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Content

Theme 1. Assessment, mapping, and monitoring of salt-affected soils	1
Salinization and sodification in irrigated agricultural areas in arid regions, Northern Patagonia Argentina Apcarian A., Imbellone P.A., Salaberry J.M.	2
Salinization processes in irrigated soils of Mirzachul Arabov S., Abdurakhmonov N., Bakhodirov Z., Sobitov U.	4
Use of aboveground electromagnetic induction meter for detecting salinity gradients and indurated soil layers in a volcanic landscape Arriola-Morales J., Batlle-Sales J.	6
Evaluation of soil salinity levels through using Landsat-8 OLI in Central Fergana Valley, Uzbekistan Aslanov I., Kholdorov S., Ochilov S., Jumanov A., Jabbarov Z., Jumaniyazov I., Namozov N.	8
Characterization and modelling of salt-affected soils properties using VNIR hyperspectral data Barman A.	11
Characterization of spatial and temporal variability in soil salinity in relationship to alfalfa (<i>Medicago sativa</i> L.) productivity Benes S.E., Singh S., Gull U., Anderson A., Scudiero E., Hutmacher R.B., Putnam D.H.	13
Application of GIS in mapping salt washing norm maps Bobomurodov Sh.M., Baxodirov Z.A., Normatov Yo.M.	15
Current condition, fertility and characteristics of irrigated soils of Peshku district of Bukhara region Bobomurodov Sh.M., Baxodirov Z.A., Tursunov Sh.T., Turdaliev J.M.	17
Wheat salinity stress detection using VNIR spectrometry Bolloorani A.D., Mirzaei S., Bahrami H.A., Mouazen A.M.	19
Soil salinity mapping and biosaline agriculture in Kazakhstan Bozayeva Z., Toderich K.	21
Salinity risk mapping using an integrated approach and land cover in semi-arid area, Morocco Chaaou A., Chikhaoui M., Naimi M., El Miad A.K., Seif-Ennasr M.	23
Saline soils in the Baixada Maranhense: a case study in Maranhão state, Brazil da Silva Martins A.L., Teixeira W.G., Silva M.B.	26

Water- and energy-use efficiencies of drip irrigation of cotton on soils prone to salinization: case study from the Karshi Steppe Karimov A.Kh., Karshiev R., Tashev R., Abdurahmanov B.	178
Opening a new door in the management of salt-affected soils with the use of pumice Kong C., Camps-Arbestain M., Clothier B., Bishop P., Macias F.	180
Fertigation system for sustainable agriculture in saline-sodic soils Kumar C., Ramawat N., Rajput V.D., Singh K.	182
Subsurface drainage technology for reclamation of waterlogged saline soils – A case study of alluvial region Kumar S., Narjary B., Prajapat K., Bundela D.S.	184
Development of a system for salt removal, crop cultivation, and salt production that does not rely on a large-scale irrigation and drainage network Kume T., Iwai C.B., Yamamoto T., Shimizu K.	186
Physiological and molecular adaptations of halophytic grasses under sodic and saline stresses Lata C., Kumar A., Rani S.	188
Reclaiming coastal saline soils by freezing saline water irrigation: mechanisms and application Liu Xiaojing, Guo Kai, Feng Xiaohui	190
The use of saline water in the irrigation of triticale fodder crop, and its effect on growth, productivity and soil properties Lubna A.-B., Tamim A.-A., Saleh A.-M., Moneim A.-H.A., Ahmad M.	192
Physiological parameters of salt tolerance of Sorghum: water status and gas exchanges Magalhães Dourado P.R., dos Santos M. A., Teixeira Lins C.M, Monteiro D.R., Paulino M.K.S.S., de Souza E.R.	194
Farmers' participatory assessment of nutrient management strategies for sustainable wheat production in saline environments Mann A., Meena B.L., Kumar A., Sheoran P., Yadav R.K.	196
Evaluation of early growth of wild rice following various salinity levels Memon F., Jamro N.B., Abbasi A.Q.	198
Subsurface irrigation of tomato with saline water using an exudation textile pipeline: an option with risks Misle E., Riveros A., Arenas Y., Garrido E., Kahlaoui B.	200
Concentrated phosphate fertilizers: agrochemical efficiency and environmental safety on saline soils Myachina O., Kim R., Mamasalieva L.	202
Saline soil reclamation through cut-soiler drainage technology: Spatio-temporal assessment Narjary B., Vivekanand, Kumar S., Bundela D.S., Yadav G., Rai A.K., Onishi J., Omori K., Yadav R.K.	204

Water- and energy-use efficiencies of drip irrigation of cotton on soils prone to salinization: case study from the Karshi Steppe

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Introduction, scope and main objectives

Irrigated land prone to salinization occupies over 50 percent of farm land in Uzbekistan, causing low yields of cotton and other crops. Growing water deficit may accelerate salinity built-up in the topsoil with economic losses for farmers. Under such conditions drip irrigation may become an instrument for preventing soil salinization. Crop cultivation on salt-affected soils using drip irrigation requires additional inputs; farmers, facing financial shortages and trying to avoid such expenses lose crops—plants become short and soil properties degrade. One way of convincing farmers to apply drip irrigation is to show mutual benefits of water saving. The objective of this study was to explore resource, including water and energy, saving benefits of drip irrigation.

Methodology

The study was implemented in 2011–2015 in Karshi Steppe. During 2011–2014 Gas Production Union ‘Shurtangas’ demonstrated drip irrigation on 100 ha of farm land in Karshi district, Kashkadarya province. Later in 2015, the research site was established in the same area on 5 ha farm field. The trial had three treatments with three replications: 1) conventional furrow irrigation; 2) drip irrigation without plastic film cover; 3) drip irrigation with plastic film cover. The research consisted of three steps. In the first step, all farming practices were monitored during the crop growing season, including labor inputs, machinery use, application of chemicals and farmyard manure, using diesel oil, electricity and water for irrigation. In the second step, energy equivalents of different input and output values used in different farming practices were adopted from published researches implemented in similar environments. In the third step energy expenses were estimated using field data and the energy equivalents.

Results

The study results showed, that the energy expenses to cultivate cotton totals to 44000-64613 MJ per ha of irrigated land under furrow irrigation, 79081 MJ using drip irrigation without plastic film cover and 81698 MJ with drip irrigation covered by plastic films. There is the difference in the value of energy inputs, mainly due to application of polyethylene sheet and using electricity to pump water into the drip system.

The yield response to irrigation was 3.8 t/ha under furrow irrigation, 5.4 t/ha under drip irrigation without plastic film cover and 5.5 t/ha under drip irrigation covered by plastic film. Water productivity was 0.47–0.53 kg/m³ under furrow irrigation, 1.01 kg/m³ and 1.98 kg/m³ under drip irrigation using plastic sheet, at farm field and the research site, accordingly and 1.65 kg/m³ under drip irrigation without plastic sheet cover.

Discussion

The results of the study differ from those of Perry, Steduto and Karajeh (2017), Pfeiffer and Lin Lawell (2010), Ward and Pulido-Velasquez (2008), indicating that hi-tech irrigation may increase water consumption. This study found that adoption of drip irrigation improves the efficiency of energy and water resources if proper resources use policies in place.

Conclusions

Water saving technologies in combination with crop diversification and intensification, and management of plant residues for improving soil properties and carbon sequestration can be the pathway for gradual rehabilitation of productivity of salinized lands. Further system-level studies require understanding a long-term response of soil salinity to wide adoption of drip irrigation at an irrigation system and river basin scale.

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References

- Perry, C., Steduto, P. & Karajeh, F.** 2017. *Does improved irrigation technology save water?* Cairo, FAO. 57pp. (also available at <https://www.fao.org/3/I7090EN/i7090en.pdf>).
- Pfeiffer, L. & Lin Lawell, C.-Y.C.** 2010. The Effect of Irrigation Technology on Groundwater Use. *Choices*, 25.
- Ward, F.A. & Pulido-Velazquez, M.** 2008. Water conservation in irrigation can increase water use. *Proceedings of the National Academy of Sciences*, 105(47): 18215–18220.



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