ABSTRACT

Kuttanad, the low-lying tract in Kerala State of south-west India, is a place where drainage problems have caused the agricultural production to remain low. The problem is more severe in the *kari* lands of Kuttanad where the soil is acid-sulphate in nature. Besides the problems inherent to acid sulphate soils, the area also experiences problems of flooding, lack of fresh water and intrusion of saline water from the Arabian Sea.

A study was conducted at the Karumady village in Alappuzha District of Kerala to assess the drainage and allied problems inhibiting crop production in a low-lying acid sulphate soil (*kari* lands) and to investigate the role of subsurface drainage in improving it. It was found that, though the existing network of open drains can improve the soil conditions of the root zone, its influence is limited to its vicinity only. The traditional method of drainage with its low density of open drains was not adequate to improve the overall crop productivity in the entire area. Studies on the present drainage pumping set up have shown that an excess electrical energy of 6.7 million kwh is consumed per year in Kuttanad because of the improper selection of pumpsets. The excess consumption is nearly 22% of the optimum requirement. The pumping capacity required for surface drainage was found to be only 0.50-0.75 hp/ha.

A subsurface drainage system consisting of 10 cm diameter clay tiles of 60 cm each was installed at a depth of 1 m with two spacings of 15 m and 30 m for evaluating its performance in improving soil quality and crop production. Substantial recharge was found to occur from the main water bodies into the low-lying paddy fields up to a distance of 60 m, though it decreased with distance. It was found that the hydraulic conductivity varied directly with the mid-spacing water table height up to 60 m from the main water body and exponentially beyond that. It also showed a decreasing trend with the distance of the field from the main water body. For areas more than 60 m away from the main water bodies, the drainable porosity decreased with the mid-spacing water table height up to a certain level beyond which it became almost constant. Hammad equation for thick layers was found to be most suitable for the area among the drainage equations tested for design purpose.

Many of the critical crop growth parameters in the subsurface drained area, particularly the grain yield and 100 grain weight, were significantly superior to that of the ill-drained areas. Drain spacings up to 30 m can significantly improve the productivity of the area. The overall increase in rice yield due to subsurface drainage was 1.36 t/ha. It was also found that subsurface drainage can remove the heterogeneity of soil which is the root cause for patchy crop growth and uneven ripening of rice crop in the area. Acidity in the subsurface drained

area was always lower throughout the cropping season. The salinity in the soil could be controlled considerably by subsurface drainage. The iron transformations were not serious enough to cause concern for rice cultivation when subsurface drainage was adopted. Accumulation of sulphates in insoluble form occurred during drainage due to the oxidation of pyrite. Subsurface drainage was also very efficient in leaching sodium, potassium, calcium and magnesium. Chloride content in soil decreased drastically during drainage. An additional paddy yield of 0.41 t/ha was found to be the break-even point for the economic feasibility of subsurface drainage in the *kari* soils.