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Content

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

A. Kh. Karimov[1], R. Karshiev[2], R. Tashev[3], B. Abdurahmanov[1]*

[1]Tashkent Institute of Irrigation and Agriculture Mechanization Engineers, akmalkarimov040@gmail.com
[2]Minsitry of Water Management of Uzbekistan
[3]Amu-Kashkadarya Basin Irrigation System Administration

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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/m^3 under furrow irrigation, 1.01 kg/m^3 and 1.98 kg/m^3 under drip irrigation using plastic sheet, at farm field and the research site, accordingly and 1.65 kg/m^3 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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The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our key objectives are to promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development.

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