

# DEFORESTATION AND CHANGE OF MICRO-MACRO CLIMATIC CONDITIONS

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Large scale denudation of forests in and around cardamom tracts in recent years is the greatest handicap in successful cultivation of cardamom. This practice has upset the ecological balance which is essential for any crop. For better plant performance, it is highly essential to maintain a suitable microclimate in cardamom plantations.

## SHADE:

Being a shade loving plant, cardamom does not tolerate direct sunlight. Shade acts as a moisture and temperature regulator thus creating a microclimate which favours vegetative growth and root development. As soon as the soil is directly exposed to the tropical sunlight, soil moisture content and soil temperature fluctuate. Thus root development becomes restricted if there is no proper shading.

## IMPORTANCE OF FOREST GROWTH:

In a thick growth of forest, the branches of trees are frequently close enough to touch each other and form a closed canopy. Small trees, shrubs etc. often make up a more or less dense undergrowth. The leaves, twigs, stems and branches of such a forest expose innumerable litter surfaces, aggregating under good conditions an area several times greater

than that of the ground beneath. This loosely woven roof is the first line of protection against soil erosion and excessive runoff. During rains, a large portion of the rain-drops shatter into spray or mist. Another part of precipitation drips gently down plant stems and tree trunks and flows harmlessly to the ground. Covering the forest floor, is a blanket of wood litter performing these dual functions:

- i) absorption by the litter, part of the rain water.
- ii) establishment of a condition favouring the infiltration (intake) of a much larger part of the rainfall by keeping the water clear and ready to filter freely into the protected soil beneath. With this covering, the soil is much more permeable to water. From the stand point of soil protection and water intake, this debris covering the forest floor is the most effective surface cover.

## EFFECT OF RAIN ON EXPOSED SURFACE:

Rain on an unprotected soil surface will spoil the soil structure completely due to various types of erosion. Moreover, the soil compacts and the large pores in the layer below the soil surface become clogged with finer soil

fractions washed down from the surface layer. Quick drainage through the soil layer just below the surface becomes more difficult, especially drainage during periods of short but heavy tropical rains. Surface run-off increases and erosion becomes severe. The breakdown of the crumb structure by the impact of heavy rain and by the accelerated decomposition of the organic matter make the soil less resistant to erosion and lose its water-holding capacity.

Soil organic matter status gradually reduce after the removal of forest growth. A tropical forest soil under its protective cover is delicately balanced. The rapid breakdown of soil organic matter is being offset by the steady accumulation of fresh organic material from the surface vegetation. Although decomposition is rapid even under shade, fresh organic material accumulates continuously when the forest is intact. Under a thick growth of plants, the plant residues are sufficient either to keep the level of soil organic matter stable or to cause a small but steady increase. Only surface wastes and roots left in the soil can supply fresh organic material after the forest is removed. Lower organic deposits together with accelerated decomposition from the soil rapidly reduce its fertility.

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## LOSS OF ORGANIC MATTER AND ITS ACTION:

When emphasis is made on the importance of afforestation and its beneficial effects, it is pertinent to talk about the importance of organic matter and the role forest plays in maintaining the soil organic matter below a thick canopy. The functions or rather, advantages of organic matter are great. By deforestation such valuable organic matter is lost. This in turn means that the following functions of organic matter also may not take place which is an irreparable loss to the crop:

- i) The addition of easily decomposable organic residues cause the synthesis of complex organic substances that bind soil particles into structural units called aggregates. These aggregates help to maintain a loose, open, granular condition. Water is then able to enter and percolate more easily through the soil. The granular condition of soil maintains favourable conditions for aeration and permeability.
- ii) Plant roots require a continuous supply of oxygen. Large pores make it easy for the soil to take in oxygen from the atmosphere and to give out carbon dioxide.
- iii) Water holding capacity of the soil is increased by organic matter. This does not necessarily mean an increase in available water supply to plants since organic matter holds water fairly tightly. Thus the permanent wilting percentage is increased.

- iv) Organic matter serves as a reservoir of nutrient elements that are essential for plant growth. Most of the soil nitrogen occurs in organic combinations. Only a small fraction, usually 1-3% is present in inorganic forms at any given time. Also a considerable quantity of phosphorus and sulphur exist in organic forms. Upon decomposition, organic matter supplies the nutrients needed by growing plants as well as many hormones and antibiotics. These are released in relation to the needs of the plants. When environmental conditions are favourable for rapid plant growth, the same conditions favour a rapid release of nutrients from the organic matter.
- v) Organic matter under decomposition produces organic acids and carbon dioxide which help to dissolve minerals such as potassium and make them available more to the growing plants.
- vi) Organic matter helps to buffer soil against rapid changes in plants due to the addition of lime and nutrients.
- vii) It serves as a source of energy for the growth of soil microorganisms. All heterotrophic organisms—forexample, nitrogen fixing organisms—require easily decomposable organic matter as their source of carbon. Without carbon, nitrogen fixation by azatobacter and clostridium would be impossible.
- viii) Humus provides a storehouse for the exchangeable and

available cations—potassium, calcium and magnesium. Ammonium fertilizers are also prevented from leaching because humus holds ammonium in an exchangeable and available form.

- ix) Fresh organic matter supplies food for earthworms, ants and rodents. These burrow in the soil and construct extensive channels that not only serve to loosen the soil but also to improve drainage and leaching. Earthworms can flourish only in soils that are rich in organic matter.
- x) Evaporation losses are reduced by organic mulches.
- xi) Trashy, coarse organic matter of shade trees on the surface of soils reduce losses of soil by wind erosion.
- xii) Surface mulches lower soil temperature in the summer and keep the soil warmer in winter.
- xiii) It has a special function in making soil phosphorus more readily available in acid soils. Upon decomposition, organic matter releases citrates, oxalates, tartarates and lactates which combine with iron and aluminium more readily than phosphorus. The result is the formation of less insoluble iron and aluminium phosphates and the availability of more phosphorus for plant growth.
- xiv) Organic acids released from decomposing organic matter helps to reduce alkalinity in soils.

The functions of organic matter and its importance in main-

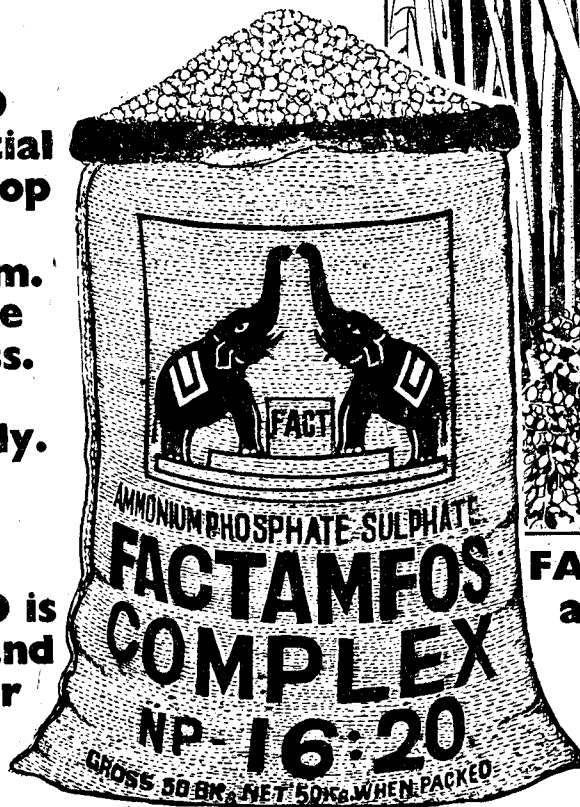
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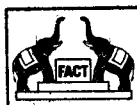
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taining soil fertility are explained in the above paragraphs. Since organic matter is being supplied by forest growth, the importance of retaining forest in good health and the detrimental effects of deforestation go without saying.

#### BIOCYCLING:

This is a unique feature found in cardamom plantations. Among plantation crops, almost no other crop experiences this benefit through the maintenance of tree growth in situ.

Often, nutrients applied to soil have chances of leaching down below the surface layer. Trees are especially effective in absorbing such nutrients and trace elements from great depths and translocating them to the leaves according to their requirements. Falling leaves thus effect a recycling of these minerals to the upper soil humus layer.

This is a normal and routine beneficial process taking place in forests. Such a facility is being lost for ever as a result of deforestation.

#### DISTURBANCE IN SOIL TEMPERATURE:

On removal of trees, filtered sunlight is removed and the soil becomes exposed to direct radiation which increases the soil temperature. As already mentioned, this upsets the ecological balance and the microclimate in plantations. Plant growth as well as chemical and biological activities in the soil are greatly influenced by the soil temperature. Soil temperature also regulates soil-air movement to some extent. The soil temperature is primarily

dependent on the heat that soil absorbs in relation to the losses through radiation and evaporation of soil moisture.

#### LATERISATION:

Fluctuations in soil temperature by the exposure of the soil to direct sunlight due to deforestation leads to laterisation. This makes the soil unfit for cultivation.

Humbert (1948) suggested that laterite forms in a climate that has alternate wet and dry seasons. His descriptions and illustrations indicate that the laterite he observed was in an open 'savannah' (open vegetation) that was gradually replacing forest. This is a common condition where a dry season is prominent. The change from soft laterite to the hard form within a few years after man has cleared the forests has been reported by Alexander and Cardy (1962) in French Guinea and other parts of West Africa.

#### WATER- HOLDING CAPACITY:

When the forest is intact, a major portion of precipitation drips gently, down plant stems and tree trunks and reach the ground. As a sponge, the vegetative bed provided by the forest growth absorbs this water and passes it on to the soil. By this process, loss of rain water is minimised. In addition, organic matter enhanced water-holding capacity. These together conserve the moisture to a greater extent. When the forest is removed, the soil cover is lost and so erosion increases.

#### WIND EFFECT:

Wind velocity is increased as there is no windbreak (no trees). Due to high velocity of wind the rate of transpiration and evaporation will be increased. Moreover, plants suffer due to the physical pull of the high velocity wind. The enhanced evaporation and transpiration deplete soil moisture rapidly.

#### LOSS IN RAINFALL DUE TO DEFORESTATION:

Of late, the receipt of rainfall has been very low. The main reason, as far as India is concerned, is attributed to deforestation. The presence of trees create a cool atmosphere in that region which condenses the clouds above and gives rain. Due to high wind velocity caused by the removal of forests, the rain-bearing clouds are carried away by the fast moving wind.

Cardamom being a moisture loving plant is greatly affected by dry winds.

Normally when some new practices are recommended or existing practices are modified, it will involve invariably the investment of money. But, in this case, though afforestation cannot be practised at all, at least deforestation can be eliminated without involving a single penny.