TEMPERATUR

Temperature is a measure of the hotness of a body. If a water vessel is kept on flame and we monítor the state of water by dipping our fingers, we first feel mild warmth, then warmth and then heat. A stage comes further when we cannot measure hotness through our fingers if the water vessel continued to be on flame. It means something flows to water from flame, which is nothing but heat flow. In other words, heat flow results change in temperature, which can be measured by a device known as thermometer.

The heat flow in unit time is known as flux. If heat flow is within the ground, it is known as ground heat flux, and it is sensible heat flux if it is from ground to air, just above the ground. The sensible heat is a part of the available heat energy at the earth surface and acts as a heat source to the atmosphere to raise its temperature.

TEMPERATURE INVERSION

If air temperature increases with height, it is known as temperature inversion. Sometimes, temperature inversion happens due to the following reasons:

(a) Earth's surface losses heat more than it gains.

(b) Cold air from hill tops and slopes tend to flow downward and replaced by warm air.

(c) Cold air masses replace warm air masses when air masses with different temperatures come together.

In crops also, temperature inversion is noticed due to active surface of crop during its maximum growth. The cropped surface becomes secondary heat source

during daytime and this results in high temperature at the crop canopy. This phenomenon mostly depends on the nature of crops.

DIURNAL AND MONTHLY VARIATIONS OF SURFACE AIR TEMPERATURE

The minimum air temperature occurs at about sunrise, after which there is a constant rise till it reaches the maximum level. The maximum air temperature is recorded between 1300 hr and 1400 hr although the maximum solar radiation level is attained at noon. A steady fall in temperature till sunset is noticed after it attains the maximum. Thus the daily march displays one maximum and one minimum.

The difference between the two is called the diurnal range of air temperature, The diurnal range of air temperature is more on clear days, while cloudy weather sharply reduces daily amplitudes. The diurnal ran temperature is also influenced by soils and their coverage in addition seasons, Addition of daily maximum and minimum temperature divided by two is nothing but daily mean or average temperature. That is

$$\text{Daily mean temperature} = \frac{\text{Daily maximum temperature} + \text{Daily minimum temperature}}{2}$$

SOIL TEMPERATURE

Soil temperature varies among different soil types depending upon the soil structure received is the same. It plays a major role in seed germination and its juvenile phase is very sensitive to variations in soil temperature. The root zone of any crop is a function of soil temperature and soil moisture if other environmental factors are homogeneous. The surface of the earth gets heated up during the day

and gets cooled during the night causing significant diurnal changes in top layers of the soil. For example at 0800 hr, the soil temperature was 28.5°C at 5 cm depth, followed by 29.9°C at 10 cm depth and 31.2°C at 15 cm depth. On the same day at noon (1300 hr), the soil temperature was 44.4°C, 39.7°C and 36.7°C at 5 cm, 10 cm and 15 cm depth respectively. It showed that the top soil is a heat source during the day and sub-surface soil during night and early morning hours.

There is also a lag time between the maximum and minimum soil temperature with depth. The maximum soil temperature was 44.4°C (5 cm), 42°C (10 cm) and 40°C (15 cm) at 1300 hr, 1600 hr and 1700 hr, respectively. The minimum soil temperature was 27.5°C (5 cm), 29.8°C (10 cm) and 31.2°C (15 cm) at 0600 hr, 0700 hr and 0800 hr respectively. The amplitude in diurnal soil temperature was high (27.5 to 44.4°C) at the surface and low (31.2 to 40.0°C) at relatively higher depths (15 cm). At higher depths, the diurnal amplitude is relatively marginal while significant difference is noticed seasonally A gradual increase in soil temperature was noticed at all the depths (2.5 to 90 cm) from the surface during the four seasons, viz., monsoon, post monsoon, winter and summer.

VEGETATION AND AIR TEMPERATURE

Natural vegetation or crop cover has considerable influence on th distribution of temperature in the layer of air near the soil. If the ground surface is totally or partially covered by crops during its maximum growth stage, the incoming solar radiation is intercepted due to their canopy and the amount received at the ground surface is relatively less, the crop surface itself acts as an active surface just like the ground surface, the temperature profile is changed within the crop surface, and it is different from the thermal structure in the open, very near the ground. A temperature inversion is noticed in crops, as the canopy acts as a

secondary heat source. In daytime the temperature of the plant cover is higher, and lower at night when compared to that of the surrounding The temperature of plant cover depends on the height of the plant, the stand density and the solar elevation. If tall trees they cover the ground, the lowest summer temperature occurs at the surface of the soil during the day.

AIR TEMPERATURE AND CROPS

The surface air temperature is one of the important variables, which influences all stages of crop during its growth, development and reproductive phase. A short-duration crop becomes medium or long duration crop depending upon its environmental temperature under which it is grown. Most of the crops have upper and lower limits of temperature, below or above which they may not come up. Also, the crop productivity is related to temperature if other crop-related environmental factors are not limiting. The influence of temperature on various phases of crops could be explained better through concepts like cardinal temperature points, Hopkins bioclimatic law, thermoperiodism and growing degree days, which are explained in brief in preceding sections.