Controlled subsurface drainage for the management of water table, soil salinity and nutrient loss in waterlogged saline vertisols of TBP command area of Karnataka, India

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INTRODUCTION

Subsurface drainage (SSD) systems are known to improve crop productivity in canal command areas with water logging and soil salinity problems (Fig.1.a). However, particularly at the tail-end of Tunga Bhadra Project (TBP) command area of Karnataka, India, paddy growers face shortage of irrigation water at critical crop growth stages due to paddy cultivation at head and mid-reach of the command. Hence, tail-end farmers block drainage lateral outlets (Fig.1.b) to save water by excessive drainage so also to minimize loss of nutrients which curtail the benefits of the system.

METHODOLOGY

To overcome the problems of tail-end farmers, controlled SSD technique was compared with conventional SSD in waterlogged saline vertisol at Agriculture Research Station, Gangavathi, Karnataka, India during 2012 to 2019. In both SSD, 80 mm PVC corrugated and perforated lateral pipes covered with synthetic filters were installed at 50 and 60 m spacing to a depth of 1.0 m having 0.1 to 0.2% slope while 100 mm PVC corrugated collector pipes, directly draining into adjacent surface drain, were installed at 1.10 m depth having 0.2 to 0.3% slope. In case of controlled SSD (Fig. 1.c), the lateral outlet was raised to 70 cm to ensure sufficient water at effective root zone of paddy (Fig. 1.d).

RESULTS

The results of seven seasons revealed that the drain discharge was 1.88 vs.0.55 and 0.87 vs.0.53 mm/day, average salinity of drainage water was 2.09 vs.1.93 and 2.89 vs.2.37 dS/m, salt removal was 2.34 vs.0.64 and 1.23 vs.0.53 t/ha/season under conventional and controlled SSD at 50 and 60 m spacing respectively. The depth to water table was shallower under controlled SSD in both *kharif* by 5.3 and 4.1 cm and *rabi* season 4.6 and 4.1cm as compared to the conventional drainage system at 50 and 60 m spacing respectively. The average irrigation water consumed was 125 vs. 97.8 and 110 vs. 81.7 cm, average loss of NO_3-N was 13.95 vs.4.17 and 5.09 vs.2.94 kg/ha/season under conventional and controlled SSD at 50 and 60 m spacing respectively. The reduction in mean root zone soil salinity (0-30 cm) from initial to *kharif*-19 was 8.26 to 1.25 dS/m, 4.7 to 0.61 dS/m and 8.97 to 1.37 dS/m and 6.14 to 1.22 dS/m under conventional and controlled SSD system at 50 and 60 m spacing respectively. Paddy grain yield increased from 46.8 to 58.0, 45.8 to 50.4, 36.3 to 56.4, and 36.5 to 54.2 q/ha under conventional and controlled drainage systems at 50 and 60 m spacing compared to pre-installation of SSD.

CONCLUSIONS

Though controlled drainage reduced the drain discharge, salt leaching was lower compared to conventional drainage by 58 to 73% at 50 and 60 m spacing. However, in spite of marginal increase in grain yield under conventional, controlled SSD appeared to be a more environmentally friendly practice and could be propagated on a large scale in the TBP command area considering savings of irrigation water (28 to 35%) and reduction in nitrogen loss (42 to 70%) both at 50 and 60 m spacing respectively.

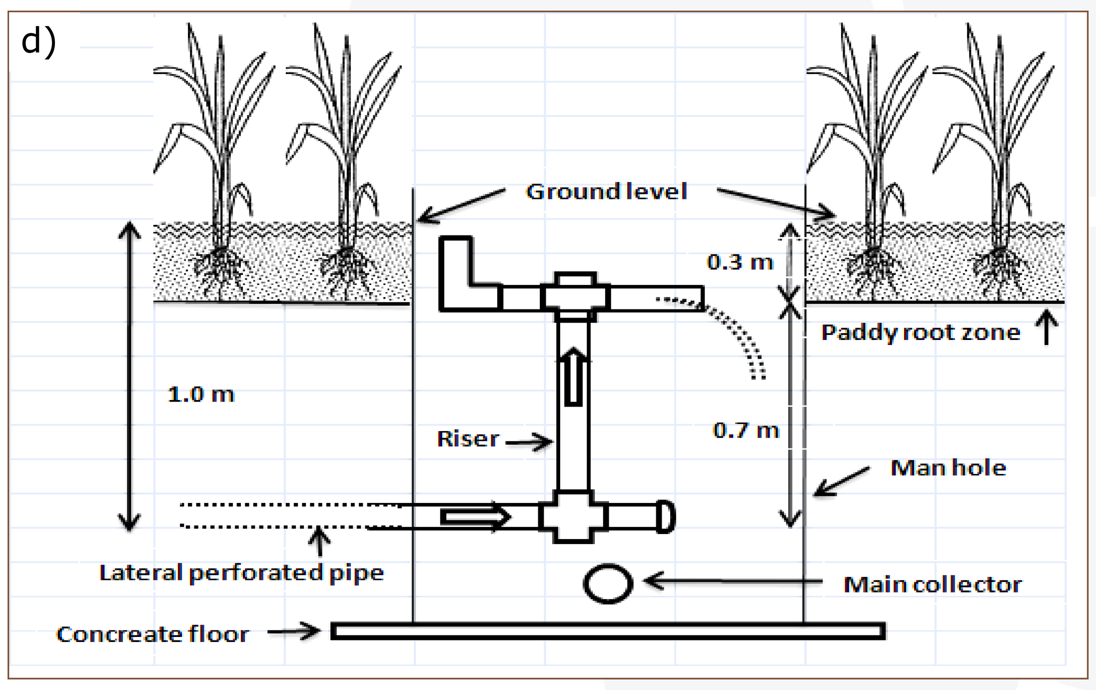

Fig 1. Comparison of conventional drainage and controlled drainage a)Conventional Subsurface Drainage, b) Conventional Drainage with blocking of lateral by farmer c) Controlled Subsurface Drainage and
d) Schematic view of Controlled Subsurface Drainage

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