

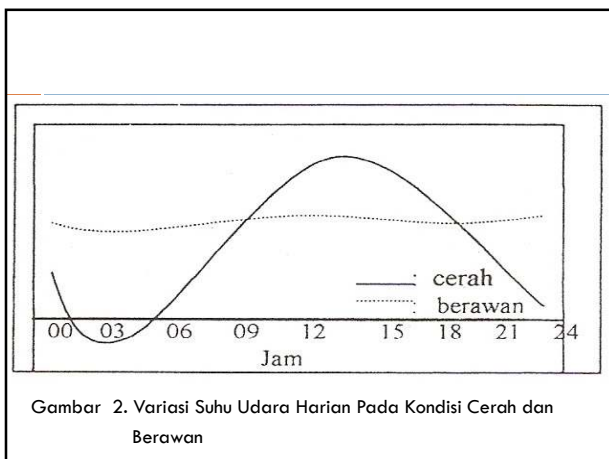
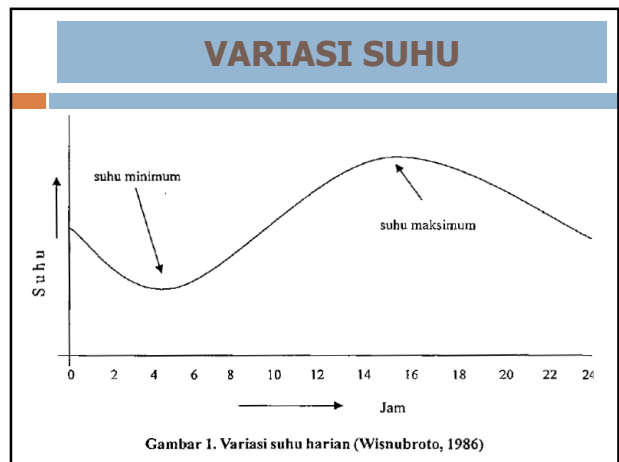
ENVIRONMENT FACTORS

TEMPERATURE

- ### TEMPERATURE
- The Sun is the Source of Heat Energy on Earth
 - Patterns of Temperature Variation on the Earth Surface
 - Responses of Plants to Temperature
 - Microclimate and Agriculture

PENGERTIAN SUHU

- ❖ Suhu : Keadaan panas atau dinginnya udara di suatu tempat pada waktu tertentu
: Ukuran energi kinetik yang dihasilkan karena adanya aktivitas pergerakan molekul yang dikandung oleh suatu benda.
Satuan : °C, °K atau °F.
- ❖ Panas : Jumlah total energi kinetik yang dihasilkan oleh aktivitas pergerakan molekul yang dikandung oleh suatu benda (kuantitas).
satuan : call, watt atau joule.



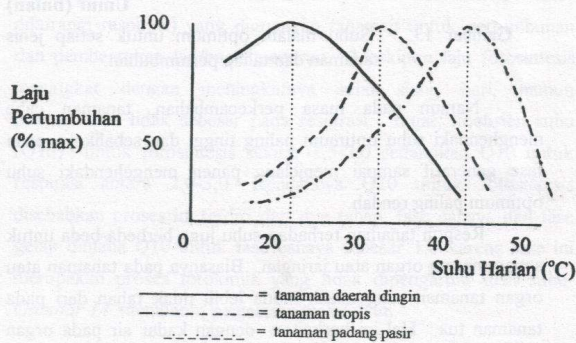
- ### MENGAPA SUHU UDARA PENTING UNTUK TANAMAN ?
- > The air-temperature is a deciding factor in plant growth
 - > Each crop has its own optimum, maximum and minimum temperature conditions for their growth and development
 - > The air-temperature affects the amount of water a crop requires

Suhu

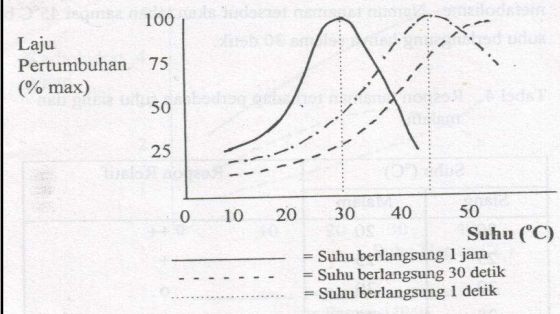
- Suhu merupakan faktor lingkungan yang berpengaruh terhadap pertumbuhan dan perkembangan tanaman
- Tinggi rendahnya suhu di sekitar tanaman ditentukan oleh:
 1. radiasi matahari,
 2. kerapatan tanaman,
 3. distribusi cahaya dalam tajuk tanaman,
 4. kandungan lengas tanah

Bagaimana pengaruh Suhu pada Proses Fisiologis Tanaman?

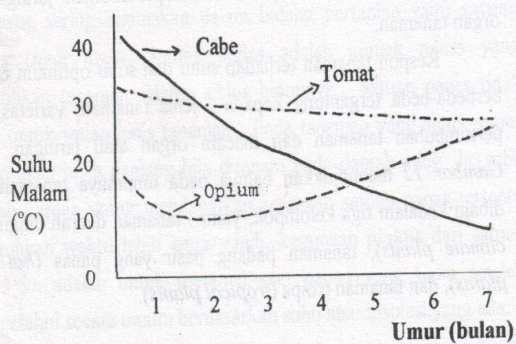
- Beberapa proses fisiologis penting yang dipengaruhi oleh suhu:
 1. bukaan stomata,
 2. laju transpirasi,
 3. laju penyerapan air dan nutrisi,
 4. fotosintesis,
 5. respirasi
- Peningkatan suhu sampai titik optimum akan diikuti oleh peningkatan proses-proses tersebut di atas



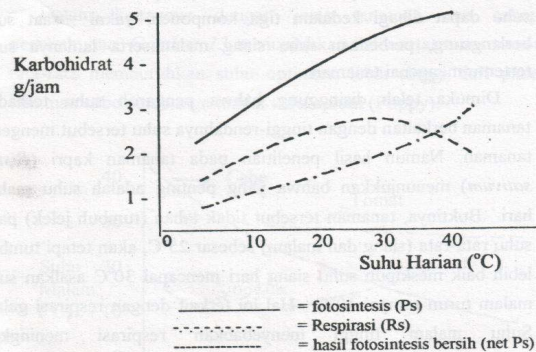
Gambar 3. Respon berbagai kelompok tanaman terhadap suhu



Gambar 4. Respon tanaman terhadap suhu dalam kaitannya dengan lama suhu berlangsung

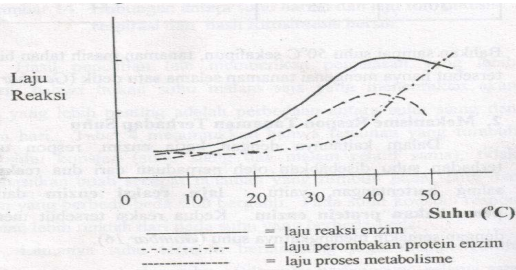


Gambar 5. Suhu malam optimum untuk setiap jenis tanaman dan tahap pertumbuhan



Gambar 6. Hubungan antara suhu harian dan laju fotosintesis, respirasi dan hasil fotosintesis bersih

Setelah melewati titik optimum, proses-proses fisiologis mulai dihambat: baik secara fisik maupun kimia menurunnya aktifitas enzim (enzim terdegradasi)



Gambar 7. hubungan antara suhu dan laju reaksi enzim serta laju perombakan protein enzim

Bagaimana Pengaruh suhu terhadap lengas tanah

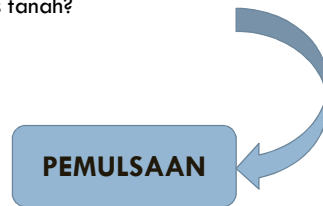
- Peningkatan suhu disekitar iklim mikro tanaman akan menyebabkan cepat hilangnya kandungan lengas tanah
- Peranan suhu kaitannya dengan kehilangan lengas tanah melewati mekanisme transpirasi dan evaporasi

- Peningkatan suhu terutama suhu tanah dan iklim mikro di sekitar tajuk tanaman akan mempercepat kehilangan lengas tanah terutama pada musim kemarau



- berpengaruh negatif pada pertumbuhan dan perkembangan tanaman terutama pada daerah yang lengas tanahnya terbatas

Bagaimana mengatasi pengaruh negatif suhu pada lengas tanah?



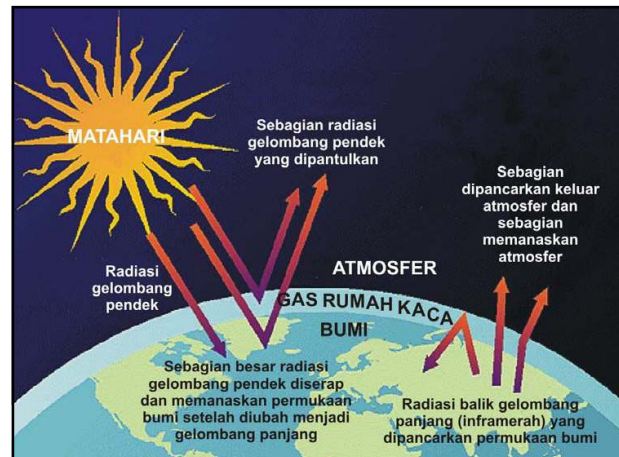
Mulsa jerami untuk tanaman cabe (foto: F. Agus)

Keuntungan pemulsaan:

1. mempertahankan kelembaban tanah, karena kelembaban tanah merupakan faktor penting bagi peningkatan penyerapan unsur hara
2. mengendalikan suhu tanah,
3. mengurangi evaporasi yang berlebihan, sehingga air tanah tidak banyak yang hilang
4. meningkatkan penyerapan air oleh tanah,
5. memperbaiki sifat fisik tanah → memperbaiki aerasi tanah sehingga akar dapat berkembang dengan baik dan pertumbuhan tanaman akan lebih subur
6. mengendalikan pertumbuhan gulma

Suhu Iklim Global

- Saat ini terjadi peningkatan suhu iklim global
- Efek gas rumah kaca, meningkatnya konsentrasi CO₂ di atmosfer
- Meningkatnya konsentrasi CO₂ di atmosfer sebenarnya berdampak positif terhadap proses fisiologis tanaman, tetapi pengaruh positif CO₂ dihilangkan oleh peningkatan suhu atmosfer yang cenderung berdampak negatif terhadap proses fisiologis tersebut



- Pengaruh positif peningkatan CO₂ atmosfer : merangsang proses fotosintesis, meningkatkan pertumbuhan tanaman dan produktivitas pertanian
- Pengaruh negatif peningkatan CO₂: meningkatnya suhu iklim global, berdampak pada peningkatan respirasi, menurunkan produktivitas tanaman. Peningkatan suhu menghilangkan pengaruh positif dari peningkatan CO₂

ENVIRONMENT FACTORS

HUMIDITY AND RAINFALL

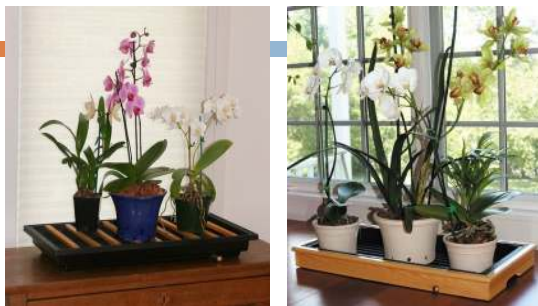
- Humidity is a measure of the amount of water that air will hold
- Humidity is important to plants because it partly controls the moisture loss from the plant
- The ideal humidity range for healthy plant growth is 50% humidity, plus or minus 10%.
- Most houseplants prefer a humidity of about 60%. Cacti, succulents and plants native to desert environments tolerate much lower humidity (30-35%), but prefer not to drop below 20%. House plants that are native to tropical rain forests require much higher humidity, 90% for example

- Under very humid environments, fungal diseases can spread. Mildew on plant leaves is an indication of excess humidity and lack of ventilation.
- Plants that prefer a more humid environment, but that are forced to grow in a dry environment will commonly suffer damage to younger leaves and to leaf tips

How to increase humidity?



Browning leaf tips on houseplants signals a lack of humidity



Controlling Humidity for Indoor Plants



Spraying house plants with water is a good way to increase humidity.

- RH together with air temperature and the solar radiation intensity, affects the rate at which water is evaporated from the leaves of the plants.

Humidity / kelembaban Udara

- Banyaknya kandungan uap air yang terdapat di udara

HUMIDITY

- Relative humidity perbandingan antara kandungan/ jumlah uap air diudara dengan kapasitas udara untuk menampung uap air.(%)
- Absolute humidity : kandungan uap air yang dinyatakan dengan masa uap air or tekananya persatuan volum over volume of the air (kg m^{-3})
- Humidity ratio: mass of water vapor per unit mass of dry air (g kg DA^{-1})

Relatif Humidity (RH) and Plant Growth

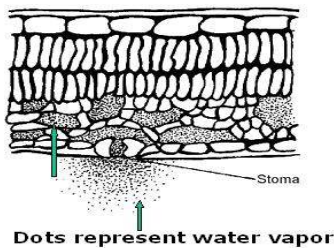
- Why RH is important for crop plants
- How RH is important for Crop plants
- What happens if RH is low
- How high RH affects plant growth

Why RH is important for crop plants

- Most plants prefer a RH range of 40 to 80%
- High humidity in the air lowers the intensity and the quality of solar radiation → reduced photosynthesis, leads to low crop yield
- High air humidity favors many plant diseases and insect pest

How RH is important for Crop plants?

- RH together with air-temperature and solar radiation intensity, affects the rate at which water is evaporated from the leaves of the plants
- If the evaporative demand is too high, the plant responds by partially or totally closing its stomata → the intake of carbon dioxide stagnates, and plant growth is impaired
- At higher RH percentages, the stomata have problems getting rid of excess water



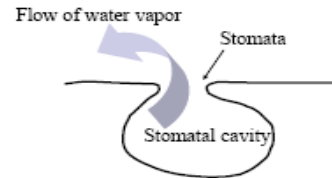
Plant responses to water vapor

- CO₂ exchange rate (net photosynthetic rate is indirectly affected by humidity through direct control of stomatal opening.
- Humidity affects plant temperature, through transpiration-induced evaporative cooling.

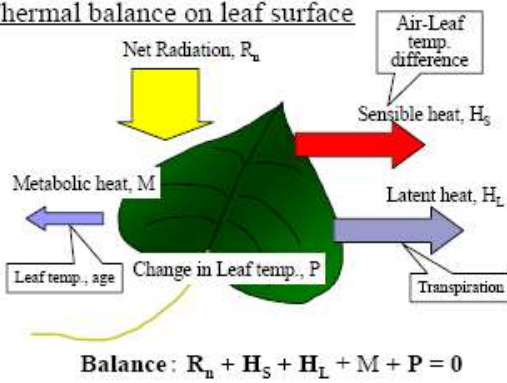
Plant responses to water vapor

- Transpiration generally increases as humidity decreases (at the same temperature)
- However, transpiration rate is determined by the integrated influence of humidity, temperature, light, air current, water availability in the root zone, etc.

Transpiration: Diffusion of water vapor through stomata



Thermal balance on leaf surface



Curah Hujan

- Titik-titik air hasil pengembunan uap air di udara yang jatuh ke bumi

PRECIPITATION

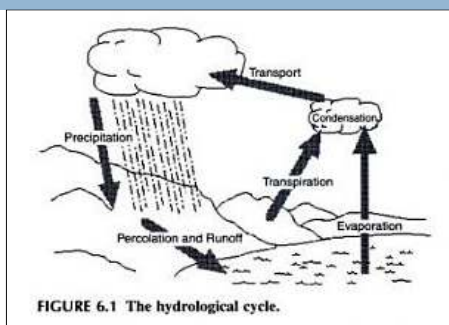


FIGURE 6.1 The hydrological cycle.

Hujan

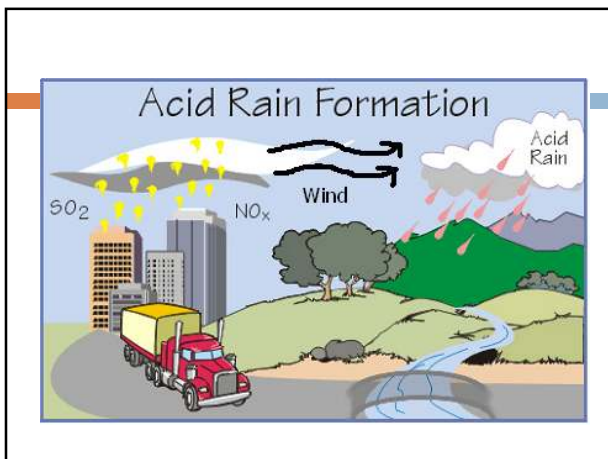
- Adalah proses sirkulasi air dimana air laut menguap lalu menjadi awan, jatuh ke bumi lalu kembali ke laut

Rainfed Agroecosystem

- Agroecosystems Adapted to a Long Wet Season
- Agroecosystems Adapted to Alternating Wet-Dry Seasons in the Tropics
- Agroecosystems Adapted to seasonal Rainfall
- Dryland Farming

HUJAN ASAM

- **Hujan asam** : segala macam hujan dengan pH di bawah 5,6.
- Hujan secara alami bersifat asam (pH sedikit di bawah 6) karena karbondioksida (CO_2) di udara yang larut dengan air hujan memiliki bentuk sebagai asam lemah
- Hujan asam → deposisi asam : *polusi udara yang disebabkan oleh adanya gas SO_x dan NO_x yang turun ke permukaan bumi*



Formation of Acid Rain

- When water vapour condenses, or as the rain falls, they dissolve in the water to form sulphuric acid (H_2SO_4) and nitric acid (HNO_3).
- While the air is cleaned of the pollutants in this way, it also causes precipitation to become acidic, forming acid rain

Effects of Acid Rain

- Harmful to aquatic life
 - Increased acidity in water bodies
 - Stops eggs of certain organisms (e.g. fish) to stop hatching
 - Changes population ratios
 - Affects the ecosystem

Effects of Acid Rain

- Harmful to vegetation
 - Increased acidity in soil
 - Leeches nutrients from soil, slowing plant growth
 - Leeches toxins from soil, poisoning plants
 - Creates brown spots in leaves of trees, impeding photosynthesis
 - Allows organisms to infect through broken leaves

Effects of Acid Rain

- Affects human health
 - Respiratory problems, asthma, dry coughs, headaches and throat irritations
 - Leeching of toxins from the soil by acid rain can be absorbed by plants and animals. When consumed, these toxins affect humans severely.
 - Brain damage, kidney problems, and Alzheimer's disease has been linked to people eating "toxic" animals/plants.