EFFECT OF IRRIGATION, SOIL AND MOISTURE CONSERVATION ON GROWTH AND YIELD OF RUBBER

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ABSTRACT

The effect of irrigation, soil and moisture conservation on growth and yield of rubber are discussed. Irrigation enhances the growth of rubber and reduces its long gestation period. Yield of rubber is dependent on the distribution of rainfall, and irrigation during the summer months will reduce the plugging and will increase the yield. Conservation practices like terracing, silt pitting, mulching and growing of cover crops will conserve soil and water, and will increase the growth and yield of rubber.

INTRODUCTION

Rubber, a major plantation crop of India is traditionally grown in the high rainfall areas of South India without irrigation. Since the scope for expanding the area under rubber in this region is limited, its cultivation is now being extended to the nontraditional areas to meet the increasing demand for natural rubber. Rao *et al.* (1992) worked out indices to assess areas hydrothermally suitable for rubber cultivation, and reported that none of the locations in India have highly suitable hydrothermal conditions for rubber growth as well as productivity. He classified traditional belts as climatically suitable areas and majority of the nontraditional areas as marginally suitable. When irrigation is an essential management practice for proper establishment and growth of rubber in nontraditional areas, its importance is increasing in the traditional areas due to the recent droughts and prolonged dry spells.

Different methods of irrigation (basin, drip and sprinkler) are being practised in rubber plantations. The traditional surface methods of irrigation, where water is applied to the soil surface are characterised by low conveyance and application efficiencies. Drip irrigation is the frequent slow application of water to the soil surface and has the advantages of high efficiency and less labour requirement. However, the high initial investment is restricting its large scale adoption. In an experiment to compare between drip and basin methods of irrigation in rubber, it was observed that, if properly scheduled and managed, both methods are comparable for rubber. It was found that the partial wetting of the root system does not affect the growth of plants (Jessy *et al.*, 1993).

WATER REQUIREMENT OF RUBBER

In Ivory Coast, Monteny *et al.* (1985) estimated the water requirement of mature rubber using the Bowen ratio-energy balance method as 4 to 6 mm d^{-1} . Haridas (1980) measured the daily water requirement of young rubber using lysimeters, and he found

that it varied from 2 to 8 mm d^{-1}. He also noticed that the daily evapotranspiration of rubber closely followed the evaporation measured using pan evaporimeter.

In one of the studies conducted at R.R.I.I., the evapotranspiration of immature rubber was measured with the help of nonweighing lysimeters, and it showed variation in response to the prevailing weather conditions. The mean evapotranspiration during the summer season (December to April) was 4.97 mm d^{-1} and that during the rainy season (May to November) was 2.99 mm d^{-1} (Jessy *et al.*, 1992).

EFFECT OF IRRIGATION ON GROWTH OF RUBBER

Rubber has a long immaturity period of seven years or more, and maintaining a favorable moisture status in the soil has been proved to reduce this long unproductive period. Pushparajah and Haridas (1977) reported the importance of irrigation during the immature phase. Haridas (1980) also reported the importance of adequate soil moisture during the shoot flush and elongation period, and suggested the restricted application of water during this period to thwart the illeffect of drought on the young rubber plants. A reduction in the immaturity period of irrigated rubber was noticed by Omont (1982) in Ivory Coast. In this experiment, irrigated plants came to tapping at five and a half years after planting, whereas the unirrigated plants took seven years to attain tappable girth. This clearly revealed that 18 months' gestation period could be reduced by irrigation.

In an experiment conducted in the nontraditional area (Konkan region), severe inhibition of photosynthesis and transpiration and increased stomatal resistance were observed due to soil moisture stress. A significant increase in absolute growth and relative growth rate was noticed in the dry season in the irrigated plants (Mohankrishna, 1991).

In the experiments conducted at R.R.I.I. also, irrigation was found to enhance the growth of rubber significantly. When two levels of deficit irrigation (30 and 50 per cent of crop evapotranspiration) was given, the irrigated plants were found to attain tappable girth one year prior to unirrigated plants (Jessy *et al.*, 1993). In another experiment, a plant which did not experience any soil moisture stress attained a girth of 46 cm at the fourth year, while the unirrigated plants attained a girth of only 31.07 cm during the same period.

EFFECT OF IRRIGATION ON YIELD

In mature rubber, irrigation has been reported to increase the yield and decrease the summer depression in yield. Sethuraj and Raghavendra (1984) observed that conditions favoring good supply of water to tissues or minimising water loss through evapotranspiration are congenial for the prolonged flow of latex and high production. In Malaysia, Haridas (1984) reported that irrigation can reduce plugging and increase the yield of GT-1, RRIM 612 and RRIM 703 clones. In an experiment conducted at RRII, it was observed that the yield drop in different *Hevea* clones during an unusual drought in the South India were in the range of 36 to 61 per cent when compared to the favorable wet season yield (Vijayakumar *et al.*, 1988)

Thomas (1992) observed that in the traditional belt, the distribution of rainfall becomes more and more unfavorable as we move north from Kulasekharam to Calicut. A similar trend was seen in the annual dry yield of rubber which is maximum at Kulasekharam, where the northeast monsoon is more active. In central Kerala, the yield is 20 per cent less while in Northern Region, the reduction is 30 per cent. In Kulasekharam, wintering is late and the summer depression in yield is low.

SOIL AND MOISTURE CONSERVATION

In a rubber plantation, there are several methods by which soil and moisture can be conserved.

Terracing

On hilly and undulating land, planting is done on terraces cut along the contours. Terracing divides a large sloping drainage area into a number of distinctly separate ones. This prevents erosion and surface runoff. While making terraces, steps of uncut earth should be left at intervals along the terrace line. This will check the lateral flow of excess rain water along the terrace, and increase infiltration of water.

Silt pits

Trenches of 4 feet length, one and a half feet width and two and a half feet depth can be dug at intervals of 8-10 feet along the contours to serve as silt pits. They act as a series of storage tanks trapping water from surface run off and through fall, and will increase the infiltration of water into the soil and thus help raise the water level, which can be readily used by the trees during dry weather. Haridas *et al.* (1987) reported that in higher slopes, higher yields of between 10 per cent and 15 per cent were obtained from rows above the silt pits than from rows below the silt pits for clones RRII 600 and RRIM 703. This trend was also observed in the latex flow properties, feeder root distribution, soil moisture storage and soil and leaf water potential. He attributed the lack of response in yield from silt pits in lower slopes to the presence of a natural catchment at this level.

Mulching

It is a normal practice to mulch the plant basins during the summer months. Any material like dry plant mulch, polythene, coconut husk etc. can be used. In Rubber Plantation, cover crop cuttings can be used as mulch materials. It reduces the loss of moisture by evaporation and also reduces the soil temperature at the plant basins.

Establishment of cover crops

Growing a leguminous cover crop in the inter row spaces of rubber plantations not only fixes atmospheric nitrogen and suppresses weed growth but also helps in soil and moisture conservation in a big way. The leguminous cover crops prevent the beating action of rain and reduce run off thus minimising soil erosion. The cover crops return to the soil large amounts of litter which raises the organic matter content. This in turn increases the water holding capacity of the soil.

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