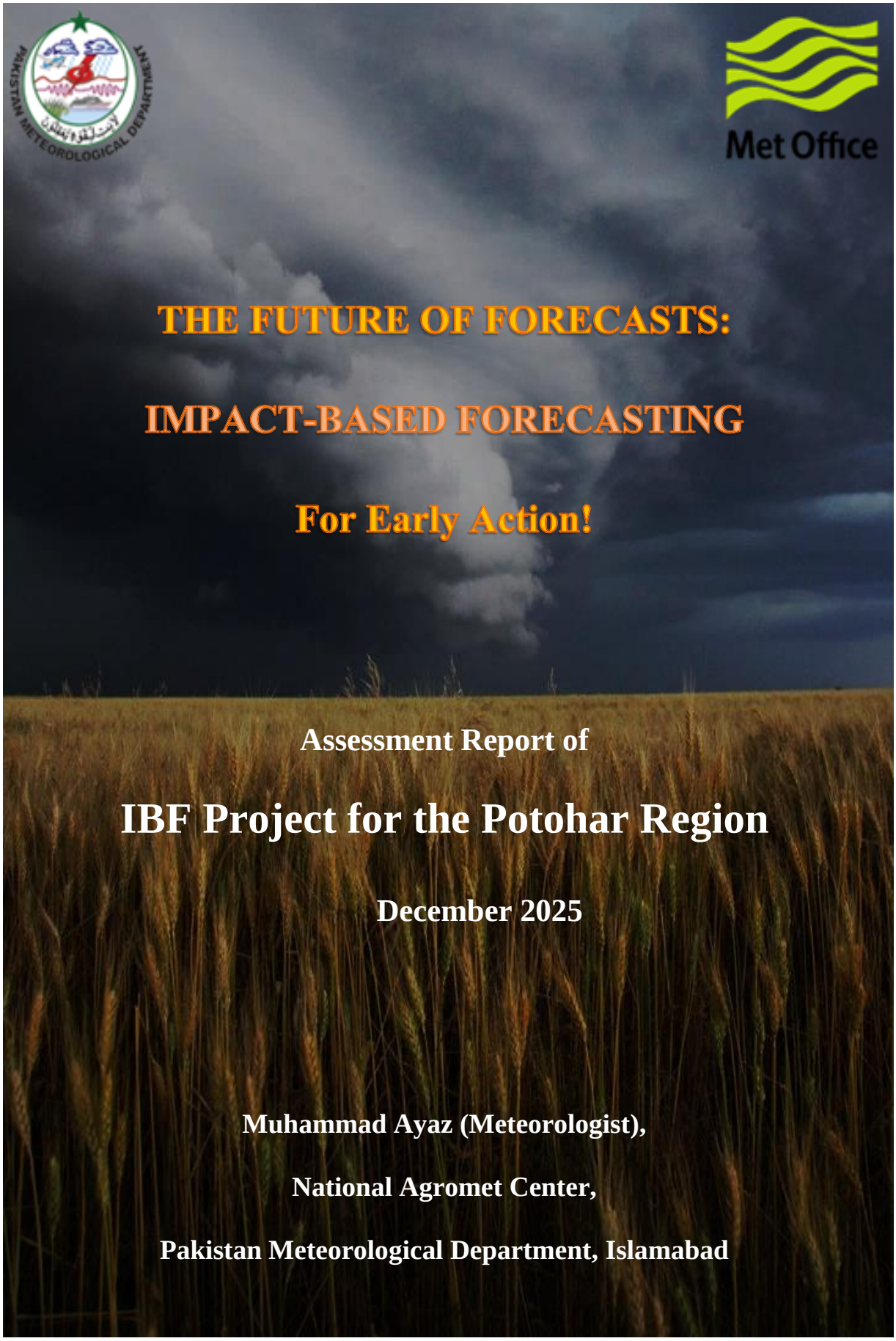

Assessment Report of

IBF Project for the Potohar Region

December 2025

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Preface

The Impact Based Forecasting (IBF) project is one of the most successful projects of the Pakistan Meteorological Department (PMD), which facilitated the implementation of Impact Based Forecasting (IBF) services for two districts, Chakwal and Attock, in the Potohar region for Kharif crops. National Agromet Centre (NAMC) and National Weather Forecasting Centre (NWFC) of PMD principally contributed to the project, besides other stakeholders, to launch this project. PMD and UK Met Office (UKMO) jointly worked with the assistance of other organizations like Punjab Agriculture Department (PAD) Extension wing, Agriculture Research institutes, and Research Academia of the region to complete the first phase of the IBF project. The strong collaboration of all stakeholders resulted in the successful completion of the project, and enabled PMD to initiate the second phase of the project for the entire Potohar Region (all four districts) by its own resources and the technical assistance from the PAD Extension wing.

A real-time survey was also conducted by PMD in all the tehsils of Potohar Region to physically interact with the farming community of the area. This survey enabled PMD to find the gaps between the existing PMD services and the additional requirements of the farming community regarding weather and climate-related information related to local agriculture for the Potohar Region. In addition, this survey has provided useful information about major crops being cultivated in the area and the impact assessment of significant weather extremes at important phenological stages of these crops.

PMD is therefore extremely grateful for the full-time collaboration of UKMO during the first phase of the IBF project. The PMD technical team, comprised of NAMC and NWFC, was technically trained by the UKMO team to conduct the project. PMD is also very grateful for the generous cooperation of the Extension wing of PAD throughout the first and second phases of the project. The survey, conducted by PMD during the second phase, would not have been possible without the active assistance of the officers and field staff of the Extension wing.

Besides the cooperation of the Extension wing of PAD, PMD is also very thankful to the farming community of the Potohar Region, and experts from Barani Agriculture Research Institute (BARI) and Peanut Research Institute, Attock, who participated in several workshops and seminars to finalize the impact tables for major crops being cultivated in the Potohar Region.

The contribution and dedication of the officers and other staff of NAMC and NWFC during both phases of the project had immense importance for the smooth completion of this task. Special gratitude in this regard goes to Director NAMC Asma Jawad Hashmi, Director NWFC Dr. Zaheer Ahmad Baber, and Deputy Director NAMC Dr. Dildar Hussain Kazmi. Without their non-stop hard work and devotion, this project would not have been processed so smoothly from the beginning to completion.

In the last, I am also very thankful to Director General PMD, Mehr Sahibzad Khan, who fully supported the project, participated in its meetings/seminars, and appreciated the professionals of PMD for their extraordinary performance and dedication during the project.

Muhammad Ayaz, Meteorologist,
NAMC, PMD, Islamabad

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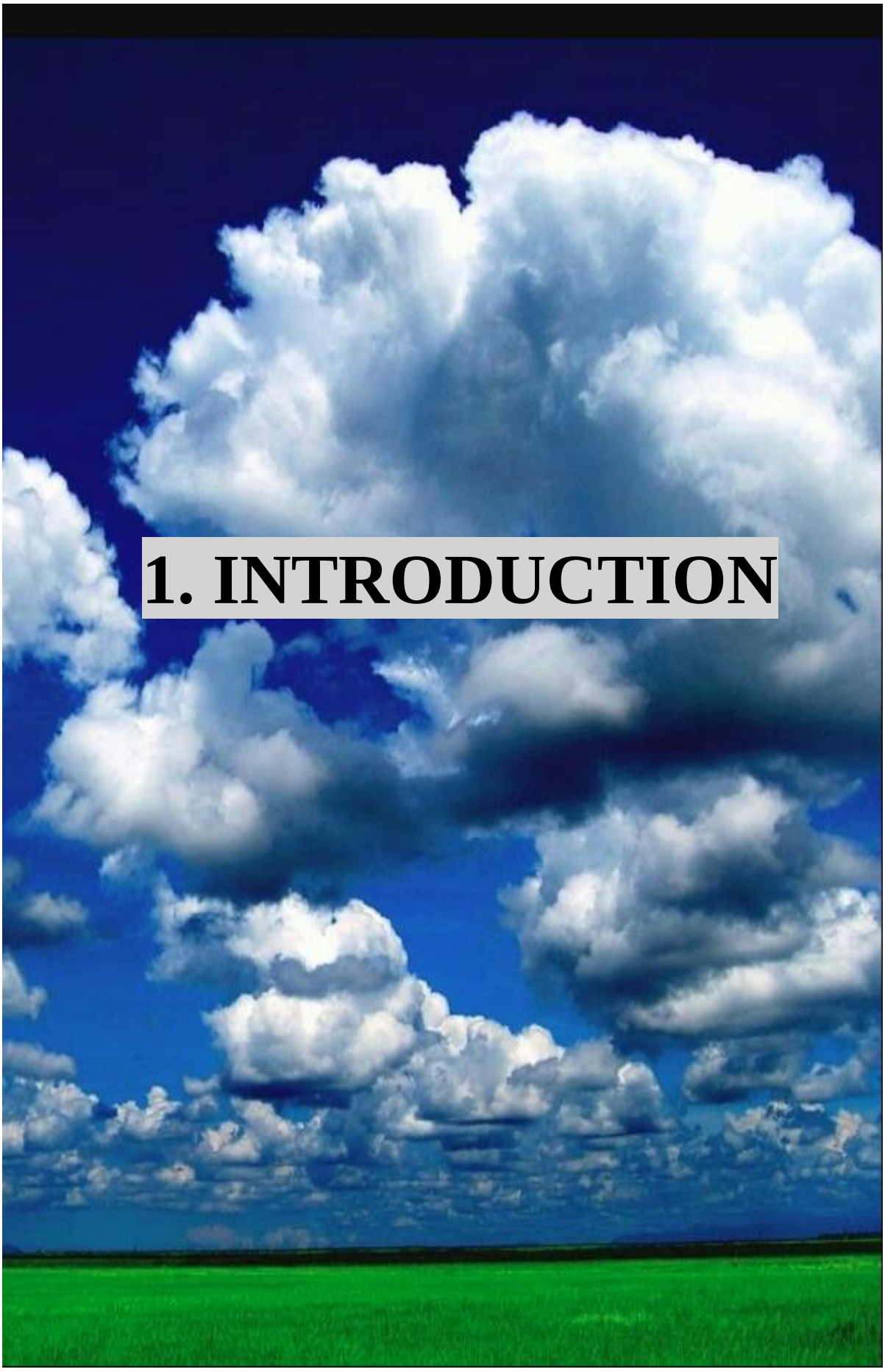
Acronyms and Abbreviations

ARRCC	Asia Regional Resilience to a Changing Climate (Programme)
BARI	Barani Agriculture Research Institute
DSS	Decision Support System
ICIMOD	International Centre for Integrated Mountain Development
IBF	Impact Based Forecasting
NAMC	National Agromet Centre
NMHS	National Meteorological and Hydrological Service
NWFC	National Weather Forecasting Centre
PAD	Punjab Agriculture Department
PMD	Pakistan Meteorological Department
RIMES	Regional Integrated Multi-Hazard Early Warning System
SWFP	Severe Weather Forecasting Programme
SOPs	Standard Operating Procedures
UKMO	UK Met Office
WMO	World Meteorological Organisation

Executive Summary of The Project

In order to enhance the capability of Pakistan Meteorological Department (PMD) to produce Impact based weather-related forecasts to accomplish the requirements of the farming community, Impact Based Forecasting project (IBF) was initiated in 2018 with the collaboration of PMD and UK Met office (UKMO) under the umbrella of Asia Regional Resilience to a Changing Climate (ARRCC), program of World Meteorological Organization (WMO). During the first phase as a pilot case, the IBF mechanism was developed for two districts (Attack and Chakwal) of the Potohar Region for the Kharif season. Several meetings, workshops, and a field survey were conducted with the cooperation of relevant stakeholders (Punjab Agriculture Department (PAD) extension wing, Academia, Agriculture Research Institutes, and farming community of the Potohar region), besides PMD and UKMO, to develop the impact tables and other necessary documentation to generate impact-based forecasts. IBF services were launched in 2022 for the two districts of the Potohar Region. After the successful completion of the first phase, PMD took the initiative for the second phase to develop IBF for the entire Potohar region for Rabi season crops in the same year. All the necessary requirements were fulfilled with the assistance of other stakeholders. PMD also conducted a second field survey for the entire Potohar region. Results of both surveys indicated that most of the farmers rely on PMD products, and there is a dire need to improve the accuracy, time span, and impact of different forecasts during various growing stages on standing crops in the Potohar region. The second phase of the project was completed in 2023, and IBF products for the entire Potohar region are regularly produced and updated on the PMD web page, as well as disseminated to the farming community through various channels. The activities of the project greatly enhanced the capability of PMD agro-meteorologists, which resulted in the successful completion of the second phase of the IBF project. PMD also conducted several post-project seminars and meetings with other stakeholders, especially the extension workers and farming community, to upgrade the IBF products. A digital feedback mechanism was also developed on the IBF web page for further improvement of IBF products. After the second phase of the IBF project, PMD has also been engaged with other provincial agriculture departments, research institutes, and academia, besides the PAD agriculture department, to further expand the concept of IBF in other parts of the country. It is expected that soon, IBF will be produced for all the climatic regions of the country with different crop patterns and management practices. For this purpose, NAMC data network and infrastructure development, a sound feedback mechanism from different stakeholders, including the farming community, and collaboration with provincial agriculture organizations and academia should be enhanced and encouraged to get optimum results regarding the implementation of IBF at the country level.



1. INTRODUCTION

1.1 Road Map of the Project

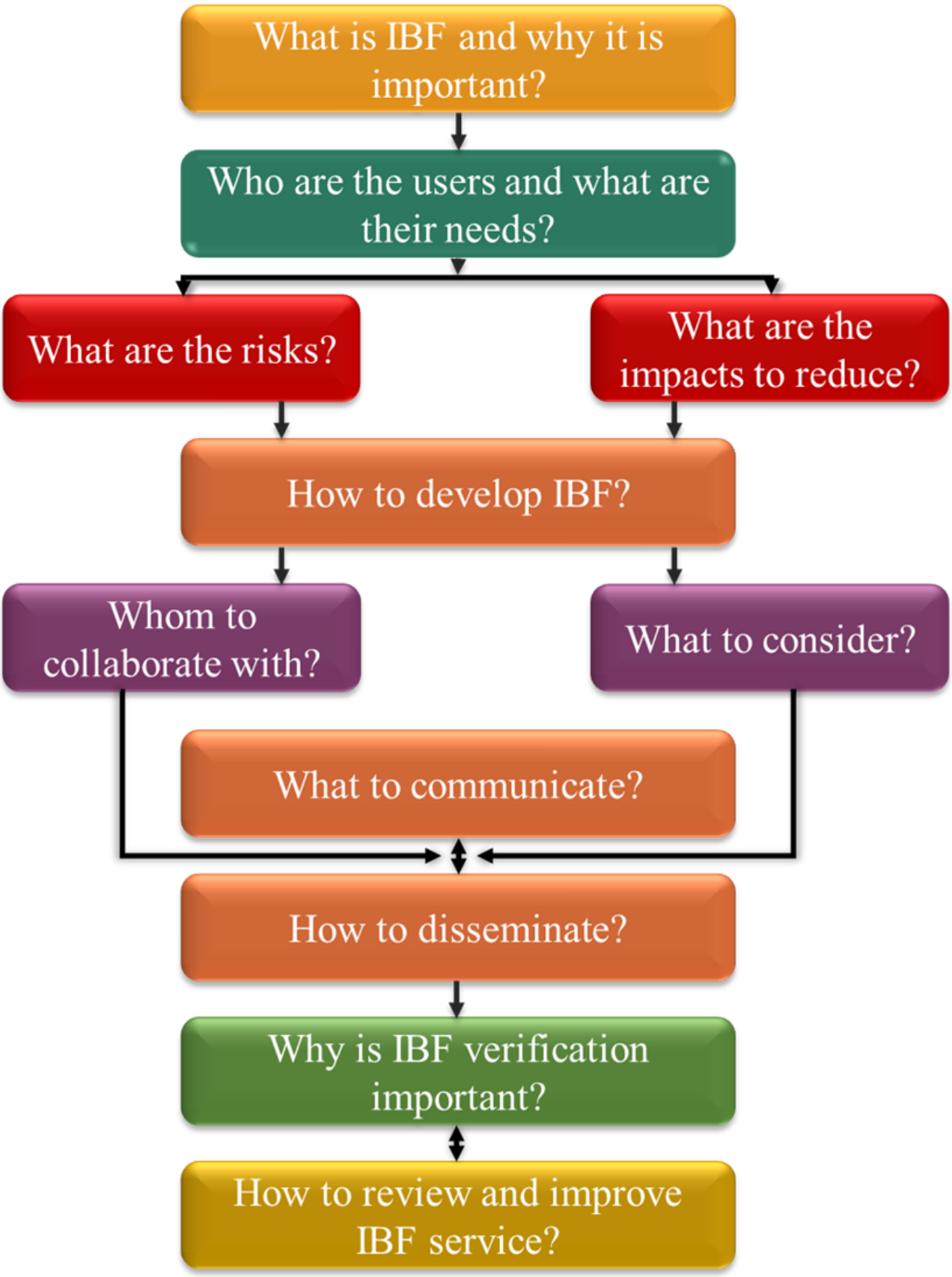


Figure 1: IBF Design, Extracted from UKMO Report on IBF [10]

1.2 Background of the Project

According to the latest national and international updates, Pakistan ranks as the 5th most populous country in the world, with over 240 million people [1]. Agriculture plays a crucial role as the backbone of Pakistan's economy, like other developing countries. Most of the rural population directly depends on agricultural production, and most of the raw material required for the industrial sector is also obtained from agriculture. It feeds the entire rural and urban population of the country [2].

Climate change has also played a vital role in the rising frequency and intensity of floods, heat waves, and heavy torrential rains, which directly affect agricultural production in Pakistan [4]. Annual variation in precipitation also affects groundwater and water stored in open-air reservoirs for irrigation and other purposes [5]. According to the Global Climate Risk Index (2021), Pakistan is ranked as the eighth country in the world most vulnerable to long-term climate risk and one of the least contributing countries to climate change [6]. It is therefore of immense importance to utilize our resources more effectively and to reduce the losses to the farming community due to day-to-day variations in the weather and climate of our region.

According to the PMD data catalog, Pakistan has a variable climate with mostly arid to semi-arid pattern. Dense fog/smog, prolonged droughts, and intense heat waves are now common features of our climate, which are drastically affecting agricultural production, especially in the rainfed areas and southern agricultural plains of the country. This alarming feature of our climate developed during the last 20-30 years has also been confirmed by the farming community in the Potohar region during the survey conducted by PMD in February-March 2023 [3,15].

It is therefore obvious that agricultural production in Pakistan varies year to year due to its varying weather conditions, especially the occurrence of the required amount of rainfall at the appropriate time. Besides other weather-related phenomena like wind/hail, thunderstorms, flash flooding, dry weather/drought, and heat waves, which occur during summer. Proper growth of both Rabi and Kharif crops like wheat, cotton, sugarcane, rice, ground nuts, and maize depends upon suitable amount of rainfall both in irrigated and rainfed areas of Pakistan [7].

PMD is responsible for producing and issuing several kinds of weather forecasts based on various time frames and related Agromet bulletins and advisories to facilitate farming

communities. To transform PMD products according to the requirements of the farming community, the IBF project was initiated in 2018 by the collaboration of PMD and UKMO. The project is based on the concept of the impact of the forecast on the livelihood of the farming community, i.e., to modify different PMD forecasts and advisories to "**what the weather will do?**" in place of "**what the weather will be?**". There was a dire need for PMD's farmer-related products to be based on various impacts from season to season and crop to crop [8].

1.3 Aim of the Project

1. To strengthen the capability of PMD according to the requirements of the farming community to develop IBF.
2. Supporting co-development and co-production approaches for IBF between PMD, provincial agriculture departments, and "end-users" in weather and climate-sensitive sectors.

1.4 Introduction to PMD: NAMC and NWFC

Pakistan Meteorological Department (PMD) is both a scientific and a service department, and functions under the Ministry of Defense. It is responsible for providing meteorological services throughout Pakistan to a wide variety of interests and for numerous public activities and projects that require weather information. PMD is headed by the Director General. Functionally, it is composed of the following four major divisions, with the head office located in Islamabad and the Camp office at Karachi. Each Division is headed by a Chief Meteorologist.

The National Agromet Centre (NAMC) is an important division of PMD, which has been set up to relate meteorological services to the most important agriculture sector of the country, to promote the overall status of the farming community. NAMC has thus extended its services since its establishment in 1988. NAMC regularly updates its different weather forecasts, advisories, and bulletins based on different time scales, besides routine forecasts of the National Weather Forecasting Center (NWFC). NAMC has a network consisting of its main office at PMD Islamabad, Regional offices, and Agromet observatories across the country (Figure 2).

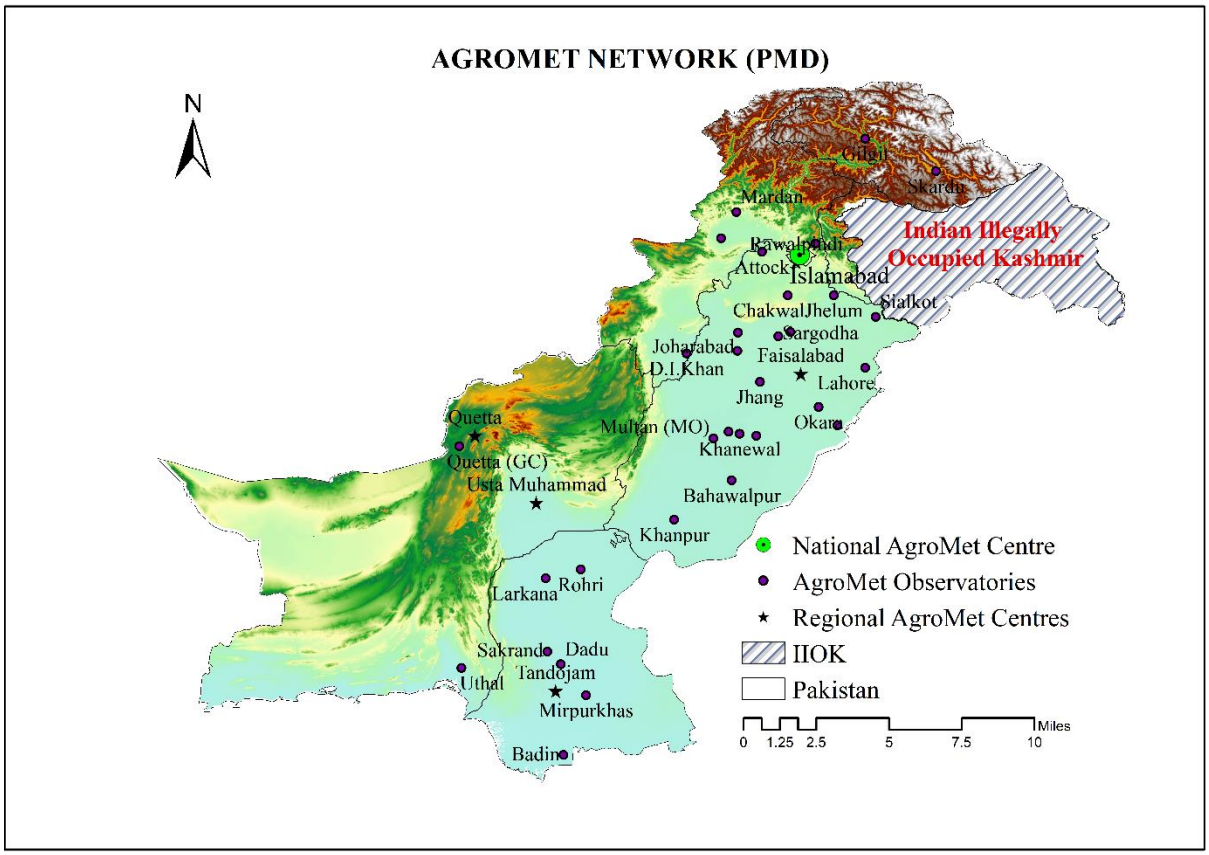


Figure 2: Agromet Network of PMD

The National Weather Forecasting Center (NWFC) has the responsibility of producing different weather forecasts ranging from nowcasting/daily forecasting to weekly weather forecasts, which are issued in the form of press releases, advisories, and early warnings based on different time spans according to the requirements of different users. NWFC also updates

the public about catastrophic weather events like flash flooding, heavy torrential rains, heavy snowfall, and landslide events in different parts of the country. It regularly updates national and provincial disaster management authorities and other government agencies, especially during the monsoon season, besides routine weather forecasting services.

1.5 Introduction to IBF Project

The IBF project was initiated in 2018 by the collaboration of UKMO and PMD under the umbrella of the Asia Regional Resilience to a Changing Climate (ARRCC) program, pursued by Leeds University, United Kingdom (UK). Impact-based forecasting produces integrated, authoritative messages being delivered to all parts of farming society so that they may take appropriate action to ensure personal safety and protect property. The first phase of the project was completed with the assistance of the PAD Extension wing, the Agriculture Research Institutes in the area, and the farming community of the Potohar region, in August 2022.

IBF was developed for two districts (Attock and Chakwal) of the Potohar region, keeping groundnut crops as the major crop for the study. After the successful completion of the first phase, PMD took the initiative to extend the concept of IBF to the entire Potohar region. The

second phase was designed to develop a mechanism for IBF for Rabi season crops, taking wheat as a major crop, which is cultivated in the entire Potohar region. During the development of the second phase, a survey was conducted by PMD in the Potohar region with the assistance of the agricultural extension wing of PAD. The survey aimed to interact with the farming community of the region and to find the requirements of the farming community regarding PMD products. Impact tables for wheat crops were produced with the assistance of the extension wing of PAD and the farming community in the same way as prepared for ground nuts during the first phase of the project. The second phase of the project was completed in 2023, and IBF products of PMD, both for the Rabi and Kharif seasons, are regularly produced and updated on the PMD web page. These products are also distributed with PAD and the farming community through different WhatsApp groups and FM Radio service.

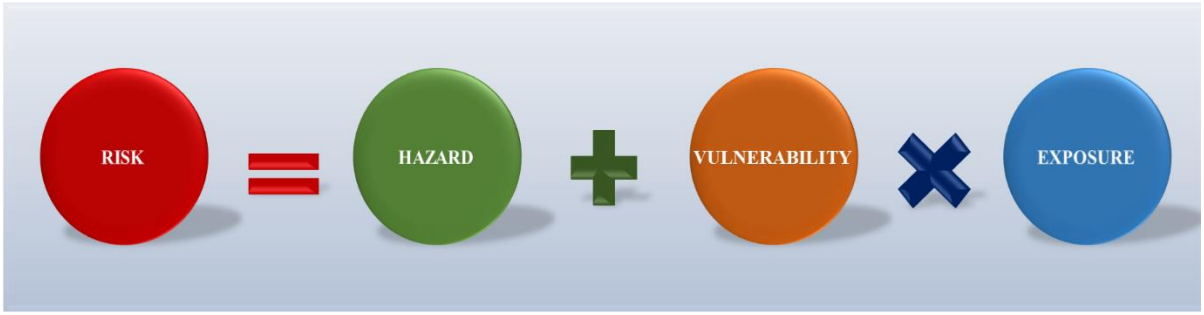
In the near future, PMD intends to expand the IBF project to other parts of the country. An initial study was conducted for South Punjab and Lower Sindh in 2023 to produce impact-based PMD products for these regions. For this purpose, PMD experts from NAMC and NWFC visited these areas to conduct initial discussions with provincial agricultural departments of respective regions and farming communities to understand the mutual requirements of PMD and farming communities of these areas. In January,2024 a PMD team visited Lahore and Quetta with the RIMES (Regional Integrated Multi-Hazard Early Warning System) team to communicate with PAD and the Agriculture Department of Baluchistan to produce a DSS (Decision Support System) for the dissemination of IBF products for other parts of Punjab and Baluchistan in the future.

1.6 Components of Impact Based Forecasting

According to WMO guidelines on multi-hazard impact-based forecast and warning services [8,14] published in 2015, Hazard, Exposure, and Vulnerability and Risk are the most important and relevant components of IBF.

1.6.1 Hazard, Exposure, Vulnerability, and Risk

Figures 3 and 4 provide a comprehensive illustration of the factors that influence the



vulnerability of an area. The subsequent explanation below offers a detailed analysis of these factors, highlighting their significance in understanding vulnerability dynamics.

Hazard: A hazard is a potentially damaging physical event, natural phenomenon, or human activity that may cause injury or loss of life, property damage, social and economic disruption, or environmental degradation. Sand and windstorms, landslides, drought, wildfires, tsunamis, and floods are common examples of hazards.

Exposure: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

Vulnerability: The characteristics and circumstances of a community, system, or asset that make it susceptible to the damaging effects of a hazard.

Figure 4: Factors Affecting Vulnerability of an Area, Extracted from WMO Guidelines on IBF [8]
Figure 3: Factors Affecting Vulnerability of an Area

Risk: It is the combination of the probability of an event and its negative consequences. It mainly depends on the type of hazard, vulnerability, and exposure of the population. Risk can be easily understood using Figure 4.

1.6.2 Impact Table

The importance of both likelihood and impact information can be illustrated through consideration of the 'impact risk matrix' (Table 1). The impact risk matrix is often used in IBF and provides a traffic light scheme, whereby warnings from 1 (Green – No Action) to 4 (Red – Take Action) are issued depending on the combination of likelihood and impact. This risk matrix has been adopted by several meteorological organizations across the globe and is in the process of being developed in Pakistan [8,9], the focus of the present study.

Table 1: Impact Table

Likelihood	**High**				
	Medium				
	Low				
	Very Low				
		Very Low	**Low**	**Medium**	**High**
	Impact				
Green	No severe weather expected				
Yellow	**Be Aware:** There is a moderate risk of severe or a low risk of extreme weather occurring. Remain alert and ensure you access the latest weather forecast				
Amber	**Be Prepared:** There is a high risk of severe or a moderate risk of extreme weather occurring. Remain vigilant and make sure you access the latest weather forecast. Take precautions where possible.				

Red	**Take Action:** There is a high risk of an extreme weather event occurring. Remain extra vigilant and ensure your access to the latest weather forecast. Follow orders and any advice given by the PMD and Disaster management authorities under all circumstances, and be prepared for extraordinary measures.

1.6.3 Impact-Based Forecasting: "the future of weather forecasting"

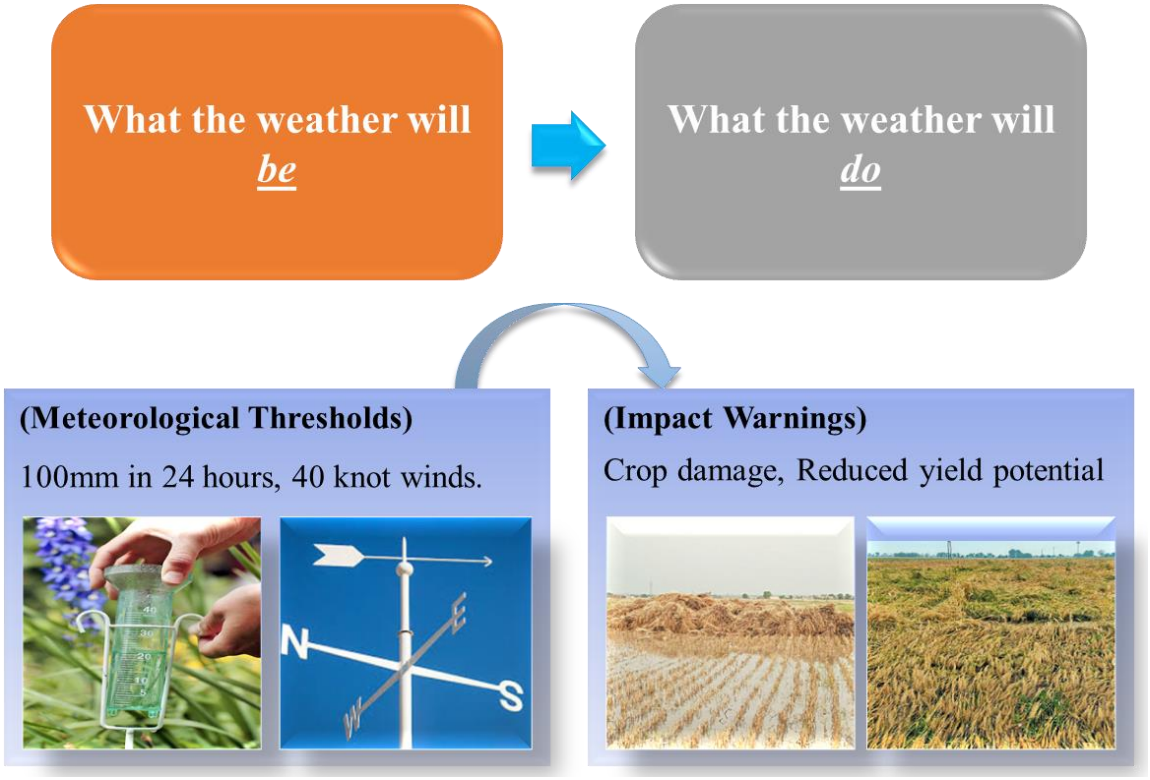


Figure 5: Impact Based Forecasting: "The Future of Weather Forecasting"

Impact-based forecasting enables anticipatory actions and revolutionizes responses to weather and climate crises, turning forecasts and warnings from descriptions of what the weather will be into assessments of what the weather will do. It is likely to enable organizations and individuals worldwide to anticipate and take action to mitigate the impacts of weather and climate events [12,13]. By developing IBF, critical information is provided to help mitigate the life-threatening impacts of vulnerable areas and communities. With ever-growing pressure on land use, energy, livelihoods, food availability, water, and shelter, global interest in minimizing the human and economic costs of extreme weather and climate events continues to increase. IBF provides the information needed to act before disasters to minimize the socio-economic

costs of weather and climate hazards. Organizations and individuals can make critical decisions to ensure that resources and supplies are in place to take early action and to respond as soon as it is safe to do so. The inclusion of risk assessments makes impact-based forecasting unique among other generic forecasts and warnings. Hazard forecast information combined with vulnerability and exposure data is used by national meteorological services and partner organizations to create a risk assessment. The following Table 2 clarifies the concept of IBF [9, 10].

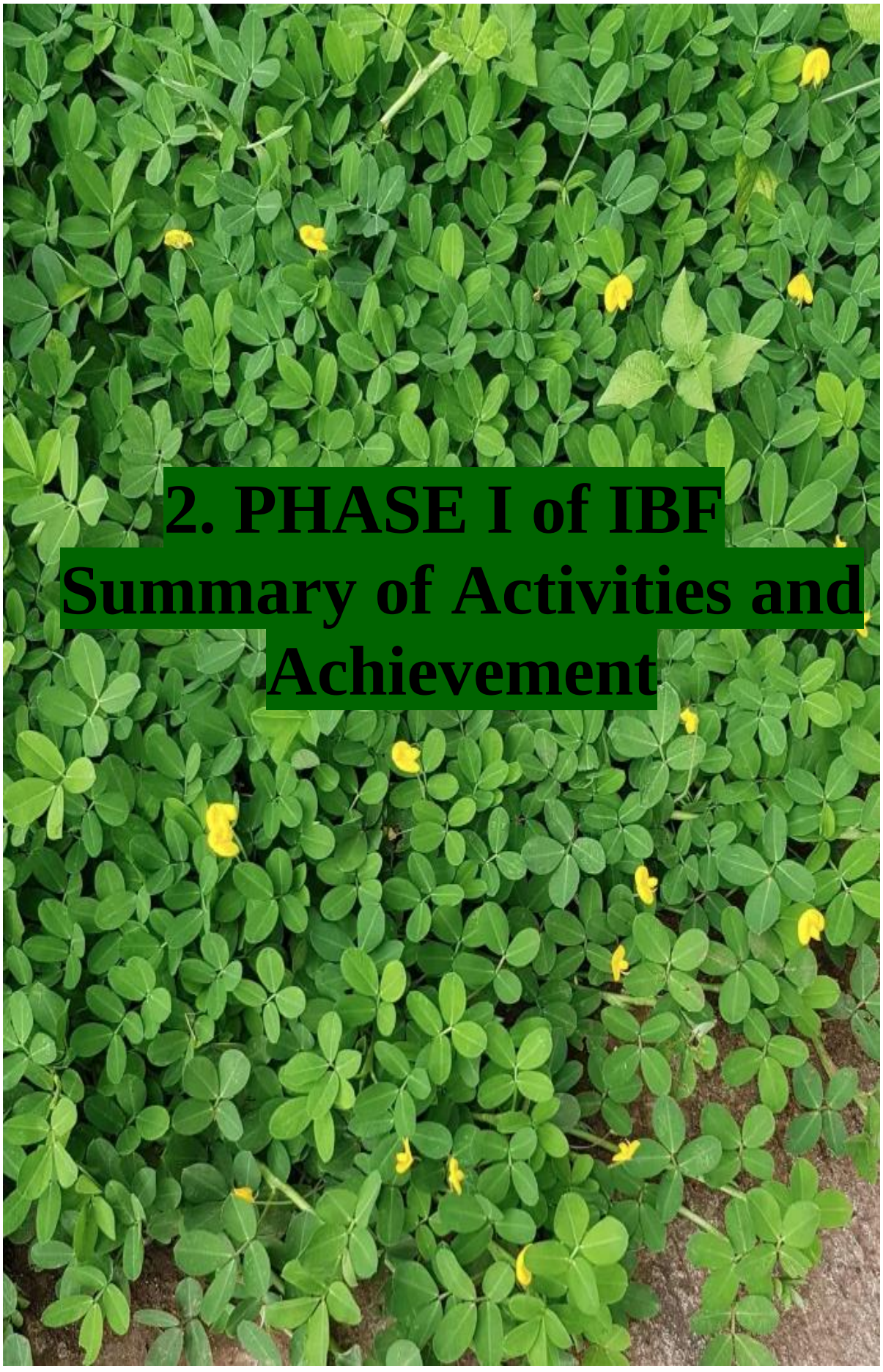
Table 2: Comparisons between Traditional Forecasts and Impact-based Forecasts

Hazard	Ordinary Met Forecast	IBF	IBF for Sector Specific Users
Flooding	Heavy rain amounting more than 150mm is expected within the next 12-hour period. This rain bearing weather system is likely to persist for next 3 days.	Due to heavy rain expected during the next 12 hours, flash flooding in the nearby nullah is expected. Residential area, Within 100m of the nullah are expected to flood and be damaged.	The forecasted water level in the annual cultural festival is expected to cross the alert threshold during next 12-18 hours and remain above for further 3 days. The impact forecast of loss of household assets is over 50% and the affected population is over 40%.
Tropical Cyclone	A tropical cyclone of category 3 with a wind speed of 125 km/h is expected in the next 48 hours.	A tropical cyclone of category 3 with a wind speed of 125 km/h is expected in the next 48 hours, likely to critical damage infrastructure such as bridges, coastal area infrastructure, and blocking transport from region X to region Y	A Tropical cyclone, lead time of 48 hours, with wind speed greater than 125 km/h are likely to cause landslides during the next 72 hours, accompanied by heavy showers in the agriculture zone, corresponding to an impact forecast of damage to orchards and other standing crops, human and livestock casualties, and damage to infrastructure in the region. Farmers and relevant disaster management authorities are advised to be alert during the next 3-4 days.

With impact-based forecasting, national meteorological services assess the impacts of the forecasted climate and weather phenomenon and consider their warnings based on the severity of those impacts at that location for the target users/groups. Understanding the users of forecasts and warnings is critical to the development and operational delivery of impact-based forecasting. These understandings are formed through partnerships with the individuals and organizations that will use the final tools. From the design to the delivery of impact-based forecasts and warnings, input from users is essential [10,11].

In the present case, the project's first phase was completed with the robust collaboration of UKMO, PMD, and related provincial agriculture departments. The second phase of the project was also completed due to the cooperation between PMD, agriculture extension academia like Barani Agriculture Research Institute, Chakwal, and the farming community for producing impact tables for the Rabi season covering the entire Potohar region, and the same cooperation was present for other activities like baseline survey, which was conducted in all 24 tehsils of

the Potohar region. Now, IBF products for the farming community of the Potohar region are regularly produced and communicated through different channels with farming communities.



2. PHASE I of IBF Summary of Activities and Achievement

2.1 Introduction to Phase I of the IBF Project

As per the details given below, the first Phase of the IBF project started in the form of a pilot case for two districts of the Potohar region with the collaboration of PMD, UKMO, and other stakeholders, including the PAD Extension wing, academia, agriculture research institutes, and the farming community of the region. The project was initiated to strengthen technical capabilities, providing appropriate training and development opportunities to PMD, and to form a collaboration network of PMD, the Agriculture department, and the farming community under the concept of impact-based forecasting for the welfare and protection of the farming community.

2.2 Timeline of Activities of Phase I

Year 1 (2018-2019) activities:

1. Launch of IBF, identification of aims and objectives at the regional and national levels.
2. Initial engagement and introduction to PMD, scoping, and planning for future engagement in the country.
3. Identification and collaboration with selected regional bodies who may have a role in facilitating delivery (i.e., International Centre for Integrated Mountain Development (ICIMOD), PAD Extension wing)
4. Stakeholder mapping and requirements reports.

Year 2 (2019-2020) activities:

1. In-country workshop (July 2019) to engage with PMD, disaster management agencies, and other selected regional bodies; sensitisation to IBF.
2. WMO Severe Weather Forecasting Programme (SWFP) Training Workshop held in Pakistan (November 2019) (Technical training).
3. Consultation workshop on IBF in Pakistan (November 2019) – Identification of key hazards and priorities within Pakistan for consideration in the selection of IBF pilot.
4. Training needs analysis and identification of capacity development opportunities through discussions with PMD, which led to the delivery of technical training centred around Numerical Weather Prediction interpretation and its application (March 2020).

Year 3 (2020-2021) activities (limited due to COVID-19):

1. Discussions to agree focus for the IBF pilot.
2. Commissioning of ICIMOD to conduct a baseline survey to support the IBF pilot.
3. Baseline survey design during the early part of 2021.

Year 4 (2021-2022) activities:

1. Baseline survey conducted (Nov 2021).
2. IBF training for PMD staff (Jan 2022)
3. IBF co-production workshops (PMD, producers and users) (Feb and Mar 2022)
4. IBF pilot launched (April 2022).
5. IBF stakeholder and focal persons workshop (Jul 22)
6. ARRCC programme concludes (end of Aug 22)

2.3 IBF Pilot

The IBF pilot has been designed to support resilient agriculture in Pakistan to enable farmers to better plan their farming activities (including planting and harvesting), which in turn should result in increased crop yields, leading to increased food security. The service launched in April 2022 and was piloted through the Kharif growing season, which runs from April to September for two districts, Attock and Chakwal, in the Potohar region. Initially, groundnut and maize were decided to be major crops for the study, but later only the groundnut crop was decided to be taken as a single major crop for IBF design and development.

2.3.1 IBF Baseline Survey for the Development of IBF Pilot

In November 2021, ICIMOD was commissioned to conduct a baseline survey to evaluate the current provision of weather and seasonal climate services of PMD in two districts: Attock and Chakwal of the Potohar region in Punjab, Pakistan, as illustrated in Figure 6, which focused on the provision of agro-met advisories/forecasts. The main objective of the survey was to understand awareness of, and access to, these services by sampling 300 households in Attock and Chakwal districts.

2.3.2 Key Findings of the Survey

The key findings of the survey were:

1. Wheat, groundnut, and maize are the major crops cultivated in the study area.

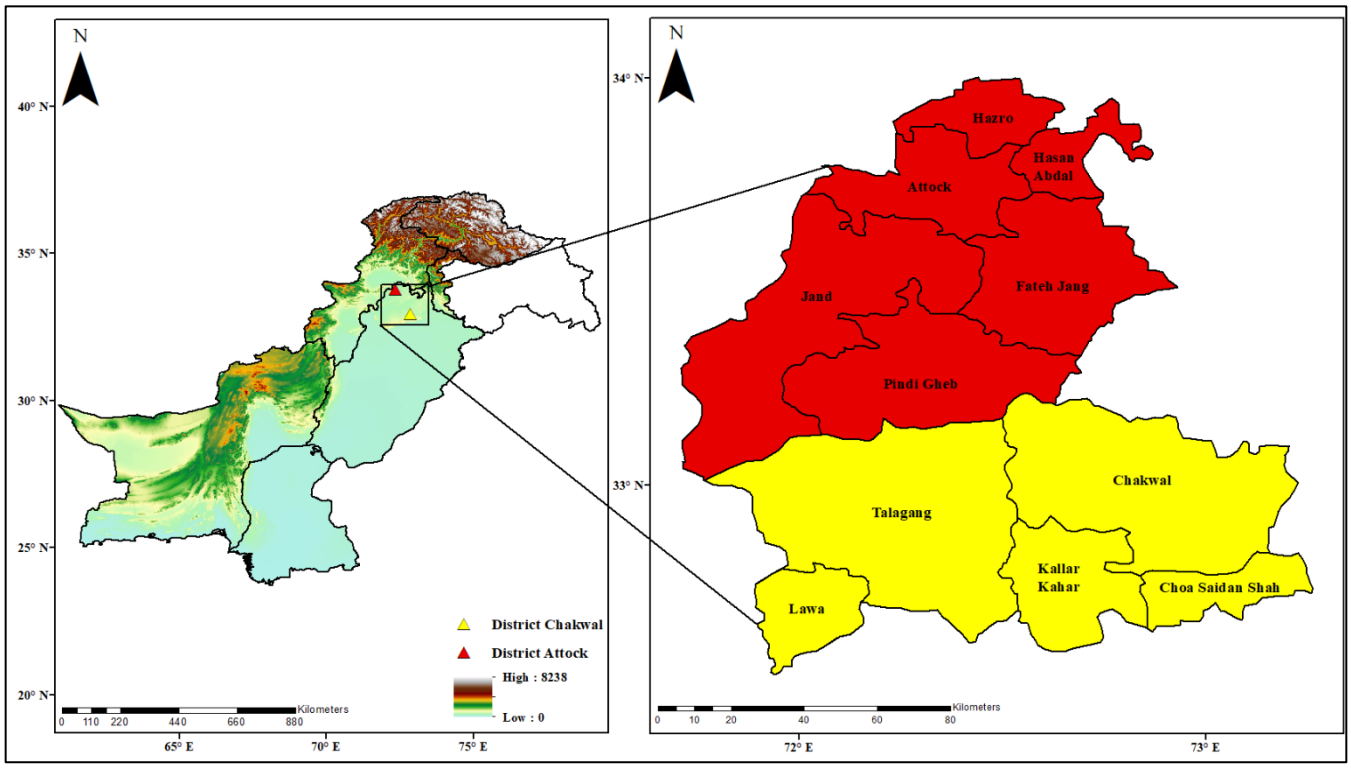


Figure 6: IBF pilot districts tehsil map within the Punjab region of Pakistan

2. Farmers have suffered mainly due to prolonged dry weather during the past several years.
3. All farmers know about the services of PMD, and more than 60% actively use PMD services. This suggests that there is scope for more accurate weather-related impact forecasts for the area.
4. Extension workers of PAD are the biggest single source of communication of Agromet and Foecasting products of PMD, followed by TV, YouTube, and social media.
5. About 26% users get weather information from non-PMD sources available online.
6. Most of the farmers credit PMD for the provision of timely weather-related news, but suggest further improving the forecast according to local requirements.

2.4 Major Stakeholders besides PMD and UKMO

The primary stakeholders and recipients of the warning service are:

1. Agricultural Extension Workers
2. Agricultural research institutes like Barani Agricultural Research Institute (BARI) and Groundnut Research Station
3. Farming community of the Potohar region

2.5 IBF Design

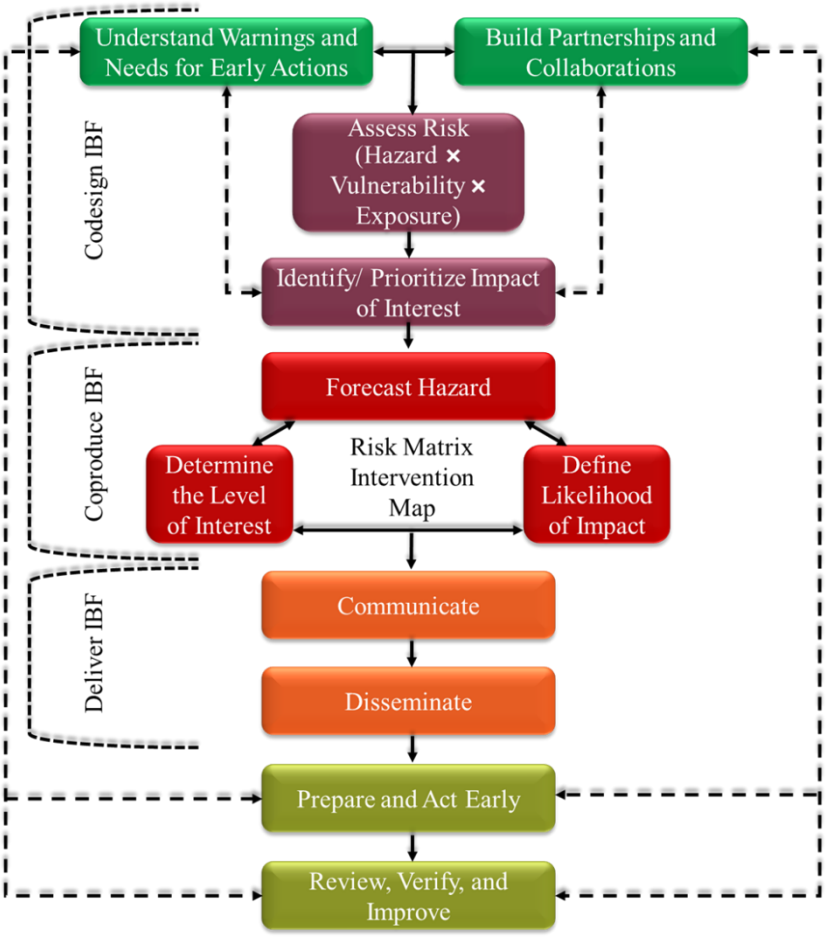


Figure 7: IBF Design, extracted from UKMO Report on IBF [10]

Following the identification of the primary weather hazards of rainfall and other related weather events and relevant stakeholders, especially the agriculture extension and farming community, there was a clear need for an IBF service. The UK Met Office team shared some examples of IBF products and related terminology from the UK Met Office as well as from other National Meteorological and Hydrological Services (NMHSs) with PMD as an initial step for developing products and services that meet the needs of PMD and other stakeholders. The PMD team, after consulting with other stakeholders, worked on an impact-based matrix and other impact tables for Groundnut according to each phenological stage, being cultivated in the Potohar region. Generalized advice for farmers related to expected weather and its possible impacts on the crop according to their phenological stage are given in these impact tables.

Figure 8: Stakeholders Training Workshops on Implementation of IBF

2.6 Generalized Impact Tables for Groundnut Crop

As mentioned above, the impact tables of the groundnut crop are given below. These tables include the impacts of expected weather on the standing crop at a given phenological phase, with possible advice for the farmers. Groundnut crop is generally cultivated in the Potohar

region in the months of April/May, and the crop matures for harvesting till October/November. A suitable amount of rainfall is very important for sowing and early growth. Whereas dry weather is required during maturity/harvesting. Prolonged dry weather before monsoon rains and consistent heavy downpour during monsoon in some areas adversely affect the growth and yield obtained in the rainfed cropping zone of the Potohar region. Details of the generalized impact tables of the crop cycle from sowing to full maturity are enclosed in the annexes. Impact tables of only sowing/early growth and full maturity are given below.

Table 3: Groundnut (at Sowing/ Early Growth) Impact Threshold-Rain - April to May

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots. 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots.			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm. and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots.		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots. 5 days accumulated rainfall > 80 mm. and/or thunderstorm/hail with/without maximum wind gust > 25 knots.	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Slight run off field and broken watts. Muddy paths.	Slight runoff off fertile land. Muddy paths and fields Germination/emergence may be affected.	Water inundation. Muddy paths and fields Germination/emergence may be affected. Insect attack (hairy caterpillar).	May produce localized flooding. Standing water in low-lying areas. Fields may become inaccessible. Damage to crop in the low-lying area of the field. Insect attack.

Advice/Action

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be Vigilant Monitoring of crops	Be cautious Be prepared for water drainage Re-sowing if required Spray of insecticide as advised by the agriculture department	Immediate drainage Re-sowing if required Spray of suitable insecticide as advised by the agriculture department

Table 4: Groundnut (at Full Maturity/Harvesting) Impact Threshold-Rain - Oct / Nov

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Very Little puddles in the field	Little puddles in the fields	Water Inundation Muddy paths and fields Difficulty in performing field operations	May produce localized flooding Damage to pods in relation to quality Aflatoxin may start Delay in harvesting

Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be Vigilant Monitoring of crops Slight rescheduling of harvest	Be cautious Be prepared for water drainage Rescheduling of harvest	Immediate drainage required Major rescheduling of harvest Immediate sun drying of the pods after harvest

2.7 Standard Operating Procedures (SOPs) for IBF Pilot

The development of SOPs was an important step that underpins the entire service, ensuring understanding and consistency throughout the process. Roles and responsibilities of each stakeholder, as decided with mutual consent, are given below. The following diagram in Figure 9 shows the proposed flow of information to the end users.

2.7.1 Details of the Responsibilities of NWFC in the SOPs

The National Weather Forecasting Centre (NWFC) would be responsible for:

1. Preparing the tehsil level forecast for the current week on each Monday, Wednesday, and Friday and sharing with NAMC.
2. In case of a significant weather phenomenon (Press release issued by NWFC), the IBF would be generated along with it. Supplementary bulletins till the dissipation of the weather system would follow this.
3. During weekends/gazetted holidays, NWFC will be sharing the script/audio messages with the focal persons of agricultural departments/research institutes, as well as PMD's media / IT units.

2.7.2 Details of the responsibilities of NAMC in the SOPs

The National Agro-Meteorological Centre (NAMC) would be responsible for:

1. Tailor the forecast received from NWFC in the context of the relevant farming community, add impacts and advice according to the weather forecast, to prepare IBF.
2. Share the prepared IBF with the heads of research institutes (already identified) for their input/feedback for the farming community (using WhatsApp group).

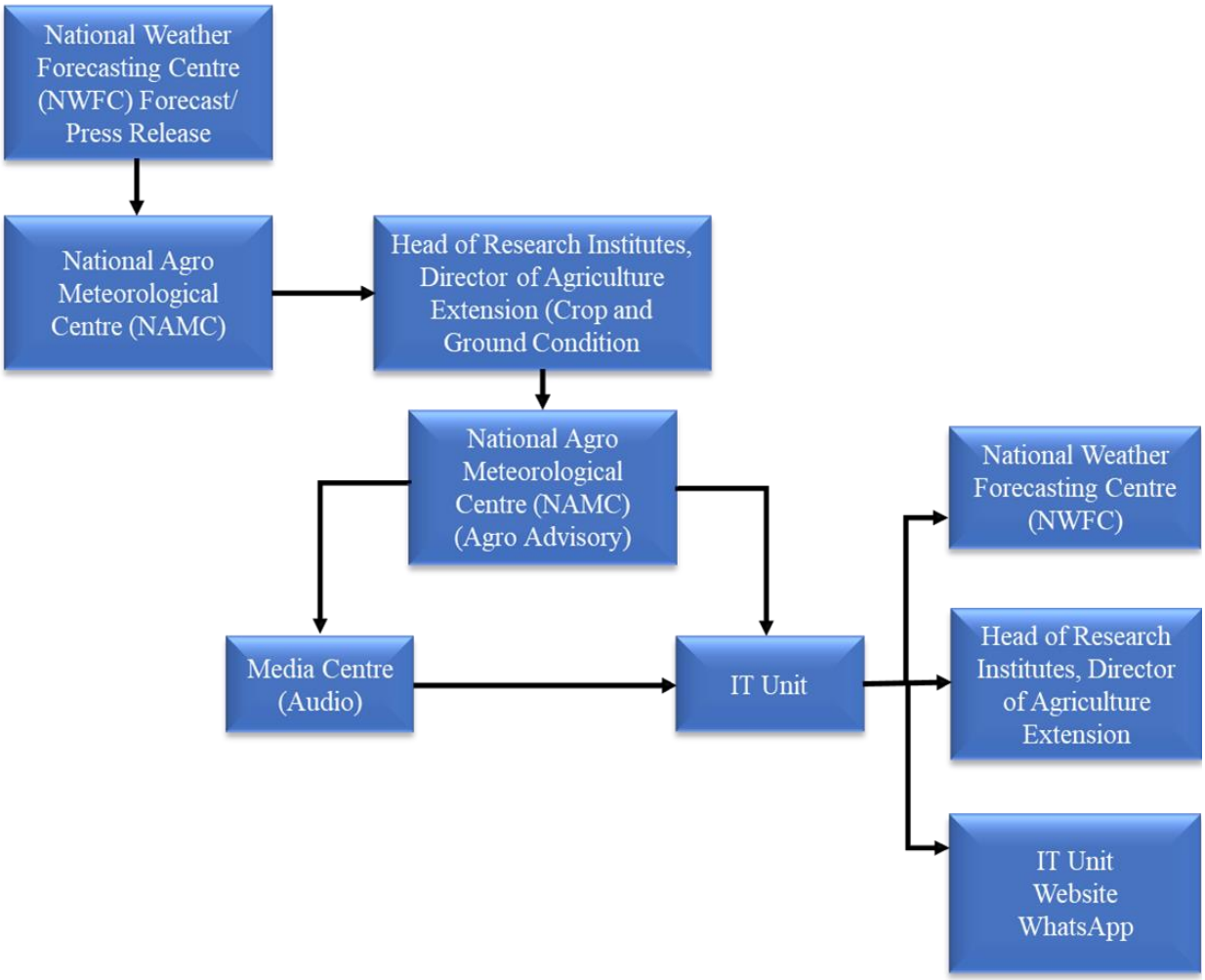


Figure 9: Proposed flow of information from producers to users as proposed within the IBF service.

3. After receiving the relevant feedback, the final IBF would be forwarded to the PMD Media unit for audio recording.
4. The final audio message (after receiving from media)/ IBF script would be shared with:
    - IT unit for uploading to the specified web page for IBF.
    - WhatsApp group including the head of research institutes and focal persons (at each tehsil level) for onward dissemination to the farmer community.
    - NWFC through email for their information.

2.7.3 Details of the responsibilities of PMD-Media Cell

The PMD Media Cell shall be responsible for the following tasks:

1. Preparing the audio clips of the final IBF forecast.
2. Share the final products through the official YouTube channel.

2.7.4 Details of the Responsibilities of the PMD-IT Unit

PMD-IT Unit would be responsible for sharing the final products through the weblink and social media, etc.

2.7.5 Details of the Responsibilities of Focal Persons

Focal Persons of Agri Departments / Research Institutes would be responsible for:

1. Actively check the WhatsApp groups/emails daily for messages from PMD
2. Share relevant information with local farmers immediately, adding additional advice. (When appropriate)
3. Provide fortnightly (1st and 15th of each month) updates on field conditions in their Tehsils to PMD via the WhatsApp group.
4. Provide feedback from local farmers on the usefulness of the warnings to PMD via the WhatsApp group.

After settling SOPs for all relevant stakeholders in the IBF project, PMD developed a dedicated website for the IBF and other related products, which included links for users to provide feedback and a risk matrix to show the level of impact and likelihood expected for the farmers of the Potohar region, including the two pilot study districts of Attock and Chakwal.

The impact tables and products were shared with the stakeholders during an IBF workshop for further validation and feedback. This was an opportunity to allow the stakeholders to practice using the product, identify how they would like to receive it, and what actions they would take on receipt, which was achieved through a Tabletop Exercise.

WhatsApp was a communication channel that was most favoured by the participants, as was local radio. From this insight, a dedicated WhatsApp group was established to link the users and producers of the IBF service, allowing users to provide feedback on impacts and ground conditions directly to PMD.

Later, due to a lack of coordination between the stakeholders and some other issues, only the PMD units remained functional (as shown in the following flow diagram in figure 10), and casual response is being received from other stakeholders regarding their responsibilities mentioned as mentioned above.

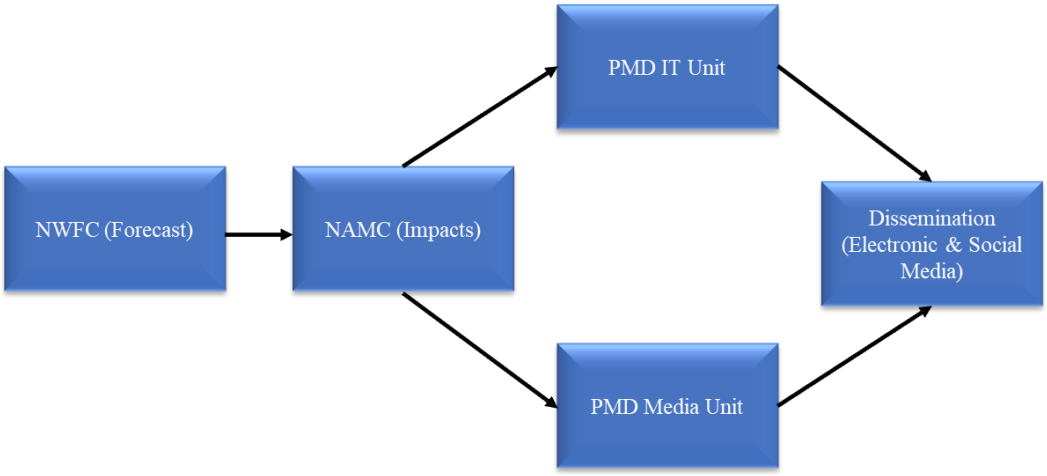


Figure 11: Present flow of information from producers to users within the IBF service

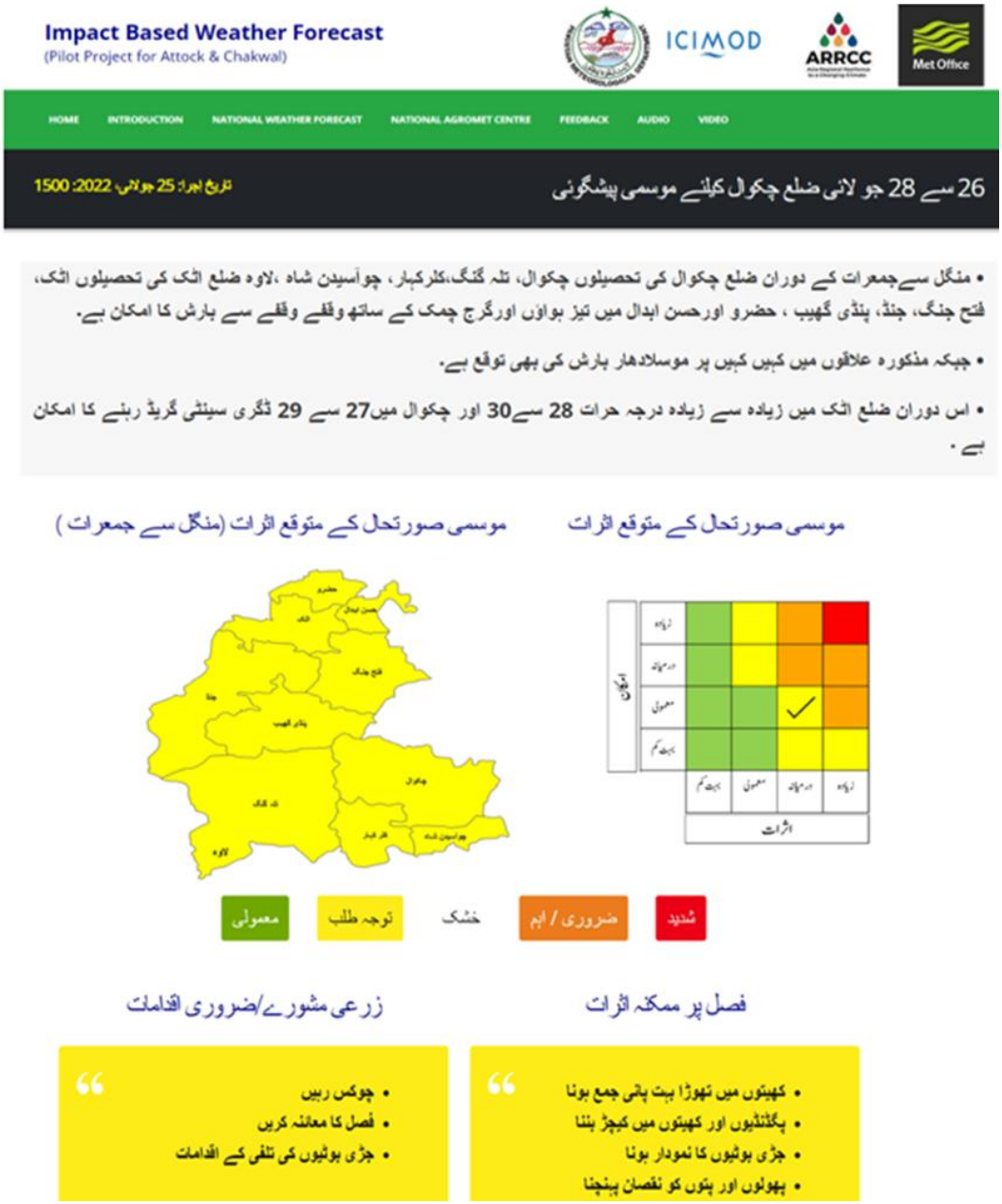


Figure 10: IBF Web page on PMD website.

IBF FOR POTOHAR REGION (Audio file)

تاریخ:01اگست2022:وقت1500

02 سے 04 اگست خطہ پوٹھوہار کیلئے موسمی پیشگوئی

- **جمعرات کے روز اسلام آباد، ضلع راولپنڈی کی تحصیلوں** راولپنڈی، کہوٹہ، گوجر خان، کلر سیداں، ٹیکسلا، مری، کوٹلی ستیاں ، **ضلع اٹک کی تحصیلوں** اٹک، فتح جنگ، جنڈ، پنڈی گھیب، حسن ابدال اور حضرو، **ضلع جہلم کی تحصیلوں** جہلم، دینہ، سوہاوہ، پنڈ دادن خان، **ضلع چکوال کی تحصیلوں** چکوال، تلہ گنگ، کلر کہار، چوآسیدن شاہ اور لاوہ میں مطلع جزوی ابر آلود اور مرطوب رہنے کا امکان ہے۔ تاہم جمعہ (شام / رات) سے ہفتہ کے دوران مذکورہ علاقوں میں تیز ہواؤں اور گرج چمک کے ساتھ بارش کا امکان ہے۔
- **زیادہ سے زیادہ درجہ حرارت:** ضلع راولپنڈی 33 سے 35، اٹک 35 سے 37، چکوال 32 سے 34، جہلم 30 سے 32 اور مری میں 21 سے 23 سینٹی گریڈ رہنے کا امکان ہے۔

ممکنہ اثرات اور حفاظتی اقدامات:

- موسلا دھار بارشوں کے نتیجے میں مخصوص ندی نالوں میں طغیانی کا اندیشہ ہے۔ اس لئے ایسی جگہوں پر انے سے گریز کریں۔ سیاح متوقع بارشوں کے دوران چوکنا رہیں اور حفاظتی تدابیر اختیار کریں۔
- ضرورت پڑنے پر اپنے کھیتوں سے جمع شدہ اضافی پانی کی نکاسی یقینی بنائیں۔
- بارشوں کے بعد کھیتوں میں نمودار ہونیوالی جڑی بوٹیوں اور حملہ آور کیڑوں کے تدارک کے لئے محکمہ زراعت کے مشورے سے ضروری اقدامات کریں۔
- کاشتکار حضرات اپنے معمولات متوقع بارشوں کی پیشن گوئی کو مدنظر رکھتے ہوئے انجام دیں۔
- بارش کے دوران بجلی کے کھمبوں اور تاروں سے دور رہیں اور برقی آلات کے استعمال میں احتیاط برتیں۔

نیشنل ایگرومیٹ سینٹر، اسلام آباد

Figure 12: IBF Audio Script

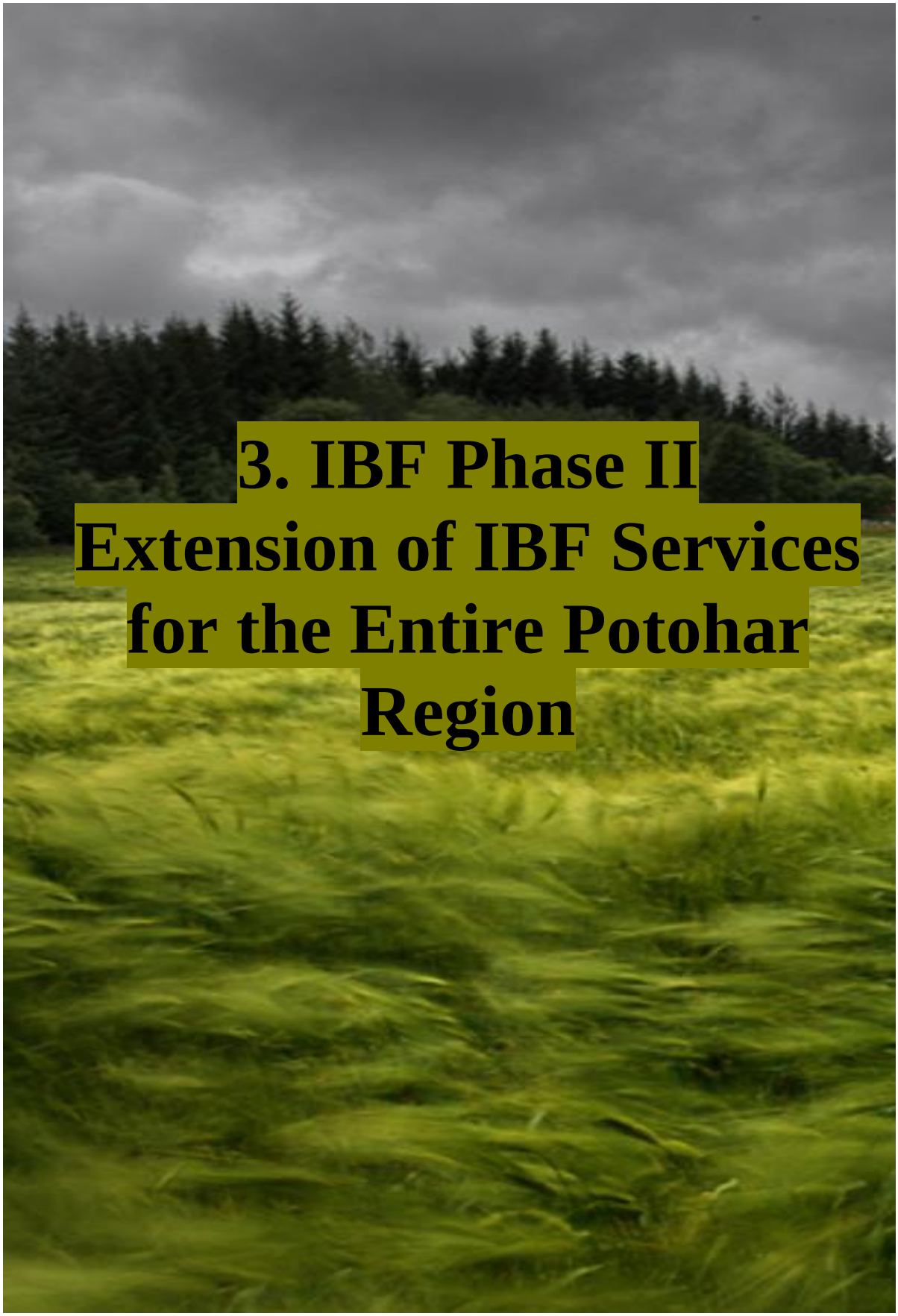
2.8 User Feedback

Figure 13: User Feedback

Stakeholder feedback is an important element of an IBF service and is used to inform and improve the service. A google form was designed to capture current conditions as well as impacts from recent weather. This, in combination with the WhatsApp group, provided PMD with validation information, which was also used to inform current and upcoming forecasts and warnings. Initially, stakeholder feedback was very limited, but PMD engaged with regional-level government departments to stress the importance of this process resulted in a good response from other stakeholders, as shown in the following figures of feedback data analysis till August 2022.

Figure 14: IBF Feedback workshop of the Extension wing of PAD Potohar Region, July 2023, PMD Islamabad

In July 2023, PMD also conducted a feedback workshop for extension wing officers and field workers of the Potohar region in PMD Islamabad. These workers gave very positive feedback about the IBF products for the Potohar region.



3. IBF Phase II Extension of IBF Services for the Entire Potohar Region

3.1 Introduction and Background of IBF Phase II

First Phase of IBF project completed for two districts, Attock and Chakwal, of Potohar Region, covering Kharif Season, taking Groundnut as the major crop. The project was completed due to the teamwork of PMD and UKMO, with the assistance of PAD Extension wing, Academia, and the farming community of the Potohar Region. In the continuity of Phase I, PMD decided to extend the same procedure of IBF for the entire Potohar Region for Rabi Season.

Wheat is the major Rabi season crop being cultivated in the Potohar Region during October – April. The crop is grown under rainfed conditions in most parts of the Potohar Region and is directly affected by varying weather conditions like prolonged dry periods, heavy rainfall, wind, and hailstorms etc. The magnitude of the impact of various weather events depends on the current growing stage of the crop.

To proceed, a real-time survey to acquire the basic information about the farming community and the cropping patterns in the Potohar region was conducted by PMD teams with the help of relevant agriculture extension staff in the entire Potohar region. Technical meetings were arranged with BARI Chakwal to give initial shape to the impact tables. Based on the survey and continuous interaction with the regional agriculture extension, impact tables were finalized. The regional weather-based hazards, including rainfall, temperature, and dry episodes, were considered while preparing the impact tables. As a result, IBF services are now regularly produced and updated on the PMD webpage. These IBF products are also disseminated through different channels to the farming community of the Potohar region.

3.2 Timelines of Phase-II

1. As pre-requisites, an initial meeting was organised to discuss the project with the heads and scientists of the Regional Agriculture Extension department of the Potohar region at the start of September 2022.
2. Technical meetings arranged at BARI, Chakwal, at the end of September 2022 to formulate the impact tables for both wet and dry periods.
3. At the start of October, the research institutes and the extension department were officially taken on board to finalize the impact tables for the wheat crop and proceed further.
4. The IBF regular services were launched at the end of October after several amendments were made after meetings with Agriculture research organizations, extension workers, and the farming community.

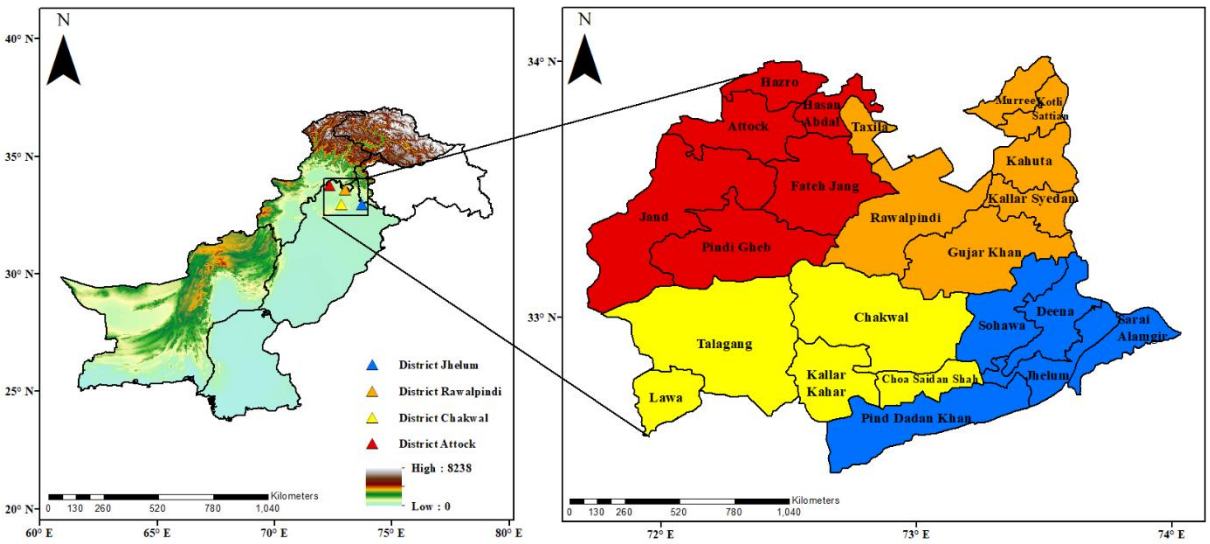


Figure 15: Tehsil map of Study Area (Potohar Region)

5. A technical survey was conducted in February 2023 in the entire Potohar region to further understand the issues and requirements of the farming community related to IBF and PMD.

3.3 PMD Field Survey for IBF in Potohar Region for Rabi Season

Learning from the previous experience of the survey conducted in the first phase of the IBF project, PMD decided to conduct a real-time survey by its own team to acquire the basic necessary information about the requirements of the farming community regarding PMD services and the cropping pattern in the Potohar region. Technical teams from the Forecasting and Agromet wings of PMD were selected for this field survey. The regional agriculture extension department was consulted to nominate the focal persons for each tehsil. Total of 440 farmers were contacted in the survey from 19 tehsils in the Potohar region using the digital platform of Kobo Collect downloaded from Google Play Store.

3.3.1 Questionnaire of the Field Survey for Rabi Season

A questionnaire for the survey was produced after several meetings and discussions between NAMC and NWFC. This questionnaire was loaded into the online digital survey platform KOBOL. The English version of the questionnaire is given below. A detailed Urdu version of the questionnaire is given in the annexure at the end of the report.

Q.1. Your Name and phone / WhatsApp number

Q.2. Which tehsil do you belong to/for which tehsil you are giving this info?

Q.3. For how long have you been engaged with agriculture, and which crops are you cultivating?

Q.4. Besides rainfall, which sources are you utilizing for irrigation purposes?

Q.5. Which sorts of weather phenomena have the major impact on your crops?

Q.6. Out of the above-stated weather phenomena, which of them remained the most damaging for your crops?

Q.7. Do you utilize PMD's services for obtaining weather-related information?

Q.8. Do you receive the weather information in time?

3.3.2 Field Survey Statistics (through KOBO tool)

Some responses to the field survey digital questionnaire are given below.

1. The following data in Figure 16 presents the percentage of participants contacted during the field survey, categorized by different Tehsils within the Potohar region.

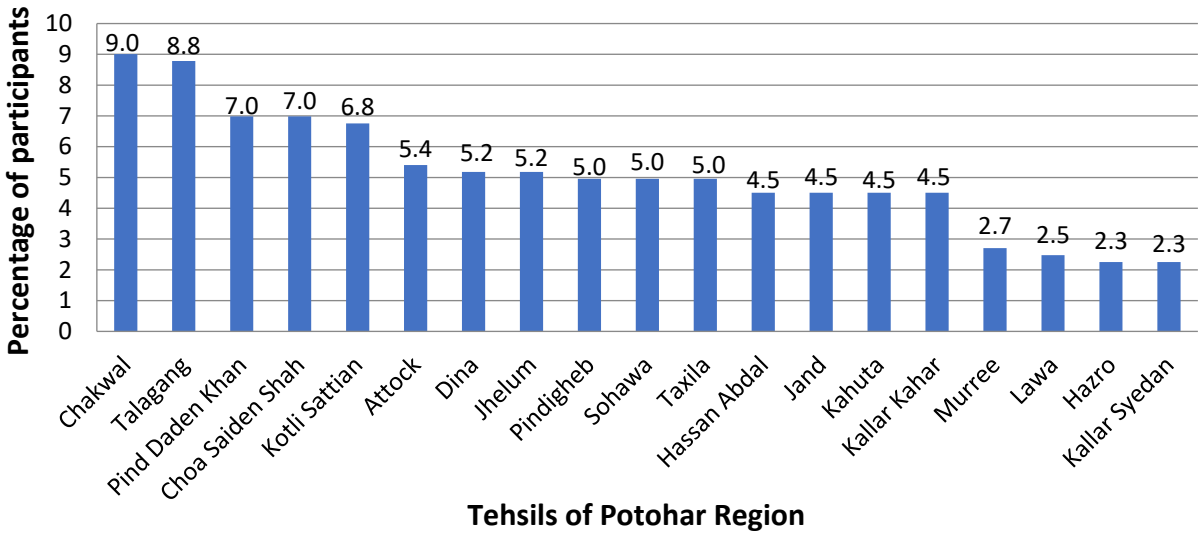


Figure 16: Percentage of participants contacted across Tehsils in the Potohar region.

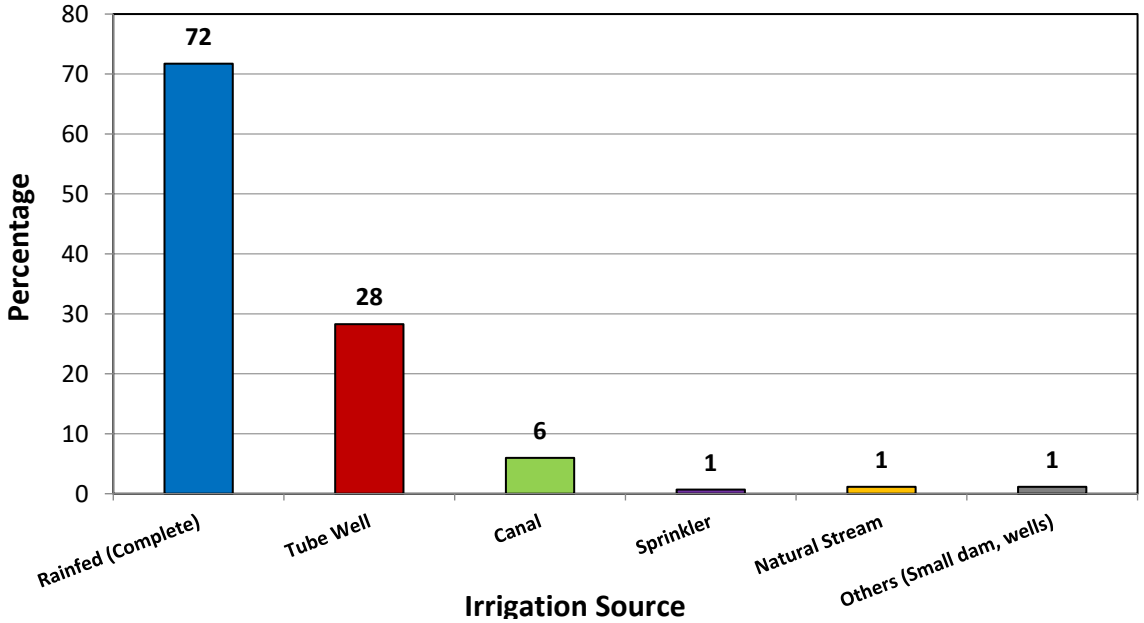


Figure 18: Irrigation sources used by farmers in addition to rainfall.

2. Irrigation sources utilized by agricultural practitioners in the Potohar region, as represented in Figure 17, show a predominant reliance on rainfall (72%), followed by tube wells (28%), with limited use of canals, sprinklers, natural streams, and other minor sources.

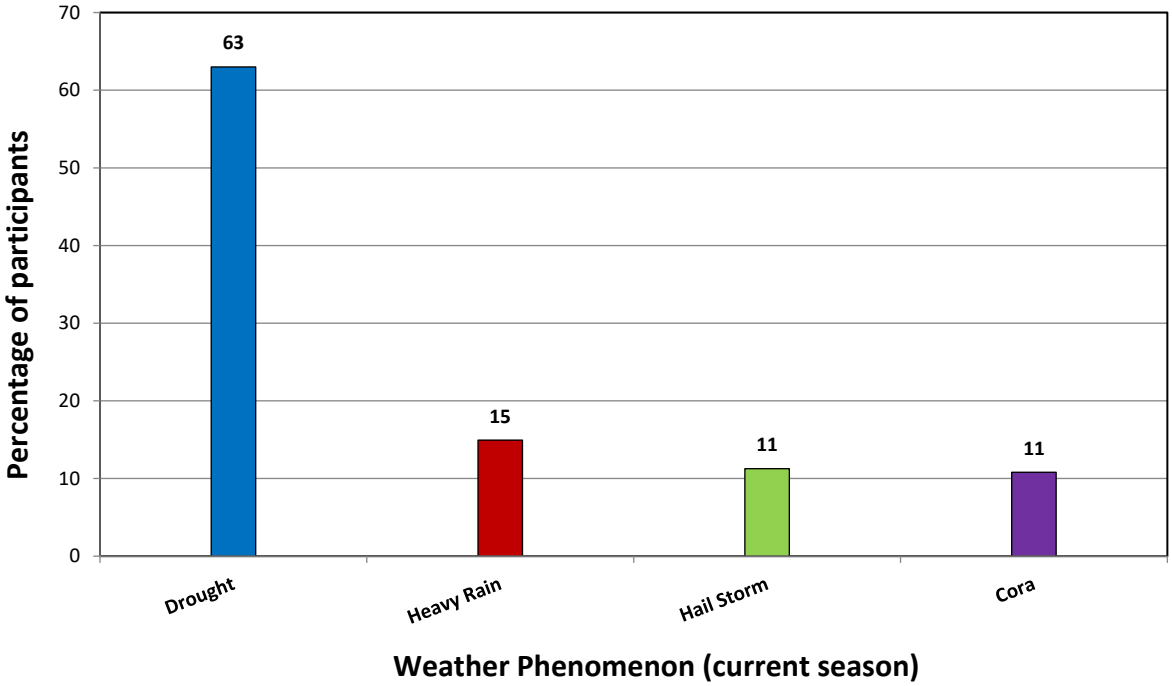


Figure 17: Most destructive weather conditions for crops in the current season.

3. Weather conditions identified by farmers as most damaging to crops during the current season are shown in Figure 18, with drought reported as the predominant threat (63%), followed by heavy rainfall (15%), hailstorms (11%), and cora (11%).

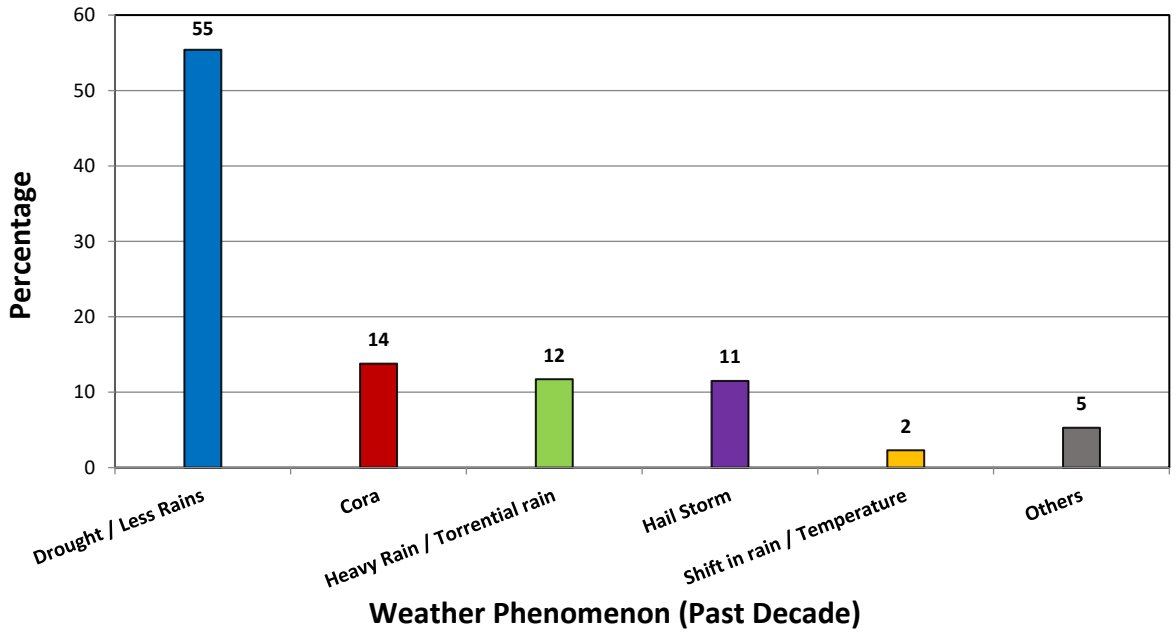


Figure 20: Most destructive weather phenomena for crops (past 5–10 years).

4. As shown in Figure 19, farmers identified drought or reduced rainfall as the most destructive weather phenomenon over the past decade (55%), followed by cora (14%), heavy rain (12%), hailstorms (11%), and other minor factors (7%). These findings highlight drought as the dominant climatic challenge threatening crop production in the region.

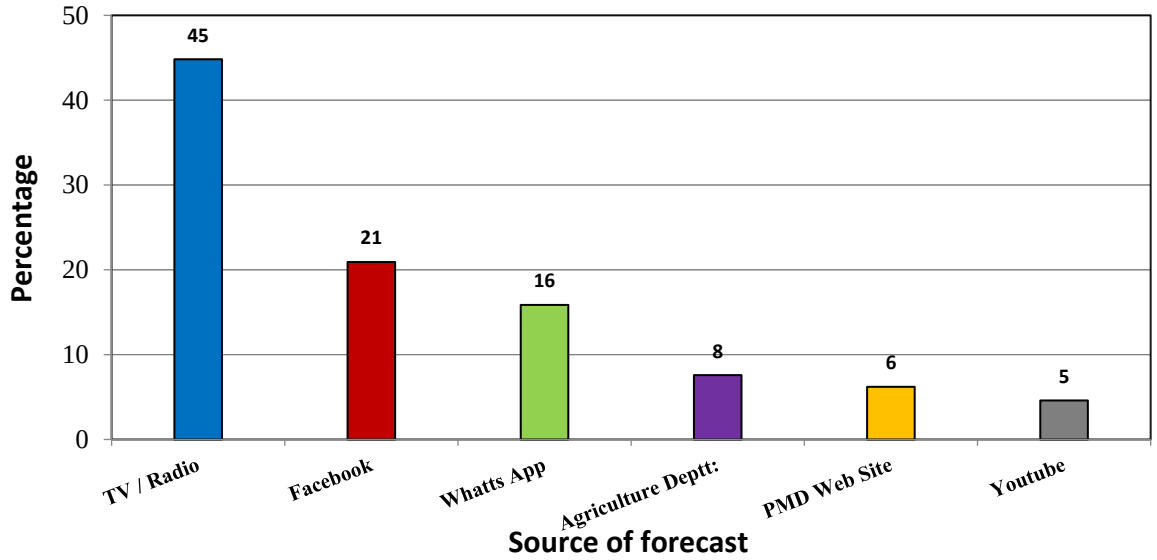


Figure 19: Most suitable communication sources for timely access to PMD services.

5. Figure 20 illustrates the communication sources farmers consider most suitable for accessing timely information from PMD services. Traditional media such as TV and radio were reported as the primary sources (45%), followed by social media platforms including Facebook (21%) and WhatsApp (16%). Comparatively fewer respondents relied on the Agriculture Department (8%), PMD website (6%), and YouTube (5%).

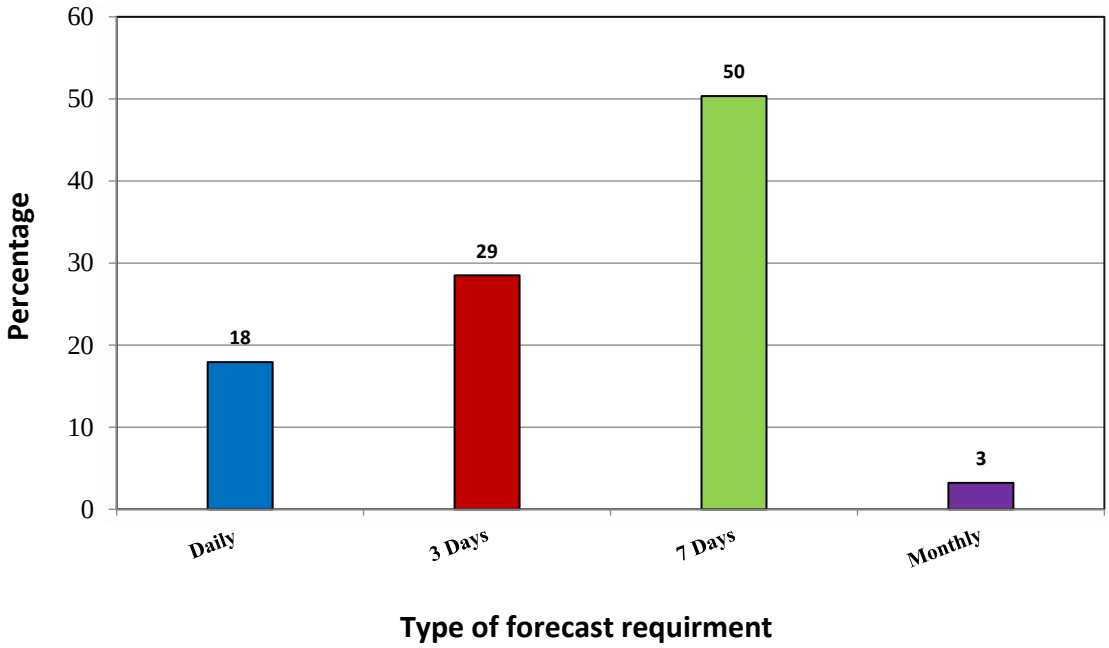


Figure 21: Farmers' preferences for weather forecasts by time span

6. As per Figure 21, Farmers expressed the greatest demand for weekly (7-day) forecasts (50%), followed by medium-range forecasts of three days (29%) and daily forecasts (18%), while only a small share preferred monthly forecasts (3%). These findings suggest that short- to medium-range forecasts are most relevant for agricultural decision-making, emphasizing the need for timely and accessible communication through suitable channels.

Figure 22: IBF Field survey 2023

3.3.3 Major findings of the Field Survey

1. Wheat, barley, mustard, and several winter vegetables are grown in the Rabi season, while Groundnut, maize, and several summer vegetables are cultivated in the Kharif season in the Potohar region.

2. The Potohar region is mainly a rainfed area without a proper canal irrigation system, like other parts of Punjab. Therefore, crop cultivation and growth mainly depend upon rainfall in the required amount at the appropriate time. About 71% of the farmers totally depend upon rainfall, followed by farmers also utilising tubewell (28%). A comparatively slight portion of land is irrigated by other sources, like canals, sprinklers, etc.
3. Prolonged dry weather/drought is the main cause that drastically affects the standing crops in the region, followed by heavy torrential rains during the monsoon. Sometimes these heavy rains are accompanied by hail and windstorms, which destroy mature crops. Frost during the Rabi season, especially during December and January, badly affects some of the crops and vegetables. Hail/windstorm, especially during pre- and post-monsoon periods, also badly damages the standing crops in the area.
4. Most of the farmers require weather forecasts and Agromet products on a weekly to daily basis.
5. Most of the respondents (342 out of 440) utilize PMD weather information using different sources. Others get weather information mostly from online available sources.
6. Most of the farmers need Mobile phone packages of PMD to access the information and the PMD weather app related only to the farming community for services on the local level.
7. Deficiency of met offices/observatories in each Tehsil to observe local data and distribute weather information to the farming community.
8. Accuracy in weather information, both on a seasonal/weekly time scale as well as according to crop stage.
9. Climate change, besides rising population density and deforestation, has drastically affected the local climate and ultimately affected crop growth and yield in several areas, like Pind Dadan Khan and Lawa. According to most of the farmers of the area, rainfall has significantly decreased during the last 20 years. In most areas, it is also observed that tube well irrigation using solar panels for power generation has also increased during recent years without any proper government planning, which has resulted in a drastic drop of the water table in most of the tehsils in the Potohar region.
10. Agriculture extension workers are playing a very active role in promoting agriculture in the area. They are an excellent source of direct interaction with the farming community of the region.

3.4 Development of Generalized impact tables (weather forecast + impact + advise) for the Wheat crop

Following the procedure adopted in the first phase of the IBF Project, the PMD team, along with other stakeholders, collaborated to develop generalized impact tables after several amendments. These tables include expected weather, its possible impact, and relevant advice related to wheat crop for the farming community, given in the annexure. IBF services for wheat crop are now regularly produced and regularly updated on the PMD website (Figures 23, 24) and disseminated to end users through WhatsApp groups, PMD YouTube channels, and in audio format on local FM radio services.

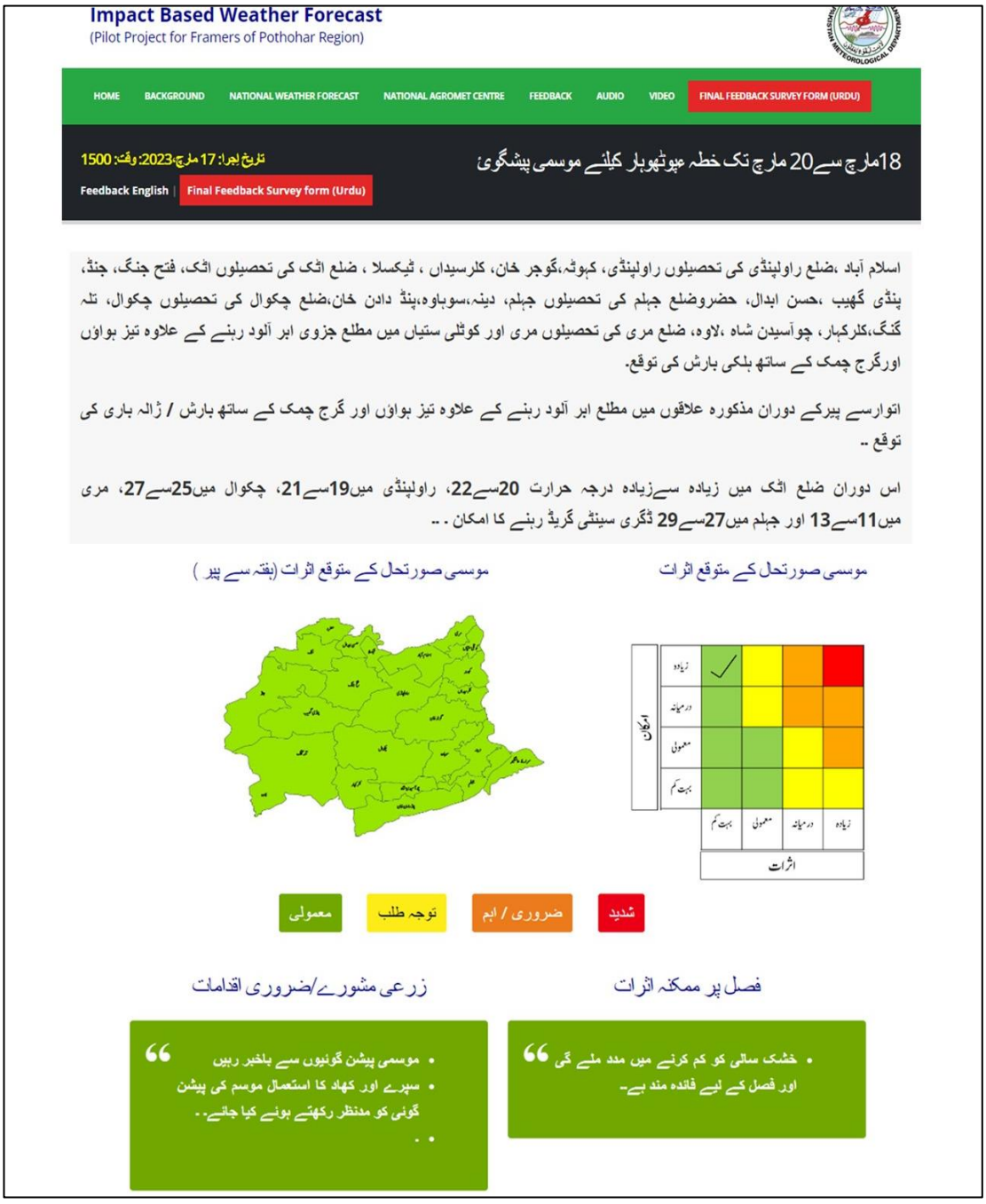


Figure 23: IBF web version (a)

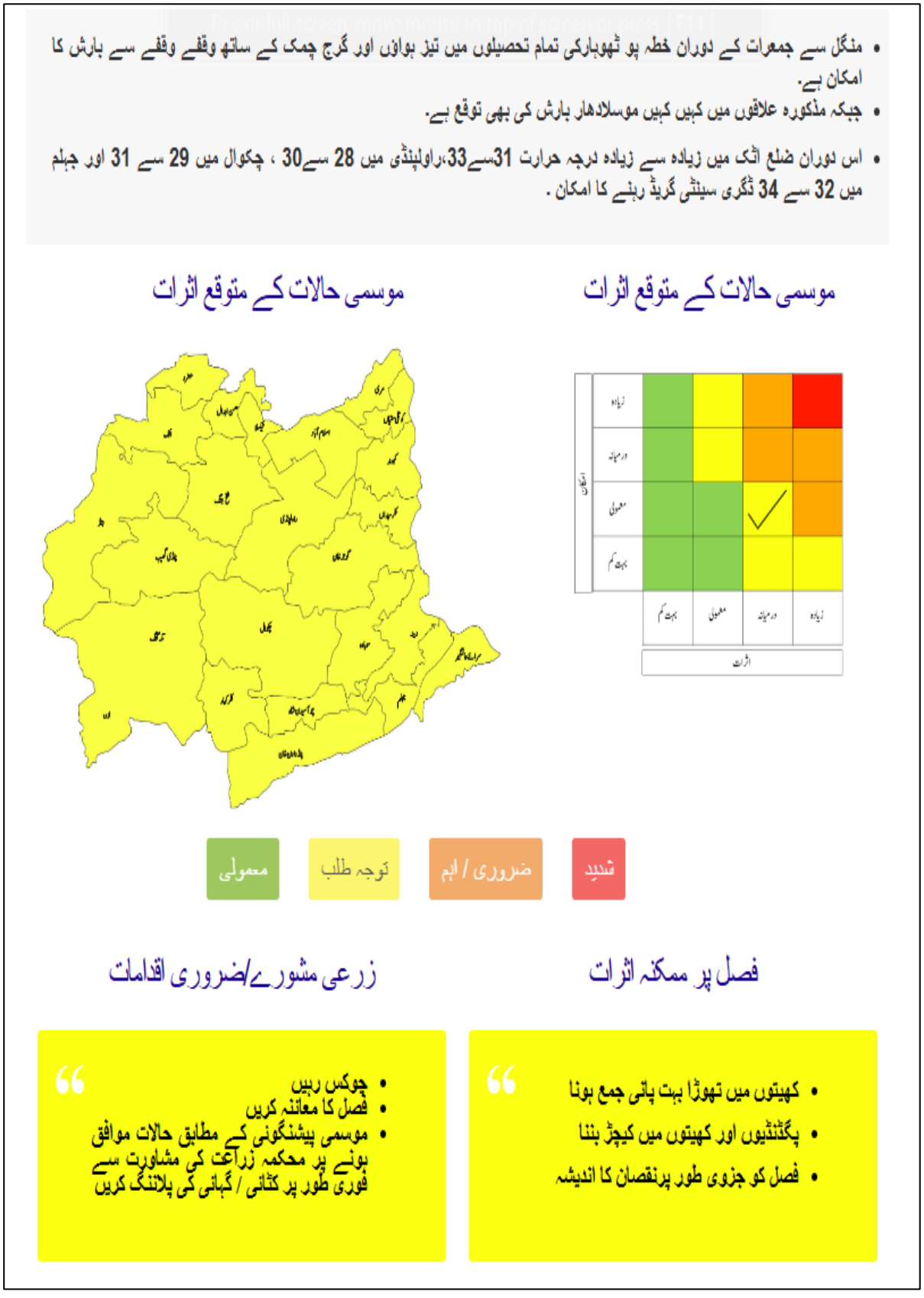
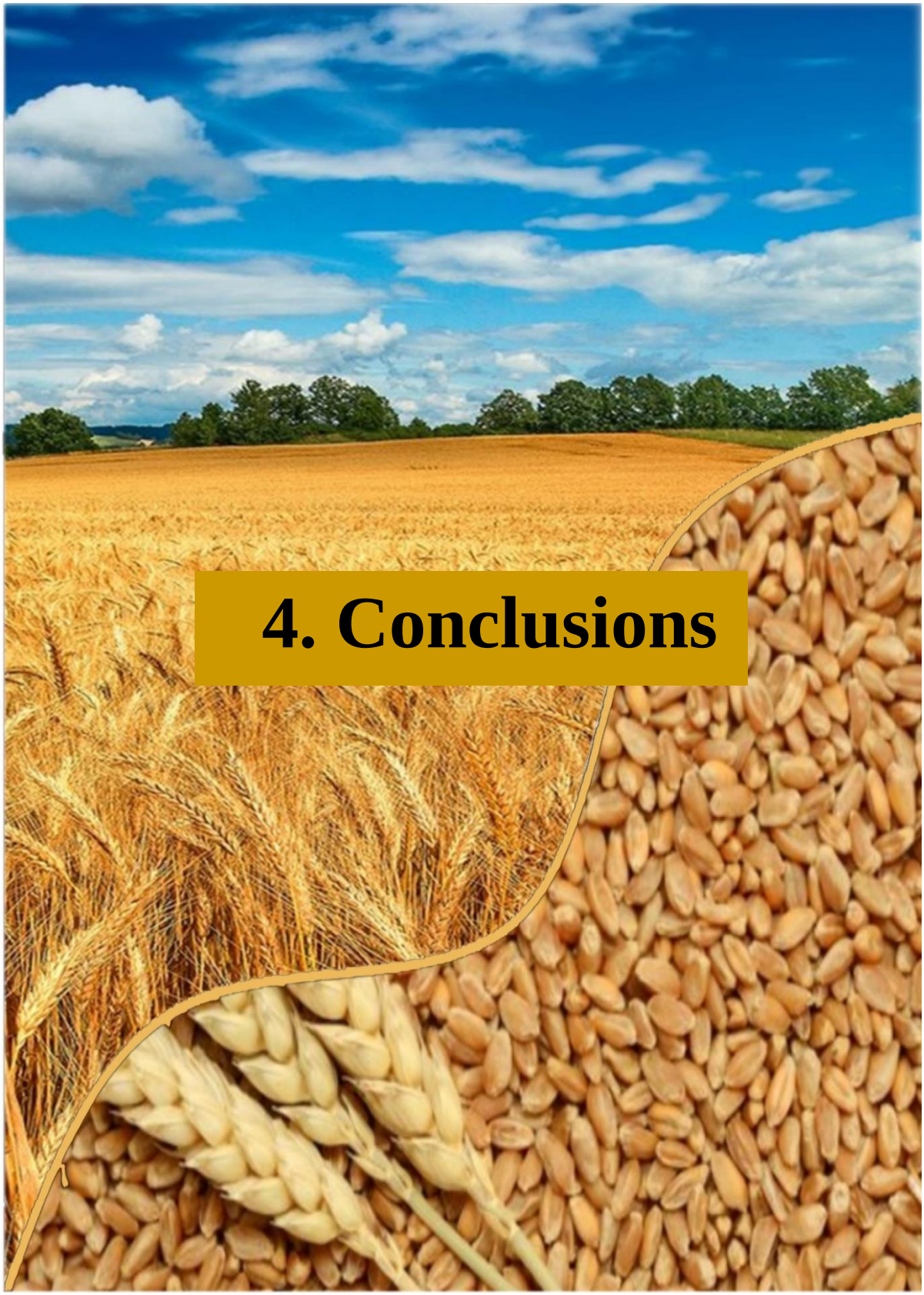


Figure 24: IBF web version (b)



4. Conclusions

4.1 Conclusions:

The IBF project was devised to enhance the performance of PMD according to the requirements of the farming community of Pakistan. The project was initiated in 2018 by the collaboration of PMD and UKMO with the participation of other stakeholders, including the PAD extension wing, research institutes, academia, and the farming community of the Potohar region. During the first phase as a pilot case, IBF mechanism was developed for two districts (Attock and Chakwal) of Potohar Region for Kharif season taking ground nuts as a major crop. Several meetings, workshops, and a field survey were conducted with the participation and assistance of other stakeholders besides PMD and UKMO to develop the impact tables and other necessary activities to generate IBF. SOPs were decided to clarify the role of all stakeholders for the smooth IBF products in future. IBF services were launched in 2022 for the two districts of Potohar region. After the successful completion of the first phase, PMD took the initiative for the second phase to develop IBF for the entire Potohar region for Rabi season crops in the same year. All the necessary requirements were fulfilled with the assistance of other stakeholders. A second field survey for the entire Potohar region was also conducted by PMD. Results of both surveys indicated that most of the farmers rely on PMD products, and it is a dire need to improve the accuracy, time span and impact of different forecasts on standing crops in the Potohar region. The second phase of the project was completed in 2023, and IBF products for the entire Potohar region are regularly produced and updated on the PMD web page as well as disseminated to the farming community using different channels. During the survey of the second phase, the challenges and benefits of IBF and issues in the present warning/dissemination system of PMD services, besides IBF services, were also analysed and investigated to further upgrade the services of IBF. The survey also enabled us to understand various issues in the present products of PMD related to the farming community of the Potohar and the issues related to disseminating these PMD products to farmers in the present social media-dominated scenario.

4.1.1 Advantages of the IBF project

Major benefits obtained and future advantages to be obtained from the IBF project are highlighted in the following points.

1. A strong working relationship was developed between UKMO and PMD staff, leading to genuine trust and understanding between the two Met Services.

2. Wide-ranging training provision for both forecasters and agro-meteorologists (technical training) and stakeholders (IBF awareness), upskilling the forecasting team and enabling the users to gain more from PMD's outputs.
3. A productive working bond has also developed between PMD and other stakeholders like the extension wing of PAD, agriculture research institutes, related academia, and the farming community of the Potohar, which will certainly make it easier for future work in the region.
4. Embedding understanding and benefits of IBF within PMD and aiming to expand these services to other districts of Potohar for the coming Rabi crop, and to further expand the same services for other parts and crops of the country.
5. Nonstop IBF services and gradual expansion of IBF products across the country and over time would be beneficial in helping the farmer understand the severity of the potential impacts of an impending event.
6. The activities of IBF have increased the reputation of PMD within the region, with other NMHSs looking to PMD as a good example of innovation.
7. Development of remote/online training during COVID.

4.2 4.1.2 Way Forward (Suggestions and Challenges)

IBF products could be further improved by increasing our knowledge of vulnerability and coping capacities through further coordination and interdisciplinary working and research. furthermore, improvements are needed for collecting and storing impact information as events occur, to inform forecasters and decision-makers about likely impacts in future events.

NAMC has already taken some actions, relying initially on its own PMD observatories network. Crop reporting from all Agromet observatories has been started for the last 2-3 months to produce more reliable impact tables and advice to the farming community.

In addition, this impact information could also assist with the verification of IBF products. NAMC is also working to further improve the two-way communication with the farming community and the agriculture extension network to get timely user feedback.

Therefore, some major suggestions to further improve the products of IBF and to expand these services to other parts of the country are pointed out below.

1. Co-ordination and relationship between PMD and other departments, especially provincial agriculture departments, agriculture research institutes, and agriculture-related academia.

2. Meteorologists still have little knowledge of impacts and should improve with time by increasing interactions with the farming community and the regional extension wing.
3. Before initiating IBF for a region, the requirement of datasets (climate, types of hazards, impacts, vulnerability, and exposure) should be obtained. In addition, crop and soil data of the focused area should also be collected to produce more accurate IBF products.
4. Feedback and verification of the IBF products.
5. Setting more realistic impact thresholds for triggering the warnings.
6. Securing funds to extend the IBF project to other parts of the country.
7. Cropping patterns, especially the specific crop data and soil features, are also very significant to begin the services for other climatic regions of the country with different cropping patterns.
8. The farming community is the main stakeholder; therefore, their relevant data would be required to expand the products into other areas. Therefore, field surveys of the region need to be conducted well in time, and technical personnel from both the met offices and the agriculture extension should be included.
9. To expand IBF in other parts of the country, enhancement of the Agromet network and infrastructure should be kept on a priority basis. The present infrastructure of the NAMC should be improved to at least regional standards before the expansion of IBF in other parts of the country.

4.3 Related Activities

After the successful completion of the second phase of the IBF project, NAMC did not stop its pace of working during the IBF Project and has been engaged in the following tasks to further expand the services of IBF to more areas and crops.

i. Maize is the second major crop, cultivated in the Potohar region. In the first and second phases of IBF, the impact tables were only produced for groundnut and wheat crops. After successful completion of the second phase, the NAMC team worked on the impact tables for the maize crop for the Potohar Region. The field survey conducted by PMD helped a lot to finalize these tables. These impact tables of the maize crop are included in the Annexures. IBF products for the maize crop will also be included in the coming Kharif season for the entire Potohar region.
ii. To expand the IBF products for other parts of the country, PMD teams visited different parts of lower Sindh in July 2023 to discuss the possibility of producing IBF products for the farming communities of these areas in the near future with the help of different

organizations like RIMES, Action against hunger, and Cesvi. PMD team from NAMC and NWFC visited lower Sindh (Hyderabad) for one week to educate local agriculture personnel from different wings of the agriculture department and farming community from Tandojam, Mirpurkhas, and Thatta Tehsils about IBF. The PMD team also enhanced their understanding of the crops of the area and the impacts of weather hazards on different crops and orchards like cotton, wheat, sugarcane, mango, banana, and others.

iii. In October 2023, the PMD team visited Quetta with the collaboration of RIMES to discuss the possibility of the formation of a decision support system based on the concept of IBF with the Agriculture Research Department of Baluchistan for different crops grown in different parts of Baluchistan.

iv. In November 2023, the PMD team visited PAD Lahore to introduce IBF products and other services of PMD with PAD and to enhance the working relationship with PAD through the collaboration of RIMES.






Figure 25: PMD Team visits PAD Lahore

Annexures

2 Generalized Impact Tables for Maize Crop in the Potohar Region

Table 5: Groundnut (at Sowing/ Early Growth) Impact Threshold-Rain - April to May

<table>
<tr><td colspan="4">Expected Weather (Rainfall Thresholds)</td></tr>
<tr><td colspan="2">24 hours’ rainfall 2-10 mm with/without wind 3-10 knots
5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">24 hours’ rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots
5 days accumulated rainfall 50-80 mm. and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots</td><td></td></tr>
<tr><td colspan="2"></td><td colspan="2">24 hours’ rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots
5 days accumulated rainfall > 80 mm. and/or thunderstorm/hail with/without maximum wind gust > 25 knots</td></tr>
<tr><td colspan="4">Impacts</td></tr>
<tr><td>Minimal</td><td>Minor</td><td>Significant</td><td>Severe</td></tr>
<tr><td>Slight run off field and broken watts
Muddy paths</td><td>Slight runoff of fertile land
Muddy paths and fields
Germination/emergence may be affected</td><td>Water inundation
Muddy paths and fields
Germination/emergence may be affected.
Insect attack (hairy caterpillar)</td><td>May produce localized flooding
Standing water in low-lying areas
Fields may become inaccessible.
Damage to the crop in the low-lying area of the field
Insect attack</td></tr>
</table>

Table 6: Groundnut (at Sowing/ Early Growth) - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of crops	Be cautious Be prepared for water drainage Re-sowing if required Spray of insecticide as advised by agriculture department	Immediate drainage Re-sowing if required. Spray of suitable insecticide as advised by agriculture department

Table 7: Groundnut (at Flowering) Impact Threshold-Rain - May / June

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields Weeds may appear Damage to leaves and flowers	Water inundation Muddy paths and fields Weeds may appear Crop may be destroyed partially Shedding of flowers	May produce localized flooding Fields may become inaccessible Weeds may appear Attack of an insect Damage to the crop in standing water

Table 8: Groundnut (at Flowering) Impact Threshold-Rain - May / June - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of crops Weedicide operations	Be cautious Be prepared for water drainage Weedicide operations	Immediate drainage Weedicide operations

Table 9: Groundnut (at Early Pod formation) Impact Threshold-Rain – June/July

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy path Profuse flowering and favourable for peg formation	Puddles in the fields Muddy paths and fields Broken watts runoff of fertile land Weeds may appear	Water inundation Muddy paths and fields Weeds may appear Shedding of fertile flowers	May produce localized flooding. Fields may become inaccessible Weeds may appear Shedding of fertile flowers

Table 10: Groundnut (at Early Pod formation) - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required. Remain updated with the weather forecast	Be Vigilant Monitoring of crops Weedicide operations	Be cautious. Be prepared for water drainage Weedicide operations Spray of fungicide Application of gypsum	Immediate drainage is required. Weedicide operations Spray of fungicide

Table 11: Groundnut (at Pod formation) Impact Threshold-Rain – July/August

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields Weeds may appear	Water inundation Muddy paths and fields Flowers may shed partially The insect population increased Weeds may appear	May produce localized flooding Fields may become inaccessible Weeds may appear rapidly Fungal diseases may start Insect attack damages the crop

Table 12: Groundnut (at Pod formation) - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of crops Weedicide operations	Be cautious Be prepared for water drainage Weedicide operations Application of gypsum Spray of insecticide	Immediate drainage required Spraying of suitable fungicide or removal of infected plants from fields Spray of insecticide

Table 13: Groundnut (at Milk Maturity) Impact Threshold-Rain – August/September

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields Weeds may appear	Water inundation Muddy paths and fields Weeds may appear Hairy caterpillar may attack Fungal diseases may start	May produce localized flooding Fields may become inaccessible Weeds may appear rapidly Fungal disease-causing damage to pods

Table 14: Groundnut (at Milk Maturity) - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required. Remain updated with the weather forecast	Be Vigilant Monitoring of crops Weedicide operations	Be cautious. Be prepared for water drainage. Weedicide operations Spraying of insecticide	Immediate drainage required. Weedicide operations Spraying of suitable fungicides

Table 15: Groundnut (at Maturity) Impact Threshold-Rain – September/October

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields	Water inundation Muddy paths and fields Fungal diseases may start	May produce localized flooding. Fields may become inaccessible. Weeds may appear rapidly. Pod damage may occur underground. Pod quality may be affected

Table 16: Groundnut (at Maturity) - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of the crop	Be cautious Be prepared for water drainage Spraying of a suitable fungicide or removal of plants	Immediate drainage is required Spray on weeds. Spraying of a suitable fungicide or removal of plants

Table 17: Groundnut (at Full Maturity/Harvesting) Impact Threshold-Rain – October/November

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/Hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Very little puddles in the field	Little puddles in the fields	Water inundation Muddy paths and fields Difficulty in performing field operations	May produce localized flooding. Damage to pods in relation to quality. Aflatoxin may start. Delay in harvesting

Table 18: Groundnut (at Full Maturity/Harvesting) - Advice/Actions

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of crops Slight rescheduling of harvest	Be cautious Be prepared for water drainage Rescheduling of harvest	Immediate drainage required Major rescheduling of harvest Immediate sun drying of the pods after harvest

3 Generalized Impact Tables for Wheat Crop in the Potohar Region

گندم (بوائی / ابتدائی نشو نماء)

متوقع موسمی صورتحال		
یا بغیر ہوا (چوبیس گھنٹوں میں 5 سے 18 کلومیٹر فی گھنٹہ ہوا) کے ساتھ 2 سے 10 ملی میٹر بارش پانچ دنوں میں مجموعی طور پر 5 سے 18 کلومیٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش		
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلومیٹر فی گھنٹہ چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 ہوا (یا بغیر ہوا) کے ساتھ کلومیٹر فی 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش		
		کلومیٹر فی گھنٹہ سے زیادہ 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلومیٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش

فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں تھوڑا بہت پانی بہنا پگڈنڈیوں پر کیچڑ بننا	کھیتوں کی اوپری زرخیز مٹی کا معمولی بہاؤ پگڈنڈیوں اور کھیتوں میں کیچڑ بننا پھوٹتے بیجوں / ابتدائی کونپلوں کا متاثر ہونا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا پھوٹتے بیجوں / ابتدائی کونپلوں کا متاثر ہونا کیڑوں کا حملہ	چھوٹے درجے کا سیلاب زیریں مقامات پر پانی اکٹھا ہونا کھیتوں میں داخلہ دشوار ہو جانا کھیتوں کے زیریں حصوں میں فصل کو نقصان ہونا کیڑوں کا حملہ

زرعی مشورے / ضروری اقدامات

انتہائی معمولی / غیر اہم	معمولی	ضروری / اہم	فوری / انتہائی ضروری
کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں اگر ضرورت ہو تو دوبارہ بوائی کریں محکمہ زراعت کے مشورے سے کیڑے مار سپرے کریں	فوری طور پر کھیتوں سے پانی نکالیں اگر ضرورت ہو تو دوبارہ بوائی کریں محکمہ زراعت کے مشورے سے مناسب کیڑے مار سپرے کریں

دسمبر / جنوری

ابتدائی نشو نما (پتوں کی تعداد اور پودے کی لمبائی میں اضافے کے مراحل)

متوقع موسمی صورتحال			
چوبیس گھنٹوں میں 5 سے 18 کلو میٹر فی گھنٹہ ہوا یا بغیر ہوا) کے ساتھ 2 سے میٹر بارش (10 ملی پانچ دنوں میں مجموعی طور پر 5 سے 18 کلو میٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش			
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلو میٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 ساتھ کلو میٹر فی گھنٹہ ہوا (یا بغیر 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش			
	کلو میٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) ہوا) کے ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلو میٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش	
فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں پر کیچڑ بننا	کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا کے واٹس اور زرخیز مٹی کا بہاؤ کھیتوں جڑی بوٹیوں کا نمودار ہونا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا جڑی بوٹیوں کا نمودار ہونا پھولوں کا جھڑنا	چھوٹے درجے کا سیلاب کھیتوں میں داخلہ دشوار ہو جانا جڑی بوٹیوں کا نمودار ہونا کھڑے پانی سے فصل کو نقصان ہونا

زرعی مشورے / ضروری اقدامات

انتہائی معمولی / غیر اہم	معمولی	ضروری / اہم	فوری / انتہائی ضروری
کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں جڑی بوٹیوں کی تلفی کے اقدامات	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں جڑی بوٹیوں کی تلفی کے اقدامات	فوری طور پر کھیتوں سے پانی نکالیں جڑی بوٹیوں کی تلفی کے اقدامات

جنوری / فروری

نشو نما (پتوں کی تعداد اور پودے کی لمبائی میں اضافے کے مراحل)

متوقع موسمی صورتحال		
یا بغیر ہوا (چوبیس گھنٹوں میں 5 سے 18 کلو میٹر فی گھنٹہ ہوا) کے ساتھ 2 سے 10 ملی میٹر بارش پانچ دنوں میں مجموعی طور پر 5 سے 18 کلو میٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش		
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلو میٹر فی گھنٹہ ہوا (یا بغیر چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 ہوا) کے ساتھ کلو میٹر فی گھنٹہ 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) ہوا (یا بغیر ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش		
	کلو میٹر فی گھنٹہ 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلو میٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش	

فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں پر کیچڑ بننا پودے کی لمبائی / پتوں میں اضافہ	کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا جڑی بوٹیوں کا نمودار ہونا پھولوں اور پتوں کو نقصان پہنچنا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا جڑی بوٹیوں کا نمودار ہونا فصل کا جزوی نقصان پھولوں کا جھڑنا	چھوٹے درجے کا سیلاب کھیتوں میں داخلہ دشوار ہو جانا جڑی بوٹیوں کا نمودار ہونا کیڑوں کا حملہ کھڑے پانی سے فصل کو نقصان ہونا

زرعی مشورے / ضروری اقدامات

انتہائی معمولی / غیر اہم	معمولی	ضروری / اہم	فوری / انتہائی ضروری
کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں جڑی بوٹیوں کی تلفی کے اقدامات	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں جڑی بوٹیوں کی تلفی کے اقدامات پھپھوندی مار زہر کا اسپرے جپسم کا استعمال	فوری طور پر کھیتوں سے پانی نکالیں جڑی بوٹیوں کی تلفی کے اقدامات پھپھوندی مار زہر کا اسپرے

جولائی / اگست

گندم (چھلکا بننے کے مراحل / دانہ بننے کی ابتداء)

متوقع موسمی صورتحال		
یا بغیر ہوا) کے ساتھ (چوبیس گھنٹوں میں 5 سے 18 کلومیٹر فی گھنٹہ ہوا 2 سے 10 ملی میٹر بارش پانچ دنوں میں مجموعی طور پر 5 سے 18 کلومیٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش		
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلومیٹر فی گھنٹہ ہوا (یا بغیر چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 ہوا) کے ساتھ کلومیٹر فی گھنٹہ 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) ہوا (یا بغیر ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش		
	کلومیٹر فی گھنٹہ سے زیادہ 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلومیٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش	

فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں پر کیچڑ بننا	کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا جڑی بوٹیوں کا نمودار ہونا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا پھولوں کا جزوی جھڑنا کیڑوں کی افزائش میں اضافہ جڑی بوٹیوں کا نمودار ہونا	چھوٹے درجے کا سیلاب کھیتوں میں داخلہ دشوار ہو جانا جڑی بوٹیوں کی نمو میں تیزی پھپھوندی کا حملہ کیڑوں کا حملے سے فصل کو نقصان ہونا

زرعی مشورے / ضروری اقدامات

انتہائی معمولی / غیر اہم	معمولی	ضروری / اہم	فوری / انتہائی ضروری
کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں جڑی بوٹیوں کی تلفی کے اقدامات	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں جڑی بوٹیوں کی تلفی کے اقدامات جپسم کا استعمال کیڑے مار زہر کا اسپرے	فوری طور پر کھیتوں سے پانی نکالیں پھپھوندی مار زہر کا اسپرے یا متاثرہ پودوں کو کھیت سے نکال لیں کیڑے مار زہر کا اسپرے

اگست / ستمبر

گندم (دانہ بننے کے مراحل)

متوقع موسمی صورتحال			
یا بغیر ہوا) کے ساتھ 2 سے 10 ملی میٹر بارش (چوبیس گھنٹوں میں 5 سے 18 کلو میٹر فی گھنٹہ ہوا پانچ دنوں میں مجموعی طور پر 5 سے 18 کلو میٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش			
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلو میٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 ساتھ کلو میٹر فی گھنٹہ ہوا (یا بغیر 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش			
		کلو میٹر فی گھنٹہ سے 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلو میٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش	
فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں پر کیچڑ بننا	کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا جڑی بوٹیوں کا نمودار ہونا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا جڑی بوٹیوں کا نمودار ہونا بالوں والے کیڑوں کا حملہ پھپھوندی کا حملہ	چھوٹے درجے کا سیلاب کھیتوں میں داخلہ دشوار ہو جانا جڑی بوٹیوں کی نمو میں تیزی پھپھوندی کے حملے سے ڈوڈے کو نقصان

زرعی مشورے / ضروری اقدامات

انتہائی معمولی / غیر اہم	معمولی	ضروری / اہم	فوری / انتہائی ضروری
کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں جڑی بوٹیوں کی تلفی کے اقدامات	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں جڑی بوٹیوں کی تلفی کے اقدامات کیڑے مار زہر کا اسپرے	فوری طور پر کھیتوں سے پانی نکالیں جڑی بوٹیوں کی تلفی کے اقدامات پھپھوندی مار زہر کا اسپرے

ستمبر / اکتوبر

گندم (فصل پک جانا / تیار ہو جانا)

متوقع موسمی صورتحال			
یا بغیر ہوا) کے ساتھ 2 سے 10 ملی (چوبیس گھنٹوں میں 5 سے 18 کلو میٹر فی گھنٹہ ہوا میٹر بارش پانچ دنوں میں مجموعی طور پر 5 سے 18 کلو میٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش			
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلو میٹر فی گھنٹہ ہوا (یا چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 بغیر ہوا) کے ساتھ کلو میٹر فی 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش			
کلو میٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلو میٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش			
فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں پر کیچڑ بننا	کھیتوں میں تھوڑا بہت پانی جمع ہونا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا پھپھوندی کا حملہ	چھوٹے درجے کا سیلاب کھیتوں میں داخلہ دشوار ہو جانا جڑی بوٹیوں کی نمو میں تیزی زیر زمین ڈوڈوں کو نقصان ہونا ڈوڈوں کی کوالٹی میں کمی / خرابی

زرعی مشورے / ضروری اقدامات

انتہائی معمولی / غیر اہم	معمولی	ضروری / اہم	فوری / انتہائی ضروری
کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں پھپھوندی مار زہر کا اسپرے یا متاثرہ پودوں کو کھیت سے نکال لیں	فوری طور پر کھیتوں سے پانی نکالیں جڑی بوٹیوں پر اسپرے کریں پھپھوندی مار زہر کا اسپرے یا متاثرہ پودوں کو کھیت سے نکال لیں

اکتوبر / نومبر

گندم (فصل پک جانا / برداشت)

متوقع موسمی صورتحال			
یا بغیر ہوا (چوبیس گھنٹوں میں 5 سے 18 کلومیٹر فی گھنٹہ ہوا) کے ساتھ 2 سے 10 ملی میٹر بارش پانچ دنوں میں مجموعی طور پر 5 سے 18 کلومیٹر فی گھنٹہ ہوا (یا بغیر ہوا) کے ساتھ 10 سے 50 ملی میٹر بارش			
چند مقامات پر گرج چمک / ژالہ باری (اور / یا) 20 سے 45 کلومیٹر فی گھنٹہ ہوا (یا بغیر ہوا) چوبیس گھنٹوں میں ملی میٹر بارش 30 سے 10 کے ساتھ کلومیٹر فی گھنٹہ ہوا (یا 45 سے 20 پانچ دنوں میں مجموعی طور پر چند مقامات پر گرج چمک / ژالہ باری (اور / یا) بغیر ہوا) کے ساتھ 50 سے 80 ملی میٹر بارش			
	کلومیٹر فی گھنٹہ سے 45 چوبیس گھنٹوں میں کہیں کہیں گرج چمک / ژالہ باری (اور / یا) زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 30 ملی میٹر سے زیادہ بارش پانچ دنوں میں مجموعی طور پر بیشتر مقامات پر گرج چمک / ژالہ باری (اور / یا) 25 کلومیٹر فی گھنٹہ سے زیادہ رفتار سے ہوا (یا بغیر ہوا) کے ساتھ 80 ملی میٹر سے زیادہ بارش		
فصل پر ممکنہ اثرات			
معمولی	توجہ طلب	اہم	شدید
کھیتوں میں معمولی پانی جمع ہونا	کھیتوں میں تھوڑا بہت پانی جمع ہونا	پانی کا کھیتوں سے باہر نکلنا پگڈنڈیوں اور کھیتوں میں کیچڑ بننا کھیتوں میں زرعی سرگرمیاں جاری رکھنے میں مشکل پیش آنا	چھوٹے درجے کا سیلاب کھیتوں میں داخلہ دشوار ہو جانا ڈوڈوں کی کوالٹی میں کمی / خرابی کا شروع ہونا Aflatoxin کٹائی گہائی / برداشت میں تاخیر

زرعی مشورے / ضروری اقدامات

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کوئی عمل درکار نہیں موسمی پیشن گوئیوں سے باخبر رہیں	چوکس رہیں فصل کا معائنہ کریں کٹائی گہائی / برداشت کے طے کردہ وقت میں معمولی تبدیلی	محتاط رہیں کھیتوں سے پانی نکالنے کے لئے تیار رہیں کٹائی گہائی / برداشت کے طے کردہ وقت میں تبدیلی	فوری طور پر کھیتوں سے پانی نکالیں کٹائی گہائی / برداشت کے طے کردہ وقت میں نمایاں تبدیلی کٹائی گہائی / برداشت کے بعد فوری طور پر ڈوڈوں کو دھوپ میں سکھانے کا بندوبست

4 Generalized Impact Tables for Maize Crop in the Potohar Region

Table 19: Maize (at Sowing/Early growth) Impact Threshold-Rain July / Aug

Expected Weather (Rainfall Thresholds)			
24 hours' rainfall 2-10 mm with/without wind 3-10 knots 5 days accumulated rainfall 10-50 mm with/without wind 3-10 knots			
	24 hours' rainfall 10-30 mm with/without isolated thunderstorm/hail and/or wind 11 to 25 knots 5 days accumulated rainfall 50-80 mm and/or isolated thunderstorm/hail with/without maximum wind gust 11 to 25 knots		
		24 hours' rainfall >30mm and/or scattered thunderstorm/hail with/without wind>25 Knots 5 days accumulated rainfall > 80 mm and/or thunderstorm/hail with/without maximum wind gust > 25 knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields Germination/ emergence may be affected. Partial damage to tillers	Water inundation Muddy paths and fields Germination/ emergence may be affected. Tillers can be destroyed	May produce localized flooding. Fields may become inaccessible. Severe damage to crops

Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of the field Weedicide operations	Be extremely cautious Be prepared for water drainage Weedicide operations	Immediate drainage required If required, switch to alternate vegetables/fodder

Table 20: Maize (at Vegetative Stage) Impact Threshold-Rain - Aug / Sep

Expected Weather (Rainfall Thresholds)			
24 hours rainfall 2-10 mm with wind 3-10 Knots			
	24 hours rainfall 10-30 mm with isolated thunderstorm/hail and wind 11 to 25 knots		
		24 hours rainfall >30mm scattered thunderstorm/hail and wind>25 Knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields Damage to plants Weeds may appear	Water inundation Muddy paths and fields Weeds may appear. Plants may be partially destroyed	Localized flooding Fields inaccessible Unrecoverable damage to crops
Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of crops Weedicide operations	Be extremely cautious. Be prepared for water drainage Weedicide operations	Immediate drainage is required.

Table 21: Maize (at Maturity) Impact Threshold-Rain - Sep / Oct

Expected Weather (Rainfall Thresholds)			
24 hours rainfall 2-10 mm with wind 3-10 Knots			
	24 hours rainfall 10-30 mm with isolated thunderstorm/hail and wind 11 to 25 knots		
		24 hours rainfall >30mm scattered thunderstorm/hail and wind>25 Knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields Damage to Plants	Water inundation Muddy paths and fields Crop may be destroyed partially	Localized flooding Fields inaccessible Unrecoverable damage to crops
Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required. Remain updated with the weather forecast	Be vigilant Monitoring of crops	Be extremely cautious Be prepared for water drainage	Immediate drainage required

Table 22: Maize (at Full Maturity/Harvesting) Impact Threshold-Rain - Oct / Nov

Expected Weather (Rainfall Thresholds)			
24 hours rainfall 2-10 mm with wind 3-10 Knots			
	24 hours rainfall 10-30 mm with isolated thunderstorm/hail and wind 11 to 25 knots		
		24 hours rainfall >30mm, scattered thunderstorm/hail and wind>25 Knots	
Impacts			
Minimal	**Minor**	**Significant**	**Severe**
Little puddles in the fields Muddy paths	Puddles in the fields Muddy paths and fields	Water inundation Muddy paths and fields	Localized flooding Fields inaccessible Damage to crops
Response Matrix			
Very Low	**Low**	**Medium**	**High**
No action required Remain updated with the weather forecast	Be vigilant Monitoring of crops Slight rescheduling of harvest	Be prepared for water drainage Rescheduling of harvest	Immediate drainage required Major rescheduling of harvest

5 Questionnaire (in Urdu) of the field survey conducted in Phase-2

سوال نمبر ۱: آپ کا نام اور فون نمبر (واٹس ایپ)؟

سوال نمبر ۲: آپ کا تعلق کس تحصیل سے ہے (ٹک کریں)؟

Table 23: Questionnaire (in Urdu) of the field survey conducted in Phase-2

تحصیل		تحصیل		تحصیل	
اٹک		تلہ گنگ		کوٹلی ستیاں	
فتح جنگ		کلر کہار		کلر سیداں	
جنڈ		چوآسیدن شاہ		ٹیکسلا	
پنڈی گھیب		لاوہ		جہلم	
حسن ابدال		راولپنڈی		دینہ	
حضرو		مری		سوہاوہ	
چکوال		کہوٹہ		پنڈ دادن خان	

سوال نمبر ۳: آپ کتنے عرصے سے زراعت سے منسلک ہیں اور کون کونسی فصلیں کاشت کرتے ہیں؟

سوال نمبر ۴: بارش کے علاوہ آپ اپنی فصلوں کی آبپاشی کے لئے کونسے زرائع استعمال کرتے ہیں؟

- ٹیوب ویل
- سپرنکلر
- نہری
- یا----------

سوال نمبر ۵: آپکی فصلیں مندرجہ ذیل میں سے کس طرح کے موسم سے سب سے زیادہ متاثر ہوتی ہیں؟

- بارش / موسلا دھار بارش / مسلسل یا لگاتار بارش
- طویل خشک سالی
- طوفان / ژالہ باری
- کورا / دھند

سوال نمبر ۶: گزشتہ پانچ یا دس سالوں میں مندرجہ بالا کس موسم سے آپکی فصلوں کو سب سے زیادہ نقصان پہنچا؟

سوال نمبر۷: کیا آپ موسم سے باخبر رہنے کے لئے محکمہ موسمیات کی موسمی خدمات سے فائدہ اٹھاتے ہیں؟

- ہاں-----
- اگر نہیں تو اس سلسلے میں آپ کونسے ذرائع استعمال کرتے ہیں----------

سوال نمبر۸: کیا موسمی معلومات آپ تک بروقت پہنچ جاتی ہیں؟

ہاں---/ نہیں---

سوال نمبر۹: آپکو اپنی فصلوں کی بہتر دیکھ بھال کے لئے محکمہ موسمیات کی موسمی وزرعی معلومات کتنے دن پہلے درکار ہیں؟

- ۳دن پہلے
- ۵دن پہلے
- ایک ہفتہ پہلے
- یا----------

سوال نمبر۱۰: محکمہ موسمیات کی موسمی وزرعی معلومات کی بروقت رسائی کے لئے آپ کے خیال میں مندرجہ ذیل میں سے کونسا ذریعہ زیادہ موزوں رہے گا؟

- ٹی وی / ریڈیو
- فیس بک
- واٹس ایپ
- یوٹیوب
- محکمہ موسمیات کی ویب سائٹ
- محکمہ زراعت کے نمائندہ افراد

سوال نمبر۱۱: محکمہ موسمیات کی مندرجہ ذیل موسمی معلومات میں سے کون کونسی آپ کے لئے زیادہ مفید ہے؟

- روزانہ کی بنیاد پر پیشگوئی
- ۳دن کی پیشگوئی
- ایک ہفتہ کی پیشگوئی
- ایک مہینہ کی پیشگوئی
- ۳مہینے کی پیشگوئی

سوال نمبر۱۲: کیا محکمہ موسمیات کی موسمی معلومات سمجھنے میں آپ کو کسی قسم کی دشواری کا سامنا کرنا پڑتا ہے؟

سوال نمبر۱۳: آپ کو اپنی فصلوں کی بہتر دیکھ بھال کے لئے موجودہ خدمات میں کس طرح کا اضافہ یا بہتری درکار ہے؟

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