Horticultural Crops Production

Level-II

Learning Guide -69

Unit of Competence: Observe and report on weather

Module Title: Observing and reporting on weather

LG Code: AGR HCP2 M17 LO1-LG-69

TTLM Code: AGR HCP2 TTLM 0120v1

LO 1: Check weather and climate information.

Instruction Sheet	Learning Guide #69

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Checking Weather and climate information
- Recognizing Changed weather and climate situations
- Anticipating impact of changes in weather and climate, property, natural resources and local environment.
- Making Report impact of weather and climate

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This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Check Weather and climate information
- Recognize Changed weather and climate situations are recognized.
- Anticipate Likely impact of changes in weather and climate
- Report anticipated impact of weather and climate.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 1 to 4.
3. Read the information written in the information “Sheet 1- 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page -6, 9, 14 and 14 respectively.

Information Sheet-1	Checking Weather and climate information

1.1. Weather and climate

Weather and climate is state of the atmosphere at a particular time and place which is highly variable over time and space that constantly changes every hour and/or day. Weather condition is the collection of values of weather variables at a given time and place .All weather systems have well-defined cycles and structural features governed by the laws of heat and motion.

1.1.1. **Climate**

Climate is the average weather of a particular region over a long period of time. It is the fluctuating aggregate of the atmosphere conditions characterized by the state of the weather of a given area. Climate includes averages and variations of all-weather elements for at least **30** years if sufficient data is available

1.1.2. **Weather**

Weather is basically the way the atmosphere is behaving, mainly with respect to its effects upon life and human activities. The difference between weather and climate is that weather consists of the short-term (minutes to months) changes in the atmosphere in most places, weather can change from

- Minute-to-minute
- Hour-to-hour
- Day-to-day, and
- Season-to-season.

1.2. **Components of weather**.

Weather includes: sunshine, rain, cloud cover, winds, hail, snow, sleet, freezing rain, flooding, blizzards, ice storms, thunderstorms, steady rains from a cold front or warm front, excessive heat, heat waves and more.

1.3. **Climatic variations**

Most of the earth's climate variation is caused by uneven heating associated with:

A. Diurnal variation:

- rotation of the earth on its axis

B. Latitudinal variation:

Global climate varies from ice-covered Polar Regions to the hottest deserts in the tropics. This variation is associated with the spherical shape of the earth. Lower latitudes receive more incoming solar radiation than the poles, since sun's rays are almost perpendicular to the surface, at higher latitudes the radiation is weaker since it is spread over a larger surface unit ground area so travels longer path through the atmosphere and part of it is absorbed, reflected, or scattered before it reaches the surface.

This deferential heating creates temperature gradient on the earth's surface. The temperature gradient in turn leads to pressure gradient in the atmosphere which is the major driving force of the global as well as regional atmospheric circulation. The atmospheric circulation influences patterns of precipitation

C. Seasonal variation:

Tilted position of earth's axis by 23.50^0 as it rotates around the Sun. As a result the latitude at which the sun is directly overhead changes with seasons. During north summer, the northern hemisphere is tilted towards the sun and receives more solar energy than the south, and the vise versa. The axis of Earth's rotation is fixed at 23.5˚ relative to its orbital plane about the sun. This tilt in Earth's axis results in strong seasonal variations in day length and the solar irradiance, i.e., the quantity of solar energy received at Earth's surface per unit time.

During the spring and autumn equinoxes, the entire earth's surface receives approximately twelve hours of daylight .At the northern-hemisphere summer solstice, the sun's rays strike Earth most directly in the northern hemisphere, and day length is maximized. At the northern-hemisphere winter solstice, the sun's rays strike Earth most obliquely in the northern hemisphere, and day length is minimized. The summer and winter solstices in the southern hemisphere are six months out of phase from those in the north. Variations in incident radiation become increasingly pronounced as latitude increases.

D. Altitudinal Variation

Lower altitudes are usually hotter than higher altitudes mainly due to:

1. Semitransparent nature of the atmosphere
2. Reverse heating process
3. Atmosphere turbidity at lower altitudes

1.3.1. Climatology

It is the science that explains a variety of climatic systems of the earth surface and their relation to human activities .It is the science dealing with the factors which determine and control the distribution of climate over the earth's surface

1.3.2. Agro- climatology

It branch of climatology which deals with the impact of climate on agricultural activities as well as, biological responses of animals and crop plants. Agro- climatology is interdisciplinary in nature and evaluates the interaction effects of various climatic factors. It links, the knowledge of atmosphere into agriculture development, with major focus on the rain-fed farming.

Application of agro- climatology

1. Acquire knowledge about available environmental resources in time and space dimension for strategic decision in long-term planning of agricultural systems such as:
    a. Designing irrigation or drainage schemes
    b. Choice of cropping systems land-use patterns
    c. Choice of crop species/ varieties, animal breeds or farm machineries
    d. Selection of planting dates for optimum crop yield
    e. Preparing long-term land use planning and crop zonation
2. Analyzing rainfall reliability with respect to determining planting dates and crop calendars
3. Understanding weather requirements of crops for input application
4. Forecasting and designing management strategies for drought and floods
5. Pest and disease monitoring and crop protection using weather based warning system
6. Designing microclimatic management and manipulation
7. Effective environmental protection
8. Avoiding/ minimizing losses due to wild fires

1.2.3. Meteorology

Meteorology is Study of earth's atmosphere and especially the weather and weather forecasting including specialized sciences such as:

1. **Physical meteorology**
    - Physical aspects of the atmosphere
        - formation of clouds,
        - rain, thunderstorms,
        - lightning
    - Visual events such as: mirages, rainbows
2. **Dynamic meteorology:** Is the study of winds and laws that govern atmospheric motion
3. **Synoptic meteorology**: Is study and analysis of large weather systems that exist for more than one day. Weather forecasting

4. **Agricultural meteorology**: deals with weather and its relationship to vegetation, crops and
   Animals
5. **Micrometeorology:** is the study of atmospheric conditions over an area smaller than 1sq km.

Self-Check -1	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define the following terms? (4pts)
   B. Weather
   C. Climate
   D. Metrology
   E. Micro meteorology
2. What are the difference between climate and weather? (3pts)
3. List the components of weather? (2pts)

Note: **Satisfactory rating - above 9 points** **Unsatisfactory - below 9 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet- 2	Recognizing Changed weather and climate situations

2.1. Recognize climate changes

Analysis of global observations of surface temperature shows that there has been a warming of about 0.6°C over the past hundred years. The trend is toward a larger increase in minimum than in maximum daily temperatures. The reason for this difference is apparently linked to associated increases in low cloudiness and to aerosol effects as well as the enhanced greenhouse effect. Changes in precipitation and other components of the hydrological cycle are determined more by changes in the weather systems and their tracks than by changes in temperature. Because such weather systems are so variable in both space and time, patterns of change in precipitation are much more complicated than patterns of temperature change.

The extreme weather conditions that cause loss and damage on staff, livestock, crops, fodder, produce, buildings sheds and/or other physical resources are explained as follows.

A. Extreme heat: is defined as a long period (2 to 3 days) of high *heat* and humidity with *temperatures* above 90 degrees. In *extreme heat*, evaporation is slowed and the body must work extra hard to maintain a normal temperature. *Extreme heat* can occur quickly and without warning.

B. Extreme cold: Cold weather can also affect crops. In late spring or early fall, cold air outbreaks can damage or kill produce for farmers, as well as residential plants and flowers. A freeze occurs when the temperature drops below 32°F. Freezes and their effects are significant during the growing season. Frost develops on clear, calm nights and can occur when the air temperature is in the mid-30s.

C. Heavy rainfall: defined as the top five percent of rainy days often forms a pattern at the local level, or also larger-scale global patterns to extreme rainfall events.

D. **Drought** -A region is considered to be in drought when rainfall is significantly low for at least three months.

E. **Strong winds**- Winds are caused by the movement of air as it circulates out of high pressure cells and into low pressure cells. On a weather map the distance between the isobars indicates wind strength. An isobar is a line that joins points of equal air pressure. A region showing isobars drawn closely together will be experiencing strong winds. Where the isobars are far apart there will be only light winds or calm weather. Cyclones and tornadoes produce the strongest winds. Thunderstorms are usually accompanied by strong wind gusts.

F. **Storms-** Thunderstorms develop when air masses become unstable. In summer, late afternoon storms result from the uneven heating of air masses near the earth's surface. The hot air rises, forming typically shaped clouds called 'anvil heads'. Water droplets in the cloud are moved up and down and may freeze forming hail. Massive static electric charges build up in the cloud. The electricity is discharged as lightning. Super heating and expansion of air as lightning passes through it produces thunder. Thunderstorms also occur when cold fronts lift warm moist air and when air masses are forced over mountains. Snowflakes are water droplets that have frozen into ice crystals. If the air temperature is cold enough to prevent them melting they fall as snow.

G. **Floods**- Heavy rainfall leading to flash flooding is usually associated with thunderstorms

The amount and speed of future climate change will ultimately depend on:

- Whether greenhouse gases and aerosol concentrations increase.
- Temperature, precipitation and sea level respond to changes in greenhouse gas and aerosol concentrations.
- How much the climate varies as a result of natural influences (e.g. from volcanic activity and changes in the sun's intensity) and its internal variability (referring to random changes in the circulation of the atmosphere and oceans

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the indicators which shows the changed climate? (6pts.)
2. What are the extreme weather condition changes? (4 pts.)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Anticipating impact of changes in weather and climate, property, natural resources and local environment.

3.1. Impact of changes in weather and climate

Climate and weather have a major impact on agricultural and horticultural enterprises and land management practices. The climate of a region will determine the plants and animals that can be successfully grown or raised there. Many districts have a history of enterprises that have failed because they were not suited to the climate.

The effect of climate and prevailing weather conditions is greater on people who work in primary industries than those whose place of work is largely indoors. It is important to monitor the weather on a daily and sometimes hourly basis and communicate warnings to others where relevant. Extreme weather conditions may affect work tasks and require strategies to prevent harm to staff.

3.1.1. Variations in temperature

A. High Temperature Limitations

The limiting effect of high temperatures on crop production takes two principal forms: limitation of vegetative growth and adverse effects on fruit settings. Vegetable crops subject to very high transpiration losses are obviously limited by the excessive transpiration concurrent with exposure to extremely high temperatures.

B. **Low-Temperature Limitations**

The obvious limitation imposed by low temperature is killing of plant tissues by freezing. Most plant tissues can be destroyed by freezing temperatures suddenly imposed during a period of rapid growth.

3.1.2. Increasing Carbon Dioxide

Carbon is constantly moving between the three active reservoirs (the atmosphere, the terrestrial (land) system, and the oceans), and these exchanges are called carbon fluxes.

A. Plant Responses to Rising CO 2

Rising atmospheric CO 2 could benefit many economically important crops, especially the C3 ; however, gains may or may not be realized in long-term growth because of the interaction of various environmental factors that complicate the issue. The photosynthetic mechanism of a plant species is the major determinant of how it will respond to rising atmospheric CO2; understanding the mechanisms of photosynthesis accumulation of rising CO2 , and other environmental stresses, could potentially be translated into a basic framework for improving the efficiency of crop production in a future climate-changed world.

B. Rising CO 2 and Limited Soil Water Availability

As atmospheric CO2 rises, potential shifts in regional scale precipitation patterns could result in increased drought conditions in many areas of the world. Responses of plants to rising CO2 in water defi cit situations have been reviewed. Despite our understanding of the responses of leaf photosynthesis to elevated CO2 as well as to soil water deficit, the interactions of CO2 enrichment and drought stress are still uncertain. A reduction in stomata conductance is a common response of plants to elevated growth (CO2).

C. Rising CO 2 and Light Intensity

Measurements of CO2 enrichment effects on photosynthesis have usually been carried out with relatively high irradiance. In nature, photosynthesis occurs in both high and low light environments, and light-limited photosynthesis can account for half of the total carbon gain. Several studies show that C3 photosynthesis is enhanced by elevated CO2 even under light-limited conditions, and the enhancement rises with temperature

D. Rising CO 2 and Nitrogen Nutrition

As CO 2 is just one of many organic substrates required by plants, long-term response of plant photosynthesis and growth to elevated CO2 also depends on the availability of mineral nutrients and the way in which plants utilize them.

3.1.3. Precipitation and Evaporation

The water-retention capacity of air increases with temperature and is a key determinant of precipitation. The relationship is described by the Clausius–Clapeyron equation. Cold air is drier than warm air and this is the reason why the poles experience such levels of precipitation (they are essentially cold deserts) and why the equatorial regions have so much rain.

i. Rainfall Distribution

Although the impact of climate change on particular stages of the water cycle remains uncertain, aggregate global precipitation is expected to increase as the atmosphere warms, but it will not be evenly distributed across the planet. Some regions will become drier and others wetter. In some areas, average annual rainfall may remain unchanged, but rain may fall at different times of the year or in fewer, more intense, events.

ii. Seasonal Water Availability

Although changes in the amount of annual rainfall are important in determining aggregate water availability for a given region, the timing and intensity of rainfall events is also critical. It is the changes in extreme dry and extreme wet periods, rather than changes in long-term averages, that can have the greatest impact.

iii. Thunder and Hail Storms

Thunder storms and their destructive winds are expected to become more frequent and severe as our climate changes. Longer hotter summers will generate warmer surface temperatures, causing the air to become more buoyant. Air, laden with moisture from increased evaporation, will rise into the atmosphere more rapidly and more often.

3.1.4. Sea Level Rise

The rate of sea level rise is actually likely to be quite slow. Sea level change over the next 100 years or so will be relatively modest, most probably up to 1.0 m and possibly only 0.5m (although some estimates range as high as 1.5 m). Rises of this magnitude would have coastal and ecosystem impacts.

3.2. Climate change and agriculture

Climate change and agriculture are interrelated processes, both of which take place on a global scale. Global warming is projected to have significant impacts on conditions affecting agriculture, including temperature, carbon dioxide, glacial run-off, precipitation and the interaction of these elements. These conditions determine the carrying capacity of the biosphere to produce enough food for the human population and domesticated animals. The overall effect of climate change on agriculture will depend on the balance of these effects. Assessment of the effects of global climate changes on agriculture might help to properly anticipate and adapt farming to maximize agricultural production.

- Despite technological advances, such as improved varieties, genetically modified organisms, and irrigation systems, weather is still a key factor in agricultural productivity, as well as soil properties and natural communities. The effect of climate on agriculture is related to variability's in local climates rather than in global climate patterns. The Earth's average surface temperature has increased by 1.5°F {0.83°C} since 1880. Consequently, agronomists consider any assessment has to be individually consider each local area.

In the long run, the climatic change could affect agriculture in several ways:

- productivity, in terms of quantity and quality of crops
- Agricultural practices, through changes of water use (irrigation) and agricultural inputs such as herbicides, insecticides and fertilizers

- Environmental effects, in particular in relation of frequency and intensity of soil drainage (leading to nitrogen leaching), soil erosion, reduction of crop diversity
- Rural space, through the loss and gain of cultivated lands, land speculation, land renunciation, and hydraulic amenities.
- Adaptation, organisms may become more or less competitive, as well as humans may develop urgency to develop more competitive organisms, such as flood resistant or salt resistant varieties of rice.

Fig.1. effect of climate change on crop production

3.3. Impact of weather and climate on natural system

Earth is composed of many natural systems with numerous interactions within and between these systems. The main natural systems of Earth include:

- Biological systems, i.e., individuals, species populations, and communities;
- Ecosystems, i.e., the interactions amongst living organisms and physical and chemical factors in the environment;
- Global energy budget, i.e., flow of energy originating from the sun into and out of Earth's systems;
- Water cycle (hydrological cycle);
- Cycling of carbon, nitrogen, and other elements or molecules (biogeochemical cycles);
- Rock cycle, i.e., geological processes

Fig 2. Active land degradation as a result of soil erosion in Northern Ethiopia

Self-Check -3	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the impact of climate change in horticultural crop production? (3pts.)
2. Discus how the climate change affect the crops? (3pts.)
3. Explain the variation of temperature on crop production? (2pts.)

Note: **Satisfactory rating – above 8 points** **Unsatisfactory - below 8 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	Making Report impact of weather and climate

4.1. **Reporting impact of weather and climate**

At a time when responding to climate change is one of the nations most important and complex endeavors, the National Academies provides helpful analysis and advice to policymakers and stakeholders through its expert, consensus reports and other activities. The reports are produced by committees of the nation's top scientists, engineers, and other experts who are convened to address key scientific and technical aspects of climate change.

4.2**. Importance of reporting**

- Making future agriculture policy
- To know the root cause of the problems
- To identify the problems
- To find out the solution
- To prepare for the next production season

Table 1. Reporting formats for weather change

S/No.	Type of crops Activities	Type of weather	Type of impact observed	Preventive action taken
1				
2				
3				
4				

Collected by_____ Date of collection _____

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the importance of reporting the impact of weather change on the crops? (4pts.)
2. What type of information will be report? (4pts.)
   b. _____
   c. _____
   d. _____
   e. _____

Note: **Satisfactory rating – above 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Reference

1. Drake BG, Gonzalez-Meler MA, Long SP (1997) More effi cient plants: a consequence of rising atmospheric CO2 ? Annu Rev Plant Physiol Plant Mol Biol 48:609–639.

2. Khalid Rehman Hakeem (2015) Effect of Climate Change on Horticultural Crops.

3. Yinhong kang , (2009) Climate change impacts on crop yield, crop water productivity and food security V.19, P.1665-1674.

Horticultural Crops Production

Level -II

Learning Guide-70

Unit of Competence: Observe and report on weather

Module Title: Observing and reporting on weather

LG Code: AGR HCP2 M17 LO2-LG-70

TTLM Code: AGR HCP2 TTLM 0120v1

LO 2: Carry out preventative action

Instruction Sheet	Learning Guide # 70

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Disseminating Information and advice
- Determining Preventative action
- Implementing Actions to minimize loss and damage
- Adjusting and revising Livestock, horticultural or crop management program

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Disseminate information and advice
- Determine preventative action
- Implement actions to minimize loss and damage are implemented.
- Adjust and revise horticultural or crop management program or schedule

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1- 4
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check **in page -27, 30, and 36 and 38** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and Operation Sheet 2” **in page 39 and 40.**
6. Do the “LAP test” **in page – 41** (if you are ready).

Information Sheet-1	Disseminating Information and advice

1.1. Sources of weather information

Weather and climate information may be sourced from Radio, T.V., Internet, email, fax, telephone, newspapers, word of mouth, weather station on property and interpretive tools.

A. Bureau of meteorology

The main roles of the Bureau are to observe and understand a country's weather and climate and to provide services in three main areas:

- **Meteorology** – the study of the earth's atmosphere, especially weather forming processes, weather forecasting and the climate.
- **Hydrology** – the study of the properties, distribution, use and conservation of water on the earth's surface, underground and in the atmosphere.
- **Oceanography** – the study of the world's oceans.

The functions of the Bureau of Meteorology relating to the weather and forecasting include:

- Maintaining a network of surface and space-based observing systems
- Observing, collecting, recording, analyzing and providing meteorological data and information
- Forecasting the weather and the state of the atmosphere
- Issuing warnings about gales, storms, floods, bushfires and other weather-related events that could harm life or property
- Publishing meteorological reports and bulletins.

B. Weather stations

The Bureau of Meteorology may have a system of automatic and manual weather stations situated across a country. A number of different measurements are taken on a daily basis or at even shorter intervals. These measurements include temperature, rainfall, wind speed and direction, humidity, evaporation, sunshine, cloud cover, atmospheric pressure and wave heights.

Many farmers also keep their own weather records in suburban backyards, on farms and in horticultural enterprises. These records are important for agricultural and horticultural production. Each property has its own topographic features and vegetation and the weather experienced there may vary from that recorded at the nearest official weather station. Local records allow farmers to plan and manage their enterprises more effectively.

C. Weather maps

Weather maps are drawn by meteorologists on a daily basis from the data collected at weather stations around. There are two main types of weather maps. Synoptic charts provide a visual synopsis or summary of current weather patterns. Prognostic charts predict weather that will occur in the future.

A basic understanding of weather systems and patterns and the key features of weather maps will enable anyone to read a weather map. Accurate reading of weather maps, in conjunction with forecasts and other weather information, allows farmers and horticulturalists to plan for expected weather events.

D. Weather warnings

Warnings may include fire, flood, wind, rain, hail, storm, cyclones, heat waves, snow, dust, frost, gale, grazier alerts, and rapid changes in temperature or weather conditions.

The Bureau of Meteorology issues a number of different warnings about weather that could cause loss of life or damage to property. These warnings include:

- **Fire weather warnings** – issued in conjunction with state fire agencies. These are a measure of fire danger based on current and forecast temperature, wind, humidity, rainfall and available fuel levels.
- **Total fire bans** – issued on authority from the relevant state fire agency.
- **Severe weather warnings** – issued when severe weather is expected such as squalls, land gales, flash flooding and dangerous surf or tides.

- **Severe thunderstorm warnings** - issued when thunderstorms are expected to produce dangerous or damaging conditions such as severe lightning, hail, squalls, gales and flash flooding.

- **Flood warnings** – can be issued for most major rivers in Australia providing an alert of possible flooding, minor, moderate, major and generalised flood warnings and predictions of expected river heights.

- **Grazier alerts** – issued to farmers when cold, windy and rainy conditions increase the risk of death in newborn lambs and recently shorn sheep.

- **Frost warnings** – issued when cold, windless conditions are likely to produce significant frosts.

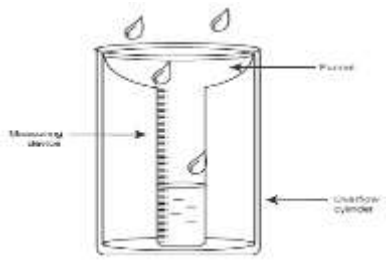
E. **Wind chill**- (often popularly called the wind chill factor) is the felt air temperature on exposed skin due to wind. The wind chill temperature is never higher than the air temperature, and the wind chill is undefined at higher temperatures (above 10 °C [50 °F]).

F. Weather records

Following are some of the weather records that might be kept by individuals. Details are included about the best position for each instrument that will result in relatively accurate and consistent records. Measurements should be taken at least once each day, usually at 9 am.

Rainfall

Rainfall is measured with a rain gauge and recorded in millimetres (mm). The gauge is usually mounted on a post on relatively flat ground. It should be in the open, away from trees, buildings and other shelters.



Temperature

Temperature is measured using a thermometer and is recorded in degrees Celsius (°C). Maximum-minimum thermometers record the hottest and coldest temperatures experienced and should be reset on a regular basis. Thermometers are usually mounted on a post or veranda wall that is shaded all day and out of the rain. At weather stations, thermometers are placed in a specially designed wooden box called a Stevenson screen.

Humidity

Relative humidity is measured using a wet bulb thermometer and is recorded as a percentage (%).

The wet bulb thermometer is placed in a shady position with free flowing air. The bulb of the thermometer is wrapped in muslin that is kept damp. The temperature recorded is compared with that of a normal (dry bulb) thermometer and the relative humidity calculated from a table of figures.

Evaporation

Evaporation is measured with a pan evaporimeter and is recorded in millimetres (mm). The pan is placed on the ground in an open area and filled with water to a set level. Wire mesh is often placed over the pan to stop birds and other animals drinking the water. The water level is measured daily and adjusted to take any rainfall into account.

Wind direction

Wind direction is measured using a weather vane or wind sock and is recorded as a compass direction.
Weather vanes are usually mounted on tall posts or roof tops where they can catch the prevailing winds. A wind sock is mounted on a tall post beside an airstrip.

Wind speed

Wind speed is measured using an anemometer and is recorded in knots. One knot approximately equals two kilometres per hour (1 knot » 2 km/hr).

Anemometers are specialized pieces of equipment usually only found in weather stations. Wind speeds can be estimated and described using terms such as calm, light, moderate, strong and gale force.

Air pressure

Air (atmospheric) pressure is measured with a barometer and is recorded in hectopascals (hPa).

Barometers are usually kept inside and hung on a wall or placed on a sideboard or cabinet as a feature.

1.2. Disseminating information

Climate and weather play a vital role in many human activities such as

- Agriculture
- Energy
- Production
- Disaster mitigation and

- Health.

There is great need for a mechanism to provide timely and advance information to the local communities in dry land areas to help them plan for appropriate interventions to prevent or avert impending disasters. In the same way, forecasting production of the main food crops and livestock is an essential outcome of such mechanisms for planning. This can be achieved through collecting, analyzing and interpreting data/ information on crop and livestock production, marketing, pricing and stocks in the affected areas. For this information to be useful, it should be:-

- Simple
- Properly interpreted and
- Disseminated in a timely and effective fashion through appropriate media.

Information can be disseminated through/ disseminator or advice tools:

- International Research Institute (IRI)
- Printed bulletins
- On the Internet
- Meteorology station

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. How can disseminate useful information regarding to the impact of the weather and climate change? (4pts)

2. What are the tools to disseminate the information and provide the advice? (2pts)

3. Discus the sources of information**? (3pts)**

Note: **Satisfactory rating above 9 points** **Unsatisfactory - below 9 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Determining Preventative action

2.1. Determining Preventative action

Implement a variety of strategies to manage weather and climate risks to agriculture. Such strategies include:

- choosing suitable locations to farm,
- varying planting dates,
- diversifying crops and varieties,
- seeking alternative sources of income,
- maintaining an emergency fund,
- storing harvested crops on site,
- choosing sustainable farming techniques.

The decision to apply one or more of these strategies is often in the hands of individual farmers. Thus, these strategies are most effective when farmers are well educated in basic risk management concepts and have access to the data and tools required to apply these principles. Significantly, this information not only empowers farmers to make sound risk management decisions, but also enables them to retain management control of their agricultural activities throughout the process.

Reducing loss and damage of climatic change

The Action Plan requires the Parties to address enhanced action on adaptation, including, inter alias, consideration of: Risk management and risk reduction strategies, including risk sharing and transfer mechanisms such as insurance.

This Multi-Window Mechanism would consist of three inter-dependent components:

1. Insurance Component
2. Rehabilitation/Compensatory Component
3. Risk Management Component

Rehabilitation/Compensatory payments could be triggered by changes in parameters relative to baselines. Parameters could include:

- Sea level rise
- Sea surface temperature
- Air temperature

- Precipitation
- Wind speed
- Soil salinity
- Ocean acidity

Loss and damage addressed should include:

- Economic loss
- Property loss and damage
- Loss of life
- Environmental damage (e.g., coral reef damage, salt-water intrusion, loss of fisheries, ecosystem damage)

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the preventive action of on the impact of wear and climate changes on the crops? (5pts)

Note: **Satisfactory rating –above 4 points** **Unsatisfactory - below 4**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Implementing Actions to minimize loss and damage

3.1. Identifying Loss and Damage

- Economic loss
- Property loss and damage
- Loss of life
- Environmental damage (e.g., coral reef damage, salt-water intrusion, loss of fisheries, ecosystem damage)

3.2. Actions to minimize loss and damage

Dealing with extreme weather

Extreme weather can also cause loss and damage to livestock, crops, fodder and property. A number of strategies can be used to minimize or prevent harm.

Generally, Preventative actions may include provision of shelter, shedding animals, covering fodder, moving fodder, firefighting equipment, auxiliary power, supplies, moving stock, securing equipment and buildings, preparing fire breaks and assured water supply, rescheduling work tasks, operating sprinklers in order to cool animals in extreme heat. Preventative action is determined according to the known effects on crops and work tasks.

Livestock

- Provide temporary shade in very hot weather.
- Plant additional shade trees and windbreaks/shelter belts.
- Move stock to higher ground in response to flood warnings.
- Move stock to timbered, less exposed paddocks if extremely cold or snow conditions are forecast.

Crops

- Use glasshouses, igloos, and tunnel or shade houses to maintain suitable temperatures for plants.
- Net fruit crops to reduce hail damage.
- Use fans or sprinkler/spray systems to reduce frost damage.
- Plant windbreaks and shelter belts.

Fodder

- Cover fodder or store it in a shed to keep it dry.
- Move stored fodder to higher ground in response to flood warnings.

Property

- Secure equipment, buildings and materials (eg sheets of iron) before storms arrive.
- Ensure auxiliary power systems are in good working order.
- Lift pumps and irrigation equipment to higher ground in response to flood and flash flood warnings.
- Stockpile supplies in response to flood warnings that may result in the isolation of the property for a period of time.
- Prepare for the bushfire season by conducting careful, authorized hazard reduction burning during the non-fire restriction period.
- Prepare for bushfires by clearing firebreaks, ensuring a good water supply and installing and maintaining firefighting equipment in a state of readiness.

A. Extreme heat

Possible risks and suggested strategies to reduce harm

Sunburn

- Wear long-sleeved shirt, trousers, broad-brimmed hat, sunscreen and sunglasses.

Dehydration

- Ensure availability of adequate supplies of cool, fresh drinking water.

Heat exhaustion

- Reschedule outdoor work tasks to cooler times of the day

B. Extreme cold

Possible risks and suggested strategies to reduce harm

Chilling leading to hypothermia

- Wear adequate warm clothing, including beanie and gloves, a wind-proof coat in dry weather and a waterproof coat in wet conditions.

Cold, stiff fingers leading to accidents with tools

- Wear gloves.
- Reschedule tasks to warmer parts of the day.

C. Heavy rainfall

Getting wet and chilled leading to hypothermia

- Wear waterproof coat, trousers, hat and gumboots.

Accidents due to wet slippery conditions

- Reschedule all but urgent outdoor tasks.
- Ensure good grip on the soles of boots.

D. Floods

Possible risks and suggested strategies to reduce harm

Vehicles and people washed off low level crossings

- Check water height and velocity before crossing.
- DO NOT drive or walk through floodwater.
- Avoid travel except in emergencies.

Working in rising floodwaters

- Access regular weather reports and flood warnings to allow sufficient time to move stock, fodder and property to higher ground.

E. Strong winds

Possible risks and suggested strategies to reduce harm

Accidents from wind-borne objects

- Ensure all potential missiles (eg iron sheets) are secured.
- Avoid working at heights.

Eye and respiratory irritation due to dust

- Wear protective clothing.
- Reschedule all but urgent outdoor tasks.

F. Storms

Possible risks and suggested strategies to reduce harm

Lightning strike

- If possible shelter in a house, shed or vehicle.
- If not, move to low ground.
- DO NOT shelter under trees or stand on high ground.

Hail

- Shelter under a permanent structure or remain in the vehicle.

Snow

- Remain indoors during blizzards.
- Wear adequate warm clothing, including beanie and gloves and a wind-proof coat.

G. Drought

Possible risks and suggested strategies to reduce harm

Dehydration due to failure of watering points

- Carry additional water supplies for staff, vehicles, horses and dogs.

Manual handling accidents moving stock feed and rescuing dehydrated/bogged stock

- DO NOT attempt to lift/move objects that are too heavy.
- Seek assistance.
- Use machinery or vehicles where appropriate.
- Consider the animal's welfare if moving weak or bogged stock.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the losses and damages on crops caused by extreme temperature? (**3 points**)
2. List out the cause of losses? (**6 points**)

a. _____

b. _____

c. _____

d. _____

3. What are the actions to minimize the losses be taken? (2pts.)

Note: **Satisfactory rating – 11points** **Unsatisfactory - 11below 8points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Adjusting and revising horticultural or crop management program

Adjusting and revising work task according to weather and climatic change

The Climate Change Adjustment Program is aimed at assisting primary producers who are likely to be affected by climate change, including those experiencing hardship caused by drought. The program assists farmers in obtaining professional advice, training and re-establishment assistance, and provides support to farmers to adjust their businesses to manage the impacts of climate change. Targeted training activities focus on areas such as whole farm planning, business and risk management, and understanding the implications of climate change.

Activities to be adjust and information for advising the farmers

A. Good sit selection
B. Follow good agriculture practices
C. Crop selection
D. Good tillage practices/ conservation tillage
E. Performing natural resources management
F. Disease resistant crop
G. Crop rotation

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. How can minimize the impact of weather on the crops by adjusting the managing the production work (5pts.)
2. List the information to be record? (3pts)
   a._____
   b. _____
   c. _____
   d. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Disseminating Information and advice

Objective: To know the amount of rainfall falls in one area per day or season in mm.

Equipment, Tools and Materials:

- Rain coat
- Umbrella
- Rain gauge
- Note book
- Pencil or pen
- Chart
- Ruler
- Calculator
- Rubber

Procedure:

Stepe 1. Prepare all the tools and materials

Stepe 2. Go to the field where you put the rain gauge

Stepe 3. Take reading on rain gauge per day for a season or month

Stepe 4. Record every reading on your note book

Stepe 5. Put an average amount of rainfall from the total recorded

Stepe 6. Then you will know the amount of rain fall for an area

Stepe 7. Put in graphs using the charts

Stepe 8. Disseminate your results to the regional metrological stations

Stepe 9. Record and document your results

Stepe 10. Clean and store tools and equipments

Operation Sheet 2	Disseminating Information and advice

Objective: to determine the temperature of farming area.

- Thermometer
- Note book
- Pencil or pen
- Chart
- Ruler
- Calculator
- Rubber

Step 1. Place the thermometer 5 feet above the ground (+/- 1 ft.).

Step 2. The thermometer must be placed in the shade.

Step 3. Have good air flow for your thermometer.

Step 4. Place the thermometer over a grassy or dirt surface.

Step 5. Keep the thermometer covered

Step 6. Take the reading

LAP Test 1	Disseminating Information and advice

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks

Task 1: Measure the daily amount of RF.

Task 2. Measure the temperature of you horticulture crop farm

Reference

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2. https://weatherworksinc.com/news/temperature-measurement
3. Vorst, J.V., 2002. National Corn Handbook NCH-1: Assessing Hail Damage to Corn. 〈http://corn.agronomy.wisc.edu/management/pdfs/nch01.pdf〉 (accessed July 11, 2014) Google Scholar
4. Waha et al., 2012 K. Waha, L.G.J. van Bussel, C. Müller, A. Bondeau**Climate-driven simulation of global crop sowing date** Global Ecol. Biogeogr, 21 (2012), pp. 247-259 CrossRefView Record in ScopusGoogle Scholar.
5. Introduction of agro-metrology hand book.

Horticultural Crops Production

Level -II

Learning Guide-71

Unit of Competence: **Observe and report on weather**

Module Title: **Observing and reporting on weather**

LG Code: **AGR HCP2 M17 LO3-LG-71**

TTLM Code: **AGR HCP2 TTLM 0120v1**

LO 3: Monitor weather and climate

Instruction Sheet	Learning Guide # 71

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Accessing regular updates
- Revising viability of horticultural Crop management practices
- Undertaking research on forecasting techniques
- Documenting and recording Relevant information

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Assess regular updates
- Revise viability of horticultural or crop management practices are reviewed
- Undertake research on forecasting techniques.
- Record and document relevant information

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1- 4 and Sheet 5”.
4. Accomplish the “Self-check 1, and Self-check 2, Self-check 3 and Self check 4” **in page - 46, 48 51 and 54** respectively.

Information Sheet-1	Assessing regular updates

1.1. Identifying update weather information

Findings indicate that weather and climate services have the potential to significantly enhance agricultural production, improve food security and contribute further to the GDP of developing countries. Confirm the socio-economic benefits of providing weather and climate products and services in the structured decision-making of farmers. Climate-smart technologies to enhance operational climate risk management in agriculture and other economic sectors need to be adopted. The crop producer will adjust crop production calendar from site selection to post-harvest activities the next growing season based on the updated weather information.

Metrologiests use weather data and information from satellites and the earth surface from the weather stations to monitor the weather. They also use this information to make weather forecasts. A weather forecast is like a prediction, many people rely on weather forecasts in their daily agricultural crop work activities.

1.2. Weather condition to be update

- **Rainfall**: see how much rain has fallen during a set period
- **Temperature**: track temperature changes over a day, week, month, or longer
- **Wind speed and direction**: wind metrics let farmers predict oncoming storms more accurately.
- **Air pressure**: another indicator of upcoming weather (such as a thunderstorm) in your immediate areas
- **Humidity**: this helps you make better decisions about water usage and pending rain

NB. Regular updates may be obtained from Radio, T.V., Internet, email, fax, telephone, newspapers, word of mouth, weather station on property, and interpretive tools.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List the importance of updating weather conditions? (2pts.)
2. List the weather conditions information to be update? (3pts)
   a._____
   b. _____
   c. _____
   d. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Revising Viability of horticultural or crop management practices

2.1. Horticulture crop management work activities to be revise

- Conservation agriculture, i.e., mulching, dry planting, no-tillage and minimum tillage, crop rotations, green-manure cover crops and broad-bed furrows that preserve moisture and aid in nutrient recycling;
- Early dry planting of short-season varieties of maize, as well as increasing planting depth to maximise the use of every drop of water received;
- Beneficial crop combinations and succession planting in areas, making it possible to establish an irrigated winter crop, given that temperatures are conducive for crop production during the dry winter months;
- Promotion of small-grain, short-season and drought-tolerant crops such as sorghum and millets which are micro-nutrient rich and do not deplete the soil of many of its nutrients;
- Promotion of short-season varieties that can escape drought and make efficient use of the available soil moisture;
- Site selection for horticultural crop productin
- Rainwater harvesting techniques, both infield and off field, groundwater recharge and seasonal water-body retention; and
- Higher efficiency irrigation systems, e.g., drip irrigation that ensures that water application is targeted to meet the requirements at different growth stages.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the horticultural crop production work to minimize the effect of weather changes? (4pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	• **Undertaking research on forecasting techniques**

3.1. **Weather forecasting**

Should you wear a raincoat or a sweater today? Should you go to the office or work from home? These are all everyday questions we might only be able to answer with the help of a weather forecast. When dangerous weather conditions like hurricanes or snowstorms arrive, our choices about what we should or shouldn't do can often mean the difference between life and death.

Weather forecasting is the prediction of what the atmosphere will be like in a particular place by using technology and scientific knowledge to make weather observations. In other words, it's a way of predicting things like cloud cover, rain, snow, wind speed, and temperature before they happen.

3.2. Importance of forecasting the weathers

Weather information is playing an increasingly instrumental role in the evolving field of precision agriculture, a farming practice that emphasizes accuracy and control when it comes to the growing of crops. An essential aspect of this approach is the use of information technology, which includes weather prediction and other items, such as satellite and aerial imagery, GPS guidance, sensors, drones, variable rate fertilizer application, and crop health indicators, Selection of crop and varieties, Adjusting crop calendar, Adjusting planting density and fertilizer application levels and Allocation of area to a given crop (heavier soils could be more preferred if forecast is for dry conditions or more freely drainage soils if forecast is for the wetter condition). The ultimate goal of precision agriculture is to maximize growth efficiency at the individual seed and plant level.

3.3. **Tools used for weather forecasting**

Weather forecasters use all kinds of tools to achieve this goal. We have instruments called barometers to measure air pressure, radar to measure the location and speed of clouds, thermometers to measure temperature, and computer models to process data accumulated from these instruments. However, to this day, humans with good experience can still do a better job at predicting the weather than computer models alone because humans are often involved in picking the most appropriate model for a situation.

The main ways we can forecast the weather include looking at current weather conditions, tracking the motion of air and clouds in the sky, finding previous weather patterns that resemble current ones, examining changes in air pressure, and running computer models.

3.3. Types of weather forecasting

There are four main types of weather prediction we're going to discuss in this lesson: short-range, medium-range, long-range, and hazardous weather forecasting.

1. Short-range forecasts are predictions made between one and seven days before they happen.
2. Medium-range forecasts are usually given between one week and four weeks in advance.
3. Long-range forecasts are given between one month and a year in advance. The further into the future you're trying to predict, the harder it is to be sure. Longer-range forecasts are only useful if the forecaster says how likely he or she believes it is that the prediction is accurate. This is called a level of confidence. For example, a forecaster may predict rain next Tuesday with a 90% level of confidence. Short-range forecasts are far more accurate than medium- or long-range ones.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is weather forecasting? (3pts)
2. What are the importance of forecasting weather for horticultural crops production? (3pts)
3. Discuss the type of forecasting? (2pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Record and document relevant information

2.1. Record relevant information

A record is recorded information however recorded whether in printed form, on file, by electronic means or otherwise and includes correspondence, a memorandum, a book, a plan, a map, a drawing, a diagram, a pictorial or graphic work, a photograph, a film, a microfilm, a sound recording, a videotape, a machine readable record, any other documentary

3.4. Why Are Records Important?

Records are important for their content and as evidence of communication, decisions, actions, and history. Records support openness and transparency by documenting and providing evidence of work activities and by making them available to the public.
Records support quality program and services, inform decision making, and help meet production work.

3.5. Activities and transactions should be documented

Records include any information that documents the mission and planning objectives of the organization which include planning, decisions, actions, and results, as follows:

- Results of significant daily activities that support the mission and objectives of the production
- Advice and recommendations made to management and the decisions and actions taken as a result, along with supporting documentation;
- Problems encountered in production and operations and the steps taken to resolve the problems caused by weather change

- Interactions with the public, customers, clients, stakeholders, consultants, vendors, partners, and other government jurisdictions;
- Verbal communications such as meetings, telephone calls, and face-to-face discussions where significant actions or decisions have occurred;
- Legal agreements of any kind, including contracts, along with supporting documentation;
- Policy, organizational planning, performance measurement, and budget activities, and supporting documentation;
- Work done for the government by consultants and other external resources; and
- Actions and decisions where payments are made or received, funds committed, services delivered, or obligations incurred.
- all kinds of information: daily average ,monthly, yearly temperature highs and lows, precipitation, sun, wind.
- The impact of weather change on horticulture crops production
- Corrective action taken

3.6. Compiling, processing weather and climate relevant information

- Gathering
- Processing
- Analyzing
- Creating charts, graphics, text

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is recording? (3pts)
2. What are the importance of recording weather for horticultural crops production? (4pts)
3. List tools used to records? (4pts)

Note: **Satisfactory rating – 11 points** **Unsatisfactory - below 11 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Reference

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2. Official and Transitory Records: A Guide for Government of Alberta Employees
3. ISO Standard - 15849 - Information and Documentation - Records Management
4. Mike Eilts (2018), The Role of Weather—and Weather Forecasting—in Agriculture

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