; under this kind of policy, the insurance claim is calculated by measuring the percentage damage in the field, soon after the damage occurs. The percentage damage measured in the field, less a deductible expressed as a percentage, is applied to the pre-agreed sum insured. The sum insured may be based on production costs or on the expected value of crop output (yield × sales price). Where damage cannot be measured accurately immediately after the loss occurrence, the assessment may be deferred until later in the crop season. Damage-based indemnity insurance is best known for hail, but is also used for other named peril insurance products (such as excess rainfall or wind).

In Punjab, there may be scope to develop NPCI to protect against specific perils such as frost, hail, and excess rain in high-value horticultural crops such as potatoes, or to protect against frost, hail, and wind damage in tree crops, including mango and citrus. Potentially, hail and wind damage insurance could also be offered for cereals if there is a significantly high exposure in these crops, especially at the time of grain maturity and harvest. If NPCI is to be successfully developed in Punjab for fruit and horticultural crops, key considerations will include:

a) The availability of time-series meteorological data to establish the frequency and severity of occurrence of each peril. While rainfall and temperature data are available from the network of meteorological weather stations in Punjab, hail occurrence and wind data are lacking, and both of these perils are very localized.
b) The availability of time-series historical crop loss and damage data for each peril and each crop

[40]Note that for crop insurance purposes, farmers with <2.5 acres who obtain seasonal crop credit from MFIs and invest in improved or hybrid seed and fertilizer technology would not be considered under this category of subsistence farmers.

at a localized level (such as the district or tehsil). According to the Punjab DoA, such data may be recorded at a local level by field extension officers, but it is not systematically analyzed or reported.

c) Given the small average size of horticultural farms and fruit farms in Punjab, it would be necessary to assess ways of designing low-cost procedures for assessing damage in the field. Otherwise such a coverage cannot be commercially viable.

Recommendation for Punjab

It is recommended that a feasibility study for the development of NPCI for horticultural and tree crops be implemented in the second phase of the Punjab agricultural insurance program, starting in 2019/20.

Yield-based Crop Insurance (multi-peril crop insurance)

A loss-of-yield policy is an individual farmer policy that protects the farmer against crop production and yield losses on his or her own farm. An insured yield (expressed, for instance, in tons per hectare) is established, as a percentage of the historical average yield of the insured farmer: the insured yield is typically set at between 50 percent and 75 percent of the average yield on the farm. For irrigated agriculture, however, in which yields tend to be much more stable, insurers may be willing to insure up to 90 percent of the farmer's average yield. The actual yield is measured by an independent assessor at the time of harvest, and if the actual yield is less than the insured yield, an indemnity is paid equal to the difference between the actual yield and insured yield, multiplied by a pre-agreed value of sum insured per unit of yield.

The most common form of a loss-of-yield policy is an MPCI policy that provides comprehensive protection against all unavoidable natural, climatic, and biological perils that may cause yield loss. This coverage is widely demanded by farmers both in developed and in developing countries because it provides all-risk protection against loss of crop production and yields.

Even so, the international experience with individual farmer MPCI is, with few exceptions, extremely poor. Common problems include low uptake,[41] high levels of anti-selection and moral hazard, and high administration and operating costs. Underwriting results are usually negative. Most individual grower MPCI programs that are voluntary suffer from very high levels of anti-selection and moral hazard. For example, farmers may purchase coverage only for fields in low-lying areas that are subject to flooding and waterlogging (anti-selection), or they may apply suboptimal levels of husbandry and pest, disease, and weed control (moral hazard) in the expectation of then claiming the yield loss on their crop insurance policy. MPCI programs are usually very exposed to systemic drought, frost, and windstorm losses that correlate at the regional and national levels, and the premium rates that have to be charged to cover the combination of high losses and high administrative costs are often in excess of 10 percent to 15 percent of the sum insured. Nearly all individual grower MPCI programs operate at a financial loss (negative underwriting results) and depend on government premium subsidies to make the coverage more affordable and acceptable to farmers and/or depend on government subsidies of excess claims.[42]

Furthermore, as noted in section 4.1.1, individual grower MPCI is a product that is generally only offered by insurance companies to large commercial farmers because the high costs of administering such a coverage make it prohibitively expensive to operate with small farmers. MPCI is the product that is most widely marketed to large cereal and oilseed producers in the USA and Canada. In Brazil, MPCI is offered to medium and large cereal and oilseed farmers (usually linked to credit provision), and in China several regional MPCI programs are implemented for smallholder farmers, but only as mandatory schemes in which all farmers are insured. All of these MPCI programs carry very high levels of premium subsidy.

[41] A major exception is the U.S. Federal Crop Insurance Program (FCIP), for which uptake rates for major grain crops such as wheat and maize are extremely high and exceed 85 percent to 90 percent of all eligible sown acreage. High uptake rates also apply to soy and sunflower. One major reason for the high uptake rates of the FCIP for these crops is the very high premium subsidy rates offered by the government to insuring farmers. For minor crops, however, uptake rates are much lower in spite of the high premium subsidies.

[42] For a comprehensive review of the performance of public-sector MPCI, refer to Hazell et al. (1986) and Mahul and Stutley (2010).

Recommendation for Punjab

Insurance companies offer individual grower MPCI only to medium and large commercial farmers because it is prohibitively expensive to administer such a coverage on small farm units. Because commercial farmers account for only 3 percent of farmers in Punjab, and because DoA's stated priorities are to address the needs of the other 97 percent—the small semicommercial/progressive and subsistence farmers—no plans exist to develop MPCI under the SMART Punjab program. This does not, however, prevent private insurance companies from developing and promoting MPCI in Punjab (and the rest of Pakistan).

Crop Revenue Insurance

A crop revenue policy combines conventional multiple peril insurance based on loss of crop yield (MPCI) with protection against loss of market price at the time of sale of the crop. Currently, this product is marketed only on a commercial basis in the USA for grains and oilseeds quoted on commodity markets (the Chicago Board of Trade) and where future price contracts can be combined into the revenue policy. Currently, crop revenue insurance could not be offered to small semicommercial/progressive and subsistence farmers in Punjab.

4.1.3. OPPORTUNITIES FOR INDEX-BASED CROP INSURANCE PRODUCTS FOR PUNJAB

Weather Index Insurance (using ground weather stations)

Crop WII is an alternative approach that aims to overcome many of the drawbacks of traditional individual grower indemnity-based crop insurance. The key feature of WII products is that they do not indemnify crop yield losses at the individual field or grower level, but rather use a proxy variable (the index) such as the amount of rainfall or temperature or wind speed to trigger insurance payouts to farmers.

WII is a simplified form of insurance in which payments are made based on a weather index, rather than measurement of crop loss in the field. The index is selected to represent, as closely as possible, the crop yield loss likely to be experienced by the farmer. The most common application of WII is against rainfall deficit or drought, where rainfall measurements are made at a reference weather station(s), during defined period(s), and insurance payouts are made based on a preestablished indemnity scale set out in the insurance policy. The sum insured is normally based on the production costs for the selected crop, and indemnity payments are made when actual rainfall in the current cropping season as measured at the selected weather station falls below predefined threshold levels.

The main advantage of WII is the elimination of the adverse selection and moral hazard problems common to MPCI. Since payouts are made based on an objective measurement at the reference weather station, there are few information asymmetries to be exploited, and the behavior of the insured cannot influence the extent of payouts. In addition, WII reduces administration costs (particularly because it does not require in-field inspections or loss adjustment) for the insurer, which could make premiums more affordable. Indexed products are also likely to facilitate risk transfer to the international reinsurance markets. However, although WII offers opportunities for reduced administration and operating costs, the development phase requires intensive technical inputs and ongoing technical inputs are required to refine products over time.

The most important challenge for WII is basis risk, which significantly limits the applicability of index instruments. Basis risk is the difference between the payout as measured by the index, and the actual loss incurred by the insured farmer(s). Because no field loss assessment is made under index insurance, the payout may either be higher, or lower, than the actual loss of crop suffered by the farmer(s). Basis risk is lower when the risk is highly correlated—that is, the risk affects a large geographical area to relatively the same extent and simultaneously. The level of basis risk can be somewhat mitigated by careful index design and by the installation of new weather stations, thereby increasing the density of weather stations and data points (typically one weather station with a coverage area of 15–20 km) and providing more localized precision in the measured climatic peril. Other challenges for WII include the need for high-quality weather data and infrastructure and the currently limited product options, with most applications in developing countries so far concentrating on rainfall indexes.

WII is being developed at different levels of aggregation, starting with individual farmers (micro-indexes) and then at a regional level—examples

including input suppliers or banks providing lending credit in a specified area (meso-indexes)—and then finally at a national level as a food security instrument (macro-level weather indexes). The first country to introduce micro-level WII was India in 2003, and many programs have been launched since. Mexico was the first country to develop macro-level WII index coverages that offer state governments catastrophe drought, rainfall, and windstorm index protection for small vulnerable subsistence farmers.

In Punjab, the density of weather stations is currently too low to support a province-wide WII program for major crops grown by the majority of the province's 5.2 million farmers. The Punjab Meteorological Agency has a network of only 30 official synoptic weather stations or less than one weather station per district. This density is inadequate to develop a large-scale WII programs for millions of farmers. An additional limitation to introducing WII in Punjab is that 85–90 percent of cultivated area is irrigated, whereas WII is best suited to rain-fed agriculture, with indexes typically designed to protect against rainfall deficits (leading to drought) or excesses (leading to flooding). Alternatives exist to develop satellite indexes, including synthetic rainfall, evapotranspiration, or Normalized Difference Vegetation Index (NDVI) in certain crops.

Recommendation for Punjab

We recommend that a feasibility study for the development of WII for horticultural and tree crops be implemented in the second phase of the Punjab agricultural insurance program starting in 2019–20, but only in areas served by a local weather station.

We also recommend that the development of WII based on satellite indexes such as the Standardized Precipitation Index and/or Standardized Precipitation Evapotranspiration Index as a "macro-level" insurance protection be examined in a feasibility study. The insured in this case would be the GoPunjab. The insurance could be used to support the social protection coverage by GoPunjab to poor subsistence farmers with less than 2.5 acres.

Area-Yield Index Insurance

Area-yield index insurance (AYII) is a loss-of-crop-yield policy that is suited to the needs of small-scale farmers and aims to overcome many drawbacks of traditional individual farmer MPCI. The key feature of this product is that it does not indemnify crop yield losses at the individual farmer or field level. Instead. it makes indemnity payments to farmers according to yield loss or shortfall against an average area yield (the index) in a defined geographical area (such as a district, tehsil, union council, or village), commonly referred to as the Unit Area of Insurance (UAI).

The key advantages of the area-yield approach are that it minimizes moral hazard and anti-selection and significantly reduces the costs of administering the policy, making an area-yield product much more suitable to offer to small-scale farmers. Under an AYII policy, yield losses are settled against the area average yield index, as opposed to settling losses on individual farmers' fields under an MPCI policy. As explained previously, individual farmers cannot influence the yield outcome by purchasing coverage only for fields subject to harm such as drought or flooding (anti-selection) or by neglecting husbandry and plant health practices, only to claim the resulting yield loss on their crop insurance policy. The costs of operating AYII are much lower than for MPCI, especially because AYII requires no prior field inspections or in-field crop loss assessments on individual farms, which means that an AYII product with lower premium costs can potentially be marketed to small- and medium-sized farmers. Table 4.2 lists still other advantages of AYII.

As with WII, the main disadvantage of an AYII policy is basis risk—which in this case is the difference in actual yield outcomes achieved by individual farmers on their own fields and the average area yield. For example, an individual farmer may incur severe crop production and yield losses due to localized perils such as hail or flooding by a nearby river, but because these localized losses do not affect the average yield across a larger area (the tehsil, village, or other area defined as the UAI), the grower receives no indemnity. Other problems include the need for an accurate procedure to measure the average area yields in the UAI (Table 4.2).

To operate an AYII coverage, it is necessary to have (1) accurate historical yield data at local area levels to provide a sound basis to construct a yield index, and (2) an objective and accurate method of establishing the actual average yield in the insured growing season to determine if a payout is due or not. In Punjab, the Crop Reporting Services (CRS) of the DoA has for many years been involved

TABLE 4.2: PRECONDITIONS, ADVANTAGES, AND DISADVANTAGES OF AREA-YIELD INDEX INSURANCE

Preconditions	Advantages	Disadvantages
Homogeneous cropping systems in the defined geographical area (e.g., region, district) that forms the Unit Area of Insurance (UAI)	No need for time-series data on yields of individual growers	Basis risk (but lower than for weather index insurance)
Accuracy of historical regional yield data	Data are likely to be available because most countries record regional yield statistics	Not suitable for localized perils (e.g., hail)
Timely, accurate, and impartial procedures for estimating "actual" average yield in the UAI	Lower cost of delivering insurance product to growers	Problems of accurately measuring "actual" average yields in UAI
Special insurance regulation may be required	Suited to systemic risk (e.g., drought)	Farmers' acceptance
	Minimizes adverse selection and moral hazard	
	Requires no in-field loss assessment	
	Cost of loss assessment reduced	
	Because the product is based on yields, it picks up all weather risks and other causes of yield shortfalls	

Source: Authors.

in implementing seasonal crop yield surveys based on random selection of farmers and fields, which are then subjected to randomly placed crop cutting experiments (CCEs) to estimate crop yields. The Punjab government uses the data from the CCEs to estimate average crop yields and crop production (yield times planted area) at the district level for all major cereal crops, including Rabi wheat and Kharif paddy and maize, and also for cash crops such as cotton and sugarcane. Currently, the CRS adopts a sample frame of 5 percent or about 1,250 villages in Punjab to conduct farmer surveys and CCEs.

Given that CRS in Punjab has estimated district area yields for many years based on objective CCEs, the CRS data could form the basis for operating a large-scale AYII program in Punjab. Because the current density of village sampling is too low, however, it would need to be increased to support an AYII program.

Recommendation for Punjab

The CRS CCE yield estimation methodology appears to offer major potential to develop and implement a large-scale AYII program for semicommercial/progressive farmers (typically operating 2.5–25 acres), who grow wheat, rice, maize, cotton, and sugarcane in Punjab. This coverage could also be extended to semicommercial/progressive farmers with <2.5 acres who receive credit for seasonal crop production from MFIs and under the e-Kissan program in Punjab. For AYII to be successfully implemented and scaled up, it would be necessary to agree on a program with the CRS to increase the density of the CCEs over time. The objective would be to conduct CCEs in all villages where the crop AYII program is implemented. The current level of reporting area yields (the district level) is too large, and the UAI for the operation of AYII must be reduced over time to the tehsil level and then eventually down to the markaz or even union council level.[43]

Furthermore, GoPunjab could offer AYII as a social protection coverage to the very poor

[43]In India under the PMFBY AYII program, the government in 2015–16 reduced the size of the insured unit from a subdistrict, block, or teluka to the gram panchayet or individual village level. This change necessitated a huge increase in the number of CCEs that are conducted. In Punjab, the CRS has advised authorities that it cannot implement AYII at the individual village level given the high fiscal costs of conducting CCEs at this level.

subsistence farmers with less than 2.5 acres. AYII could also be used as an ex-ante crop insurance coverage to trigger objective payouts to the large number of subsistence farmers (who do not borrow seasonal crop credit from financial institutions)[44] in Punjab and to operate as a disaster risk financing and insurance coverage to the GoPunjab's existing natural disaster compensation program, which is operated through the Punjab Disaster Risk Management Agency.

4.1.4. CONCLUSIONS ON CROP INSURANCE OPPORTUNITIES FOR PUNJAB

Based on the analysis in this feasibility study, the following conclusions and recommendations are drawn with respect to crop insurance opportunities for the GoPunjab to consider under the SMART Punjab program:

- **Indemnity-based MPCI** can be cost effectively implemented only with farmers who cultivate more than 100 acres (40 hectares) under a single crop. This coverage would therefore be restricted to a relatively small number of large-scale commercial farmers in Punjab.
- **Crop revenue insurance coverage** providing protection for both crop production and yield loss and also market price loss is available only in the United States for a few globally traded commodities (wheat, maize, soybeans), and in the start-up phase in Punjab it would not be available.
- **WII coverage** will also have limited application in the short term because of the low density of weather stations (only 30 weather stations in the province) and because 85–90 percent of cultivated area is irrigated. In addition, WII is normally bested suited to rain-fed cropping and insures against rainfall deficit or excess rainfall. WII has not yet successfully developed solutions for flood-prone areas, the major concern for many farmers in Punjab. The feasibility of WII based on satellite indexes at the macro-level may be examined for protecting/insuring the social protection scheme to support subsistence farmers with holdings of less than 2.5 acres.
- **AYII** appears to offer considerable potential for insuring "subsistence" as well as "semicommercial/progressive" small-scale farmers in Punjab for major cereal crops, including wheat, rice, and maize, and also for industrial crops such as cotton and sugarcane (crops for which the CRS conducts CCEs).
- **AYII coverage could be particularly appropriate for small semicommercial/progressive farmers with less than five acres as an automatic crop-credit insurance coverage bundled with loans through noncommercial banks such as MFIs and through GoPunjab's e-Kissan program.** In these cases, the programs are not insured under CLIS and a full-value "ground-up" policy would be issued to the loanee farmers, covering an area yield shortfall from say 80 percent down to 0 percent of the expected area yield. Any non-loanee farmer could also purchase ground-up coverage on a purely voluntary basis.
- **For farmers borrowing from commercial banks who are already automatically insured under CLIS for catastrophe losses exceeding 50 percent of expected production and yield, it may be possible to offer AYII "top-up" coverage.** These farmers would then be covered for area-yield shortfalls from say 80 percent down to 50 percent of expected area yield (see the next section for further discussion of this possibility).
- **There may also be scope in Punjab to develop NPCI** coverage (both parametric and nonparametric) against specific perils such as frost, wind, and hail for vegetable crops (such as potatoes) and tree fruit (citrus, mangoes, and others).

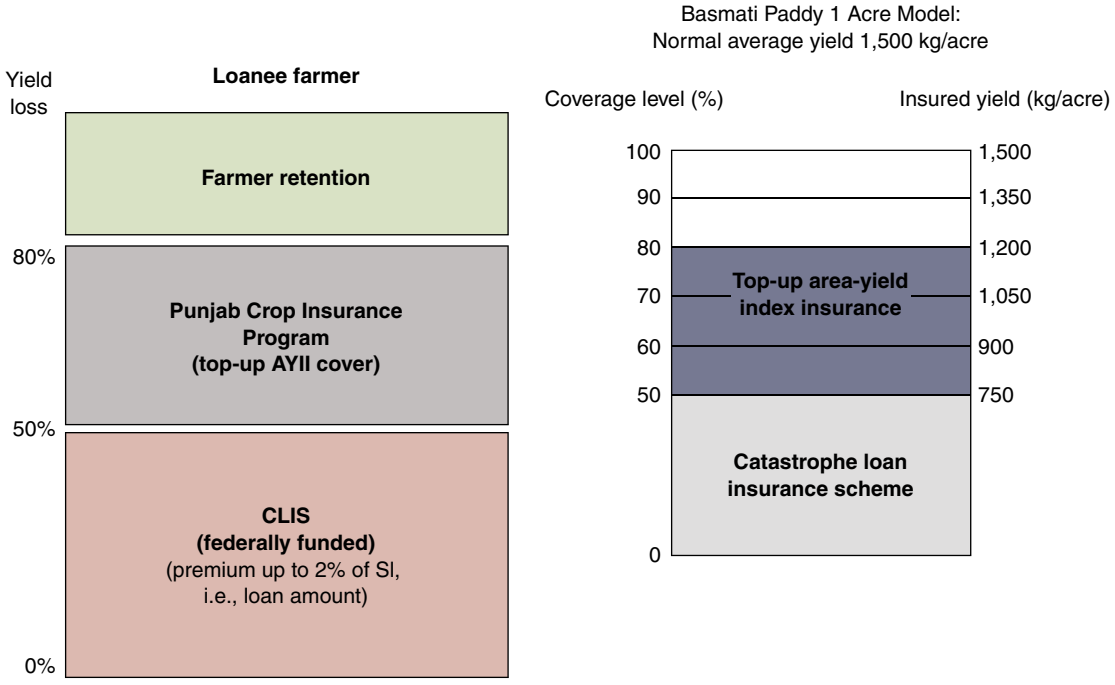
4.2. BUILDING ON THE CROP LOAN INSURANCE SCHEME

4.2.1. LINKAGES BETWEEN THE CROP LOAN INSURANCE SCHEME AND A NEW CROP AREA-YIELD INDEX INSURANCE PROGRAM FOR SEMICOMMERCIAL/PROGRESSIVE FARMERS

By building on the current CLIS, GoPunjab could consider developing commercial crop insurance for semicommercial/progressive farmers who access seasonal production credit through commercial banks (Figure 4.2). Chapter 3 highlighted the fact that the CLIS product is primarily a catastrophic insurance coverage, paying out when crop yields drop

[44]This social protection coverage would not, however, be provided to small progressive farmers with <2.5 acres who access seasonal crop loans.

FIGURE 4.2: OPTION FOR LINKING CLIS AND GOPUNJAB AYII TOP-UP COVERAGE FOR SEMICOMMERCIAL/PROGRESSIVE FARMERS



Source: Authors.

below 50 percent of the historical yield for the area. For that reason, farmers incurring more frequent yield losses have no insurance protection. This gap in coverage exposes both the farmer and credit provider (that is, the financial institutions) to significant credit risk.

GoPunjab could support an AYII program for crops providing "top-up" coverage in excess of the CLIS 50 percent yield coverage level, up to approximately 80 percent of the area average yield. This coverage could be marketed either on a voluntary or mandatory basis to farmers accessing seasonal crop loans through the existing bank channels and who are protected by CLIS. In some cases, insurers may be willing to offer higher coverage to farmers in areas with assured irrigation and where yield variation is low for area-yield losses, up to a maximum of 90 percent of the area average yield.

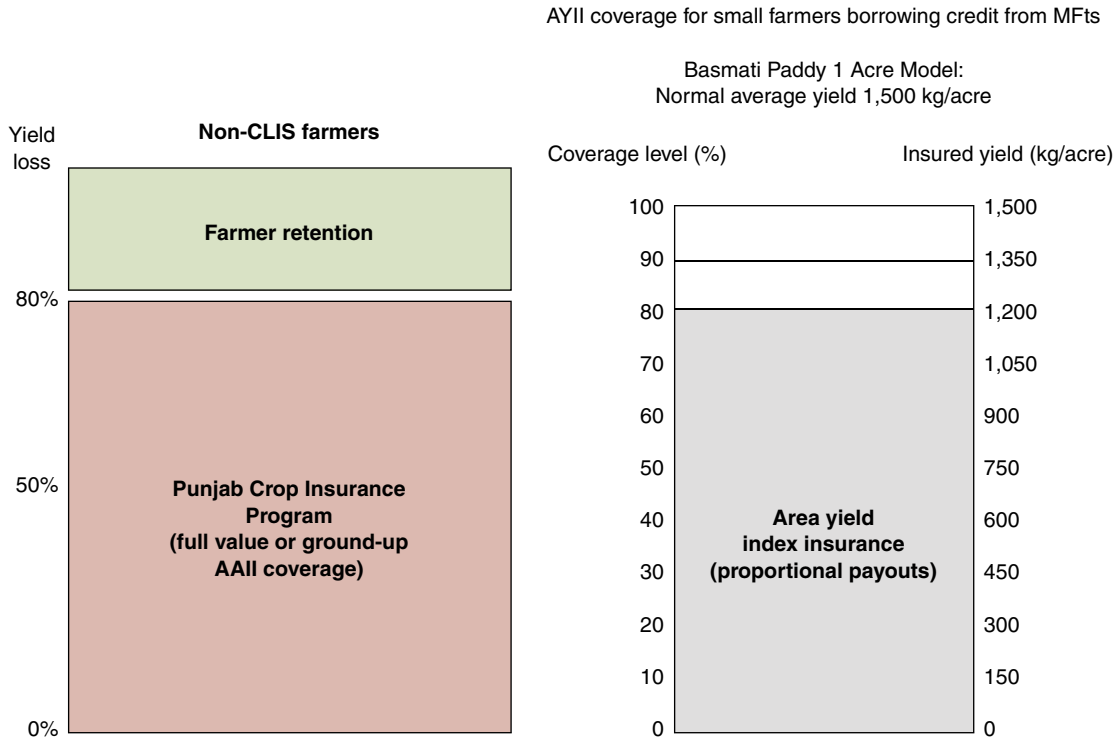
Currently the CLIS is insuring approximately 1 million loanee farmers, of whom about 70 percent (700,000) are located in Punjab (see Chapter 3 for details). If the GoPunjab crop AYII program for semicommercial/progressive farmers was linked to the CLIS on a mandatory basis, it would offer considerable business potential to the participating insurers for scaling up and for spreading risk.

If a direct linkage is to be promoted between the CLIS and a new AYII program for commercial crops, SBP would need to agree to adopt the seasonal CCEs to establish the actual average yield in each defined UAI and to settle payouts on this basis. This would be in place of the current procedure, which requires the local provincial authorities to declare a natural calamity when they estimate crop damage and losses to exceed 50 percent of expected crop production. In addition, the CRS would need to significantly increase the density of its CCEs throughout the districts and tehsils of Punjab where the CLIS is currently being sold.

4.2.2. OPTIONS FOR OFFERING CROP AYII TO SEMICOMMERCIAL/ PROGRESSIVE FARMERS WHO ARE NOT INSURED UNDER CLIS

As mentioned, the AYII coverage could also be offered to semicommercial/progressive farmers who are not insured under CLIS as a full-value loss-of-yield coverage from approximately 80 percent

FIGURE 4.3: FULL-VALUE OR "GROUND-UP" AYII COVERAGE FOR SEMICOMMERCIAL/ PROGRESSIVE FARMERS NOT INSURED UNDER CLIS



Source: Authors.

down to 0 percent yield (ground-up coverage), as illustrated in Figure 4.3. Two types of semicommercial/ progressive farmer could be offered full-value AYII coverage. The first group consists of small farmers (<5 acres) who are beneficiaries of loans distributed through MFIs under the GoPunjab e-Kissan credit program, but who are not insured by CLIS. In this instance, GoPunjab would make crop insurance compulsory for the Kissan e-credit recipients. The second group would be non-loanee farmers wishing to purchase crop AYII insurance on a purely voluntary basis. In that case, the challenge would be to identify suitable marketing, promotion, and delivery channels for the voluntary coverage for non-loanee farmers.

4.3. INTERNATIONAL EXPERIENCE WITH CROP AREA YIELD INDEX INSURANCE

Crop AYII is implemented in a wide range of developed and developing countries. India introduced AYII in the late 1970s and the USA and Canada introduced this product in the early 1990s. More recently, other countries like Brazil, Ghana, Kenya, Mexico, Morocco, Peru, the Philippines, and Sudan have developed AYII programs specifically for small farmers.

India is the world's largest crop insurance market, insuring about 32 million farmers in 2012–13; more than 65 percent of those farmers are insured under AYII programs, which have operated there for 37 years. The Agricultural Insurance Company of India (AICI) was responsible for implementing AYII under the National Agricultural Insurance Scheme (NAIS) between 2000 and 2015. Key features of the NAIS included:

- The program targeted small and marginal farmers (<2 hectares), who are highly dependent on access to seasonal crop credit.
- Crop insurance was compulsory for borrowing farmers and voluntary for non-borrowing farmers.
- The program covered a wide range of food, oilseed, pulse, and cash crops.
- The program was heavily subsidized in two ways. First, the maximum insurance charges payable by farmers were capped at 2.0 percent (Kharif) and 1.5 percent (Rabi) of the sum insured or actuarial rate, whichever was less, for food and oilseeds crops (all cereals, millets, oilseeds, pulses); and 5 percent

for annual commercial/horticultural crops. Second, in the case of catastrophic losses computed at the national level for an agricultural crop season, the liability of insurance companies was up to 350 percent of the total premium collected (the farmer share plus the government subsidy), or 35 percent of the TSI of all the insurance companies combined, whichever was higher. Losses at the national level in a crop season beyond this ceiling were met by equal contributions (that is, on a 50:50 basis) from the central government and the concerned state governments.

- The UAI was normally the taluka or block, but in some cases was as low as the gram panchayat (village council) or individual village.
- Levels of insured yield coverage were set for each district and UAI according to the degree of variability in historical area crop yields and actuarial experience. Three levels of threshold or insured yield were offered under NAIS—60 percent, 80 percent, and 90 percent of the historical annual area average yield (or "expected yield")—according to the degree of yield variability of each insured crop in each UAI. Under NAIS the expected yield was calculated as the average of the middle three out of the past five years, excluding the years with the highest and lowest yields.
- The program was implemented and administered through the bank branch network, including Agriculture Credit Cooperatives in each state, district, and block (group of villages). Insurers paid the banks a commission for managing the scheme on their behalf, including crop insurance premium financing, which is included as part of the loan of the borrower.
- Actual area yields were measured by the State Department of Agriculture extension officers for each crop through sample CCEs at the time of harvest. This major and costly exercise suffers from delays in processing the results, and for that reason, indemnity payments under NAIS were often delayed for six months or more. Recently, governments have been involving the private sector in conducting CCEs, including steps such as outsourcing CCEs and using technology (such as mobile smartphones) in the CCE process to reduce downtime significantly.

For Rabi 2010, India launched the modified NAIS (mNAIS), which adopted market-based principles technical refinements. Between 2010 and 2014, nearly 10 million farmers were insured under mNAIS. The key market-based principles that differentiate the mNAIS relative to the NAIS are that crop premium rates are actuarially determined rather than being capped, the central and state governments pay direct premium subsidies to make the coverage affordable to farmers, and the program was reinsured with General Insurance Corporation (GIC) of India, which is the national reinsurer and international reinsurer, rather than by the federal and national government. The technical refinements were a reduction in the size of the UAI to the village level to reduce basis risk, and steps to strengthen the crop-cutting procedure to make it more transparent, accurate, and rapid to complete. Other changes included raising the minimum insured yield from 60 percent to 70 percent while maintaining the 80 percent and 90 percent maximum yield coverage levels. Also, the average or expected yield was calculated as the average of the last seven years, excluding two years of declared calamities.

Under mNAIS, the move to an actuarial regime led to major increases in premium rates, as evidenced by the average commercial premium rate from 2011 to 2014 of 11.1 percent. Table 4.3 summarizes the main features of mNAIS by state for the four-year period, including the number of insured farmers in each season, and in total, the average premium rates charged for Kharif and Rabi crops, and the four-year long-term average loss ratio for each season. The scale of the mNAIS program varied considerably between states, with the largest number of insured farmers in Andhra Pradesh, Bihar, and Rajasthan. Average premium rates charged by commercial insurers also varied widely between states. The lowest average rates in the Kharif season were in Uttar Pradesh (2.70 percent, with a loss ratio of 15.4 percent); Uttrakhand (3.28 percent, loss ratio 99.3 percent); Orissa (3.59 percent, but the incredibly high loss ratio of 996.3 percent, indicates that premium rates need to be much higher) and Haryana (5.05 percent, loss ratio 75.3 percent). At the other extreme, in large states such as Bihar, the Kharif average premium rates were extremely high at 21.7 percent (loss ratio 41 percent), probably due to the very high flood risk exposure in the Kharif season, and in Rajasthan average rates were 15.10 percent (62.7 percent loss ratio). In the Rabi season, the lowest average premium rates were seen in Haryana (1.20 percent, with a loss ratio of 87.1 percent) and Uttrakhand (2.80 percent, 10.1 percent loss ratio). States with high average premium rates in the Rabi season included West Bengal (15.26 percent, but with a very low loss ratio of 19.8 percent) and Karnataka (12.9 percent, loss ratio 45 percent).

TABLE 4.3: INDIA: INSURED FARMERS, AVERAGE PREMIUM RATES, AND AVERAGE LOSS RATIOS BY STATE AND SEASON FOR THE AREA-YIELD INDEX INSURANCE PROGRAM OF THE MODIFIED NATIONAL AGRICULTURAL INSURANCE SCHEME, 2001–14

State	Number insured farmers			Average premium rates			Average loss ratios		
	Kharif	Rabi	Overall	Kharif	Rabi	Overall	Kharif	Rabi	Overall
Haryana	73,813	27,841	101,654	5.05%	1.20%	4.01%	75.3%	87.1%	76.3%
Rajasthan	560,682	1,824,946	2,385,628	15.10%	8.02%	8.85%	62.7%	46.7%	49.9%
Uttrakhand	36,469	9,421	45,890	3.28%	2.80%	3.18%	99.3%	10.1%	82.3%
Gujarat	231	201	432	19.01%	5.31%	10.81%	0.0%	0.0%	0.0%
Uttar Pradesh	77,293	610,802	688,095	2.70%	5.15%	4.71%	15.4%	309.4%	279.1%
Madhya Pradesh	6,709	72,228	78,937	5.81%	3.58%	3.85%	1.5%	3.1%	2.8%
Bihar	758,927	77,483	836,410	21.70%	9.79%	20.39%	41.0%	24.2%	40.1%
Jharkhand	2,895	8,794	11,689	12.99%	6.69%	9.05%	0.0%	5.7%	2.7%
West Bengal		861,655	861,655		15.26%	15.26%		19.8%	19.8%
Assam	9,310	7,676	16,986	4.49%	3.78%	4.21%	34.4%	22.5%	30.2%
Orissa	69,489	50,209	119,698	3.59%	4.11%	3.81%	996.3%	79.9%	575.3%
Andhra Pradesh	1,007,946	170,071	1,178,017	9.47%	4.57%	8.66%	184.2%	48.1%	172.3%
Karnataka	500,578	62,064	562,642	11.76%	12.90%	11.84%	42.3%	45.0%	42.5%
Tamil Nadu	301,070	130,114	431,184	13.78%	7.75%	11.74%	205.0%	14.1%	162.4%

Source: AIC www.aicofindia.com/

To help small and marginal farmers afford the mNAIS coverage, the Federal Government of India accepted to provide a significantly higher premium subsidy, equivalent to 61 percent of total premiums. The main benefit to the government was that it no longer assumed responsibility for an unknown and unbudgeted level of excess claims, as 100 percent of the program liability was transferred from the government's balance sheet to local insurers and to the state and international reinsurers. The average loss ratio for mNAIS was 73 percent,[45] indicating commercial viability for the participating insurers and reinsurers.

In 2016 the Government of India announced a radical plan to replace NAIS and mNAIS with a single program, the Pradan Mantri Fasal Bima Yogana (Prime Minister's Crop Insurance Scheme, PMFBY). The main aim of PMFBY is to increase the penetration of crop insurance in India to 50 percent of all farmers (about 65 million farmers) by 2020. The main change is that government has reverted to flat or capped premium rates charged to farmers because of its concern that mNAIS is too expensive for farmers. Farmers will in the future pay a uniform premium rate of 2.0 percent for Kharif crops and 1.5 percent for Rabi crops, while the rate for commercial and horticultural crops will be 5 percent. The rest of the premium will be paid by the government with no upper limit on the subsidy amount. In other words, rates will be actuarially determined, and the government will settle the difference between the flat rate paid by the farmer and the rate charged by the insurer. A further major change, introduced to reduce basic risk, is the reduction in the size of the UAI from the block to the gram panchayat or village level. With the move to the village level, the minimum number of CCEs has been set at four per village for cereals and major crops, which means that the number of CCEs will need to increase from about 2 million per year to about 8 to 9 million per year—a major challenge for the participating states.

Further information on the experience with AYII in India, the USA, and Brazil is contained in Annex 4.

[45]www.aicofindia.com

4.4. AREA-YIELD INDEX INSURANCE FOR SEMICOMMERCIAL/ PROGRESSIVE FARMERS IN PUNJAB

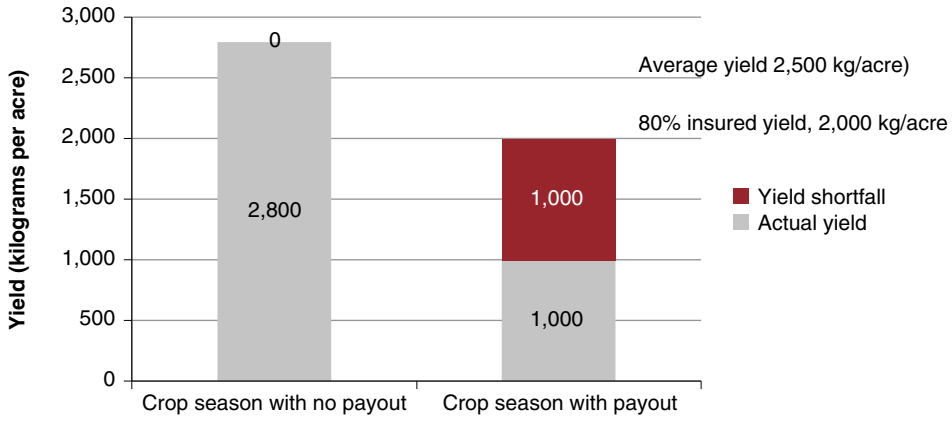
The sections that follow present the central features of an AYII coverage for semicommercial/ progressive farmers in Punjab. The discussion begins by describing the basis of insurance and indemnity of an AYII product providing (1) full-value or "ground-up" yield coverage for non-CLIS farmers and (2) layered or "top-up" coverage for farmers already insured under CLIS. It moves on to review the preconditions for operating an AYII program and to describe how the insured yield coverage level and the sums insured are set. The next section focuses on methods for rating an AYII coverage. The discussion draws on actual sample crop yield data from three tehsils in Lodhran District, Punjab, which were provided by CRS-DoA-GoPunjab.

4.4.1. BASIS OF INSURANCE AND INDEMNITY (PAYOUTS) ON AN AYII POLICY

The key principle of a crop AYII coverage is that it insures and indemnifies farmers for losses against the average area yield in a defined geographic location, such as the tehsil or village where they farm, and is therefore not an individual farmer yield policy that insures them against losses on their own farms and fields. The operation of an AYII policy providing full-value, ground-up coverage is illustrated for a hypothetical crop of maize over two growing seasons in Figure 4.4. In this example, Village X has a farming population of about 10,000 small farmers and an average maize area of about 50,000 acres. The average or normal expected yield of maize in Village X is 2,500 kg/acre, which is similar to the average yield of maize in Punjab. This forms the area-yield index. AYII insurers typically offer insured yield coverage levels (termed the "coverage" level) that are between a minimum of 50 percent and a maximum of 90 percent of the average area yield. In the example in Figure 4.4, the insured yield (or threshold yield) is set at 80 percent of the average, which in this case is 2,000 kg/acre. The insured yield represents a guarantee of the yield level, such that if the actual area yield, as measured at the time of harvest in Village X, falls below an average of 2,000 kg/acre, insurers will pay all insured farmers the amount of yield shortfall or loss per acre times the agreed value (the "sum insured") times each farmer's acreage of the insured crop. In this instance it is assumed that the agreed sum insured is US$500 per acre. This is the maximum amount the insurer will pay out if there is zero recorded yield (total crop failure) in Village X in the forthcoming season. The example also assumes that 2,000 farmers in Village X elect to buy the AYII at the 80 percent coverage level, and that the DoA has for many years conducted CCEs at harvest time on a statistically selected sample of maize farms in Village X to determine actual average yield at that location.

In the first crop season, climatic conditions are better than normal for growing maize, and the actual average maize yield in Village X as measured by the DoA is 2,800 kg/acre, which exceeds

FIGURE 4.4: EXAMPLE OF AN AYII CONTRACT PROVIDING GROUND-UP COVERAGE FOR MAIZE GROWN IN VILLAGE X



the insured yield of 2,000 kg/acre, so no payout is due to the 2,000 insured maize farmers. In the second season, however, severe drought causes the actual average yield in Village X to fall to only 1,000 kg/acre—a yield shortfall of 1,000 kg/acre or 50 percent of the insured yield. All 2,000 farmers receive a payout based on this area-yield shortfall of 1,000 kg/acre, irrespective of the actual yields on their own farms. The per acre payout each farmer receives is calculated as the percentage yield shortfall (1,000 kg divided by 2,000 kg = 50 percent) times the sum insured (US$500), for a payout of US$250/acre. Each farmer is compensated according to the area of maize that the farmer has grown and insured. For example, Farmer 1 has 5 acres of insured maize and therefore receives a payment of 5 acres × US$250/acre = US$1,250. Farmer 2 has 2 acres insured and receives 2 acres × US$250/acre = US$500/acre.

4.4.2. PRECONDITIONS FOR THE DESIGN AND OPERATION OF AYII

The preconditions for operating AYII for Kharif and Rabi crops grown in Punjab include:

- Definable, homogeneous crop producing zones (UAI) with low yield variation between farmers in the insured unit (IU).
- For the defined UAI, historical crop sown area, production, and average yield data for the past 15 years or more to provide the basis for establishing the insured yield and technical premium rates for an AYII policy.
- An independent and statistically accurate system of measuring actual average area-yields in the defined IU to provide the basis for triggering claim payments when actual yields fall short of the insured yield(s).

As noted in section 4.1, the CRS in Punjab can meet these data preconditions for an AYII program in Punjab. CRS has for many years been involved in field survey work and CCEs to measure the cultivated area and actual average yields of all major crops grown throughout the 36 districts of Punjab. The CRS samples 5 percent of Punjab's 26,000 villages (about 1,250 villages) to conduct the farmer surveys and CCEs. In each sample village, CRS randomly selects three farmers and takes two crop cuts per farmer/field for the selected crop, for a total of six CCEs per crop per sample village.

The CRS crop sampling frame will need to be modified, however. The CRS sampling frame is set up to provide accurate estimates of cropped area, production, and average yields for all major crops at the district level, so official statistics on these variables are reported only at the district level. The district is, however, too big a geographic area for the operation of an AYII coverage, and ideally the sampling frame should be adapted over time to the area of a tehsil or union council.

For the feasibility study team to analyze the design of an AYII coverage for Punjab, CRS provided area-yield data at the tehsil level. The data covered five main crops (Rabi wheat, Kharif rice, maize, sugarcane, and cotton) in three tehsils in Lodhran District (Kehror Placa, Dunyapur, and Lodhran). Lodhran is an important wheat and cotton growing area of Punjab, with a high percentage of irrigated area. Yields and variation in crop yields in Lodhran over time are very similar to those in other districts of Punjab that have assured irrigation (see Annex 1 for 10-year crop yields at the district level). Lodhran is therefore considered to be a "representative" district for the purposes of this preliminary AYII coverage design and rating analysis.

4.4.3. AYII COVERAGE DESIGN

Initial Crops Selected for Coverage

AYII can, in principle, be designed for any field crop for which area-yield data are available at harvest, including cereals, oilseeds, pulses, fibers (such as cotton), and industrial crops such as sugarcane. AYII is not, however, suitable for short-duration horticultural and vegetable crops, which tend to be grown on a very small scale.

For the start-up phase of the Punjab agricultural insurance program, it is proposed to develop AYII for the five major crops (wheat, rice, maize, sugarcane, and cotton). The three reasons for focusing on these crops initially is that they are the most important crops grown throughout the province by small-scale farmers, CRS can provide historical yield data on these crops to construct the AYII yield index, and CRS conducts CCEs at harvest to form the basis for determining claims settlements.

Unit Area of Insurance and Minimum Cultivated Area

Ideally, the UAI should be defined as a homogeneous micro-agroclimatic zone where farmers grow the

same varieties of the insured crop and use similar husbandry practices (including inputs) so that normal average yields are similar for all farmers. In reality, UAIs are typically defined based on administrative units for which crop area, production, and yield statistics are collected and reported. As mentioned, the UAI in India under the NAIS was formerly based on the subdistrict block (tehsil/taluka), but farmers maintained that this UAI was too large and that rainfall, crop conditions, and yield outcomes were not uniform across the block. Subsequently, under the mNAIS and now the PMFBY, the UAI is defined at the village (gram panchayat) level.

At this stage it is not possible to determine whether the tehsil or a smaller area should be considered as the UAI. To give an idea of the considerations involved, note that the three sample tehsils in Lodhran District are quite large geographic areas where Rabi wheat and Kharif cotton are the predominant crops. Together these tehsils produce an average of 125,000–185,000 acres of these two crops each year, on an area equivalent to 22–27 square kilometers. Conversely maize, rice, and cotton are cultivated on very small areas in these tehsils (see Table 4.4 and Annex 5). It is not clear how homogeneous crop yields are between farmers across these tehsils. Typically, the tehsil-level annual crop yield data compiled by CRS are based on the average of about 60 CCEs, and therefore there may be scope to use these data to define a smaller administrative area to serve as the UAI. It will be important to validate these points with CRS during the detailed design phase of the AYII program.

Given these circumstances, it is likely that the crop AYII program in Punjab will start by using the tehsil as the UAI.

TABLE 4.4: LODHRAN DISTRICT, PUNJAB: AVERAGE CULTIVATED AREA OF MAIN CROPS IN KEHROR PLACA, DUNYAPUR, AND LODHRAN TEHSILS

Crop	Kehror Pacca (acres)	Dunyapur (acres)	Lodhran (acres)
Wheat	126,961	163,053	178,121
Cotton	136,320	156,960	186,786
Rice	3,678	4,074	8,635
Maize	7,861	3,414	2,158
Sugarcane	2,104	1,456	2,048

Source: CRS data for the 10 years from 2007–08 to 2016–17 (see also Annex 5).

Expected Yields and Insured Yield Coverage Levels

For the insured unit (in this case the tehsil), it is necessary to establish the normal average or "expected yield" for the insured crop. AYII programs conventionally adopt one of two approaches for establishing the expected yield:

- The simplest approach is to take an average of the past three to five to seven years' actual area yields. As noted, this approach was adopted by the NAIS in India, which used the average of the middle three of the past five years (after eliminating years with the highest and lowest annual yields) to calculate the expected yield. The successor program (PMFBY), in recognition that the relatively short period of five years did not always represent the average yield, now uses the average of seven years by eliminating two bad years.
- The alternative is to ***detrend*** the time-series yields using appropriate statistical curve fitting procedures and to extend the detrended yields to calculate the expected yield in the forthcoming insurance season. In the USA under the Group Risk Plan (GRP) program, Skees et al. (1997) recommended the use of linear spline regression to detrend county average yield data. Conversely in Romania, Varangis et al. (2003) recommended the use of LOESS econometric procedures in SAS software to adjust area yields for trends. The reasons for detrending yields are discussed in the following section.

Average or expected yield can be calculated in different ways, as illustrated in Table 4.5 for the five crops grown in the three sample tehsils. The first column of the table shows the long-term average yield, which is the average of the yields over ten years (2007–08 to 2016–17), along with the standard deviation and coefficient of variation (CV). It is immediately noticeable that average wheat yields are very similar across the three tehsils and that yields exhibit very low variation over the 10-year period, as shown by CVs in mean yield of 11–13 percent. Conversely maize and cotton yields are much more variable, as shown by CVs of 27–34 percent. Three other estimates of expected yield are shown in Table 4.5, including the most recent three-year average yield, the average of the middle three of the past five years (discarding the years with the lowest and highest yields), and the long-term average detrended yield. For wheat, all three estimators of average yield are very similar, because wheat yields have been stable over time. In comparison, for maize in Kehror Pacca the 10-year long-term

TABLE 4.5: PUNJAB: COMPARISON OF METHODS FOR CALCULATING AVERAGE OR EXPECTED YIELDS FOR SAMPLE TEHSILS

Crop/tehsil	Methods of calculating the average or expected yield					
	Long term average (LTA) yield	LTA standard deviation	Coefficient of variation percent	3-year average yield	Average of middle 3 years out of 5-year yields	Long term average detrended yield
Wheat						
Kehror Pacca	1,387	152	11%	1,364	1,432	1,460
Dunyapur	1,383	163	11.8%	1,418	1,433	1,504
Lodhran	1,408	180	12.8%	1,491	1,521	1,639
Rice						
Kehror Pacca	1,285	189	14.7%	1,454	1,434	1,506
Dunyapur	1,257	240	19.1%	1,460	1,422	1,503
Lodhran	1,331	228	17.1%	1,550	1,428	1,599
Maize						
Kehror Pacca	2,060	561	27.2%	2,831	2,447	2,827
Dunyapur	1,889	601	31.8%	2,609	2,246	2,579
Lodhran	1,778	532	29.9%	2,423	2,093	2,645
Cotton						
Kehror Pacca	688	186	27.0%	613	737	677
Dunyapur	696	235	33.8%	638	768	758
Lodhran	758	238	31.4%	703	846	840
Sugarcane						
Kehror Pacca	24,606	2,910	11.8%	27,947	27,463	28,844
Dunyapur	21,063	2,652	12.6%	23,777	23,100	22,893
Lodhran	25,501	2,776	10.9%	27,232	27,232	28,758

average yield is 2,060 kg/acre, whereas the average yield over the past three years is very much higher (2,381 kg/acre) because farmers in recent years have been using an improved technology that increased yields. Rice and sugarcane also exhibit small increases in yield over time (see Annex 5 for full details on annual yields for these crops and tehsils). Where crop yields are increasing (or decreasing) over time, it becomes necessary to detrend yields to design and rate crop insurance coverages.

Insured Yield Coverage Levels

AYII policies typically offer optional insured yield coverage levels of between a maximum of 90 percent and a minimum of 50 percent of the average area yield. In India, the PMFBY offers three coverage levels: 60 percent, 80 percent, or a maximum of 90 percent of the average yield in five of the last seven years in each UAI. The decision over which coverage level will apply in a UAI is based on the CV around the mean yield: in UAIs with low-yield CVs, the maximum 90 percent coverage level will be applied, and in UAIs with high CVs, only 60 percent coverage is offered.

In the USA under the GRP, farmers may select from optional coverage levels of between 50 percent and 90 percent of the county average yield. However, recognizing that some farmers achieve much higher average yields than the maximum insured yield (90 percent of the county average), the GRP allows farmers to insure their crop at up to 150 percent of the reference value.[46]

In Punjab it is recommended that coverage levels of between 50 percent and 90 percent of the

[46]Skees et al. (1997).

TABLE 4.6: DUNYAPUR TEHSIL, PUNJAB: LEVELS OF INSURED YIELD COVERAGE FOR MAIZE (KG/ACRE)

Insured yield coverage level (percent of average yield)	Long-term average (LTA) yield	3-year average yield	Average of middle 3 years out of 5-year yields	Long-term average detrended yield
Average yield (100%)	**1,889**	**2,609**	**2,246**	**2,579**
90	1,700	2,349	2,022	2,321
85	1,606	2,218	1,909	2,192
80	1,511	2,088	1,797	2,063
75	1,417	1,957	1,685	1,934
70	1,322	1,827	1,572	1,805
65	1,228	1,696	1,460	1,676
60	1,134	1,566	1,348	1,547
55	1,039	1,435	1,235	1,418
50	945	1,305	1,123	1,290

average expected yield be considered for each crop in each UAI, subject to the level of yield variability and price.[47] The principles of setting the levels of insured yield coverage are illustrated in Table 4.6 for maize grown in Dunyapur tehsil.

Basis of Valuation and Sum Insured

Under an AYII policy, the insured crop yields can be valued either on a "costs of production basis" through to a "farm-gate sale price" or revenue basis. In India the NAIS commonly set the sum insured according to the amount of seasonal production credit provided to the farmer. In the USA, the GRP permits farmers to set their yield coverage level up to as much as 150 percent of the reference price.

In Pakistan, the CLIS establishes the sum insured based on the loan amount per acre, subject to the maximum permitted limits recommended by the SBP for agricultural loans. These per acre values are shown in Table 4.7 for the main field crops to be insured in the start-up phase of the Punjab AYII program for semicommercial/progressive farmers. For Rabi wheat, the maximum loan size is PKR 30,000 per acre, whereas for most Kharif crops the maximum loan size is between PKR 38,000 per acre (hybrid maize) and PKR 53,000 per acre (sugarcane).

Under the AYII program for semicommercial/progressive farmers in Punjab, key stakeholders will need to decide whether to base the sum insured per acre on the value of the loan given to the farmer, or on a higher value representing the full costs of production per acre or the expected value of output (yield times price). Table 4.7 shows the typical average costs per acre for the five crops, which in the case of sugarcane and maize are 48 percent higher than the maximum loan size, but only 11 percent for rice. It is not known why the maximum loan size for wheat is in fact higher than the reported average costs of production. For budgeting purposes in Chapter 6, the average sums insured for Rabi crops are assumed to be PKR 30,000 per acre, and for Kharif crops for full-value or "ground-up" AYII coverage, they are assumed to be PKR 40,000 per acre.

Note that subsequent to the submission of the draft of this feasibility study in July 2017, the sums insured for the Kharif 2018 pilot AYII program were set by project management for both cotton and rice at the same levels of (1) PKR 50,000 per acre for "ground-up" AYII coverage for non-CLIS farmers, proving yield shortfall protection from 80 percent down to 0 percent of expected yield, and (2) PKR 20,000 per acre for "top-up" AYII coverage for CLIS farmers, providing layered protection from 80 percent down to 50 percent of expected yield.

[47]Note that for the Kharif 2018 Pilot AYII program, insurers and their reinsurers advised the GoPunjab Crop Insurance Team that they would agree only to offer a maximum 80 percent insured yield coverage level.

TABLE 4.7: CROP LOAN INSURANCE SCHEME, PAKISTAN: LIMITS ON SUM INSURED PER ACRE (MAXIMUM LOAN SIZE)

Crop	2016–17 production cost PKR/acre [1]	CLIS maximum sum insured PKR/acre for Rabi crops [2]	CLIS maximum sum insured PKR/acre for Kharif crops [2]
Wheat	26,723	30,000	
Cotton	51,138		40,000
Rice (Basmati)	43,180		39,000
Sugarcane	78,280		53,000
Maize (hybrid)	56,290		38,000

Source: [1] DoA Punjab; [2] SBP 2014.

4.4.4. AYII RATING ANALYSIS: METHODOLOGY, PURE RATES, AND INDICATIVE COMMERCIAL PREMIUM RATES

This section presents indicative results of a preliminary historical burning cost rating analysis (HBA), which forms the basis of all actuarial rating and pricing, based on the sample yield data from the three tehsils. The HBA results are presented (1) for the actual 10-year historical yield data provided by CRS and (2) for the detrended 10-year yield data. It not only demonstrates the principles of AYII rating analysis but shows the importance of detrending historical yield data before calculating coverage levels and premium rates. Full results of the HBA for wheat, rice, maize, sugarcane, and cotton are presented in Annex 5.

Ultimately, all final insurance rating and pricing decisions for the AYII program will be made by insurers and reinsurers in the detailed design phase. This section merely illustrates pricing methodology and presents indicative rates.

Importance of Adjusting Time-series Yield Data for Trends

It is very important to check the historical yield data for trends over time. Yields typically show an increasing trend over time as farmers switch to new improved varieties and technology, but yields may also show a declining trend where the impacts of soil degradation or climate change (for example) are severe.

On a loss-of-yield insurance policy, before setting the Insured Yield Coverage level and calculating the pure loss cost premium rates, it is extremely important to adjust for any yield trends that are identified by detrending the data. This concept is illustrated in Figure 4.5 using actual maize yields in Dunyapur Tehsil, Lodhran District, from 2007–08 to 2016–17. Since 2014–15, average maize yields in Dunyapur Tehsil increased dramatically from 1,600 kg/acre to about 2,600 kg/acre, a change that DoA attributes to the introduction of high-yielding hybrid maize and improved practices, along with higher levels of fertilizer use. The data show a very definite increasing yield trend over the last five years in the series, interrupted by a major yield reduction in 2013–14, presumably due to adverse climatic conditions. The upper red graph in the figure shows the effect of detrending the yield data using linear trending: the effect is to adjust the historical yields in earlier years upwards, while maintaining years in which major yield shortfalls occur, such as 2013–14.

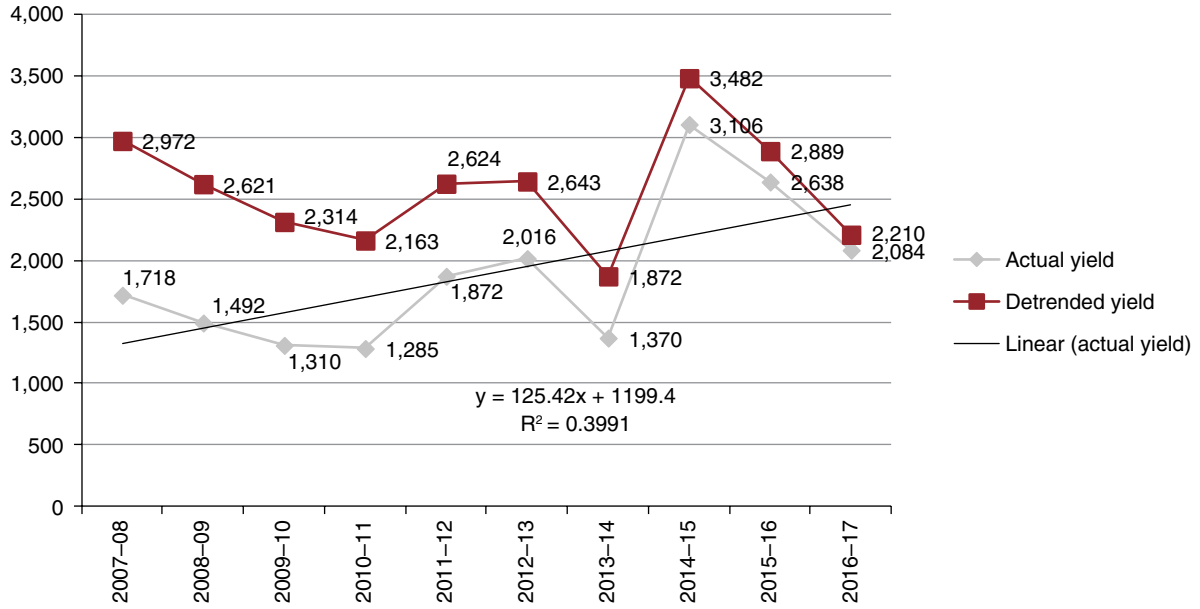
Recommendation for Punjab

Under the design of the AYII program for Punjab, it is recommended that all crop yield data be detrended for calculating the expected yield (and thus coverage levels), the pure risk rates, and commercial premium rates.

Historical Burning Cost Rating Analysis for "Ground-up" AYII Coverage

Annex 4 presents the full details of the HBA for the two options: (1) HBA applied to the actual 10-year yield data and (2) HBA applied to the 10-year detrended yields using linear trending. Results are summarized here for the five main crops.

FIGURE 4.5: DUNYAPUR TEHSIL, PUNJAB: ACTUAL HISTORICAL MAIZE YIELDS AND DETRENDED MAIZE YIELDS (KG/ACRE)



Rabi wheat

The 10-year wheat yields in the three sample tehsils in Lodhran District are very stable and exhibit only a small increasing trend over time, with no years of severe yield loss, probably due to the twin facts that the crop is irrigated and flooding is not an issue in the Rabi season. The HBA applied to actual yields suggests that for ground-up AYII coverage in these tehsils, a high level of coverage of 70 percent to 80 percent could be provided, with indicative commercial premium rates of 3.5–5 percent applied to the sum insured. Results of the HBA applied to the detrended yields suggest that very high coverage levels of 80–90 percent could be offered, with average commercial premium rates of 3.5 percent or less.

Kharif rice

The 10-year rice yields are also fairly stable across the three tehsils, but they show a higher increasing yield trend than wheat. The HBA applied to the actual yields suggests that for ground-up AYII coverage and with coverage levels of 80 percent, indicative commercial premium rates might vary from about 2.5 percent to 7.5 percent. However, the HBA applied to the detrended rice yields suggests that very high coverage levels of 80–90 percent could be offered, with average commercial premium rates of 3.5 percent or less. The difference in these rates again stresses the importance of detrending time-series yield data.

Kharif sugarcane

Sugarcane yields are also very stable in these three tehsils over the 10-year period and exhibit a modest increasing trend over time. The HBA suggests that for ground-up AYII coverage, 90 percent coverage levels could be marketed with indicative commercial premium levels of about 7.5 percent, and for 80 percent coverage, rates would be much lower at about 1.75 percent. The HBA applied to the detrended yields suggest that very high coverage levels of 80–90 percent could be offered, with average commercial premium rates of 2.0 percent or less.

Kharif maize

As discussed, the 10-year maize yields in the three tehsils exhibit much higher variability compared to the other crops, with a marked increasing trend over the last five years in the series. These characteristics have a major influence on the HBA rating results applied (1) to the 10-year actual yields and (2) the detrended yields.

Table 4.8 presents results of the HBA of actual 10-year annual average area yields for maize in Dunyapur. In Dunyapur, the actual long-term average yield for maize is 1,889 kg/acre. As current maize yields are much higher, however, the conventional approach is for an AYII program to calculate the average yield index

TABLE 4.8: DUNYAPUR TEHSIL, PUNJAB: HISTORICAL BURNING COST RATING ANALYSIS FOR GROUND-UP AYII COVER FOR ACTUAL MAIZE YIELDS FROM 2007–08 TO 2016–17 (KG/ACRE)

		90% Insured Yield			80% Insured Yield			70% Insured Yield			60% Insured Yield		
Year	Actual Yield	Trigger Yield	Yield Shortfall	Percent loss %	Trigger Yield	Yield Shortfall	Percent loss %	Trigger Yield	Yield Shortfall	Percent loss %	Trigger Yield	Yield Shortfall	Percent loss %
2007-08	1,718	2,022	**303.5**	**15.01%**	1,797	**78.9**	**4.39%**	1,572	0.0	0.00%	1,348	0.0	0.00%
2008-09	1,492	2,022	**529.3**	**26.18%**	1,797	**304.7**	**16.96%**	1,572	**80.1**	**5.09%**	1,348	0.0	0.00%
2009-10	1,310	2,022	**711.1**	**35.18%**	1,797	**486.5**	**27.07%**	1,572	**261.9**	**16.65%**	**1,348**	**37.2**	**2.76%**
2010-11	1,285	2,022	**736.5**	**36.43%**	1,797	**511.9**	**28.49%**	1,572	**287.2**	**18.27%**	**1,348**	**62.6**	**4.65%**
2011-12	1,872	2,022	**149.7**	**7.41%**	1,797	0.0	0.00%	1,572	0.0	0.00%	1,348	0.0	0.00%
2012-13	2,016	2,022	**5.7**	**0.28%**	1,797	0.0	0.00%	1,572	0.0	0.00%	1,348	0.0	0.00%
2013-14	1,370	2,022	**651.4**	**32.22%**	1,797	**426.8**	**23.75%**	1,572	**202.1**	**12.86%**	1,348	0.0	0.00%
2014-15	3,106	2,022	0.0	0.00%	1,797	0.0	0.00%	1,572	0.0	0.00%	1,348	0.0	0.00%
2015-16	2,638	2,022	0.0	0.00%	1,797	0.0	0.00%	1,572	0.0	0.00%	1,348	0.0	0.00%
2016-17	2,084	2,022	0.0	0.00%	1,797	0.0	0.00%	1,572	0.0	0.00%	1,348	0.0	0.00%
LTA Average Yield	**1,889**												
Stdev	570.25												
COV%	25.4%												
Average for AYII Insurance#	**2,246**												
Annual Average Loss (AAL) %				**15.27%**			**10.07%**			**5.29%**			**0.74%**
Indicative Commercial Premium Rate (%)				**22.22%**			**14.94%**			**8.06%**			**1.27%**
# average middle 3 out of last 5 years													

either as the average of the yields for the past three to five years, or—as in this example—the middle three of the last five years, eliminating the lowest yield year and the highest yield year, which produces an average yield of 2,246 kg/acre.

The analysis shows that with a 90 percent insured yield coverage level or 2,022 kg/acre, actual yields would have fallen short of this guarantee yield level in seven years out of ten. Shortfalls would have occurred in all years from 2007–08 to 2013–14, with the worst losses in 2010–11. In that year, the yield shortfall would have been 736.5 kg/acre, equivalent to a percentage yield shortfall or loss cost of 36.43 percent of the insured yield of 2,022 kg/acre. For the 90 percent coverage level, the annual average loss (AAL) over 10 years would have been 15.27 percent, which is also termed the "pure risk rate." Once loadings are added to cover data uncertainties and insurers' operating costs and profit margin, the illustrative commercial premium rate might be in the order of about 22 percent for 90 percent coverage, which would be prohibitively expensive for any farmer to pay. At the 80 percent coverage level (an insured yield of 1,792 kg/acre), the number of yield shortfall years would have been five, and the yield loss would have been smaller in each year, as shown by the reduced AAL of 10.07 percent, and the indicative commercial premium rate would be 15 percent. At the 70 percent coverage level (an insured yield of 1,572 kg/acre), the number of loss years would have been further reduced to four, with an AAL of 5.29 percent, and the indicative commercial premium rate would be 8.06 percent.

This analysis is potentially misleading, however, because of the major increasing yield trend for maize grown in Dunyapur in recent years.

Table 4.9 shows the same HBA applied to the Dunyapur detrended maize yields. In this case, at the 90 percent coverage level with an insured yield (detrended) of 2,321 kg/acre, there would have been small payouts in four years only. The year with the highest payouts would have been 2013–14, with an average yield shortfall of 449.3 kg/acre, a loss cost of 19.36 percent, and a 10-year AAL of only 3.13 percent and indicative commercial premium rate of 5.33 percent. At the 80 percent coverage level, with an insured yield (detrended) of 2,063 kg/acre, the only year with yield losses would have been 2013–14; the AAL would be 0.93 percent and the indicative commercial premium rate 1.81 percent. These indicative rates for 90 percent or 80 percent yield coverage obviously represent much more affordable crop AYII premium rates for a maize farmer to pay. Table 4.9 also shows that for this 10-year analysis, there would have been no losses at the 70 percent insured yield coverage level or lower coverage levels.

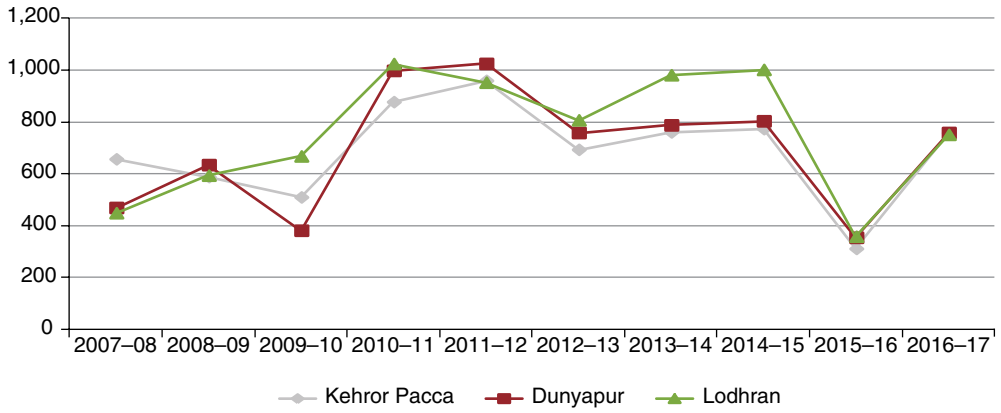
Kharif cotton

Cotton yields in the three sample tehsils are highly variable owing to two years of severe yield loss: 2009–10 and 2015–16, when actual yields were less than 50 percent of the LTA (Figure 4.6). Cotton shows no significant yield trends over time. The

TABLE 4.9: DUNYAPUR TEHSIL, PUNJAB: HISTORICAL BURNING COST RATING ANALYSIS FOR GROUND-UP AYII COVER FOR DETRENDED MAIZE YIELDS FROM 2007–08 TO 2016–17 (KG/ACRE)

		90% Insured Yield			80% Insured Yield			70% Insured Yield			60% Insured Yield		
Year	Detrended Yields	Trigger Yield	Yield Shortfall	Percent loss %	Trigger Yield	Yield Shortfall	Percent loss %	Trigger Yield	Yield Shortfall	Percent loss %	Trigger Yield	Yield Shortfall	Percent loss %
2007-08	2,972	2,321	0.0	0.00%	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2008-09	2,621	2,321	0.0	0.00%	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2009-10	2,314	2,321	**7.3**	**0.31%**	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2010-11	2,163	2,321	**158.1**	**6.81%**	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2011-12	2,624	2,321	0.0	0.00%	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2012-13	2,643	2,321	0.0	0.00%	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2013-14	1,872	2,321	**449.3**	**19.36%**	2,063	**191.4**	**9.27%**	1,805	0.0	0.00%	1,547	0.0	0.00%
2014-15	3,482	2,321	0.0	0.00%	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2015-16	2,889	2,321	0.0	0.00%	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
2016-17	2,210	2,321	**111.5**	**4.80%**	2,063	0.0	0.00%	1,805	0.0	0.00%	1,547	0.0	0.00%
LTA Detrended yield#	2,579												
Stdev	465.96												
COV%	18.1%												
Annual Average Loss (AAL) %				3.13%			0.93%			0.00%			0.00%
Indicative Commercial Premium Rate (%)				5.33%			1.81%			0.00%			0.00%
# Long Term Average Detrended Yield													

FIGURE 4.6: KEHROR PACCA, DUNYAPUR, AND LODHRAN TEHSILS, PUNJAB: 10-YEAR AVERAGE COTTON YIELDS (KG/ACRE)



Source: CRS data. See Annex 5 for full analysis.

HBA applied to both actual and detrended yields suggests that for ground-up AYII cover and a maximum 80 percent insured yield, indicative commercial premium rates would have to be between 10 percent and 15 percent, and that for coverage of between 60 percent and 70 percent, indicative commercial premiums would need to be on the order of 7.5 percent.

Historical Burning Cost Rating Analysis for "Top-up Cover" AYII Cover for CLIS Farmers

This section briefly illustrates the application of HBA to a layered or "top-up" AYII cover, which is proposed for CLIS farmers. The same rating methodology is used as for the ground-up cover: the only difference is that the policy has both a threshold insured yield, which opens the policy for a payout, and an exit yield, which sets the maximum payout amount. For this analysis, the threshold yield is set at 80 percent of the area average yield, and the exit yield is set at 50 percent of the area average yield.

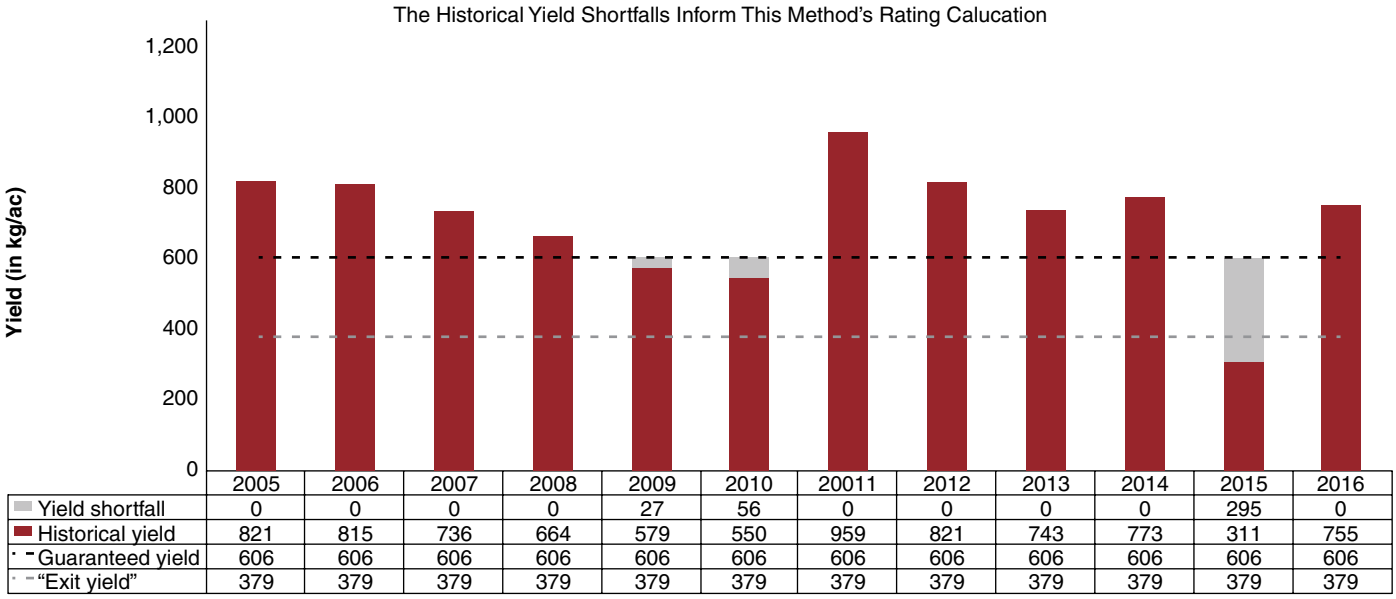
The operation of the top-up AYII cover is illustrated in Figure 4.7 for cotton grown in Kehror Pacca Tehsil, using the original historical (untrended) 12-year yields.[48] The average yield

[48]This updated analysis for cotton in Kehror Pacca is based on 12 years of historical crop yields provided by CRS, as opposed to the original 10-year yield data.

(middle three of the past five years) is 757 kg/acre, so the 80 percent threshold yield is 606 kg/acre, while the 50 percent exit yield is 379 kg/acre. Reference to Figure 4.7 shows that over the 12 years, payouts would have been due in three years: 2009, when the actual cotton yield was 579 kg/acre, resulting in a payout of 27 kg/acre to all insured farmers in this tehsil; 2010, when the actual cotton yield was 550 kg/acre, resulting in a payout of 56 kg/acre to all insured farmers; and 2015, when the average cotton yield was a very low 311 kg/acre. In this last case, the actual yield of 311 kg/acre was below the exit trigger of 379 kg/acre, so the yield shortfall paid to farmers would have been capped at 227 kg/acre, equivalent to a full payout.

Table 4.10 presents a comparison of the HBA for (1) the AYII top-up cover option linked to CLIS and (2) the ground-up cover option for cotton grown in Kehror Pacca. For the top-up cover option (trigger yield 80 percent; exit yield 50 percent) and insured yield layer of 227 kg/acre, the 2009 yield shortfall of 27 kg/acre

FIGURE 4.7: KEHROR PAKKA TEHSIL, PUNJAB: EXAMPLE OF HBA FOR TOP-UP AYII COVER WITH AN 80 PERCENT TRIGGER YIELD AND 50 PERCENT EXIT YIELD FOR COTTON, BASED ON ACTUAL 12-YEAR HISTORICAL YIELDS (KG/ACRE)



	2005	2006	2007	2008	2009	2010	20011	2012	2013	2014	2015	2016
Yield shortfall	0	0	0	0	27	56	0	0	0	0	295	0
Historical yield	821	815	736	664	579	550	959	821	743	773	311	755
Guaranteed yield	606	606	606	606	606	606	606	606	606	606	606	606
"Exit yield"	379	379	379	379	379	379	379	379	379	379	379	379

Source: World Bank.

TABLE 4.10: KEHROR PACCA TEHSIL, PUNJAB: COMPARISON OF HBA RESULTS FOR (1) TOP-UP AYII COVERAGE AND (2) GROUND-UP AYII COVERAGE FOR COTTON

(1) Layered or Top Up Cover for Yield Loss from 80% to 50%

Year	Historical Yield	Trigger Yield (80%)	Exit Yield (50%)	Insured Yield Layer	Yield Shortfall	Percentage Payout
2005	821	606	379	227	0	0%
2006	815	606	379	227	0	0%
2007	736	606	379	227	0	0%
2008	664	606	379	227	0	0%
2009	579	606	379	227	27	12%
2010	550	606	379	227	56	24%
2011	959	606	379	227	0	0%
2012	821	606	379	227	0	0%
2013	743	606	379	227	0	0%
2014	773	606	379	227	0	0%
2015	311	606	379	227	295	100%
2016	755	606	379	227	0	0%
Average Yield	758					
Annual Average Loss (AAL-%)						11.35%
Indicative Commercial Premium Rate (%)						21.25%
Sum Insured (PKR/Acre)						20,000
Indicative Commercial Premium (PKR/Acre)						4,250

(2) Ground Up Cover for Yield Loss from 80% to 0%

Year	Historical Yield	Trigger Yield	Exit Yield	Yield Shortfall	Percentage Payout
2005	821	606	0	0	0
2006	815	606	0	0	0
2007	736	606	0	0	0
2008	664	606	0	0	0
2009	579	606	0	27	0
2010	550	606	0	56	0
2011	959	606	0	0	0
2012	821	606	0	0	0
2013	743	606	0	0	0
2014	773	606	0	0	0
2015	311	606	0	295	0
2016	755	606	0	0	0
Average Yield	758				
Annual Average Loss (AAL-%)					5.18%
Indicative Commercial Premium Rate (%)					9.90%
Sum Insured (PKR/Acre)					50,000
Indicative Commercial Premium (PKR/Acre)					4,950

Source: Authors.

represents a payout of 11.7 percent, the 2010 shortfall of 56 kg/acre represents a 24.5 percent payout, and the 2015 shortfall, capped at 227 kg/acre, represents a 100 percent payout. The 12-year average annual payout (pure loss cost) would have been equivalent to 11.35 percent of the insured yield per year. Using standard rating assumptions presented in Annex 5, the indicative commercial premium rate for top-up coverage for cotton in this tehsil would be on the order of 21.25 percent, which if applied to the indicative sum insured of PKR 20,000/acre produces an indicative premium of PKR 4,251/acre for top-up cover. For the ground-up cover option (trigger yield of 80 percent, exit yield 0 percent) and insured yield of 606 kg/acre, the 2009 yield shortfall of 27 kg/acre represents a 4.4 percent payout, the 2010 shortfall of 56 kg/acre represents a 9.2 percent payout, and the 2015 shortfall of 295 kg/acre represents a payout of 48.6 percent, with an average payout of 5.2 percent for the 12-year period. In this case the corresponding indicative commercial premium rate would be 9.9 percent, and this rate, applied to the higher sum insured of PKR 50,000/acre for ground-up coverage, produces an indicative commercial premium of PKR 4,951/acre.

This comparative analysis clearly illustrates the first loss nature of a top-up loss of yield policy and very much higher payout rate than for a ground-up loss of yield policy. For cotton grown in Kehror Pacca Tehsil, the average percentage premium rate that would have to be charged for the AYII top-up coverage is more than double the premium rate that would have to be charged for ground-up coverage, because of the very much higher payout rate of the top-up coverage. The calculated premium rate for a top-up coverage will always be much higher than for a ground-up policy. It is most important that insurers in Pakistan bear these rating principles in mind when they rate the two AYII coverage options.

Preliminary Conclusions on AYII Rating Analysis and Next Steps in Rating Under Phase II Design Study in Punjab

In summary, with very limited sample data from three tehsils in one district and for 10–12 years only, it is currently not possible to predict with any degree of confidence the likely premium rates that will need to be charged on a program for ground-up AYII and coverage levels of approximately 70–80 percent of expected yield. Some guidance can be taken from the four years of published results (2011–14) from the mNAIS program in India, assuming that coverage levels are similar at about 70–80 percent. Climatic and farming conditions in Haryana State in India are possibly similar to those in Punjab province in Pakistan. In Haryana the average premium rate charged for ground-up coverage is 5.05 percent for Kharif crops and 1.2 percent for Rabi crops. The Kharif loss ratio suggests this average rate of 5.05 percent is actuarially adequate, but in the case of Rabi crops the rate may need to be higher (Table 4.3).

Chapter 6, which outlines a five-year plan for building up a crop insurance program for Punjab, presents two main scenarios for target commercial premium rates for ground-up AYII coverage. Under the low rate option, the target average commercial premium rates are 5.0 percent for the Kharif season and 3.5 percent for the Rabi season. Under the higher rate option, the target average commercial premium rates are 7.50 percent for the Kharif season and 5.0 percent for Rabi season.

To achieve these target commercial premium rates for ground-up AYII coverage, the insured yield coverage levels must be adjusted accordingly. The preliminary analysis presented in this chapter for the three tehsils shows that rates are highly influenced by lowering the coverage level from say 80 percent to 70 percent.

The preliminary rating analysis also shows that for top-up AYII coverage linked to CLIS, average pure loss cost rates, and therefore commercial premium rates, are likely to be considerably higher, as this is a first loss or layered protection.

If GoPunjab elects to proceed with the launch of AYII coverage for semicommercial/progressive farmers in Kharif 2018, it will be necessary to conduct a full actuarial rating analysis. Key steps in this crop AYII rating exercise would include:

1. The CRS will need to provide tehsil-level annual crop yield data for all five main crops for all tehsils in the 36 districts of Punjab. Ideally CRS will extend the historical data series to at least 15 years to ensure that loss years are included in the time series.
2) CRS should advise whether the tehsil is the most appropriate level of UAI or whether the density of CCEs will permit the UAI to be defined at the union council level.

3. The approach to rating should use standard statistical procedures to (1) detrend all yield data for each crop and UAI; (2) then, through curve fitting and simulation, extend the analysis of yields to say 5,000–10,000 iterations (years); and (3) calculate the yield shortfall for both policy options—ground-up coverage and top-up coverage—for insured yield trigger levels of say 70 percent up to a maximum of 90 percent of expected yield and thus the *average pure loss cost rates* for each coverage level and crop and UAI.
4. Insurers will need to have access to the output of the AYII rating study (namely, the calculated pure rates for each coverage level). It is likely that "rate smoothing" will need to be done to ensure consistency in rates between neighboring UAIs in each tehsil and district.
5. Insurers will need to add an uncertainty load to cover data quality issues and catastrophic events that have not occurred to date to derive their *technical rates* for each AYII product option (ground-up coverage and top-up coverage) for trigger yield levels from 70 percent to a maximum of 90 percent of expected yield for each insured crop in each UAI.
6. Finally, insurers will need to add their loadings to the technical rates for each AYII product option to derive the final commercial premium rates to be charged to farmers: the loadings are to cover their business acquisition costs and own operating costs and reasonable profit margins.

4.5. CROP AYII INSURANCE FOR SMALL SUBSISTENCE FARMERS IN PUNJAB

GoPunjab has indicated that it is also interested in receiving proposals outlining how crop insurance could be linked with current provincial and/or federal natural disaster relief schemes to protect the 2.2 million mainly subsistence farmers in the province with operations of less than 2.5 acres. This section presents a preliminary proposal for GoPunjab to consider for developing crop AYII as a macro-level "social protection" insurance coverage that the GoPunjab would purchase on behalf of this target group of subsistence farmers. The key aim of this coverage would be to enable those farmers to smooth their consumption and incomes following a major climatic shock, as well as to purchase seed and other inputs to get back into production the following season. The discussion starts by looking at international experience—specifically at how the Government of Mexico has used index insurance as a social protection coverage for subsistence farmers—and then moves on to outline the key features of a comparable program for Punjab.

It is proposed to design this program for subsistence farmers in 2018 for launch in Kharif 2019. Chapter 6 presents further details on the proposed timing for developing and launching each crop and livestock insurance program in Punjab under the five-year SMART Punjab program.

4.5.1. MEXICO'S EXPERIENCE WITH CROP AND LIVESTOCK INDEX INSURANCE AS A MACRO-LEVEL SOCIAL SAFETY NET COVER FOR POOR SUBSISTENCE FARMERS

Mexico is unique in having a national- and state-level catastrophe climatic parametric insurance program for subsistence farmers. The program—Componente Atención a Desastres Naturales (CADENA, Natural Disaster Response Component Ministry of Agriculture, Livestock, Rural Development, Fisheries, and Food)—is designed to provide social safety net protection for the large numbers of small, semi-subsistence rural farming households. The program was introduced in 2003 under a public-private partnership between the federal government (Ministries of Finance and Agriculture), local state governments, Mexican insurance companies, and the national agricultural reinsurance company (Agroasemex), which provides both technical design and underwriting capacity for CADENA.

Mexico uses the CADENA ex-ante insurance instruments to replace traditional ex-post natural disaster compensation programs for the rural poor. The program targets crop and livestock producers who are deemed too poor to purchase commercial agricultural insurance and who were beneficiaries of the direct natural disaster compensation programs operated by federal and state governments. The insurance payouts are designed to tide farmers over until the next crop season and enable them to purchase inputs. The state governments are responsible for identifying and registering subsistence crop and livestock farmers using criteria

based on farm size for irrigated and nonirrigated holdings and numbers of livestock owned (see Annex 6 for further details).

For crops, CADENA uses two types of index insurance policy: (1) WII based on ground weather stations and/or satellite data and (2) AYII, where the municipality forms the UAI and the index is based on historical municipality-yield data provided by the Ministry of Agriculture. The AYII program provides catastrophe yield shortfall coverage only for yield losses that exceed 70 percent of normal average yield. The affected farmers receive a fixed level of compensation, which is currently set at about US$100 per hectare for rainfed crops and US$200 per hectare for tree crops and irrigated crops (see Annex 6).

Mexico's federal and state governments fund CADENA based on a ratio of about 85 percent to 15 percent, and during 2003–11 the cost of premiums totaled about 5.01 billion Mexican pesos (MXN) (US$375 million). CADENA beneficiaries do not make any contributions to the crop and livestock insurance premiums, as they have been assessed to be too poor to afford coverage.

Over the past 13 years, the government has massively scaled up the CADENA crop and livestock macro-level index insurance programs. These programs now reach about 2.5 million small vulnerable crop and livestock producers (about 56 percent of all eligible farmers) in 31 states.

Evaluation results show that the CADENA program not only helps to put small farmers back in business after a disaster but reduces their need to sell productive assets and leads to higher sown area compared to non-beneficiaries. A recent study by de Janvry et al. (2016) shows that CADENA payouts increase expenditures by about 27 percent and incomes by about 38 percent for beneficiaries, and the benefits of the program exceed its costs under a wide range of estimates (Annex 6).

4.5.2. PROPOSED GOPUNJAB AYII COVERAGE DESIGN FOR SUBSISTENCE FARMERS

It is proposed that GoPunjab consider purchasing a macro-level AYII insurance coverage on behalf of the approximately 2.2 million subsistence farmers in Punjab. GoPunjab itself would be the insured and the policyholder, and it would buy the coverage on behalf of subsistence farmers who are landowners, tenants, or sharecroppers with fewer than 2.5 acres. It is understood that all land is registered in Punjab by the Board of Revenue, and this database could form the basis for a registry of the targeted subsistence farmers in each tehsil (UAI).

The proposal is to use the same AYII product and program that is being designed for semicommercial/progressive farmers (with 2.5–25 acres) to insure the target group of subsistence farmers (with less than 2.5 acres). The rationale for using the same AYII product—in this case, it is likely that the ground-up coverage option would be adopted—is that subsistence farmers live in the same villages and communities as semicommercial/progressive farmers and grow the same main food crops to be insured under the AYII program. All of these farmers are affected by climatic risk, which in turn affects area yields. Using the same AYII product to insure and indemnify subsistence farmers will also ensure that the approach to settling crop production and yield losses in these communities is unified and consistent. The same premium rates will apply for both programs, and there will be major cost savings in using the same UAIs, yield indexes, and CCEs to trigger losses and payouts.

For subsistence farmers it is proposed to simplify the AYII program by selecting the main Rabi and Kharif crops grown in the UAI where they reside to serve as reference crops for triggering payouts. The semicommercial/progressive farmer AYII program will be linked to seasonal crop credit, and the insurance is therefore linked to a specific crop and area for which the semicommercial/progressive farmer is obtaining credit. For subsistence farmers, however, it is not recommended that GoPunjab register the specific crop(s) they grow and the area of each crop they plan to grow on a seasonal basis and to insure these crop areas accordingly. Such an exercise would be a major and costly undertaking. Instead, it is recommended that in each UAI the main crop grown in the Rabi season (such as wheat) and the Kharif season (such as rice) be selected as the reference crop to trigger payouts to subsistence farmers.

A further simplification for the operation of this social protection AYII coverage for subsistence farmers would be to insure them all for a fixed crop area in each crop season (Kharif and Rabi). According to the 2010 census, the average farm size for

subsistence farmers with < 2.5 acres is 1.2 acres. Therefore one option for GoPunjab to consider would be to agree to a fixed insured cropped area for each beneficiary in each UAI of one acre per season. The advantage is that there would be no need to collect information on the actual area each subsistence farmer has planted each season.

In principle, subsistence farmers should be offered the same yield coverage levels as semicommercial/progressive farmers for each insured crop in each UAI. Therefore, if semicommercial/progressive farmers purchase ground-up AYII for 80 percent–0 percent area yield coverage in a given village, subsistence farmers should also be provided with exactly the same 80 percent trigger yield coverage level and 0 percent exit yield. This approach would differ from the CADENA model, which is a Constructive Total Loss Policy that insures only against catastrophe yield losses that exceed 70 percent of average production and yields, or a 30 percent coverage level.[49]

Subsistence farmers are likely to use lower levels of purchased inputs than semicommercial/progressive farmers, and it is recommended that they should be provided with a lower fixed sum insured per acre in the Kharif and Rabi seasons. In the context of this study, it is suggested that the SBP should set an agreed fixed sum insured per acre of 50 percent of the maximum credit guidelines, namely PKR 15,000 per acre for the Rabi reference crop and PKR 20,000/acre for the Kharif reference crop.

The indemnity payment formula would be exactly the same for AYII programs for semicommercial/progressive farmers and for subsistence farmers. A hypothetical example for Kharif rice in UAI 1 can illustrate this approach. Assuming that the 80 percent insured yield of rice is 1,500 kg/acre and the actual yield for UAI 1 is only 1,000 kg/acre, all semicommercial/progressive and subsistence farmers would be indemnified for a shortfall of 500 kg/acre (33.33 percent). The difference would be that the semicommercial/progressive farmer with a sum insured of approximately PKR 40,000 per acre would be paid PKR 13,333 per acre (40,000 × 33.33 percent), and the subsistence farmer would be paid PKR 6,667 per acre (PKR 20,000 × 33.33 percent).

[49]This coverage might, however, be modified to include both proportional payouts and Constructive Total Loss payouts once actual area yields fall below a specified threshold.

4.5.3. LINKAGES BETWEEN CROP INSURANCE FOR SUBSISTENCE FARMERS AND GOPUNJAB DISASTER COMPENSATION PROGRAMS FOR FARMERS

Crop insurance could be used to complement and eventually substitute for disaster compensation programs for subsistence farmers. In the short term, crop insurance could complement the GoPunjab budget for disaster compensation for subsistence farmers, and in the medium term, timelier and more cost-effective ex-ante crop insurance could become a substitute for ex-post disaster relief, as in Mexico. For governments there are several key advantages of using an ex-ante macro-level insurance product to finance natural disaster payments, including:

1) For the payment of a pre-agreed premium, the maximum liability can be quantified in advance and transferred out of the fiscal budget to local and international insurance and reinsurance markets.
2) Insurance payouts under an index program can be made very rapidly to state governments (and to farmers when there is an ex-ante farmer registry), as under weather index programs there is no need for infield assessments, and under area yield-based index programs there is a reduced need for such assessments.
3) Insurance brings transparency and standardization of payout rules to disaster compensation payments.

For that reason, in planning and designing the proposed social protection AYII coverage for subsistence farmers, the key stakeholders should work closely with PDMA Punjab to review ways of coordinating both the insurance and disaster management programs. In particular, they should ensure that the programs complement each other and do not cause any beneficiaries to be indemnified twice in the event of a declared disaster or a triggered AYII insurance payout.

4.5.4. OPERATIONAL CONSIDERATIONS FOR AN AYII PROGRAM FOR SUBSISTENCE FARMERS

In designing the GoPunjab macro-level social protection coverage for subsistence farmers, it will be important to address key issues relating to the operation of the program, including:

- How to register the subsistence farmers who will become the beneficiaries of the program in each district and UAI.

- How to ensure that the beneficiaries receive awareness education on the objectives of the government-funded AYII scheme and training to understand how the compensation payments will be triggered and the amount of compensation calculated in their UAI.
- How to ensure that beneficiaries either have a bank account or an Easy-paisa mobile bank account into which the AYII insurance payment can be made directly. It will be essential to register each beneficiary's bank account details at the time of enrolment into the program.

4.6. CROP INSURANCE FOR CASH CROPS (FRUITS AND VEGETABLES)

A recommendation under Component 3 of the SMART Punjab program is to research and develop suitable crop insurance products for commercial horticultural farmers in Punjab in 2018, with a view to launching these products into the market in 2019. As noted in section 4.1, options exist to develop both indemnity-based NPCI coverages and WII coverages.

Fruit and vegetable crops are complex to insure because damage or loss to the crop usually involves a combination of quantitative (physical) damage and qualitative damage that reduce the price the crop can command. There are major challenges to design: (1) an insurance and indemnity payout system that will cater both for physical losses and for a reduction in quality in fruits or vegetables, and (2) field-based loss assessment procedures for measuring physical damage and qualitative losses. A further complication is that for many fruits and vegetables, the crop matures and is harvested over a period of weeks or even months, and when losses occur it is necessary to adjust the policy for the amount that has already been harvested.

NPCI coverages are most suited to insuring against perils such as hail or windstorm where direct damage to the crop can be assessed at the time of loss. To design such a policy for farmers in Punjab, it will be necessary to have localized time series damage data for each insured peril in each crop. Often the lack of data and statistics on fruit and vegetable production—and especially historical data on the damage caused to each type of fruit and vegetable by different climatic perils (including excess rain, flooding, and so on)—is a major constraint to the design and rating of a traditional named peril damage-based policy for these crops. In the short to medium term, the only way to address this problem would be to try to conduct a farm-level risk assessment survey with key fruit and vegetable producers in Punjab and to attempt to evaluate their loss histories over the past 5–10 years for key selected crops.

There may be opportunities to develop specific WII coverages for tree crops (such as mango and citrus crops) and for vegetable crops (such as potatoes) in Punjab if the crops are located in areas served by an official weather station of the Punjab Meteorological Department. India has considerable experience in the design of WII coverages for these crops, including insurance coverage for mango production against wind, excess humidity, and temperature, designed by AICI.

In 2007, ICICI Lombard helped Pepsico to design a WII coverage to protect Pepsico's large-scale contract growers of potatoes in Punjab, India. This WII coverage is designed to protect against late blight disease in potatoes, and the index was constructed according to high humidity and temperature, both of which are conducive to potato blight. The program offers sums insured of US$500–600 per acre based on potato production costs, and it carries average premium rates of between 3–5 percent of the sum insured. This program has operated successfully for nearly a decade. Useful lessons from the Pepsico experience and product design could possibly be adopted in Punjab under a potato insurance program for commercial farmers (IFAD and WFP 2010).

4.7. LIVESTOCK INSURANCE OPPORTUNITIES FOR PUNJAB

4.7.1. LIVESTOCK INSURANCE PRODUCTS

A preliminary assessment of opportunities to develop livestock insurance was conducted as part of this feasibility study. Punjab Province is an important producer of dairy cattle and milk. GoPunjab sees major potential for increasing the productivity of

TABLE 4.11: TYPES OF TRADITIONAL INDEMNITY AND INDEX-BASED LIVESTOCK INSURANCE PRODUCTS AND THEIR SUITABILITY FOR PUNJAB

Type of livestock insurance product	Basis insurance and indemnity	Availability	Suitable for Punjab
a) Indemnity-based livestock insurance			
1. Accidental death (named peril)	Individual animal mortality	Widespread	**Currently being offered by local insurers**
2. All risk accident and mortality	Individual animal mortality	Widespread	**Only for livestock producers with good animal husbandry and sanitation**
3. Business interruption	e.g., loss of milk production and income from sales	Very restricted (e.g., Germany)	Currently not available. Only applicable to large commercial dairy herds.
4. Bloodstock insurance	Individual animal mortality	Restricted	Only applicable to high value breeding/stud animals
b) Index-based livestock insurance			
5. Livestock named peril mortality index	Livestock mortality index for defined area	Very restricted (Mongolia)	Lack of mortaility data to construct such an index
6. Satellite pasture drought NDVI index insurance	NDVI index	Fairly widespread	Satellite data freely available. Only suitable for large rangeland areas.

dairy farmers by introducing improved cattle breeds coupled with modern animal husbandry and health practices, as well as improved milk marketing systems.

There may be opportunities for GoPunjab to promote individual animal accident and mortality coverage for dairy cattle through the banks, dairy cooperatives, or (fresh) milk processors. For large commercial dairy herds, insurers may be willing to offer All Risk Mortality coverages (see Table 4.11). At present, however, there appear to be no major opportunities to develop livestock index-based insurance (for instance, pasture drought NDVI coverage).

4.7.2. DEVELOPMENT OF INDEMNITY-BASED ACCIDENT AND MORTALITY COVERAGE FOR DAIRY CATTLE IN 2019

Under the SMART Punjab program, it is proposed to assist the GoPunjab in 2018 to research and develop dairy cattle insurance with a view to launching coverage in 2019. This initiative will aim to build on the existing SBP-promoted LISB Program reviewed in Chapter 3 and other private sector livestock insurance initiatives.

CHAPTER 5
LEGAL, INSTITUTIONAL, AND OPERATIONAL CONSIDERATIONS FOR A PUNJAB AGRICULTURAL INSURANCE PROGRAM

5.1. LEGAL AND REGULATORY CONSIDERATIONS

In some countries, crop and livestock index insurance is not a recognized class of insurance but rather falls under the category of a derivative coverage. Prior to designing the crop AYII program for individual semicommercial/progressive farmers, it will be important to verify with the government insurance regulator—in this instance the Insurance Division of the Securities and Exchange Commission of Pakistan (based in Islamabad)—that the AYII coverage is permitted under current nonlife insurance legislation in Pakistan. Given that Pakistan already has experience with the operation of crop index insurance, including both WII and AYII coverages, it is anticipated that approval to introduce such coverages into the market has already been provided by the insurance regulator, the Securities and Exchange Commission of Pakistan.

It may also be useful to present the proposed macro-level policy for subsistence farmers to the insurance regulator for approval. The insurance sector in Pakistan has no previous experience with macro-level crop insurance policies, which are issued to the government; the government itself is thus the insured policy holder, acting on behalf of large numbers of beneficiaries (subsistence farmers) and responsible for paying the premium.

5.2. INSTITUTIONAL AND ORGANIZATIONAL OPTIONS

Pakistan has a group of about 12 dedicated crop and livestock insurers that operate separately and compete for business under the SBP publicly subsidized CLIS and LISB programs, which operate as public-private partnerships. Each company therefore has established its own agricultural insurance marketing, underwriting, and claims adjusting departments, with separate reinsurance arrangements.

GoPunjab and private insurance companies interested in participating in large-scale crop and livestock insurance programs for Punjab may have another option for organizing their operations. As an alternative to registering their interest with GoPunjab to underwrite the programs separately, as they currently do with CLIS, private insurance companies could consider some form of coinsurance pool agreement, under which they agree to pool the business and to purchase common account reinsurance coverage.

Coinsurance pools are fairly common features of major national or regional agricultural insurance programs based on PPPs, including the Agroseguro Program in Spain, the Tarsim pool program in Turkey, and various regional coinsurance pools in China. Key features of the Spanish and Turkish agricultural insurance pool programs are presented in Annex 8. Similarly, several developing countries in Africa, including Ghana, Kenya, Malawi, and Senegal, have formed agricultural coinsurance pools in recent years.

The potential advantages of coinsurance pools include: (1) cost sharing in the research and development and start-up stages; (2) cost savings in establishing a single underwriting unit, staff, and equipment, either within the lead coinsurer or as a separate underwriting entity (namely, a Special Purpose Vehicle); (3) the ability for each company to select a share according to its risk appetite; and (4) major cost savings in purchasing pooled reinsurance (common account) protection (Mahul and Stutley 2010). Further information on the advantages and disadvantages of coinsurance pools is contained in Box 5.1.

It will be important to seek guidance from the insurance regulator on the formation of any pool insurance agreement in Pakistan. In the short term it is unlikely that the participating insurers would want to create and incorporate a new pool insurance company for the specific purpose of insuring crops and livestock in Punjab. Rather, they are more likely to seek a simple coinsurance agreement which would allow each of them to take up an agreed share of the risk. In this case, as the pool would not be a legal entity, it is likely that one company would be appointed to lead the pool and to issue policies on their own paper. The pool insurers would also need to agree on how they would manage the business. One option would be to share the workload among themselves for the key functions of marketing and promotion, education and training, underwriting and policy issuance, premium collection, and claims settlement and processing. Another option would be to appoint the lead insurer to conduct these activities on behalf of all of the other companies in the pool, which would then contribute to the lead insurer's operating expenses under an agreed formula. In Tukey's Tarsim pool, the lead insurer is selected via a competitive process.

5.3. OPERATIONAL CONSIDERATIONS FOR COMMERCIAL CROP INSURANCE FOR SEMICOMMERCIAL/ PROGRESSIVE FARMERS

5.3.1. BUNDLING WITH CROP CREDIT: THE KISSAN PROGRAM

Chapter 4 recommended bundling the AYII program with the GoPunjab Kissan seasonal credit program, so that farmers who are not already insured under the CLIS would be targeted to receive ground-up AYII coverage. International experience shows that bundling crop credit with crop insurance on an automatic or compulsory basis can bring many advantages for:

1) **Farmers.** Bundling makes it easier for farmers to access crop loans for purchasing production inputs and offers a better value proposition than stand-alone crop insurance. The advantages of this approach are particularly strong if the credit and insurance packages are also linked to input supply (for instance, bulk deliveries to farmers' villages) and the provision of training and extension advice on how to use improved seed/ fertilizer technology.
2) **Insurance companies.** Mandatory bundling of credit and insurance significantly increases the potential for an insurance company to achieve scale and a proper spread of risk, as well as saving on the operating costs entailed in marketing and promoting the coverage, issuing policies, collecting premiums, and settling claims, because the business can largely be administered through bank branch offices and crop insurance policies marketed at the same time that the farmer receives the loan. Here it is reasonable for the bank to charge a commission to manage the crop

BOX 5.1: BENEFITS AND LIMITATIONS OF COINSURANCE POOL ARRANGEMENTS

Given that agricultural insurance is a specialized class of insurance, and given the catastrophic nature of the risk, many insurance companies will not venture into agricultural insurance on their own, without either backing or support from the government and/or some sort of collaboration by a host of insurance companies within a country or province. Coinsurance pool arrangements have benefits that can encourage private insurance companies to participate in offering agricultural insurance, although they have limitations as well.

Benefits

- ***Economies of scale through operating as a single entity with shared (pooled) administration and operating functions leading to costs savings due to:***
  - Reduced staffing requirements (fixed costs).
  - Shared costs of product research and development, actuarial rating, and pricing.
  - Reduced costs of underwriting, claims control, and loss adjustment.
- ***Cost advantages in purchasing common account (pooled) reinsurance protection*** rather than having each company trying to put its own reinsurance program into place. The advantages of pooled reinsurance protection are due to:
  - Stronger negotiating position with reinsurers.
  - Larger and more balanced portfolio and better spread of risk.
  - Reduced costs of reinsurance due to pooled risk exposure.
  - Reduced transaction costs (reinsurance brokerage, and so on).
- ***No competition on rates in a soft market and ability to maintain technically set rates.*** Most pools operate as the sole insurance provider or monopoly (as in Austria, Senegal, Spain, and Turkey), and therefore there is no competition on pricing, but significant competition on service delivery (quality).
- ***Ability to maintain underwriting and loss adjustment standards.*** Under a pool monopoly arrangement, the pool manager can ensure that common and high standards are maintained in the underwriting of crop and livestock insurance and in the adjusting of claims. Where companies are competing against each other for standard crop insurance business, there is often a problem of varying loss adjustment standards between companies.

Limitations

- ***A pool may act as the sole agricultural insurer, resulting in lack of competition in the market in terms of the:***
  - Range of products and services offered by the monopoly pool underwriter.
  - Restrictions on the range of perils that are insured.
  - Restrictions on the regions where agricultural insurance is offered or the type of farmer insured.
  - Lack of competitiveness in premium rates charged by the pool.

Source: Mahul and Stutley 2010.

insurance business on behalf of the insurance company.

3) **Financial institutions lending to farmers.** These lenders are protected against catastrophic crop failure of the kind that leads large numbers of farmers to default on loans. It is common under a crop-credit insurance program serving individual farmers for the bank to be named in the crop insurance policy as the first beneficiary for its respective rights and interests—namely the loan amount, any interest due, and also the crop insurance premium if the bank prefinanced the premium.

For that reason, it is recommended that in designing the AYII program for semicommercial/progressive farmers, interested insurers should actively engage from the very start with the lending institutions involved in the Kissan Program in Punjab (but are not already insured under CLIS) to agree on bundling crop credit with crop insurance and to define their respective roles and responsibilities.

5.3.2. LINKING THE CROP AYII PROGRAM FOR SEMICOMMERCIAL/ PROGRESSIVE FARMERS WITH CLIS

Chapter 4 discussed the option of linking top-up AYII insurance for semicommercial/progressive farmers with CLIS. As mentioned, a top-up cover would enable a farmer to insure against a yield shortfall, say from 80 percent of the area yield down to 50 percent, when CLIS would cut in and ensure that the bank is protected for a loss below 50 percent of the insured yield. If such a proposal were to be adopted, the main changes that would need to be agreed with SBP, participating insurers, and GoPunjab authorities are that rather than declaring a calamity to trigger payouts on CLIS, the government authorities would agree to follow the terms and conditions of the AYII policy, including (1) the definition of the UAI, (2) the average yield index for that UAI, and (3) to base any payouts on the objective CCEs that the CRS is conducting at the time of harvest, and to make payouts only if the actual average area yield falls short of 50 percent.

5.3.3. SALES OF AYII COVERAGE TO SEMICOMMERCIAL/ PROGRESSIVE FARMERS WHO ARE NON-LOANEES

GoPunjab wishes to promote crop insurance to all farmers, including both loanees and non-loanees. In designing the AYII program for semicommercial/ progressive farmers, it will be necessary to consider options for promoting, marketing, and administering crop insurance for these "non-borrowing" farmers. One option would be for the insurance companies (or pool) to market AYII ground-up coverage to non-loanee farmers on a voluntary individual basis through their networks of sales agents. International experience usually shows, however, that it is prohibitively expensive for insurers to retail coverage to individual small-scale farmers often located in remote rural areas, and that it is necessary to seek to distribute coverage through a regional risk aggregator such as a lending institution, farmer cooperative, or input dealer.

5.3.4. TECHNOLOGY SOLUTIONS FOR CROP-CUTTING EXPERIMENTS

The SMART Punjab program proposes to work closely with CRS-DoA to identify cost-effective ways of using technology to strengthen the CCE methodology and ensure maximum transparency, accuracy, and timeliness in conducting CCEs and recording and transmitting sample yield results from the field to CRS headquarters and the participating companies offering AYII. Two of the key technological alternatives that CRS may wish to consider are moisture meters and wireless data entry and transmission using smartphones or tablets.

Grain moisture meters could speed the process of deriving a dry weight sample yield. The current CRS methodology for CCEs involves two steps in the field. First, grain is harvested from the sampled CCE plot and weighed when it is wet; second, the grain is dried for up to two weeks and then weighed again to obtain the final yield. From a crop insurance view, it is extremely important to pay claims in a timely fashion. Grain moisture meters make it possible to electronically measure the wet and dry weights of a grain sample from a CCE plot at the same time, speeding the generation of yield data by at least two weeks. It would not be necessary to issue a moisture meter (which costs US$250–350) to each CCE field team. Rather, the regional supervisors could be issued a moisture meter, collect a small sample of the grain (carefully bagged and labeled) obtained from each CCE conducted by the teams under their supervision, measure the moisture content of each sample the day it is collected, and convert that measurement to a dry weight using standardized conversion tables.

Simple smartphones or tablets could facilitate electronic data entry for CCEs and transmit data in real-time to CRS and participating insurance companies. The largely paper-based process for recording CCE field data is both cumbersome and liable to errors, as well as to data losses arising from mailing the data to CRS headquarters. By introducing a simple short message system (SMS) based app that can be loaded into a low-cost smartphone (with GPS[50] and video recording capability), CCE results can be recorded faster, with greater accuracy, and texted to CRS. Phones equipped with GPS can record the actual location of the CCE, which is useful not only for auditing CCE results if necessary, but also for reducing the number of crop cuts taken at the tehsil or village levels over the medium term. A phone with video capabilities can record crop cuts while they are conducted, which again can be useful for auditing. The World Bank Group has worked with the insurance industry in India to test the use of smartphone

[50]Global Positioning System, GPS.

technology in CCEs, and the methodology has proved very popular with the field survey teams because it speeds the process and reduces the work load.

5.4. KEY ROLES OF PUBLIC-PRIVATE PARTNERSHIP PLAYERS

5.4.1. ROLE OF PRIVATE INSURERS

The full participation of private agricultural insurers will be critical for successfully implementing the very ambitious GoPunjab program to develop suitable crop and livestock insurance products and programs for each segment of the farming population. The following insurance functions are considered to be principally private sector functions:

1) Product design and rating.
2) Data collection for risk assessment and product design and rating.
3) Risk acceptance and underwriting.
4) Decisions about risk retention and reinsurance strategies.
5) Marketing, promotion, and farmer insurance education and training.
6) Distribution of crop and livestock insurance products.
7) End-of-season results declaration and claims settlement strategy.

In practice, many functions are shared by the private and public sectors. The public sector often plays a role in both risk financing and data collection; and although the private sector is responsible for product design and rating, the government will have a strong interest in the price of the product—and therefore in the product's rating—where it provides significant subsidies (World Bank 2015b). For example, in the case of CLIS the GoP fully subsidizes the premium and also caps the losses (at 300 percent loss ratio), and hence would be very keen to understand the pricing model and should be involved in vetting the process. The functions listed above are reviewed in more detail below for the planned AYII program for semicommercial/progressive farmers.

Data for Product Design and Rating

For insurers to design and rate the AYII program for semicommercial/progressive farmers, it is first necessary to seek CRS-DoA's assistance in amassing the date required. CRS will need to process time series CCE yield data for the five major crops in up to 36 districts to recalculate average yields for up to 127 tehsils in Punjab. The task of recalculating average crop yields at the tehsil level represents a major undertaking, in which the insurers will need to seek GoPunjab's assistance. Similarly, the task of designing and rating an AYII coverage requires specialized actuarial skills and experience with designing crop insurance coverage. Here the insurers may need to request technical assistance from the SMART Punjab program to design and rate this new AYII crop cover.

Risk Acceptance and Underwriting

Under the proposal to link the AYII program for semicommercial/progressive farmers to the Kissan crop credit program on a mandatory basis, the insurers will need to agree on the terms and conditions for risk acceptance with the participating banks, which will ultimately be responsible for processing the crop insurance coverage along with the loan application for each farmer. Equally important, the insurers will need to agree on policy issuance to the farmers and premium payments and collection with the banks.

Risk Retention and Reinsurance

Insurers usually assume full responsibility for decisions over how much risk they will retain (subject to solvency requirements set by the insurance regulator) and how much risk they will cede to local and international reinsurers. In many countries, however, governments also elect to participate in risk financing and reinsurance, either through a specialist national reinsurer (as in Spain and Mexico) or where federal and provincial governments assume the role of a catastrophe reinsurer (as in India under the old NAIS program). In some start-up programs which are very small, insurers may have difficulty placing their business with international reinsurers at competitive prices, and here governments may step in to reinsure the program in its early years and until it has scaled up.

In Punjab, the insurance and reinsurance capacity requirements of the large-scale crop and livestock insurance programs will be substantial when they are fully implemented, and the participating local insurers are likely to need major

support from international reinsurers. The next chapter provides estimates that under a scenario in which insurance is widely adopted (a high-uptake scenario), the total sum insured for the AYII program for semicommercial/progressive farmers in Year 1 may be on the order of US$718 million, rising to US$2.475 billion by Year 5 for all three of the crop insurance programs assessed in this report. The insurers will need to engage with international reinsurers at an early stage in the design of this ambitious crop insurance program for Punjab.

Marketing, Promotion, and Farmer Insurance Education and Training

If the AYII program for semicommercial/progressive farmers is linked to crop credit on a mandatory basis, the need to promote and market the policy will be much reduced. Even so, it is very important that farmers in Punjab are made aware of the insurance program and receive education and training about how it works. It is likely that the insurers will need to seek support from the financial institutions and GoPunjab to design and implement such training and communication programs.

Distribution Channels

Subject to the approval of the banks, it is proposed to distribute the AYII coverage through the banks as part of a bundled package with credit.

End-of-Season Results Declaration and Claims Settlement Strategy

The success or failure of the AYII program for semicommercial/progressive farmers will hinge on the ability of the CRS to conduct the random CCEs in each UAI in a timely, transparent, and accurate fashion to derive the actual average yield for the insured crop in each UAI. The system must be one in which insured farmers and their local representative have full trust. The insurers in conjunction with CRS-DoA and the supporting banks will need to design an end-of-season results declaration strategy for each UAI, including the publication of CCE yield results in each UAI whether a claim is due or not. Where claims payouts are due, the procedure for settling the claims and repayment of farmer loans must be agreed by the insurers with the banks.

5.4.2. ROLE OF LENDING INSTITUTIONS/BANKS

The lending institutions (banks) will play a central role in implementing and managing the crop AYII program for semicommercial/progressive farmers. If the banks agree to the bundling of crop credit and crop insurance and to act as the distribution channel for the AYII program, their initial roles will be to agree on coverage terms and conditions with the insurers, including the coverage levels that will be offered to farmers in each UAI, the basis of the sum insured, and maximum sums insured for each crop. Then they will need to adopt the premium rates set by insurers for the agreed coverage levels. At the time of negotiating the seasonal loan, the banks will also need to process each insured farmer's insurance application according to the planned cultivated area of the crop, the sum insured, and premium, and then either to collect the premium up front or to add it to the loan amount (prefinancing), and finally to issue the farmer with some form of insurance cover certificate. The banks will also play a very important role when claims are settled by distributing payments to loanees' bank accounts.

5.4.3. ROLE OF THE GOVERNMENT OF PUNJAB

International experience[51] shows that governments can support agricultural crop and livestock programs in a number of ways. For example governments can create an enabling legal and regulatory framework; strengthen data collection and information systems; provide technical assistance for risk assessment and product design; fund communication efforts to create awareness about the insurance products and programs to educate and train farmers to use them; make insurance more affordable for small farmers by subsidizing premiums; and provide risk financing (catastrophe layer reinsurance). This section highlights key ways in which GoPunjab can potentially support the successful implementation and upscaling of large-scale crop and livestock insurance programs.

There are four main areas where GoPunjab's financial support to the crop insurance start-up

[51]For a review of government support to agricultural insurance, see Mahul and Stutley (2010), which presents the findings for a survey of public and private agricultural insurance programs in 65 countries and types of support provided by government.

and annual operating costs would be critical to the successful implementation of this program, including:

1) **Data strengthening for crop insurance,** including designing and implementing a farmer electronic registration and database system, and providing insurers with time series yield data at the tehsil level for the major crops.
2) **Strengthening the CCEs for area yield estimation.** As noted, the government can support this effort by: (1) significantly increasing the density of CCEs to permit the UAI to be set at the union council or eventually even the individual village level, and (2) introducing technology (moisture meters, as well as smartphone or tablet technology) to rapidly obtain and record CCE data and transmit it in real-time to underwriters and other stakeholders. This technology has been developed, tested, and widely implemented in India's PMFBY program.
3) **Investing in farmer awareness, education, and training in the role of crop insurance and the operation of the various insurance products and programs.** Building insurance literacy among farmers is a key pillar of a sustainable crop insurance program under SMART Punjab.
4) **Monitoring and evaluation (M&E).** It is critical to implement an M&E system to assess the insurance programs' inputs and outputs, timeliness, and effectiveness, as well as their impacts over time on the input purchasing decisions, crop yields, and incomes of semicommercial/progressive farmers. For subsistence farmers, M&E should focus on measuring whether insurance enables them to maintain their consumption levels following major floods or droughts and whether they are able to return to production in the following season.

In addition, GoPunjab support in the form of subsidies for crop (and livestock) insurance premiums for small farmers will be very important in determining the demand for insurance programs and their capacity to scale up. The following premium subsidy levels are recommended for GoPunjab to consider for the four programs outlined in this report:

- Program 1: AYII for semicommercial/progressive farmers: 50 percent premium subsidy.
- Program 2: AYII social protection program for subsistence farmers: 100 percent premium subsidy.
- Program 3: NPCI for tree fruit producers: 50 percent premium subsidy.
- Program 4: Dairy cattle insurance: 50 percent premium subsidy.

GoPunjab will need to establish an annual budget to cover the premium subsidies and contributions to start-up and operating costs, and appoint an institution that will be responsible for administering the premium subsidy regime on its behalf. The norm in most subsidized agricultural insurance programs is that (1) the farmer is charged only the unsubsidized portion of the premium, and (2) the insurer then reclaims the amount of the premium subsidy from the entity appointed by the government to audit, process, and repay the premium subsidies.

The next chapter presents a five-year plan for building up a crop insurance program, complete with physical and financial projections for Punjab Province, based on the World Bank team's best estimates for the types of crop insurance envisioned.

CHAPTER 6
A FIVE-YEAR PLAN AND BUDGET FOR BUILDING AND SCALING UP A LARGE-SCALE CROP INSURANCE PROGRAM IN PUNJAB

For the consideration of GoPunjab, this chapter presents a five-year (FY2018/19 to FY2022/23) plan to build up a crop insurance program along the lines discussed in previous chapters, starting in Kharif 2018. Four scenarios distinguished by contrasting uptake and premium rates are used to develop projections for scaling up the program (numbers of insured farmers, insured area, indicative sums insured, and premiums) and of the fiscal load for GoPunjab.

6.1. A FIVE-YEAR BUILD-UP PLAN, PORTFOLIO PROJECTIONS, AND FINANCIAL REQUIREMENTS

Figure 6.1 shows a proposal for GoPunjab, in conjunction with its private sector partners, to introduce three large-scale crop insurance programs in two phases over FY2018/19 and FY2019/20. The first phase, starting in Kharif 2018, would introduce an AYII program for semicommercial/progressive farmers with 2.5–25 acres. The second phase, starting in Kharif 2019, would introduce two additional crop insurance programs: AYII for subsistence farmers with less than 2.5 acres, and NPCI for tree fruit and vegetable farmers.

The three main crop insurance programs to be developed and launched over 2018–19 to 2022–23 were presented in detail in Chapter 4. To recapitulate:

1) **AYII Program 1: AYII for semicommercial/progressive farmers with 2.5–25 acres.** This group of 2.9 million farmers represents 56 percent of all farmers in Punjab (Table 6.3). For the reasons discussed in Chapter 4, AYII Program 1 will be explicitly linked to two crop-credit/seasonal loan schemes in Punjab, the federal CLIS and the GoPunjab Kissan credit program. This seasonal AYII program will initially insure Kharif rice, maize, cotton, and

FIGURE 6.1: PUNJAB: PROPOSED PHASING OF NEW CROP INSURANCE PROGRAMS, FY2018/19 TO FY2022/23

Financial year	FY 2018–19		FY2019–20		FY2020–21		FY2021–22		FY2022–23	
Crop season	**Kharif**	**Rabi**	**Kharif**	**Rabi**	**Kharif**	**Rabi**	**Kharif**	**Rabi**	**Kharif**	**Kharif**
Crop insurance programs										
1. Area yield index insurance for progressive farmers >2.5 Ac <25 Ac	Launch Kharif 2018									
2. Area yield index insurance for subsistence farmers <2.5 Ac			Launch Kharif 2019							
3. Named peril crop insurance for tree fruit and vegetable farmers			Launch Kharif 2019							
Livestock insurance programs										
1. Dairy cattle insurance (indemnity-based accident and mortality cover)			Launch in FY2019–20							

sugarcane, and Rabi wheat. The CRS will provide seasonal area yield estimates for these crops based on objective CCEs to enable the area yield index approach.

2) **AYII Program 2: AYII for subsistence farmers with less than 2.5 acres.** GoPunjab will implement this fully subsidized social protection program in conjunction with suitable local risk aggregators/distributors. AYII Program 2 is also seasonal; it will insure an agreed sum per acre in the Kharif and Rabi seasons.
3) **Program 3: Tree fruit NPCI for mango and citrus farmers.** This program would protect producers from specific perils such as frost, hail, and wind.

6.1.1 FOUR SCENARIOS FOR THE PROPOSED CROP INSURANCE PROGRAMS

Four scenarios for the proposed crop insurance programs are presented in Table 6.1. Each scenario reflects a combination of two premium pricing rates (a target low rate and a higher rate) and two uptake levels (a target high uptake level and a medium uptake level).

More specifically, the premium pricing rates in Table 6.1 consist of the target (low) average commercial premium rates (Kharif season 5.0 percent, Rabi season 3.5 percent) and higher average commercial premium rates (Kharif season 7.5 percent, Rabi season 5.0 percent). The target commercial premium rates are based on international experience as well as the preliminary analysis presented in Chapter 4 and Annex 5 for ground-up AYII crop insurance. The targets will need to be refined and confirmed by insurers and their reinsurers in the design phase of the program. Premium rates will need to be established for each crop in each UAI according to the type of AYII policy that applies—namely, ground-up cover for non-CLIS farmers and top-up cover for CLIS farmers—and for the agreed coverage level(s).

TABLE 6.1: UPTAKE AND PRICING SCENARIOS ANALYZED

Premium pricing/ uptake scenarios	Target high uptake rate	Medium uptake rate
Target (low) average commercial premium rates	Scenario 1	Scenario 3
Higher average premium rates	Scenario 2	Scenario 4

The two uptake levels in Table 6.1 consist of a high uptake level, in which the assumed penetration rates by Year 5 are 25 percent for semicommercial/progressive farmers and 80 percent for subsistence farmers, and a medium uptake level, estimated at 50 percent of the Year 5 uptake (number of farms and insured area) for all three crop insurance programs.

6.1.2. PORTFOLIO PROJECTIONS: NUMBERS OF INSURED FARMERS, INSURED CROPS, AND INSURED AREA

For AYII Program 1 (focusing on semicommercial/progressive farmers), it is assumed that at full scale implementation by Year 5, about 750,000 farmers would be insured in both the Rabi and Kharif season, respectively (or 1.5 million farmers in total per year) (Table 6.2 and Figure 6.2). This level of participation represents an uptake (penetration) rate of about 1 in every 4 (26 percent) of all semicommercial/progressive farmers. This assumption is based both on the numbers of CLIS and Kissan farmers, as well as on international experience. According to the 2010 census data, the average farm size for semicommercial/progressive farmers is 6.9 acres, and the portfolio is modeled on the basis that the average farmer cultivates and insures 50 percent of his/her farm area each season under any of the five insurable crops, giving an insured area of 3.5 acres per semicommercial/progressive farmer per season. Based on these assumptions, about 13 percent of the total farm area of this group of farmers would be insured under AYII Program 1 each season (Table 6.2). Total insured area of Rabi and Kharif crops for semicommercial/progressive farmers is projected to rise from 2.1 million acres in FY2018/19 to 5.25 million acres in FY2022/23 (Table 6.2).

For AYII Program 2 (the macro-level fully funded program for subsistence farmers), the assumed uptake rate by Year 5 would be 1.75 million farmers per season (Kharif and Rabi), or 3.5 million farmers per year, equivalent to an uptake rate of nearly 80 percent (Table 6.2 and Figure 6.2). The reason for the very high planned uptake rate is that GoPunjab would provide this cover on an automatic basis for all subsistence farmers who are eligible and who register for it. Subsistence farmers have an average farm size of 1.2 acres, and this analysis assumes that each will receive automatic AYII coverage for a fixed area of 1 acre per season (Table 6.3). It is planned to launch AYII Program 2 for subsistence farmers in FY2019/20 with a total insured Kharif and Rabi area of 0.75 million acres, rising to 3.5 million acres by FY2022/23 (Table 6.2).

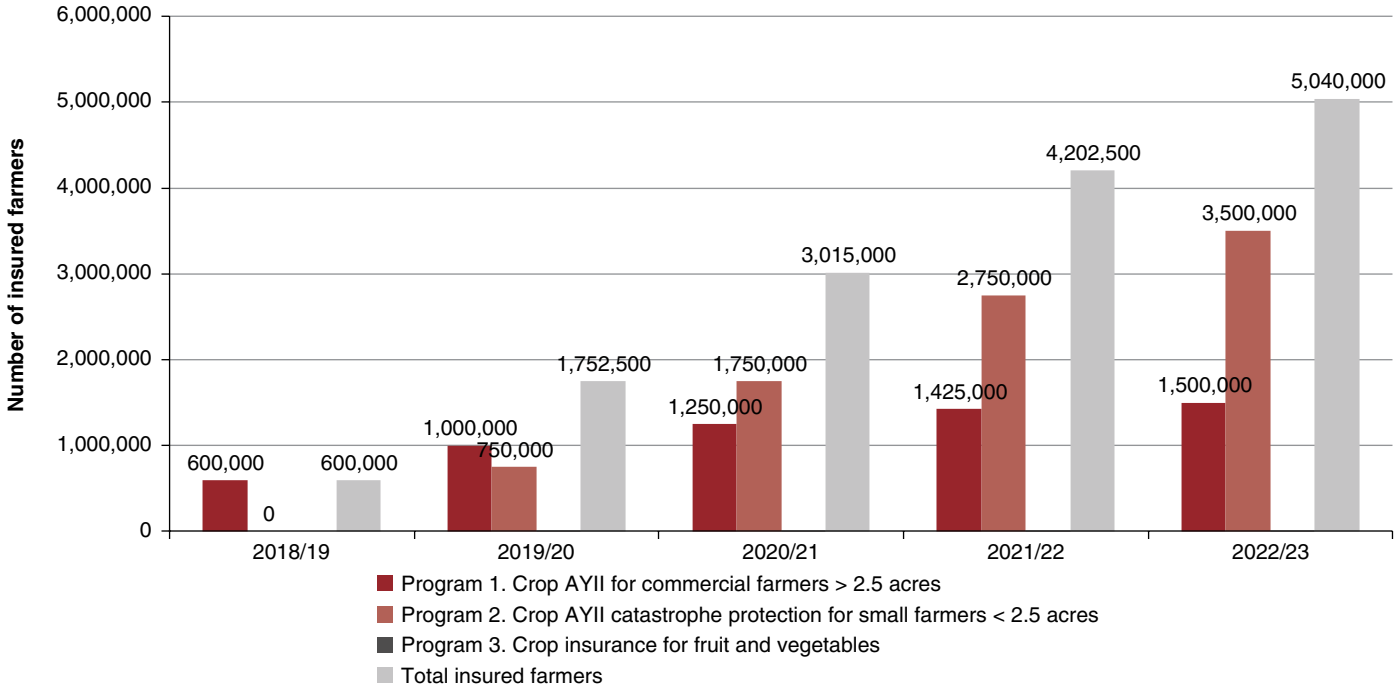
For Program 3, NPCI for citrus and mango farmers, the uptake rate by Year 5 is assumed to be 10,000 farmers with a total of 25,000 insured acres in Punjab. (Table 6.3 and Figure 6.1). This estimate may need to be revised upward if the government makes this program a priority.

TABLE 6.2: PORTFOLIO PROJECTIONS, FY2018/19 TO FY2022/23: NUMBER OF INSURED FARMERS, INSURED AREA, AND SUM INSURED FOR SCENARIO 1 (AVERAGE COMMERCIAL PREMIUM RATES 5.0 PERCENT IN KHARIF SEASON AND 3.5 PERCENT IN RABI SEASON)

Program / Item	FY2018/19	FY2019/20	FY2020/21	FY2021/22	FY 2022/23	Total
Number of Insured Farmers:						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	600,000	1,000,000	1,250,000	1,425,000	1,500,000	5,775,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		750,000	1,750,000	2,750,000	3,500,000	8,750,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		2,500	5,000	7,500	10,000	25,000
Total Insured Farmers	**600,000**	**1,752,500**	**3,005,000**	**4,182,500**	**5,010,000**	**14,550,000**
Insured Area (Acres)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	2,100,000	3,500,000	4,375,000	4,987,500	5,250,000	20,212,500
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		750,000	1,750,000	2,750,000	3,500,000	8,750,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250	12,500	18,750	25,000	62,500
Total Insured Area (Acres)	**2,100,000**	**4,256,250**	**6,137,500**	**7,756,250**	**8,775,000**	**29,025,000**
Sum Insured (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	717,500,000	1,207,500,000	1,522,500,000	1,741,250,000	1,837,500,000	7,026,250,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		125,000,000	300,000,000	475,000,000	612,500,000	1,512,500,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250,000	12,500,000	18,750,000	25,000,000	62,500,000
Total Sum Insured (US$)	**717,500,000**	**1,338,750,000**	**1,835,000,000**	**2,235,000,000**	**2,475,000,000**	**8,601,250,000**
Premium Income (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	30,362,500	51,712,500	65,887,500	75,643,750	80,062,500	303,668,750
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		5,125,000	12,750,000	20,375,000	26,687,500	64,937,500
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		625,000	1,250,000	1,875,000	2,500,000	6,250,000
Total Premium Income (US$)	**30,362,500**	**57,462,500**	**79,887,500**	**97,893,750**	**109,250,000**	**374,856,250**

Source: Authors' calculations.

FIGURE 6.2: NUMBER OF INSURED FARMERS BY YEAR AND PROGRAM TYPE, 2018/19–2022/23



Source: Authors.

Note: Total number of insured farmers per year is sum for Kharif and Rabi seasons.

TABLE 6.3: UPTAKE PROJECTIONS FOR AREA YIELD INDEX INSURANCE FOR SEMICOMMERCIAL/PROGRESSIVE FARMERS AND SUBSISTENCE FARMERS (AYII PROGRAMS 1 AND 2)

Farm size (acres)	Number of farms	Percent of farms	Farm area (acres)	Percent of farm area	Average farm size (acres)
< 2.5	2,203,102	42%	2,602,187	9%	1.2
2.5 to < 25.0	2,916,214	56%	20,186,927	69%	6.9
>25.0	130,512	2%	6,525,444	22%	50.0
Total	**5,249,828**	**100%**	**29,314,558**	**100%**	**5.6**
Crop insurance program	**Number insured farmers per season by year 5**	**Percent of farms insured**	**Insured area per season by year 5 (acres)**	**Percent of farm area insured**	**Average insured area/season (acres)**
2) Subsistence farmers < 2.5 acres	1,750,000	79%	1,750,000	67%	1.0
1) Progressive farmers 2.5 to < 25 acres	750,000	26%	2,625,000	13%	3.5

Source: Farm size data based on 2010 Census.

Note: With two cropping seasons, the total number of insured farmers for AYII Program 1 is 750,000 × 2 = 1,500,000 per year. For AYII Program 2, the total number of insured farmers per year is 1,750,000 × 2 = 3,500,000. The portfolio modeling assumes the same farmers are insured in both seasons.

6.1.3. SUMS INSURED

For AYII Program 1 (ground-up AYII for semi-commercial/progressive farmers linked to crop credit), the sum insured is likely to be linked to the amount of the loan extended by the financial institution, although farmers wishing to obtain this coverage with a higher sum insured could request to do so. The following per acre dollar sums insured are used in this budgeting exercise for AYII Program 1:

- Rabi crop: US$300 (PKR 30,000) per acre
- Kharif crops: US$400 (PKR 40,000) per acre

For AYII Program 2 (ground-up AYII as a social protection coverage for subsistence farmers), this budgeting exercise assumes a flat rate sum insured of US$200 per acre for Kharif crops and US$150 per acre for Rabi crops. These sums insured are equal to 50 percent of the indicative sums insured for semicommercial/progressive farmers and reflect the fact that subsistence farmers are likely to use lower levels of purchased inputs. In the design phase, these estimates of sums insured should be refined with program management.

For Program 3 (tree crops), a sum insured of US$1,000 (PKR 100,000) per acre is assumed.

In Year 1 of the crop insurance program, for Scenarios 1 and 2 (the high uptake scenarios), total sum insured (TSI) is estimated at US$717.5 million, rising by Year 5 to US$2,475.0 million. AYII Program 1 for semicommercial/progressive farmers is the largest program, with an estimated TSI of US$1,837.5 million by Year 5 (FY2022/23), followed by AYII Program 2 for subsistence farmers, with a TSI of US$612.5 million, and Program 3 for tree fruit, with a TSI of US$25 million (Table 6.2).

6.1.4 INDICATIVE COMMERCIAL PREMIUMS

Indicative commercial crop insurance premiums are presented here so that GoPunjab can assess the possible annual cost of premiums and plan the premium subsidy program accordingly. At the same time, it is vital to stress that all crop insurance pricing decisions will be made by local insurers and their reinsurers.

Under Scenario 1, the target average commercial premium rates identified for AYII Programs 1 and 2 are 5 percent for Kharif crops and 3.5 percent for Rabi crops, and an indicative commercial premium rate of 10.0 percent is estimated for Program 3 (tree fruit). Based on these assumptions, Table 6.2 shows that in Year 1 (FY2018/19) the commercial premium income is estimated at US$30.4 million, rising by Year 5 (FY2022/23) to US$109.2 million. Given that AYII Program 1 is by far the largest, it accounts for nearly three-quarters of the annual premium (US$80 million) by Year 5. Full details are presented by cropping season in Annex 9.

The above five-year crop insurance physical uptake and financial projections are intended to assist GoPunjab to prepare its own five-year crop insurance business plan and financial budget to cover (1) premium subsidies and (2) financial support to other start-up and ongoing operating costs as identified in Chapter 5. It is noted that at the time of finalizing this report, the Crop Insurance Team attached to CRS-DOA-GoPunjab is in the process of finalizing its own five-year crop insurance projections and costed business plan and budget.

6.2. COSTS TO GOVERNMENT OF CROP INSURANCE PREMIUM FINANCING AND OTHER PROGRAM OPERATING COSTS

GoPunjab has indicated its commitment to providing financial support to the crop insurance programs both in the form of (1) support to start-up and operating costs, and (2) premium subsidies. This section presents the indicative costs of government financial support to the crop insurance program over 5 years for Scenario 1, high uptake rates and target premiums on the 2 AYII programs of 5 percent for the Kharif season and 3.5 percent for the Rabi season. Note, however, that these cost estimates are based on the analyses in the previous chapters, and therefore potentially subject to substantial change depending on the GoPunjab's policies and decisions.

6.2.1. COST OF CROP INSURANCE PREMIUM SUBSIDIES

The costings are based on the following premium subsidy levels expressed as a percentage of the commercial premium rate for each crop program:

1. Program 1: AYII for semicommercial/progressive farmers: 50 percent premium subsidy.
2. Program 2: AYII social protection program for subsistence farmers: 100 percent premium subsidy.
3. Program 3: NPCI for tree fruit producers: 50 percent premium subsidy.

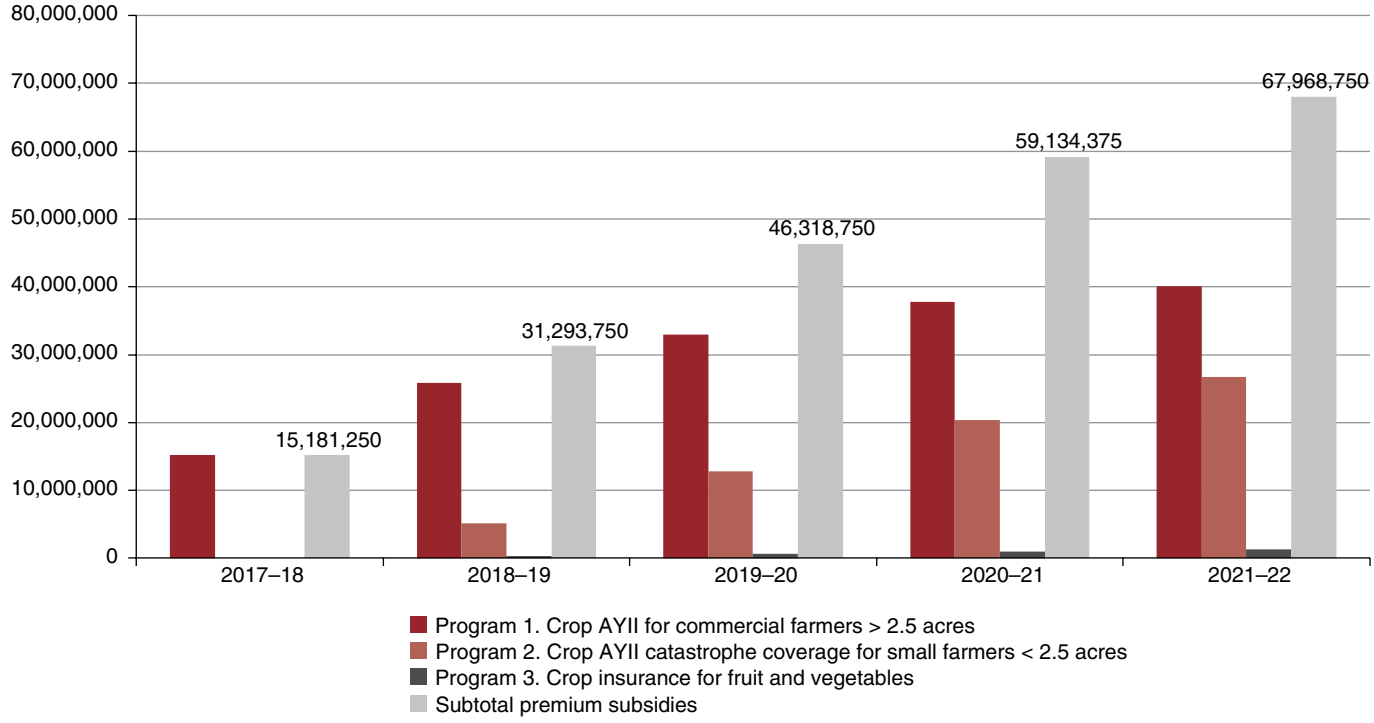
Using these assumptions, the cost to GoPunjab of premium subsidies could be in the order of US$15.2 million in year 1, rising to US$68.0 million by year 5 at full-scale implementation of the program. Over the five-year life of the program, the total cost of premium subsidies may be in the order of about US$220 million (Table 6.4 and Figure 6.3).

TABLE 6.4: PUNJAB: COSTS OF GOVERNMENT SUPPORT TO CROP INSURANCE PREMIUM SUBSIDIES AND PROGRAM IMPLEMENTATION COSTS, SCENARIO 1 (HIGH UPTAKE RATES AND AVERAGE PREMIUM RATES OF 5.0 PERCENT IN KHARIF SEASON AND 3.5 PERCENT IN RABI SEASON)

Program / Item	FY 2018/19	FY 2019/20	FY 2020/21	FY 2021/22	FY 2022/23	Total
Premium Subsidies (US$)						
Program 1. Crop AYII for Commercial Farmers > 2.5 Acres	15,181,250	25,856,250	32,943,750	37,821,875	40,031,250	151,834,375
Program 2. Crop AYII Catastrophe Cover Small Farmers < 2.5 Ac.		5,125,000	12,750,000	20,375,000	26,687,500	64,937,500
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		312,500	625,000	937,500	1,250,000	3,125,000
Sub-Total Premium Subsidies	**15,181,250**	**31,293,750**	**46,318,750**	**59,134,375**	**67,968,750**	**219,896,875**
Other Financial Costs borne by Government (US$)						
Data strenthening for Crop Insurance	1,500,000	1,000,000	750,000	500,000	500,000	4,250,000
Strenthen Crop Cutting Experiments (mobile phone system)	300,000	1,200,000	1,500,000	1,800,000	2,100,000	6,900,000
Farmer insurance awareneness, education and training	1,200,000	1,000,000	1,000,000	1,000,000	1,000,000	5,200,000
Monitoring and Evaluation	250,000	400,000	400,000	400,000	1,000,000	2,450,000
Sub-Total Other costs	**3,250,000**	**3,200,000**	**3,250,000**	**3,300,000**	**4,600,000**	**18,800,000**
Total Budgeted Costs to Government of Punjab	**18,431,250**	**34,493,750**	**49,568,750**	**62,434,375**	**72,568,750**	**238,696,875**
Cost per insured farmer	**30.7**	**19.7**	**16.5**	**14.9**	**14.5**	**16.4**

Source: Authors' calculations.

FIGURE 6.3: ESTIMATED COSTS OF CROP INSURANCE PREMIUM SUBSIDIES FY2017/18 TO FY2021/22 (US$)



Source: Authors' calculations.

6.2.2. OTHER CROP INSURANCE PROGRAM COSTS BORNE BY GOPUNJAB

Chapter 5 identified four ways in which financial support from GoPunjab is critical for successfully starting up and implementing a crop insurance program on a large scale:

1) Data strengthening for crop insurance.
2) Strengthening the CCEs for area yield estimation.
3) Investing in farmer awareness, education, and training in crop insurance.
4) M&E.

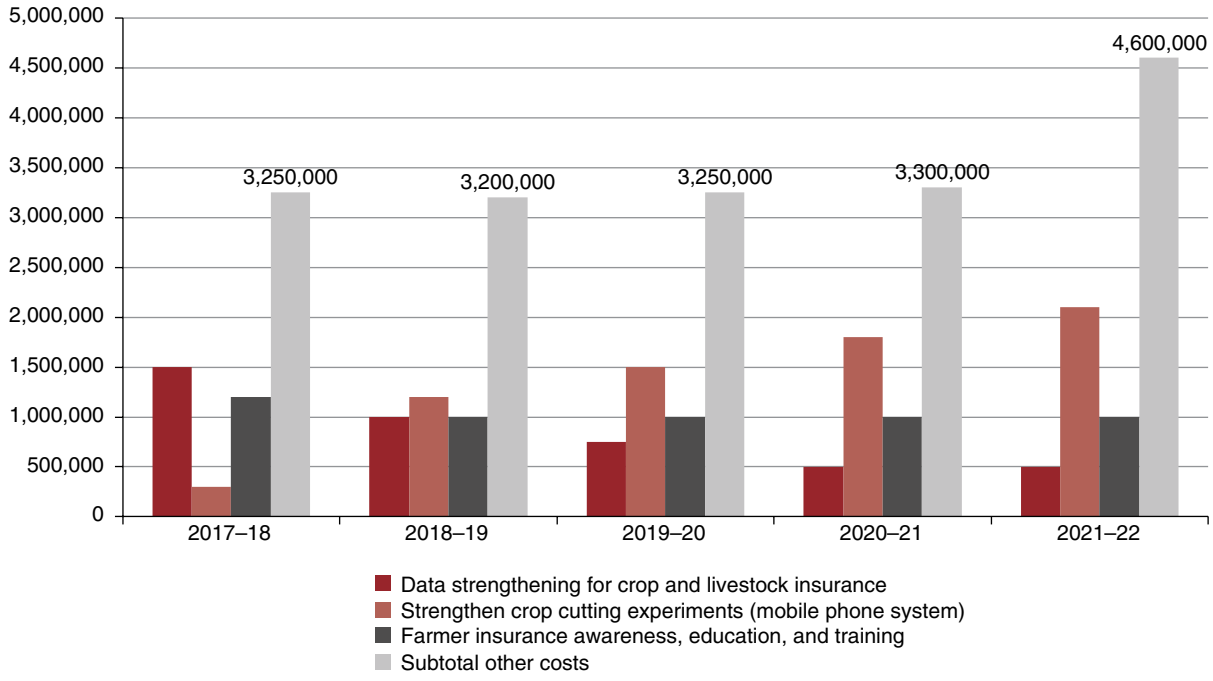
The sections that follow present preliminary estimates of the program support costs involved with (1)–(4) above. Note, however, that like the estimates of premium subsidy costs, these estimates are based purely on the analyses in the previous chapters, and therefore they are potentially subject to substantial change depending on GoPunjab policies and decisions.

Under Scenario 1 (high uptake), these other program support costs are estimated at US$3.25 million in Year 1, rising to US$4.6 million by Year 5, with a total estimated cost to GoPunjab of US$18.8 million (Figure 6.4 and Table 6.4). For data strengthening, the Year 1 budget of US$1.5 million includes the design of an electronic registration system, the purchase of hardware and software, and subsequent allocations for the field-level costs of registering farmers, for a total budget over five years of US$4.25 million. For the CCEs, the budget includes an allocation for purchasing equipment (smartphones and design of a suitable SMS-based app, grain moisture meters, weighing scales, and other items), along with a contribution toward the costs of conducting CCEs. The budget for strengthening the CCEs over five years is estimated at US$6.9 million. The cost of farmer awareness, education, and training is estimated at US$5.2 million over five years and includes the initial costs of designing training materials and of training the trainers and farmers in each district over time. Finally, the M&E budget is estimated at US$2.45 million over five years.

6.2.3. TOTAL COSTS TO GOPUNJAB OF SUPPORT TO CROP INSURANCE PROGRAMS

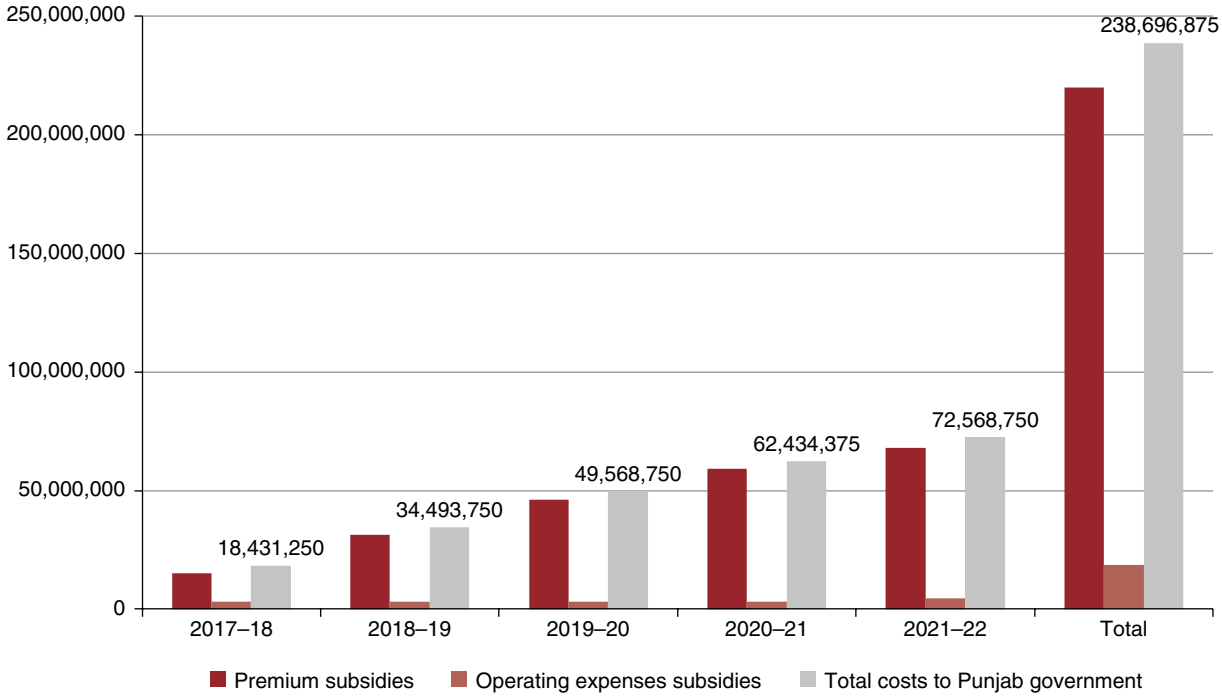
Under Scenario 1 (high uptake and target premium rates of 5.0 percent Kharif and 3.5 percent Rabi) the total budgeted costs to GoPunjab of the premium subsidy, start-up, and operation of the

FIGURE 6.4: ESTIMATED COSTS OF GOVERNMENT SUPPORT TO CROP INSURANCE PROGRAM START-UP AND OPERATING COSTS, FY2017/18–FY2021/22 (US$)



Source: Authors' calculations.

FIGURE 6.5: TOTAL COSTS OF GOPUNJAB SUPPORT TO CROP INSURANCE (PREMIUM SUBSIDIES AND SUBSIDIES ON OPERATING COSTS), FY2017/18–FY2021/22 (US$)



Source: Authors' calculations.

three crop insurance programs are estimated to reach US$72.6 million per year by Year 5 (or at full implementation). Over the five years, the total cost of government support is estimated at US$238.7 million, which works out at US$16.4 of crop insurance subsidy support per farmer beneficiary (Table 6.4, Figure 6.5).

6.3. CROP INSURANCE SENSITIVITY ANALYSIS

6.3.1. SCENARIO 2: HIGH UPTAKE RATES, BUT HIGHER AVERAGE CROP INSURANCE PREMIUM RATES

Scenario 2 is based on the same high uptake rates as Scenario 1, but the average premium rates for both AYII Programs 1 and 2 are higher, at 7.5 percent for Kharif season and 5.0 percent for Rabi season. During the detailed design and planning stage of this crop insurance program, a granular actuarial analysis at the tehsil level in all districts of Punjab may show that higher average premium rates will need to be charged by insurers and their reinsurers to provide the desired levels of protection to farmers. GoPunjab will need to budget for the event that higher rates are required.

Under Scenario 2, the total cost of crop insurance premiums will be about 47 percent higher than under Scenario 1. In other words, at Year 5 (full-scale implementation) the premium bill will rise from US$109.2 million per year to US$160 million per year, and the total premium over five years will rise from US$375 million to US$549 million (Table 6.5).

Under Scenario 2, the costs to GoPunjab of premium subsidies at Year 5 will increase from US$68 million to nearly US$100 million per year, and total premium subsidies over five years will rise to US$322.5 million. The costs of government support for start-up and operating costs would remain the same under Scenario 2, at US$18.8 million over five years. The total costs to GoPunjab of financial support to the crop insurance programs would be about US$104.3 million at Year 5, full-scale implementation (Table 6.5).

TABLE 6.5: SCENARIO 2: FIVE-YEAR CROP INSURANCE PORTFOLIO PROJECTIONS FOR HIGH UPTAKE AND HIGHER AVERAGE PREMIUM COSTS

Program / Item	FY2018/19	FY2019/20	FY2020/21	FY2021/22	FY 2022/23	Total
Number of Insured Farmers:						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	600,000	1,000,000	1,250,000	1,425,000	1,500,000	5,775,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		750,000	1,750,000	2,750,000	3,500,000	8,750,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		2,500	5,000	7,500	10,000	25,000
Total Insured Farmers	**600,000**	**1,752,500**	**3,005,000**	**4,182,500**	**5,010,000**	**14,550,000**
Insured Area (Acres)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	2,100,000	3,500,000	4,375,000	4,987,500	5,250,000	20,212,500
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		750,000	1,750,000	2,750,000	3,500,000	8,750,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250	12,500	18,750	25,000	62,500
Total Insured Area (Acres)	**2,100,000**	**4,256,250**	**6,137,500**	**7,756,250**	**8,775,000**	**29,025,000**
Sum Insured (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	717,500,000	1,207,500,000	1,522,500,000	1,741,250,000	1,837,500,000	7,026,250,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		125,000,000	300,000,000	475,000,000	612,500,000	1,512,500,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250,000	12,500,000	18,750,000	25,000,000	62,500,000
Total Sum Insured (US$)	**717,500,000**	**1,338,750,000**	**1,835,000,000**	**2,235,000,000**	**2,475,000,000**	**8,601,250,000**
Premium Income (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	44,625,000	76,125,000	97,125,000	111,562,500	118,125,000	447,562,500
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		7,500,000	18,750,000	30,000,000	39,375,000	95,625,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		625,000	1,250,000	1,875,000	2,500,000	6,250,000
Total Premium Income (US$)	**44,625,000**	**84,250,000**	**117,125,000**	**143,437,500**	**160,000,000**	**549,437,500**

Program / Item	FY 2018/19	FY 2019/20	FY 2020/21	FY 2021/22	FY 2022/23	Total
Premium Subsidies (US$)						
Program 1. Crop AYII for Commercial Farmers > 2.5 Acres	22,312,500	38,062,500	48,562,500	55,781,250	59,062,500	223,781,250
Program 2. Crop AYII Catastrophe Cover Small Farmers < 2.5 Ac.		7,500,000	18,750,000	30,000,000	39,375,000	95,625,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		312,500	625,000	937,500	1,250,000	3,125,000
Sub-Total Premium Subsidies	**22,312,500**	**45,875,000**	**67,937,500**	**86,718,750**	**99,687,500**	**322,531,250**
Other Financial Costs borne by Government (US$)						
Data strenthening for Crop Insurance	1,500,000	1,000,000	750,000	500,000	500,000	4,250,000
Strenthen Crop Cutting Experiments (mobile phone system)	300,000	1,200,000	1,500,000	1,800,000	2,100,000	6,900,000
Farmer insurance awareneness, education and training	1,200,000	1,000,000	1,000,000	1,000,000	1,000,000	5,200,000
Monitoring and Evaluation	250,000	400,000	400,000	400,000	1,000,000	2,450,000
Sub-Total Other costs	**3,250,000**	**3,200,000**	**3,250,000**	**3,300,000**	**4,600,000**	**18,800,000**
Total Budgeted Costs to Government of Punjab	**25,562,500**	**49,075,000**	**71,187,500**	**90,018,750**	**104,287,500**	**341,331,250**
Cost per insured farmer	**42.6**	**28.0**	**23.7**	**21.5**	**20.8**	**23.5**

Source: Authors' calculations.

6.3.2. SCENARIO 3: MEDIUM CROP INSURANCE UPTAKE AND LOW PREMIUM RATES

Under Scenario 3, with medium uptake, the number of insured farmers and the insured area over five years would be exactly half of the estimates under the high-uptake Scenarios 1 and 2, for a total of about 2.5 million farmers insured in the Kharif and Rabi seasons by Year 5. This number of insured farmers is still very large, bearing in mind that CLIS, which is compulsory for borrowing farmers, currently lends to only about 1 million farmers per year throughout Pakistan.

Under Scenario 3, then, the sum insured and premium costs would be reduced by 50 percent, as would the costs of the premium subsidy. At full-scale implementation in Year 5, the total annual cost of premiums would be about US$55 million per year (Table 6.6). Whereas the costs of GoPunjab premium subsidies in Year 5 are US$68 million under Scenario 1, they decline to US$34 million under Scenario 3. The total costs of premium subsidy support over five years would be US$110.9 million (Table 6.6).

6.3.3. SCENARIO 4: MEDIUM CROP INSURANCE UPTAKE AND HIGHER AVERAGE PREMIUM RATES

The only difference under Scenario 4 relative to Scenario 1 is that higher average costs of crop insurance premiums apply: 7.5 percent for Kharif crops and 5.0 percent for Rabi crops.

TABLE 6.6: SCENARIO 3: FIVE-YEAR CROP INSURANCE PORTFOLIO PROJECTIONS FOR MEDIUM UPTAKE AND LOW AVERAGE PREMIUM COSTS

Program / Item	FY2018/19	FY2019/20	FY2020/21	FY2021/22	FY 2022/23	Total
Number of Insured Farmers:						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	300,000	500,000	625,000	712,500	750,000	2,887,500
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		375,000	875,000	1,375,000	1,750,000	4,375,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		2,500	5,000	7,500	5,000	20,000
Total Insured Farmers	**300,000**	**877,500**	**1,505,000**	**2,095,000**	**2,505,000**	**7,282,500**
Insured Area (Acres)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	1,050,000	1,750,000	2,187,500	2,493,750	2,625,000	10,106,250
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		375,000	875,000	1,375,000	1,750,000	4,375,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250	12,500	18,750	12,500	50,000
Total Insured Area (Acres)	**1,050,000**	**2,131,250**	**3,075,000**	**3,887,500**	**4,387,500**	**14,531,250**
Sum Insured (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	358,750,000	603,750,000	761,250,000	870,625,000	918,750,000	3,513,125,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		62,500,000	150,000,000	237,500,000	306,250,000	756,250,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		3,125,000	6,250,000	9,375,000	12,500,000	31,250,000
Total Sum Insured (US$)	**358,750,000**	**669,375,000**	**917,500,000**	**1,117,500,000**	**1,237,500,000**	**4,300,625,000**
Premium Income (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	15,181,250	25,856,250	32,943,750	37,821,875	40,031,250	151,834,375
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		2,562,500	6,375,000	10,187,500	13,343,750	32,468,750
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		312,500	625,000	937,500	1,250,000	3,125,000
Total Premium Income (US$)	**15,181,250**	**28,731,250**	**39,943,750**	**48,946,875**	**54,625,000**	**187,428,125**
Program / Item	**FY 2018/19**	**FY 2019/20**	**FY 2020/21**	**FY 2021/22**	**FY 2022/23**	**Total**
Premium Subsidies (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	7,590,625	12,928,125	16,471,875	18,910,938	20,015,625	75,917,188
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		2,562,500	6,375,000	10,187,500	13,343,750	32,468,750
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		156,250	312,500	468,750	625,000	1,562,500
Sub-Total Premium Subsidies	**7,590,625**	**15,646,875**	**23,159,375**	**29,567,188**	**33,984,375**	**109,948,438**
Other Financial Costs borne by Government (US$)						
Data strenthening for Crop Insurance	1,500,000	1,000,000	750,000	500,000	500,000	4,250,000
Strenthen Crop Cutting Experiments (mobile phone system)	300,000	1,200,000	1,500,000	1,800,000	2,100,000	6,900,000
Farmer insurance awareneness, education and training	1,200,000	1,000,000	1,000,000	1,000,000	1,000,000	5,200,000
Monitoring and Evaluation	250,000	400,000	400,000	400,000	1,000,000	2,450,000
Sub-Total Other costs	**3,250,000**	**3,200,000**	**3,250,000**	**3,300,000**	**4,600,000**	**18,800,000**
Total Budgeted Costs to Government of Punjab	**10,840,625**	**18,846,875**	**26,409,375**	**32,867,188**	**38,584,375**	**128,748,438**
Cost per insured farmer	**36.1**	**21.5**	**17.5**	**15.7**	**15.4**	**17.7**

Source: Authors' calculations.

Under this Scenario, the total annual premium income would be about US$80 million at full-scale implementation (Year 5). Over the five years, the total estimated premiums would be about US$275 million (Table 6.7). The costs to GoPunjab of premium subsidies would rise to nearly US$48 million at Year 5, and over the five years the total cost of premium subsidies would be about US$155 million (Table 6.7).

TABLE 6.7: SCENARIO 4: FIVE-YEAR CROP INSURANCE PORTFOLIO PROJECTIONS FOR LOW UPTAKE AND HIGHER PREMIUM COSTS

Program / Item	FY2018/19	FY2019/20	FY2020/21	FY2021/22	FY 2022/23	Total
Number of Insured Farmers:						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	300,000	500,000	625,000	712,500	750,000	2,887,500
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		375,000	875,000	1,375,000	1,750,000	4,375,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		2,500	5,000	7,500	5,000	20,000
Total Insured Farmers	**300,000**	**877,500**	**1,505,000**	**2,095,000**	**2,505,000**	**7,282,500**
Insured Area (Acres)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	1,050,000	1,750,000	2,187,500	2,493,750	2,625,000	10,106,250
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		375,000	875,000	1,375,000	1,750,000	4,375,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		6,250	12,500	18,750	12,500	50,000
Total Insured Area (Acres)	**1,050,000**	**2,131,250**	**3,075,000**	**3,887,500**	**4,387,500**	**14,531,250**
Sum Insured (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	358,750,000	603,750,000	761,250,000	870,625,000	918,750,000	3,513,125,000
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		62,500,000	150,000,000	237,500,000	306,250,000	756,250,000
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		3,125,000	6,250,000	9,375,000	12,500,000	31,250,000
Total Sum Insured (US$)	**358,750,000**	**669,375,000**	**917,500,000**	**1,117,500,000**	**1,237,500,000**	**4,300,625,000**
Premium Income (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	22,312,500	38,062,500	48,562,500	55,781,250	59,062,500	223,781,250
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		3,750,000	9,375,000	15,000,000	19,687,500	47,812,500
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		312,500	625,000	937,500	1,250,000	3,125,000
Total Premium Income (US$)	**22,312,500**	**42,125,000**	**58,562,500**	**71,718,750**	**80,000,000**	**274,718,750**
Program / Item	**FY 2018/19**	**FY 2019/20**	**FY 2020/21**	**FY 2021/22**	**FY 2022/23**	**Total**
Premium Subsidies (US$)						
Program 1. Crop AYII for Commercial Farmers >2.5 Acres	11,156,250	19,031,250	24,281,250	27,890,625	29,531,250	111,890,625
Program 2. Crop AYII Catastrophe Cover Small Farmers <2.5 Ac.		3,750,000	9,375,000	15,000,000	19,687,500	47,812,500
Program 3. Crop Insurance for Tree Fruit (Mango, Citrus)		156,250	312,500	468,750	625,000	1,562,500
Sub-Total Premium Subsidies	**11,156,250**	**22,937,500**	**33,968,750**	**43,359,375**	**49,843,750**	**161,265,625**
Other Financial Costs borne by Government (US$)						
Data strenthening for Crop Insurance	1,500,000	1,000,000	750,000	500,000	500,000	4,250,000
Strenthen Crop Cutting Experiments (mobile phone system)	300,000	1,200,000	1,500,000	1,800,000	2,100,000	6,900,000
Farmer insurance awareneness, education and training	1,200,000	1,000,000	1,000,000	1,000,000	1,000,000	5,200,000
Monitoring and Evaluation	250,000	400,000	400,000	400,000	1,000,000	2,450,000
Sub-Total Other costs	**3,250,000**	**3,200,000**	**3,250,000**	**3,300,000**	**4,600,000**	**18,800,000**
Total Budgeted Costs to Government of Punjab	**14,406,250**	**26,137,500**	**37,218,750**	**46,659,375**	**54,443,750**	**180,065,625**
Cost per insured farmer	**48.0**	**29.8**	**24.7**	**22.3**	**21.7**	**24.7**

Source: Authors' calculations.

CHAPTER 7

LAUNCH OF PUNJAB AGRICULTURAL CROP INSURANCE PROGRAM IN KHARIF SEASON 2018: PLANNING CONSIDERATIONS AND IMPLEMENTATION CHALLENGES

This final chapter, which originally detailed the steps involved in preparing to launch a pilot AYII program in Kharif 2018, has been updated with new information on issues encountered in implementing the pilot through May 2018. The first section, prepared in July 2017, describes activities undertaken in the second half of 2017 and first quarter of 2018 to prepare the way for a pilot of AYII Program 1 (for semicommercial/progressive farmers) in Kharif 2018 in selected districts and tehsils of Punjab. The second section provides an update on the pilot program and highlights key issues and challenges experienced up to May 2018.

7.1. STEPS AND TIMETABLE FOR LAUNCHING A CROP INSURANCE PILOT IN KHARIF 2018

The provisional work plan and timetable detailed here was presented for the consideration of GoPunjab in planning and designing a pilot of AYII Program 1 for a proposed launch date in Kharif 2018. GoPunjab had originally hoped to launch a pilot in Rabi 2017/18 for wheat, but with planting occurring between late September and the end of December, a policy inception date of September 2017 would have been required. This timeframe was considered inadequate to conduct all of the implementation planning and design tasks, so the World Bank team recommend deferring the pilot launch to Kharif 2018. The cover inception date would be March 1, 2018, to coincide with the start of the sugarcane growing season, followed by the sowing of cotton in April–May 2018 and finally the planting of rice and maize in June–August 2018. This schedule would leave a window of six months (from September 1, 2017, through the end of February 2018) to design and rate the AYII product, plan all operating systems and procedures, and put them into place. This timeframe was still very tight and required all stakeholders to complete the tasks and activities allocated to them on time.

The detailed work plan and timetable leading up to the proposed launch of the pilot on March 1, 2018, is presented at the end of this chapter in Table 7.1. The 19 major activities outlined in the work plan are discussed next, concluding with an update on implementation progress for each activity as at May 2018.

(1) Preparation of diagnostic report (lead entity: World Bank)

The draft feasibility study was submitted to GoPunjab in July 2017. Based on the results, GoPunjab decided to launch a pilot crop AYII program for semi-commercial/progressive farmers in Kharif 2018.

(2) Approval of five-year plan by GoPunjab and allocation of financial resources

For the Kharif 2018 pilot, GoPunjab approved a budget of PKR 170 million for two kharif crops (cotton and rice) in four selected districts.[52] A sum of PKR 100 million was allocated to premium subsidies and PKR 70 million to implementation support and operating costs, including the design of public awareness programs for farmers, media campaigns, and farmer training programs. The FY2019 Annual Development Plan contains an allocation of PKR 1,000 million by the Planning and Development Department of the Government of Punjab to cover the following three seasons (Rabi 2018/19, Kharif 2019, Rabi 2019/20). The Punjab crop insurance team prepared a five-year crop insurance business plan and budget, which is now with the provincial parliament for approval.

(3) Engagement with public and private stakeholders to support the Punjab Agricultural Insurance Initiative and formation of a Steering Committee and Technical Implementation Committee

The 2017 feasibility study recommended that GoPunjab engage with key stakeholders, including the Department of Agriculture (DoA), private sector insurers, the insurance regulator, and the lending institutions to secure their agreement to participate in a PPP for the proposed five-year crop and livestock insurance initiative. In October 2017, a Steering Committee and a Technical Design and Implementation Committee were established and have met subsequently as needed to guide policy and planning and offer technical guidance, respectively, to launch the Kharif 2018 pilot AYII program.

The Steering Committee is chaired by the Chairman P&D Board, and the Secretary DoA figures as the Secretary General. The Steering Committee comprises senior decision makers for the private insurance sector, the insurance regulator, SBP, financial lending institutions, and key public sector organizations in Punjab, including the Ministry of Finance, Meteorological Agency, Irrigation Department, Punjab Information Technology Board, National Agricultural Research Centre, and PDMA, among others. The Steering Committee is responsible for overall policy and planning and implementation and financial decisions on the large-scale crop and livestock insurance programs.

The Technical Design and Implementation Committee, under the leadership of the Secretary, DoA–GoPunjab, consists of representatives from CRS and Agriculture Extension Division–GoPunjab, Agriculture Credit Unit–SBP, participating insurance companies and financial (lending) institutions, and the Punjab Information Technology Board. The Technical Design and Implementation Committee is responsible for planning all operating systems and procedures and for implementing the program, including the design and rating of crop insurance products.

(4) Setting up a Technical Support Unit

Due to the highly specialized, technical nature of crop insurance, and also given the high level of fiscal support (or cost) on the part of GoPunjab, the World Bank team recommended that GoPunjab should establish a Technical Support Unit (TSU). The team recommended that the TSU be mandated to provide objective technical analysis and oversight of the crop insurance market to GoPunjab, offer objective actuarial analysis of crop insurance product proposals (thus acting like a quality control unit), ensure that farmers are receiving appropriate, good value products, develop technical standards, test and disseminate market innovations, and manage scaled-up implementation of successful innovations.

In October 2017, GoPunjab established the Punjab Crop Insurance Team, headed by the director CRS–DoA, GoPunjab, to serve as the TSU. Three Crop Insurance Implementation Teams (CIITs) were established under the supervision of the Project Director, CRS: a Crop Insurance Policy Team, Crop Insurance Operation Team, and Crop Insurance Regional Team. These teams work closely with the implementing agencies (financial sector, insurers, crop cutting and extension services, and others).

[52]These districts are Sheikhupura, Lodhran, R.Y. Khan, and Sahiwal.

(5) Processing historical crop yield data at the tehsil or union council level (lead entity: CRS-DoA, GoPunjab)

This report recommends that CRS conduct a major exercise to review its historical crop area, production, and crop cut yield data (officially published at the district level each season) and rework the data at the tehsil or preferably union council level for all 36 districts. The analysis would be conducted for the five major crops for which CRS has 10 years or more of CCE data: Rabi wheat and Kharif cotton, rice, maize, and sugarcane. It recommended that CRS provide guidance on (1) which departments have the most comprehensive historical yield data for a minimum of the last 10 years (and hopefully 15 years) and where the program should be launched in Kharif 2018, and (2) whether the density of CCEs that CRS uses to estimate the actual average yield at the departmental level is adequate to support establishing UAIs at the tehsil level or possibly the lower union council level.

As noted, CRS selected four districts for the Kharif 2018 pilot: Lodhran, Rahim Yar Khan, Sahiwal, and Sheikhupura. In each district the UAI has been defined at the tehsil level for 2018, and CRS has provided the appointed insurer with 12 years of historical crop yield data (2005–16) for the selected tehsils.

(6) Crop area-yield product design and rating

The TSU used a tender process to select and appoint one insurance company to underwrite the Kharif 2018 pilot AYII program. The appointed insurer submitted its winning bid and premium rates to GoPunjab in February 2018. The World Bank has assisted the TSU-GoPunjab by developing an Excel-based AYII Crop Insurance Contract Design and Training Tool and has provided initial training for GoPunjab and interested insurance companies (including the appointed insurer) for Kharif 2018.

(7) Product approval

GoPunjab and the appointed insurer have entered into a formal services agreement for provision of AYII crop insurance in the Kharif 2018 season. The World Bank prepared a draft crop AYII Policy Wording which was shared with GoPunjab and the appointed insurer in May 2018.

(8) Insurance planning

For the Kharif 2018 pilot, GoPunjab used competitive bidding to select one insurance company to underwrite the program. For the main Rabi 2018/19 launch, GoPunjab plans to issue a new tender.

(9) Insurance and reinsurance planning and finalization of coverage levels and commercial premium rates

The projections in Chapter 6 for FY2018/19 for number of farmers and sum insured under a large-scale crop insurance program differ from the number of farmers and sum insured anticipated under the pilot. The Chapter 6 projections indicated that insurers would need to place coverage for up to 600,000 semicommercial/progressive farmers (250,000 in Kharif 2018 and 350,000 in Rabi 2018/19), for a TSI over both seasons of US$717 million. Under the much smaller Kharif 2018 pilot approved by GoPunjab, however, the FY2018 budget for premium subsidies may enable 30,000–50,000 farmers to be insured under the crop AYII program for loanee farmers (ground-up and top-up cover options). The appointed insurer has confirmed its terms and conditions and premium rates; it has also confirmed that reinsurance protection is in place for Kharif 2018.

(10) Agree distribution channels through the lending institutions (lead entities: insurers and banks)

The feasibility study recommended establishing a mandatory linkage between the AYII program for semicommercial/progressive farmers in Punjab and seasonal crop loans offered under various programs, including top-up coverage for the CLIS and coverage for the GoPunjab Kissan loan scheme. As noted in Chapter 5, wherever possible, the AYII coverage should be implemented though the financial institutions to reduce the administrative costs of marketing and issuing policies, charging and collecting premiums, and settling the payment of claims through the banks. The Kharif 2018 pilot offers ground-up coverage (80–0 percent of expected yield) on an automatic basis for farmers who are beneficiaries of the Kissan e-credit program and who are borrowing through the MFIs. The pilot also offers top-up coverage (80–50 percent of expected yield) for loanee farmers insured under CLIS.

(11) Design operating systems and procedures (farmer enrolment, policy issuance, premium collection, and settlement of claims)

To launch the pilot, the insurers, in conjunction with the lending institutions, needed to put in place all operating systems and procedures required for underwriting and settling claims

on the AYII Program 1 for semicommercial/ progressive farmers. Key tasks included agreement on procedures for issuing farmers who apply for crop loans with an individual insurance policy, arriving at the agreed coverage levels and premium rates that apply, and determining procedures for collecting premiums, for reimbursing them on loan expiry, and for settling claims where they are due. The parties also needed to decide on a system whereby the banks submit premium bordereau[53] on a weekly or monthly basis to the insurers so that they can track the number of farmers who have been issued with AYII coverage and for which crops, as well as their insured acreage, sum insured, and premium due. Responding to these needs, the GoPunjab Crop Insurance Team invested heavily in the design of a web-based crop insurance portal to enable the financial institutions (lending banks) and insurance company(ies) to input all crop loans and crop insurance-related information on a routine or daily basis.

(12) Crop insurance marketing and sales and farmer awareness creation and education

For the Kharif 2018 Pilot, GoPunjab agreed that ground-up coverage will be compulsory for all e-Kissan crop credit recipients, and that for CLIS farmers, top-up coverage will be offered on a voluntary basis with the sales window closing one month before the expected crop harvest.[54] Given the proposal to link crop AYII coverage on a mandatory basis with crop loans, insurers will not need to market and promote coverage to individual farmers, yet it is still very important that the insurers agree with the banks on the approach to create farmer awareness and educate them about the crop insurance coverage for which they are signing up as part of their loan package. GoPunjab has invested heavily in designing and implementing farmer awareness and training programs, including media and materials.

(13) Initiate crop insurance coverage for Kharif crops, starting with sugarcane in March–April 2018

The Kharif 2018 AYII program was launched for cotton and rice loanee farmers in the four selected districts on March 1, 2018. The AYII policy is designed to cover farmers in each UAI (in this case, tehsil) during the Kharif season from the time of planting to completion of the harvest and determination of the actual area yield.

(14) Design and implement strengthened sample area-yield measurement based on crop-cutting experiments

The CRS Regional and Operations Teams are currently planning for increased CCE coverage at the cotton and rice harvests in the UAIs in the four pilot districts. The recommendations for CRS in Chapter 5 were to (1) increase the number of villages sampled and number of CCEs over time to facilitate implementation of the AYII program at the tehsil or union council levels; (2) simplify and speed up procedures by introducing grain moisture meters to determine wet and dry grain weights after one field visit; and (3) introduce smartphone or tablet SMS technology to record and transmit CCE results from the field at the time of the crop cuts.

(15) Train CRS field extension staff in new CCE procedures

The feasibility study's recommendation is to start training field extension staff in November 2017 and for training to run into 2018, up to the time the Kharif harvest begins. It is important that all staff receive equipment, are trained to use it, and learn the procedures for electronic data entry and transmission. This activity is ongoing as of June 2018. The New Crop Insurance Portal has a module for uploading CCE data that is transmitted electronically by smartphones or tablets.

(16) Implement end of 2018 Kharif season CCEs

The timing of CCEs is critical. Kharif crops are harvested mainly between September and the end of November, with the timing of the harvest varying by crop, district, and the prevailing climatic conditions during each season. CCEs must be completed in a timely fashion so that claim payments (where they are due) are also made as quickly as possible after the harvest.

(17) Settle claim payouts

The insurers will need to agree in advance with the lending institutions on the procedures for settling claims. It is likely that the banks will require that claim payments are settled through the bank to enable

[53]A premium bordereau contains a detailed list of policies insured under an insurance contract during the reporting period, reflecting such information as the name and address of the (primary) insureds, the amount and location of the risk, the effective and termination dates of the insurance, the amount insured, and the insurance premium applicable.

[54]The World Bank has advised that the convention for multiple peril crop insurance policies is to close sales at the time the crop is planted. It is recommended that GoPunjab reconsider the cut-off dates for selling policies prior to the main launch in Rabi 2018–19 season.

the bank to recover the loan, plus interest and premium payments, and to then transfer any remaining money from the claim to the insured farmer.

(18) Design and implement a monitoring and evaluation system

The design of an M&E system started in November 2017, with a view to launching the system in the 2018 Kharif season.

(19) World Bank technical support to the Punjab Agricultural Insurance Programs

The World Bank fielded a number of missions to provide technical support to GoPunjab, the proposed TSU, and the insurance sector in planning and designing the AYII program for semicommercial/progressive farmers. As of June 2018, technical support missions had visited Punjab in October/November 2017, February 2018, and May 2018.

7.2. KEY LESSONS AND CHALLENGES EXPERIENCED IN ROLLING OUT CROP AYII IN KHARIF 2018

The key lessons and challenges encountered as Crop AYII has been rolled out in Punjab in Kharif 2018 reflect a number of technical and logistical concerns, as well as stakeholders' perceptions. The sections that follow summarize the major lessons and challenges arising to date.

7.2.1. THE IMPORTANT COORDINATING ROLE PERFORMED BY THE TSU

Early formation of the Punjab Crop Insurance Team as the TSU for the insurance program was key to the successful launch of the AYII pilot in Kharif 2018. This TSU has been responsible for coordinating the planning, design, and implementation of the Punjab crop insurance program from the very beginning, starting with the Kharif 2018 pilot. Specialized staff were recruited to complement the team, including a project manager and a local crop insurance specialist, who formerly headed the SBP CLIS initiative. The World Bank has channeled its technical assistance for the design of the AYII product and program through the TSU.

7.2.2. IMPORTANCE OF INVESTMENT IN A WEB-BASED CROP INSURANCE PORTAL

GoPunjab has invested significantly in the design of a web-based crop insurance portal to enroll farmers in the crop insurance program and facilitate easy communication and rapid transfer of data between financial institutions, insurance companies, and GoPunjab. The portal also enables farmers to register online for crop insurance. The system is designed to ensure maximum transparency. For example, access to CCE yield results is essential for insurers and reinsurers, and the system permits CCE yield results to be uploaded in real-time as they become available in the field. The crop insurance portal came on line in May 2018 and will greatly assist the day-to-day management and implementation of the Punjab crop insurance project, especially if it is scaled up as planned, to underwrite several million policies by Year 5.

7.2.3. THE NEED FOR TRAINING IN AREA-YIELD INDEX INSURANCE CONTRACT DESIGN AND RATING

AYII is a new crop insurance product in Pakistan, and insurance companies lack detailed knowledge and expertise in designing and rating this product. Insurers are not familiar with the concepts of crop loss of yield insurance and the need to detrend time series crop yield data before establishing the average or expected yield and setting insured yields and (where applicable) exit yields. Aside from these issues of AYII contract design, local insurers have no experience of methods for rating (pricing) AYII products. For the Kharif 2018 pilot, it appears that most tendering insurers based their pricing decisions on the rates charged on CLIS (maximum 2 percent rate) rather than on systematic loss of yield rating analysis for the AYII coverage.

The lack of knowledge on designing and rating AYII contracts in the local insurance market complicated the tender and bidding processes for the Kharif 2018 pilot. This included specific problems related to understanding the differences between top-up AYII coverage for farmers who are already insured under CLIS, and ground-up coverage for farmers who are not insured under CLIS. This insufficient understanding was reflected in the commercial premium rates of the winning bid, which did not adequately reflect the underlying risk exposures, particularly for cotton in several UAIs in the pilot districts. It seems that insurers submitted bids without clearly establishing the expected yields and

insured yields that would apply in Kharif 2018 for each insured crop in each UAI. Furthermore, the original tender was issued with a 300 percent loss ratio cap, which subsequently had to be withdrawn, and the tender was reissued.

To address these issues, the World Bank team developed an Area-Yield Index Insurance Contract Design and Rating Tool, as well as a series of modular training programs aimed at key public and private sector stakeholders in Punjab. The Crop AYII Contract Design and Rating Tool was delivered to the Punjab Crop Insurance Team at the time of the February 2018 World Bank mission. Since the tender process was under way, the Punjab Crop Insurance Team decided it was not appropriate to share the tool with the insurance companies at that time. Some preliminary training in the use of the tool was provided by the World Bank team to the insurance companies during its May 2018 mission. The current tool enables the user to design an AYII contract for the selected Kharif 2018 pilot crops and tehsils/districts under either Option 1: Ground-up coverage using the agreed terms for 2018, i.e., fixed (for all crops/tehsils) threshold or trigger yield of 80 percent of expected yield and exit yield of 0 percent of expected yield; and Option 2: Top-up coverage for farmers insured under CLIS with fixed threshold or trigger yield of 80 percent of expected yield and exit yield of 50 percent of expected yield. The tool can generate expected average loss costs (pure rates) using actual historical yield data provided by CRS for each crop and tehsil or detrended yields. The tool also allows users to generate technical rates and indicative commercial premium rates using their own assumptions. It is stressed that the tool is a training tool and that all final pricing decisions rest with the insurers and their reinsurers. In August 2018, the World Bank plans to deliver to GoPunjab an updated Crop AYII Contract Design and Rating Tool (version 2), which incorporates a more sophisticated rating methodology that conforms to best practices used by international crop reinsurers.

7.2.4. THE NEED TO ASSIST THE PAKISTAN INSURANCE MARKET TO DEVELOP CROP INSURANCE POLICY WORDINGS

Under this commercial crop insurance initiative, it is recommended that insurers observe international norms by designing tailor-made crop insurance policy wordings and individual farmer insurance certificates that should be easily understood by farmers, many of whom have no insurance knowledge or literacy. Under the CLIS program, insurers and financial institutions enter into insurance agreements, but no form of insurance wording or insurance certificate is issued to the individual farmers protected under this scheme. In Punjab, the World Bank team strongly recommended to the TSU and the appointed insurer that (1) each financial institution should be issued with a Master Policy Wording and Schedule for the new AYII product and (2) that each insured farmer should receive a Certificate of Insurance. During the May 2018 mission, the World Bank team shared specimen copies of an AYII policy wording and farmer certificate with the TSU and the appointed insurer.

7.2.5. FINANCIAL INSTITUTIONS' VIEW ON COMPULSORY VERSUS VOLUNTARY CROP INSURANCE

For the Kharif 2018 pilot, GoPunjab decided that any small farmer who wished to access e-Kissan crop loans (e-credit) will be insured on a compulsory basis. This principle has been agreed by the financial institutions for e-credit farmers who are not already insured under CLIS. However, for farmers already insured under CLIS (which is free to the farmer), the financial institutions were very reluctant to impel the farmers to purchase top-up AYII coverage on a compulsory basis and then require them to pay 50 percent of the cost of the top-up coverage premium. Therefore, under the Kharif 2018 pilot it has been agreed that top-up AYII coverage will be offered on a voluntary basis to farmers who are already insured under CLIS. The sale of voluntary crop insurance will require the identification of suitable distribution channels to market and promote voluntary coverage, as well as the design of mechanisms to collect premiums from farmers. This decision will be reviewed prior to the Rabi 2018–19 launch of the crop insurance program in Punjab.

7.2.6. THE NEED TO INCLUDE ALL TYPES OF FARMER IN THE PUNJAB CROP INSURANCE INITIATIVE

The Kharif 2018 pilot specifically targets small cotton and rice farmers who are e-credit recipients. GoPunjab would like to see the program rapidly start to develop crop insurance products that meet the needs of medium and large farmers as well, however, and to provide incentives for those farmers to purchase

crop insurance. Although some larger farmers may want to purchase AYII coverage, the crop insurance build-up plan identifies individual farmer MPCI and NPCI products that are designed for larger farmers and planned to become available in 2019–20.

7.2.7. CONCERNS ABOUT CAPPING INSURED YIELDS AT 80 PERCENT OF EXPECTED YIELD

For the Kharif 2018 pilot, the AYII insurers and their reinsurers expressed a desire to cap the maximum insured yield (threshold yield) at 80 percent of the expected yield. Their concern was that as the program was new and untested in Punjab, they wish to avoid over-insuring average area yields and would not want to offer more than an 80 percent insurance yield coverage level in the start-up phase. The GoPunjab crop insurance team therefore elected to adopt a fixed 80 percent insured yield for both cotton and rice in all tehsils for the 2018 pilot, because it would be simple to convey the concept to farmers. At the same time, results of the feasibility study had clearly shown that yields of cotton in Lodhran District exhibit extreme variability year-on-year and that an actuarially rated AYII coverage with 80 percent insured yield would be very expensive in those tehsils. Conversely, the 12-year average yield data provided by CRS show that yields of kharif paddy rice are extremely stable. With few exceptions, actual annual yields have never fallen short of 90 percent of average yields at the district and tehsil level. During the launch of the Kharif pilot program, farmers reported to the TSU and the insurers that they did not believe it was fair to offer AYII for paddy with an 80 percent insured yield, because they believe that there will never be a payout. For that reason, for the main Rabi 2018/19 launch, it is recommended that the insured yield for wheat in each tehsil (UAI) should be closely related to the historical yield variability and that insurers should be requested to consider a higher maximum insured yield of 90 percent of expected yield in UAIs with low yield variability.

TABLE 7.1: AREA-YIELD INDEX INSURANCE PROGRAM 1 (FOR SEMICOMMERCIAL/PROGRESSIVE FARMERS LINKED TO CROP CREDIT): IMPLEMENTATION WORK PLAN AND TIMETABLE LEADING UP TO LAUNCH IN KHARIF SEASON 2018

Key Tasking	Lead Entity	2017									2018												
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Prepare Diagnostic Report	WBG																					
2. Approval by Govt. Punjab & Allocation of Financial Resources	GoPunjab																					
3. Agreement by Public and Private stakeholders to support the PPP agricultural insurance initiative and form Steering Committee and Technical committees																						
4. Establishment of Technical Support Unit (TSU)																						
5. Historical Crop Area Yield Data Provision at Tehsil / Union Council level	Crop Reporting Services (CRS)																					
6. Crop Insurance Product Design & Rating	WBG / Insurers																					
7. Product Approval (Insurance Regulator)	Insurers / Regulator																					
8. Insurance Planning (Consortium, Pool, Special Purpose Vehicle)	Insurers / GoPunjab																					
9. Insurance & Reinsurance Planning and approval of coverage levels and premium rates	Insurers & reinsurers																					
10. Agree Distribution Channels through Banks (Linkage with KISAN Credit Scheme)	Insurers / Banks & MFIs																					
11. Design Operating Systems & Procedures (farmer enrolment, policy issuance, premium collection)	Insurers / Banks & MFIs																					
12. Crop Insurance Policy Sales and Farmer Eduction	Kisan Banks / Insurers / Crop Extension Dept										Sugar Cane / Cotton			Rice		Maize						
13. Incept Crop Insurance Cover for Kharif Season 2018 starting in April with Sugar Cane & Cotton	Insurers												Sugar Cane	Cotton		Rice	Maize					
14. Design and Test Strengthened Sample Yield Measurement (Crop Cutting Experiements)	WBG / CRS																					
15. Train CRS Extension staff in new CCE Procedures																						
16. Implement end of Kharif 2018 season CCE's	CRS																					
17. Settle Claims Payouts	Insurers																					
18. Design Monitoring & Evaluation Systems and Implement	WBG / GoPunjab / Insurers									Design				Implement M&E								
19. WBG Technical Support Missions																						

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ANNEX 1

AREA, PRODUCTION, AND YIELDS OF MAJOR CROPS IN PUNJAB, PAKISTAN, 2006/07–2015/16

TABLE A1.1: PUNJAB: AREA, PRODUCTION, AND YIELDS OF MAJOR CROPS, 2006/07–2015/16

Year	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	10 Year Average	Average 2006-07 to 2010-11	Average 2011-12 to 2015-16
Punjab : Cultivated Area by year ("000" Acres)													
Wheat	15,896	15,820	16,893	17,084	16,534	16,020	16,090	17,054	17,247	17,085	16,572	16,445	16,699
Gram	2,251	2,444	2,395	2,388	2,384	2,274	2,244	2,120	2,136	2,113	2,275	2,372	2,177
Cotton	6,086	5,992	5,495	6,019	5,438	6,261	5,705	5,434	5,740	5,542	5,771	5,806	5,736
Rice	4,271	4,259	4,887	4,773	4,366	4,236	4,229	4,470	4,640	4,399	4,453	4,511	4,395
Maize	1,217	1,321	1,321	1,248	1,343	1,492	1,452	1,704	1,662	1,770	1,453	1,290	1,616
Sugar cane	1,759	2,044	1,647	1,501	1,661	1,881	1,897	1,870	1,756	1,743	1,776	1,722	1,829
Total	31,480	31,880	32,637	33,013	31,726	32,164	31,617	32,651	33,181	32,651	32,300	32,147	32,453
Punjab : Crop Production ("000" Tonnes)													
Wheat	17,853	15,607	18,420	17,919	19,041	17,739	18,587	19,739	19,282	19,527	18,371	17,768	18,975
Gram	728	388	658	488	429	225	691	331	322	227	449	538	359
Cotton	4,968	4,350	4,200	4,104	3,769	5,342	4,572	4,389	4,932	3,045	4,367	4,278	4,456
Rice	3,076	3,286	3,643	3,713	3,384	3,277	3,478	3,481	3,648	3,502	3,449	3,420	3,477
Maize	2,162	2,694	2,627	2,502	2,959	3,442	3,353	4,021	4,020	4,391	3,217	2,589	3,845
Sugar cane	37,542	40,306	32,295	31,324	37,481	42,893	42,982	43,704	41,074	41,968	39,157	35,790	42,524
Total	66,329	66,631	61,844	60,050	67,063	72,917	73,663	75,664	73,278	72,660	69,010	64,383	73,637
Punjab: Crop Yields (Kilograms/Acre)			37										
Wheat	1,123	986	1,090	1,049	1,151	1,107	1,155	1,157	1,118	1,143	1,108	1,080	1,136
Gram	324	159	275	204	180	99	308	156	151	107	196	228	164
Cotton	816	726	764	682	693	853	801	808	859	549	755	736	774
Rice	720	771	745	778	775	774	822	779	786	796	775	758	791
Maize	1,776	2,040	1,989	2,005	2,203	2,306	2,309	2,360	2,418	2,481	2,189	2,003	2,375
Sugar cane	21,343	19,719	19,608	20,869	22,565	22,803	22,658	23,371	23,390	24,074	22,040	20,821	23,259

Source: CRS-DoA, GoPunjab.

TABLE A1.2: PUNJAB: AVERAGE WHEAT YIELDS (KG/ACRE) BY DISTRICT, 2006/07–2015/16

NAME	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	average	stdev	cov	min	max
THE PUNJAB	1,123	987	1,090	1,049	1,152	1,107	1,155	1,157	1,118	1,143	1,108	54	4.9%	987	1,157
Attock.	821	516	690	395	656	435	427	556	701	722	592	146	24.7%	395	821
Rawalpindi.	806	649	732	360	557	499	739	568	653	676	624	131	21.0%	360	806
Islamabad.	816	616	673	340	597	491	680	560	667	668	611	128	21.0%	340	816
Jhelum.	854	657	826	587	766	562	728	660	803	910	735	116	15.8%	562	910
Cahkwal.	646	455	530	250	532	375	658	531	670	729	538	148	27.5%	250	729
Sargodha.	1,067	958	1,079	908	1,045	1,077	1,110	937	934	1,008	1,012	73	7.2%	908	1,110
Khushab.	798	642	721	779	815	683	775	670	749	798	743	60	8.1%	642	815
Mianwali.	841	742	767	849	969	892	1,014	1,013	719	824	863	108	12.5%	719	1,014
Bhakkar.	959	867	920	935	990	904	986	1,019	901	923	940	47	5.0%	867	1,019
Faisalabad.	1,255	1,062	1,183	1,150	1,280	1,231	1,263	1,275	1,295	1,272	1,227	74	6.0%	1,062	1,295
T.T. Singh.	1,190	1,175	1,217	1,134	1,392	1,262	1,331	1,340	1,337	1,367	1,275	91	7.1%	1,134	1,392
Jhang.	1,250	1,049	1,133	1,103	1,187	1,147	1,202	1,235	1,244	1,170	1,172	65	5.6%	1,049	1,250
Chiniot				1,109	1,259	1,245	1,261	1,273	1,175	1,186	1,215	61	5.0%	1,109	1,273
Gujrat.	803	656	752	586	771	714	780	723	622	686	709	71	10.1%	586	803
M.B.Din.	1,067	1,037	1,095	1,041	1,056	1,103	1,149	1,052	987	1,042	1,063	44	4.2%	987	1,149
Sialkot.	1,030	1,015	1,041	878	1,069	1,176	1,212	1,221	693	991	1,033	160	15.5%	693	1,221
Narowal.	937	824	793	743	950	894	985	1,001	713	843	868	101	11.6%	713	1,001
Gujranwala.	1,217	1,225	1,293	1,302	1,272	1,410	1,280	1,284	1,100	1,197	1,258	81	6.4%	1,100	1,410
Hafizabad.	1,131	1,162	1,165	1,036	1,288	1,250	1,231	1,249	1,238	1,242	1,199	75	6.3%	1,036	1,288
Sheikhupura.	1,076	997	1,081	1,014	1,230	1,162	1,234	1,240	1,300	1,165	1,150	103	9.0%	997	1,300
Nankana Sahib	1,206	1,148	1,201	1,071	1,213	1,265	1,255	1,257	1,347	1,306	1,227	79	6.4%	1,071	1,347
Lahore.	1,063	992	1,011	1,036	1,162	1,214	1,248	1,184	1,109	1,207	1,122	93	8.3%	992	1,248
Kasur.	1,225	1,093	1,203	1,096	1,249	1,254	1,213	1,218	1,242	1,172	1,197	59	4.9%	1,093	1,254
Okara.	1,419	1,283	1,380	1,376	1,450	1,436	1,444	1,452	1,403	1,287	1,393	63	4.5%	1,283	1,452
Sahiwal.	1,234	1,088	1,247	1,219	1,313	1,258	1,264	1,295	1,233	1,269	1,242	61	4.9%	1,088	1,313
Pakpattan.	1,369	1,258	1,384	1,461	1,525	1,360	1,414	1,437	1,362	1,384	1,396	71	5.1%	1,258	1,525
Multan.	1,153	940	1,195	1,014	1,137	1,052	1,176	1,195	1,223	1,225	1,131	97	8.6%	940	1,225
Lodhran.	1,199	1,044	1,302	1,198	1,265	1,218	1,284	1,325	1,263	1,371	1,247	90	7.2%	1,044	1,371
Khanewal.	1,276	1,085	1,260	1,221	1,250	1,188	1,256	1,283	1,276	1,302	1,240	63	5.1%	1,085	1,302
Vehari.	1,188	1,122	1,167	1,168	1,277	1,299	1,325	1,339	1,331	1,324	1,254	83	6.6%	1,122	1,339
Muzaffargarh.	1,099	960	1,096	1,099	1,170	1,114	1,135	1,138	1,130	1,167	1,111	59	5.3%	960	1,170
Layyah.	1,079	882	1,026	1,035	1,140	964	1,058	1,097	1,029	1,044	1,035	71	6.9%	882	1,140
D.G.khan.	1,086	1,028	940	1,020	1,071	1,077	1,153	1,180	1,208	1,118	1,088	81	7.4%	940	1,208
Rajanpur.	1,161	944	1,037	1,092	1,107	956	1,049	1,055	1,143	1,246	1,079	92	8.5%	944	1,246
Bahawalpur.	1,178	1,043	1,212	1,143	1,273	1,291	1,214	1,224	1,233	1,306	1,212	77	6.4%	1,043	1,306
Rahim Yar Khan	1,221	971	1,099	1,111	1,263	1,257	1,348	1,364	1,277	1,330	1,224	126	10.3%	971	1,364
Bahawalnagar.	1,225	1,037	1,157	1,212	1,264	1,190	1,207	1,228	1,273	1,235	1,203	67	5.6%	1,037	1,273

TABLE A1.3: PUNJAB: AVERAGE COTTON YIELDS (KG/ACRE) BY DISTRICT, 2006/07–2015/16

NAME	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	average	stdev	cov	min	max
THE PUNJAB	816	726	764	682	693	853	801	808	859	549	755	95	12.6%	549	859
Attock.															
Rawalpindi.															
Islamabad.															
Jhelum.	206	206	225	94	125	245	187	442	480	187	240	125	52.2%	94	480
Cahkwal.	197	187					197		461	0	208	164	78.8%	0	461
Sargodha.	324	294	421	474	409	491	466	234	348	253	371	94	25.3%	234	491
Khushab.	230	235	269	590	614	420	367	362	291	394	377	135	35.9%	230	614
Mianwali.	637	711	830	642	477	530	517	597	584	456	598	114	19.0%	456	830
Bhakkar.	563	456	640	497	426	657	689	568	644	377	552	108	19.6%	377	689
Faisalabad.	554	550	716	562	495	543	507	477	642	417	546	84	15.4%	417	716
T.T. Singh.	593	518	741	505	452	632	623	656	898	471	609	136	22.4%	452	898
Jhang.	563	585	723	421	490	561	492	494	536	405	527	91	17.3%	405	723
Chiniot				498	440	485	370	349	354	336	405	68	16.9%	336	498
Gujrat.															
M.B.Din.	304	299	302	246	263	291	255	205	383	224	277	50	18.2%	205	383
Sialkot.															
Narowal.															
Gujranwala.															
Hafizabad.															
Sheikhupura.									537		537			537	537
Nankana Sahib	264	225							355		282	67	23.7%	225	355
Lahore.															
Kasur.	381	365	492	417	422	501	482	461	474	334	433	58	13.4%	334	501
Okara.	553	582	660	551	698	832	964	853	891	577	716	156	21.8%	551	964
Sahiwal.	587	546	845	532	691	895	910	777	845	419	705	175	24.8%	419	910
Pakpattan.	758	732	895	610	786	938	839	846	854	474	773	140	18.1%	474	938
Multan.	848	781	780	694	708	941	889	847	885	420	779	149	19.1%	420	941
Lodhran.	902	803	625	723	652	895	818	798	886	467	757	141	18.6%	467	902
Khanewal.	840	749	885	623	729	981	911	946	908	445	802	167	20.9%	445	981
Vehari.	752	558	737	816	731	936	912	873	883	457	765	156	20.4%	457	936
Muzaffargarh.	681	725	539	539	793	750	721	696	866	424	673	134	19.9%	424	866
Layyah.	601	631	662	508	493	598	563	549	622	605	583	54	9.3%	493	662
D.G.khan.	947	847	701	704	626	777	646	701	838	502	729	128	17.5%	502	947
Rajanpur.	978	844	669	859	623	742	684	900	945	873	812	124	15.2%	623	978
Bahawalpur.	926	772	849	667	785	933	836	835	894	643	814	99	12.2%	643	933
Rahim Yar Khan	875	787	905	803	689	896	801	858	916	699	823	82	9.9%	689	916
Bahawalnagar.	863	739	846	752	796	957	919	924	910	717	842	86	10.3%	717	957

TABLE A1.4: PUNJAB: AVERAGE RICE YIELDS (KG/ACRE) BY DISTRICT, 2006/07–2015/16

NAME	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	average	stdev	cov	min	max
THE PUNJAB	720	772	745	778	775	774	822	779	786	796	775	27	3.5%	720	822
Attock.															
Rawalpindi.															
Islamabad.															
Jhelum.	680	680	848	505	640	677	677	727	680	693	681	83	12.3%	505	848
Cahkwal.															
Sargodha.	651	789	660	680	638	678	657	761	729	643	689	53	7.7%	638	789
Khushab.	750	807	705	534	677	694	584	630	729	710	682	80	11.8%	534	807
Mianwali.	683	796	753	543	781	723	586	674	577	578	669	93	13.9%	543	796
Bhakkar.	690	830	680	620	610	597	600	673	660	700	666	69	10.4%	597	830
Faisalabad.	581	649	643	665	733	687	741	702	730	725	686	51	7.5%	581	741
T.T. Singh.	644	776	684	724	758	714	752	690	837	839	742	64	8.6%	644	839
Jhang.	672	728	716	678	704	653	647	713	719	713	694	29	4.2%	647	728
Chiniot				661	796	775	810	754	691	742	747	54	7.3%	661	810
Gujrat.	682	755	748	686	636	603	712	646	591	590	665	62	9.3%	590	755
M.B.Din.	735	821	688	742	689	755	782	741	696	714	736	43	5.8%	688	821
Sialkot.	738	787	724	837	819	776	813	705	718	734	765	47	6.2%	705	837
Narowal.	623	713	563	643	707	652	681	654	666	701	660	45	6.8%	563	713
Gujranwala.	734	799	803	895	851	885	947	803	802	863	838	62	7.4%	734	947
Hafizabad.	687	732	764	842	837	806	855	827	778	847	797	56	7.0%	687	855
Sheikhupura.	651	680	680	725	676	720	752	725	720	781	711	39	5.5%	651	781
Nankana Sahib	687	718	744	731	725	726	783	814	826	778	753	45	6.0%	687	826
Lahore.	643	749	772	738	733	708	834	691	789	763	742	53	7.2%	643	834
Kasur.	783	824	806	760	756	772	866	804	795	816	798	33	4.1%	756	866
Okara.	893	956	921	906	953	938	995	1,036	1,023	951	957	48	5.0%	893	1,036
Sahiwal.	778	729	707	724	823	700	794	682	811	735	748	49	6.6%	682	823
Pakpattan.	860	893	842	942	987	906	1,041	956	959	904	929	60	6.5%	842	1,041
Multan.	603	725	650	619	665	652	675	698	773	813	687	67	9.7%	603	813
Lodhran.	660	770	653	611	578	609	700	544	772	864	676	100	14.8%	544	864
Khanewal.	645	718	767	662	694	693	739	703	842	732	719	56	7.8%	645	842
Vehari.	720	750	747	646	734	759	805	790	833	756	754	51	6.8%	646	833
Muzaffargarh.	720	823	829	711	692	719	808	817	783	751	765	53	6.9%	692	829
Layyah.	685	806	818	669	718	589	565	694	661	725	693	81	11.7%	565	818
D.G.khan.	851	881	891	970	838	933	895	907	880	890	894	38	4.2%	838	970
Rajanpur.	626	818	808	834	783	788	780	845	695	653	763	77	10.1%	626	845
Bahawalpur.	697	580	691	592	689	646	654	534	773	820	668	87	13.0%	534	820
Rahim Yar Khan	694	768	778	685	617	731	768	773	802	747	736	56	7.6%	617	802
Bahawalnagar.	753	705	728	840	816	820	865	847	846	798	802	55	6.9%	705	865

TABLE A1.5: PUNJAB: AVERAGE MAIZE YIELDS (KG/ACRE) BY DISTRICT, 2006/07–2015/16

NAME	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Average	Stdev	COV	Min	Max
THE PUNJAB	1,776	2,040	1,989	2,005	2,203	2,306	2,309	2,360	2,418	2,481	2,189	227	10.4%	1,776	2,481
Attock.	351	419	423	376	453	470	615	908	875	806	570	216	37.9%	351	908
Rawalpindi.	438	405	361	287	409	407	384	656	479	489	432	98	22.7%	287	656
Islamabad.	436	394	357	294	413	409	381	486	394	472	403	55	13.7%	294	486
Jhelum.	2,265	2,875	2,716	2,984	2,957	2,740	2,327	2,863	2,562	2,868	2,716	254	9.3%	2,265	2,984
Cahkwal.	400	400	424	333	375	360	350	344	333	319	364	35	9.5%	319	424
Sargodha.	1,120	1,217	1,277	1,324	1,379	1,374	1,365	1,334	1,317	1,248	1,296	82	6.3%	1,120	1,379
Khushab.	500	522	625	481	550	750	652	645	628	583	594	82	13.9%	481	750
Mianwali.	533	533	500	1,269	1,188	1,000	800	870	489	500	768	303	39.4%	489	1,269
Bhakkar.	444	360	379	367	400	414	481	462	471	460	424	46	10.7%	360	481
Faisalabad.	1,627	2,166	1,884	1,891	2,012	2,119	2,271	2,256	2,440	2,390	2,106	254	12.1%	1,627	2,440
T.T. Singh.	1,885	2,036	1,948	2,172	2,256	2,263	2,580	2,558	2,545	2,660	2,290	283	12.3%	1,885	2,660
Jhang.	2,348	2,480	2,391	2,462	2,610	2,506	2,523	2,410	1,830	2,380	2,394	213	8.9%	1,830	2,610
Chiniot				2,463	2,609	2,632	2,440	2,177	2,370	2,754	2,492	191	7.7%	2,177	2,754
Gujrat.	692	703	659	692	750	800	757	735	702	673	716	43	6.0%	659	800
M.B.Din.	753	851	916	929	914	950	911	856	819	690	859	84	9.8%	690	950
Sialkot.	1,214	1,935	2,376	2,269	2,167	2,360	2,404	2,288	2,190	1,804	2,101	367	17.5%	1,214	2,404
Narowal.	667	923	1,338	1,375	1,750	1,667	1,600	1,000	630	500	1,145	461	40.3%	500	1,750
Gujranwala.	600	1,261	1,552	1,636	1,750	1,762	1,588	1,444	1,294	1,514	1,440	339	23.6%	600	1,762
Hafizabad.	676	941	945	861	909	1,000	1,000	893	632	621	848	148	17.5%	621	1,000
Sheikhupura.	680	687	688	700	706	714	724	750	752	806	721	39	5.4%	680	806
Nankana Sahib	679	688	703	723	740	747	757	758	730	717	724	28	3.8%	679	758
Lahore.	1,865	1,675	1,551	1,695	1,692	1,734	1,759	725	717	730	1,414	483	34.1%	717	1,865
Kasur.	2,174	2,388	2,641	3,198	2,933	3,083	3,121	3,115	2,824	3,158	2,863	355	12.4%	2,174	3,198
Okara.	1,828	2,586	2,464	2,512	2,731	2,894	2,638	2,720	2,868	3,129	2,637	346	13.1%	1,828	3,129
Sahiwal.	2,665	2,859	2,630	2,626	2,961	2,950	2,837	2,818	2,939	2,799	2,808	129	4.6%	2,626	2,961
Pakpattan.	2,774	2,709	2,727	2,605	2,817	2,773	2,871	2,937	3,064	3,033	2,831	146	5.2%	2,605	3,064
Multan.	937	1,015	952	919	953	1,117	1,664	1,647	1,727	1,775	1,271	378	29.7%	919	1,775
Lodhran.	652	778	1,709	1,685	1,722	1,852	1,851	1,661	2,743	2,424	1,708	633	37.1%	652	2,743
Khanewal.	2,630	2,538	2,558	2,707	2,890	2,548	3,060	2,901	2,929	2,935	2,770	194	7.0%	2,538	3,060
Vehari.	2,304	2,489	2,431	2,351	2,508	2,472	2,747	2,833	3,160	3,025	2,632	293	11.1%	2,304	3,160
Muzaffargarh.	602	612	609	627	608	613	625	610	673	678	626	27	4.4%	602	678
Layyah.	700	727	750	667	667	656	667	667	667	630	680	36	5.2%	630	750
D.G.khan.	690	727	750	737	714	714	593	696	677	672	697	45	6.4%	593	750
Rajanpur.	571	571	400	571	500	571	600	583	548	444	536	66	12.4%	400	600
Bahawalpur.	657	650	648	649	651	1,000	2,000	2,020	3,259	2,876	1,441	1,018	70.6%	648	3,259
Rahim Yar Khan	673	698	690	690	688	957	1,067	1,321	1,638	1,886	1,031	445	43.2%	673	1,886
Bahawalnagar.	1,987	2,154	2,110	2,113	2,301	2,470	2,391	2,429	3,099	3,232	2,429	420	17.3%	1,987	3,232

TABLE A1.6: PUNJAB: AVERAGE SUGARCANE YIELDS (KG/ACRE) BY DISTRICT, 2006/07–2015/16

NAME	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	average	stdev	cov	min	max
THE PUNJAB	21,343	19,719	19,608	20,869	22,565	22,803	22,658	23,371	23,391	24,078	22,041	1,569	7.1%	19,608	24,078
Attock.	7,930	15,860	16,040	14,300	15,720	14,920					14,128	3,107	22.0%	7,930	16,040
Rawalpindi.															
Islamabad.															
Jhelum.	8,400	16,800	17,160	15,120	15,300	15,400	15,600	16,090	15,230	14,860	14,996	2,435	16.2%	8,400	17,160
Cahkwal.															
Sargodha.	20,491	18,886	18,289	18,849	22,992	22,283	20,528	20,342	19,969	20,081	20,271	1,474	7.3%	18,289	22,992
Khushab.	20,678	17,767	17,281	17,916	18,886	18,326	19,446	16,759	20,006	19,036	18,610	1,231	6.6%	16,759	20,678
Mianwali.	17,729	15,938	15,490	21,910	23,141	25,231	24,261	23,216	18,737	20,342	20,599	3,488	16.9%	15,490	25,231
Bhakkar.	17,356	15,490	15,863	18,252	20,155	20,528	21,574	20,566	21,088	22,096	19,297	2,386	12.4%	15,490	22,096
Faisalabad.	22,469	19,409	19,782	19,707	21,126	20,902	20,976	21,462	21,872	22,208	20,991	1,070	5.1%	19,409	22,469
T.T. Singh.	22,731	19,931	20,230	20,753	23,514	23,664	23,514	23,141	23,328	22,768	22,357	1,462	6.5%	19,931	23,664
Jhang.	20,715	18,140	19,036	20,155	22,320	21,760	22,208	23,328	22,693	22,022	21,238	1,679	7.9%	18,140	23,328
Chiniot				20,230	22,731	21,462	20,342	22,022	21,648	21,835	21,467	901	4.2%	20,230	22,731
Gujrat.	17,207	17,729	15,863	15,490	17,767	17,915	18,102	17,990	17,692	16,422	17,218	949	5.5%	15,490	18,102
M.B.Din.	19,969	16,721	16,423	17,543	18,289	19,595	19,409	18,662	18,774	19,035	18,442	1,201	6.5%	16,423	19,969
Sialkot.	11,683	12,242	12,018	11,980	12,690	13,250	13,438	13,250	13,063	12,317	12,593	627	5.0%	11,683	13,438
Narowal.	12,615	12,877	12,318	12,130	15,340	15,750	15,713	15,750	13,623	12,690	13,880	1,566	11.3%	12,130	15,750
Gujranwala.	14,818	15,490	15,303	15,080	19,446	19,408	19,036	18,738	15,788	15,043	16,815	2,042	12.1%	14,818	19,446
Hafizabad.	18,699	15,676	15,378	15,303	15,863	17,916	18,849	18,476	18,625	17,543	17,233	1,501	8.7%	15,303	18,849
Sheikhupura.	18,066	18,290	18,290	17,804		20,977	22,544	18,887	19,036	21,312	19,467	1,702	8.7%	17,804	22,544
Nankana Sahib	17,356	18,103	18,364	18,588		19,483	18,812	18,961	20,715	20,902	19,031	1,167	6.1%	17,356	20,902
Lahore.	16,610	17,540	17,650	17,360		18,290	18,400	19,040	20,300	19,780	18,330	1,198	6.5%	16,610	20,300
Kasur.	20,342	18,289	17,916	20,454	20,491	20,528	18,924	20,342	20,491	20,603	19,838	1,040	5.2%	17,916	20,603
Okara.	18,774	16,759	18,476	18,812	19,782	19,969	19,894	19,484	19,222	19,035	19,021	944	5.0%	16,759	19,969
Sahiwal.	16,348	16,796	16,647	16,050	16,796	19,222	19,110	19,409	19,521	19,969	17,987	1,569	8.7%	16,050	19,969
Pakpattan.	22,470	20,491	19,409	20,193	20,902	21,275	21,089	20,155	20,267	20,342	20,659	831	4.0%	19,409	22,470
Multan.	17,654	17,767	17,356	16,050	20,080	20,529	20,678	19,931	19,856	20,529	19,043	1,666	8.7%	16,050	20,678
Lodhran.	21,275	19,520	18,662	21,275	18,886	20,902	22,768	22,842	23,030	25,754	21,491	2,189	10.2%	18,662	25,754
Khanewal.	21,461	19,819	20,155	20,977	22,021	21,051	21,462	20,902	24,821	25,231	21,790	1,821	8.4%	19,819	25,231
Vehari.	24,261	22,507	21,387	24,672	25,008	24,634	24,821	23,813	23,701	23,888	23,869	1,137	4.8%	21,387	25,008
Muzaffargarh.	22,022	21,648	19,782	21,424	21,350	23,962	22,395	24,261	23,514	25,381	22,574	1,678	7.4%	19,782	25,381
Layyah.	19,931	19,707	20,267	21,499	21,275	21,686	21,648	22,021	21,835	21,723	21,159	855	4.0%	19,707	22,021
D.G.khan.	22,283	20,193	20,230	21,834	22,955	23,328	22,768	23,141	22,880	24,821	22,443	1,408	6.3%	20,193	24,821
Rajanpur.	22,581	21,835	21,648	29,524	27,620	29,113	28,740	29,486	27,434	30,233	26,821	3,425	12.8%	21,648	30,233
Bahawalpur.	22,059	21,126	20,902	21,126	26,911	25,157	25,008	25,381	25,008	26,687	23,936	2,376	9.9%	20,902	26,911
Rahim Yar Khan	26,314	26,053	24,298	26,575	27,993	28,927	30,046	30,233	30,121	30,905	28,146	2,239	8.0%	24,298	30,905
Bahawalnagar.	20,528	18,476	18,961	20,118	24,559	22,880	23,328	22,955	23,179	23,291	21,827	2,111	9.7%	18,476	24,559

TABLE A1.7: PUNJAB: SOWN AREA, UNIRRIGATED AREA, AND IRRIGATED AREA BY DIVISION AND DISTRICT, 2013–14

Division / District	Sown Area (000 Hectares)	Un-irrigated Area (000 hectares)	Un-irrigated Area (% of total)	Irrigated Area (000 hectares)	Irrigated Area (% of total)
Bahawalpur Divn.	**3,096**	**25**	**1%**	**3,071.00**	**99%**
Bahawalpur	1,564	4	0%	1,560.00	100%
Bahawalnagar	644	16	2%	628.00	98%
R. Y. Khan	888	5	1%	883.00	99%
D.G.Khan Divn.	**1,892**	**196**	**10%**	**1,696.00**	**90%**
D. G. Khan	346	44	13%	302.00	87%
Layyah	503	44	9%	459.00	91%
Muzaffargarh	668	20	3%	648.00	97%
Rajanpur	375	56	15%	319.00	85%
Faisalabad Divn.	**2,033**	**79**	**4%**	**1,954.00**	**96%**
Faisalabad	691	0	0%	691.00	100%
Chiniot	287	0	0%	287.00	100%
Jhang	682	79	12%	603.00	88%
Toba Tek Singh	373	79	21%	294.00	79%
Gujranwala Divn.	**2,256**	**213**	**9%**	**2,043.00**	**91%**
Gujranwala	548	546	100%	2.00	0%
Gujrat	296	131	44%	165.00	56%
Hafizabad	344	0	0%	344.00	100%
Mandi Baha-ud-Din	345	4	1%	341.00	99%
Narowal	307	65	21%	242.00	79%
Sialkot	416	11	3%	405.00	97%
Lahore Divn.	**1,484**	**2**	**0%**	**1,482.00**	**100%**
Lahore	163	2	1%	161.00	99%
Kasur	505	0	0%	505.00	100%
Nankana Sahib	299	0	0%	299.00	100%
Sheikhupura	517	0	0%	517.00	100%
Multan Divn.	**2,089**	**7**	**0%**	**2,082.00**	**100%**
Multan	451	4	1%	447.00	99%
Khanewal	544	2	0%	542.00	100%
Lodhran	455	0	0%	455.00	100%
Vehari	639	1	0%	638.00	100%
Rawalpindi Divn.	**811**	**722**	**89%**	**89.00**	**11%**
Rawalpindi	231	221	96%	10.00	4%
Attock	227	199	88%	28.00	12%
Chakwal	248	232	94%	16.00	6%
Jhelum	105	70	67%	35.00	33%
Sahiwal Divn.	**1,424**	**0**	**0%**	**1,424.00**	**100%**
Sahiwal	426	0	0%	426.00	100%
Okara	617	0	0%	617.00	100%
Pakpattan	381	0	0%	381.00	100%
Sargodha Divn.	**2,109**	**741**	**35%**	**1,368.00**	**65%**
Sargodha	561	0	0%	561.00	100%
Bhakkar	788	386	49%	402.00	51%
Khushab	427	286	67%	141.00	33%
Mianwali	333	69	21%	264.00	79%
Islamabad	**25**	**25**	**100%**	**0.00**	**0%**
Punjab	**17219**	**2010**	**12%**	**15209**	**88%**

Source: Government of Punjab, Bureau of Statistics, 2014.

Note: Excludes 485,000 hectares under orchards and 17,000 hectares under tobacco, sown under "Zaid Rabi" crop.

TABLE A1.8: PUNJAB: CORRELATION BETWEEN PERCENTAGE OF 2013–14 SOWN AREA UNIRRIGATED PER DISTRICT AND COEFFICIENT OF VARIATION IN WHEAT YIELDS, 2006–07 TO 2015–16

NAME	Average Yield (Kg/Ha)	Standard Deviation (Kg/Ha)	Cofficient of Variation (%)	Percent Sown area Un-irrigated (%)
THE PUNJAB	1,108.1	54.4	4.9%	12%
Cahkwal.	537.6	147.6	27.5%	94%
Attock.	592.1	146.3	24.7%	88%
Rawalpindi.	623.9	131.2	21.0%	96%
Islamabad.	610.8	128.1	21.0%	100%
Jhelum.	735.3	116.5	15.8%	67%
Sialkot.	1,032.7	160.2	15.5%	3%
Mianwali.	863.2	107.7	12.5%	21%
Narowal.	868.2	100.7	11.6%	21%
Rahim Yar Khan	1,223.9	126.4	10.3%	1%
Gujrat.	709.3	71.4	10.1%	44%
Sheikhupura.	1,149.8	103.4	9.0%	0%
Multan.	1,131.1	96.8	8.6%	1%
Rajanpur.	1,079.1	92.1	8.5%	15%
Lahore.	1,122.5	92.7	8.3%	1%
Khushab.	742.9	60.5	8.1%	67%
D.G.khan.	1,088.0	80.6	7.4%	13%
Lodhran.	1,246.9	90.0	7.2%	0%
Sargodha.	1,012.4	73.0	7.2%	0%
T.T. Singh.	1,274.6	90.8	7.1%	21%
Layyah.	1,035.3	71.5	6.9%	9%
Vehari.	1,254.0	83.2	6.6%	0%
Gujranwala.	1,257.9	81.1	6.4%	100%
Nankana Sahib	1,226.9	78.7	6.4%	0%
Bahawalpur.	1,211.8	77.2	6.4%	0%
Hafizabad.	1,199.0	75.4	6.3%	0%
Faisalabad.	1,226.6	73.8	6.0%	0%
Bahawalnagar.	1,202.9	67.2	5.6%	2%
Jhang.	1,171.9	65.2	5.6%	12%
Muzaffargarh.	1,110.8	59.2	5.3%	3%
Khanewal.	1,239.6	63.4	5.1%	0%
Pakpattan.	1,395.5	71.0	5.1%	0%
Bhakkar.	940.3	47.2	5.0%	49%
Chiniot	1,215.4	60.6	5.0%	0%
Sahiwal.	1,242.0	61.2	4.9%	0%
Kasur.	1,196.6	58.9	4.9%	0%
Okara.	1,393.0	63.1	4.5%	0%
M.B.Din.	1,062.9	44.2	4.2%	1%
		Correlation	**73%**	

ANNEX 2

PAKISTAN CRED-EM-DAT DATABASE FOR NATURAL DISASTERS, 1900–2017

TABLE A2.1: PAKISTAN: TOP 10 DISASTERS BY TOTAL NUMBER OF DEATHS

Year	Disaster type	Occurrence	Total deaths	Injured	Affected	Homeless	Total affected	Total damage (US$000)
2005	Earthquake	1	73,338	128,309		5,000,000	5,128,309	5,200,000
1935	Earthquake	1	60,000					
1965	Storm	1	10,000					
1974	Earthquake	1	4,700	15,000	30,000	5,200	50,200	3,255
1945	Earthquake	1	4,000					
1950	Flood	1	2,900					
2010	Flood	4	2,113	2,946	20,360,550		20,363,496	9,500,000
1992	Flood	2	1,446		9,888,553	2,951,315	12,839,868	1,000,230
2015	Extreme temperature	1	1,229		80,000		80,000	
1995	Flood	3	1,063		1,855,000		1,855,000	
Total		**16**	**160,789**	**146,255**	**32,214,103**	**7,956,515**	**40,316,873**	**15,703,485**

Source: http://www.emdat.be/database

TABLE A2.2: PAKISTAN: DAMAGE RECORD BY TYPE OF EVENT, 1900–2017

Type of natural disaster	Number of events	Total deaths	Injured	Affected	Homeless	Total affected	Total damage (US$000)
Flood	94	17,248	11,670	75,078,228	4,242,150	79,332,048	20,969,178
Earthquake	31	143,734	150,279	1,937,624	5,187,485	7,275,388	5,329,755
Storm	25	11,969	1,456	2,369,040	234,090	2,604,586	1,715,036
Landslide	22	789	209	30,645	3,300	34,154	18,000
Extreme temperature	17	2,774	324	80,250	0	80,574	18,000
Epidemic	10	283	211	16,275	0	16,486	
Mass movement (dry)	2	63	0	0	0	0	0
Drought	1	143		2,200,000		2,200,000	247,000
Insect infestation	1						
Total	**203**	**177,003**	**164,149**	**81,712,062**	**9,667,025**	**91,543,236**	**28,296,969**

Type of natural disaster	Number of events	Total deaths	Injured	Affected	Homeless	Total affected	Total damage (US$000)
Flood	46%	10%	7%	92%	44%	87%	74%
Earthquake	15%	81%	92%	2%	54%	8%	19%
Storm	12%	7%	1%	3%	2%	3%	6%
Landslide	11%	0%	0%	0%	0%	0%	0%
Extreme temperature	8%	2%	0%	0%	0%	0%	0%
Epidemic	5%	0%	0%	0%	0%	0%	0%
Mass movement (dry)	1%	0%	0%	0%	0%	0%	0%
Drought	0%	0%	0%	3%	0%	2%	1%
Insect infestation	0%	0%	0%	0%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: http://www.emdat.be/database

TABLE A2.3: PAKISTAN: ANALYSIS OF DAMAGE RECORD BY DECADE

Decade	No. of occurrences	Total deaths	Injured	Affected	Homeless	Total No people affected	Total damage (US$ 000)
1900-1909							
1910-1919							
1920-1929	1	0	0	0	0	0	0
1930-1939	2	60,000	0	0	0	0	0
1940-1949	2	4,000	0	0	10,000	10,000	0
1950-1959	8	3,850	0	0	0	0	0
1960-1969	5	10,519	0	625,502	0	625,502	7,400
1970-1979	8	6,850	15,000	13,412,200	260,200	13,687,400	1,169,755
1980-1989	20	1,074	3,578	315,875	1,002,000	1,321,453	5,000
1990-1999	44	6,654	1,451	17,881,338	3,233,770	21,116,559	1,361,166
2000-2009	68	77,142	131,479	12,369,076	5,019,420	17,519,975	7,536,648
2010-2017	45	6,914	12,641	37,108,071	141,635	37,262,347	18,217,000
Total	**203**	**177,003**	**164,149**	**81,712,062**	**9,667,025**	**91,543,236**	**28,296,969**

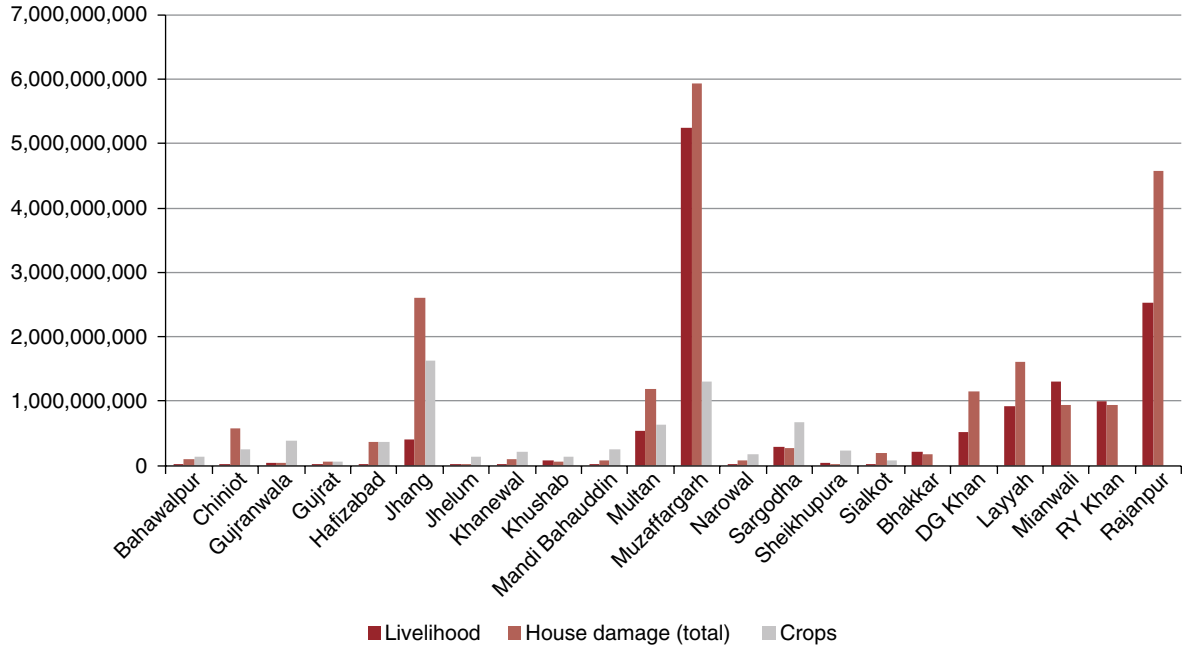
Source: http://www.emdat.be/database

ANNEX 3
COMPENSATION PAID TO FLOOD VICTIMS IN PUNJAB, 2010–15

TABLE A3.1: PUNJAB: COMPENSATION PAID (PKR) TO FLOOD VICTIMS FOR LOSS OF LIVELIHOOD, HOUSING, AND CROPS, 2010–15, BY DISTRICT

DISTRICT	DEATHS	INJURIES	LIVELIHOOD	HOUSE DAMAGE (TOTAL)	CROPS	%Crops	TOTAL	%Total
Bahawalpur			31,390,000	94,580,000	137,407,200	2%	263,377,200	1%
Chiniot			28,340,000	570,890,000	245,529,000	4%	844,759,000	2%
Gujranwala			39,820,000	48,825,000	395,900,750	6%	484,545,750	1%
Gujrat			11,000,000	70,630,000	67,415,000	1%	149,045,000	0%
Hafizabad			13,450,000	359,155,000	366,131,800	5%	738,736,800	2%
Jhang			406,170,000	2,613,805,000	1,625,415,000	24%	4,645,390,000	11%
Jhelum			13,310,000	9,185,000	142,310,250	2%	164,805,250	0%
Khanewal			20,880,000	97,415,000	223,437,500	3%	341,732,500	1%
Khushab			89,340,000	59,960,000	129,290,250	2%	278,590,250	1%
Mandi Bahauddin			16,750,000	76,340,000	251,043,000	4%	344,133,000	1%
Multan			534,920,000	1,193,455,000	644,680,675	10%	2,373,055,675	6%
Muzaffargarh			5,242,110,000	5,947,260,000	1,306,791,600	19%	12,496,161,600	30%
Narowal			13,520,000	81,645,000	169,279,800	3%	264,444,800	1%
Sargodha			298,190,000	272,110,000	671,862,638	10%	1,242,162,638	3%
Sheikhupura			38,430,000	30,475,000	238,809,500	4%	307,714,500	1%
Sialkot			29,090,000	204,210,000	88,897,200	1%	322,197,200	1%
Bhakkar			223,220,000	175,800,000		0%	399,020,000	1%
DG Khan			525,760,000	1,158,580,000		0%	1,684,340,000	4%
Layyah			916,860,000	1,606,040,000		0%	2,522,900,000	6%
Mianwali			1,297,780,000	951,160,000		0%	2,248,940,000	5%
RY Khan			998,480,000	938,120,000		0%	1,936,600,000	5%
Rajanpur			2,522,540,000	4,574,220,000		0%	7,096,760,000	17%
Total			**13,311,350,000**	**21,133,860,000**	**6,704,201,163**	**100%**	**41,149,411,163**	**100%**

FIGURE A3.1: PUNJAB: COMPENSATION PAID (PKR) TO FLOOD VICTIMS FOR LOSS OF LIVELIHOOD, HOUSING, AND CROPS, 2010–15, BY DISTRICT



Source: PDMA Punjab April 2017.

ANNEX 4
INTERNATIONAL EXPERIENCE WITH CROP AREA-YIELD INDEX INSURANCE

The origins of area-yield index crop insurance date to 1952 in Sweden. India introduced area-based crop insurance in the late 1970s, and the USA and Canada introduced it in the early 1990s. Countries that have developed area-based crop insurance in the past decade include Brazil, Mexico, Morocco, Peru, and Sudan.[55] In recent years, the World Bank has provided assistance for technical feasibility studies of AYII in Bangladesh (paddy rice), Burkina Faso (cotton), Guyana (paddy rice), Kazakhstan (rainfed spring wheat), Nepal, (rainfed and irrigated food crops and oilseeds), Senegal (rainfed food crops and oilseeds), and most recently Kenya (maize). The experiences of India, the USA, and Brazil are reviewed here.

AREA-YIELD INDEX INSURANCE IN INDIA

India has the world's largest public-sector index-based crop insurance program. National in scope, this program now covers tens of millions of mainly small and marginal farmers. The national program originated in the late 1970s, when AYII was implemented on an experimental basis. Between 1985 and 1999, the government implemented AYII under the Comprehensive Crop Insurance Scheme (CCIS), which was formally replaced in the Rabi 1999–2000 season by the National Agricultural Insurance Scheme (NAIS), underwritten by the Agricultural Insurance Company of India Ltd (AIC).

NAIS was conceived originally as a public-sector social crop insurance program. It was designed to provide small and marginal farmers access to seasonal production credit to invest in high-yielding crop technology and to remain creditworthy in the event of severe crop losses. The program was a partnership between the national and state governments. In recognition that individual farmer MPCI would have been impossible given the large number of very small landholdings, an area yield indexed approach was adopted from the outset. The NAIS program was explicitly linked on a compulsory basis to the provision of seasonal crop production credit through the rural banking network, but non-borrowing farmers were also encouraged to purchase coverage on a voluntary basis. The program, which covered a wide range of food, oilseed,

[55]In Peru, the AYII program covers a range of crop types, from quinoa, potatoes, and cereals (such as barley) to cotton.

pulse, and cash crops, is heavily subsidized in two ways: (1) premium rates for crops are capped at 1.5–2 percent for Rabi crops and 2.5–3.5 percent for Kharif crops, and (2) federal and state governments reinsure (on a 50:50 basis) all losses in excess of a 100 percent loss ratio for food crops and oilseeds and a 150 percent loss ratio for commercial crops. The sum insured for loanees was usually based on the value of the loan, but they were entitled to purchase additional coverage up to 150 percent of the value of threshold yield for the payment of commercial premium rates. Small and marginal farmers qualified for an additional premium subsidy on the capped premium rates. The scheme used government-implemented sample yield CCEs to establish the actual average area yield, which was the basis for indemnifying losses if the actual yield was below the trigger yield. Box A4.1 summarizes other key features of NAIS.

AIC has continued to innovate. In 2007, AIC launched a new series of market-based and actuarially rated micro-level WII programs (organized under

BOX A4.1: KEY FEATURES OF INDIA'S AREA-BASED NATIONAL AGRICULTURAL INSURANCE SCHEME FOR CROPS

Implementing agencies. The Agricultural Insurance Company of India (AIC), a public-sector insurer specializing in crop insurance, is responsible for implementing area-yield index insurance (AYII) under the National Agricultural Insurance Scheme (NAIS). The program started implementation in 1980.

Target audience. The program is targeted at small and marginal farmers (with less than 2 hectares), who are highly dependent on access to seasonal crop credit. Crop insurance is compulsory for borrowing farmers and voluntary for non-borrowing farmers.

Insured crops include wheat, paddy rice, maize, other cereals, oilseeds, pulses, and industrial crops such as cotton and sugarcane.

Insured unit. The insured unit is normally the block or panchayat, which comprises a group of nearby villages and which may include up to 10,000 hectares or more of a single crop and several thousands of small and marginal farmers. Farmers may select coverage levels of 60 percent, 80 percent, or a maximum of 90 percent of the five-year average area yield.

Sum insured. The sum insured for each insured yield coverage level is based on the amount of seasonal crop credit borrowed by the farmer.

Premium rates. Premium rates are capped by the government at 2.5–3.5 percent for most food crops, oilseeds, and pulses to make the program affordable to small and marginal farmers. Commercial crops are charged at the full actuarially determined premium rates.

Administration and distribution channels. The program is marketed through the rural agricultural bank branch network in each state and department and block (group of villages). AIC maintains a national headquarters staff and a small regional team in each state. It has not, however, attempted to establish branch offices, as there is no need to duplicate the rural bank branch network. The insurers' administrative costs are kept to a minimum by linking insurance with rural finance.

Area-yield measurement. Actual area yields are established through sample crop cutting and weighing of crop yields from randomly selected farms in each insured unit. The crop cut yields are averaged to calculate the actual average area yield in each insured unit. This major and costly exercise can suffer from delays in processing the results; indemnity payments are often delayed for six months or more.

Scale and outreach. By virtue of being a mainly compulsory program, the NAIS is the world's largest crop insurance program, currently insuring about 34 million Indian farmers (representing an insurance uptake rate of about 24 percent percent of all farmers).

Government financial and reinsurance support. The program is highly dependent on government subsidies and operates at a major financial loss. The federal and state governments provide excess of loss claims reinsurance protection to AIC and also fund premium subsidies. AIC's administrative and operating expenses are subsidized by the government.

Modified NAIS. Since the Rabi 2010–11 season, AIC has operated a fully commercial modified version of NAIS (mNAIS) in about 10 percent of the departments covered by the program. Under this market-based program, AYII is charged at the full commercial premium rates, and AIC places a combination of proportional and non-proportional reinsurance with international reinsurers.

Source: Authors.

BOX A4.2: MAIN FEATURES OF INDIA'S MODIFIED NAIS (MNAIS) SCHEME FOR RABI 2010–11

Actuarial regime. The mNAIS scheme operates on an "actuarial regime" in which the government's financial liability is predominantly in the form of premium subsidies given to AIC and funded ex-ante, thereby reducing the contingent and uncertain ex-post fiscal exposure faced by the government under NAIS and reducing delays in settling claims.

Up-front premium subsidies. AIC receives premiums (farmer collections plus premium subsidies from the government) and is responsible for managing the liability of mNAIS through risk transfer to private reinsurance markets and risk retention through its reserves. It is financially able to operate on a sustainable basis.

On-account partial payment. The mNAIS product continues to be based on an area yield approach, with a provision for an early partial payment to farmers (in season) based on weather indices.

Small insurance units. Crop cutting experiments to estimate crop yields are lowered from the block level to the village level to reduce basis risk (i.e., the mismatch between the actual, individual crop yield losses and the insurance indemnity).

Cutoff dates. Adverse selection is reduced through the enforcement of early purchase deadlines ahead of the crop season.

Additional benefits. Additional benefits are offered for prevention of sowing, replanting, and post-harvest losses, as well as for localized risk, such as hail losses or landslides.

Early settlement of claims. mNAIS combines weather-based indices for on-account partial payment of claims in case of adverse mid-season conditions, while area yield indices are used for final payment of claims. The final estimation of loss is based on area yield measurement at the time of harvest using crop cutting experiments.

Source: GFDRR 2011.

TABLE A4.1: INDIA: PUBLIC SECTOR CROP INDEX INSURANCE COVERAGE, 2012–13

Program	Insured farmers (million)	Insured area (million hectares)	Sum insured (US$ million)	Premium (US$ million)	Type of program
NAIS	15.45	29.92	5,892.35	195.67	Administered
WBCIS	13.23	18.39	4,038.47	379.45	Actuarial
MNAIS	2.98	2.97	1,149.20	125.10	Actuarial
Total	**31.66**	**51.28**	**11,080.02**	**700.22**	

Source: Rao 2015.

the umbrella of AIC's Weather-Based Crop Insurance Scheme), and in 2010 it launched a Modified NAIS (mNAIS), which is a market-based actuarially rated program (described in Box A4.2).

The Indian crop insurance program has expanded significantly in recent years. In 2008, NAIS was insuring 18 million farmers (16 percent of all rural households, of which two-thirds were small and marginal farmers with less than 2 hectares) and generated total premiums of Rs 800 crore (US$178 million) (World Bank 2011). In 2013–14, with the addition of the Weather-Based Crop Insurance Scheme and modified mNAIS, the number of insured farmers had risen to 34 million (24 percent of all farming households) with premiums of US$700 million (Table A4.1).

Between the start of NAIS in 2000 and 2014, the program insured nearly 229 million farmers. Over this period, 59 million farmers (26 percent of total) have received a claim payment, but on account of the capped premium rates (average rate of 3.0 percent), the program has operated at a huge financial loss (cost to government), as shown by the loss ratio of 314 percent (or a payout of Rs 3.14 for every Rs 1.0 of collected premium) (Table A4.2). While NAIS has successfully provided crop credit and insurance for about one in four Indian farmers, the program has also been criticized at several levels, including: (1) the basis risk associated with unit areas of insurance that are too large and a number of CCEs that are too low, (2) the significant delays in settling claims (often 6–9 months), and (3) the unpredictable and unbudgeted financial burden to the state

TABLE A4.2: INDIA: SUMMARY OF COVERAGE AND PERFORMANCE OF PUBLIC SECTOR SUBSIDIZED CROP INDEX INSURANCE FOR SMALL FARMERS

Program	Period	Number of Farmers Insured (000)	Area Insured (000 Ha)	Sum Insured (Rs. Crore)	Premium (Rs. Crore)	Average Premium Rate %	Premium Subsidy (Rs.Crore)	% Premium subsidy	Claims (Rs. Crore)	Loss ratio %	No. Farmers receiving a Payout (000)	%farmers receiving a payout
National Agricultural Insurance Scheme NAIS	Rabi 1999/2000 to Kharif 2014 (30 seasons)	229,349	339,674	349,667	10,599	3.0%	1,392	13%	33,329	314%	59,154	26%
Modified NAIS	Rabi 2010/11 to Kharif 2014 (8 seasons)	9,681	10,836	21,359	2,363	11.1%	1,444	61%	1,719	73%	1,656	17%
Weather Based Crop Insurance Scheme (WBCIS)	Kharif 2007 to Kharif 2014 (16 Seasons)	34,136	45,987	62,714	5,950	9.5%	3,948	66%	4,079	69%	19,006	56%

Source: AIC, http://www.aicofindia.com/

and national governments of compensating excess claims (World Bank 2011). For these reasons, in 2005 the Government of India requested assistance from the World Bank to reform the NAIS.

As noted, the Government of India has heavily promoted weather-based crop index insurance since 2007. Many types of WII coverage have been tested in India over the past decade, including: total seasonal rainfall indexes; weighted rainfall indexes; multiple-phase weather indexes where the growing season for a named crop is divided into phases from sowing and germination to the vegetative stage, flowering, grain formation, and maturity; specific indexes for excess rain, high or low temperature, and humidity; and even weather indices for pests and diseases (Clarke et al. 2012). The Weather-Based Crop Insurance Scheme has proved popular with the state governments of India, several of which have switched from NAIS to a Weather-Based Crop Insurance Scheme linked to credit. Between 2007 and 2014, the scheme has insured 34 million farmers. Actuarially determined premium rates are again high at 9.5 percent on average, and attract very high levels of government premium subsidies (66 percent on average). The program operated profitably between 2007 and 2014, with a loss ratio of 69 percent (Table A4.2). The main criticisms of WII programs in India center on spatial and product basis risk (Clarke et al. 2012; Rao 2014; see further discussion below).

In 2016, the government announced a radical plan to replace the NAIS and mNAIS programs with a single program termed the Pradan Mantri Fasal Bima Yogana (PMFBY, Prime Minister's Crop Insurance Scheme). The main change is that the government will revert to charging farmers flat or capped premium rates, on account of its concern that mNAIS is too expensive for farmers to afford. Farmers in the future will pay a uniform premium rate of 2.0 percent for Kharif crops and 1.5 percent for Rabi crops, while the rate for commercial and horticultural crops will be 5 percent. The rest of the premium will be paid by the government with no upper limit on the subsidy amount—in other words, rates will be actuarially determined, and government will settle the difference between the flat rate paid by the farmer and the rate charged by the insurer. The program will be open to all 4 public sector insurance companies (including AIC) and to 11 private sector insurers that are involved in crop insurance provision. The government hopes to roll out PMFBY to 50 percent of farmers over the next two years, which would require coverage to increase by roughly 100 million people.

BRAZIL

Brazil introduced a maize-seed AYII program for small farmers in 2001 under a PPP between the government of Rio Grande do Sul State, local insurers, and international reinsurers. The AYII coverage—known as the Grupo de Risco Municipalizado (GRM, Municipalized Risk Group) program—was linked to the state government maize seed swap program.[56] The seed swap program was aimed at introducing new hybrid maize and was a voluntary crop insurance program for individual farmers. The insured unit was the municipality, and in the first year the program provided a fixed insured yield coverage level of 90 percent of the expected or average maize yield for the municipality, which was reduced to 80 percent coverage in subsequent years. The state government provided very high premium subsidies (around 90 percent of the premium costs) to promote the

[56]Programa Troca Troca de Sementes (PTTS).

BOX A4.3: BRAZIL'S MAIZE AYII PROGRAM IN RIO GRANDE DO SUL STATE

The Grupo de Municipalized Group Risk (Risco Municipalizado, GRM) plan was a public-private partnership between the State Department of Agriculture and Supply (SSAA), the State Bank of Rio Grande do Sul (BANRISUL), the State Data Processing Company (PROCERGIS), various private local insurers, IRB (the national reinsurer), and international reinsurers. At its launch in 2001, the program was underwritten by Porto Seguro Insurance Company, with reinsurance support from PartnerRe. Agro-Brazil, a private risk management agency based in Rio Grande do Sul, implemented the program. The GRM product used the average maize yield at the municipality level as the index for triggering payouts to insured farmers. The Brazilian Institute of Geography and Statistics (IBGE) provided historical and real-time (i.e., during the insurance coverage period) maize production and yield data in each municipality (the insured unit). The insured yield level was initially set in 2001–02 at 90 percent of the expected yield in each municipality but adjusted downwards to 80 percent coverage across all states in 2002–03 to avoid over-insurance of actual average yields. The program was marketed on a voluntary basis to farmers participating in the state maize seed swap program (PTTS). The sum insured was based on the cost of maize production and specifically included the cost of hybrid seed provided under PTTS; it varied from a low of Real (R)$ 200 per hectare to a maximum of R$ 1,000 per hectare. Premium rates varied from an average low of 11.1 percent in 2001–02 for 90 percent coverage to a maxim average of 17.1 percent for 80 percent coverage in 2007–08. The program experienced a high loss ratio in Year 1 of 215 percent, largely because expected yields were overestimated (they were subsequently corrected). The loss ratio in 2004–05, a severe drought year in Rio Grande do Sul, was 377 percent. The overall loss ratio was 80.1 percent over the life of the GRM. The main operational drawback of the program was that IBGE publishes crop yield estimates by municipality and state in October, so farmers had to wait 3–6 months to receive payouts.

GRM MAIZE RESULTS 2001–02 TO 2007–08

Crop year	Number insured farmers	Sum insured (RS)	Premium (R$)	Average premium rate %	Number claims payouts	Value of payouts (RS)	Loss ratio %
2001–02	25,068	17,804,385	1,978,154	11.1	17,590	4,247,742	215
2002–03	38,620	28,445,320	4,174,436	14.7	59	5,550	0
2003–04	20,122	14,993,630	2,278,775	15.2	4,254	1,063,611	47
2004–05	24,151	19,320,800	2,749,323	14.2	23,248	10,364,084	377
2005–06	46,175	36,940,000	6,139,370	16.6	9,547	1,914,202	31
2006–07	25,071	20,056,800	3,343,580	16.7	129	30,461	1
2007–08	14,893	11,914,400	2,037,171	17.1	2,951	593,551	29
Total	**194,100**	**149,475,335**	**22,700,809**	**15.2**	**57,778**	**18,219,201**	**80**

Source: IFAD and WFP 2010.

program and make it more affordable to the farmers, defined as those with less than 80 hectares. The Instituto Brasileiro de Geografia e Estatística (IBGE, Brazilian Institute of Geography and Statistics) provided historical data on maize production and yield at the municipality level for contract design and rating analysis. IBGE was also appointed as the official organization responsible for declaring the average maize yield in each municipality. Payouts to individual farmers were triggered when the actual municipality average maize yield fell short of the 80 percent trigger yield. The program operated until 2007–08. Over its lifespan, the program insured 194,100 maize farmers, issued claim payments to nearly 58,000 farmers, and had an overall loss ratio of 80.3 percent. A key lesson from this program was that great caution should be taken in starting up a new AYII program to avoid overestimating expected yield potential, and also in setting the maximum insured yield coverage at a realistic level of no more than 80 percent (IFAD and WFP 2010). Further details of the program are included in Box A4.3.

USA

In the USA, AYII is marketed under the Group Risk Plan (GRP). Rather than being based on the yield loss experienced by each individual farmer, payouts under the GRP are based on the actual value of an area yield index in a certain area (the insured unit), which in the USA is the county (the average insured unit is 2,500 square kilometers). A farmer is indemnified when the actual yield for the insured crop in the county where the insured is

situated, as determined by the National Agricultural Statistics Service, falls below the guaranteed yield chosen by the farmer. Under the GRP, farmers can choose among different coverage levels (insured yield options): 90 percent, 85 percent, 80 percent, 75 percent, or 70 percent of the expected county yield. The sum insured for each crop is based on a percentage of the expected market price. The grower may elect an insured value of between a minimum of 90 percent and a maximum of 150 percent of the expected market price. The justification for permitting growers to insure at up to 150 percent of the expected market price is that this affords adequate protection for growers whose own yields are higher than the county average. Final payments are not determined until six months after the crop is harvested, when the National Agricultural Statistics Service releases the actual yields for each county. Payments are then made within 30 days. GRP insurance policies are easier to administrate and less costly than the traditional individual grower MPCI policy. The GRP policies may not cover individual crop losses, however, if the county yield does not suffer a similar level of loss. This type of insurance is most appropriate for farmers whose crop production and yields (and losses) typically follow the county pattern.

ANNEX 5

RESULTS OF PRELIMINARY AYII COVERAGE AND RATING ANALYSIS FOR LODHRAN DISTRICT, PUNJAB

The tables and figures that follow present data on area and yields of the five main crops (wheat, cotton, rice, maize, and sugarcane) over 10 years in Kehror Pacca, Dunyapur, and Lodhran tehsils of Lodhran District, along with the results of AYII rating analysis using actual and detrended yields.

For wheat, there is very little evidence of any trend toward increasing yields over the past 10 years in these three tehsils (Table A5.1, Figure A5.1). Table A5.2 shows the AYII rating analysis results with average and detrended wheat yields for the three tehsils.

TABLE A5.1: WHEAT CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)

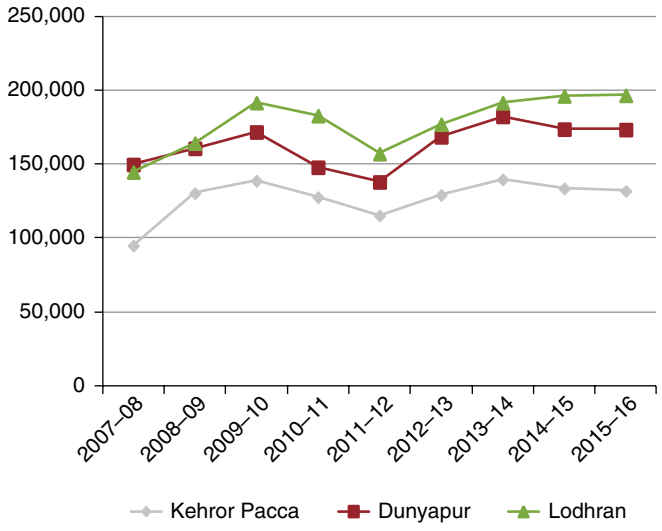
Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	95,082	149,926	144,837
2008-09	130,530	160,880	164,392
2009-10	138,917	171,924	191,770
2010-11	127,801	148,070	182,965
2011-12	115,441	138,130	157,231
2012-13	129,260	168,657	177,182
2013-14	139,844	182,466	191,690
2014-15	133,759	173,857	196,292
2015-16	132,014	173,565	196,729
2016-17	132,458	174,150	197,392
Average	**126,961**	**163,053**	**178,121**
StDev	13,912	14,735	18,721
Cov	11%	9%	11%
Min	95,082	138,130	144,837
Max	139,844	182,466	196,729

(b) Average yield (kg/acre)

Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	1,122	1,165	1,074
2008-09	1,535	1,565	1,387
2009-10	1,370	1,187	1,275
2010-11	1,446	1,427	1,463
2011-12	1,294	1,262	1,375
2012-13	1,401	1,355	1,388
2013-14	1,606	1,618	1,651
2014-15	1,196	1,310	1,281
2015-16	1,371	1,360	1,524
2016-17	1,526	1,585	1,668
Average	**1,387**	**1,383**	**1,408**
StDev	152	163	180
Cov	11.0%	12%	13%
Min	1,122	1,165	1,074
Max	1,606	1,618	1,668

FIGURE A5.1: WHEAT CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)



(b) Average yield (kg/acre)

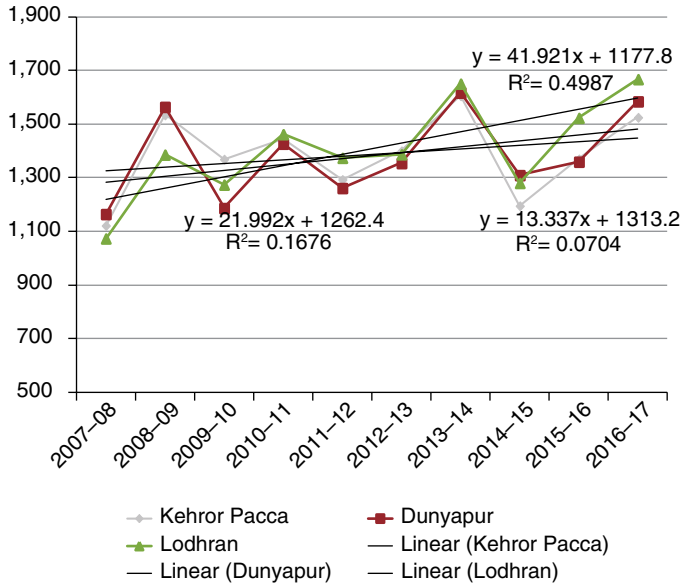


TABLE A5.2: WHEAT AYII RATING ANALYSIS BASED ON ACTUAL AVERAGE AND DETRENDED YIELDS

5 Year - Average Yield excluding min and max years

Kehror Pacca	Average Yield (Kg/Acre)		1,432		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	1289	2.02%	12.94%	2.66%	3.06%	3.46%	4.00%
80%	1146	0.21%	2.06%	0.31%	0.35%	0.40%	0.46%
70%	1002	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	859	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	716	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/Acre)		1,433		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	1,290	1.98%	9.70%	2.47%	2.84%	3.21%	3.70%
80%	1,147	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,003	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	860	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	717	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/Acre)		1,521		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%		3.48%	21.55%	4.56%	5.25%	5.93%	6.84%
80%		1.17%	11.74%	1.76%	2.03%	2.29%	2.64%
70%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Detrended Yields

Kehror Pacca	Average Yield (Kg/Acre)		1,460		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30%load)	Hard (50% Load)
90%	1,314	1.04%	5.94%	1.33%	1.53%	1.73%	2.00%
80%	1,168	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
70%	1,022	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
60%	876	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50%	730	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Dunyapur	Average Yield (Kg/Acre)		1,504		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30%load)	Hard (50% Load)
90%	1,354	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
80%	1,203	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,053	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	902	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	752	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/Acre)		1,639		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30%load)	Hard (50% Load)
90%	1,475	0.46%	4.63%	0.69%	0.80%	0.90%	1.04%
80%	1,311	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,147	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	983	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	820	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

For cotton, there is no clear trend toward increasing yields over time in the three tehsils (Table A5.3, Figure A5.2). Average yields per acre have been severely reduced in two years out of ten, however—namely in 2009–10 and again in 2015–16. In 2015–16 excess rain, high temperatures, and pest attacks led to a major reduction in cotton production and yields in Punjab Province. Table A5.4 shows the AYII rating analysis results with average and detrended cotton yields for the three tehsils.

TABLE A5.3: COTTON CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)

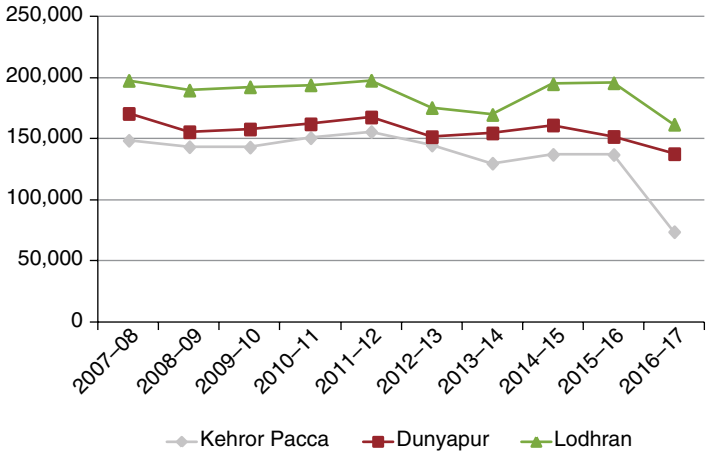
Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	148,528	170,491	197,532
2008-09	143,262	155,520	189,585
2009-10	142,970	157,760	192,270
2010-11	150,625	161,965	193,882
2011-12	155,674	167,583	197,617
2012-13	144,626	151,477	175,299
2013-14	129,807	154,537	169,656
2014-15	137,014	161,049	194,794
2015-16	136,916	151,655	195,570
2016-17	73,776	137,566	161,658
Average	**136,320**	**156,960**	**186,786**
StDev	23,201	9,313	12,992
Cov	17%	6%	7%
Min	73,776	137,566	161,658
Max	155,674	170,491	197,617

(b) Average yield (kg/acre)

Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	656	468	448
2008-09	587	634	593
2009-10	509	381	667
2010-11	877	997	1,024
2011-12	959	1,024	952
2012-13	693	758	807
2013-14	760	787	981
2014-15	773	803	1,001
2015-16	311	353	358
2016-17	757	758	751
Average	**688**	**696**	**758**
StDev	186	235	238
Cov	27%	34%	31%
Min	311	353	358
Max	959	1,024	1,024

FIGURE A5.2: COTTON CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)



(b) Average yield (kg/acre)

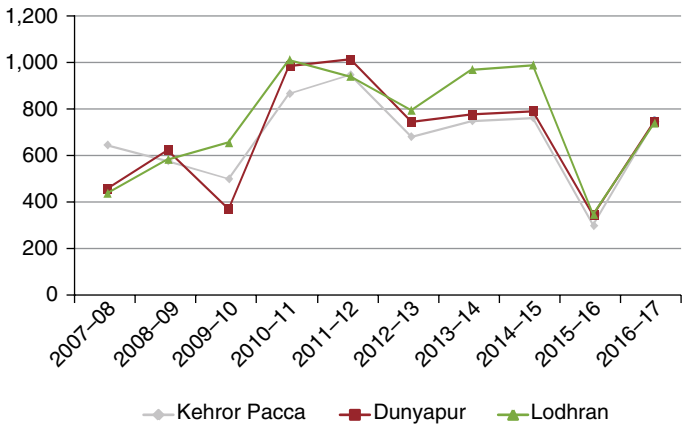


TABLE A5.4: COTTON AYII RATING ANALYSIS BASED ON ACTUAL AVERAGE AND DETRENDED YIELDS

5 Year - Average Yield excluding min and max years

Kehror Pacca	Average Yield (Kg/Acre)		737		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	663	8.87%	53.15%	11.53%	13.26%	14.99%	17.30%
80%	590	6.12%	47.30%	8.48%	9.76%	11.03%	12.73%
70%	516	4.10%	39.77%	6.09%	7.00%	7.92%	9.14%
60%	442	2.97%	29.73%	4.46%	5.13%	5.80%	6.69%
50%	369	1.57%	15.68%	2.35%	2.70%	3.06%	3.53%

Dunyapur	Average Yield (Kg/Acre)		768		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	691	13.42%	48.83%	15.86%	18.24%	20.61%	23.79%
80%	614	10.41%	42.43%	12.54%	14.42%	16.30%	18.80%
70%	538	7.62%	34.21%	9.33%	10.73%	12.12%	13.99%
60%	461	4.06%	23.25%	5.22%	6.00%	6.79%	7.83%
50%	384	0.87%	7.89%	1.26%	1.45%	1.64%	1.90%

Lodran	Average Yield (Kg/Acre)		846		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	761	13.00%	53.03%	15.65%	18.00%	20.35%	23.48%
80%	677	9.47%	47.16%	11.82%	13.60%	15.37%	17.74%
70%	592	6.39%	39.61%	8.37%	9.63%	10.88%	12.56%
60%	508	4.12%	29.55%	5.60%	6.44%	7.28%	8.40%
50%	423	1.55%	15.46%	2.32%	2.67%	3.01%	3.48%

Detrended Yields

Kehror Pacca	Average Yield (Kg/Acre)		677		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	609	7.53%	49.70%	10.02%	11.52%	13.02%	15.03%
80%	542	5.24%	43.41%	7.41%	8.52%	9.63%	11.11%
70%	474	3.53%	35.33%	5.30%	6.09%	6.89%	7.95%
60%	406	2.45%	24.55%	3.68%	4.23%	4.79%	5.52%
50%	339	0.95%	9.46%	1.42%	1.63%	1.84%	2.13%

Dunyapur	Average Yield (Kg/Acre)		758		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	682	9.08%	44.90%	11.33%	13.02%	14.72%	16.99%
80%	606	6.47%	38.02%	8.37%	9.62%	10.88%	12.55%
70%	531	4.05%	29.16%	5.51%	6.33%	7.16%	8.26%
60%	455	1.74%	17.36%	2.60%	2.99%	3.38%	3.90%
50%	379	0.08%	0.83%	0.12%	0.14%	0.16%	0.19%

Lodran	Average Yield (Kg/Acre)		840		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	756	7.35%	48.76%	9.79%	11.26%	12.73%	14.68%
80%	672	5.34%	42.36%	7.46%	8.58%	9.70%	11.19%
70%	588	3.41%	34.13%	5.12%	5.89%	6.65%	7.68%
60%	504	2.31%	23.15%	3.47%	3.99%	4.51%	5.21%
50%	420	0.78%	7.78%	1.17%	1.34%	1.52%	1.75%

For rice, as shown in Table A5.5 and Figure A5.3, there is a slight gradual trend of increasing average annual yields in all three tehsils over the past ten years. Table A5.6 shows the AYII rating analysis results with average and detrended rice yields for the three tehsils.

TABLE A5.5: RICE CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)

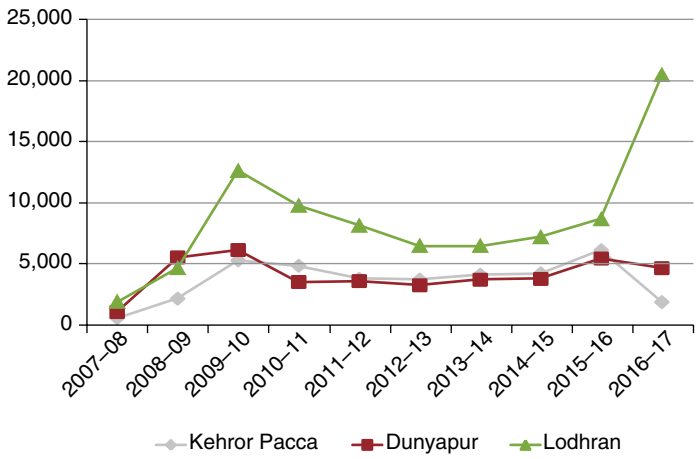
Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	581	1,069	1,909
2008-09	2,162	5,540	4,662
2009-10	5,293	6,144	12,615
2010-11	4,853	3,530	9,762
2011-12	3,793	3,603	8,127
2012-13	3,723	3,257	6,481
2013-14	4,124	3,712	6,481
2014-15	4,240	3,778	7,189
2015-16	6,128	5,446	8,661
2016-17	1,883	4,659	20,463
Average	**3,678.00**	**4,073.80**	**8,635.00**
StDev	1,687.64	1,456.50	5,051.57
Cov	46%	36%	59%
Min	581.00	1,069.00	1,909.00
Max	6,128.00	6,144.00	20,463.00

(b) Average yield (kg/acre)

Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	1,265	1,278	1,229
2008-09	1,098	948	1,117
2009-10	1,022	1,189	1,132
2010-11	1,201	961	1,269
2011-12	1,299	1,338	1,412
2012-13	1,097	978	1,043
2013-14	1,504	1,499	1,458
2014-15	1,504	1,499	1,458
2015-16	1,564	1,613	1,825
2016-17	1,294	1,269	1,369
Average	**1,285**	**1,257**	**1,331**
StDev	189	240	228
Cov	15%	19%	17%
Min	1,022	948	1,043
Max	1,564	1,613	1,825

FIGURE A5.3: RICE CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)



(b) Average yield (kg/acre)

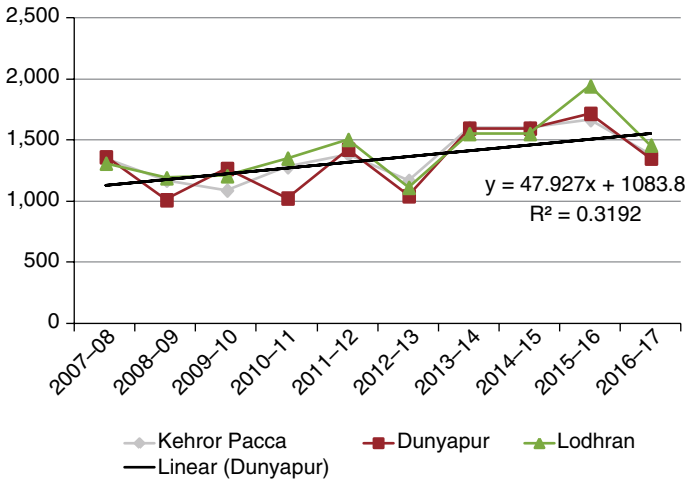


TABLE A5.6: RICE AYII RATING ANALYSIS BASED ON ACTUAL AVERAGE AND DETRENDED YIELDS

5 Year - Average Yield excluding min and max years

Kehror Pacca	Average Yield (Kg/ Acre)		1,434		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	1,291	5.96%	20.80%	7.00%	8.05%	9.09%	10.49%
80%	1,147	1.95%	10.90%	2.50%	2.87%	3.24%	3.74%
70%	1,004	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	860	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	717	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/ Acre)		1,422		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	1,291	8.27%	25.97%	9.57%	11.00%	12.44%	14.35%
80%	1,147	4.63%	16.72%	5.47%	6.29%	7.11%	8.20%
70%	1,004	1.00%	4.82%	1.25%	1.43%	1.62%	1.87%
60%	860	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	717	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/ Acre)		1,428		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	1,291	4.95%	18.83%	5.89%	6.77%	7.65%	8.83%
80%	1,147	1.18%	8.68%	1.61%	1.86%	2.10%	2.42%
70%	1,004	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	860	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	717	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Detrended Yields

Kehror Pacca	Average Yield (Kg/ Acre)		1,506		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30%load)	Hard (50% Load)
90%	1,355	0.67%	4.23%	0.88%	1.01%	1.14%	1.32%
80%	1,205	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,054	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	904	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	753	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/ Acre)		1,503		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30%load)	Hard (50% Load)
90%	1,355	2.01%	11.16%	2.57%	2.95%	3.34%	3.85%
80%	1,205	0.01%	0.06%	0.01%	0.01%	0.01%	0.01%
70%	1,054	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	904	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	753	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/ Acre)		1,599		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30%load)	Hard (50% Load)
90%	1,355	1.21%	10.59%	1.74%	2.00%	2.26%	2.61%
80%	1,205	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,054	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	904	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	753	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

For maize, the cultivated area increased significantly in 2016–17, especially in Kehror Pacca Tehsil. Average maize yields show a marked increasing trend since 2014–15, with an average increase over this period of about 1 metric ton per acre (Table A5.7, Figure A5.4). According to DoA-GoPunjab, the increase is the result of higher yields obtained from introducing new hybrid maize varieties, coupled with government support programs for balanced fertilizer use and improved crop management practices.

As shown in the examples for maize grown in Dunyapur (Figures A5.5 and A5.6), it is extremely important to detrend yields for crop area yield ratings. Table A5.8 shows the AYII rating analysis results with average and detrended maize yields for the three tehsils.

TABLE A5.7: MAIZE CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)

Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	543	1,016	841
2008-09	1,182	2,214	1,833
2009-10	1,153	2,159	1,788
2010-11	1,680	1,846	1,614
2011-12	1,678	1,774	1,544
2012-13	2,552	2,135	1,486
2013-14	5,577	3,777	1,486
2014-15	5,290	2,984	1,889
2015-16	7,493	2,960	2,097
2016-17	51,459	13,273	7,003
Average	**7,861**	**3,414**	**2,158**
StDev	15,494	3,548	1,735
Cov	197%	104%	80%
Min	543	1,016	841

(b) Average yield (kg/acre)

Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	1,845	1,718	1,140
2008-09	1,845	1,492	1,140
2009-10	1,307	1,310	1,314
2010-11	1,697	1,285	1,754
2011-12	1,891	1,872	1,754
2012-13	1,820	2,016	1,816
2013-14	1,705	1,370	1,592
2014-15	2,853	3,106	2,146
2015-16	2,973	2,638	2,806
2016-17	2,668	2,084	2,318
Average	**2,060**	**1,889**	**1,778**
StDev	561	601	532
Cov	27%	32%	30%
Min	1,307	1,285	1,140
Max	2,973	3,106	2,806

Dunyapur Maize: Historical Burn Analysis Based on Actual 10-year Yields

Average yield in 3 out of last 5 years = 2,246 kg/acre
80 percent yield coverage, insured yield = 1,797 kg/acre

Actual yields would have been below the 80 percent insured yield in five out of 10 years (2007–08, 2008–09, 2009–20, 2010–11, and 2013–14), equal to an annual average yield shortfall over 10 years of 10.07 percent of the insured yield.

FIGURE A5.4: MAIZE CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

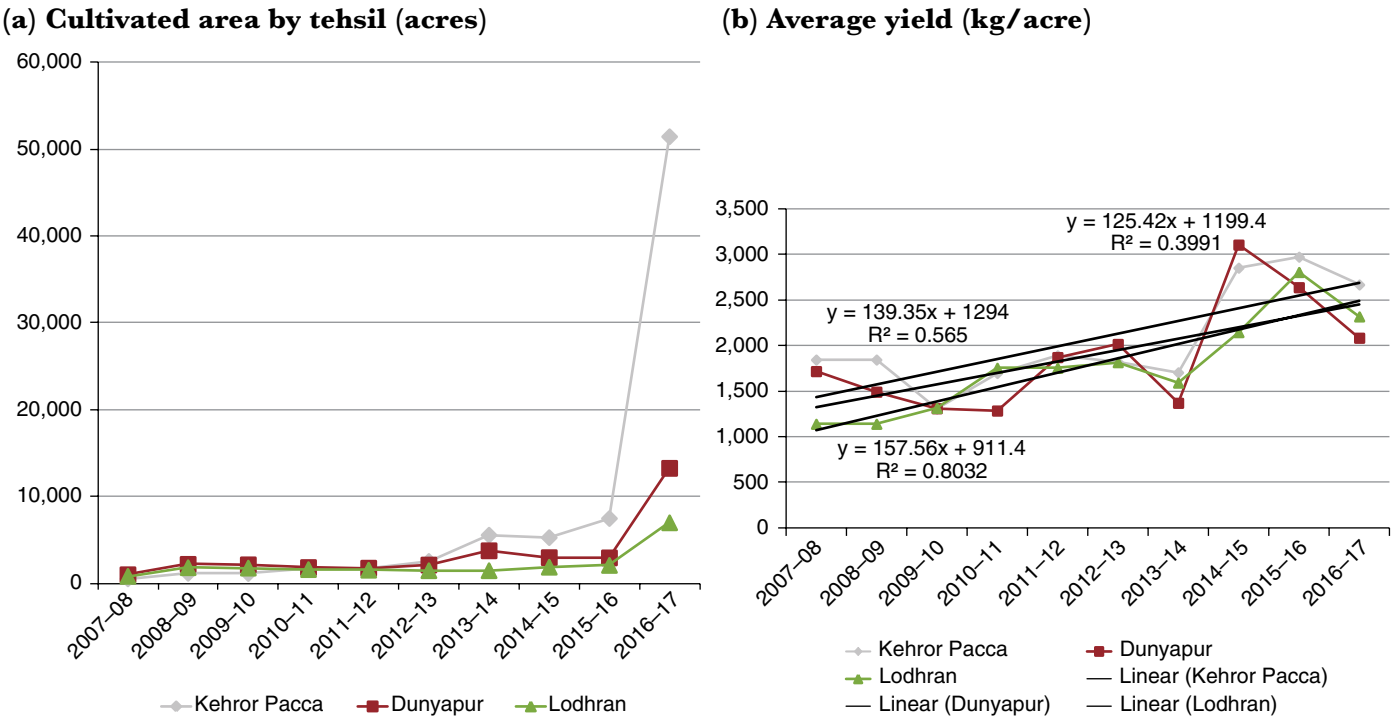
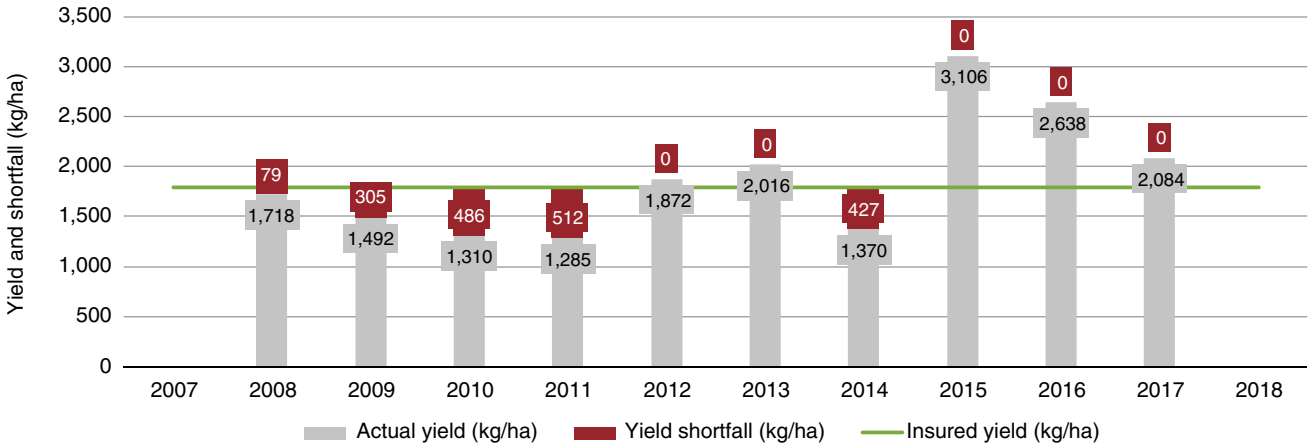


FIGURE A5.5: MAIZE YIELD AND SHORTFALL BASED ON ACTUAL 10-YEAR YIELDS



Historical performance of key variables

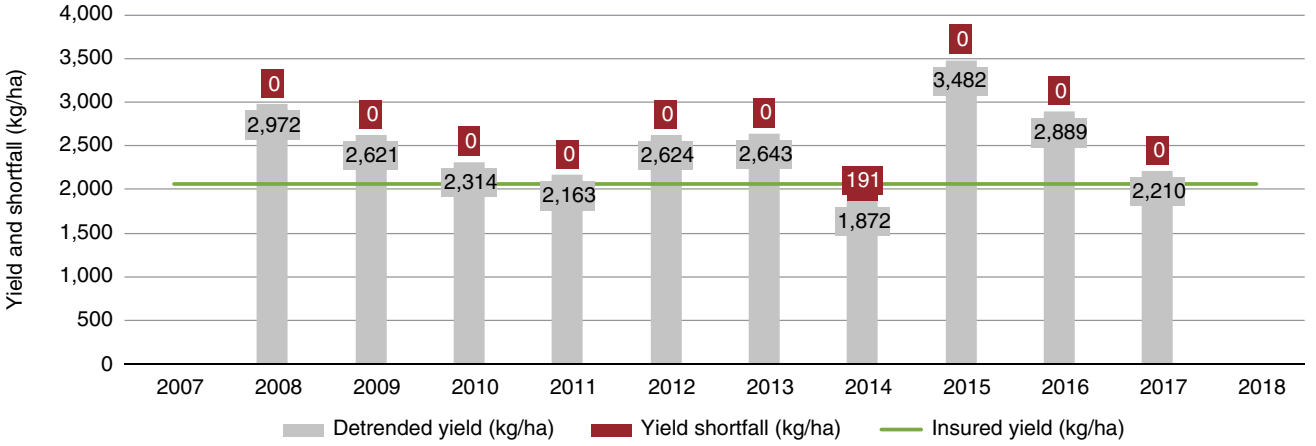
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Insured yield (kg/ha)	1,797	1,797	1,797	1,797	1,797	1,797	1,797	1,797	1,797	1,797	1,797	1,797	
Actual yield (kg/ha)		1,718	1,492	1,310	1,285	1,872	2,016	1,370	3,106	2,638	2,084		Average
Yield shortfall (kg/ha)		79	305	486	512	0	0	427	0	0	0		shortfall
Yield shortfall (% of ins. Y)		4.4%	17.0%	27.1%	28.5%	0.0%	0.0%	23.7%	0.0%	0.0%	0.0%		10.07%

Dunyapur Maize: Historical Burn Analysis Based on Detrended 10-year Yields

Average detrended yield = 2,579 kg/acre
80 percent yield coverage, insured yield = 2,063 kg/acre

Detrended yields would have been below the 80 percent insured yield in only one out of 10 years (2013–14), equal to an annual average yield shortfall over 10 years of 0.93 percent of the insured yield.

FIGURE A5.6: MAIZE YIELD AND SHORTFALL BASED ON DETRENDED 10-YEAR YIELDS



Historical performance of key variables

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Insured yield (kg/ha)	2,063	2,063	2,063	2,063	2,063	2,063	2,063	2,063	2,063	2,063	2,063	2,063	
Detrended yield (kg/ha)		2,972	2,621	2,314	2,163	2,624	2,643	1,872	3,482	2,889	2,210		Average
Yield shortfall (kg/ha)		0	0	0	0	0	0	191	0	0	0		shortfall
Yield shortfall (% of Ins. Y)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.3%	0.0%	0.0%	0.0%		0.93%

TABLE A5.8: MAIZE AYII RATING ANALYSIS BASED ON ACTUAL AVERAGE AND DETRENDED YIELDS

5 Year - Average Yield excluding min and max years

Kehror Pacca	Average Yield (Kg/ Acre)		2,447		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	2,202	15.01%	40.63%	17.05%	19.60%	22.16%	25.57%
80%	1,958	8.14%	33.21%	9.80%	11.27%	12.74%	14.70%
70%	1,713	2.51%	23.67%	3.69%	4.25%	4.80%	5.54%
60%	1,468	1.10%	10.95%	1.64%	1.89%	2.14%	2.46%
50%	1,224	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/ Acre)		2,246		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	2,021	15.27%	36.43%	17.09%	19.66%	22.22%	25.64%
80%	1,797	10.07%	28.49%	11.49%	13.21%	14.94%	17.23%
70%	1,572	5.29%	18.27%	6.20%	7.13%	8.06%	9.30%
60%	1,348	0.74%	4.65%	0.97%	1.12%	1.27%	1.46%
50%	1,123	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/ Acre)		2,093		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	1,884	14.21%	39.50%	16.19%	18.62%	21.04%	24.28%
80%	1,674	9.03%	31.94%	10.63%	12.23%	13.82%	15.95%
70%	1,465	5.47%	22.21%	6.58%	7.57%	8.56%	9.88%
60%	1,256	1.85%	9.25%	2.31%	2.66%	3.01%	3.47%
50%	1,047	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Detrended Yields

Kehror Pacca	Average Yield (Kg/ Acre)		2,827		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	2,544	1.69%	11.09%	2.25%	2.59%	2.92%	3.37%
80%	2,262	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,979	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	1,696	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	1,414	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/ Acre)		2,579		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	2,321	3.13%	19.36%	4.10%	4.71%	5.33%	6.14%
80%	2,063	0.93%	9.27%	1.39%	1.60%	1.81%	2.09%
70%	1,805	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	1,547	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	1,290	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/ Acre)		2,645		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	2,381	0.66%	6.64%	1.00%	1.15%	1.29%	1.49%
80%	2,116	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	1,852	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	1,587	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	1,323	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

In sugarcane, there is a small trend toward increasing yields per acre over the past 10 years (Table A5.9, Figure A5.7). Table A5.10 shows the AYII rating analysis results with average and detrended sugarcane yields for the three tehsils.

TABLE A5.9: SUGARCANE CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)

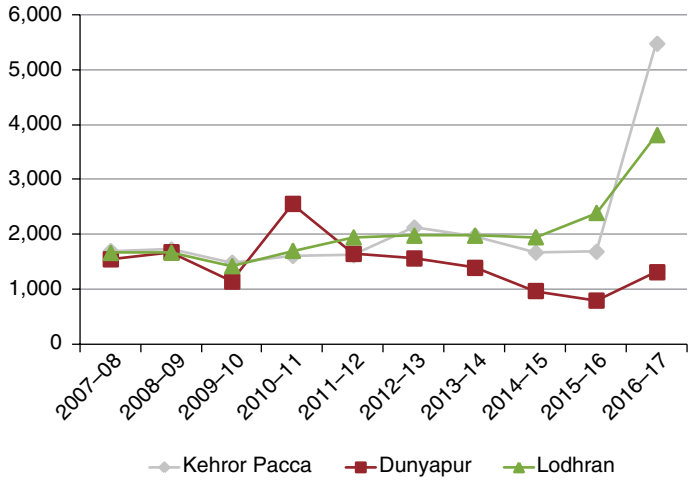
Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	1,693.00	1,543.00	1,660.00
2008-09	1,722.00	1,673.00	1,663.00
2009-10	1,482.00	1,136.00	1,418.00
2010-11	1,604.00	2,556.00	1,698.00
2011-12	1,616.00	1,642.00	1,942.00
2012-13	2,123.00	1,559.00	1,974.00
2013-14	1,971.00	1,387.00	1,974.00
2014-15	1,666.00	964.00	1,946.00
2015-16	1,681.00	789.00	2,390.00
2016-17	5,480.00	1,307.00	3,812.00
Average	**2,103.80**	**1,455.60**	**2,047.70**
StDev	1,200.74	486.05	673.25
Cov	57%	33%	33%
Min	1,482.00	789.00	1,418.00
Max	5,480.00	2,556.00	3,812.00

(b) Average yield (kg/acre)

Year	Kehror Pacca	Dunyapur	Lodhran
2007-08	24,034	23,785	24,902
2008-09	22,135	20,158	20,086
2009-10	20,846	17,029	25,656
2010-11	22,464	20,468	24,418
2011-12	21,012	20,611	25,358
2012-13	25,863	18,622	26,447
2013-14	25,863	18,622	26,447
2014-15	27,289	22,240	22,984
2015-16	28,915	25,131	29,911
2016-17	27,638	23,961	28,803
Average	**24,606**	**21,063**	**25,501**
StDev	2,910	2,652	2,776
Cov	12%	13%	11%
Min	20,846	17,029	20,086
Max	28,915	25,131	29,911

FIGURE A5.7: SUGARCANE CULTIVATED AREA AND AVERAGE YIELDS, 2007–08 TO 2016–17

(a) Cultivated area by tehsil (acres)



(b) Average yield (kg/acre)

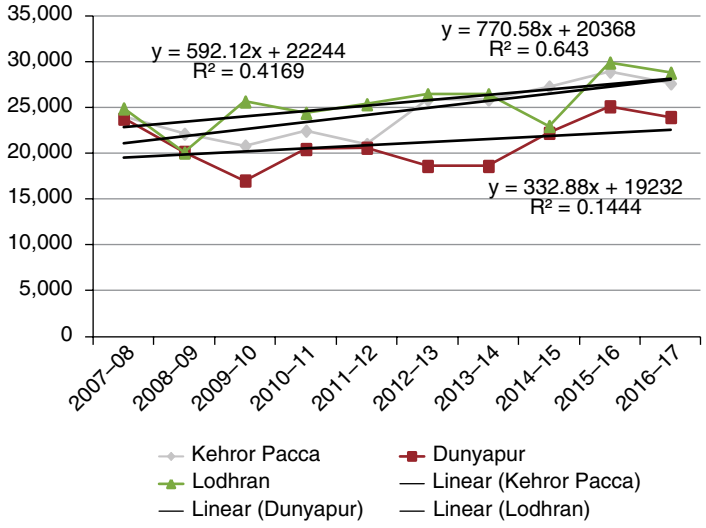


TABLE A5.10: SUGARCANE AYII RATING ANALYSIS BASED ON ACTUAL AVERAGE AND DETRENDED YIELDS

5 Year - Average Yield excluding min and max years

Kehror Pacca	Average Yield (Kg/ Acre)		27,463		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	24,717	5.30%	15.66%	6.08%	6.99%	7.90%	9.12%
80%	21,970	0.95%	5.12%	1.20%	1.39%	1.57%	1.81%
70%	19,224	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	16,478	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	13,732	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/ Acre)		23,100		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	20,790	4.44%	18.09%	5.35%	6.15%	6.95%	8.02%
80%	18,480	0.79%	7.85%	1.18%	1.35%	1.53%	1.77%
70%	16,170	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	13,860	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	11,550	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/ Acre)		27,232		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	24,509	2.46%	18.05%	3.37%	3.87%	4.38%	5.05%
80%	21,786	0.78%	7.80%	1.17%	1.35%	1.52%	1.76%
70%	19,062	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	16,339	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	13,616	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Detrended Yields

Kehror Pacca	Average Yield (Kg/ Acre)		28,884		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	25,996	0.13%	1.25%	0.19%	0.22%	0.24%	0.28%
80%	23,107	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	20,219	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	17,330	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	14,442	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Dunyapur	Average Yield (Kg/ Acre)		22,893		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	20,604	0.91%	4.43%	1.13%	1.30%	1.47%	1.70%
80%	18,314	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	16,025	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	13,736	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	11,447	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Lodran	Average Yield (Kg/ Acre)		28,758		Range of Indicative Comm. Premium		
Insured Yield Coverage level	Insured Yield (Kg/ Acre)	Annual Average Loss	Worst Annual Loss	Technical Premium (5% WAL)	Soft (15% load)	Medium (30% load)	Hard (50% Load)
90%	25,882	0.61%	4.33%	0.83%	0.96%	1.08%	1.25%
80%	23,006	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70%	20,131	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
60%	17,255	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50%	14,379	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

ANNEX 6

THE CADENA PROGRAM IN MEXICO: STATE-LEVEL CATASTROPHE INSURANCE AS A SAFETY NET FOR SMALLHOLDERS

ORIGINS OF A NATIONAL SAFETY NET PROGRAM FOR POOR FARMERS

Mexico is unique in having a national- and state-level parametric insurance program (Seguro Catastrófico Agropecuario, SAC) designed specifically to provide social safety net protection for the large numbers of small, semisubsistence farming households in rural areas who experience climate-induced catastrophes but are below the threshold of insurability by the commercial sector.[57] In 2003, Mexico was the first country in the world to recognize the potential of replacing traditional ad-hoc post disaster relief schemes with formal parametric crop and livestock insurance solutions at the state level.

Since 1995, the federal and state governments had operated an ex-post national scheme under FONDEN,[58] ***a program that provided financial compensation to small rural farming families who had been affected by natural disasters but were not eligible for private crop and livestock insurance.*** Between 1995 and 2003, the federal and state governments paid out US$212 million and US$74 million, respectively, in direct support payments to small rural farmers under FONDEN. In 2003, under FAPRACC[59]—a fund to support rural people affected by climatic events—the government contracted Agroasemex, the national agricultural reinsurer, to substitute the ex-post disaster compensation programs with an ex-ante macro-level index insurance for catastrophic climatic perils (Agroasemex 2006).

[57]This annex draws extensively on two reports about CADENA to which the author was a major contributor: World Bank (2013); Arias et al. (2014).
[58]Fondo de Desastres Naturales (Natural Disaster Fund).
[59]Fondo para Atender a la Población Rural Afectada por Contingencias Climatológicas (Support Fund for Rural People Affected by Climatic Events).

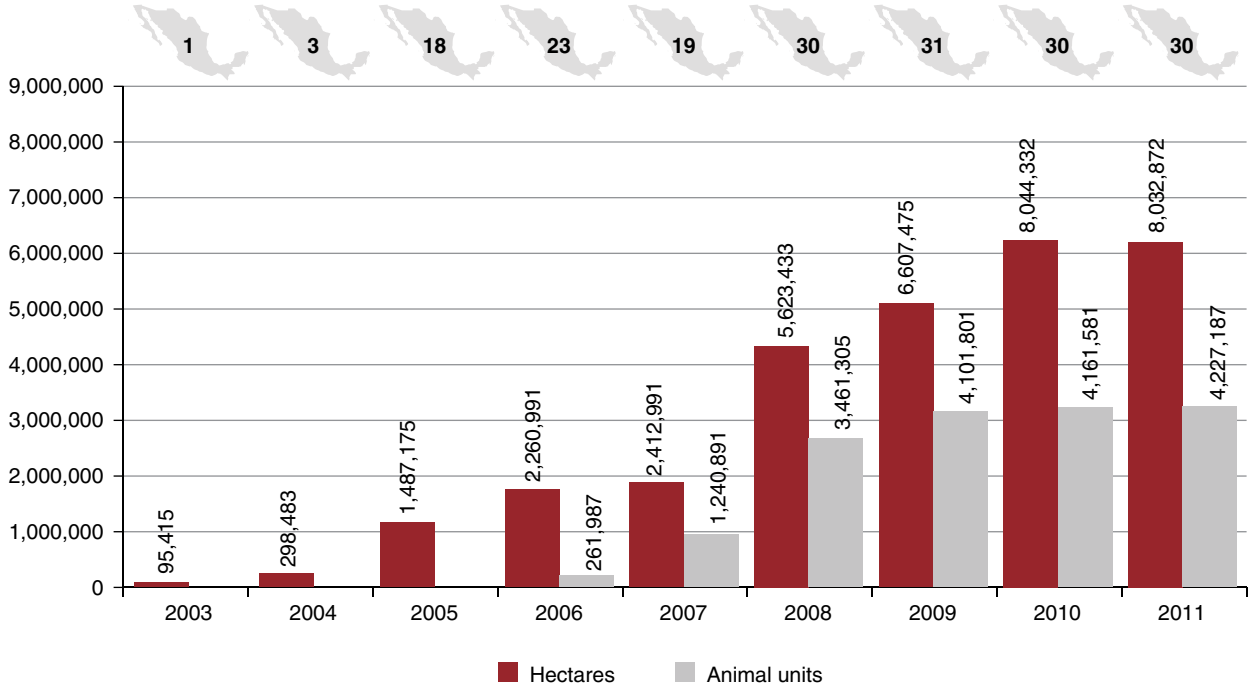
In 2003, Agroasemex designed the world's first macro-level drought index insurance coverage for rainfed cereals grown in Guanajuato State, and since then its range of parametric crop and livestock insurance products for catastrophic perils has expanded into nearly all other states of Mexico. Since 2004, private insurance companies have also actively provided traditional nonparametric catastrophe crop and livestock coverages to the state governments. In 2008, FAPRACC was replaced by PACC,[60] which operated for three years before being superseded in 2011 by CADENA—Componente Atención a Desastres Naturales (the Natural Disaster Response Component of SAGARPA, which is the Ministry of Agriculture, Livestock, Rural Development, Fisheries, and Food). Today CADENA contains two main elements: (1) the SAC (Catastrophic Agricultural Insurance) programs for farmers, livestock producers, aquaculture farmers, and fishers, and (2) in states where SAC is not provided, continued direct support (apoyo directo) compensation payments to farmers for climatic disasters.

CADENA EVOLUTION AND FUNDING

Since inception in 2003, the CADENA-SAC program has expanded hugely. By 2011, approximately 8 million hectares of crops were insured in 27 states, benefiting over 2.5 million insured farmers who represented about 56 percent of the target group (4.5 million subsistence farmers operating on 16.5 million hectares). In addition, more than 4.2 million head of livestock were insured throughout Mexico under the livestock catastrophe program in 2011. In the same year, CADENA crop and livestock insurance programs covered 2,362 municipalities in 30 of Mexico's 31 states,[61] with a total premium income of more than MXN 1.5 billion and total sum insured (TSI) of MXN 12 billion (Figure A6.1) (World Bank 2013; Arias et al. 2014).

Governments see three key advantages in using an ex-ante macro-level insurance product to finance natural disaster payments. First, for the

FIGURE A6.1: MEXICO: EVOLUTION OF THE CADENA PROGRAM, 2003–11 (INSURED CROP AREA IN HECTARES AND NUMBER OF INSURED LIVESTOCK)



Source: World Bank 2013, based on SAGARPA data.

[60]Programa de Atención a Contingencias Climatológicas (Climatic Event Response Program).

[61]Mexico has 31 states, 1 federal district, and 2,445 municipalities.

payment of a pre-agreed premium, the maximum liability can be quantified in advance and transferred out of the fiscal budget to local and international insurance and reinsurance markets. Second, insurance payouts under an index program can be made very rapidly to state governments (and to farmers, where there is a prior registry of farmers), because there is no need to assess damage in individual farmers' fields under weather index programs and a reduced need for such assessments under area yield-based index programs. Third, insurance brings transparency and standardization of payout rules to disaster compensation payments.

CADENA is funded by the federal and state governments and underwritten by the national reinsurer, Agroasemex and several private sector insurance companies. CADENA is administered by SAGARPA. The state governments separately purchase macro-level crop and livestock index insurance to finance their catastrophe climatic disaster programs for poor farmers in their states. The costs of the program (including most importantly premium financing) are shared on a ratio of about 90 percent federal government and 10 percent state governments. A system of competitive annual tendering is used each year to appoint insurers to underwrite the program.

CADENA INSURANCE PRODUCTS AND ELIGIBILITY CRITERIA

CADENA offers two types of crop macro-level index insurance. The first type is catastrophic parametric or WII policies, which typically use ground-based weather stations to insure crops against key perils such as rainfall deficit (drought) or excess rain and other catastrophic climatic perils such as hurricane windspeeds, low temperature/freezing, and floods. The second type is AYII policies, which usually operate at the level of a municipality, agrarian nucleus, or ejido (land that was formerly held in common at a locality). The AYII policies involve actual infield sampling of crop yields to establish the actual average municipality yield and, if applicable, the amount of yield loss (Table A6.1). The AYII policies are designed to insure against catastrophic yield loss at the municipality or locality level. For each insured crop, the insured yield is set at 30 percent of the municipality average yield using SAGARPA historical production and yield data. Thus, the products respond to catastrophic crop losses exceeding 70 percent of expected production.

TABLE A6.1: MEXICO: CADENA CROP AND LIVESTOCK INSURANCE PRODUCTS AND PROGRAMS

Type of CADENA catastrophe insurance program	Basis of insurance and indemnity	Insured perils
1. **Parametric crop weather index insurance** *(Seguro Agrícola de Índices Climáticos, SAIC)*	Weather indexes measured at ground stations	Drought, excess rain, flood, hurricane, windstorm
2. **Crop area-yield index insurance** *(Seguro Agrícola de Índices de Producción, SAIP)*	Area yields measured by infield loss assessment	Comprehensive multiple-peril
3. **Livestock-pasture Normalized Difference Vegetation Index (NDVI)** *(Seguro Pecuario de Índices de Vegetación, SPIV)*	Satellite-measured NDVI index	All perils that reduce pasture growth (mainly drought)
4. **Traditional livestock insurance** *(Seguro Pecuario Catastrófico, SPC)*	Decreased forage and extraordinary weight loss in animals	Drought

Source: World Bank 2013.

Note: The program types listed in the table are SAGARPA's classifications of the CADENA crop and livestock insurance programs.

For livestock, CADENA also offers two products. The first is a livestock loss of pasture/grazing policy based on satellite imagery (NDVI), the second is a traditional livestock coverage against loss of forage.

Mexico applies strict eligibility criteria to define poor farmers who are eligible for free protection under the CADENA crop and livestock insurance programs. For farmers the criteria are based on farm size limits and for livestock producers on the maximum number of Livestock Units owned. These criteria apply both for CADENA Direct Support Payments and Catastrophe Agricultural Insurance (SAC). The CADENA also carries fixed sums insured/compensation payments which are applied throughout the country: for rain-fed annual crops the 2012 payout was a fixed value of MXN 1,300/ha or about US$100/ha and for tree fruit a higher value of MXN 2,200/ha or about $175/ha. The insurance value for livestock was MXN 600 per or US$45 per livestock unit (Table A6.2). These compensation amounts are small, but are designed to tide the small farmer over until the next season.

In the event of a triggered payout on the CADENA macro-level crop and livestock insurance programs, payment is made to the state government as the insured, or to SAGARPA in the case where the latter purchases coverage. It is then the responsibility of the state-level governments and SAGARPA to distribute the benefits to the farmers in the affected areas.

There are two systems for disbursing insurance CADENA claims payments. The first method is where the state government purchases aggregate coverage for a particular crop in a municipality, but does not pre-register the eligible farmers (beneficiaries). In the event of a loss being triggered, the state government receives a lump sum payout and then uses infield assessment to establish which farmers have incurred losses and then distributes

TABLE A6.2: ELIGIBILITY CRITERIA FOR CADENA PROGRAMS (DIRECT SUPPORT AND SAC) IN 2012

CADENA component	Maximum Amount of Support (DIRECT SUPPORT)	Maximum Amount of Support (CATASTROPHE AGRICULTURAL INSURANCE -SAC)	Amount of Payout per Unit (MXN)
A. Agriculture.			
I. Annual crops.	Up to 10 Has. per producer	Up to 10 Has. Per producer	$1,300 pesos per hectare in rainfed crops
			$2,200 pesos per hectare in irrigation crops
II. Fruit trees, coffee and prickly pear (nopal).	Up to 10 Has. per producer	Up to 10 Has. Per producer	$2,200.00 pesos per hectare under irrigated and rainfed crops
B. Livestock.	Up to 50 Animal Units in case of feeding supplement.	Up to 50 Animal Units in case of feeding supplement.	$600 pesos per Animal Unit
	Up to 5 Animal Units in case of death.		$1,500 pesos per Animal Unit
C. Fishing	One boat per fisherman	One boat per fisherman	$10,000 pesos per boat
D. Fish farming.			
I. Extensive or semi intensive.	Up to 2 Has. per producer.	Up to 2 Has. Per producer.	$8,000 pesos per hectare.
II. Intensive.	Up to 2 Aquaculture Units per producer	Up to 2 Aquaculture Units per producer	$8,000 pesos per Aquaculture Unit
III. Molluscs.	Up to 2 Aquaculture Units per producer	Up to 2 Aquaculture Units per producer	$1,000 pesos per Aquaculture Unit

Source: World Bank 2013.

the payout accordingly to the affected farmers. The main drawback of this two-stage method of distributing payouts is that conducting farm-level loss assessment is very time consuming. The second method involves the a-priori registration using the PROCAMPO lists of the targeted beneficiaries in each municipality and establishment of the sum insured for each named farmer. In the event of payout being triggered on the policy, each registered beneficiary receives a direct payment in accordance with the insured area of the crop (or number of insured animals). The second method is more transparent, and timely payments can be made to each beneficiary. SAGARPA is actively promoting the registration of CADENA beneficiaries in each state and municipality and conducts seasonal monitoring surveys to ensure farmers are receiving their correct payouts in a timely fashion.

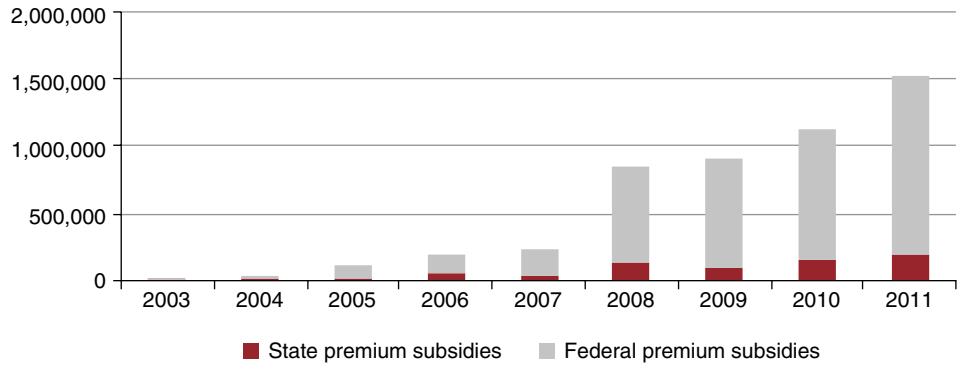
CADENA PREMIUMS AND CLAIMS AND COSTS AND BENEFITS

Since 2003 the costs of the CADENA agricultural insurance premium subsidies has been MXN 5.01 billion (about US$375 million) of which SAGARPA (federal government) has covered 86 percent and the state governments have subsidized 14 percent. Benefiting farmers do not make any contributions toward the costs of the CADENA insurance programs (Figure A6.2).

The CADENA program has experienced two major loss years, i.e., 2009 which was the second worst drought year in 60 years[62] with a loss ratio of 118 percent, and 2011 which was both a severe drought year and a major freeze year (one in 50-year return period) with a loss ratio of 129 percent. Over the nine-year period, total claims payouts have amounted to MXN 4.1 billion. The fact that the program has been able to sustain such severe loss years is due to the actuarial basis of rating and the high premium rates charged by the insurers, averaging 11.9 percent over the nine years of operations. The long-term average loss ratio at end of 2011 was 82.1 percent which represents a break-even position after deduction of operating expenses and underwriting margins (Table A6.3).

Over the same period, the CADENA program has paid out a similar amount, or MXN 4.04 billion in direct compensation payments to resource poor farmers who are not yet included under the CADENA catastrophe index insurance programs. (Table A6.4).

FIGURE A6.2: CADENA COST OF PREMIUM SUBSIDIES TO STATE AND FEDERAL GOVERNMENTS (MXN '000)



Source: World Bank 2013 based on SAGARPA data.

[62]SAGARPA, 30 October 2012.

TABLE A6.3: CADENA CONSOLIDATED AGRICULTURAL INSURANCE RESULTS 2003–2011 (MXN '000)

Year	Total sum insured (MXN '000)	Total premium (MXN '000)	Average premium rate (%)	Total claims (MXN '000)	Loss ratio %	Loss cost %
2003	34,445	3,438	10.0		0.0	0.0
2004	229,134	25,896	11.3	1,001	3.9	0.4
2005	906,866	124,327	13.7	110,329	88.7	12.2
2006	1,667,406	200,875	12.0	52,941	26.4	3.2
2007	2,106,128	238,624	11.3	104,093	43.6	4.9
2008	7,617,721	839,488	11.0	311,118	37.1	4.1
2009	8,477,013	917,748	10.8	1,079,160	117.6	12.7
2010	9,025,091	1,136,499	12.6	488,000	42.9	5.4
2011	12,039,010	1,523,137	12.7	1,966,190	129.1	16.3
Total	***42,102,815***	***5,010,031***	***11.9***	***4,112,833***	***82.1***	***9.8***

Source: World Bank 2013 based on SAGARPA data.

TABLE A6.4: COST OF DIRECT COMPENSATION PAYMENTS (MXN)

Year	Federal government (MXN)	Federal government (%)	State government (MXN)	State government (%)	Total (MXN)
2003	73,765,783	70	31,591,733	30	105,357,516
2004	195,308,915	70	83,679,029	30	278,987,944
2005	529,104,634	70	227,002,198	30	756,106,832
2006	301,407,030	70	129,176,036	30	430,583,066
2007	242,269,883	70	103,849,063	30	346,118,946
2008	87,531,603	60	58,017,640	40	145,549,243
2009	113,993,830	50	113,993,830	50	227,987,660
2010	80,697,614	50	80,697,614	50	161,395,228
2011	792,113,066	50	792,113,066	50	1,584,226,132
Total, 2003–11	***2,416,192,358***	***60***	***1,620,120,209***	***40***	***4,036,312,567***
Annual average	***268,465,818***		***180,013,357***		***448,479,174***

Source: SAGARPA, 30 October 2012.

OPPORTUNITY COSTS OF CATASTROPHE INSURANCE VERSUS DIRECT COMPENSATION PAYMENTS

A key advantage to federal and state governments of purchasing CADENA catastrophe insurance is the ability to leverage much higher levels of financial protection against unforeseen climatic contingencies than can be achieved through budgetary allocations alone. Over the past nine years, the Mexican government has expended a total of MXN 9.1 billion on a combination of direct support payments to small farmers and insurance premium payments to the insurance sector, in return for total liability (TSI) protection valued at MXN 42.1 billion. In the underwriting year 2011, agricultural crop and livestock insurance premiums amounted to MXN 1.52 billion

against a TSI of MXN 12.0 billion and insurance payouts of MXN 1.97 billion. The government expensed a further MXN 1.58 billion in direct support payments for a total financial outlay of MXN 3.5 billion. Had 2011 been an even more severe loss year, the CADENA insurance programs would have afforded government protection up to MXN 12 billion (Figure A6.3).

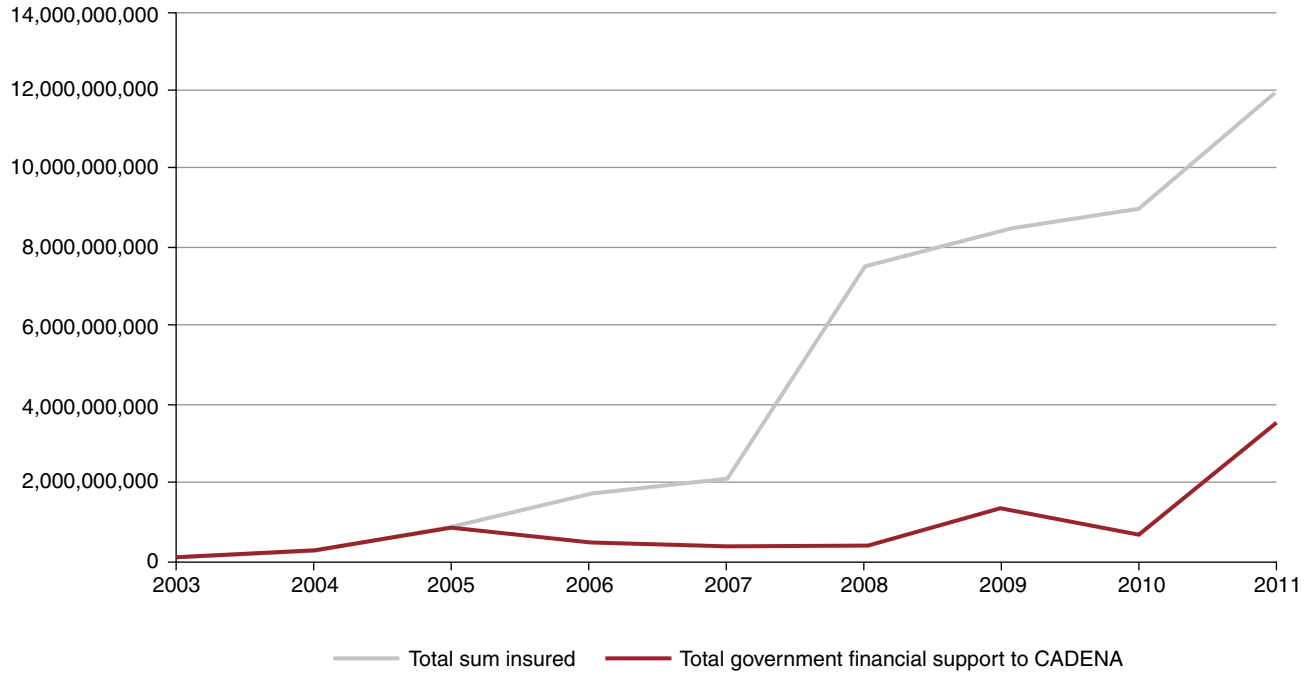
Another way of analyzing the cost-effectiveness of the CADENA agricultural insurance programs is to assume a situation in which no insurance program was in place and to calculate the benefits in terms of direct support payments that could have been made using the saved premium costs. This analysis has been conducted for the crop insurance programs and the results are presented in Figure A6.4. The gray line shows the actual insured area rising to 8.03 million hectares in 2011 for a premium cost of MXN 1.33 billion. The red line shows that had no insurance been in place, the MXN 1.33 billion in saved premiums could have been used in 2011 to fund direct compensation payments for 1.17 million hectares or only 15 percent of the actual insured area. Over the full period 2003 to 2011, the saved insurance premiums could only have compensated an average of 14 percent of the actual insured area.

CADENA WELFARE IMPACTS

There have been several studies to measure the impacts of the CADENA program on vulnerable farmers. Agricultural insurance has a direct effect of making payouts in the event of crop failure or death of livestock, which can help smooth consumption or ensure sufficient resources for production in subsequent seasons. The risk reduction that this entails can have indirect effects on economic outcomes by altering farmers' investment decisions. Fuchs and Wolff (2010) found that the CADENA program increased small farmers maize yields and rural per capita expenditure and income. De Janvry (2015) found that CADENA increased the sown area of maize in the year after a payout, but did not lead to significant increases in agricultural income.

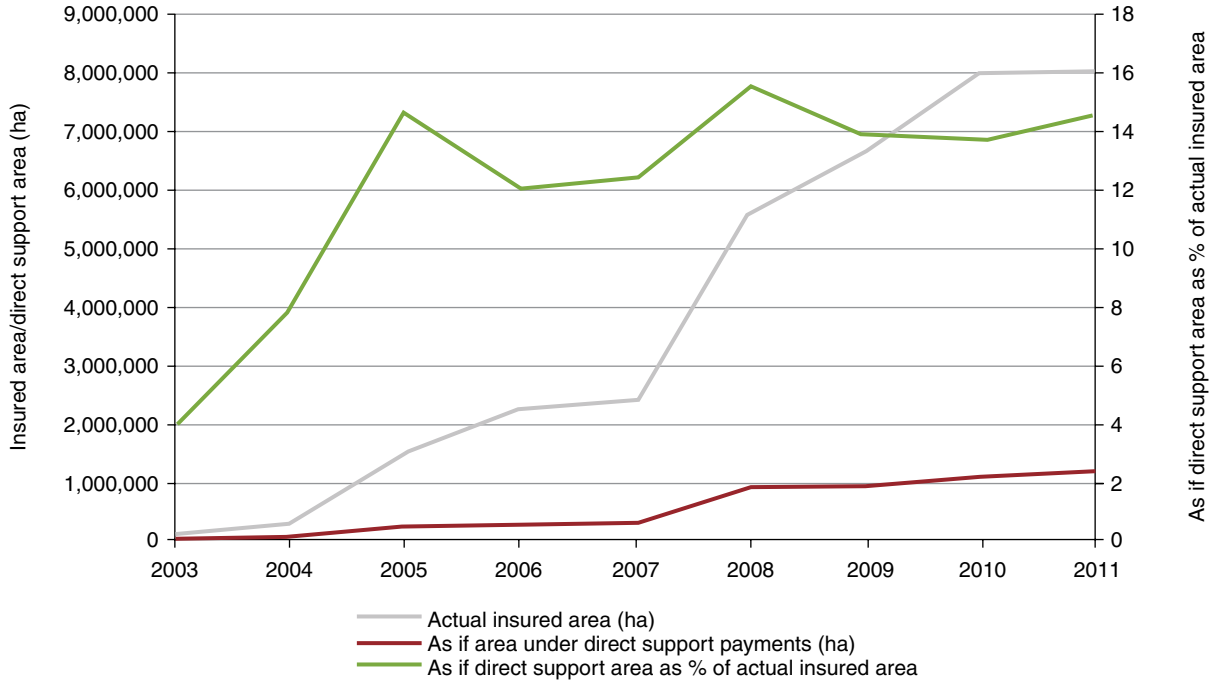
A recent study by Arias et al. (2014) found that CADENA WII reduced moderate income poverty by 1.78 percentage points, but income inequality

FIGURE A6.3: CADENA: COMPARISON OF INSURANCE COVERAGE PURCHASED (TSI) VERSUS TOTAL COST OF GOVERNMENT FINANCIAL SUPPORT (PREMIUM SUBSIDIES AND DIRECT PAYMENTS) (MXN)



Source: World Bank 2013.

FIGURE A6.4: HYPOTHETICAL ANALYSIS OF ALTERNATIVE USE OF CROP INSURANCE PREMIUMS TO MAKE DIRECT SUPPORT PAYMENTS



Source: World Bank 2013.

increased marginally. While CADENA WII had no effect on extreme poverty, the study could not determine if this was due to ineligibility of the extreme poor under CADENA rules of operation, or because of ineffective targeting.

In a separate study, de Janvry et al. (2016) analyzed the effects of the CADENA insurance payouts on ex-post investment decisions and coping mechanisms, providing evidence that index insurance can improve welfare for rural households by providing resources to invest in the subsequent planting season. This finding is confirmed in an earlier study by the Autonomous University of Chapingo 2009 (cited by Arias et al. 2014) which showed that nearly 100 percent of surveyed beneficiaries had continued to remain in agricultural production following the catastrophe event due to the CADENA payouts they had received. De Janvry et al. concluded that the benefits of the program exceed the costs, even without taking into account the risk management effect which prevents households from resorting to costly coping mechanisms, such as reducing consumption.

In contrast to the above studies that highlight the positive consequences of CADENA WII, Fuchs and Wolff (2011) emphasize the potential unintended consequences of the large-scale WII programs under CADENA. WII can create disincentives to invest in other noninsured crops leading to potential overspecialization and monoculture. WII may generate disincentives to invest in irrigation systems because farmers are insured only as long as production takes place on nonirrigated land. Finally, in case of catastrophic events, indemnity payments may contribute to food price inflation at the expense of the uninsured poor.

KEY OPERATIONAL ISSUES AND CHALLENGES FOR CADENA

From an operational and implementation viewpoint, one of the main areas requiring improvement on CADENA is in the timeliness of payouts reaching the targeted beneficiaries. CADENA first makes payouts to the state governments, which are then responsible for distributing the payouts to affected farmers. This process requires speeding up: the Autonomous University of Chapingo 2009 study indicates that the average time taken post-event for beneficiaries to receive

their CADENA payouts was 89 days. Overall, 62.1 percent of surveyed farmers received their payouts between three and six months after the event. However, a significant 37.9 percent of payouts were received between six and nine months after the event. It is important to reduce the time for the payouts to reach the beneficiaries to no more than 90 days for all CADENA programs in all states. Moreover, while farmers benefiting from CADENA payouts fell strictly within the farmer size eligibility criteria, about a third of all livestock beneficiaries owned more livestock than the maximum permitted limit. And finally, surveyed beneficiaries considered the value of the CADENA payouts as too allow to cover the costs of their investments in their agricultural enterprises. Overall, 60 percent of respondents (and as high as 72.2 percent of crop producers) indicated that the payouts covered less than 25 percent of the amounts invested up to the time of loss. Overall, only 14.2 percent replied that the payouts exceeded 50 percent of their investment costs. SAGARPA is trying to address this issue by increasing the payout levels over time.

ANNEX 7
EXAMPLES OF AGRICULTURAL INSURANCE POOL PROGRAMS IN SPAIN AND TURKEY

CASE STUDY 1: AGROSEGURO POOL, SPAIN

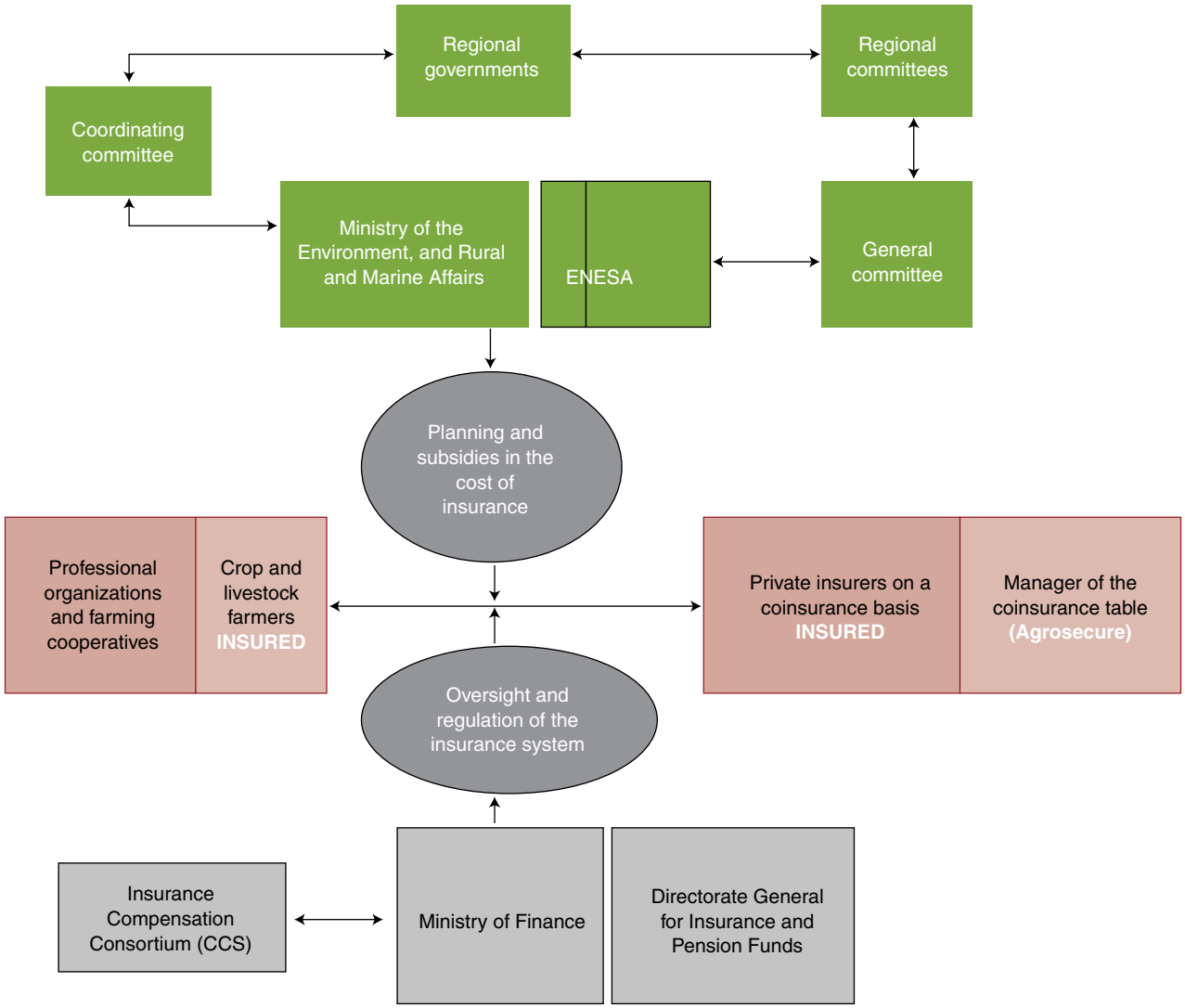
Prior to 1980, there was very limited agricultural insurance provision in Spain. In 1980, the Spanish government enacted legislation to create a national agricultural insurance program, termed the Combined Agricultural Insurance *(Seguros Agrarios Combinados)* program, a public-private partnership (PPP) underwritten by Agroseguro—a private coinsurance pool with a mandate to provide subsidized agricultural insurance to all of Spain's regions and farmers on a voluntary basis. Today, Agroseguro is Europe's largest and most comprehensive national agricultural insurance program underwriting over 200 different crop, livestock, aquaculture, and forestry programs and generating total commercial premiums of €676 million in 2012.

The key forms of government support to agricultural insurance in Spain include insurance legislation, subsidies on agriculture insurance premiums paid by farmers/herders, coinsurance and reinsurance through the National Catastrophe Reinsurance Company (*Consorcio de Compensación de Seguro* [CCS]), and assistance to data collection and insurance product research and development.

The key parties involved in the implementation of the Spanish agricultural insurance PPP include the following (Figure A 7.1):

- **National administrator:** ENESA (*Entidad Estatal de Seguros Agrarios*—National Agricultural Insurance Agency) coordinates the system and manages resources for subsidizing insurance premiums.
- **Ministry of Agriculture Food and Environment:** Responsible for data coordination and information collection for new product research and development in conjunction with Agroseguro's insurance specialists.
- **Pool coinsurers companies:** There are currently 28 coinsurers in the Agroseguro pool, which include both private and mutual insurance companies, including Mapfre Insurance and Reinsurance Company (Spain's largest insurance company) and the Spanish public sector catastrophe reinsurer *(Consorcio de Compensación de Seguros)*. The largest shareholder in the pool is Mapfre, with a shareholding of 20 percent; the smallest coinsurer has less than a 1 percent share in the pool. Each company's share of annual agricultural insurance premiums

FIGURE A7.1: AGROSEGURO SPAIN: INSTITUTIONAL FRAMEWORK



Source: Antón et al. 2011.

and liability is determined according to its percentage share in the pool during the underwriting year. Participation in the pool is completely voluntary and insurance companies are permitted to join and leave the pool after completion of an underwriting campaign (year). In order to maintain continuity, companies usually agree to join the pool for a three-year period.

» **Managing underwriter:** Agroseguro, which is owned by the 28 shareholders/coinsurers, has been appointed by the coinsurers to underwrite, adjust, and settle claims on their collective behalf. Agroseguro started with a very small team of agricultural underwriters, claims managers, loss assessors, and office support staff; today it has grown into Europe's largest agricultural insurance management company, underwriting more than 260,000 agricultural insurance policies and a further 30,000 livestock, forestry, and aquaculture policies generating total commercial premiums of €676 million in 2012. Agroseguro has a full-time complement of about 75 permanent staff based in its headquarters in Madrid and an equal number based in each of the 14 autonomous regions. It has a general management unit, a legal department, and regional branches, as well as core operational departments responsible for (1) product research and development, (2) production and communication (underwriting), (3) claims administration and loss assessment, (4) administration and accounting, and (5) organization and information technology systems. As such, it functions as a very professional

commercial managing company on behalf of its coinsurers. Agroseguro's internal administration and operating (A&O) costs are financed out of earned premiums on the agricultural insurance business it writes on behalf of the pool. Over the past five years, its internal A&O expenses have amounted to 3.5 percent of total earned premiums (Agroseguro 2012).

- **Consorcio de Compensación de Seguro (CCS).** The national (state) catastrophe reinsurer providing reinsurance to Agroseguro pool coinsurers.
- **International commercial reinsurers:** Providers of (1) stop-loss reinsurance to pool reinsurers on their viable line retentions and (2) multiyear catastrophe stop loss to CCS.

ENESA in conjunction with the Ministry of Agriculture, Food and Environment (MAFE) is responsible for developing a three-year rolling agricultural insurance plan in consultation with the state governments, producer organizations, and Agroseguro. ENESA is also responsible for drafting the annual implementation plan setting out the premium subsidy levels that will apply to each product line and program in the current year and the agreed budget from the government for premium subsidies. For 2013, the approved state budget for agricultural insurance premium subsidies was €205 million.

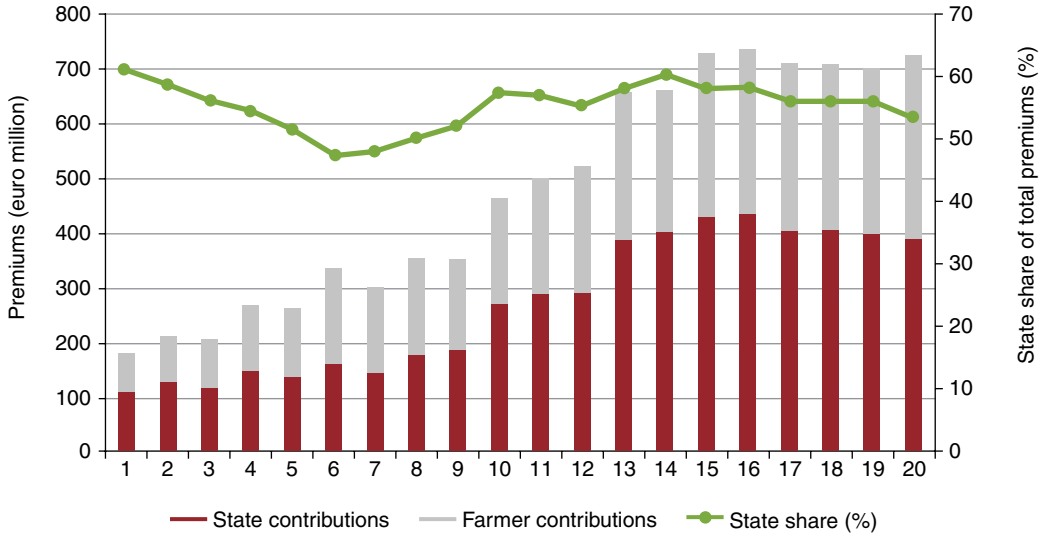
Under the Spanish model, premium subsidies are used as a policy instrument to promote the widest possible voluntary adoption of agricultural insurance by farmers and to replace ad hoc ex-post natural disaster relief compensation payments by a comprehensive national agricultural insurance program. Spanish farmers are not eligible for disaster payments for perils for which insurance is offered. For non-covered perils, ad hoc disaster payments are available, but only if the producer has already purchased agricultural insurance for covered perils.

The costs to government of premium subsidies are high as shown in Figure A7.2. Over the past 33 years (1980 to 2012), the total cost of premium subsidy support by federal and autonomous state governments amounted to €5.98 billion or 56 percent of the total costs of premiums while farmers paid the remaining 44 percent of total premium earnings. In 2012, the total premium income amounted to €728.3 million and state financed premiums were €393 million (54 percent of the total).

The government is responsible for fixing premium subsidy levels. A system of differential premium subsidies applies, which provides different levels of premium subsidies for each category of crops and livestock and the type of insurance product (named-peril, etc.). Additional subsidies are provided for collectively purchased policies through associations, for target groups of farmers including young farmers, and for the contracting of multi-crop policies or multiyear coverages.

In 2012 Agroseguro underwrote almost 485,000 crop and livestock policies with total premium volume of

FIGURE A7.2: AGROSEGURO PREMIUMS AND SHARE PAID BY FARMERS AND BY THE STATE



Source: Agroseguro 2013.

€728 million. The year 2012 was a very severe year for frosts, drought, and hail, and total claims amounted to €800 million equivalent to a loss ratio of 118.5 percent (Agroseguro 2013).

Agroseguro currently underwrites about 200 viable and experimental crops, livestock, and marine aquaculture lines, and forestry insurance covering a wide range of crop types including cereals, oilseeds, horticultural crops, leaf and fibers, tree fruits and vines, and livestock types. The company offers a comprehensive range of single-peril hail, named-peril, and multi-peril crop insurance policies. Agroseguro only underwrites two index insurance coverages: one for bees and the other a livestock NDVI pasture-drought index policy. In 2012, the company retained a national network of 397 crop loss adjusters and 123 livestock veterinary inspectors.

Agroseguro has traditionally purchased stop-loss reinsurance protection from the national catastrophe reinsurer, CCS. There are different reinsurance agreements in place for the different insurance lines of A, B, and C according to the perils insured and their degree of catastrophe loss potential. The reinsurance protection provided by CCS has been a major factor in the financial viability of the Agroseguro pool program over the past 33 years. Traditionally, CCS has purchased multiyear Stop-Loss Retrocession protection on its liability. The individual pool coinsurers have also been permitted to purchase additional stop-loss reinsurance protection on their retentions from international reinsurers.

CASE STUDY 2: TARSIM POOL, TURKEY

The Turkish agricultural insurance pool, Tarsim, was established by Law No. 5365 in 2005. The law covers the establishment of the pool, the risks to be insured, the pool's income and expenses, government support in the form of premium subsidies and excess of loss reinsurance support, insurance contracts, the contracting of reinsurance, and the principle duties of the pool operating company and the coinsuring members. Additional legislation that governs Tarsim's operations is defined by the Regulation of the Application of the Agricultural Insurance (No. 26172, 18 May 2006) and the Agricultural Insurance Pool Operating Procedures and the Principles of the Agricultural Insurance Regulations (No. 26172, 18 May 2006).

Prior to the formation of the Tarsim pool in Turkey in 2005, only 0.5 percent of agricultural areas in Turkey were insured (Bora 2010). A number of private insurance companies provided limited crop and greenhouse insurance mainly against hail, and livestock insurance was poorly developed. The agricultural insurance market was fragmented; the system operated with limited data on which to design and rate products and programs; and there was inadequate actuarial expertise, a lack of transparency and underfunded research, coordination, and monitoring. At the time, the Turkish government did not support agricultural insurance but rather provided limited ex-post ad hoc disaster relief to crop and livestock producers after a catastrophic loss event. The Tarsim PPP initiative was promoted to overcome these constraints and to create a modern national agricultural insurance capability (Bora 2010). Turkey elected to model its new system on the Spanish pool structure with centralized underwriting claims handling and reinsurance purchasing (see Box A7.1 for further details).

Tarsim's pool operating company is a joint stock company owned by the 24 insurance companies that participated in the agricultural insurance pool in 2012, each with an equal shareholding. As in Spain, the role of each pool insurance company is two-fold: (1) to market Tarsim's standard policies at approved rates to Turkish crop, greenhouse, livestock, poultry, and aquaculture producers, and (2) to provide insurance capacity to the pool. The pool operating company is responsible for all underwriting and claims management and IT systems and procedures. Tarsim reports to a management board comprised of two representatives from the Ministry of Agriculture; two representatives from the Under Secretariat of the Treasury; and one member from each of the insurance and reinsurance companies of Turkey, the union of chambers of agriculture, and from Tarsim (the operating company) (Figure A7.3).

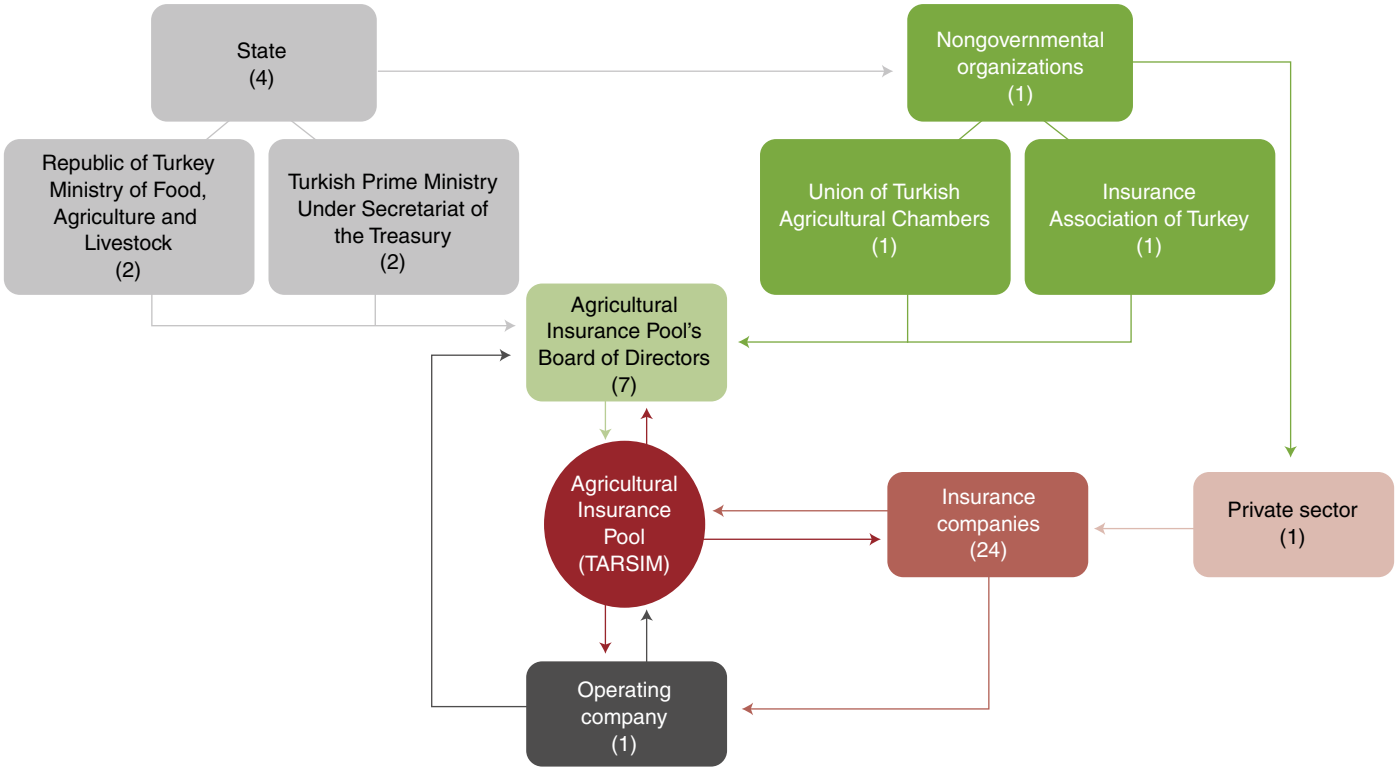
Under the PPP for agricultural insurance, the Turkish government provides Tarsim with 50 percent premium subsidies on all classes of agricultural insurance, except for crop policies which also include coverage against frost for which the subsidy level is 66 percent. In addition, the government provides catastrophe excess of loss (stop-loss) protection to Tarsim. Other benefits include subsidies on Tarsim's administration and operating expenses and loss adjustment costs, and sales tax exemption for agricultural insurance premiums (Mahul & Stutley 2010). Tarsim is responsible for deciding its risk retention and reinsurance strategy. The

BOX A7.1: OBJECTIVES OF THE TARSIM POOL

- To contribute to the development and generalization of agricultural insurance.
- To provide standard insurance contracts covering the risks falling within the scope of the Act.
- To centralize and standardize loss adjustment activities.
- To have claims processed quickly and paid fairly by a central entity.
- To lay down procedures and principles for the operation of agricultural insurance.
- To provide insurance coverage for catastrophe risks like drought, frost, etc., that could overwhelm an individual insurance company.
- To expand reinsurance capacity and coverage by introducing incentives for participation in reinsurance.
- To make effective, joint use of insurance companies' information, and human and financial resources.
- To make effective use of government subsidies and the government's catastrophe stop-loss protection.
- To prevent unfair price competition.
- To encourage participation in insurance.

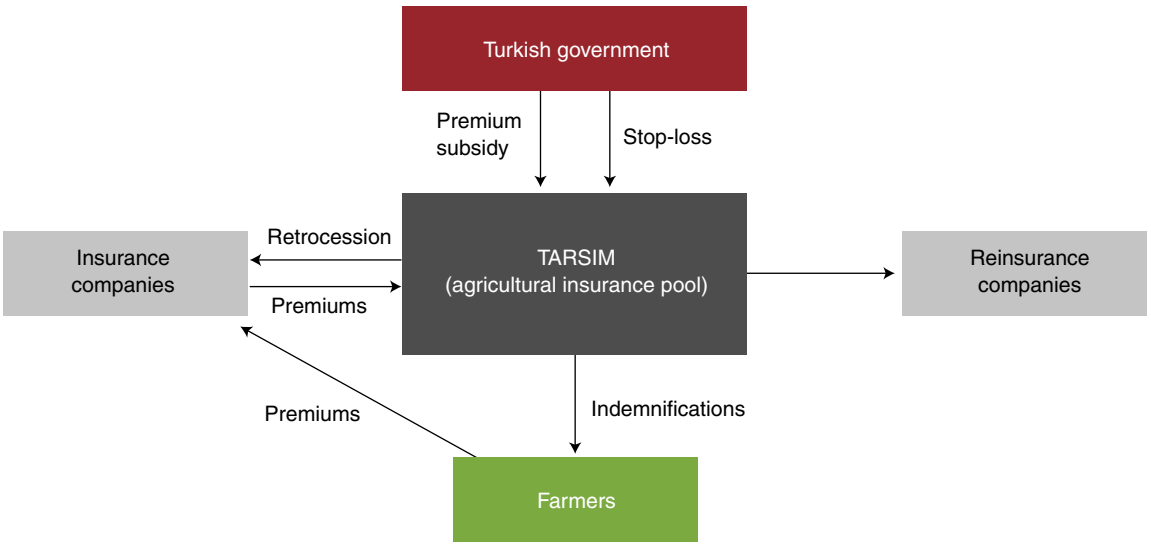
Source: Bora 2010.

FIGURE A7.3: TURKEY: INSTITUTIONAL FRAMEWORK OF THE TARSIM AGRICULTURAL INSURANCE POOL



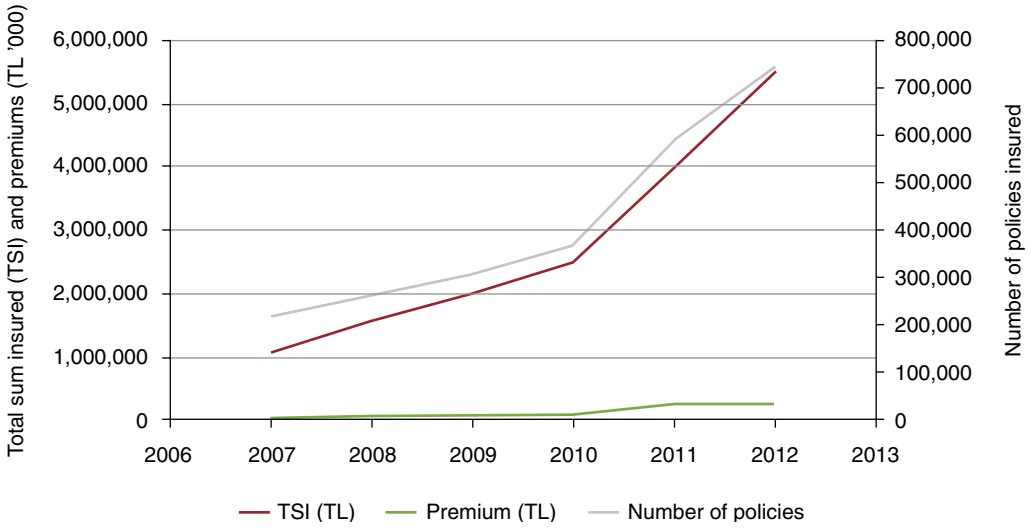
Source: Tarsim Annual Report 2012.

FIGURE A7.4: TARSIM AGRICULTURAL INSURANCE POOL: RISK TRANSFER MECHANISMS



Source: SwissRe: Sigma No1/2013.

FIGURE A7.5: TARSIM: GROWTH IN NUMBER OF POLICIES SOLD, TSI AND PREMIUM INCOME, 2007–2012



Source: Tarsim 2012 Annual Report.

law permits Tarsim to retrocede business back to the pool insurers and/or to reinsure through the local reinsurer MilliRe and international reinsurers (Figure A7.4).

Since its formation, Tarsim has standardized all agricultural insurance policies and tariffs, increased its range of product lines, and made a major investment in a web-based centralized national insurance application, underwriting, and claims administration system. In addition, the pool operator has established a national crop and livestock farm inspection and loss assessment capability, which can draw on 536 qualified and registered crop inspectors and 568 livestock inspectors.

Following the establishment of Tarsim, there has been a major expansion in the demand by farmers for agricultural insurance in Turkey. This demand has also been stimulated by the close PPP with the government which provides a minimum 50 percent premium subsidy on the costs of all agricultural insurance policies. In the five years that Tarsim has been operational, the number of policies sold has increased from 218,938 to 744,093 (an increase of 240 percent), and premium income has increased from Turkish Lira (TL) 47 million to TL 273 million (a 482 percent increase) (Figure A7.5). Over this period Turkey has grown to be the third largest agricultural insurance market in Europe by premium volume.

ANNEX 8
POSSIBLE OPTIONS FOR COINSURANCE POOLS IN PUNJAB

This annex is taken from the World Bank 2015 report "Kenya—Towards a National Crop and Livestock Insurance Program."

NON-STATUTORY COINSURANCE POOLS

Insurance pools can be statutory (established by specific legislation) or non-statutory (not established by specific legislation).

Different structures are commonly used to establish **non-statutory insurance pools:**

1) A coinsurance pool may be established by the participating insurers as an insurer in its own right, so that it is the pool itself that issues the insurance contracts and assumes the risk on behalf of the insurers. In this case, either the pool would sell its own insurance contracts or the insurers would sell insurance contracts as intermediaries (i.e., agents) on the pool company's behalf, the risk being underwritten by the pool company.
2) The insurance contracts may be written by the insurer pool members on an individual basis, but with the risk ceded to the pool. In this case, the pool may be either (1) a special pool company established by the insurers; or (2) an arrangement between the insurers whose terms are set out in a pool agreement.
3) The insurance contracts may be written by a lead insurer on behalf of the other insurers that are members of the pool. Again, under this scenario, the pool may be a special company established by the insurers or an arrangement between the insurers set out in a pool agreement.

If a coinsurance pool is established as an insurer, the pool company underwrites the risks directly in its own right. A pool company that underwrites risks must, of course, be licensed to write insurance business and must be fully capitalized as an insurer.

Other coinsurance pools, whether or not established solely by contract or as a special (non-insurer) company, usually share the following features:

1) Each insurer accepts a pre-agreed share in all the risks that are covered by the pool agreement.
2) All premiums are paid into the pool, less an amount to cover expenses.

3) The pool manager or administrator assesses and settles claims.
4) If there is an underwriting gain, the surplus (beyond any reserve retained in the pool) is paid to each insurer in accordance with its agreed share.
5) If there is an underwriting loss, the insurers contribute to the loss in accordance with their agreed share.

If a pool is established solely through a contractual arrangement, the "pool" is not a legal person and does not have the power to contract. The pool could not, therefore, write insurance contracts.

If the insurers enter into their own individual insurance contracts, the insurance business is conducted under their individual licenses. The capital of the participating insurers supports the risk. The position may be rather more complicated if the insurance contracts are underwritten by a lead insurer on behalf of the other insurers.

It is important to appreciate that where the insurers write their own insurance contracts and cede the risk to the pool, each participating insurer typically accepts a preagreed share of all the risks ceded to the pool, not just the risks that the insurer has written.

Management of a coinsurance pool, where the pool is incorporated as a (noninsurance) company, involves the pool company acting as the pool manager or administrator. Where a special pool company is not incorporated, the pool may be managed by a lead insurer; by a technical management unit contracted or employed by, or on behalf of, the participating insurers; or by a third party such as a broker, another nonparticipating insurer, or a reinsurer. The participating insurers typically share the management costs in accordance with their proportionate risk share.

STATUTORY COINSURANCE POOLS

Statutory insurance pools are often, but not necessarily, corporate bodies. Usually, statutory coinsurance pools are part of a national or regional program and are established as part of a PPP. Relevant legislation typically provides for the governance of the pool and sets out the pool's functions. The legislation may also cover other matters, such as the provision of some form of subsidy. Because they are established by legislation, statutory pools take many forms and may be structured very differently than a typical voluntary pool.

The legislation may establish a coinsurance pool, but not as a corporate body. For example, the pool may be established as a contractual arrangement between participating insurers. In this case, although the legislation would set out the functions of the pool, those functions would not usually include acting as an insurer, since the pool is not a legal person. Of course, the legislation may establish a corporate body to act as manager of the pool, but not to write insurance contracts.

The legislation establishing the pool would usually provide the pool with exclusive rights in relation to the business underwritten by the pool. This is necessary to prevent non-pool insurers undermining the pool by offering similar insurance products at a lower, non-sustainable, price.

Statutory coinsurance pools sometimes operate as hybrids, with some limited reinsurance functions.

BENEFITS OF AN AGRICULTURAL INSURANCE POOL

All coinsurance pools offer benefits but also have limitations. These are summarized in Box A8.1.

INTERNATIONAL PRECEDENTS

If a program steering committee is established to address the institutional framework for agricultural insurance, it could consider a number of precedents: (1) the Turkish agricultural insurance pool (Tarsim); (2) the Spanish agricultural insurance pool (Agroseguro); and (3) the proposed Mongolian Index-Based Livestock Reinsurance Company (which will have features of a pool and a reinsurance company).

BOX A8.1: BENEFITS AND LIMITATIONS OF COINSURANCE POOL ARRANGEMENTS

Coinsurance pools offer these benefits:

- **They achieve economies of scale through operating as a single unit with shared (pooled) administration and operating functions.** These lead to costs savings from (1) reduced staffing requirements (fixed costs); (2) shared costs of product research and development, and actuarial services including rating; and (3) reduced costs of underwriting and claims control and loss adjustment.
- **There are cost advantages to companies when they purchase common account (pooled) reinsurance protection rather than trying to place their own reinsurance program.** The advantages arise from (1) a stronger negotiating position with reinsurers; (2) larger and more balanced portfolios and better spread of risk; (3) reduced costs of reinsurance due to pooled risk exposure; and (4) reduced transaction costs (reinsurance brokerage, etc.).
- **There is no competition on rates in a soft market, and pools can maintain technically set rates.** Most pools operate as the sole insurance provided or monopoly (as in Austria, Senegal, Spain, and Turkey, for example), and there is therefore no competition on pricing.
- **Pools are able to maintain underwriting and loss adjustment standards.** Under a pool monopoly arrangement, the pool manager can ensure that common and high standards are maintained in the underwriting of crop and livestock insurance and in the adjusting of claims. Where companies are competing against each other for standard crop insurance business, there is often a problem of varying loss adjustment standards between companies.
- **Within a PPP, governments can more easily coordinate support to a pool than to individual insurers.** Governments seeking to coordinate national agricultural insurance policy and planning and specific support functions (e.g., provision of premium subsidies, research and development, education and training) can work more easily with a pool than with individual insurers, each of which may have very different priorities for agricultural insurance.

Coinsurance pools have these limitations:

- **When a pool acts as the sole agricultural insurer, lack of competition in the market may result.** This could (1) limit the range of products and services offered by the monopoly pool underwriter; (2) restrict the range of perils insured; (3) restrict the regions where agricultural insurance is offered and/or the type of farmer insured; and (4) lead to a lack of competitiveness in premium rates charged by the pool.

Source: Mahul and Stutley 2010.

ANNEX 9

DETAILS REGARDING NUMBER OF INSURED FARMERS, INSURED AREA, SUM INSURED AND PREMIUM, UNDER ALTERNATIVE SCENARIOS

TABLE A9.1: PUNJAB CROP INSURANCE PROGRAM: NUMBER OF INSURED FARMERS, INSURED AREA, SUM INSURED AND PREMIUM: SCENARIO 1, HIGH LEVEL OF UPTAKE PERCENT TARGET AVERAGE PREMIUM RATES: KHARIF 5.0 PERCENT AND RABI 3.5 PERCENT (US$)

Year/season	Kharif 2018	Rabi 2018/19	Kharif 2019	Rabi 2019/20	Kharif 2020	Rabi 2020/21	Kharif 2021	Rabi 2021/22	Kharif 2022	Rabi 2022/23	TOTAL (cumulative)
Crop Program 1.											
AYII For Progressive Farmers linked to KISAN Credit Package (2.5 Acres to 12.5 Acres)											
Number of Insured Farmers	250,000	350,000	450,000	550,000	600,000	650,000	700,000	725,000	750,000	750,000	5,775,000
Insured Area per Farmer (Acres/farmer)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Insured Crop Area (Acres)	875,000	1,225,000	1,575,000	1,925,000	2,100,000	2,275,000	2,450,000	2,537,500	2,625,000	2,625,000	20,212,500
Sum Insured (US$ per Acre)	400	300	400	300	400	300	400	300	400	300	
Total Sum Insured (US$)	350,000,000	367,500,000	630,000,000	577,500,000	840,000,000	682,500,000	980,000,000	761,250,000	1,050,000,000	787,500,000	7,026,250,000
Premium Rate (%)	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	
Total Premium Income(US$)	17,500,000	12,862,500	31,500,000	20,212,500	42,000,000	23,887,500	49,000,000	26,643,750	52,500,000	27,562,500	303,668,750
Crop Program 2.											
AYII for Subsistence Farmers <2.5 Acres											
Number of Insured Farmers			250,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000	1,750,000	8,750,000
Insured Area per Farmer (Acres/farmer)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Insured Crop Area (Acres)			250,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000	1,750,000	8,750,000
Sum Insured US$ per Acre			200	150	200	150	200	150	200	150	
Total Sum Insured (US$)			50,000,000	75,000,000	150,000,000	150,000,000	250,000,000	225,000,000	350,000,000	262,500,000	1,512,500,000
Premium Rate (%)			5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	
Total Premium Income(US$)			2,500,000	2,625,000	7,500,000	5,250,000	12,500,000	7,875,000	17,500,000	9,187,500	64,937,500
Crop Program 3. Tree Crops (Mango, Citrus)				**2019/20**		**2020/21**		**2021/22**		**2022/23**	
Number of Insured Farmers				2,500		5,000		7,500		10,000	25,000
Insured Area per Farmer (Acres/farmer)				2.5		2.5		2.5		2.5	2.5
Total Insured Crop Area (Acres)				6,250		12,500		18,750		25,000	62,500
Sum Insured US$ per Acre				1,000		1,000		1,000		1,000	
Total Sum Insured (US$)				6,250,000		12,500,000		18,750,000		25,000,000	62,500,000
Premium Rate (%)				10.00%		10.00%		10.00%		10.00%	
Total Premium Income US$				**625,000**		**1,250,000**		**1,875,000**		**2,500,000**	**6,250,000**
TOTAL ALL CROP PROGRAMS											
TOTAL INSURED FARMERS	**250,000**	**350,000**	**700,000**	**1,052,500**	**1,350,000**	**1,655,000**	**1,950,000**	**2,232,500**	**2,500,000**	**2,510,000**	**14,550,000**
TOTAL INSURED AREA (ACRES)	**875,000**	**1,225,000**	**1,825,000**	**2,431,250**	**2,850,000**	**3,287,500**	**3,700,000**	**4,056,250**	**4,375,000**	**4,400,000**	**29,025,000**
TOTAL SUM INSURED (US$)	**350,000,000**	**367,500,000**	**680,000,000**	**658,750,000**	**990,000,000**	**845,000,000**	**1,230,000,000**	**1,005,000,000**	**1,400,000,000**	**1,075,000,000**	**8,601,250,000**
TOTAL PREMIUM INCOME (US$)	**17,500,000**	**12,862,500**	**34,000,000**	**23,462,500**	**49,500,000**	**30,387,500**	**61,500,000**	**36,393,750**	**70,000,000**	**39,250,000**	**374,856,250**

TABLE A9.2: PUNJAB CROP INSURANCE PROGRAM: NUMBER OF INSURED FARMERS, INSURED AREA, SUM INSURED, PREMIUM AND PREMIUM SUBSIDIES: SCENARIO 2, HIGH LEVELS OF UPTAKE AND HIGHER TARGET AVERAGE PREMIUM RATES: KHARIF 7.5 PERCENT AND RABI 5.0 PERCENT (US$)

Year/season	Kharif 2018	Rabi 2018/19	Kharif 2019	Rabi 2019/20	Kharif 2020	Rabi 2020/21	Kharif 2021	Rabi 2021/22	Kharif 2022	Rabi 2022/23	TOTAL (cumulative)
Crop Program 1.											
AYII For Progressive Farmers linked to KISAN Credit Package (2.5 Acres to 12.5 Acres)											
Number of Insured Farmers	250,000	350,000	450,000	550,000	600,000	650,000	700,000	725,000	750,000	750,000	5,775,000
Insured Area per Farmer (Acres/farmer)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Insured Crop Area (Acres)	875,000	1,225,000	1,575,000	1,925,000	2,100,000	2,275,000	2,450,000	2,537,500	2,625,000	2,625,000	20,212,500
Sum Insured (US$ per Acre)	400	300	400	300	400	300	400	300	400	300	
Total Sum Insured (US$)	350,000,000	367,500,000	630,000,000	577,500,000	840,000,000	682,500,000	980,000,000	761,250,000	1,050,000,000	787,500,000	7,026,250,000
Premium Rate (%)	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	
Total Premium Income(US$)	26,250,000	18,375,000	47,250,000	28,875,000	63,000,000	34,125,000	73,500,000	38,062,500	78,750,000	39,375,000	447,562,500
Crop Program 2.											
AYII for Subsistence Farmers <2.5 Acres											
Number of Insured Farmers			250,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000	1,750,000	8,750,000
Insured Area per Farmer (Acres/farmer)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Insured Crop Area (Acres)			250,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000	1,750,000	8,750,000
Sum Insured US$ per Acre			200	150	200	150	200	150	200	150	
Total Sum Insured (US$)			50,000,000	75,000,000	150,000,000	150,000,000	250,000,000	225,000,000	350,000,000	262,500,000	1,512,500,000
Premium Rate (%)			7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	
Total Premium Income(US$)			3,750,000	3,750,000	11,250,000	7,500,000	18,750,000	11,250,000	26,250,000	13,125,000	95,625,000
Crop Program 3. Tree Crops (Mango, Citrus)				**2019/20**		**2020/21**		**2021/22**		**2022/23**	
Number of Insured Farmers				2,500		5,000		7,500		10,000	25,000
Insured Area per Farmer (Acres/farmer)				2.5		2.5		2.5		2.5	2.5
Total Insured Crop Area (Acres)				6,250		12,500		18,750		25,000	62,500
Sum Insured US$ per Acre				1,000		1,000		1,000		1,000	
Total Sum Insured (US$)				6,250,000		12,500,000		18,750,000		25,000,000	62,500,000
Premium Rate (%)				10.00%		10.00%		10.00%		10.00%	
Total Premium Income US$				**625,000**		**1,250,000**		**1,875,000**		**2,500,000**	**6,250,000**
TOTAL ALL CROP PROGRAMS											
TOTAL INSURED FARMERS	**250,000**	**350,000**	**700,000**	**1,052,500**	**1,350,000**	**1,655,000**	**1,950,000**	**2,232,500**	**2,500,000**	**2,510,000**	**14,550,000**
TOTAL INSURED AREA (ACRES)	**875,000**	**1,225,000**	**1,825,000**	**2,431,250**	**2,850,000**	**3,287,500**	**3,700,000**	**4,056,250**	**4,375,000**	**4,400,000**	**29,025,000**
TOTAL SUM INSURED (US$)	**350,000,000**	**367,500,000**	**680,000,000**	**658,750,000**	**990,000,000**	**845,000,000**	**1,230,000,000**	**1,005,000,000**	**1,400,000,000**	**1,075,000,000**	**8,601,250,000**
TOTAL PREMIUM INCOME (US$)	**26,250,000**	**18,375,000**	**51,000,000**	**33,250,000**	**74,250,000**	**42,875,000**	**92,250,000**	**51,187,500**	**105,000,000**	**55,000,000**	**549,437,500**

TABLE A9.3: PUNJAB CROP INSURANCE PROGRAM: NUMBER OF INSURED FARMERS, INSURED AREA, SUM INSURED, PREMIUM AND PREMIUM SUBSIDIES: SCENARIO 3, MEDIUM LEVELS OF UPTAKE AND LOWER AVERAGE PREMIUM RATES: KHARIF 5.0 PERCENT AND RABI 3.5 PERCENT (US$)

Year/season	Kharif 2018	Rabi 2018/19	Kharif 2019	Rabi 2019/20	Kharif 2020	Rabi 2020/21	Kharif 2021	Rabi 2021/22	Kharif 2022	Rabi 2022/23	TOTAL (cumulative)
Crop Program 1.											
AYII For Progressive Farmers linked to KISAN Credit Package (2.5 Acres to 12.5 Acres)											
Number of Insured Farmers	125,000	175,000	225,000	275,000	300,000	325,000	350,000	362,500	375,000	375,000	2,887,500
Insured Area per Farmer (Acres/farmer)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Insured Crop Area (Acres)	437,500	612,500	787,500	962,500	1,050,000	1,137,500	1,225,000	1,268,750	1,312,500	1,312,500	10,106,250
Sum Insured (US$ per Acre)	400	300	400	300	400	300	400	300	400	300	
Total Sum Insured (US$)	175,000,000	183,750,000	315,000,000	288,750,000	420,000,000	341,250,000	490,000,000	380,625,000	525,000,000	393,750,000	3,513,125,000
Premium Rate (%)	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	
Total Premium Income(US$)	**8,750,000**	**6,431,250**	**15,750,000**	**10,106,250**	**21,000,000**	**11,943,750**	**24,500,000**	**13,321,875**	**26,250,000**	**13,781,250**	**151,834,375**
Crop Program 2.											
AYII for Subsistence Farmers <2.5 Acres											
Number of Insured Farmers			125,000	250,000	375,000	500,000	625,000	750,000	875,000	875,000	4,375,000
Insured Area per Farmer (Acres/farmer)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Insured Crop Area (Acres)			125,000	250,000	375,000	500,000	625,000	750,000	875,000	875,000	4,375,000
Sum Insured US$ per Acre			200	150	200	150	200	150	200	150	
Total Sum Insured (US$)			25,000,000	37,500,000	75,000,000	75,000,000	125,000,000	112,500,000	175,000,000	131,250,000	756,250,000
Premium Rate (%)			5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	5.0%	3.50%	
Total Premium Income(US$)			**1,250,000**	**1,312,500**	**3,750,000**	**2,625,000**	**6,250,000**	**3,937,500**	**8,750,000**	**4,593,750**	**32,468,750**
Crop Program 3. Tree Crops (Mango, Citrus)				**2019/20**		**2020/21**		**2021/22**		**2022/23**	
Number of Insured Farmers				1,250		2,500		3,750		5,000	12,500
Insured Area per Farmer (Acres/farmer)				2.5		2.5		2.5		2.5	2.5
Total Insured Crop Area (Acres)				3,125		6,250		9,375		12,500	31,250
Sum Insured US$ per Acre				1,000		1,000		1,000		1,000	
Total Sum Insured (US$)				3,125,000		6,250,000		9,375,000		12,500,000	31,250,000
Premium Rate (%)				10.00%		10.00%		10.00%		10.00%	
Total Premium Income US$				**312,500**		**625,000**		**937,500**		**1,250,000**	**3,125,000**
TOTAL ALL CROP PROGRAMS											
TOTAL INSURED FARMERS	**125,000**	**175,000**	**350,000**	**526,250**	**675,000**	**827,500**	**975,000**	**1,116,250**	**1,250,000**	**1,255,000**	**7,275,000**
TOTAL INSURED AREA (ACRES)	**437,500**	**612,500**	**912,500**	**1,215,625**	**1,425,000**	**1,643,750**	**1,850,000**	**2,028,125**	**2,187,500**	**2,200,000**	**14,512,500**
TOTAL SUM INSURED (US$)	**175,000,000**	**183,750,000**	**340,000,000**	**329,375,000**	**495,000,000**	**422,500,000**	**615,000,000**	**502,500,000**	**700,000,000**	**537,500,000**	**4,300,625,000**
TOTAL PREMIUM INCOME (US$)	**8,750,000**	**6,431,250**	**17,000,000**	**11,731,250**	**24,750,000**	**15,193,750**	**30,750,000**	**18,196,875**	**35,000,000**	**19,625,000**	**187,428,125**

TABLE A9.4: PUNJAB CROP INSURANCE PROGRAM: NUMBER OF INSURED FARMERS, INSURED AREA, SUM INSURED, PREMIUM AND PREMIUM SUBSIDIES: SCENARIO 4, MEDIUM LEVELS OF UPTAKE AND HIGHER AVERAGE PREMIUM RATES: KHARIF 7.5 PERCENT AND RABI 5.0 PERCENT (US$)

Year/season	Kharif 2018	Rabi 2018/19	Kharif 2019	Rabi 2019/20	Kharif 2020	Rabi 2020/21	Kharif 2021	Rabi 2021/22	Kharif 2022	Rabi 2022/23	TOTAL (cumulative)
Crop Program 1.											
AYII For Progressive Farmers linked to KISAN Credit Package (2.5 Acres to 12.5 Acres)											
Number of Insured Farmers	125,000	175,000	225,000	275,000	300,000	325,000	350,000	362,500	375,000	375,000	2,887,500
Insured Area per Farmer (Acres/farmer)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Insured Crop Area (Acres)	437,500	612,500	787,500	962,500	1,050,000	1,137,500	1,225,000	1,268,750	1,312,500	1,312,500	10,106,250
Sum Insured (US$ per Acre)	400	300	400	300	400	300	400	300	400	300	
Total Sum Insured (US$)	175,000,000	183,750,000	315,000,000	288,750,000	420,000,000	341,250,000	490,000,000	380,625,000	525,000,000	393,750,000	3,513,125,000
Premium Rate (%)	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	
Total Premium Income(US$)	**13,125,000**	**9,187,500**	**23,625,000**	**14,437,500**	**31,500,000**	**17,062,500**	**36,750,000**	**19,031,250**	**39,375,000**	**19,687,500**	**223,781,250**
Crop Program 2.											
AYII for Subsistence Farmers <2.5 Acres											
Number of Insured Farmers			125,000	250,000	375,000	500,000	625,000	750,000	875,000	875,000	4,375,000
Insured Area per Farmer (Acres/farmer)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Insured Crop Area (Acres)			125,000	250,000	375,000	500,000	625,000	750,000	875,000	875,000	4,375,000
Sum Insured US$ per Acre			200	150	200	150	200	150	200	150	
Total Sum Insured (US$)			25,000,000	37,500,000	75,000,000	75,000,000	125,000,000	112,500,000	175,000,000	131,250,000	756,250,000
Premium Rate (%)			7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	7.5%	5.00%	
Total Premium Income(US$)			**1,875,000**	**1,875,000**	**5,625,000**	**3,750,000**	**9,375,000**	**5,625,000**	**13,125,000**	**6,562,500**	**47,812,500**
Crop Program 3. Tree Crops (Mango, Citrus)				**2019/20**		**2020/21**		**2021/22**		**2022/23**	
Number of Insured Farmers				1,250		2,500		3,750		5,000	12,500
Insured Area per Farmer (Acres/farmer)				2.5		2.5		2.5		2.5	2.5
Total Insured Crop Area (Acres)				3,125		6,250		9,375		12,500	31,250
Sum Insured US$ per Acre				1,000		1,000		1,000		1,000	
Total Sum Insured (US$)				3,125,000		6,250,000		9,375,000		12,500,000	31,250,000
Premium Rate (%)				10.00%		10.00%		10.00%		10.00%	
Total Premium Income US$				**312,500**		**625,000**		**937,500**		**1,250,000**	**3,125,000**
TOTAL ALL CROP PROGRAMS											
TOTAL INSURED FARMERS	**125,000**	**175,000**	**350,000**	**526,250**	**675,000**	**827,500**	**975,000**	**1,116,250**	**1,250,000**	**1,255,000**	**7,275,000**
TOTAL INSURED AREA (ACRES)	**437,500**	**612,500**	**912,500**	**1,215,625**	**1,425,000**	**1,643,750**	**1,850,000**	**2,028,125**	**2,187,500**	**2,200,000**	**14,512,500**
TOTAL SUM INSURED (US$)	**175,000,000**	**183,750,000**	**340,000,000**	**329,375,000**	**495,000,000**	**422,500,000**	**615,000,000**	**502,500,000**	**700,000,000**	**537,500,000**	**4,300,625,000**
TOTAL PREMIUM INCOME (US$)	**13,125,000**	**9,187,500**	**25,500,000**	**16,625,000**	**37,125,000**	**21,437,500**	**46,125,000**	**25,593,750**	**52,500,000**	**27,500,000**	**274,718,750**

Report No. 133553-PK