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Assessment of the status of agricultural irrigation with wastewater and effluent in Kurdistan

Seyed Jamaleddin Ebrahimi, Leila Ebrahimzadeh*

MSc of Environmental Health Engineering, Kurdistan University of Medical Sciences, Sanandaj, Iran

ABSTRACT

More than eighty percent of the wastewater in the world enters the environment without collection and treatment and urban people are the main source of wastewater production. Iran, as one of the Middle Eastern countries, is faced with the loss of renewable water resources, hence one of the main social and economic policies in the Islamic Republic of Iran is to make optimal use of renewable resources. In view of that, there is an emphasis on water turnover and reuse, groundwater recharge, and human and industrial wastewater treatment and reuse in agriculture and other activities. The aim of this study was to investigate agricultural irrigation with wastewater and effluent in Kurdistan province in 2015. This cross-sectional descriptive study was conducted in summer 2015. The study used the available data collected in Wastewater Health Program which had been administered by health deputy of the Kurdistan University of medical sciences. After reviewing the available data, statistical analysis of data was performed by means of Excel software.The results of the study showed that the amount of effluent used for agricultural irrigation in the two cities of Sanandaj and Marivan, respectively, was 500 and 450 liters per second. Due to the decrease in water resources, the area of cucurbits farms irrigated with effluent increased from zero in 2014 to 898 hectares in 2015 and the area of non-cucurbits farms irrigated with effluent increased from 41.5 hectares in 2014 to 260 hectares in 2015. In addition, the area of cucurbits farms irrigated with raw wastewater increased from zero in 2014 to 1.5 hectares in 2015 and the area of non-cucurbits farms irrigated with raw wastewater increased from zero in 2014 to 225 hectares in 2015. Finally, it can be concluded that the authorities in the country must pay serious attention to wastewater and effluent management, because it will help to prevent the damages to agricultural fields which is now occurring due to contamination of groundwater and soil. Wastewater management could help to provide a better health perspective for the next generations of people in this country.

KEY WORDS: EFFLUENT, WASTEWATER, AGRICULTURAL IRRIGATION

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**Corresponding Author: Leila.e980@gmail.com*

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INTRODUCTION

More than eighty percent of the wastewater in the world enters the environment without collection and treatment and urban people are the main source of wastewater production (World Water Assessment Programme, 2012). Every year, 80 million tons of nitrogen and 10 million tons of phosphorus created due to agricultural activities are evacuated into waterways and coastal areas (UN-Water Decade Programme on Capacity Development, 2013).

The presence of nutrient materials is one of the reasons for using wastewater for agricultural irrigation in developing countries. However, maintaining proper levels of these substances is a challenge. Moreover, the wastewater contains high levels of dissolved salts and organic matter.

Iran, as one of the Middle Eastern countries, is faced with the loss of renewable water resources; hence one of the main social and economic policies in the Islamic Republic of Iran is to make optimal use of renewable resources. In view of that, there is an emphasis on water turnover and reuse, groundwater recharge, and human and industrial wastewater treatment and reuse in agriculture and other activities (Environmental regulations for the use of returned water and effluent, 2010).

The use of wastewater to irrigate agricultural fields has many economic benefits for farmers, because it conserve water resources, reduces the disposal of contaminated wastes to surface water, reduces the use of fertilizers, and reduces the cost of water consumption and irrigation (Paranychianakis et al, 2006; Haruvy, 1998; Fatta and Kythreotou, 2005, and Corcoran et al, 2010). Salinity is the most important factor limiting the use of waste water and returned water for the land reclamation in desert habitats; however, with a proper management we can overcome this problem (Alinejad, 2013). Heavy metals and trace elements are among other impurities found in the wastewater treatment plants especially in industrial areas; such materials can accumulate in soils and groundwater and reach a concentration which is toxic to plants (Tabatabaei et al. 2001).

The use of wastewater can lead to a decrease or increase in soil pH (Saber, 1986) and can also increase chloride (Mahida, 1981) and other chemical compounds. In addition to pathogenic microorganisms, domestic and industrial wastewater contains different chemical compounds such as drugs, hormones, antibiotics, and other substances that affect hormone system (Fatta and Kythreotou, 2005). Kurdistan province has a precipitation of about 500 mm per year (more than double the average precipitation in Iran) and is one of the Iranian provinces with the highest level of water resources. However, unfortunately, in recent years the province has been faced with a sharp decline in rainfall. This has motivated the farmers to use wastewater and effluent.

To use the effluents and to authorize the farmers to use the remains of wastewater treatment it is necessary to observe the standards related to the wastewater disposal. The standards cover most of qualitative parameters including physical, chemical, microbiological features of waste water and heavy metals. However, these standards are not much observed in our country. The aim of this study was to investigate agricultural irrigation with wastewater and effluent in Kurdistan province in 2015.

MATERIAL AND METHODS

This cross-sectional descriptive study was conducted in summer 2015. The study used the available data collected in Wastewater Health Program which had been administered by health deputy of the Kurdistan University of medical sciences. Kurdistan province, with an area of 28203 square kilometers, is one of the provinces located in the western part of Iran which is adjacent to the provinces of West Azerbaijan, Zanjan, Hamedan, and Kermanshah; it has also more than 200 kilometer of common borders with Iraq. Sanandaj is the capital of the province and is located at an altitude of 1373 meters above the sea level. The other cities of the province are: Shaqez, Marivan, Qurveh, Baneh, Bijar, Dehgolan, Divandarreh, Kamyaran, and Sarvabad.

In Kurdistan province, the cities of Sanandaj, Saqez, Marivan, Qurveh, and Bijar have wastewater treatment plants; however, the wastewater treatment plant n Bijar has not been launched yet. The data required for the Wastewater Health Program are collected from the district health centers every six months. After reviewing the available data, statistical analysis of data was performed by means of Excel software.

RESULTS

Farmers in Sanandaj and Marivan use the effluents of wastewater treatment plants to irrigate their crops. Tables 1 and 2 present the status of effluent and wastewater used to irrigate agricultural fields in Kurdistan province. As shown, the amount of effluent used for agricultural irrigation in the two cities of Sanandaj and Marivan, respectively, was 500 and 450 liters per second. The most common agricultural products in Sanandaj are garden fruits, cucurbits (chamber cucumber, tomatoes, okra, and cucumber) and in Marivan the products are tobacco, alfalfa, and vegetables. The two parameters of BOD and COD are the only analysis parameters listed in national standards of the effluent which had been analyzed and both of them were less than the allowed vales (100 and 200 milligram per liter, respectively).

Table 1. Status of effluents used for irrigation of agricultural field in urban areas of Kurdistan province

No.	District	The amount of effluent used (l/s)	Characteristic of agriculture crops		Results of testing the output of effluent	
			Type of crops	Cultivated area (hectare)	BOD	COD
1	Sanandaj	500	Garden fruits, cucurbits (chamber cucumber, tomatoes, okra, and cucumber)	893	56	110
2	Marivan	450	tobacco	200	61.4	100
			alfalfa	60		
			vegetables	5		

Table 2. Status of effluents used for irrigation of agricultural field in rural areas of Kurdistan province

No.	District	Raw wastewater used for irrigation of agricultural fields		Characteristic of agriculture crops	
		Place of use	Amount of use (l/s)	Type of crops	Cultivated area (hectare)
1	Divandareh	Qazal ozen river bank	50	Garden fruits (apple) and alfalfa	150
2	Dehgolan	Dehgolan	64	Meadow (animal consumption)	15
		Bolban Abad	0.8	Garden and meadow	6
		Qarebelaq panjeh	1.25	Cucumber and wheat	5 (Cucumber: 1.5 and wheat: 5)
		Bashmakh	3.7	Potato	0.5
3	Kamyaran	Bolan	20	Corn and wheat	50

As shown in Table 2, the farmers in rural areas of Divandarreh, Dehgolan, and Kamyaran used raw wastewater for irrigation of gardens and cucurbits farms. The irrigation of cucurbits farms with wastewater can increase the risk of transmission of enteric diseases. It should be noted that about 1 hectare of cucurbits farms irrigated with raw effluent in Qorveh was destroyed this year.

As shown in Figures 1 and 2, due to decreasing rainfall in recent years, the area of cucurbits farms irrigated with raw wastewater increased from zero in 2014 to 1.5 hectares in 2015 and the area of non-cucurbits farms

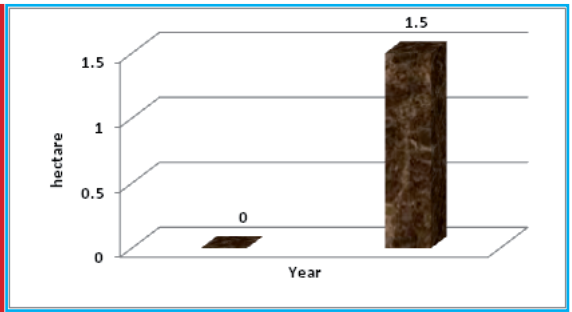

FIGURE 1. Comparison of the areas of cucurbits farms irrigated with raw wastewater in 2014-2015

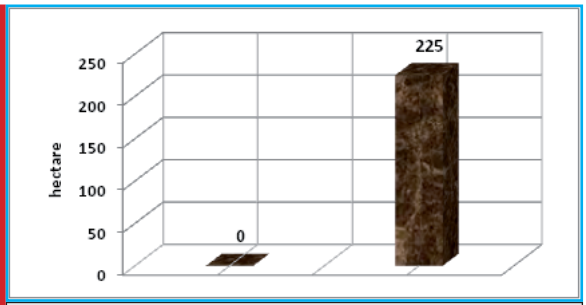

FIGURE 2. Comparison of the areas of non-cucurbits farms irrigated with raw wastewater in 2014-2015

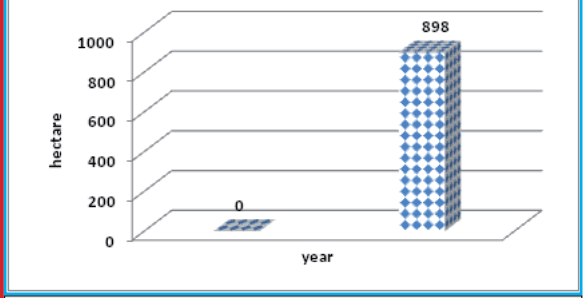

FIGURE 3. Comparison of the areas of cucurbits farms irrigated with effluent in 2014-2015

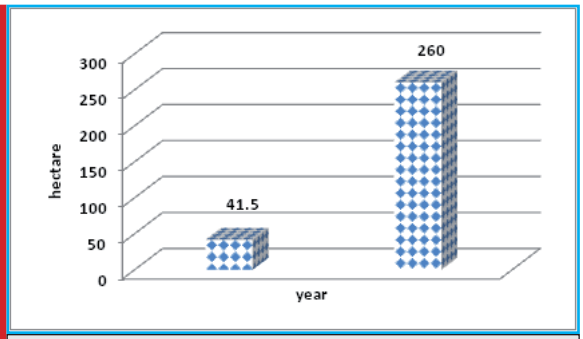

FIGURE 4. Comparison of the areas of non-cucurbits farms irrigated with effluent in 2014-2015

irrigated with raw wastewater increased from zero in 2014 to 225 hectares in 2015.

According to Figures 3 and 4, due to the decrease in water resources, the area of cucurbits farms irrigated with effluent increased from zero in 2014 to 898 hectares in 2015 and the area of non-cucurbits farms irrigated with effluent increased from 41.5 hectares in 2014 to 260 hectares in 2015.

DISCUSSION

Climatic conditions, characteristics of produced effluent, type of crops, and economic, social, technological, cultural, and health conditions in different countries are diverse; as a result the countries cannot simply enjoy the results of studies conducted in the other countries to make successful planning.

To ensure the continuity and long-term success of the plans designed for the use of wastewater in agriculture it is necessary to makes such plans based on data and results obtained from multiple short-term and long-term researches conducted in local conditions. The researches should be conducted on a variety of subjects such as: positioning, type of crop and cropping patterns, environmental and health risks, determination of acceptable risk levels, determination of the risk management methods to reduce risk, management of costs associated with the various options to reduce risks, localization of guidelines and standards, providing good alternatives, training farmers and people, etc (Danesh and Alizadeh, 2008).

Some of the problems and challenges in the field of irrigation with effluent and wastewater are as follows:

1. Lack of wastewater treatment plant for treating wastewater in a number of towns and villages of the province
2. Improper functioning of the urban wastewater treatment plants which prevents urban waste water treatment plants to meet the standards designed for a number of items
3. Low rainfall and lack of self-purification in the revivers and water resources which receive effluent streams in most parts of the province
4. Lack of coordination between the concerned departments (environment and agriculture organizations) and the district health centers to legally react against offenders who use effluent or wastewater for irrigation of crops. Are the health centers the only body responsible for reacting against the offenders?
5. It is not clear under what time frequency (monthly / quarterly / annual) should the effluents would be compared with the standards.
6. Water scarcity and declining the levels of surface water and groundwater have motivated the farmers to use effluent and raw wastewater to irrigate farms.
7. Lack of laboratory for detecting and counting nematode eggs while it is one of the important prerequisites for using wastewater in agricultural fields in the province.
8. Need for funds for the development of wastewater treatment plants.
9. Preventing farmers from the use of raw wastewater for irrigation of agricultural fields.

The following items are suggested to improve and promote the use of wastewater in agriculture.

1. Paying attention to all the parameters and standards recommended for the use of wastewater in agricultural fields.
2. Providing the instruments and equipment required for the analysis of the wastewater and launching them in the reference laboratories of the health centers in all the provinces, or at least in the three provinces in the country.
3. Reviewing the effluent standards based on the standards of wastewater use in agriculture pro-

posed by the World Health Organization or other important global centers.
4. Increasing the area of farms under the cultivation of rain-fed crops in the country.
5. Conducting short-term and long-term research in this field.
6. Evaluating the status of agricultural soil salinity and other important parameters in this field.

Finally, it can be concluded that the authorities in the country must pay serious attention to wastewater and effluent management, because it will help to prevent the damages to agricultural fields which is now occurring due to contamination of groundwater and soil. Wastewater management could help to provide a better health perspective for the next generations of people in this country.

REFERENCES

Alinejad, A. Karimi, A. Jhangrdy, M. Nikokhah, F. Newman Andersom, M. (2005): Study of bacterial quality of soil and crops irrigated with treated urban wastewater. Journal of Health and Environment. Sixth Volume. Third Issue, Fall, PP 365-377.

Corcoran, E., C. Nellemann, E. Baker, R. Bos, D. Osborn, and H. Savelli, eds. (2010): Sick Water? The central role of wastewater management in sustainable development.

Danesh, Sh. Alizadeh, A. (2008): The use of wastewater in agriculture, opportunities and challenges.

Environmental regulations for the use of returned water and effluent. (2010): Vice president of strategic planning and monitoring. Publication No. 535.

Fatta, D. and Kythreotou, N. (2005): Wastewater as Valuable Water Resource - Concerns, Constraints and Requirements Related to Reclamation, Recycling and Reuse. IWA International Conference on Water Economics, Statistics, and Finance, Greece.

Fatta, D. and Kythreotou, N. (2005): Wastewater as Valuable Water Resource - Concerns, Constraints and Requirements Related to Reclamation, Recycling and Reuse. IWA International Conference on Water Economics, Statistics, and Finance, Greece.

Haruvy, N. (1998): Wastewater Reuse-regional and Economic Considerations. Resources, Conservation and Recycling. Vol. 23, pp.57-66.

Mahida, U. N. (1981): Water Pollution and Disposal of Wastewater on Land. Mc Grow-Hill pub., New Delhi, p 323.

Paranychianakis N.V. Nikolantonakis M. Spanakis Y. and Angelakis A. N. (2006): The effect of recycled water on the nutrient status of soultanina grapevines grafted on different rootstocks. Agricultural water management. 81(1-2), 185-198.

Saber, M. S. M. (1986): Prolonged Effect of Land Disposal of Human Waste on Soil Conditions. Wat. Sci. Tech. Vol. 18, pp.371-374.

Tabatabaei, S. H., Liaghat, A., Heidarpor, M. (2001): Use of Zeolite to Control Heavy Metal in Municipal Wastewater Applied for Irrigation. International Workshop on Wastewater Reuse Management. ICID-CIID. Seoul. Korea. PP. 33-41.

UN-Water Decade Programme on Capacity Development (UNW-DPC) (2013): Safe Use of Wastewater in Agriculture.

World Water Assessment Programme (WWAP) (2012): The United Nations World Water Development Report 4: Managing water under Uncertainty and Risk. Paris, UNESCO.