THESIS

EVALUATION OF EFFECTIVENESS OF SULPHUROUS ACID GENERATOR IN TREATING THE SODIC WATER UNDER DIFFERENT SCENARIOS FOR WHEAT CROP

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For the Degree of

MASTER OF PHILOSOPHY

IN

WATER RESOURCES MANAGEMENT

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING,

UNIVERSITY OF ENGINEERING AND TECHNOLOGY, LAHORE,

PAKISTAN

2002

ABSTRACT

The quality in irrigation water plays an important role in enhancing agricultural productivity. The use of proper quality of irrigation water ensures crop yield and sustainability of soil health. The groundwater quality of the aquifer in Indus Basin varies considerably from fresh to hazardous. Most of the area has saline-sodic and sodic groundwater. The application of these waters for irrigation purpose is converting the normal soil to saline-sodic and sodic and long-term use of these waters may render productive lands to barren.

To overcome the problem, different soil and water amendments are applied conventionally. Recently, Sweetwater International Inc. USA has introduced an innovative technique 'Sulphurous Acid Generator (SAG)' in Pakistan. The generator converts the elemental sulphur into sulphur dioxide gas during burning in the combustion chamber of the generator and then this gas is mixed with water to produce sulphurous acid. This acid is then mixed with tubewell water in the watercourse to amend the saline-sodic and sodic water.

The present study was intended to use the effectiveness of this innovative technique to amend groundwater quality under local conditions. For this purpose, the SAG was used to apply treated irrigation of different frequencies to wheat crop during Rabi season 2000-2001. The experiment was conducted at Muhammad Akram Farm, near Bhalwal. The following experimental treatments were used during the field trials:

Tillage Practice	Exp. Plot No.	Treatment Scenarios
Zero-Tillage	Plot-1	All irrigations with SAG treated water
	Plot-2	1st, 2nd and 4th irrigations with SAG treated water
	Plot-3	3rd and 5th irrigations with SAG treated water
	Plot-4	All irrigations with untreated tubewell water
Conventional-Tillage	Plot-5	All irrigations with untreated tubewell water
	Plot-6	All irrigations with SAG treated water
Bed-Furrow	Plot-7	All irrigations with SAG treated water
	Plot-8	All irrigations with untreated tubewell water

The infiltration rates in plots of zero-tillage practices were measured before and after the growing season. The change in chemical parameters of the soil was monitored up to 120 cm depth at head, middle and tail reaches of all the plots. Moreover, the leachates were collected in each plot to measure the changes in chemical concentration of different ions.

It was observed that the infiltration rate increases almost five times as compared to the infiltration rate at the start of the growing season in plot-1in which all the

irrigations were applied with SAG treated water. In plot-2 with first, second and fourth irrigation with treated water, the infiltration rate doubled at the end of the season. There was not any significant change in plot-3 while in plot-4, the infiltration rate decreased with the application of untreated water.

A change in pH, EC_e and SAR within 0-120 cm soil profile with different frequencies of treated and untreated irrigations was evaluated. The results indicated that, a maximum reduction of 5, 14 and 50 percent in the pH, EC_e and SAR of whole soil profile occurred with continuous treated irrigations, followed by 1, 7 and 37 percent reduction in 1st, 2nd and the 4th treated irrigations in pH, EC_e and SAR respectively. Similarly, an increase of 4 percent in pH and decrease of 9 and 25 percent in EC_e and SAR was observed in 3rd and 5th treated irrigations respectively. A maximum increase of 4, 44 and 6 percent in the pH, EC_e and SAR of the whole soil profile was recorded with continuous untreated irrigations, respectively.

The yield data recorded indicate that the continuous treated plot-1, plot-6, and plot-7 produced 2096, 2223 and 2146 kg/acre as compared to continuous untreated plot-4, plot-5 and plot-8 which produced 1696, 1883 and 1975 kg/acre respectively. Thus an increase of 19, 15 and 8 percent occurred in continuous treated plot-1, plot-6 and plot-7 with respect to continuous untreated plot-4, plot-5 and plot-8 respectively under zero-tillage, conventional tillage and bed-furrow practices. Similarly, the 1st, 2nd and 4th treated irrigations plot-2 yielded 1892 kg/acre and 3rd and 5th treated irrigation plot-3 produced 1756 kg/acre wheat yield indicating 10 and 3 percent increase, respectively as compared to continuous untreated plot-4 yielding 1696 kg/acre wheat yield in the zero-tillage field.

It was also observed from wheat yield data recorded that among all the plots which were continuously treated with SAG treated water under different tillage practices, minimum yield was obtained from continuously treated zero-tillage plot-1 yielding 2096 kg/acre whereas 2146 and 2223 kg/acre yield was produced from bed-furrow plot-7 and conventional-tillage plot-6 indicating about 2 and 6 percent increase in wheat yield respectively. Similarly, among all continuously untreated plots under different tillage practices, it was found that minimum wheat yield was obtained from zero-tillage plot-4 producing 1696 kg/acre whereas, 1883 and 1975 kg/acre yield was recorded from conventional-tillage plot-5 and bed-furrow plot-8 indicating increase of 10 and 14 percent in wheat yield respectively.