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SEMESTER – II

MULBERRY CROP PROTECTION (UNIT 3)

IRRIGATION

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Mulberry leaf production is often limited by the amount of available soil moisture and it can be substantially increased by supplemental irrigation. Since deficiencies of precipitation often occur in the major mulberry growing tracts of the world, it is necessary to provide supplemental irrigation to maintain optimum soil moisture conditions. Of all the inputs in mulberry cultivation, irrigation is known to bear the highest correlation with leaf productivity. It interacts remarkably with every other input. The water in plants, as in all other living systems, contributes as much as to the essential properties of life as do the more complex proteins, carbohydrates, etc. It is a well known fact that water is essential for most of the physiological reactions in plant tissues and in its absence life does not exist.

A large portion of the water taken up by the plant roots is lost through transpiration. For each unit of dry matter produced, the plant absorbs several hundred units of water. To produce one gram of dry matter about 280 to 400 ml of water is required. Over a period of 12 months about 50 to 60 acre inches or 125 to 150 cm of water has to be irrigated.

In order to make the most efficient use of water the methods and practices in irrigation must be based on the climatic factors and soil conditions. The following four approaches are followed for finding out the optimum irrigation schedules:

(a) physiological growth stages of the crop;

(b) soil moisture tension or depletion of available moisture;

(c) soil moisture tension-cum-physiological growth stages of the crop;

(d) cumulative evaporation from free water surface.

The evapo-transpiration loss in mulberry has been worked out as 4 to 5 mm per day. In addition to the total quantity, uniform distribution of rainfall during the growth phase of mulberry plant is essential. Where uniform rainfall at the rate of 100-150 mm per month is received, the crop needs no supplementary irrigation. But such ideal conditions do not exist in the major sericultural countries of the world, except perhaps in Japan. In the arid and semi-arid areas of most mulberry growing regions of Karnataka State in India, the rainfall is hardly 600 mm per annum and its distribution is also erratic and unpredictable. Thus, the mulberry crop raised under the monsoon rains suffers to a great extent due to the limited soil moisture conditions. In such mulberry growing regions, irrigation will have the profound influence on the leaf yield and quality of the leaf produced.

8.1 Irrigation in relation to soil: For efficient use of irrigation water, just enough water is to be applied to bring the moisture content of the soil in the root zone to its field capacity. If excess water is applied, it is lost from the root zone by downward percolation and this is a waste. The amount of moisture held in any soil is limited by its field capacity (upper limit) and wilting coefficient (lower limit). The moisture held by the soil between these two limits represents the available water. The amount of available water that can be stored in the root zone of the soil depends on its depth and soil texture and structure.

The available water held by soil is not uniformly utilized by the growing mulberry plant. At the field capacity level the plant draws more water from the soil and grows rapidly. The growth, however, progressively decreases as the soil moisture approaches the wilting point. In practice, the mulberry crop should never be allowed to extract more than 60-70 percent of the available water from soil, only then will there be well regularized plant growth and foliage production.

8.2 Appearance of mulberry crop: Mulberry plants with abundant supply of water are characterized by luxuriant growth, the foliage well developed and the leaves succulent and shiny. Whereas, mulberry plants of dry regions with limitation of soil moisture, tend to be stunted with reduced leaf size. A light green colour with succulency and glossy surface are generally indicative of adequate soil moisture and satisfactory plant growth. Stunted mulberry growth, with small dark green puckered and over and early matured leaves which become powdery and fragile are indicative of lack of soil moisture.

Mulberry crop growth should not lead to retardation for want of soil moisture. The practice of witholding irrigation until the plants show wilting symptoms is not desirable since it would involve additional energy, water and nutrients for the plant to pick up normal growth. It is therefore essential to maintain ready moisture availability in the soil for satisfactory plant growth and leaf production.

8.3 Frequency of irrigation: Frequency of irrigation for the mulberry crop depends upon several factors such as growth phase of plant, soil type and other agro-climatic conditions. Frequency of irrigation can be determined by assessing the amount of moisture depleted from the soil by the consumptive use per day. In India the frequency may vary from around 15 days for clayey loam type soils to between 8 to 10 days for sandy soils. The most critical period of irrigation is during November to April. Thus 12 to 15 irrigations are given during November-April. In the Soviet Union, when mulberry is raised as a mixed crop, it receives five to six irrigations between April and October and when raised as block plantations up to eight irrigations in 12 months are considered necessary.

8.4 Quantity of water irrigated: The important considerations for the quantity of water to be irrigated is the root distribution pattern of plant, the climatic conditions and soil type. In order to provide effective irrigation, the following methods of soil moisture measurements are followed.

8.5 Measure of soil moisture

1. Gravimetric method of determination of soil moisture;

2. Using electronic properties of porous blocks;

3. Use of Tensiometers;

4. Neutron method of measuring soil moisture.

In Japan, mulberry is cultivated on undulating highlands, hilly and mountainous terrains where facilities for irrigation are limited and therefore the entire mulberry cultivation in Japan is under rainfed conditions. But fortunately unlike in Karnataka (India), where the bulk of mulberry cultivation is concentrated, the rainfall in Japan is abundant, ranging from 1 000 mm to 2 500 mm per year. The rainfall is also well distributed in Japan with a monthly rainfall ranging between 100-200 mm particularly during March to October which coincides with the sericultural seasons. Thus mulberry crops do not suffer for want of soil moisture at any time and no supplemental irrigation is therefore found necessary.

In the sericultural areas of the Soviet Union, the rainfall is low, but mulberry crops are raised either in linear systems or block plantations, along with cotton and on the borders of agricultural crops and receive irrigation along with the companion and mixed crops

Sufficient quantity of water has to be added to bring the moisture level to the field capacity and to cover the entire root zone. For mulberry it is necessary to bring the soil moisture level to field capacity up to three feet in depth. A quantity of about 50 to 75 mm per acre of water has to be applied uniformly to bring the desirable moisture level up to root zone. If excess water is applied, it will be lost from the root zone by downward percolation. If less water is applied it will not wet the root zone uniformly.

8.6 Interval between irrigation: When the mulberry plant is in the active growth phase, i.e. the sprouting and foliar developmental stages, the crop has to be irrigated frequently In the tropics like India, plant growth takes place all the year round. However, moisture shortage occurs mostly during November-April. Monsoon rains are received between April and October during which period the crop does not require any supplementary irrigation However, if there is unforeseen drought during this period, the crop should be irrigated.

In the temperate regions like Japan, the active mulberry growth period is during March to October. During this period, the average monthly rainfall ranges from 100 to 200 mm. Thus the mulberry crops do not suffer for want of soil moisture and therefore no supplemental irrigation is required.

In the Soviet Union, the mulberry crop needs supplemental irrigation to keep a favourable soil moisture level between April and November and thus irrigation is practised.

8.7 Quality of water: In addition to the quantity of water, quality of irrigation is also equally important. Normally irrigation water for mulberry should contain less than 1 000 PPM of total soluble salts.

8.8 Methods of irrigation: Of the different methods of irrigation adopted, the furrow, flat bed and basin methods are normally practised.

8.8.1: Furrow method: In the furrow method the field is laid out into a series of ridges and furrows The basal part of the furrows is made wet by the flowing water and the ridge is moistened by the capillary movement of water. This method is more efficient from the points of view of economy in water use. Advantages of furrow irrigation are: (i) it is suitable for wide spaced as well as close spaced mulberry plantations; (ii) evaporation from the soil surface is relatively less; (iii) the ridges carrying the plant root system are freely aerable helping root development; and (iv) the furrow serves as a drainage channel during heavy rains and thus water stagnation is avoided.

8.8.2: Flat bed method: The field is divided into rectangular beds with bunds all around and channels on the sides The bed size may vary from 3.5 x 2.0 m, to 4.0 x 6m. The advantages of this system are (i) it is suitable to most soil types; (ii) relatively economic in use of water; (iii) there is low wastage of water dur to run off; (iv) the soil is not eroded; and (v) irrigation is relatively quicker than in other systems. However, more labour required for forming beds and wastage of space.

8.8.3: Basin method: The basin method is suitable mostly for tree plantations. In this system irrigation water from the supply source is lead into the basin around the trunk. The diameter of the basin may vary according to age and size of the tree from 1.0 to 1.5

8.8.4: Overhead or sprinkler method of irrigation can be practised in undulating lands where low and high bushes are cultivated. The advantages are (i) most efficient in economizing water use; (ii) there is uniform distribution of water on the foliage; (iii) the percolation loss in porous and sandy soils is avoided; (iv) this is most suited for emergency irrigation; and (v) it can be followed with advantage on slopey and shallow lands. Even though the sprinkler method is highly efficient, the high cost of installation prohibits its adoption in the hands of economically poor Indian farmers

8.9 Influence on the leaf yield: Yield of mulberry leaves is strongly influenced by both quantity and quality of irrigation water.