International Journal of Research in Agronomy 2025; SP-8(12): 217-219

E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; SP-8(12): 217-219
Received: 11-10-2025
Accepted: 13-11-2025

AV Karegoudar
AICRP on Management of Saline Water & Associated Salinisation in Agriculture ARS, Gangavathi, Karnataka, India

Rajkumar RH
Department of Soil and Water Engineering, CAE, UAS, Raichur, Karnataka, India

Viswanath J
AICRP on Management of Saline Water & Associated Salinisation in Agriculture ARS, Gangavathi, Karnataka, India

Corresponding Author:
AV Karegoudar
AICRP on Management of Saline Water & Associated Salinisation in Agriculture ARS, Gangavathi, Karnataka, India

Impact on soil salinity and crop yield under traditional and controlled SSD system in saline vertisols of TBP irrigation command

AV Karegoudar, Rajkumar RH and Viswanath J

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i12Sc.4384

Abstract
Farmers at the tail-end of the TBP irrigation command facing water scarcity problem especially at the later part of crop growth are in practice of clogging the existing traditional SSD outlets so as to retain water in the field for the crop. This habit of practice leads to trouble the regular function of the SSD system. In order to avoid this habit adopt controlled drainage mode of technology to the existing traditional SSD system was the better option. Keeping this view performance study was conducted between traditional and controlled SSD with 40, 50 and 60 m spacing at Agricultural Research Station, Gangavathi during 2021-22.The results of the study reported that irrespective of the spacing under traditional and controlled SSD treatments salinity (EC_e) was reduced. The grain yield was increased from 33 to 48.3 (31%), 38 to 54.2(30%), 36 to 56.3 qha^{-1} (36%) and 31 to 43.7 (29%),37.6 to 47.2 (20%),36 to 51.3 qha^{-1} (30%) under traditional and controlled SSD at 40, 50 and 60 m spacing respectively. As concerned water scarcity issues especially in the downstream region can adopt this controlled SSD technology to the existing traditional SSD system helps to regular function of the SSD system.

Keywords: Subsurface drainage, controlled drainage, soil salinity, crop yield

Introduction
During inception of Tungabhadra Project (TBP) based on availability of water (Anonymus, 2013) [1] in the dam decided (1953) cropping pattern in that nearly 8 and 4 per cent of command area under paddy and sugarcane (downstream region), and rest of the area should follow arable cropping system (upstream region) as practicing earlier during rainfed situation it helps to avoid development of waterlogged and soil salinity problems in the command area (Karegoudar *et al*., 2022) [4]. Presently cropping pattern was deviated in the upstream region leads to created not only shortage of water for paddy crop but also the problem of secondary salinization and thus reduction in the yield levels drastically in the downstream region.
To reclaim these lands TBP-CADA has taken up surface and sub surface drainage (SSD) works especially in the downstream area of the command. However, there are issues related to operation of SSD systems. The farmers in downstream area stop/ block the SSD system due to fear of water shortage during critical stages of paddy crop. However, earlier results reported that blockage of outlets after two years of installation of SSD system leads to increased soil salinity from 2.22 to 4.1 dSm^{-1} during *rabi* and from 2.22 to 2.68 dSm^{-1} during *Kharif* season. It means that blockage of the system undo benefits of SSD system. This experience suggested that SSD system should function regularly but whenever water is very much essential for the crops then switching to controlled drainage approach can be a better option. Ghannam *et al*.,(2016) [2] reported that adoption of controlled SSD to the existing traditional drainage significantly reduced drainage outflow and salt loads leads to increase in soil salinity due to rising of water table but carefully monitored and managed the system. Considering this point we have planned very well and managed three spacing with traditional and the controlled SSD system in paddy field under saline Vertisols of TBP Command area.

Materials and Methods

The SSD system was laid in 9.62 ha plot at Agricultural Research Station, Gangavathi during the year of 2021-22. The treatments consisted of traditional and controlled SSD spacing *viz*., 40 (2.62 ha), 50 (3.0 ha) and 60 m (4.0 ha) each with a lateral depth of 1.0 m which were covered with synthetic nylon. The collector drains (100 mm diameter PVC corrugated plastic pipe) were laid at perpendicular to surface drain at 1.10 m depth. The slope of lateral drain was 0.1 to 0.2% and connected to the collector drains whose slope was 0.2 to 0.3% which directly drains into *nala* through man hole (Karegoudar *et al*., 2022) [4].

In the controlled SSD system, groundwater table control consisted of a small device connected to the existing outlet of the lateral drain in the manhole. Further, the small device comprised two horizontal PVC pipes (80mm dia) and riser (Fig.1). The first horizontal PVC pipe was fitted at the bottom to the lateral drain and its end was closed with an end cap. To maintain a desired groundwater table depth in the paddy field, say, at 0.30m, a riser pipe (of 0.70m) was provided from the bottom horizontal PVC pipe through a T-section. The other horizontal PVC pipe was fitted to the riser pipe to serve as a lateral drain at 0.30m depth from the soil surface in the case of the controlled SSD system to restrict the drain outflow by blocking the actual drain under the traditional SSD system. The controlled drainage system compared to the existing traditional SSD system required an additional cost of about Rs.1000 per ha (Karegoudar *et al*., 2019) [3].

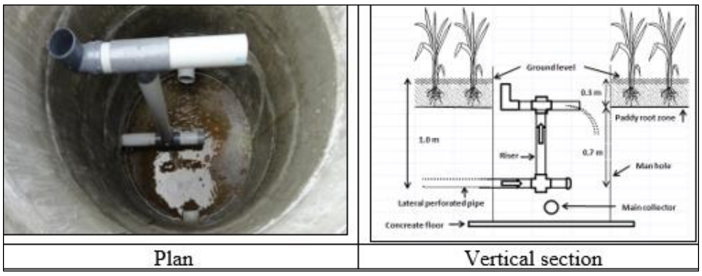

Fig 1: A view of indigenously developed water table control device installed in manhole (Adopted from: M.A.S.Wahba *et.al*, 2001) [6]

The Kharif paddy crop was transplanted in August and harvested in December season and except the control device, rest of the agronomical practices were followed between the treatments. The soil samples were collected (0-90cm) in zigzag position using GPS and analyzed for initial soil salinity (EC, dSm^{-1}) from before and after the harvest of crops in both traditional and controlled SSD plots (USSL, 1954) [5].

Results and Discussion

Soil salinity

The mean soil salinity under 40 m spacing under traditional SSD system during *Kharif*-21 reduced from 8.05 to 2.44 at 0-15cm, from 8.66 to 3.35 at 15-30 cm, from 9.70 to 4.17 at 30-60 cm and from 9.94 to 4.30 dSm^{-1} at 60-90 cm, respectively (Table.1). Similarly under controlled SSD system, the salinity was reduced from 7.34 to 1.20 dSm^{-1} at 0-15 cm, from 8.15 to 3.15 dSm^{-1} at 15-30 cm and salinity increased from 8.63 to 4.34 dSm^{-1} at 30-60 cm and from 9.18 to 3.90 dSm^{-1} at 60-90 cm, respectively.

The mean soil salinity under 50 m spacing under traditional SSD system during *Kharif*-21 reduced from 4.30 to 1.34 at 0-15cm, from 5.09 to 1.22 at 15-30 cm, from 5.91 to 1.73 at 30-60 cm and from 5.26 to 2.71 dSm^{-1} at 60-90 cm, respectively. Similarly under controlled SSD system, salinity was reduced from 6.30 to 1.50 dSm^{-1} at 0-15 cm, from 8.29 to 3.44 dSm^{-1} at 15-30 cm, from 12.0 to 3.75 dSm^{-1} at 30-60 cm and from 13.85 to 4.57 dSm^{-1} at 60-90 cm, respectively.

The mean soil salinity under 60 m spacing under traditional SSD system during *Kharif*-21 reduced from 3.06 to 1.87 at 0-15cm, from 3.83 to 2.66 at 15-30 cm, from 7.21 to 4.52 at 30-60 cm and from 8.79 to 4.50 dSm^{-1} at 60-90 cm, respectively. Similarly under controlled SSD system, salinity was reduced from 5.99 to 2.24 dSm^{-1} at 0-15 cm, from 6.29 to 3.26 dSm^{-1} at 15-30 cm, from 6.42 to 3.33 dSm^{-1} at 30-60 cm and from 6.11 to 5.20 dSm^{-1} at 60-90 cm, respectively. The result of the data clearly shows that adoption of controlled SSD technology to the existing traditional SSD system significantly reduced the soil salinity and also the better option for the farmers to avoid habit of clogging of the outlet.

Table 1: Changes in soil salinity (EC_e,dSm^{-1}) over cropping season under different spacing of traditional and controlled SSD

Season	40 m spacing							
	Traditional SSD (cm)				Controlled SSD (cm)			
	0-15	15-30	30-60	60-90	0-15	15-30	30-60	60-90
Initial	8.05	8.66	9.70	9.94	7.34	8.15	8.63	9.18
Kharif-21	2.44	3.35	4.17	4.30	1.20	3.15	4.34	3.90
50 m spacing								
Initial	4.30	5.09	5.91	5.26	6.30	8.29	12.00	13.85
Kharif-21	1.34	1.22	1.73	2.71	1.50	3.44	3.75	4.57
60 m spacing								
Initial	3.06	3.83	7.21	8.79	5.99	6.29	6.42	6.11
Kharif-21	1.87	2.66	4.52	4.50	2.24	3.26	3.33	5.20

Grain yield

The grain yield was increased from 33 to 48.3 (31%), 38 to 54.2(30%), 36 to 56.3 qha^{-1} (36%) and 31 to 43.7 (29%),37.6 to 47.2 (20%),36 to 51.3 qha^{-1} (30%) under traditional and controlled SSD systems at 40,50 and 60 m drain spacing as compared to the initial soil salinity (Table.2).

Table 2: Variation of paddy grain yield (qha^{-1}) as influenced by spacing of SSD and controlled SSD systems

Season	Traditional SSD			Controlled SSD		
	40 m	50 m	60 m	40 m	50 m	60 m
Initial	33.0	38.0	36.0	31.0	37.6	36.0
Kharif-21	48.3	54.2	56.3	43.7	47.2	51.3
Improved over initial (%)	31	30	36	29	20	30

Conclusion

The rate of reclamation was improved under both traditional and controlled SSD systems in all the spacing as the mean soil salinity (EC_e) was reduced from initial. The paddy grain yield improvement was slightly higher (from 30 to 36%) for traditional as compared to controlled SSD conditions (from 20 to 30%) at 40 to 60 m spacing respectively. As concerned water scarcity issues especially in the downstream region can adopt this controlled SSD technology to the existing traditional SSD system helps to regular function of the SSD system.

References

1. Anonymous. Annual Report. Command Area Development Authority (CADA), Tungabhadra Project, Munirabad, Karnataka, India; 2013. p. 30.
2. Ghannam EMK, Waly ME, Gaheen SA, Karajeh FF, Gendy AA. Controlled drainage effects on nitrate leaching, salinity buildup and sugar beet production (Egypt). Merit Res J Agric Sci Soil Sci. 2016;4(2):23-32.
3. Karegoudar AV, Vishwanath J, Anand SR, Rajkumar RH,

Ambast SK, Kaledhonkar MJ. Feasibility of controlled drainage in saline vertisols of TBP command area of Karnataka, India. Irrig Drain. 2019;68:969-978.
4. Karegoudar AV, Viswanath J, Rajkumar RH, Anand SR, Polisgowdar BS, Ayyanagowdar MS, *et al*. Economic feasibility of subsurface drainage to control waterlogging and soil salinity under different scenarios in Tungabhadra Project command, Karnataka. Irrig Drain. 2022;71:1063-1076. doi:10.1002/ird.2716.
5. USSL. Diagnosis and improvement of saline and alkali soils. In: Richards LA, editor. USDA Handbook. Washington (DC): USDA; 1954. p. 60.
6. Wahba MAS, El-Ganainy M, Abdel-Dayem MS, Gobran A, Kandil. Controlled drainage effects on water quality under semi-arid conditions in the western delta of Egypt. J Irrig Drain. 2001;50:295-308.