



Crop Weather Calendar



**National Centre for Hydrology and Meteorology
and
Department of Agriculture, MoAF
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ABBREVIATIONS AND ACRONYMS

NCHM	<i>National Centre for Hydrology and Meteorology</i>
ARID	<i>Agriculture Research and Innovation Division</i>
DoA	<i>Department of Agriculture</i>
MoAF	<i>Ministry of Agriculture and Forecast</i>
ARDC	<i>Agriculture Research and Development Centre</i>
NCOA	<i>National Centre for Organic Agriculture</i>
NPPC	<i>National Plant Protection Centre</i>
GLOF	<i>Glacial Lake Outburst Flood</i>
GCF	<i>Green Climate Fund</i>
CWC	<i>Crop Weather Calendar</i>

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Climate is defined as the average weather conditions over a longer period of time. Climate change are the changes that occur over a longer period of time, typically over decades or longer. In a broader context, climate change is manifested as a variety of natural disasters that cause widespread concern around the world and have a negative impact on human activities, ecological systems, and the country's economic outlook.

At the global, national, and local levels, climate-related disasters have become more frequent and more severe over the past year. Countries are now more vulnerable to social, economic, and environmental effects. Bhutan is especially susceptible to the effects of climate change because of its location and mountainous landscape. The frequency of various disasters that have an impact on various sectors of the nation can be used to determine the vulnerability. The agriculture industry is particularly affected by these climate-related hazards because it is one of the most climate-sensitive industries.

The monsoon season's rains heavily influence Bhutan's farming, which is primarily small-scale production. Due to farmers' small landholdings, capacity for adaptation, and subsistence level of productivity, Bhutan's agricultural system is extremely susceptible to the effects of the climate. Changes in weather patterns significantly lower production because agrometeorological variables continue to dominate agriculture.

To encourage resilient agricultural practices in the face of climate change, it is crucial to develop and incorporate climate risk data into planning at the national and sub-national levels. The continued increase in economic exposure and climate change are expected to lead to an increase in natural disasters. Therefore, it is necessary to evaluate the current framework and suggest improvements.

The Royal Government of Bhutan (RGoB), with technical assistance from the United Nations Development Programme (UNDP), is carrying out a project titled "Supporting Climate Resilience and Transformational Change in the Agriculture Sector in Bhutan" that is funded by the Green Climate Fund in order to increase the resilience to climate change and transform Bhutanese agriculture. The project serves as a climate financing project and supports numerous initiatives in 8 project Dzongkhags of the nation.

The project under output 1: Promote Resilient Agricultural practices in the face of Changing Climate Pattern, identify developing and disseminating weather and climate tailored information/products to the farmers to incorporate those services in the agricultural planning and decision making. This is primarily due to the fact that the project recognized the critical intervention required to make services available at the national and local level for planning and ultimately take actions that will minimize losses from climate impacts. Consequently, the crop weather calendar is one of these tools to enhance current agricultural practices taking into account both the weather and crop data.

I. Introduction

The "Crop Weather Calendar" (CWC), is a tool that offers comprehensive details for each major crop regarding its dates of planting, sowing, and harvesting periods of locally adapted crops in a particular agro-ecological zone. A CWC includes the typical life history of the crop, including the stages of sowing, vegetative growth, flowering, grain growth, and maturation, warnings to be issued based on the current weather, and meteorological conditions that are conducive to the development of crop pests and diseases. For effective crop planning, as well as to maximize and stabilize the nation's food production, these calendars are helpful for scheduling irrigation and plant protection procedures.

The weather forecaster must be knowledgeable about the crops grown in a specific agro-climatic zone in order to provide the farmer with an effective weather service. It is also important to be aware of the type of warning that should be given based on the crop's stage and state. Farmers should familiarize themselves with and learn how to interpret weather bulletins. To meet the above requirement, the NCHM has worked out the comprehensive data gathered from the agricultural departments and presented it in a visual format known as the crop weather calendar.

The information provided in these calendars provides general indications of the direction of development, which may be helpful to planners, agriculturalist, plant breeders, and farmers in forming policy regarding plant breeding, crop adaptation, drought proofing, supplemental irrigation, and yield maximization. This tool aids agricultural extension specialists and farmers in making timely, effective management decisions. Additionally, it offers a strong foundation for emergency and contingency planning for the restoration of farming systems following catastrophes. The value of CWC is increased by the inclusion of information on stage-by-stage pest/disease infestation for warning the farmers for a field level management.

II. Objectives

The primary goal of the CWC is to evaluate current methods and create a comprehensive calendar that takes both crop and weather component into account. The aim of the activity is to create a crop weather calendar for the identified major and specific crops. This product development is to improve existing procedures through the use of these new services. The crop weather calendar shall be applied uniformly in all the 20 Dzongkhags.

III. Participants

The following agromet representatives from various Department of Agriculture and NCHM agencies attended the program.

Sl No.	Agencies
1	Department of Agriculture
	Agriculture Research and Innovation Division, Department of Agriculture, Thimphu
	Agriculture Research and Development Centre, Bajo, Wangduephodrang
	Agriculture Research and Development Centre, Samtenling, Sarpang
	Agriculture Research and Development Centre, Wengkhar, Mongar
	National Centre for Organic Agriculture, Yusipang, Thimphu
	National Plant Protection Centre, Simtokha, Thimphu
2	National Centre for Hydrology and Meteorology, Thimphu

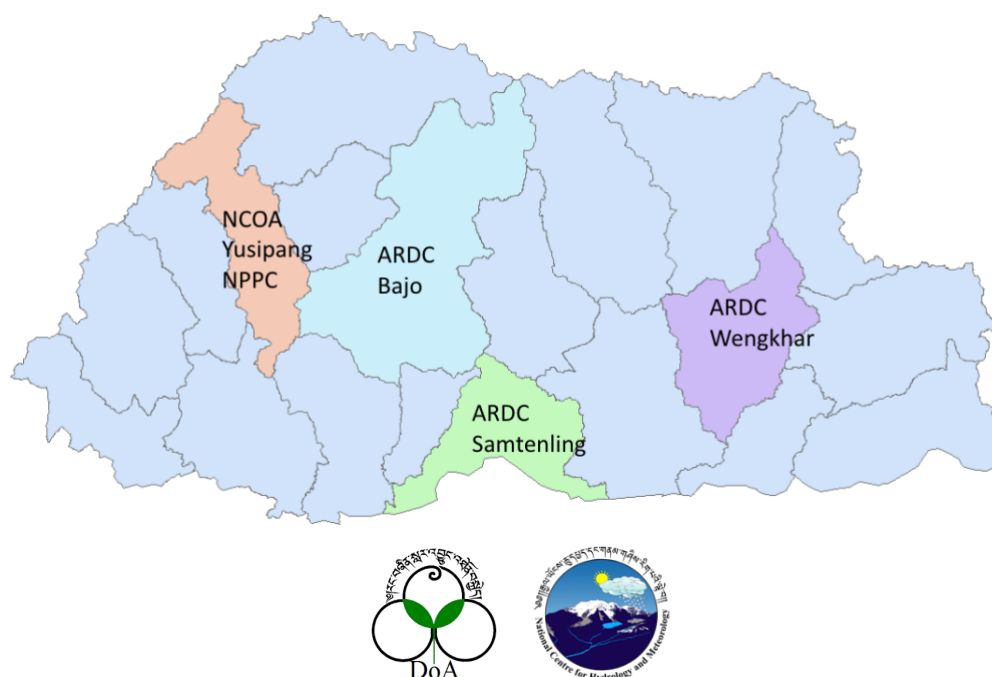


Figure 1: Participants from various agencies

IV. Methodology

The crop weather calendar is prepared using three parts; A, B and C.

Table 1: Crop weather calendar template

Months		PART A
Standard Meteorological Week		
Name of Meteorological Parameters	Climatic Normal	PART B
Name and Pictures of Phenological stages of crop		
Stage wise Climatic normals for high yield of crop		
Climatic normals for disease		PART C
Name of diseases or insect pests of crops	Climatic normals required for major diseases of the crop along with susceptible crop phenological stages	

- A. The uppermost part of the calendar contains the standard meteorological weeks for the location / station for each month's average weather data for the duration of the crop's growth. There are several meteorological parameters listed that can be calculated from long-term averages (depending on the data that is available at that station or location), such as maximum and minimum temperatures, rainfall, relative humidity, solar radiation, and sunshine hours. At the top of the calendar are the months and regular meteorological weeks.

Table 2: Standard weeks and months in crop weather calendar

Months	January				February				March					April				
Standard Week/Normal	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	
Rainfall (mm)	7.44	3.32	8.14	9.52	7.00	10.84	17.84	17.42	22.17	19.76	28.90	38.16	57.81	47.18	56.07	70.38	65.39	
Maximum Temperature (°C)	13.29	12.84	12.81	12.86	13.16	13.97	14.4	Standard weeks			23	17.67	18.13	18.54	19.60	19.77	19.98	
Minimum Temperature (°C)	-0.43	-0.55	-0.13	-0.03	0.30	1.10	1.79				56	5.52	6.49	7.16	7.69	8.90	9.08	
Mean Temperature (°C)	6.43	6.14	6.34	6.42	6.73	7.53	8.10				90	11.60	12.31	12.85	13.65	14.33	14.53	
Relative Humidity Maximum (%)	73.25	73.31	73.26	73.13	72.65	72.33	72.50		71.89	73.06	72.26	69.97	72.09	73.11	72.26	71.86	73.92	73.07
Relative Humidity Minimum (%)	66.44	67.35	66.79	67.27	67.04	65.55	66.24		66.76	60.93	66.52	65.10	65.15	66.42	66.79	65.65	68.30	67.51
Relative Humidity Mean (%)	69.85	70.33	70.02	70.20	69.84	68.94	69.37	69.32	66.99	69.39	67.53	68.62	69.77	69.52	68.76	71.11	70.29	
Sunshine Hour (hrs)	5.93	5.80	5.64	5.67	5.71	6.01	5.54	5.30	4.92	5.46	5.46	5.22	4.95	4.87	5.26	4.60	4.71	
Wind Direction (Degree)	183.25	180.15	185.77	185.78	183.37	183.59	189.74	183.30	187.14	187.02	181.97	183.43	182.70	188.70	186.66	186.24	184.71	
Wind Speed (m/s)	0.87	0.89	0.89	0.92	0.95	1.00	1.01	1.00	1.00	1.04	1.07	1.06	0.99	1.02	1.04	1.01	0.96	

Table 4: Computation of standard weeks

Week No.	Dates	Week No.	Dates
1	01 Jan - 07 Jan	27	02 Jul - 08 Jul
2	08 Jan - 14 Jan	28	09 Jul - 15 Jul
3	15 Jan - 21 Jan	29	16 Jul - 22 Jul
4	22 Jan - 28 Jan	30	23 Jul - 29 Jul
5	29 Jan - 04 Feb	31	30 Jul - 05 Aug
6	05 Feb - 11 Feb	32	06 Aug - 12 Aug
7	12 Feb - 18 Feb	33	13 Aug - 19 Aug
8	19 Feb - 25 Feb	34	20 Aug - 26 Aug
9*	26 Feb - 04 Mar	35	27 Aug - 02 Sep
10	05 Mar - 11 Mar	36	03 Sep - 09 Sep
11	12 Mar - 18 Mar	37	10 Sep - 16 Sep
12	19 Mar - 25 Mar	38	17 Sep - 23 Sep
13	26 Mar - 01 Apr	39	24 Sep - 30 Sep
14	02 Apr - 08 Apr	40	01 Oct - 07 Oct
15	09 Apr - 15 Apr	41	08 Oct - 14 Oct
16	16 Apr - 22 Apr	42	15 Oct - 21 Oct
17	23 Apr - 29 Apr	43	16 Oct - 28 Oct
18	30 Apr - 06 May	44	29 Oct - 04 Nov
19	07 May - 13 May	45	05 Nov - 11 Nov
20	14 May - 20 May	46	12 Nov - 18 Nov
21	21 May - 27 May	47	19 Nov - 25 Nov
22	28 May - 03 Jun	48	26 Nov - 02 Dec
23	04 Jun - 10 Jun	49	03 Dec - 09 Dec
24	11 Jun - 17 Jun	50	10 Dec - 16 Dec
25	18 Jun - 24 Jun	51	17 Dec - 23 Dec
26	25 Jun - 01 Jul	52**	24 Dec - 31 Dec

* Week No. 9 will have 8 days during leap year

** Week No. 52 will always have 8 days

Table 5: Meteorological parameters and climatic normal

Meteorological Parameters	Months	January				February				March					April			
	Standard Week/Normal	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
	Rainfall (mm)	7.44	3.32	8.14	9.52	7.00	10.84	17.84	17.42	22.17	19.76	28.90	38.16	57.81	47.18	56.07	70.38	65.39
	Maximum Temperature (°C)	13.29	12.84	12.81	12.86	13.16	13.97	14.42	15.03	15.31	16.36	17.23	17.67	18.13	18.54	19.60	19.77	19.98
	Minimum Temperature (°C)	-0.43	-0.55	-0.13	-0.03	0.30	1.10	1.79	2.59	3.31	4.15	4.56	5.52	6.49	7.16	7.69	8.90	9.08
	Mean Temperature (°C)	6.43	6.14	6.34	6.42	6.73	7.53	8.10	8.81	9.31	10.26	10.90	11.60	12.31	12.85	13.65	14.33	14.53
	Relative Humidity Maximum (%)	73.25	73.31	73.26	73.13	72.65	72.33	72.50	71.89	73.06	72.26	69.97	72.09	73.11	72.26	71.86	73.92	73.07
	Relative Humidity Minimum (%)	66.44	67.35	66.79	67.27	67.04	65.55	66.24	66.76	60.93	66.52	65.10	65.15	66.42	66.79	65.65	68.30	67.51
	Relative Humidity Mean (%)	69.85	70.33	70.02	70.20	69.84	68.94	69.37	69.32	66.99	69.39	67.53	68.62	69.77	69.52	68.76	71.11	70.29
	Sunshine Hour (hrs)	5.93	5.80	5.64	5.67	5.71	6.01	5.54	5.30	4.92	5.46	5.46	5.22	4.95	4.87	5.26	4.60	4.71
Climatic Normal	Wind Direction (Degree)	183.25	180.15	185.77	185.78	183.37	183.59	189.74	183.30	187.14	187.02	181.97	183.43	182.70	188.70	186.66	186.24	184.71
	Wind Speed (m/s)	0.87	0.89	0.89	0.92	0.95	1.00	1.01	1.00	1.00	1.04	1.07	1.06	0.99	1.02	1.04	1.01	0.96

The Climatic normal/averages are defined as the arithmetic average of the historical meteorological data as per the availability of data for 20 Class A stations. These averages are calculated for the total amount of weekly rainfall (mm), maximum temperature (°C), minimum temperature (°C), mean temperature (°C), relative humidity maximum (%), relative humidity minimum (%), relative humidity mean (%), sunshine hours (hrs), wind direction (degree) and wind speed (m/hr).

Table 6: Class A station data availability used for computing normal

Sl.No	Name	Station Type	Data availability
1	Sarpang Bhur	Class A	1996 - 2021
2	Deothang	Class A	1996 - 2021
3	Phuentsholing	Class A	1996 - 2021
4	Sipsoo	Class A	1996 - 2021
5	Dagana	Class A	1996 - 2021
6	Damphu	Class A	1996 - 2021
7	Mongar	Class A	1996 - 2021
8	Pemagatshel	Class A	1996 - 2021
9	Punakha	Class A	1996 - 2021
10	Tangmachu	Class A	2006 - 2021
11	Wangdue Phodrang	Class A	1996 - 2021
12	Bumthang	Class A	1996 - 2021
13	Gasa	Class A	2003 - 2021
14	Haa	Class A	1996 - 2021
15	Kanglung	Class A	1996 - 2021
16	Paro	Class A	1996 - 2021
17	Thimphu Babesa	Class A	1996 - 2021
18	Trashi Yangtse	Class A	1996 - 2021
19	Trongsa	Class A	1996 - 2021
20	Zhemgang	Class A	1996 - 2021






The normal value for a standard week is computed by average the week 1 data from the available data for a particular stations. The calculation of the weekly normal using the available historical data is briefly shown in the table below.

Table 6: Calculation of weekly normal from thee data availability

Year	Data	Week 1	Normal value for Standard Week 1
1996	1-Jan 2-Jan 3-Jan 4-Jan 5-Jan 6-Jan 7-Jan	1996 Average Value	Average Value of 1996, 1997, 1998, 1999.....
1997	1-Jan 2-Jan 3-Jan 4-Jan 5-Jan 6-Jan 7-Jan	1997 Average Value	
1998	1-Jan 2-Jan 3-Jan 4-Jan 5-Jan 6-Jan 7-Jan	1998 Average Value	
1999	1-Jan 2-Jan 3-Jan 4-Jan 5-Jan 6-Jan 7-Jan	1999 Average Value	

- B. The middle part represents the typical life history of the crop in the form of a diagram. Important “growth phases” associated with the crop species such as sowing, germination, transplanting, vegetative growth, flowering, grain formation and maturity period etc. are indicated in this middle portion. These “phases” cover certain time intervals which are influenced by variations in crop variety, growth date from location to location and from year to year as well as the characteristics of the crop itself. Along with the previously mentioned details, the middle section of crop weather calendars shows the favourable meteorological conditions for the crop (stage-wise or during the entire crop growth period) which will result in high yield of the crop.

Table 7: Phenological stages of crops and optimum requirements

					
Phenological stages	Seedling	Vegetative	Flowering	Fruiting	Maturity
Favorable Weather Conditions					
Temperature (°C)	>10		Night 16-18 & Day 26-28, >15 causes cold injury		
Soil Temperature (°C)			Above 16		
Light Intensity (Lux)			3,000-8,000 lux		
Relative Humidity (%)			60-70		
Normal phase wise water requirement (mm/week)	30		45		

- C. The weather conditions that are conducive to the occurrence of pests and diseases are listed at the bottom of the calendar, along with the type of weather warnings that can be issued. The diagrams like these assist the weather forecaster in quickly determining what warnings should be issued for a specific district during a specific weather situation during a specific stage of a crop.

Table 8: Favourable conditions for occurrence of pest and diseases

Congenial Weather Condition for Pests & Diseases			
Phytophthora blight	Temperature 25-30 °C, Relative Humidity >90%, Cloudy, High soil moisture		
Chilli Pod borer	Temperature 13-29 °C, Relative Humidity >77%		
Cut worm	Temperature 10-30 °C, young and tender seedlings are affected		
Weather Warning			
Rainfall (mm/day)	35mm/day		>50mm/day
Temperature	<10°C		<15°C
RH (%)	>90%		

V. Major Crops

The crop weather calendar must be created for specific crops in a constrained area, and it must include the area's meteorological normal value. However, due to the geographic terrain of the country, the crops were identified based on the altitude range.

The stations were divided into the following three altitude categories:

- Low altitude (less than 800 masl)
- Mid altitude (between 800-1600 masl)
- High altitude (above 1600 masl)

As shown in the table below, the stations that fell under the designated altitude were averaged and the normal value for standard weeks was determined.

Table 9: Altitude wise station for calculating the meteorological normal value

Sl.no	Name	Station Type	Latitude	Longitude	Elevation(m)	Altitude
1	Sarpang Bhur	Class A	26.907064	90.4309878	382	Low (less than 800 masl)
2	Deothang	Class A	26.859713	91.463251	861	
3	Phuentsholing	Class A	26.8509197	89.3919602	280	
4	Sipsoo	Class A	27.0086481	88.8782773	404	
5	Dagana	Class A	27.0707704	89.8836337	1531	Mid (800-1600 masl)
6	Damphu	Class A	27.0094739	90.1220685	1548	
7	Mongar	Class A	27.279206	91.235737	1564	
8	Pemagatshel	Class A	27.0347995	91.4241977	1567	
9	Punakha	Class A	27.571509	89.869939	1264	
10	Tangmachu	Class A	27.6700822	91.1826453	1338	
11	Wangdue Phodrang	Class A	27.4891197	89.8980719	1204	High (above 1600 masl)
12	Bumthang	Class A	27.5454764	90.7537821	2567	
13	Gasa	Class A	27.907072	89.7276728	2852	
14	Haa	Class A	27.4033755	89.2617138	2764	
15	Kanglung	Class A	27.277962	91.5015722	1987	
16	Paro	Class A	27.387247	89.4194965	2393	
17	Thimphu Babesa	Class A	27.427437	89.6458	2330	
18	Trashig Yangtse	Class A	27.6136933	91.497662	1839	
19	Trongsa	Class A	27.5036842	90.5055168	2167	
20	Zhemgang	Class A	27.2162	90.6556	1843	

Subsequently, crops were also identified on an altitude basis. The crop weather calendar was prepared for the following crops:

a. Rice/Paddy

The most significant cereal crop in Bhutan is rice, which is crucial to both household and national food security. More than half of the world's population relies on rice as a staple food. Rice is produced in the following three main agro-ecosystems.

- 20% of the total rice area is in the high-altitude zone (1600–2600 masl), which has a warm, temperate climate.
- The mid altitude region of valleys and foothills (800–1600 masl), which comprises 45% of the entire rice-growing area, and has a humid subtropical and dry subtropical climate.
- 35% of the total rice area is in the low-altitude (below 800 masl) wet subtropical climate zone.

b. Maize

One of the most widely grown food crops in Bhutan is maize. Maize is grown by most of the rural households. In Bhutan, maize is grown extensively in the eastern districts. Since maize is highly adaptable, it is grown in Bhutan at elevations between 300 and 3000 masl.

c. Potato

In Bhutan, the potato is one of the horticultural crops that is most frequently grown, consumed, and traded. In Bhutan, there are four primary potato varieties. These four varieties have different yield potentials and are suitable for various agro-ecological zones.

d. Chili

In most of the Dzongkhags in Bhutan, chili is one of the most valued spice crops. Farmers prefer it as a cash crop because of the high potential returns and the ability to earn profit in one season.

e. Tomato

One of the most crucial supplemental vegetables in a Bhutanese cuisine is the tomato. Since, local demand for tomatoes cannot be met in Bhutan, major portion of tomatoes are imported from India. Tomatoes can be grown in wide range of temperature and soils.

f. Lychee

Lychee is well adapted in wet to humid sub-tropical region of the country. Samtse, Sarpang, and Samdrup Jongkhar and in the lower belts of Zhemgang are appropriate growth places and it mostly prefers moist climate.






Table 10: List of crops identified for developing a crop weather calendar

SI No	Altitude Range	Items
1	Low altitude	Chilli Lychee Maize Paddy
2	Mid altitude	Maize Tomato Paddy Potato
3	High altitude	Paddy Potato

Low Region Crops

CROP WEATHER CALENDAR

CROP WEATHER CALENDAR																																			
Region: Low Altitude (< 800 masl)		CHILLI																												Duration: 210 Days					
Months		September					October					November					December					January				February				March					
Standard Weeks		32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	01	02	03	04	05	06	07	08	09	10	11	12	13
Rainfall (mm)		509.99	589.46	552.73	531.47	448.99	381.51	391.02	268.20	191.43	166.03	107.47	71.69	25.31	8.23	12.97	11.97	4.60	7.85	6.82	8.36	7.81	9.72	7.15	17.05	17.62	18.55	16.43	28.79	38.50	46.54	36.92	43.22	85.87	139.45
Maximum Temperature (°C)		30.55	29.70	29.85	29.64	29.52	29.60	29.58	29.25	29.50	29.11	29.07	28.08	28.08	27.44	26.21	25.41	25.18	24.61	23.71	23.15	22.72	22.39	21.82	21.85	21.84	22.70	23.38	24.15	24.68	25.14	26.19	26.78	27.17	27.30
Minimum Temperature (°C)		23.62	23.26	23.05	22.99	22.88	22.66	22.39	21.95	21.52	20.73	20.18	19.21	18.47	17.71	16.81	16.10	15.61	14.98	13.99	13.19	12.62	12.35	11.84	12.26	12.33	12.95	13.77	14.56	15.32	15.74	16.49	17.29	17.87	18.30
Mean Temperature (°C)		27.09	26.48	26.45	26.32	26.20	26.13	25.98	25.60	25.51	24.92	24.63	23.64	23.28	22.58	21.51	20.75	20.40	19.79	18.85	18.17	17.67	17.37	16.83	17.05	17.08	17.82	18.57	19.36	20.00	20.44	21.34	22.03	22.52	22.80
Relative Humidity Maximum (%)		88.06	89.32	87.99	88.49	89.03	85.70	85.58	85.41	81.43	80.67	74.61	73.59	69.88	68.20	69.81	69.38	66.83	67.03	68.86	66.29	67.14	67.05	68.42	69.15	68.86	67.12	66.35	69.07	67.49	74.23	68.05	68.41	69.58	74.96
Relative Humidity Minimum (%)		83.97	85.89	84.70	84.76	84.88	81.92	81.63	81.20	77.63	73.24	70.63	67.78	65.12	62.56	65.60	65.47	62.92	61.62	64.53	62.41	60.74	61.90	60.05	64.62	63.84	62.03	61.28	62.12	62.36	63.64	61.50	62.15	62.35	66.60
Relative Humidity Mean (%)		86.02	87.61	86.34	86.63	86.96	83.81	83.60	83.30	79.53	76.96	72.62	70.68	67.50	65.38	67.71	67.43	64.88	64.33	66.69	64.35	63.94	64.48	64.24	66.89	66.35	64.58	63.81	65.60	64.93	68.93	64.77	65.28	65.97	70.78
Sunshine Hour (hrs)		3.19	2.87	3.32	3.18	3.35	4.03	3.93	3.89	5.24	5.83	6.94	6.90	7.63	7.51	6.32	6.31	6.56	6.31	5.90	6.14	6.44	6.27	6.13	5.49	5.34	5.39	5.67	5.33	5.10	4.98	5.17	5.38	5.04	4.81
Wind Direction (Degree)		192.53	199.02	194.75	197.67	194.01	199.52	202.38	197.25	204.84	199.46	198.13	197.69	200.84	196.30	195.26	205.60	203.38	201.00	196.03	200.66	196.44	201.98	207.27	208.29	204.17	196.50	206.88	193.66	198.16	195.74	199.18	196.27	200.70	194.80
Wind Speed (m/s)		0.62	0.56	0.62	0.60	0.63	0.65	0.61	0.65	0.74	0.82	0.96	1.00	1.05	1.07	0.98	1.00	1.03	1.01	0.99	0.98	1.04	1.04	0.99	0.97	0.98	1.06	1.10	1.16	1.14	1.17	1.20	1.22	1.32	1.21




Phenological Stages of Crops					
	Seedling	Vegetative	Flowering	Fruiting	Maturity
Favorable Weather Conditions					
Temperature (°C)	>10°C		Night 16-18°C and Day 26-28°C, >15°C casues cold injury		
Soil Temperature (°C)			Above 16°C		
Light Intensity (Lux)			3,000-8,000 Lux		
Relative Humidity (%)			60-70%		
Normal phase wise water requirement (mm/week)	30mm/week		45mm/week		

Congenial Weather Condition for Pests and Diseases					
Phytophthora blight	Temperature 25-30°C, Relative humidity >90%, Cloudy, High soil moisture				
Chilli Pod borer				Temperature 13-29°C, Relative humidity >77%	
Cut worm	Temperature 10-30°C, young and tender seedlings are affected				
Weather Warning					
Rainfall (mm)			35mm/day		>50mm/day
Temperature (°C)	<10°C		<15°C		
Relative Humidity (%)			>90%		

Low Region Crops

CROP WEATHER CALENDAR








Region: Low Altitude (< 800 masl)	LYCHEE																					Duration: 180 Days				
Months	January				February				March					April				May				June				
Standard Weeks	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Rainfall (mm)	9.72	7.15	17.05	17.62	18.55	16.43	28.79	38.50	46.54	36.92	43.22	85.87	139.45	120.94	136.66	235.18	265.19	251.92	257.72	321.88	478.18	398.04	526.19	676.85	611.08	770.88
Maximum Temperature (°C)	22.39	21.82	21.85	21.84	22.70	23.38	24.15	24.68	25.14	26.19	26.78	27.17	27.30	27.65	28.51	28.03	28.17	28.23	28.93	29.28	28.87	29.30	29.52	29.56	29.44	29.13
Minimum Temperature (°C)	12.35	11.84	12.26	12.33	12.95	13.77	14.56	15.32	15.74	16.49	17.29	17.87	18.30	18.64	19.33	19.58	19.73	20.02	20.59	21.19	21.55	21.79	22.20	22.55	22.72	22.79
Mean Temperature (°C)	17.37	16.83	17.05	17.08	17.82	18.57	19.36	20.00	20.44	21.34	22.03	22.52	22.80	23.14	23.92	23.80	23.95	24.12	24.76	25.24	25.21	25.55	25.86	26.06	26.08	25.96
Relative Humidity Maximum (%)	67.05	68.42	69.15	68.86	67.12	66.35	69.07	67.49	74.23	68.05	68.41	69.58	74.96	74.45	73.31	78.93	78.01	80.55	80.10	81.48	85.85	84.44	85.81	87.65	89.27	89.88
Relative Humidity Minimum (%)	61.90	60.05	64.62	63.84	62.03	61.28	62.12	62.36	63.64	61.50	62.15	62.35	66.60	69.40	68.25	71.45	71.79	75.79	74.92	77.10	80.85	80.52	81.88	82.88	85.41	86.76
Relative Humidity Mean (%)	64.48	64.24	66.89	66.35	64.58	63.81	65.60	64.93	68.93	64.77	65.28	65.97	70.78	71.92	70.78	75.19	74.90	78.17	77.51	79.29	83.35	82.48	83.85	85.26	87.34	88.32
Sunshine Hour (hrs)	6.27	6.13	5.49	5.34	5.39	5.67	5.33	5.10	4.98	5.17	5.38	5.04	4.81	4.95	5.25	4.36	4.47	4.78	4.79	4.30	3.16	3.32	3.51	2.95	2.51	2.09
Wind Direction (Degree)	201.98	207.27	208.29	204.17	196.50	206.88	193.66	198.16	195.74	199.18	196.27	200.70	194.80	198.59	198.33	195.02	199.77	195.60	196.75	189.06	197.74	196.80	193.70	195.03	196.00	201.08
Wind Speed (m/s)	1.04	0.99	0.97	0.98	1.06	1.10	1.16	1.14	1.17	1.20	1.22	1.32	1.21	1.15	1.18	1.07	1.07	1.00	0.97	0.88	0.74	0.78	0.73	0.66	0.62	0.55

Phenological Stages of Crops			
	Flowering	Fruit Development	Fruit Maturity
Favorable Weather Conditions			
Temperature (°C)	<15°C for chilling requirement, >20°C causes floral primordia to atrophy		25-30°C
Soil Temperature (°C)	<20°C		25-35°C
Relative Humidity (%)	50-60%		
Normal phase wise water requirement (mm/week)	Low		Two irrigations at an interval of 45 – 60 days

Congenial Weather Condition for Pests and Diseases		
Litchi Fruit and Shoot Borer	Intermittent	
Weather Warning		
Temperature (°C)	>20°C	

Low Region Crops







CROP WEATHER CALENDAR																					
Region: Low Altitude (< 800 masl)		MAIZE																	Duration: 110 Days		
Months	January				February				March					April				May			
Standard Weeks	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
Rainfall (mm)	9.72	7.15	17.05	17.62	18.55	16.43	28.79	38.50	46.54	36.92	43.22	85.87	139.45	120.94	136.66	235.18	265.19	251.92	257.72	321.88	478.18
Maximum Temperature (°C)	22.39	21.82	21.85	21.84	22.70	23.38	24.15	24.68	25.14	26.19	26.78	27.17	27.30	27.65	28.51	28.03	28.17	28.23	28.93	29.28	28.87
Minimum Temperature (°C)	12.35	11.84	12.26	12.33	12.95	13.77	14.56	15.32	15.74	16.49	17.29	17.87	18.30	18.64	19.33	19.58	19.73	20.02	20.59	21.19	21.55
Mean Temperature (°C)	17.37	16.83	17.05	17.08	17.82	18.57	19.36	20.00	20.44	21.34	22.03	22.52	22.80	23.14	23.92	23.80	23.95	24.12	24.76	25.24	25.21
Relative Humidity Maximum (%)	67.05	68.42	69.15	68.86	67.12	66.35	69.07	67.49	74.23	68.05	68.41	69.58	74.96	74.45	73.31	78.93	78.01	80.55	80.10	81.48	85.85
Relative Humidity Minimum (%)	61.90	60.05	64.62	63.84	62.03	61.28	62.12	62.36	63.64	61.50	62.15	62.35	66.60	69.40	68.25	71.45	71.79	75.79	74.92	77.10	80.85
Relative Humidity Mean (%)	64.48	64.24	66.89	66.35	64.58	63.81	65.60	64.93	68.93	64.77	65.28	65.97	70.78	71.92	70.78	75.19	74.90	78.17	77.51	79.29	83.35
Sunshine Hour (hrs)	6.27	6.13	5.49	5.34	5.39	5.67	5.33	5.10	4.98	5.17	5.38	5.04	4.81	4.95	5.25	4.36	4.47	4.78	4.79	4.30	3.16
Wind Direction (Degree)	201.98	207.27	208.29	204.17	196.50	206.88	193.66	198.16	195.74	199.18	196.27	200.70	194.80	198.59	198.33	195.02	199.77	195.60	196.75	189.06	197.74
Wind Speed (m/s)	1.04	0.99	0.97	0.98	1.06	1.10	1.16	1.14	1.17	1.20	1.22	1.32	1.21	1.15	1.18	1.07	1.07	1.00	0.97	0.88	0.74

Phenological Stages of Crops										
		Emergence and seedling		Vegetative		Tasseling	Silking	Milky	Dough	Maturity and Harvesting
Favorable Weather Conditions										
Temperature (°C)		>10°C			17-23°C	17-23°C		20-25°C		
Soil Temperature (°C)	<20°C	>10°C					17 -25°C			
Relative Humidity (%)	50-65%									
Normal phase wise water requirement (mm/week)		60mm/week			1-2 weeks interval					

Congenial Weather Condition for Pests and Diseases					
Turcicum Leaf Blight		Temperature range of 18-27°C, 6-18 hours of wet period, favoured by frequent light shower and prolong dew period, spread by moderate wind speed and resticted by hot and dry weather			
Gray Leaf Spot		Temperature range of 23-30°C, Relative humidity of more than 90% for 11-13 hours, favoured by light rain and heavy fog condition, spread by moderate wind speed			
Armyworm	Temperature range of 17-29°C, Relative humidity of more than 75%, favoured by period of drought followed by heavy rain				
Weather Warning					
Temperature (°C)		<10°C		>35°C	
Wind Speed (m/s)				>30m/sec	

Low Region Crops

CROPPING WEATHER CALENDAR																			
Region: Low Altitude (< 800 masl)	PADDY															Duration: 133 days			
Months	June			July				August				September				October			
Standard Weeks	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Rainfall (mm)	676.85	611.08	770.88	720.15	812.98	718.81	607.16	538.18	509.99	589.46	552.73	531.47	448.99	381.51	391.02	268.20	191.43	166.03	107.47
Maximum Temperature (°C)	29.56	29.44	29.13	29.17	29.00	29.29	29.74	30.18	30.55	29.70	29.85	29.64	29.52	29.60	29.58	29.25	29.50	29.11	29.07
Minimum Temperature (°C)	22.55	22.72	22.79	22.90	22.89	23.08	23.33	23.46	23.62	23.26	23.05	22.99	22.88	22.66	22.39	21.95	21.52	20.73	20.18
Mean Temperature (°C)	26.06	26.08	25.96	26.03	25.95	26.19	26.53	26.82	27.09	26.48	26.45	26.32	26.20	26.13	25.98	25.60	25.51	24.92	24.63
Relative Humidity Maximum (%)	87.65	89.27	89.88	90.76	91.46	89.77	89.69	88.61	88.06	89.32	87.99	88.49	89.03	85.70	85.58	85.41	81.43	80.67	74.61
Relative Humidity Minimum (%)	82.88	85.41	86.76	87.65	87.28	86.58	84.82	84.82	83.97	85.89	84.70	84.76	84.88	81.92	81.63	81.20	77.63	73.24	70.63
Relative Humidity Mean (%)	85.26	87.34	88.32	89.21	89.37	88.17	87.26	86.72	86.02	87.61	86.34	86.63	86.96	83.81	83.60	83.30	79.53	76.96	72.62
Sunshine Hour (hrs)	2.95	2.51	2.09	2.28	2.04	2.48	2.95	3.30	3.19	2.87	3.32	3.18	3.35	4.03	3.93	3.89	5.24	5.83	6.94
Wind Direction (Degree)	195.03	196.00	201.08	196.13	196.94	199.85	199.67	200.05	192.53	199.02	194.75	197.67	194.01	199.52	202.38	197.25	204.84	199.46	198.13
Wind Speed (m/s)	0.66	0.62	0.55	0.55	0.52	0.55	0.56	0.64	0.62	0.56	0.62	0.60	0.63	0.65	0.61	0.65	0.74	0.82	0.96









Phenological Stages of Crops						
	Nursery	Transplanting	Tillering	Head/Flowering	Grain Filling	Maturity
Favourable Weather Conditions						
Temperature (°C)	Atleast 10°C for germination		25-30°C		22-35°C	25-35°C
Soil Temperature (°C)			18-30°C			
Light Intensity (Lux)			≤ 200% of normal			
Relative Humidity (%)			High			
Nominal Phase wise water requirement (mm/week)	76mm/week		120mm/week		190mm/week	145mm/week
					100mm/week	

Congenial Weather Conditions for Pests and Diseases								
Blast	Night temperature 16-20 0C, for 07 hours day temperature 25-30 0C, for 07 hours day night temperature >10 0C, Relative Humidity >90%, Cloudy							
Brown Spot		Temperature 16-36°C, soil pH 6.6-8.8, Relative humidity >89% for 8-24hrs						
Stem Borer			Minimum temperature > 20.3°C, Maximum temperature: 29.5-34.7°C, Optimum temperature: 24-29°C, Higher morning Relative Humidity > 84%, Afternoon Relative Humidity >38.7%, Dry weather					
Brown Plant Hopper				High temperature >32°C, high Relative humidity: 80-90%, drizzle, wet spell, rainfall less than 75mm				
Weather warning								
Rainfall (mm)	>50 mm/day		>100 mm/day			>50 mm/day		
Duration of wet spell	>25 mm for 3 days		>50 mm for 4 days			20 mm for 4 days		
Cloudy weather			Cloudy weather			Cloudy weather		
High wind	>50 km/hr		>40 km/hr			>30 km/hr		
Temperature (°C)	Minimum Temperature <10°C		Minimum temperature <10°C			Minimum temperature <10°C		

Mid Region Crops







CROP WEATHER CALENDAR

CROP WEATHER CALENDAR																							
Region: Mid altitude (between 800 1600 masl)	MAIZE (YANGTSEPA)																		Duration: 150 Days				
Months	March	April					May				June				July				August				
Standard Weeks	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Rainfall (mm)	50.67	37.90	47.06	70.98	65.34	80.10	53.32	76.96	118.36	116.76	101.17	141.79	178.36	229.54	211.66	234.22	218.56	186.50	151.03	141.43	209.17	157.85	138.54
Maximum Temperature (°C)	21.39	21.93	22.94	23.08	23.23	23.63	24.28	24.78	24.74	25.07	25.78	25.90	25.95	25.73	25.86	25.72	25.89	26.15	26.55	26.67	26.02	25.95	25.88
Minimum Temperature (°C)	12.91	13.54	14.21	15.13	15.16	15.87	16.50	17.42	17.95	18.23	18.96	19.37	19.63	19.73	19.93	19.87	19.98	19.88	19.97	20.03	19.76	19.52	19.52
Mean Temperature (°C)	17.15	17.73	18.57	19.10	19.20	19.75	20.39	21.10	21.34	21.65	22.37	22.63	22.79	22.73	22.90	22.79	22.93	23.01	23.26	23.35	22.89	22.73	22.70
Relative Humidity Maximum (%)	75.20	74.25	72.91	77.18	75.29	77.48	76.39	78.25	81.10	81.56	81.51	82.80	85.02	86.39	86.14	86.57	86.04	85.54	84.62	84.12	85.12	85.15	85.13
Relative Humidity Minimum (%)	68.80	67.75	67.49	71.80	70.28	71.60	70.68	73.72	76.27	76.27	76.93	77.31	80.30	81.03	82.49	82.73	82.95	81.05	79.53	80.15	82.19	81.97	81.10
Relative Humidity Mean (%)	72.00	71.00	70.20	74.49	72.78	74.54	73.53	75.98	78.68	78.92	79.22	80.06	82.66	83.71	84.32	84.65	84.50	83.29	82.07	82.14	83.66	83.56	83.12
Sunshine Hour (hrs)	4.70	5.05	5.51	4.70	5.07	4.66	4.83	4.49	3.87	4.14	4.32	3.94	3.67	3.28	3.21	3.21	3.26	3.92	4.29	4.31	3.86	4.16	4.12
Wind Direction (Degree)	190.82	190.95	189.06	192.95	188.14	195.24	189.71	185.53	195.76	193.20	187.06	193.96	195.78	195.90	189.22	190.02	194.60	192.00	196.40	192.53	195.18	186.67	193.85
Wind Speed (m/s)	1.11	1.14	1.20	1.13	1.11	1.04	1.01	1.04	0.95	0.91	0.88	0.88	0.78	0.78	0.78	0.79	0.76	0.77	0.79	0.74	0.69	0.68	0.71

Phenological Stages of Crops								
	Sowing	Seedling	Vegetative					
				Tasseling				
				Silking/Pollination				
						Milking		
						Ripening		
							Harvesting	
Favorable Weather Conditions								
Temperature (°C)	25-28°C		21-27°C					
Soil Temperature (°C)	10°C		Above 15°C					
Light Intensity (Lux)			≤200% of normal					Sunny
Relative Humidity (%)			55-65%					
Rainfall (mm/week)		75mm/week	120mm/week		190mm/week	145mm/week		100mm/week

Congenial Weather Conditions for Pests and Diseases					
Fall Army Worm		Outbreaks appear to be favoured by periods of drought followed by heavy rain. The presence of alternative hosts also sustain populations. Adults survive better, and produce more eggs, when maximum temperatures are around 15°C			
Gray Leaf Spot		As temperatures rise and humidity increases the spores in crop residues start to develop. Once mature they are picked up by the wind and infect the lower leaves of the new maize crop. Infection requires the leaf surface to be wet for 11-13 hours and the relative humidity on the leaf canopy to be above 90%			
Turicum Leaf Blight		Fungal growth and spores survive on plant remains such as leaves, stalks and husks. Thick walled spores allow survival of the fungus for up to 2 years. Survival also occurs on “volunteer” plants. It does not appear to be seed-borne in maize. Water covering the leaves for 6-18 hours, and temperatures between 18 and 27°C, are needed for spore germination and infection			
Weather Warning					
Rainfall (mm/day)		>50 mm/day		>100 mm/day	
Duration of dry spell		>25 mm for 3 days		>50 mm for 4 days	
Cloudy weather				Cloudy weather	
High wind				>30 m/sec	
Temperature (°C)		Low temperature of <5°C or high temperature of >35°C for prolonged number of days (>5) may result in poor crop yield			








CROP WEATHER CALENDAR

Phenological Stages of Crops												
	Sowing	Germination	Transplanting			Flowering	Fruiting			Harvesting		
Favorable Weather Conditions												
Temperature (°C)			16-29°C				15-27°C				20-25.9°C	
Soil Temperature (°C)			15-30°C									
Light Intensity (Lux)									It requires at least 6 hours of full sun exposure daily			
Relative Humidity (%)							50 - 70%					
Rainfall (mm/week)							400 to 600 mm					

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Mid Region Crops







CROP WEATHER CALENDAR																									
Region: Mid altitude (between 800 - 1600 masl)	PADDY																				Duration: 175 Days				
Months	May				June				July				August				September				October				
Standard Weeks	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Rainfall (mm)	53.32	76.96	118.36	116.76	101.17	141.79	178.36	229.54	211.66	234.22	218.56	186.50	151.03	141.43	209.17	157.85	138.54	121.40	103.56	143.84	100.63	81.83	77.02	57.57	37.89
Maximum Temperature (°C)	24.28	24.78	24.74	25.07	25.78	25.90	25.95	25.73	25.86	25.72	25.89	26.15	26.55	26.67	26.02	25.95	25.88	25.63	25.69	25.38	24.95	24.87	24.13	23.56	22.62
Minimum Temperature (°C)	16.50	17.42	17.95	18.23	18.96	19.37	19.63	19.73	19.93	19.87	19.98	19.88	19.97	20.03	19.76	19.52	19.52	19.22	18.91	18.67	18.16	17.43	16.36	15.18	13.85
Mean Temperature (°C)	20.39	21.10	21.34	21.65	22.37	22.63	22.79	22.73	22.90	22.79	22.93	23.01	23.26	23.35	22.89	22.73	22.70	22.43	22.30	22.02	21.55	21.15	20.25	19.37	18.24
Relative Humidity Maximum (%)	76.39	78.25	81.10	81.56	81.51	82.80	85.02	86.39	86.14	86.57	86.04	85.54	84.62	84.12	85.12	85.15	85.13	85.07	84.51	85.31	84.99	81.43	79.62	77.66	77.75
Relative Humidity Minimum (%)	70.68	73.72	76.27	76.27	76.93	77.31	80.30	81.03	82.49	82.73	82.95	81.05	79.53	80.15	82.19	81.97	81.10	80.89	80.75	79.76	78.66	76.91	74.77	72.72	71.63
Relative Humidity Mean (%)	73.53	75.98	78.68	78.92	79.22	80.06	82.66	83.71	84.32	84.65	84.50	83.29	82.07	82.14	83.66	83.56	83.12	82.98	82.63	82.53	81.82	79.17	77.20	75.19	74.69
Sunshine Hour (hrs)	4.83	4.49	3.87	4.14	4.32	3.94	3.67	3.28	3.21	3.21	3.26	3.92	4.29	4.31	3.86	4.16	4.12	4.54	4.44	4.21	4.81	5.59	6.14	6.72	6.67
Wind Direction (Degree)	189.71	185.53	195.76	193.20	187.06	193.96	195.78	195.90	189.22	190.02	194.60	192.00	196.40	192.53	195.18	186.67	193.85	192.99	192.90	192.12	198.54	198.58	194.66	198.54	193.95
Wind Speed (m/s)	1.01	1.04	0.95	0.91	0.88	0.88	0.78	0.78	0.78	0.79	0.76	0.77	0.79	0.74	0.69	0.68	0.71	0.66	0.65	0.60	0.66	0.67	0.70	0.75	0.75

Phenological Stages of Crops							
	Nursery	Transplanting	Tillering	Heading	Flowering	Grain Filling	Maturity
Favourable Weather Conditions							
Temperature (°C)	At least 10°C for germination				22-25°C		23-27°C
Soil Temperature (°C)			Above 16°C				
Light Intensity (Lux)			≤ 200% of normal				
Relative Humidity (%)			High				
Normal phase wise water requirement (mm/week)	76mm/week		120mm/week		190mm/week		145mm/week 100mm/week

Congenial Weather Condition for Pests and Diseases						
Blast	Night temperature 16-20°C, for 07 hours day temperature 25-30°C, for 07 hours day night temperature >10°C, Relative Humidity >90%, Cloudy					
Brown Spot	Temperature16-36°C, soil pH 6.6 - 8.8, RH >89% for 8-24 hrs					
Stem Borer	Minimum temperature > 20.3°C, Maximum temperature: 29.5- 34.7°C, Optimum temperature: 24-29°C, Higher morning Relative humidity > 84%, Afternoon relative humidity >38.7%, Dry weather					
Brown Plant Hopper	High temperature >32°C, high Relative Humidity:80-90%, drizzle, wet spell, rainfall less than 75 mm					
Weather warning						
Rainfall (mm)	>50 mm/day		>100 mm/day		>50 mm/day	
Wet spell	>25 mm for 3 days		>50 mm for 4 days		20 mm for 4 days	
Cloudy weather	Cloudy weather		Cloudy weather			
High Wind	>50 km/hr		>40 km/hr		>30 km/hr	
Temperature (°C)	Minimum Temperature <10°C					

Mid Region Crops









CROPPING WEATHER CALENDER																							
Region: Mid altitude (between 800 - 1600 masl)	POTATO																				DURATION: 147 Days		
Months	March			April				May				June				July				August			
Standard Weeks	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Rainfall (mm)	23.32	35.10	50.67	37.90	47.06	70.98	65.34	80.10	53.32	76.96	118.36	116.76	101.17	141.79	178.36	229.54	211.66	234.22	218.56	186.50	151.03	141.43	209.17
Maximum Temperature (°C)	20.63	21.09	21.39	21.93	22.94	23.08	23.23	23.63	24.28	24.78	24.74	25.07	25.78	25.90	25.95	25.73	25.86	25.72	25.89	26.15	26.55	26.67	26.02
Minimum Temperature (°C)	11.41	11.98	12.91	13.54	14.21	15.13	15.16	15.87	16.50	17.42	17.95	18.23	18.96	19.37	19.63	19.73	19.93	19.87	19.98	19.88	19.97	20.03	19.76
Mean Temperature (°C)	16.02	16.53	17.15	17.73	18.57	19.10	19.20	19.75	20.39	21.10	21.34	21.65	22.37	22.63	22.79	22.73	22.90	22.79	22.93	23.01	23.26	23.35	22.89
Relative Humidity Maximum (%)	72.24	72.63	75.20	74.25	72.91	77.18	75.29	77.48	76.39	78.25	81.10	81.56	81.51	82.80	85.02	86.39	86.14	86.57	86.04	85.54	84.62	84.12	85.12
Relative Humidity Minimum (%)	67.05	67.85	68.80	67.75	67.49	71.80	70.28	71.60	70.68	73.72	76.27	76.27	76.93	77.31	80.30	81.03	82.49	82.73	82.95	81.05	79.53	80.15	82.19
Relative Humidity Mean (%)	69.64	70.24	72.00	71.00	70.20	74.49	72.78	74.54	73.53	75.98	78.68	78.92	79.22	80.06	82.66	83.71	84.32	84.65	84.50	83.29	82.07	82.14	83.66
Sunshine Hour (hrs)	5.51	5.21	4.70	5.05	5.51	4.70	5.07	4.66	4.83	4.49	3.87	4.14	4.32	3.94	3.67	3.28	3.21	3.21	3.26	3.92	4.29	4.31	3.86
Wind Direction (Degree)	182.65	186.53	190.82	190.95	189.06	192.95	188.14	195.24	189.71	185.53	195.76	193.20	187.06	193.96	195.78	195.90	189.22	190.02	194.60	192.00	196.40	192.53	195.18
Wind Speed (m/s)	1.18	1.19	1.11	1.14	1.20	1.13	1.11	1.04	1.01	1.04	0.95	0.91	0.88	0.88	0.78	0.78	0.78	0.79	0.76	0.77	0.79	0.74	0.69

Phenological Stages of Crops						
	Sprout Development	Vegetative stage	Tuber Initiation	Tuber Bulking	Maturity	Harvesting
	Favorable Weather Conditions					
	Temperature (°C)	18-21°C	10-18°C	Daily temperature 18-20°C, Night temperature <15°C		15-18°C
	Soil Temperature (°C)			15-18°C		
	Sunshine Hour (hrs)	Atleast 6-9		Atleast 6-9		
	Relative Humidity (%)	65-80%		65-80%		
Rainfall (mm)			400-600 mm			
Normal phase wise water requirements (mm/week)	400-450 mm/week					

Congenial Weather Condition for Pests and Diseases			
Potato Late Blight			Temperature 4-26 °C, Relative Humidity 100%, Cloudy, High soil moisture
Early Blight			Temperature 10-35 °C, Relative Humidity 90% more, 2 hours favorable conditions
Potato Tuber Moth	Temperature: 15-40C with optimum of 28C, Potato tuber moths can move up to 0.15 miles between crops to infest plants or tubers. Transmitted through infested tubers. It can produce up to 13 generations in a season		
Weather Warning			
Rainfall (mm)			>25mm/day
Duration of wet spell			>25mm for 3 days
Cloudy weather			Cloudy Weather
Drought			>15 days
High Winds			>30KM/HR
Hail Storm			Hail Storm

High Region Crops







CROPPING WEATHER CALENDER																																																		
Region: High altitude (above 1600 masl)	PADDY																																												DURATION: 294 Days					
Months	February					March					April					May					June					July					August					September					October					November				
Standard Weeks	05	06	97	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46								
Rainfall (mm)	7.00	10.84	17.84	17.42	22.17	19.76	28.90	38.16	37.81	47.18	56.07	70.38	65.39	75.53	66.74	78.59	116.15	96.26	87.00	125.37	153.32	173.96	161.85	194.05	185.62	179.46	144.29	168.45	177.82	142.83	122.52	115.75	107.29	114.83	82.22	80.69	62.67	56.79	35.73	10.66	5.56	7.10								
Maximum Temperature (°C)	13.16	13.97	14.42	15.03	15.31	16.36	17.23	17.67	18.13	18.54	19.60	19.77	19.98	20.28	20.86	21.45	21.67	22.02	22.00	23.28	23.28	23.29	23.57	23.28	23.55	23.72	24.10	24.24	23.66	23.47	23.48	23.21	22.92	22.61	22.23	21.87	21.10	20.37	19.39	18.75	18.16	17.17								
Minimum Temperature (°C)	0.30	1.10	1.79	2.59	3.31	4.15	4.56	5.52	6.49	7.16	7.69	8.90	9.08	9.74	10.35	11.46	12.49	12.81	13.85	14.49	15.07	15.46	15.63	15.67	15.74	15.55	15.62	15.60	15.45	15.15	15.05	14.79	14.39	13.82	13.23	12.21	10.72	8.97	7.60	5.99	4.60	4.54								
Mean Temperature (°C)	6.73	7.53	8.10	8.81	9.31	10.26	10.90	11.60	12.31	12.85	13.65	14.33	14.53	15.01	15.60	16.46	17.08	17.41	18.37	18.88	19.17	19.38	19.60	19.48	19.65	19.63	19.86	19.92	19.56	19.31	19.26	19.00	18.66	18.22	17.73	17.04	15.91	14.67	13.50	12.37	11.38	10.86								
Relative Humidity Maximum (%)	72.65	72.33	72.50	71.89	73.06	72.26	69.97	72.09	73.11	72.26	71.86	73.92	73.07	74.37	73.75	74.93	78.72	78.23	78.00	80.19	81.05	83.03	82.63	84.46	84.06	83.51	82.23	82.33	83.34	82.79	82.15	82.17	82.17	81.61	81.69	79.01	77.48	75.72	74.68	70.85	70.23	72.23								
Relative Humidity Minimum (%)	67.04	65.55	66.24	66.76	66.93	66.52	65.10	65.15	66.42	66.79	65.65	68.30	67.51	68.93	67.81	69.71	73.44	72.65	73.45	74.72	77.01	78.86	78.59	79.51	79.78	79.44	78.02	78.40	79.11	78.48	78.12	77.38	77.77	76.92	75.78	74.77	71.90	70.58	69.42	65.79	63.31	66.28								
Relative Humidity Mean (%)	69.84	68.94	69.37	69.32	69.99	69.39	67.53	68.62	69.77	69.52	68.76	71.11	70.29	71.65	70.78	72.32	76.08	75.44	75.72	77.46	79.03	80.95	80.61	81.98	81.92	81.48	80.12	80.36	81.22	80.63	80.14	79.78	79.97	79.26	78.73	76.89	74.69	73.15	72.05	68.32	66.77	69.25								
Sunshine Hour (hrs)	5.71	6.01	5.54	5.30	4.92	5.46	5.46	5.22	4.95	4.87	5.26	4.60	4.71	4.45	4.56	4.35	3.68	3.92	3.92	3.56	3.12	2.87	3.10	2.79	2.94	3.39	3.80	3.77	3.49	3.77	3.78	4.09	3.80	3.92	4.44	5.20	5.73	6.19	6.38	6.50	6.85	5.91								
Wind Direction (Degree)	183.37	183.59	189.74	183.30	187.14	187.02	181.97	183.43	182.70	188.70	186.66	186.24	184.71	185.00	192.14	186.24	189.82	184.36	182.20	183.92	186.61	186.19	182.38	187.43	187.21	190.98	183.39	183.84	189.53	186.86	185.08	184.48	185.57	190.33	187.53	183.91	181.98	181.21	184.14	178.26	177.26									
Wind Speed (m/s)	0.95	1.00	1.01	1.00	1.00	1.04	1.07	1.06	0.99	1.02	1.04	1.01	0.96	0.90	0.90	0.90	0.82	0.85	0.85	0.80	0.72	0.69	0.68	0.63	0.63	0.68	0.66	0.61	0.63	0.63	0.62	0.58	0.60	0.60	0.66	0.69	0.73	0.76	0.78	0.80	0.76									

Phenological Stages of Crops																																																			
	Sowing/Germination					Transplanting					Tillering					Heading					Flowering					Grain filling					Maturity					Harvesting															
	Favorable Weather Conditions																																																		
	Temperature (°C)					At least 10°C for germination																				Above 16°C										22-25°C										23-27°C					
	Soil Temperature (°C)																									Above 16°C																									
	Light Intensity (Lux)																									≤ 200% of normal																									
	Relative Humidity (%)																									High																									
	Normal phase wise water requirement (mm/week)					76 mm/week										120 mm/week										190 mm/week										145 mm/week										100 mm/week					

Congenial Weather Condition for Pests and Diseases													
Blast		Night temperature 16-20°C, for 07 hours day temperature 25-30°C, for 07 hours day night temperature >10°C, Relative Humidity >90%, Cloudy											
Sheath Rot								Temperature 25-28°C, Cloudy weather, RH > 90%					
Stem Borer								Minimum temperature > 20.3°C, Maximum temperature: 29.5-34.7°C, Optimum temperature: 24-29°C, Higher morning Relative humidity > 84%, Afternoon relative humidity >38.7%, Dry weather					
Leaf Roller								Maximum Temperature: 32-33°C, Relative Humidity 92-95%					
Brown Plant Hopper								High temperature >32°C, , high relative humidity:80-90%, drizzle, wet spell, rainfall less than 75 mm					
Weather Warning													
Rainfall (mm)		>50 mm/day				>100 mm/day				>50 mm/day			
Duration of wet spell		>25 mm for 3 days				>50 mm for 3 days				>50 mm for 4 days			
Cloudy weather						Cloudy weather				Cloudy weather			
High wind		>50 km/hr				>40 km/hr				>30 km/hr			
Temperature (°C)		Minimum temperature <10°C				Minimum temperature <10°C				Minimum temperature <10°C			

High Region Crops

CROPPING WEATHER CALENDER																														
Region: High altitude (above 1600 masl)	POTATO																												DURATION 182 Days	
Months	February	March					April					May					June					July					August			
Standard Weeks	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33				
Rainfall (mm)	17.42	22.17	19.76	28.90	38.16	57.81	47.18	56.07	70.38	65.39	75.53	66.74	78.59	116.15	96.26	87.90	125.37	153.32	173.96	161.85	194.05	185.62	179.46	144.29	168.45	177.82				
Maximum Temperature (°C)	15.03	15.31	16.36	17.23	17.67	18.13	18.54	19.60	19.77	19.98	20.28	20.86	21.45	21.67	22.02	22.90	23.28	23.28	23.29	23.57	23.28	23.55	23.72	24.10	24.24	23.66				
Minimum Temperature (°C)	2.59	3.31	4.15	4.56	5.52	6.49	7.16	7.69	8.90	9.08	9.74	10.35	11.46	12.49	12.81	13.85	14.49	15.07	15.46	15.63	15.67	15.74	15.55	15.62	15.60	15.45				
Mean Temperature (°C)	8.81	9.31	10.26	10.90	11.60	12.31	12.85	13.65	14.33	14.53	15.01	15.60	16.46	17.08	17.41	18.37	18.88	19.17	19.38	19.60	19.48	19.65	19.63	19.86	19.92	19.56				
Relative Humidity Maximum (%)	71.89	73.06	72.26	69.97	72.09	73.11	72.26	71.86	73.92	73.07	74.37	73.75	74.93	78.72	78.23	78.00	80.19	81.05	83.03	82.63	84.46	84.06	83.51	82.23	82.33	83.34				
Relative Humidity Minimum (%)	66.76	60.93	66.52	65.10	65.15	66.42	66.79	65.65	68.30	67.51	68.93	67.81	69.71	73.44	72.65	73.45	74.72	77.01	78.86	78.59	79.51	79.78	79.44	78.02	78.40	79.11				
Relative Humidity Mean (%)	69.32	66.99	69.39	67.53	68.62	69.77	69.52	68.76	71.11	70.29	71.65	70.78	72.32	76.08	75.44	75.72	77.46	79.03	80.95	80.61	81.98	81.92	81.48	80.12	80.36	81.22				
Sunshine Hour (hrs)	5.30	4.92	5.46	5.46	5.22	4.95	4.87	5.26	4.60	4.71	4.45	4.56	4.35	3.68	3.92	3.92	3.56	3.12	2.87	3.10	2.79	2.94	3.39	3.80	3.77	3.49				
Wind Direction (Degree)	183.30	187.14	187.02	181.97	183.43	182.70	188.70	186.66	186.24	184.71	185.00	192.14	186.24	189.82	184.36	182.20	183.92	186.61	186.19	182.38	187.43	187.21	190.98	183.39	183.84	189.53				
Wind Speed (m/s)	1.00	1.00	1.04	1.07	1.06	0.99	1.02	1.04	1.01	0.96	0.90	0.90	0.90	0.82	0.85	0.85	0.80	0.72	0.69	0.68	0.65	0.63	0.63	0.68	0.66	0.61				


Phenological Stages of Crops						
	Sprout Development	Vegetative stage	Tuber Initiation	Tuber Bulking	Maturity	Harvesting
Favorable Weather Conditions						
Temperature	18-21°C	10-18°C	Daily Temp. 18-20°C, Night Temp. <15°C			15-18°C
SShr(hrs)	Atleast 6-9		Atleast 6-9			
RH(hr)	65-80%		65-80%			
Soil Temp (°C)			15-18°C			
Rainfall(mm)			400-600 mm			
Normal phase wise water requirements (mm/week)	400-450 mm					

Congenial Weather Condition for Pests and Diseases			
Potato Late Blight			Temperature 4-26 °C, Relative Humidity 100%, Cloudy, High soil moisture
Early Blight			Temperature 10-35 °C, Relative Humidity 90% more, 2 hours favorable conditons
Potato Tuber Moth	Temperature: 15-40C with optimum of 28C, Potato tuber moths can move up to 0.15 miles between crops to infest plants or tubers. Transmitted through infested tubers. It can produce up to 13 generations in a season		
Weather Warning			
Rainfall (mm)	>25mm/day		>100mm/day
Duration of wet spell	>25mm for 2 days		>50mm for 3 days
Cloudy Weather			Cloudy Weather
Drought	> 10 days		>15 days
High Winds			>30KM/HR
Hail Storm	Hail Storm		Hail Storm
Temperature (°C)	Minimum temperature < 10°C and maximum temperature >30°C		


CONCLUSION

The crop weather calendar for specific crops over the country was developed through joint collaboration with NCHM and DoA. The next step, the Centre will take in the coming years is to introduce this techniques to the agriculture extensions to reach down the information to the community to incorporate it into planning phase.

ATTENDANCE















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 NATIONAL CENTRE FOR HYDROLOGY AND METEOROLOGY
 THIMPHU: BHUTAN
"Centre of Excellence in Hydrology, Meteorology and Cryosphere Science and Services"



Supporting Climate Resilience and Transformational Change in the Agriculture Sector in Bhutan
 GCF Project

In House Workshop
 Development of Cropping Weather Calendar

Date: 23-25 November, 2022
 Venue: NCHM, Thimphu

Sl No.	Name	Division/Designation	Date		
			23rd November, 2022	24th November, 2022	25th November, 2022
1.	Tshering Dorje	NCOA-Yusipang			
2.	Sangay Chaphel	NPPC, Sentsokha			
3	Pema Tobgay	NPPC, Sentsokha			
4	Ugyen Dorji	ARDC Bgyo			

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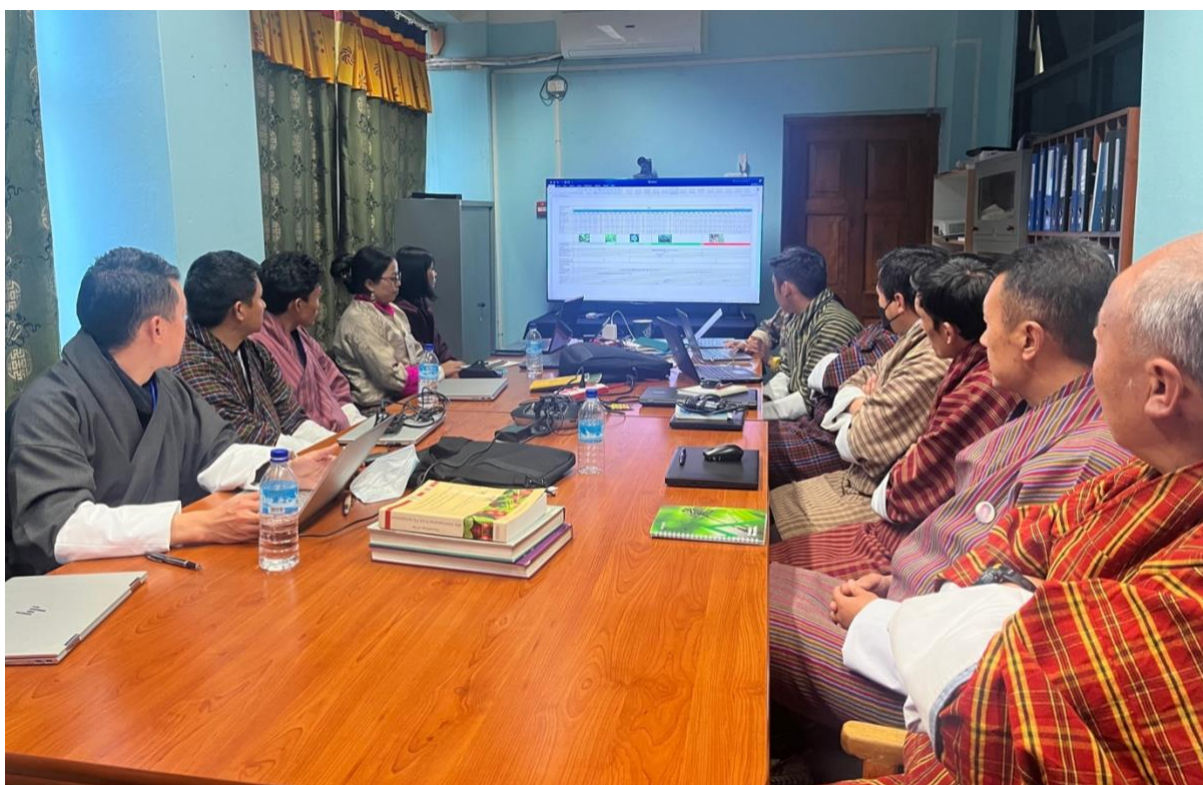


Figure 2: Participants and glimpse of the session