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Effect of sub-surface drainage (SSD) system with different filters (envelopes) on hydraulic properties of salt affected and water logged soil

S.D. RATHOD, B.M. KAMBLE AND D.H. PHALKE

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See end of the article for authors' affiliations

Correspondence to:

S.D. RATHOD
Agricultural Research Station, K. Digraj, SANGLI (M.S.) INDIA

ABSTRACT

The subsurface drainage system (SSD) was installed at Agricultural Research Station K. Digraj, Dist. Sangli (M.S.) in December, 2002 on 8.81 ha of salt affected and water-logged soils. The 80 mm corrugated perforated PVC pipes were used with three types of filter *i.e.* geotextile envelope, coarse sand and geotextile envelope + coarse sand filter. The initial hydraulic conductivity of soil was in the range of 0.0236 to 0.0579 m/day. The water table fluctuations were recorded in the range of 0.265 to 1.85 m from the soil surface in different seasons. The average depth of collector and lateral drains was 1.32 m. The spacing between two laterals was 25 m. The results revealed that the water table decline, drain discharge, drainage coefficient and hydraulic conductivity were recorded highest in SSD with coarse sand filter over the other envelopes *i.e.* geotextile envelope and geotextile envelope + coarse sand filter within three years after installation of SSD.

Key words : Subsurface drainage systems (SSD), Water table, Drain discharge, Drainage coefficient and Hydraulic conductivity.

The salt affected and waterlogged area in India estimated as 11.534 Mha of which about 3.0 Mha are coastal saline soils which have been developed due to seawater intrusion . In Maharashtra, the salt affected area estimated as 5.34 lakh ha and waterlogged area 1.11 lakh ha. (Tyagi, 1999) In Maharashtra, sugarcane crop is being grown on large area, which requires excessive irrigation even under restricted drainage conditions. Mann and Tamhane (1910) estimated that 6-7 per cent of the area was being damaged annually due to application of heavy irrigation to deep black soils with insufficient drainage. Kulkarni (1961) also pointed out that there was a regular increase in the development of salt affected area on the major canals of western Maharashtra. The black soils, commonly known as black cotton soils belong to *Vertisols*. Deep black clayey soils with low hydraulic conductivity and low drainability, indiscriminate use of irrigation water for cash crops like sugarcane, lack of crop rotation and less use of organic manures, low lying lands and less rainfall resulted in development of salt affected and waterlogged soils in Western Maharashtra.

The function of envelope materials is not only to protect the pipe drain from silting up but also to reduce the entry resistance. The perforated corrugated PVC drainage pipes are not completely pervious; their perforated area occupies only 1-2 % of total pipe surface. Compared to flow towards on ideal, commercial drain causes an extra head loss due to flow concentration towards the isolated inlet opening. This flow produces an extra resistance, which is known as entrance resistance. Drain filter material reduces the entrance resistance and improves the effectiveness of the system (Willardson, 1987and Stuyt, 1989). Granular material such as graded coarse sand and fine gravel, is widely used in semi-arid and arid regions, it provides an effective and durable filter if available at reasonable cost and if properly installed. Now a days synthetic filter materials are available world wide and accepted due to its cost factor and ease of installation without considering the effectiveness of filter materials.

In this view to above, the research experiment was under taken to study the effect of sub-surface drainage (SSD) system with different filters (envelopes) on hydraulic properties of salt affected and water logged soils of Western Maharashtra.

METHODOLOGY

The subsurface drainage system with corrugated perforated PVC pipes was installed at Agricultural Research Station K. Digraj. Dist: Sangli (M.S.) on 8.81 ha of salt affected soils in December, 2002, to study the effect of sub-surface drainage (SSD) system with different filters on hydraulic properties of salt affected and waterlogged soil. The experimental initial soil status was in the range pH-8.13 to 8.52, EC 2.22 to 17.82 dS/m, ESP 7.04 to 17.50. The hydraulic conductivity was in the range of 0.0236 to 0.0579 m/day. The water table fluctuations were observed in the range of 0.265 to 1.85 m from the surface in different seasons.

The design and layout was fixed according to slope and soil properties. Perforated corrugated PVC pipes of 80 mm diameter were laid down into the lateral drains and non perforated corrugated PVC pipes of 80 mm diameter for collector drains. The average depth of