Micro-met Modification

Microclimate Modification in Agriculture

- **Controlling the heat load**
- **Controlling the water balance**
- **Atmosphere turbulence or wind velocity**

Micromet modification-Heat Evasion

1. Controlling the heat load

a. Heat Evasion: It is important in tropics and subtropics

i. Shading a plant in daytime is common method for evading solar radiation. It keeps the temperature low and retards ET.

ii. Increase the density of plant to increase the reflectance.

iii. Adjustment of canopy structure of vegetation by more orientation of the row direction in such a manner to increase the reflectance.

iv. Mulching a material in inter row space with high albedo

v. Multistoried cropping: Crop with high heat requirement and short crop with low heat requirement. Long crop will reflect most of radiation so as to reach less radiation in short crops.

vi. Planting of crop on north side of slope and furrow in northern hemisphere and in south side of slope in southern hemisphere.

Micromet Modification- Heat Trapping

b. Heat trapping: Applicable in temperate area with short growing season. Opposite of heat evasion is heat trapping. Heat trapping can be achieved by taking into account the angle of solar radiation relative to plants. By proper placement of the crop canopy, the flow of solar radiation and temperature can be increased.

Following methods can be adopted for heat trapping

i. Planting the tree on steep sunny slopes

ii. Erecting alternate rows of low stonewalls. The low stonewalls reflect the light back towards the lower portion and shaded sides of the trees. Additionally, the thermal capacity of the wall material will increase the local source of the heat by night.

iii. Planting of crops on the sunny wall of furrow. The soil itself acts as reflector during the day.

iv. Adjustment of canopy structures of vegetation by more orientation of the row direction in such a manner that solar radiation penetration in the crop canopy rather than reflected away by the upper parts of the canopy.

v. Heat can be trapped by employing an intermittent space covering practice. The soil between plant rows is covered with white plastic sheets. These sheets reflect light to the lower sections of the canopy. Any additional benefit of this device is that it directs rainfall towards the plants and reduces evaporative loss from the soil.

Micromet Modification- Heat Trapping

vi. Covering heat sensible crops by plastic enclosures during the night.

vii. Mulching and ploughing are effective methods to retards head flux from soil and to save crops from excessive cooling it reduces the radiation's from soil and tends to decrease evaporation. Mulching and ploughing create a still air layer between soil and free air above the crop field, this still air behave like a insulating material.

viii. Burning the crop residues from the previous crop. The burnt matter decreases the albedo of the soil, thus increasing the absorption of solar radiation. Burning process also increases the soil temperature by generating heat.

ix. Sprinkling the canopy with water provide protection from cold by the release of latent heat of fusion, when water turns from liquid to ice. As long as the mixture of the ice and water is maintained the transfer of energy to the plant is sufficient if too little water is sprinkled, the damage is worse.

x. Brushing is commonly used against frost protection in vegetation. Shield of brown coarse paper are attached to stem on North side of the east west rows of the plants, which look alike brush. During daytime, they act as windbreaker against cold wind and reflect the radiation on shaded portion of plant. At night, the shields reduces radiation loss to the sky.

Improving water balance

a. By increasing the amounts of the water stored in root zone.
b. By reducing water losses due to ET

a. By increasing the amounts of the water stored in root zone:

i. Run-off control: Strip cropping, contour ploughing, bunding etc protect the run off, while terracing with vegetation protect soil by reducing the velocity of raindrops.

ii. Increase Infiltration: tillage, mulches or straw of crop residue by breaking the impact of raindrops markedly improve infiltration.

b. By reducing losses due to ET:

i. By decreasing turbulent transfer of water vapor by windbreaks and mulches.

ii. By breaking capillaries connecting upper surface of soil

iii. *By chemical treatment:* Hexadecanol a long chain alcohol, mixed with one-quarter inch of soil reduced evaporation by 40%. Thick film forming material such as latex, waxes and plastics are also effective for controlling transpiration losses.

iv. Stomata closing materials such as Atrazine

v. Use of anti-transparent such as glycoryl half-ester decenyl succinic Acid (GLOSA) can reduce upto 12% water losses through transpiration.

Increasing the albedo of plant by applying Kaolinite.

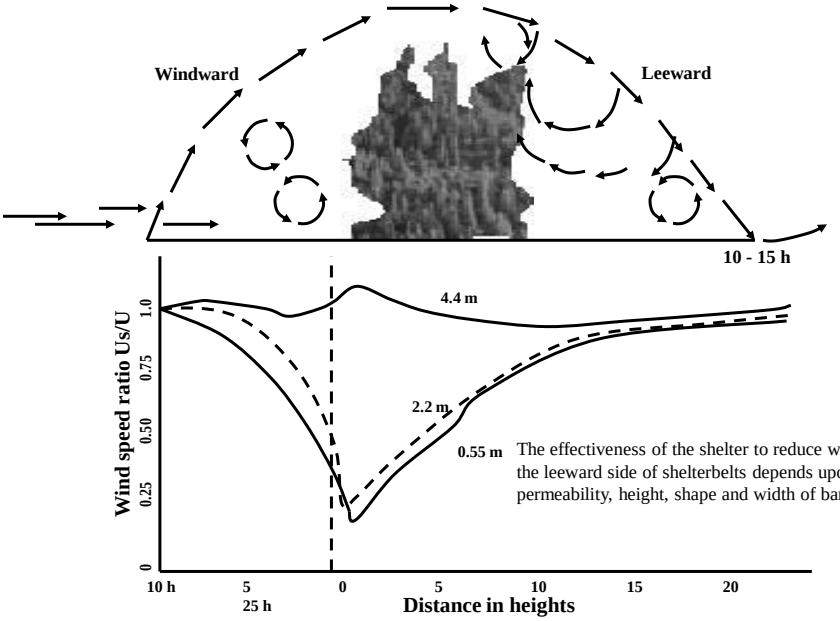
Modification of Atmospheric-turbulence or wind velocity

Windbreaks and shelterbelts effect: Though wind is necessary for certain process in the plant and atmosphere such as CO_2 diffusion for photosynthesis, ET, cooling effect, mixing of gases in atmosphere etc. Sometimes wind causes detrimental effects on plants such as desiccation, lodging, soil erosion, cooling effect in temperate region and mechanical damage of plants. In these case there is a need of modification of wind velocity. ***Wind breaks*** (Any structure that reduces wind speed) and ***Shelter belts*** (rows of trees planted for wind protection) can, by reducing these damages be profoundly beneficial to the growth on plant in their lee.

Shelterbelts and winds: Properly oriented and designed shelterbelts are very effective in stabilizing the agricultural crops in region where strong winds cause mechanical damages and impose sever moisture stress on growing crops. In cold climate wind breaks save plants from freezing and mechanical damages. Wind breaks save the loose soil from erosion, aid in the uniform distribution of snow cover and increase the supply of moisture to the soil in spring.

Various tall crops such as corn, sugarcane, sunflower, wheat and oats are being successfully used, as temporary wind barriers to protect small crop like sugarbeet, soybean, groundnut and tomatoes.

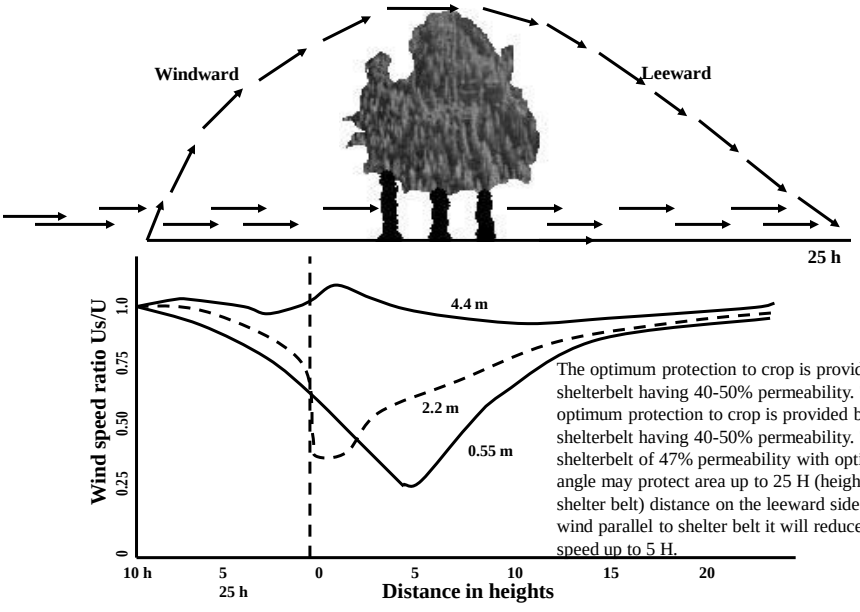
Dense Windbreak



The effectiveness of the shelter to reduce wind speed on the leeward side of shelterbelts depends upon the permeability, height, shape and width of barrier.

Influence of a dense windbreak on the ratio of wind speed in shelter (Us) and in the open (U)

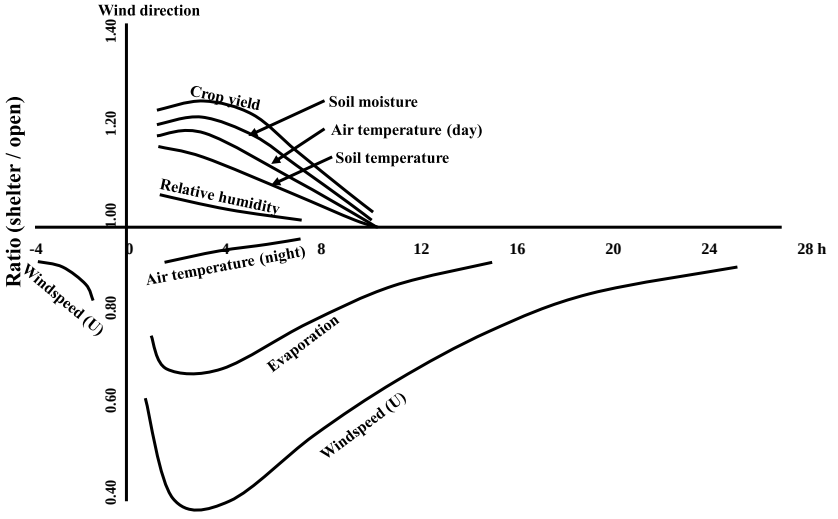
Permeable Windbreak



The optimum protection to crop is provided by a shelterbelt having 40-50% permeability. The optimum protection to crop is provided by a shelterbelt having 40-50% permeability. The shelterbelt of 47% permeability with optimum angle may protect area up to 25 H (height of shelter belt) distance on the leeward side. When wind parallel to shelter belt it will reduce wind speed up to 5 H.

Influence of a permeable windbreak on the ratio of wind speed in shelter (Us) and in the open (U)

Micrometeorology of windbreak



Summary diagram of the effect of barriers on micrometeorological factors. The arrows indicate the direction in which values of different factors have been found to vary relative to the control values measured in unsheltered areas. H = height of barrier